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Experiments and Lessons From College Students

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Abstract

Changing small factors that influence consumer choice may lead to healthier eating within controlled settings, such as school cafeterias. This report describes a behavioral experiment in a college cafeteria to assess the effects of various payment options and menu selection methods on food choices. The results indicate that payment options, such as cash or debit cards, can significantly affect food choices. College students using a card that prepaid only for healthful foods made more nutritious choices than students using either cash or general debit cards. How and when individuals select their food can also influence food choices. College students who preselected their meals from a menu board made significantly different food choices than students who ordered their meals while viewing the foods in line.

Keywords: Behavioral economics, healthy eating, diet quality, food choices, school meal programs, experimental economics, ERS, USDA.

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Summary

Poor diet quality, overconsumption, and inactivity can lead to poor health. Even with the plethora of weight-loss programs and diet books currently available, diet-related health conditions like obesity and diabetes continue to rise. Traditional economic analyses seem inadequate to explain why so many people choose risky health behaviors. Consequently, some researchers are turning to behavioral economics, which tries to explain why people act as they do and what incentives can modify behavior.

What Is the Issue?

Experiments have shown that the eating environment, such as the social atmosphere, the presence and level of distractions, or even lighting, can affect people's food choices and how much they eat. Some of those same cues can also be used to help individuals make healthier food choices. Finding successful ways to promote healthier food choices could be an important tool for the school meals programs, for example, which aim to strike a balance between meeting the dietary needs of students who are undernourished and encouraging healthy diets and body weight. Cafeteria administrators are in a unique position to control many of the elements that have been shown to influence food choice. By understanding how these behavioral interventions influence food choice and diet quality, managers of school and workplace cafeterias can devise possible strategies to promote healthy eating. This report describes a behavioral experiment in a college cafeteria, which assessed the effects of various menu selection methods and payment options on food choices. The experiment was designed to apply within the context of any cafeteria—whether college, work, or secondary school.

What Did the Study Find?

College students who preselected their meals from a menu board before seeing them did not always make healthier food choices than students who made their selections in line where they could see the food. In fact, viewing led to significantly greater consumption of healthier foods—salad and turkey sandwiches—and significantly less consumption of less healthy foods—French fries and caffeine. Viewing brownies, however, also significantly increased brownie consumption. The impact of viewing different foods may have more to do with how attractive they are than how healthy they are.

Students who participated in the experiment could pay for their meals in one of three ways—cash, prepaid cards to be used for any menu item (unrestricted debit cards), or prepaid cards to be used for more healthful items only (restricted debit cards). Their payment method affected the amount of money they spent on meals. Those using cash spent more on average than those who used an unrestricted debit card. Students using the restricted debit card spent the least on less nutritious items, whereas those using the unrestricted card spent the most on these foods.

The payment option significantly affected the types of foods chosen as well. College students paying with cash made healthier food choices than those paying with an unrestricted debit card, who were significantly more likely to purchase a brownie and a soda but less likely to buy skim milk and healthful side items and desserts. Parting with cash appeared to force more cognizant

decisionmaking. Students using restricted cards made significantly healthier choices than students paying with either cash or unrestricted cards. In many cases, these differences were prominent and suggest that it is possible to change behavior by altering payment methods used for different foods.

Students using the unrestricted debit card consumed significantly more calories than students using either cash or the restricted card, with those using the restricted card consuming the fewest calories. Not only did the number of calories differ by payment method, the calories derived from healthful foods varied as well. Although those using the unrestricted card consumed the most calories, they consumed the least amount of calories from more nutritious foods. Those using the restricted card consumed the fewest calories overall but consumed more calories from more nutritious foods. Students using the restricted card also consumed significantly less added sugar, total fat, saturated fat, and caffeine than those who used the unrestricted card.

How Was the Study Conducted?

This report presents results from an experiment comparing the effects of various behavioral intervention strategies on the food choices of college students. Participants in the experiment were recruited from Cornell University. The experiment's participants used three types of payment options and two different meal selection methods.

Introduction: What Are the Merits of Using Behavioral Cues To Influence Food Choice?

Consistent overconsumption, poor diet quality, and inactivity are widely recognized as factors that can lead to severely poor health conditions. And the continued popularity of weight-loss programs and diet books indicate that individuals are interested in improving their own health and wellness. Public information programs like the *Dietary Guidelines for Americans* and mandatory nutrition labels have also been in existence for years. Yet the incidences of diet-related health conditions like obesity and diabetes continue to rise. So, why do poor diet and lifestyle choices persist among nearly all segments of the population?

Traditional economic analysis that emphasizes the role of prices, income, and time-consistent preferences seem to inadequately explain why so many people choose to take on these risky health behaviors. Consequently, more researchers are turning to behavioral economics, which identifies predictable and systematic contradictions to many standard assumptions of economics. For example, the idea of complete rationality is challenged by repeated observance of cognitive biases that can lead to systematic errors in decisionmaking.

A growing body of research also suggests that today's food environment is replete with instances in which these biases can influence dietary choice. Other behavioral studies show that environmental factors seem to strongly affect the amount of food people eat. In particular, both the eating and food environments affect consumption volume by setting consumption norms (an indication of how much people should consume) and inhibiting monitoring accuracy. Thus, these subtle cues can have large impacts on consumption volume, often without the individual being aware of their effect (see Wansink, 2006, for a complete review of the literature on consumption volume and the eating environment).

Behavioral studies on dietary choice also suggest that subtle changes in the food environment may help to leverage some of these cognitive biases and offer novel ways for improving diets and health (Just, Mancino, and Wansink, 2007). A key advantage of behavioral interventions is that, in theory, they can be targeted to improve food choices among individuals who behave contrary to their own long-term health objectives without reducing the welfare of individuals who feel they do make optimal choices. As such, these changes have the added benefit of being less paternalistic (Camerer et al., 2003; Sunstein and Thaler, 2003). Another advantage of leveraging behavioral influences is that they may require only slight modifications to existing programs.

To gauge the efficacy of behavioral economic tools in shaping food choices and eating environments, this report summarizes the results of a behavioral experiment designed to apply within the context of a cafeteria—college, work, or secondary school. For these experiments, we focus on when diners select their meals and how they pay for them because these elements are common to most cafeterias. Understanding how slight modifications to payment and selection methods may influence food choice and diet quality

can be used to augment specific policies, such as work and school wellness programs that are meant to combat obesity and promote healthy eating among students or employees.

For example, knowing how changes in payment options affect food choices can identify specific ways to help individuals make choices that are better aligned with their own dietary goals and intentions. Further, by understanding how expenditures may vary with payment and selection options, behavioral interventions can be designed to encourage better eating without necessarily reducing profitability. Note, however, that this is a small-scale study, the results of which should not be interpreted as widely generalizable. Pilot studies within cafeterias would be needed to accurately assess the full costs, benefits, and feasibility of the interventions discussed in this study.

In the following section, we provide some background information on the theory and literature used to develop our research hypotheses. (For a more detailed treatment of the literature on behavioral economics as it relates to nutrition assistance programs, see Just, Mancino, and Wansink, 2007.) We then describe the experiment design, sample population, and findings. We conclude with implications for possible policy interventions and directions for future research.

Behavioral Studies Show That *When You Choose* Can Affect Your Selection

One of the most widely documented anomalies in behavioral studies is that individuals tend to view the tradeoff between immediate consumption and future consumption as having a larger impact on satisfaction than if this same tradeoff were between two future adjacent periods (Laibson, 2004). This tendency implies that individuals are more sensitive to time delays that occur sooner rather than later. As such, one's willingness to make sacrifices in terms of limiting salt, calories, and fat for better health in the future would be lower if one were considering limiting salt, calories, and fat right now versus limiting salt, calories, and fat tomorrow.

This behavior, sometimes referred to *present-biased preferences,* can cause a rift between long-term objectives and short-term desires and, in turn, may lead to seemingly inconsistent choices. Other behavioral studies have found that specific situations and behavioral cues may further bias preferences towards the present. For example, certain visceral influences, like feeling hungry or stressed, are also associated with more seemingly impulsive behavior (Loewenstein, 2004; Polivy et al., 1986). Simply seeing a food can also lead to unplanned consumption (Boon et al., 1998; Cornell, Rodin, and Weingarten, 1989). Distracting environments can also exacerbate present-biased preferences and cause individuals to make less healthful choices (Shiv and Fedorikhin, 1999).

Behavioral studies, however, show that individuals who commit to their decision before being confronted with distractions, visceral influences, or the promise of immediate gratification are less likely to exhibit present-biased preferences. These studies also show that individuals can improve their longrun well-being through some commitment technology, such as 401k plans, that set limits on current consumption levels. For example, Thaler and Benartzi (2004) found that savings rates increased dramatically when employees were offered a plan where a specified fraction of their future pay increases were automatically diverted into a savings account. Applying this finding to school or work cafeterias suggests that allowing individuals to precommit to healthful meal options before they consume the food likely will improve the healthfulness of their meal choices.

How You Pay Can Also Influence What You Choose

In most cafeterias, individuals have the option of using cash or some form of credit, debit, or prepaid card. At colleges, students typically enroll in a specific, prepaid meal plan, where a meal card functions as a prepaid debit card or entitles students to a preset number of visits. It is becoming increasingly more common for parents to prepay for meals in high, middle, and grade schools as well, where students receive meal cards that are used to debit the account when they go through the cafeteria line each day. These prepaid cards are also used by students receiving free and reduced-price meals, minimizing any appearance of differences in payment between them and students who are paying full price (Bland, 2004). In most systems, the cash that parents deposit into these prepaid accounts can be used for a la carte items as well as meals provided by the U.S. Department of Agriculture (USDA), although some systems offer parents the opportunity to prohibit a la carte purchases. Students still have the option of paying cash.

This choice of using a prepaid card or cash presents individuals with two different payment options. While both are denominated in dollars, cash not spent on cafeteria meals can be spent on other items either immediately or sometime in the future. Alternatively, money on the prepaid account can be used only on food, until some date in the future when excess money is returned. Because the use of prepaid dollars is limited (both by time and choice), these dollars have less value to the consumer than cash in their pockets that can be used for anything at any time. Thus, putting $20 on a prepaid account may lead to greater food consumption than $20 in cash. This *discount effect* suggests that, compared with cash, prepayment cards may lead to greater spending on food and, thus, greater consumption volume.

Prepayment is also a form of commitment device. Findings from the behavioral and experimental economics literature indicate that allowing individuals to prepay for certain items may also tighten the link between intentions and behaviors. Contrary to standard economic models, individuals exhibit a "flat-rate bias," where they undervalue fixed costs, relative to variable costs (Thaler, 2004). For example, health club members typically choose to pay for their gym membership on a monthly or annual basis, even when a per use fee would have lower total costs (DellaVigna and Malmendier, 2002).

An implication of a flat-rate bias is that, when only certain items can be selected using prepayment, those items will be chosen with greater frequency compared with items that can be purchased only with cash. Thus, if only the more healthful menu items can be selected using prepayment, then individuals using this prepayment method would be more likely to make significantly healthier food choices.

Behavioral studies show that individuals also tend to categorize their income into mental accounts, earmarking it for specific purposes or specifying that it be used within a certain timeframe (Thaler, 1980; Shefrin and Thaler, 2004). Mental accounting suggests that a prepaid card for only healthful menu items may also provide cues about how much money should be spent on healthful items. As such, the combined effect of flat-rate biases and mental accounting should increase the healthfulness of meals chosen by students who have prepaid for healthful menu items.

Another implication of a flat-rate bias is that, because of these different levels of valuation, if one has prepaid into a flexible lunch account, he or she is likely to be less sensitive to variations in price compared with students who pay with cash. Thus, prepayment can reduce awareness of the cost of foods, creating less discriminating consumers. If all foods in a school cafeteria are available for purchase on this account, people should behave differently, being more willing to spend extra money on unnecessary foods or to buy more food, in terms of portion sizes or variety, because prepaid funds are less fungible.

Finally, prepayment for all items may increase sensitivity to environmental factors by reducing the general level of cognition and encouraging impulse buying. Thus, students using an unrestricted prepaid card likely will spend more money on "frivolous" items compared with students using cash or restricted debit cards.

Testing Our Hypotheses: Experiment Design, Sample, and Setting

Observations from behavioral economic literature on the relationship among food choices, the timing of these choices, and payment options suggest a number of hypotheses related to school meal environments. As such, the food choice experiments in this study were designed to test the following hypotheses:

- Individuals who preselect their meals from a menu board are likely to make healthier food choices than those who make their selection in line.
- Individuals using prepayment cards are likely to spend more on cafeteria meals than those who pay with cash.
- Individuals using a restricted prepaid card will make healthier food choices than those using either cash or an unrestricted prepaid card.
- Individuals using an unrestricted prepaid card will spend less money on nutritious items than individuals using cash or restricted debit cards.

To test our hypotheses, the experiment included three types of payment options and two different selection methods (table 1). For selecting foods, individuals either chose their foods at the point of purchase or precommitted to a choice made beforehand from a menu. The menus used in these experiments listed the name of food and beverage choices within each category and their corresponding price (table 2). The three payment options were prepaid cards that could be used for any menu item (prepaid, unrestricted), prepaid cards that could be used for healthful items only (prepaid, restricted), and cash.

The menu items chosen for this experiment were typical of cafeteria menus and familiar to participants. Under each heading, we included an equal number of more nutritious (those with a green dot) and less nutritious options. Prices were taken from existing menus at Cornell University dining facilities and rounded to the nearest half dollar.

Participants for the experiments were recruited from Cornell University, primarily from an introductory business course (74.9 percent) and consisted

Table 1
Experimental treatments

	Prepaid		
Treatments	Unrestricted: All menu items are eligible	Restricted: Only healthful items are eligible	Cash only
Preselection: Foods are chosen off menu before consumption	Sample size: 52	Sample size: 55	Sample size: 49
Selection onsite: Foods are chosen in line	Sample size: 58	Sample size: 62	Sample size: 47

Source: Economic Research Service, USDA.

mostly of freshmen business students. Of those reporting their age, 51 percent were ages 19 or younger. Additional participants walked on or were brought by other participants. A potential drawback of using a convenience sample of college students is that the results may not be widely generalizable to other population groups of interest. This drawback is especially problematic if the convenience sample does not regularly consume the goods or services in question. In this case, however, the goods in question were foods offered in a school cafeteria and that college students consume regularly. While college and high school students may behave differently in terms of social norms, it is not clear a priori how this would systematically affect food choices. In addition, cafeteria habits could be well ingrained by the time they reach college. That is, because students are used to the cafeteria context (in elementary, middle, and high school), they already have ingrained behavior that would not change much in the college context. Also, efforts were made to increase the realism of the study. The experimental sessions took place in a section of one of the dining facilities at Cornell University where the layout of the room and presentation of the food was closely controlled so that differences in behavior would not be ascribed to inadvertent changes in presentation. This section, which we refer to as the cafeteria, was separated from the rest of the eating facility by temporary walls made of opaque material.

All experimental procedures were reviewed and approved by Cornell University's Institutional Review Board. Each participant was assigned to a prepayment treatment and asked to participate in two lunch sessions 1 week apart, the first sessions requiring the participant to preorder from a menu board without seeing the food and the second requiring them to order while viewing the food. A total of 191 students participated in the study—167 participated in the first session, 156 participated in the second, which gave a total of 323 observed orders, where 109 were from students who participated in both sessions. The variation in participation allows us to discern how the design of the experiment may have influenced behavior. In particular, because those participating in both sessions always participated in the preorder condition first, this experience may have had some influence on behavior in the

Table 2
Menu choices

Choices	Item	Price
Entrees	Bacon cheeseburger	$5.00
	● Chicken breast sandwich	$5.00
	● Turkey sandwich	$4.50
	Chicken fingers	$4.00
Sides	French fries	$1.00
	● Baked potato chips	$1.00
	● Salad	$2.00
	Macaroni and cheese	$2.50
Desserts	● Peaches	$1.00
	Brownie	$1.50
Drinks	● Skim milk	$1.00
	Soda	$1.00
	● Bottled water	$1.50

● = More nutritious.

Source: Economic Research Service, USDA.

second session. For example, having already tried some of the foods may have led one to choose based on taste recall rather than the aesthetics of the food.

A standard script was read to each group before entering the cafeteria. Each participant was given a combination of $20 in either prepayment money or in cash each time they participated. In both prepayment conditions, participants were given $10 on the prepaid card and $10 in cash to ensure that participants were not truly restricted in their lunch purchases. For example, a participant in the healthy card condition could have spent cash to purchase any combination of entrée, side, dessert, and drink. Rather, the healthy card only suggests a restriction by drawing attention to the tradeoffs between current and future consumption. In the cash condition, participants were given $20 in cash. To track individual purchases, all participants were given an identification card that was the size of a standard credit card.

Participants in the prepaid conditions were informed that the card would serve as a debit card upon which they had been given $10. They were informed that all cash not used that day could be kept and all money left on the card after the second week could be picked up at a separate location on campus after a specified date 2 weeks after the close of the experiment. All participants were informed that more money would be given for the second session and that balances on the debit cards would carry over. Finally, participants assigned to the prepayment—healthy session were given plastic cards (identical to standard credit cards) with circular green stickers placed on the nonmagnetic face. The menu they viewed had a similar green sticker placed next to each of the healthy items (table 2) as well as on the name plates placed in front of items in the cafeteria line. They were informed that the debit card could be used only for these items and that they could still use cash for other menu items.

Participants in the preselection condition were instructed to choose their food selections from the menu board and fill out an order card before entering the cafeteria. This order was then given to a researcher who would accompany the participant into the food line and give the order card to those preparing the food orders. Alternatively, when ordering from sight, participants would fill out the same card in line while viewing all the menu options. In this case, the cards were handed directly from the participant to those preparing the dishes. We tracked the orders of all participants and collected sociodemographic information by survey after lunch was completed.

Experimental Results

In this section, we report the differences in food choices, calories consumed, nutrient intake, and total expenditures by selection method and payment mechanism. To measure actual consumption, each participant's order was recorded. His or her plate was then weighed at the end of the meal. The difference between the average weight for each item and the end weight of each individual's plate was then taken to be the amount consumed in grams. For each outcome—food choice, calories consumed, nutrient intake, and total expenditures—we first report the mean intake by treatment and whether the mean differed significantly from the other treatment(s). Summary statistics for the entire sample are reported in table 3. Here, more nutritious foods are defined as those that were included on the green-dotted menu (chicken breast sandwich, turkey sandwich, baked potato chips, salad, peaches, skim milk, and bottled water) and the less nutritious foods are those without a green dot (bacon cheeseburger, chicken fingers, French fries, macaroni and cheese, brownie, and soda).

Individuals were randomly assigned into different treatment groups, so mean differences should provide a meaningful measure of the treatment effect. Because each individual participated in both selection treatments, we can also measure within subject variation. However, we do not have multiple observations for individuals by payment method. If gender or bodyweight

Table 3
Summary statistics—All treatments

Variable	Definition and units	Mean	Standard deviation
Males	Percent of sample	0.4829	0.5005
Weight	Pounds	154.6	31.84
Body Mass Index	Height/weight^2	23.38	3.434
Hours since last eaten	Hours	6.959	5.807
Bacon cheeseburger	Percent of sample that chose menu item	0.1615	0.3686
Chicken breast sandwich	Percent of sample that chose menu item	0.2671	0.4431
Turkey sandwich	Percent of sample that chose menu item	0.2391	0.4344
Chicken fingers	Percent of sample that chose menu item	0.1863	0.3900
Salad	Percent of sample that chose menu item	0.1957	0.3973
Baked potato chips	Percent of sample that chose menu item	0.2019	0.4020
Macaroni and cheese	Percent of sample that chose menu item	0.1308	0.3378
French fries	Percent of sample that chose menu item	0.2112	0.4088
Brownie	Percent of sample that chose menu item	0.0590	0.2360
Peaches	Percent of sample that chose menu item	0.2298	0.4214
Skim milk	Percent of sample that chose menu item	0.1242	0.3396
Soft drink	Percent of sample that chose menu item	0.2516	0.4346
Bottled water	Percent of sample that chose menu item	0.4068	0.4920
Calories	Calories consumed at that meal	633.3	296.0
Calories from more nutritious foods	Calories from "healthy" (green-dotted) foods	276.4	232.3
Calories from less nutritious foods	Calories from "unhealthy" foods	358.2	373.8
Added sugar	Grams	7.138	6.937
Total fat	Grams	27.23	17.03
Saturated fat	Grams	7.572	6.173
Percent calories from fat	Percent	37.04	20.86
Percent calories from caturated fat	Percent	10.48	09.14
Sodium	Milligrams	1,212	669.4
Caffeine	Milligrams	10.37	17.64
Expenditures	Dollars spent at that meal	6.508	2.214
Sample size		322	

Source: Economic Research Service, USDA.

are unevenly distributed within these treatments, mean comparisons may be misleading. For example, if more men are randomly assigned to the cash treatment group than to the restricted debit card group and men also eat more than women, the mean effect of the cash treatment would appear larger than it truly is. We then use propensity score matching to control for potentially confounding factors, such as gender and weight, to estimate the impact of each payment treatment on food choice, diet quality, and expenditures. However, table 4 shows that there were only small variations across treatment groups, so the effect of confounding factors is likely insignificant.

The Effect of Preselection on Food Choice, Diet Quality, and Expenditures

Preselecting foods before seeing them did not always lead to healthier food choices. Past studies found that precommitment mechanisms helped individuals assuage the effect of present-biased preferences to make decisions that were more harmonious with future well-being. However, in this experiment, we found that the effect of ordering in line while viewing the food was nuanced and not so simple as "viewing drives one to order less healthy foods." In fact, viewing led to significantly greater consumption of salad and turkey sandwiches and significantly less consumption of French fries, chicken sandwiches, and caffeine. Viewing brownies increased their consumption significantly. Thus, viewing different foods can have a varied impact that may have more to do with how attractive they are than how healthy they are. Table 5 presents differences in average consumption for foods preselected while viewing a menu board and selected in line while viewing the food.

The Effect of Payment Mechanism on Food Choice, Diet Quality, and Expenditures

We find that the frequency with which certain foods are ordered significantly differs by payment type (table 6, figs. 1a-c). In particular, individuals using an unrestricted debit card are significantly more likely to purchase a brownie

Table 4
Mean height, weight, gender, and hours since last eaten by treatment

Factors	In line	Menu board	Cash	Unrestricted card	Restricted card
Males:					
Mean	0.47	0.471	0.50	0.50	0.4615
Standard deviation	(0.501)	(0.501)	(0.503)	(0.502)	(0.501)
Weight (pounds):					
Mean	155.69	153.44	150.76	161.33	151.45
Standard deviation	(32.10)	(31.51)	(29.25)	(32.66)	(32.36)
Body Mass Index:					
Mean	23.41	23.34	22.78	24.29	23.00
Standard deviation	(3.422)	(3.448)	(3.349)	(3.445)	(3.342)
Hours since last meal:					
Mean	7.08	6.80	7.24	7.64	6.103
Standard deviation	(6.038)	(5.557)	(5.745)	(6.192)	(5.421)
Sample size	167	152	95	109	117

Source: Economic Research Service, USDA.

(about 25 percent more likely) and a soda (about 27 percent more likely) but less likely to buy skim milk (about 7 percent less likely) than those using cash. Individuals using the unrestricted card were also more likely to buy less healthful (though similarly priced) side items and desserts than those using cash. In general, a prepaid card may change an individual's valuation of the dollar with respect to particular foods. However, note that very little difference is observed for entrees and both groups purchased water at about the same rate.

Behavior when using the restricted debit card was markedly different compared with behavior when using either cash or the unrestricted cards. In every case, except for the turkey sandwich and skim milk, green-dotted items were consumed significantly more under the restricted treatment. In many cases, these differences are prominent and suggest that it is possible to change behavior by altering payment methods used for different foods.

Comparing the restricted and unrestricted debit card treatments, the differences again are stark, with healthy items being consumed about twice as often in most cases. The restricted card cuts consumption significantly for most unhealthy items, the exceptions being the brownie and macaroni and cheese. However, these unhealthy items were seldom consumed under either treatment.

Table 5
Mean differences in consumption and expenditures by selection treatment

	In line		Menu board		Within subject differences (in line–menu board)	
Food choice	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Bacon cheeseburger	0.1667	0.3739	0.1557	0.3637	0.0227	0.4534
Chicken breast sandwich**	0.3269	0.4706	0.2096	0.4082	0.1061	0.5133
Turkey sandwich**	0.1923	0.4114	0.2874	0.4539	-0.0758	0.5187
Chicken fingers	0.1987	0.4003	0.1737	0.3799	-0.0152	0.5240
Salad**	0.1474	0.3557	0.2395	0.4281	-0.0909	0.4532
Baked potato chips	0.2308	0.4227	0.1796	0.3850	0.0303	0.4613
Macaroni and cheese	0.1538	0.3620	0.1084	0.3119	0.0229	0.3816
French fries*	0.2500	0.4344	0.1737	0.3799	0.0455	0.4764
Brownie***,†	0.0192	0.1378	0.0958	0.2952	-0.0758	0.2930
Peaches	0.2179	0.4142	0.2395	0.4281	-0.0076	0.4004
Skim milk	0.1218	0.3281	0.1257	0.3502	0.000	0.3027
Soft drink	0.2243	0.4185	0.2754	0.4481	-0.0530	0.3771
Bottled water	0.4038	0.4922	0.4132	0.4939	0.0076	0.4539
Calories	643.99	295.44	623.23	297.04	-2.8230	258.72
Calories from more nutritious foods	282.99	239.22	270.84	225.75	14.4091	235.78
Calories from less nutritious foods	362.56	378.20	351.90	370.66	-13.8779	345.91
Percent Calories from fat	38.61	22.75	34.80	20.28	01.98	24.14
Percent calories from saturated fat	10.93	10.23	13.17	23.67	-2.87	24.90
Added sugar (grams)	6.50	6.10	7.74	7.61	-0.4918	5.6485
Total fat (grams)	26.35	17.59	26.17	16.48	1.7804	16.6218
Saturated fat (grams)	7.87	6.34	7.30	5.97	0.4212	6.7961
Sodium (milligrams)	1,246.65	704.14	1,179.98	635.25	45.7224	731.75
Caffeine (milligrams)**	9.11	16.95	11.56	18.24	-2.4688	14.8186
Expenditures (dollars)	6.14	2.40	6.41	2.03	0.00	1.6939
Sample size	156		167		132	

*,**,***Mean of menu board and in-line selection differ by 10, 5, and 1 percent using within-subject variation.

†,‡Differences are significant at the 10- and 5-percent level after using the Bonferroni corrected p-values.

Source: Economic Research Service, USDA.

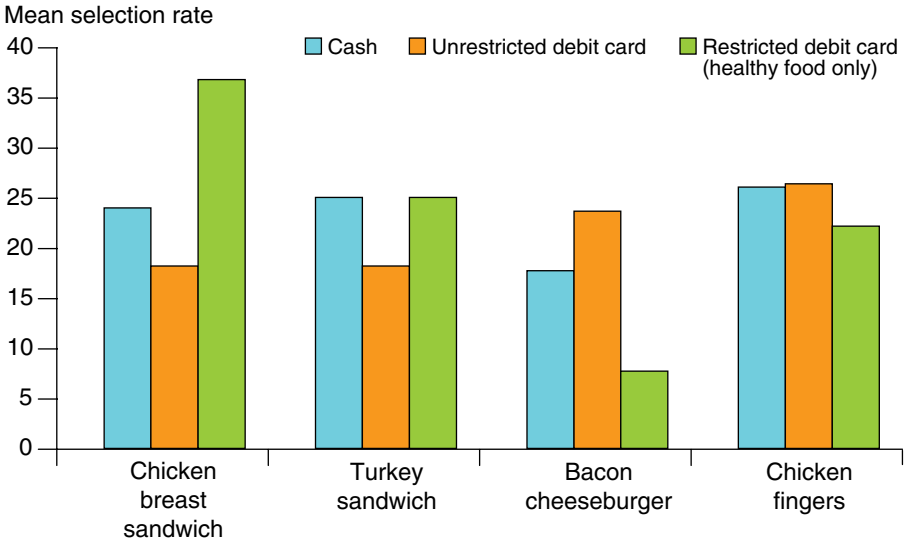
Table 6
Differences in mean consumption and expenditures by payment method

Food choice	Cash		Unrestricted card		Restricted card	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Bacon cheeseburger$^{++,\wedge\wedge\ddagger}$	0.1771	0.3837	0.2364	0.4268	0.0769	0.2676
Chicken breast sandwich$^{++,\wedge\wedge\dagger}$	0.2396	0.4291	0.1818	0.3875	0.3675	0.4842
Turkey sandwich$^{\wedge}$	0.2500	0.4353	0.1818	0.4105	0.2906	0.4560
Chicken fingers$^{+++\ddagger,\wedge\wedge\ddagger}$	0.2604	0.4412	0.2636	0.4426	0.0513	0.2215
Salad$^{+++\ddagger,\wedge\wedge}$	0.1146	0.3202	0.1455	0.3542	0.3077	0.4635
Baked potato chips$^{+++\ddagger,\wedge\wedge\dagger}$	0.0938	0.2930	0.1636	0.3716	0.3333	0.4734
Macaroni and cheese^{+}	0.1875	0.3924	0.1091	0.3132	0.1034	0.3059
French fries$^{+,\wedge\wedge}$	0.2292	0.4225	0.2727	0.4474	0.1368	0.3451
Brownie*	0.0313	0.1749	0.0909	0.2888	0.0513	0.2215
Peaches$^{++,\wedge\wedge\ddagger}$	0.1875	0.3924	0.1455	0.3542	0.3419	0.4764
Skim milk$^{**,\wedge\wedge}$	0.1563	0.3650	0.0545	0.2281	0.1624	0.3930
Soft drink$^{***\dagger,+,\wedge\wedge\ddagger}$	0.2188	0.4156	0.4182	0.4955	0.1197	0.3260
Bottled water$^{+++\dagger,\wedge\wedge}$	0.3229	0.4700	0.3636	0.4832	0.5214	0.5017
Calories$^{++,\wedge\wedge\dagger}$	644.37	275.00	692.14	306.64	568.90	292.27
Calories from more nutritious foods$^{**,+++\ddagger,\wedge\wedge\ddagger}$	248.88	198.27	192.36	222.97	377.14	230.83
Calories from less nutritious foods$^{**,+++\ddagger,\wedge\wedge\ddagger}$	397.43	346.19	502.01	377.42	190.55	326.90
Added sugar (grams)$^{***\dagger,\wedge\wedge}$	6.0659	6.3776	9.0728	7.9937	6.2067	5.9092
Total fat (grams)$^{+++\ddagger,\wedge\wedge\ddagger}$	30.4493	17.1860	30.0914	17.4616	21.8740	15.2179
Saturated fat (grams)$^{+++\ddagger,\wedge\wedge}$	8.8062	6.3338	8.2227	6.5460	5.9387	5.3173
Percent calories from fat$^{+++\dagger,\wedge}$	41.64	20.16	37.44	21.00	32.84	20.63
Percent calories from saturated fat^{++}	12. 23	09.15	10.42	92.13	09.08	08.88
Sodium (milligrams)$^{*,+}$	1,320.766	643.611	1,165.417	723.959	1,166.808	631.227
Caffeine (milligrams)$^{***\ddagger,+,\wedge\wedge\ddagger}$	8.9144	16.7695	17.3058	20.1072	5.0487	13.3341
Expenditures (dollars)$^{+,\wedge\wedge}$	$6.53	2.26	$6.33	1.96	$6.66	2.40
Sample size	96		110		117	

*,**,***Mean of cash treatment and unrestricted card treatment differ by 10, 5, and 1 percent. $^{+,++,+++}$Mean of cash treatment and restricted card treatment differ by 10, 5, and 1 percent. $^{\wedge,\wedge\wedge,\wedge\wedge\wedge}$ Mean of restricted and unrestricted card treatment differ by 10, 5, and 1 percent. †,‡Differences are significant at the 10- and 5-percent level after using the Bonferroni corrected p-values.

Source: Economic Research Service, USDA.

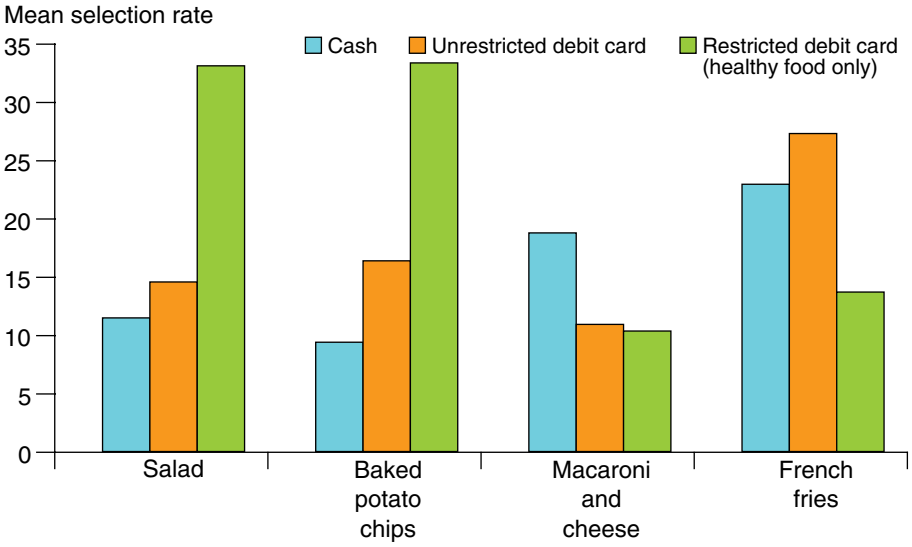
Figure 1a
Variations in food choice by payment type—entrees



Source: Economic Research Service, USDA.

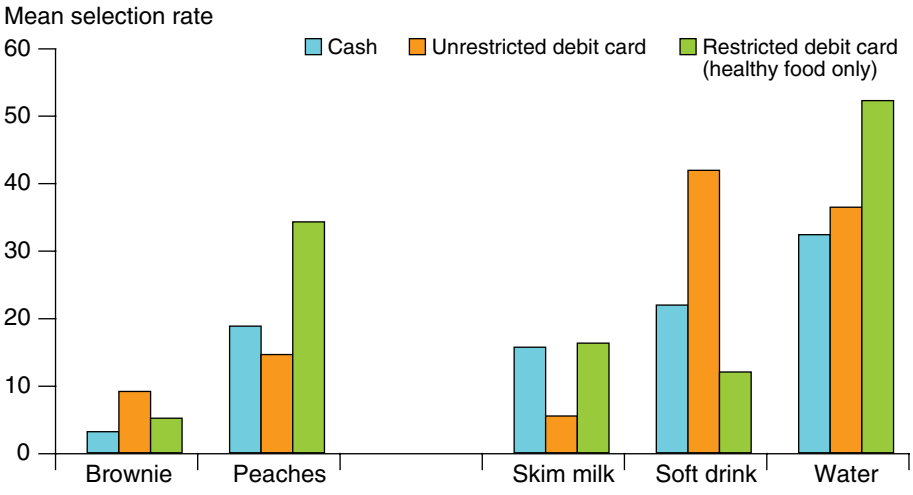
The differences among food choices, by payment treatment, also led to significant differences in diet quality. In terms of calories, those using the unrestricted debit card consumed significantly more calories than either the cash or restricted treatment groups, with those using the restricted card consuming the fewest calories at that meal. Not only did the total number of calories differ by payment method, the calories derived from healthful foods varied as well (fig. 2). Although those using the unrestricted card consumed the most calories at lunch, they got the fewest calories from more nutritious foods. In comparison, those using the restricted card consumed the fewest calories overall but consumed more calories from more nutritious foods. Compared with the individuals who used the unrestricted card, those using the restricted card also consumed significantly less added sugar, total fat, saturated fat, and caffeine.

Figure 1b
Variations in food choice by payment type—sides



Source: Economic Research Service, USDA.

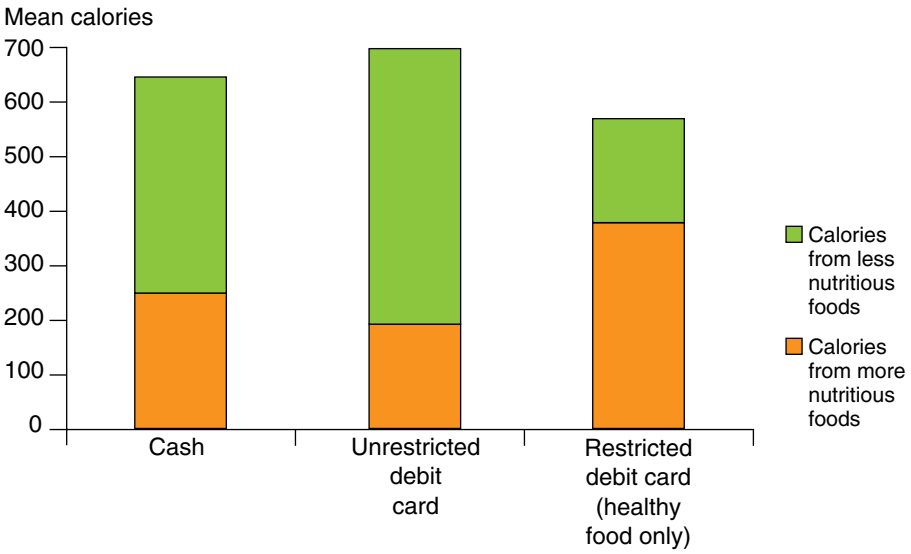
Figure 1c
Variations in food choice by payment type—desserts and sides



Source: Economic Research Service, USDA.

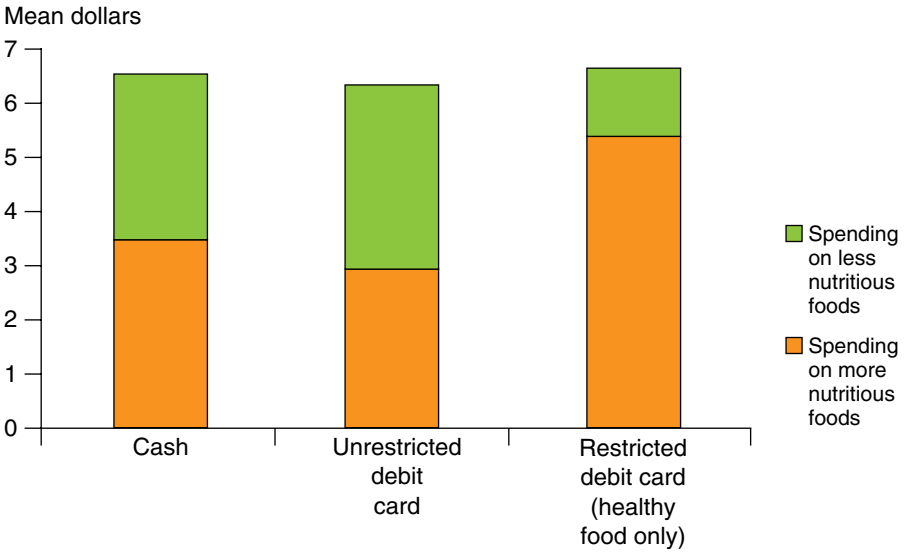
Our results show no greater spending when using unrestricted prepaid cards compared with using cash. In fact, individuals using cash spent more on average than those who used an unrestricted prepaid card (fig. 3). However, individuals using the restricted card spent the least on unhealthy items, whereas those using the unrestricted card spent the most on these foods. The maximum amount spent was $16.50, with an average of $6.51. In fact, only one participant from the combined cash and restricted card experiment spent more than the $10 given in cash. Thus, only this participant could have been constrained in his or her choice by the funds given. The average amount spent in either card treatment was $6.51, and less than 1 percent of individuals spent all of their money on the card in a single lunch.

Figure 2
Differences in caloric intake by payment type



Source: Economic Research Service, USDA.

Figure 3
Differences in spending by payment type

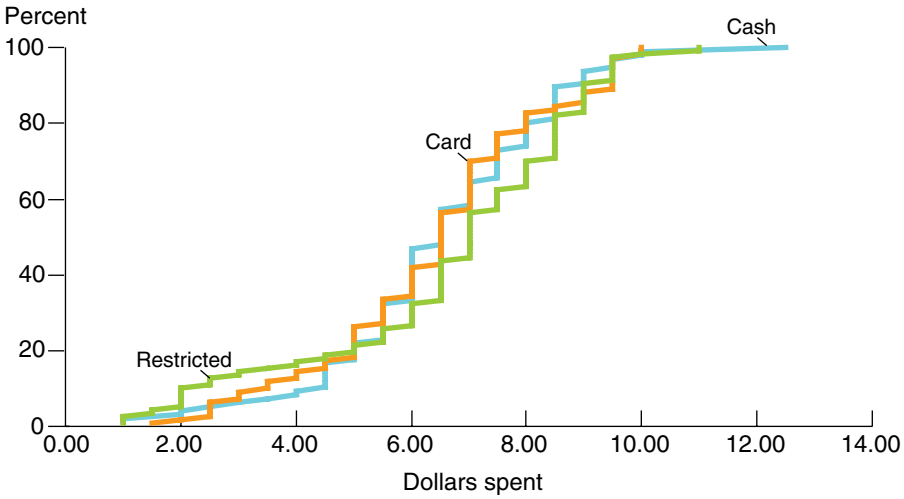


Source: Economic Research Service, USDA.

Figure 4 displays the cumulative distribution of spending by the three different payment methods. Comparing those using cash to those using the unrestricted debit card, the distributions are nearly identical, except that no one using the card spent above $10. One explanation for this result could be that the amount on the card suggested a limit on spending that would not otherwise exist, curbing the consumption of those on the upper tail. In fact, no individual spent any cash when given an unrestricted debit card. However, little weight should be placed on differences in the tails of distributions, and further tests would be needed to determine whether this result is robust to altered levels of card endowments.

When faced with the restricted debit card, individuals spent an average of 13 cents more than they did when using cash. Unlike the unrestricted treatment, here we observe that the spending distribution for the restricted treatment diverges from the cash treatment, with more mass placed on the tails of the distribution. Again, we note that individuals using the card tended not to spend more than $10. In this case, the effect is clearly due to the spending norm suggested by the amount on the debit card. Most participants spent some cash in addition to the money spent on a debit card (on average $1.04).

Figure 4
Cumulative distribution of spending for cash and debit card treatments



Source: Economic Research Service, USDA.

Measuring Treatment Effects: How Much of the Variation in Food Choice Is Due to Payment Effect?

Testing for differences in mean values among payment and preselection options suggests that these treatments do correlate with different food choices. However, it is important to recognize that other factors, such as an individual's gender, Body Mass Index (BMI), or how long he or she had gone between meals, may also affect his or her food choices. Thus, for a more precise measure of the effect of each treatment, we use propensity matching scores to estimate how much expenditures and nutrient intake respond to each treatment, while holding these factors constant. In particular, we use the matching estimation procedure developed by Abadie, Drukker, Herr, Imbens (2004), which matches outcomes between treated observations to those in the control based on a vector of independent variables. Matches are determined by minimizing Euclidean distance, and a sample of nearest matches are drawn for estimation of the treatment effect. See Abadie, Drukker, Herr, and Imbens (2001) for details.

After controlling for these factors, we still find that our results hold (table 7). Namely, individuals using the unrestricted card consumed 95 more calories, 2 more grams of added sugars, 7 more grams of fat, 2 more grams of saturated fat, and 11 more milligrams of caffeine than individuals using the restricted debit card. Over time, these seemingly small differences could lead to substantial changes in diet quality, body weight, and health.

Table 7
Mean effect controlling for Body Mass Index, gender, and hours since last meal

	Cash versus unrestricted		Cash versus restricted		Unrestricted versus restricted	
Item	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Calories	21.3002	52.3336	76.45016*	45.34302	94.4898**	48.8895
Calories from more nutritious foods	102.0725***‡	34.5758	86.6949**	35.8072	198.0445***‡	34.7789
Calories from less nutritious foods	123.1275**	56.9196	170.5736***‡	52.2125	294.8636***‡	54.7064
Added sugar	2.9611**	1.3731	0.3440	0.9638	2.2396*	1.2265
Total fat	2.3344	2.9570	8.4740***‡	2.6522	6.8768***†	2.5082
Saturated fat	1.1275	1.1311	2.9113***‡	0.9678	2.0220**	0.9455
Percent calories from fat	7.01*	4.02	9.82***†	3.56	6.38**	3.15
Percent calories from saturated fat	3.02*	1.86	3.77**	1.59	2.28*	1.41
Sodium	259.931**	124.093	193.369*	104.652	37.9986	105.659
Caffeine	9.6243***‡	3.1801	4.3701*	2.3337	11.7405***‡	3.0359
Expenditures	0.5038	0.4112	0.2252	0.3718	0.3853	0.3771

*,**,***Treatments differ by 10, 5, and 1 percent.
†, ‡Differences are significant at the 10- and 5-percent level after using the Bonferroni corrected p-values.

Possible Policy Implications

While this study is on a small scale and the results should not be interpreted as widely generalizable, the results may have implications for environmental strategies for obesity protection. In particular schools may find these concepts useful as they strive to design wellness policies that would promote healthful food choices by students.

Schools participating in the National School Lunch Program (NSLP) receive cash and some commodities from USDA. In return, these schools provide free or reduced-price lunches to needy school children whose families meet the income cutoffs. National food consumption survey data indicate that many children choose foods high in saturated fat, sodium, and added sugars at the expense of fruits, vegetables, low-fat milk, and whole grains (Lin et al., 2001). In response, today's NSLP seeks to promote both adequate intake of healthful foods and limits on high-calorie, low-nutrient foods. Meals sold as part of the NSLP must meet Federal dietary standards, which include limits on fat and saturated fat (Oliveira, 2006; for a detailed account of the history, trends, and objectives of the NSLP, see Ralston et al., 2007).

However, most American schools choose to sell at least some foods and beverages that are not a part of the USDA school meal program (O'Toole et al., 2007). These foods and beverages are often labeled "competitive foods" because they compete with NSLP meals and have been criticized as being frequently high in calories, saturated fat, sodium, or sugars (O'Toole et al., 2007). A 2005 study of U.S. public schools found that, although less than half of all public schools have vending machines, nearly 80 percent of schools offer a la carte foods (Finkelstein, Hill, and Whitaker, 2008). This study also found that school food environments are less healthy among children in higher grade levels and that most secondary schools offer less nutritious foods through a la carte and vending machines sales. Competition with less nutritious options may result in decreased consumption of the healthier choices provided through USDA meals. The School Nutrition Dietary Assessment Study-III (SNDA-III) found that, although USDA school meals provided to all grade levels regularly include fruit or juice, only 32 percent of high school student participants reported consuming fruit at lunch compared with 55 percent of elementary school participants (Gordon et al., 2007).

To address current concerns about high-calorie, low-nutrient foods being sold in American schools, the Child Nutrition and WIC (Special Supplemental Nutrition Program for Women, Infants, and Children) Reauthorization Act of 2004 (Public Law 108-265) required that every school district participating in the NSLP, as of school year 2006-07, have a local school wellness policy. It is intended to be a tool to address obesity and promote healthy eating and physical activity through changes in school environments. Each district's wellness policy must provide assurances that school meals meet Federal guidelines; provide nutrition guidelines for all foods available at school; and specify goals for nutrition education, physical activity, and other school-based wellness activities. However, districts have flexibility as to the specific policies and guidelines they develop.

Suggested strategies for improving the choices of foods and beverages made by children and adolescents at school have included nutrition education,

restricting sales of some items, or manipulating prices of a la carte items to encourage healthful choices (Story et al., 2006). While such intervention policies have been shown to influence food choice, psychological and behavioral tools may be as equally effective as these more traditional interventions (Just, Mancino, and Wansink, 2007).

Our research findings suggest that allowing individuals, or in the case of younger school-aged children, their parents, to prepay for a restricted set of approved foods may result in increased consumption of healthful foods. Depending on the infrastructure of the cafeteria, offering a restricted card along with an unrestricted card may be possible. How closely the results of this experiment resemble those in an actual cafeteria setting will depend heavily on how well individuals understand the debit card system and its potential impacts on diet quality.

It may also be important to evaluate which foods should be displayed when ordering and which should be hidden until after ordering has taken place. This choice should be based on the visual appeal of the items and their nutritional content. Thus, it may be useful for cafeterias to monitor the specific reactions to the foods they consider placing prominently. This effect can be fine tuned by tracking how sales of each item change with changes in product placement.

A key advantage of leveraging behavioral influences is that they may only require slight modifications to existing programs. Also, administrators of school food services are in a unique position to control many of the elements that have been shown to influence food choice, such as the order and way in which foods are presented, when they can be selected, and the actual eating environment. Results of this experiment suggest that placing limitations on items that can be purchased with prepaid debit cards improves the healthfulness of food choices. An advantage of such a system is that it could allow parents significant control over their child's purchases, without necessarily decreasing overall choice within a school. However, the interventions discussed in this study may be better suited for middle and high school meal programs. And of course, pilot studies within school cafeterias would be needed to accurately assess the full costs, benefits, and feasibility of these interventions.

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