

Using Incentives to Encourage Healthy Eating in Children

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We use data from a field experiment at 15 elementary schools to examine effective incentives that increase the fraction of children eating a serving of fruit or vegetable as part of their school lunch. We were able to raise the fraction of children eating fruits or vegetables at lunch by 27.3 percentage points (an 80% increase) by providing a small incentive. The incentives also reduced the fraction of fruits and vegetables being thrown away by 43%. Our results indicate that small incentives can dramatically increase fruit and vegetable consumption during school lunch. Incentives also increase the cost effectiveness of the money schools are already spending on fruits and vegetables by increasing the fraction of those items that actually get consumed.

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The United States continues to confront the growing levels of obesity among all age groups, but particularly among children (Hedley et al. 2004). Childhood obesity carries with it numerous future costs including decreased labor productivity and healthcare expenses associated with increased risk of diabetes. While there are a number of competing claims about the root causes of the increase in obesity among children, the recommended behavioral changes for individuals are pretty clear: a better diet and more exercise. Though there are many structural issues that hinder these personal improvements, the real question is how to promote these behavioral changes in individuals (Bertrand and Schanzenbach 2009).

There is a growing body of research that examines the impacts of financial incentives on various positive behaviors in school-age children (Angrist and Lavy 2009; Bettinger 2006; Kremer, Miguel, and Thornton 2009). Research on the use of financial incentives to encourage healthy behaviors has mostly focused on adults. Incentivized health behaviors have included weight loss, smoking cessation, health screenings, and immunizations (Cawley and Price 2009; Volpp et al. 2008; Volpp et al. 2006; Malotte, Rhodes, and Mais 1998; Moran et al. 1996). In this paper, we examine the degree to which the use of small rewards can increase the fraction of children who eat fruits and vegetables as part of their school lunch.

Several studies have documented the fact that children in low-income households consume fewer amounts of fruits and vegetables (Krebs-Smith et al. 1996; Muñoz et al. 1997). One explanation for the persistent income gaps in fruit and vegetable consumption is the high cost (or perceived high cost) of purchasing fruits and vegetables (Cassady, Jetter, and Culp 2007; Havas et al. 1998). The school lunch program provides an opportunity for low income children to have free access to fruits and vegetables as part of their school-provided lunch. However, the potential benefits of these opportunities will only be realized if these children actually eat the

healthy items being offered. Our rewards were designed as one way in which a habit of eating fruits and vegetables might be encouraged (Krebs-Smith et al. 1995).

Research on other interventions indicates that children may be particularly sensitive to even small changes when making food decisions. In one intervention, the fraction of children eating fruit increased by simply having the cafeteria workers ask whether the child wanted some fruit or juice (Schwartz 2007). Other studies provide similar evidence about the importance of the cafeteria workers providing encouragement to eat fruits and vegetables (Perry et al. 2004). A number of other programs that include educational materials, food service changes, and parental involvement have shown modest but consistent improvements in fruit and vegetable consumption, though the effects of these programs are sometimes limited to only fruit or even just fruit juice consumption (Gortmaker et al. 1999; Perry et al. 1998; Cassady et al. 2006).

In this study, we examine the impact of providing rewards and test the degree to which the response to incentives depends on the nature of the reward being offered. Past research suggests that physical prizes and cash rewards may have a different effect and that the timing of when the reward is received will matter as well (Kivetz and Simonson 2002; Laibson 1997; Bettinger and Slonim 2007). We randomly assign each school to one of five different incentives that vary in size (quarter or nickel), type (cash or prize), and timing (now or in a few weeks).

I. Experimental Design

We conducted a field experiment at fifteen elementary schools in Utah. The schools in our study provide a main entrée and students are allowed to choose as many items as they want from a selection of fruits, vegetables, and other side dishes. Our research assistants stood by the trash cans in each cafeteria and recorded the number of fruits and vegetables both taken and consumed by each child (potatoes, corn, and fruit juices were not included as fruits or

vegetables). Most of the fruits and vegetables came in special cups while others left behind a peel or core. Our data collectors were instructed to not mention fruits or vegetables when asked what they were doing but rather to reply that they were collecting data about school lunches.

During our baseline data collection period, 61.7% of children took at least one serving of fruits or vegetables and 54.1% of those children ate at least one serving of those items (for an overall consumption rate of 33.3%). We also found that about 42.7% of the servings of fruits and vegetables that were served ended up in the trash.

After the baseline period, we randomly assigned each of the 15 participating schools to one of 5 groups: (1) receive money immediately, (2) receive prize immediately, (3) receive money at the end of the month, (4) receive a prize at the end of the month, (5) no incentive (control). The money or prize equivalent was set to a quarter for each day that the child ate a serving of fruits or vegetables. In two of the no treatment schools, we also introduced an additional group (6) that received a nickel immediately. Rather than giving out prizes that were worth a quarter, we gave the children raffle tickets for a prize that they could win that day. The total value of these prizes was equal to the number of kids who ate their fruits or vegetables for that day multiplied by 25 cents. Many of the prizes were related to some form of active recreation such as rip-sticks, tennis rackets, soccer balls, and swim goggles.

The treatment days occurred over 5 lunch periods spanning 2-3 weeks. On each treatment day there was a message in the morning announcements, read over the schools public address system, about the reward students could receive by eating a serving of fruits or vegetables that day. We displayed prizes near where we were collecting data, visible to all students.

II. Results

In Table 1, we provide pre and post-treatment information about the fruit and vegetable consumption patterns for each of our school treatment groups. Our key measures are the fraction of kids who took at least one serving of fruits or vegetables, the fraction of kids who ate at least one serving of fruits or vegetables, and the fraction of these items that ended up being thrown away. Among schools that provided an immediate reward, the change in behavior was lowest when the reward was a nickel (a 15.4 percentage point jump), and was highest when the reward was a quarter (a 38.4 percentage point jump). The regression results that follow test more precisely how the response to incentives differed based on nature and timing of the reward.

In Panel A of Table 2, we report the overall effect of the incentives program on the fraction of kids that ate a serving of fruits or vegetables, the number of items eaten, and the wastage rate. All of the regressions include school fixed effects, day of the week fixed effects, controls for the child's grade and gender, and an indicator for whether there were only vegetables offered that day. The incentive variable is an indicator for whether this was a day in which we were providing rewards for fruit and vegetable consumption.

The coefficient on the incentive variable in Panel A indicates that there was a 27.3 percentage point increase in the fraction of children eating at least a serving of fruits or vegetables when any incentive was offered. Panel B of Table 2 provides the specific effects of each type of incentive. In general, money rewards produced a larger response than a cost-equivalent prize. The largest behavioral change came in response to the same-day quarter award, which increased the fraction of those eating a serving of fruits or vegetables by 38.8 percentage points while students who had to wait a few weeks to receive their quarter increased by 27.7 percentage point (the test of the difference in these two coefficients has a p-value of 0.110).

Surprisingly, the results in Table 2 actually show a slightly greater response to a delayed prize than an immediate prize. This is likely the result of the way in which the prizes were displayed to the students. At the schools where we were doing an immediate prize we would display the set of prizes that they would win that day. At the schools where the prize was going to be received at a later date we displayed the set of prizes that we would give out at the later date, which was a much larger set of prizes since the future raffle would involve all five days of prizes at once.

One concern with our reward mechanism is that it creates an incentive to eat one serving and no more. This could lead to a social norm, in which individuals already consuming multiple servings decrease their consumption to just one serving. Figure 1 displays the distribution of the number of servings of fruits and vegetables that children were consuming. There was a big drop in the fraction consuming zero and a large increase in the fraction consuming one serving. At the higher levels, the fraction of children eating two servings increases from 3.8% to 6.6% and the fraction of children eating 3 or more drops from 0.7% to 0.5%.

Another concern with incentivizing behavior is the cost of providing the rewards. Given that we are working with children, the size of the rewards needed to incentivize behavior is small. Even if a school were to provide a quarter each day to each student for the entire school year, the cost for one year would only be \$45 if the child ate a serving of fruits and vegetables every day. The labor costs of distributing the rewards, using our method, would cost up to an additional \$24 per child (based on two workers per school being paid a wage of \$8.50 an hour). This is less than the \$50-\$75 allotted to schools per student through the Fresh Fruit and Vegetable program, which is designed to increase fresh fruit and vegetable consumption by providing children opportunities to receive fruits and vegetables at other times during the day besides breakfast and lunch. As such, a small-rewards program, implemented over a one or two

week period, would constitute only a small fraction of the money allocated to programs with similar goals.

The rewards program could also have an additional cost to schools in terms of the additional items of fruits and vegetables that they would serve. There was a minor increase in the number of items being served by the schools (about .122 servings per child) but the number of discarded items per student decreased by 0.184 (a 43% decrease). As a result, the rewards led to a dramatic increase in the cost-effectiveness of the money the school was already spending on fruits and vegetables since fewer of these items were ending up in the trash.

We also examine whether the incentives had a larger impact on the schools with a larger fraction of low-income children (as measured by the fraction of children receiving a free or reduced price lunch). The schools in our sample range from 17% of the students receiving a free or reduced price lunch up to 77%. We re-center this measure at each school by 17 percentage points so that the coefficient on the incentive variable represents the effect at the schools with the smallest fraction of low income children.

The coefficients in the first row of panel C in Table 2 indicate that at the richest schools the fraction of children eating a serving of fruits and vegetables increased by 17.7 percentage points (about 35% lower than the overall effect across all schools). The effect of the incentive is larger at schools with a greater fraction of low-income students, such that the effect was 38.2 percentage points at the schools in our sample with the most low-income children. As a result, the incentives appear to have a much larger effect at the schools for the which the benefits to consuming fruits and vegetables are likely to be the largest (given the low levels of consumption at home for these students).

Many past studies of interventions to increase the consumption of fruits and vegetables have only found the effects for fruit consumption but not for vegetables (Krebs-Smith et al.

1996). We did not collect data on which item each child ate but rather simply recorded whether they had eaten at least one serving of fruits or vegetables. However, we restrict our analysis to the twenty days in which only vegetables were offered (and no fruit). Of these 20 days, 12 occurred during the baseline period and 8 occurred during the incentive period.

We find that on the 12 baseline vegetable-only days, the fraction of kids eating a serving of vegetables was 16.4% well below the overall sample average of 33%. During the 8 days in which we were providing some type of incentive, this rate jumps up to 45.4%, almost a three-fold increase. When we estimate this change using a simple regression that controls for day of the week and child gender and age, we find an increase vegetable consumption of 26.6 percentage points (p -value=.003). In order to include school fixed effects in this regression, we focus on the five schools that have a vegetable-only day both prior to and during the incentive period (with a combined 14 days of data). For these five schools we find an increase in vegetable consumption of 24.0 percentage points (p -value=.015).

We also examine the degree to which our short-run incentives influenced consumption patterns after the incentives were removed. Underlying much of the debate about the use of incentives is the question of whether removing the incentives might return the child to a lower consumption level (Lepper, Greene, and Nisbett 1973). This may happen if the incentive replaces the intrinsic motivation for consumption. Our original field experiment was only designed to capture the immediate effect of the incentives and we did not collect any consumption data after the removal of the incentives. However, we were able to run a follow-up experiment in which we conducted the quarter-now treatment at 8 additional schools in exactly the same ways as we did in the original field experiment (five days of baseline data and five days of incentives). However, in the follow-up experiment we were able to collect data for the four

weeks after the end of the incentive (with data collected two days each week for those four weeks).

In Table 3, we present the results of this second field experiment. These regressions are set-up in the same way as Table 2, except now there is the additional variable of post-incentive, which indicates the change in consumption patterns during the four weeks after the incentives are removed. In this follow-up experiment, we again find that the incentives created a larger increase in the the fraction of children eating a serving of fruits or vegetables (a 70% increase) and a large decrease in the wastage rate (a 43% decrease). These effects are larger than the overall effect of the original experiments, but smaller than would be expected for the quarter-now treatment, based on the original experiment.

When we look at the change in behavior after the removal of the incentives, there appears to be a modest but significant increase in the fraction of children eating fruits and vegetables. However, in panel B, when we divide this up into the effects that occurred during the first two weeks after the removal of the incentives and the next two weeks, we find that effect is entirely concentrated into the first two weeks after the end of the incentives, with no apparent long-run effect on behavior.

III. Conclusion

We implemented a randomly assigned rewards program at 15 elementary schools. We collected individual-level data on the number of fruits and vegetables that each student both placed on their tray and ate for lunch. Our results indicate that providing small rewards can lead to large increases in the fraction of children who ate fruits and vegetables as part of their school lunch. We find that cash rewards created a larger response than cash-equivalent prizes and that the children were responsive to even really small monetary rewards (a nickel).

We also find that the rewards increased even on days when only vegetables are served, which is in contrast to some past interventions that have only been successful in increasing fruit or even just fruit juice consumption. Also, when we look at the distribution of the number of items that each child ate, we find that nearly all of the change was occurring by moving children from eating zero servings of fruits and vegetables up to one serving of fruits and vegetables. We find little evidence that setting a benchmark of one serving reduced the consumption of fruits and vegetables for children who were already consuming above the benchmark. We also provide suggestive evidence based on administrative data that the introduction of short-term rewards may have had some positive long-run increases in fruit and vegetable consumption, though we hope to address this particular question in future research.

One of the most encouraging findings of the project, from a cost effectiveness perspective, was that the incentives reduced the amount of fruits and vegetable items that were being thrown away by 40%. As a result, a small-rewards program can increase the cost effectiveness of money that schools are already spending on fruits and vegetables by increasing the fraction of those items that actually get consumed.

REFERENCES

- Angrist, Joshua and Victor Lavy. 2002. "The Effects of High School Achievement Awards: Evidence from a Randomized Trial." *American Economic Review*, 99, 1384-1414.
- Bertrand, Marianne and Diane Whitmore Schanzenbach. 2009. "Time Use and Food Consumption." *American Economic Review*, 99, 170-76.
- Bettinger, Eric and Robert Slonim. 2007. "Patience among Children." *Journal of Public Economics*, 91, 343-63.
- Bettinger, Eric. 2006. "Paying for Performance in Grade School: Evidence from a Policy Experiment." Work in progress.
- Cassady, Diana; Karen Jetter and Jennifer Culp. 2007. "Is Price a Barrier to Eating More Fruits and Vegetables for Low-Income Families?" *Journal of the American Dietetic Association*, 107, 1909-15.
- Cassady, Diana; Rainbow Vogt, Debbie Oto-Kent, Ramona Mosley and Richard Lincoln. 2006. "The Power of Policy: A Case Study of Healthy Eating Among Children." *American Journal of Public Health*, 96, 1570-71.
- Cawley, John and Joshua Price. 2009. "Outcomes in a Program that Offers Financial Rewards for Weight Loss." NBER Working Paper No. 14987.
- Gortmaker, Steven; Lilian Cheung, Karen Peterson, Ginny Chomitz, Jay Hammond Cradle, Hank Dart, Mary Kay Fox, Reba Bullock, Arthur Sobol, Graham Colditz, Alison Field and Nan Laird. 1999. "Impact of a School-based Interdisciplinary Intervention on Diet and Physical Activity among Urban Primary School Children: Eat Well and Keep Moving." *Archives of Pediatrics and Adolescent Medicine*, 153, 975-83.
- Havas, Stephen; Katherine Treiman, Patricia Langenberg, Michael Ballesteros, Jean Anliker, Dorothy Damron and Robert Feldman. 1998. "Factors Associated with Fruit and Vegetable Consumption among Women Participating in WIC." *Journal of the American Dietetic Association*, 98, 1141-48.
- Hedley, Allison; Cynthia Ogden, Clifford Johnson, Margaret Carroll, Lester Curtin and Katherine Flegal. 2004. "Prevalence of Overweight and Obesity among U.S. Children, Adolescents, and Adults, 1999-2002." *Journal of the American Medical Association*, 291, 2847-50.
- Kivetz, Ran and Itamar Simonson. 2002. "Earning the Right To Indulge: Effort As a Determinant of Customer Preference Toward Frequency Program Rewards." *Journal of Marketing Research*, 39, 155-70.
- Krebs-Smith, Susan; D. Annetta Cook, Amy Subar, Linda Cleveland, James Friday and Lisa Kahle. 1996. "Fruit and Vegetable Intakes of Children and Adolescents in the United States." *Archives of Pediatrics and Adolescent Medicine*, 150, 81-86.

- Krebs-Smith, Susan; Jerianne Heimendinger, Blossom Patterson, Amy Subar, Ronald Kessler and Elizabeth Pivonka. 1995. "Psychosocial Factors Associated with Fruit and Vegetable Consumption." *American Journal of Health Promotion*, 10, 98–104.
- Kremer, Michael; Edward Miguel and Rebecca Thornton. 2009. "Incentives to Learn: Merit Scholarships that Pay Kids to Do Well." *Review of Economics and Statistics*, 91, 437-56.
- Laibson, David. 1997. "Golden Eggs and Hyperbolic Discounting." *Quarterly Journal of Economics*, 112, 443–77.
- Lepper, Mark; David Greene and Richard Nisbett. 1973. "Undermining Children's Intrinsic Interest with Extrinsic Reward: A Test of the 'Overjustification' Hypothesis." *Journal of Personality and Social Psychology*, 28, 129–37.
- Malotte, C. Kevin; Fen Rhodes and Kathleen Mais. 1998. "Tuberculosis Screening and Compliance with Return for Skin Test Reading among Active Drug Users." *American Journal of Public Health*, 88, 792–96.
- Moran, William; Karen Nelson, James Wofford, Ramon Velez and L. Douglas Case. 1996. "Increasing influenza immunization among high-risk patients: education or financial incentive?" *American Journal of Medicine*, 101, 612–20.
- Muñoz, Kathryn; Susan Krebs-Smith, Rachel Ballard-Barbash and Linda Cleveland. 1997. "Food Intakes of U.S. Children and Adolescents Compared With Recommendations." *Pediatrics*, 100, 323–29
- Perry, Cheryl.; Donald Bishop, Gretchen Taylor, David Murray, Rita Warren Mays, Bonnie Dudovitz, Mary Smyth and Mary Story. 1998. "Changing Fruit and Vegetable Consumption among Children: The 5-a-day Power Plus Program in St. Paul, Minnesota." *American Journal of Public Health*, 88, 603–9.
- Perry, Cheryl; Donald Bishop, Gretchen Taylor, Marsha Davis, Mary Story, Clifton Gray, Susan Bishop, Rita Warren Mays, Leslie Lytle and Lisa Harnack. 2004. "A Randomized School Trial of Environmental Strategies to Encourage Fruit and Vegetable Consumption among Children." *Health Education and Behavior*, 31, 65–76.
- Schwartz, Marlene. 2007. "The Influence of a Verbal Prompt on School Lunch Fruit Consumption: a Pilot Study." *The International Journal of Behavioral Nutrition and Physical Activity*, 4, 6.
- Volpp, Kevin; Leslie John, Andrea Troxel, Laurie Norton, Jennifer Fassbender and George Lowenstein. 2008. "Financial Incentive–Based Approaches for Weight Loss: A Randomized Trial." *Journal of the American Medical Association*, 300, 2631–37.
- Volpp, Kevin; Andrea Levy, David Asch, Jesse Berlin, John Murphy, Angela Gomez, Harold Sox, Jingsan Zhu and Caryn Lerman. 2006. "A Randomized Controlled Trial of Financial Incentives for Smoking Cessation." *Cancer Epidemiology, Biomarkers & Prevention*, 15, 12–18.

Table 1. Comparison of child eating behavior by treatment group.

		Overall	Quarter now	Nickel Now	Quarter later	Prize now	Prize later
Ate a serving of fruits or vegetables	(pre)	0.333	0.327	0.311	0.356	0.333	0.331
	(post)	0.599	0.712	0.465	0.627	0.532	0.596
Took a serving or fruits or vegetables	(pre)	0.633	0.701	0.511	0.695	0.615	0.562
	(post)	0.774	0.870	0.628	0.753	0.729	0.823
Wastage rate	(pre)	0.442	0.513	0.363	0.433	0.449	0.386
	(post)	0.259	0.217	0.257	0.190	0.272	0.351
N=		47,745	11,907	5,900	9,496	6,677	9,889

Notes: “Pre” refers to days prior to any incentives and “post” refers to days in which we provided an incentive. The unit of observation is the student–day. Incentives that were received later occurred 1–2 weeks after the child ate the fruits or vegetables. The wastage rate is the fraction of items that students took that ended up being discarded in the trash.

Table 2. Effect of incentives on children's fruit and vegetable consumption (original field experiment).

A. Overall Effect	Ate a serving	Number of items eaten	Wastage rate
Incentive	0.273** [0.031]	0.274** [0.032]	-0.184** [0.039]
B. Specific Effects			
Quarter Now	0.388** [0.050]	0.433** [0.065]	-0.305** [0.030]
Quarter Later	0.277** [0.047]	0.268** [0.052]	-0.231** [0.044]
Nickel Now	0.170** [0.040]	0.207** [0.052]	-0.079* [0.031]
Prize Now	0.220** [0.050]	0.202** [0.058]	-0.165** [0.031]
Prize Later	0.252** [0.031]	0.213** [0.036]	-0.070 [0.051]
C. Overall Effect			
Incentive	0.177** [0.040]	0.201** [0.045]	-0.134* [0.053]
Incentive * (Fraction of school with free/reduced price lunch)	0.342* [0.151]	0.263 [0.173]	-0.174 [0.128]
Mean (pre-period)	0.336	0.433	0.428

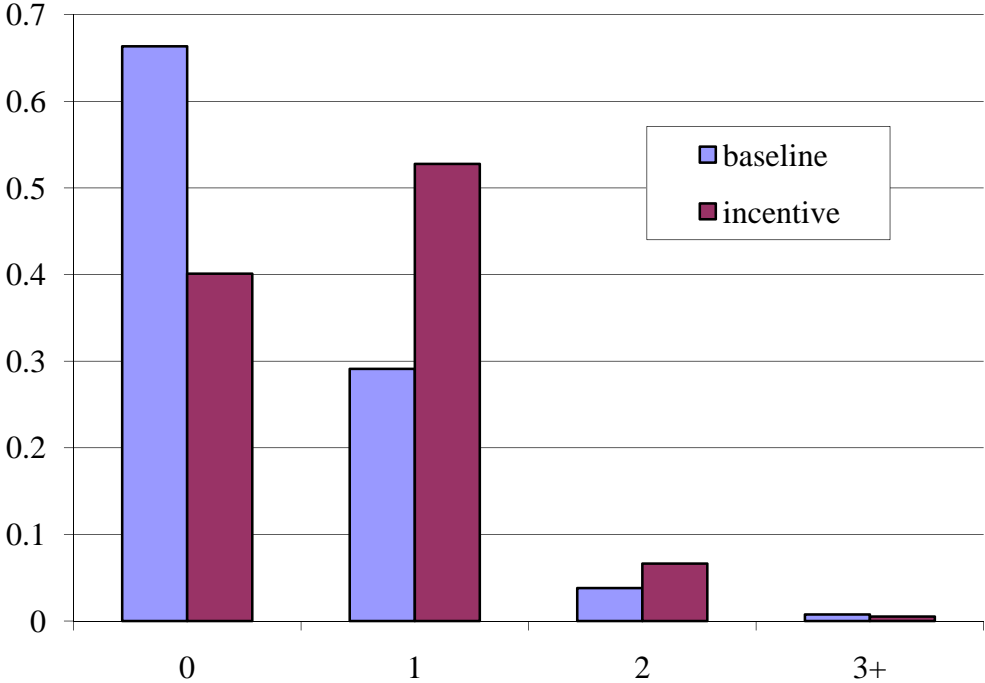
Notes: The unit of analysis is the student day (N=47,745). The regressions also include school and day of week fixed effects and controls for the child's grade and gender and whether only vegetables were offered that day. Standard errors are clustered at the school level. The regression with number of items wasted is weighted by the number of items each child took. The fraction of the school with free/reduced price lunch has been centered at the 20%, which is the lowest rate that we observe among the schools in our sample. **, and * indicate statistical significance at the 1% and 5% levels respectively.

Table 3. Impact of incentives on behavior after incentives are removed (follow-up field experiment).

A.	Ate a serving	Number of items eaten	Wastage rate
Incentive	0.304** [0.020]	0.250** [0.018]	-0.222** [0.021]
Post-incentive	0.053* [0.021]	0.022 [0.023]	-0.008 [0.020]
B.			
Incentive	0.305** [0.020]	0.251** [0.018]	-0.225** [0.020]
First 2 weeks after	0.094** [0.022]	0.062* [0.024]	-0.052 [0.025]
Next 2 weeks after	0.023 [0.026]	-0.006 [0.027]	0.023 [0.028]
Mean (pre-period)	0.420	0.578	0.519

Notes: The data in this table is based on a separate set of field experiments than Table 2. The unit of analysis is the student day (N=36,196). The post-incentive period includes the four weeks after the removal of the incentives. The regressions include school and day of week fixed effects and controls for the child's grade and gender. Standard errors are clustered at the school level. The regression with number of items wasted is weighted by the number of items each child took. **, and * indicate statistical significance at the 1% and 5% levels respectively.

Figure 1. Changes in the number of servings of fruits and vegetables consumed.



Notes: This figure shows the fraction of children who ate that number of servings of fruits and vegetables during the baseline period and during the incentive period.