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Student responses to the changing content of school meals in India

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Abstract

Can countries with binding budget constraints increase the benefits of school transfers through better program design? We use a cost-neutral change in the design of India's school meal program to study this question. Municipal schools in Delhi switched from packaged snacks to cooked meals in 2003, with no change in payments to meal providers. We use variation in the timing of this transition and child-level panel data to estimate a 3 percentage point rise in average monthly attendance in response to the new program. The effects are largest for early grades, morning school shifts and schools serving diverse menus.

Keywords: school meals, attendance, program design

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1 Introduction

Transfers to poor families have become a popular instrument for increasing the enrollment, attendance and academic performance of children in school. A variety of programs have been implemented across the world, including cash transfers, scholarships, free textbooks and school meals. Many of these initiatives have improved participation rates, especially for girls and young children, but at relatively high cost (Glewwe and Kremer, 2006; Schultz, 2004). Can countries with binding budget constraints increase the benefits of these transfers through better program design? In this paper we study the attendance effects of a fiscally neutral transition in India's school meal program from ready to eat snacks to cooked meals for children in public primary schools. We combine the variation in timing and composition of these meals across schools with student-level panel data on attendance, to identify the most effective components of the new program and the types of students most responsive to it.

The Indian mid-day program is remarkable both for its size and its very low cost. Three and a half million children in the world today are estimated to have access to school meals and about one third of these are in India (World Food Programme, 2013). In 2003, at the start of our study period, the cost of grain and meal preparation borne by the government was 2.35 Indian rupees per day per student which was a little under 5 cents or 10 dollars for a 200-day school year. To put these figures in perspective, the average cost of running the Food for Education (FFE) program at the World Food Program in 2005 was 15.79 USD (Adelman et al., 2008), the FFE program in Bangladesh cost 25 USD in 1996 (Ahmed and Del Ninno, 2002) and school meals administered by the World Food Program in Burkina Faso in 2005 cost about 40 USD per student per year (Kazianga et al., 2012) .

The current program has its origins in the Nutritional Support for Primary Education Program launched by the Indian government in 1995 under which each of the Indian states received free transfers of food grains and were responsible for their conversion into cooked meals for free distribution in public schools. As with many well-intentioned development schemes in India, implementation of the 1995 program was slow until the courts intervened. Most states provided either dry rations for students to take home or biscuits and other snacks. In a landmark judgement in November 2001, the Supreme Court of India ordered all states to complete the transition to on-site meals. States started to comply in 2003. Public schools in Delhi did so in two phases during the 2003-2004 academic year. Municipal authorities responsible for implementation shifted the existing allocations from the purchase of packaged snacks to privately contracted meal providers. The providers purchased meal ingredients, prepared the meals and transported them to schools for distribution during recess. Thus, from the perspective of the state-budget, the transition was cost-neutral.

The academic school year for public schools in Delhi starts in April and ends in March. We record student-level monthly attendance for the period April 2002- April 2004. The contracts for cooked meals were issued starting in July 2003 and this process was completed by April 2004. After the signing of contracts, schools transitioned to cooked meals in two phases. We adopt a difference-in-differences strategy to compare attendance rates of students in schools that transitioned early to those that transitioned later to cooked meals. By using multiple observations on the same student over our study period, we are able to control for unobservable individual heterogeneity that affects the level of attendance rates.

Our data are assembled from attendance and administrative records of over 1500 students in 19 randomly sampled schools. The schools in our sample are at most 15 kilometers apart and they are all in a single school district and administered by the same nodal authority, the Municipal Corporation of Delhi (MCD). We restrict attention to this geography within the vast expanse of Delhi to limit the otherwise wide variation we are likely to encounter in both observable and unobservable school, child and household characteristics. Although we track attendance by child and can therefore control for unobservable child characteristics that affect the level of attendance, this restricted sample makes it more likely that trends in attendance for the different schools are similar. We also explicitly examine this by comparing attendance in treatment and control schools in the year prior to the change in the meal program. We find that both sets of schools have very similar intra-year attendance patterns before the intervention.

We find an average increase in attendance rates of 3-4 percentage points in response to the transition to cooked meals. This effect however varies by grade, menu composition and the timing of the meal. The largest effects are seen for young children, diverse menus and schools that operate in the morning. We observe no effects for grade 5 children while those in grade 2 experience a 7 percentage point increase in average monthly attendance. We find that attendance gains were concentrated in schools where meals consisted of multiple items with pulses or vegetables provided in addition to cereals. Most of the boys schools in our sample operate in the afternoon shift, in the same building occupied by a girls school in the morning. This makes it difficult to disentangle gender effects from those related to meal timing.

Our results suggest that cooked meals may have made attending school more attractive. Since our data are administrative and collected retrospectively, we do not have measures of food intake or detailed household characteristics during the program transition. We conjecture that two main features of new program caused the attendance gains. First, the more perishable and less portable cooked meals increased the regularity with which students were fed. The Nutrition Foundation of India reported that packaged snacks were distributed on only 50 days in a school year on average, although the national policy mandated 200 days (Sharma et al., 2006). The school records for our sample show that cooked school meals were served for most days after the transition to the new program. The shift away from packaged food with a long shelf-life may have reduced leakages in the system of delivery and improved accountability. Second, a hot cooked meal may be perceived as nutritionally balanced and more satisfying than the biscuits that were distributed under the previous regime. Many of the households in our sample are among the poorest in Delhi and parents work as day laborers or are self-employed in the informal sector. The convenience of a meal at school may also have saved them the time and expense involved in feeding young children at home.

There is now a sizable literature on school feeding programs across the world. Some of this research is based on randomized evaluations in particular settings. For example, Alderman et al. (2012) estimate the effects of take-home rations and school feeding programs of equivalent value in Uganda by randomly assigning schools to the two programs and to a control group. They find that both programs are equally effective and improve school attendance by 8-9 percentage points. The sample of households in this study are however victims of civil conflict and so attendance rates are especially low, and food security a more serious issue than in normal school settings. Kazianga et al. (2012) use a similar randomized design in Burkina Faso in which all students are provided lunch on each school day while only girls are eligible for take-home rations conditional on an attendance threshold. In spite of the high program costs, there was almost no impact on absenteeism.

There are also several studies that use observational and administrative data to estimate the effect of school meals on schooling and health. Ravallion and Wodon (2000) and Ahmed (2004) find that the take-home rations program in Bangladesh resulted in higher school enrollment and daily attendance by students. Most research on India finds enrollment, nutrition and health effects are concentrated among young children. Afridi (2010, 2011) finds significant positive effects on child nutrition and school participation of girls in Grade 1 in a set of villages in central India while higher grades show no systematic effects. Singh et al. (2014) use longitudinal data on children from the state of Andhra Pradesh and find that cooked school meals are able to insulate children from household income shocks during drought years. Jayaraman and Simroth (2015) use enrollment data for the Indian states between 2003 and 2004. They use children in public schools in states without the program and in private schools as a quasi-control group. Once again enrollment effects are found only for Grade 1. These findings support earlier, more descriptive studies across states (Khera, 2006, 2013; Dreze and Goyal, 2003).

Our paper complements this body of research in several ways. First, we are able to track children and the schools they are in more carefully than previous studies. We can therefore avoid the contamination of our estimates by selection effects. For instance, an increase in transfers that raises both enrollment and attendance may lower average attendance if newly enrolled children have a lower propensity to attend school. Second, we are focussing on attendance while most studies of school meals in India have used enrollment as a measure of participation. While enrollment rates have been steadily rising, regular attendance continues to be a serious problem (Government of India, 2014; Educational Consultants India Limited, 2007). Third, we have records of the type of meal served and can specifically look at effects of meal menus which has not been done before. Finally, we observe costs within a large existing program, so the link between our results and implementable policy is much more direct than for studies based on randomized trials which may be difficult to scale-up. Our main contribution is to show that merely modifying the design of an existing program can lead to significant benefits. This is especially relevant in budget-constrained developing countries.

The rest of the paper is organized as follows: Section 2 provides a very simple theoretical framework which forms the basis of our empirical approach and also illustrates why the impact of school meal programs may differ greatly by school and country context. Section 3 discusses the data and estimation strategy. The results are presented in section 4 and section 5 concludes.

2 The attendance decision

An enrolled child attends school on a particular day based on the expected benefits and costs of attendance. We are agnostic about how these are aggregated within families and the precise role parents have in the attendance decision. We assume only that families trade-off benefits and costs of school participation which depend on many factors such as the opportunity cost of parental time, the need for the child's labor at home and the quality of school instruction. Transfers of food have effects at the margin on attendance decisions that may be largely determined by these other factors.

For a child indexed by i, we denote the average cost of attendance by μ_i. Idiosyncratic factors related to a child or family, may result in higher or lower costs on a particular day. We capture these factors by the random variable ϵ. Since all factors that systematically affect a given child are included in the mean μ_i, we assume the distribution of ϵ over each month has zero mean and is identical across students with distribution function $F(.)$ and density f.

For a student i on a day d of a given month, the cost of attending school is:

$$c_{id} = \mu_i + \epsilon_d$$

and if benefits per day are b_i conditional on attendance, a child will attend if $c_{id} < b_i$ or , so the monthly attendance rate is

$$A_i = F(b_i - \mu_i)$$

A transfer that increases benefits by t will increase the attendance rate by

$$\Delta A_i = F(b_i + t - \mu_i) - F(b_i - \mu_i) \tag{1}$$

We see from (1) that the change in attendance in response to a transfer depends on child characteristics as captured by the levels of b_i and μ_i. Figure 1 illustrates the gain in attendance as a result of the transfer for three different levels of the average cost μ_i and a given level of benefits and transfers, b and t respectively. The higher the density $f(\epsilon)$ over the interval $[b_i, b_i+t]$, the bigger the change in attendance rates. Unless f is monotonic, the change in attendance is not systematically related to the level of μ_i. We illustrate this in Figure 1 for ϵ distributed normally with unit variance and $\mu_i \in \{5, 5.5, 9\}$. To emphasize the role of shifting cost distributions we fix benefits across the three categories of students at $b = 6.6$, $b + t = 7$. Baseline attendance for the lowest cost students is 94.5 per cent and this changes by 3.2 percentage points (the sum of the solid and striped areas). For the student with slightly higher mean cost, the attendance rate changes from 86 to 93 percent (the sum of all three shaded areas) and for the student with the highest average costs, it barely changes (the solid area). Varying benefits by child would further complicate this figure. The main point we wish illustrate is that the effects of transfers will depend on the various factors that influence the costs and benefits of attendance such as grade level, gender, age and unobservable characteristics. The effects of these differences are theoretically ambiguous and need empirical investigation.

3 Data and Empirical Strategy

3.1 Data

Our data come from a sample of public primary schools run by the Municipal Corporation of Delhi (MCD). The MCD administers 80% of all primary schools in Delhi and 90% of primary school students in the state system are in these schools (Mahajan and Goyal, 2005). In 2003, the year of the transition to cooked meals, there were about 1800 MCD schools divided into 12 zones. We sampled schools from one of these- the central zone. We restricted our sample to a single zone to ensure that the schools in our sample served similar households. There were multiple meal providers serving cooked meals in this zone and the heterogeneity in meal menus across providers and schools allows us to study the effects of meal content on attendance rates. Table A1 in the Appendix indicates that the demographic characteristics of the central zone of the MCD are comparable to the average characteristics of urban Delhi. Figure 2 has our sample of schools marked on a map of the central zone with school names in the legend.

Students in the MCD schools first started receiving packets of biscuits and other snacks in 1997, but distribution was infrequent.[1] Following the Supreme Court's mandate on cooked meals in 2001, the MCD invited applications from potential meal providers. This was done in two phases in 2003. The first set of contracts for 410 MCD schools was signed in July. The program was extended in September and all schools were covered by April 2004. This resulted in exogenous staggering of the transition from ready-to-eat to cooked meals across schools. We use these differences in timing as well as the variation in meal timings and menus to study the effect of changes in the design of the meal program on attendance.

At the time we began our data collection in January 2008, there were three different meal providers in the central zone. The MCD administration provided us with lists of the schools served by them and we selected a random sample of 8 schools from each of the three lists, giving

[1] Biscuits were by far the most common snack distributed. Rice or wheat puffs and roasted pulses were also sometimes given.

us a total sample of 24 schools. These were not the original meal providers in 2003 but this type of stratification ensured that our sample covered most areas in the school zone. We gathered administrative data on attendance and meal content for two school years, 2002 and 2003. The transition occurred in 2003 but data for 2002 are useful in testing for whether the control and treatment schools in our sample had different attendance trends in the pre-program period.

We collect three types of data: child-level monthly attendance rates from school records, meal frequency and content from school meal records, and school infrastructure from a retrospective survey with school principals. The most time-intensive part of our data collection process was the digitization of student attendance records from classroom registers. These attendance rates are our primary dependent variable. The academic year in Delhi typically starts on April 1st and has 200 work days. After joining their new classes in April, students get a summer vacation of about six weeks from the middle of May to early July. July has some late enrollments and also high absenteeism of already enrolled students because many families delay coming back to Delhi after the summer. By September most students are attending regularly. This continues until February. Annual exams are in March and attendance becomes once again sporadic and dependent on the schedule of exams. Our focus is on the months of April to February. Some of the larger schools have more than one section per grade level and in these cases we requested attendance registers for a randomly chosen section. Since students seldom change their section as long as they are in the same school, by combining attendance of the same section over years we were able to construct a student level panel data set.

Gathering retrospective attendance data was complicated by the fact that schools are required to maintain attendance records for only 5 years and we started our study in 2008. We were able to get some attendance records for 22 of the 24 schools. For 19 of these 22 schools, we could obtain records of 2002 and 2003 for at least some grades. For 13 of the 22 schools, we were able to get attendance records for all grades (2-5) for the year 2003. Our grade-level analysis is therefore restricted to this smaller sample.[2]

The attendance rates for grade 1 are more noisy than those for the other grades because we are not certain of the date at which newly enrolled students actually began school. We therefore restrict our analysis to grades 2 through 5. Of the 19 schools for which we have attendance data, cooked meals began in 9 schools by early August 2003. We call these Phase 1 schools. The

[2] The few observable school level characteristics we have are similar for the 19 schools for which we obtained data and the 5 schools for which school records were missing.

rest continued to receive packaged snacks and transitioned to the meal program in October and November 2003. We call these Phase 2 schools. Children in Phase 1 schools form our treatment group and we compare changes in their attendance between April and September 2003 with those in the Phase 2 schools.

Each school maintains a school meal register with a daily entry for the menu offered and the number of students present. These data are used by the MCD to compensate meal providers, who receive payments based on average daily attendance. From this register we obtained the exact date each school transitioned to cooked meals and also recorded the menu provided for all school days in the month prior to the date of transition and the month immediately following it. We are able to get the date of transition for all schools but detailed menu information for only 14 out of our sample of 19 schools. Some schools under the cooked meal regime had mostly single item menus such as sweet or salty porridge while others frequently had two items- some form of cereal (rice or wheat) together with either vegetables or pulses. At the time, the MCD did not prescribe any norms on the type of meals to be served. In later years strict nutritional norms for daily calorie and protein requirements were introduced and the two-item menu became standard.

All the schools in our sample had transitioned to the new program by November 2003. For our analysis of the effects of menus on attendance, we examine the differential changes in attendance between April and December 2003 for children in schools that served two-items more frequently than others. We do not have retrospective data on the actual consumption of meals and therefore estimate the impact of meal availability. At the time of our data collection in 2008, we did measure uptake and found that it was near universal. In a random sample of 571 students in our sampled schools, 94.2% had consumed the cooked school meal on the day of our school visit.

Table 1 presents descriptive statistics for the 19 schools in our sample, by treatment status. The top half of the table is based on census data for 2001, the census year closest to the meal transition. We use literacy rates and the fraction of disadvantaged castes for each of the census areas (called wards) in which a school was located and average these for schools in the treatment and control groups.[3] The bottom half of the table is based on our own administrative and survey data. On average, the areas in which the two types of schools are located are similar and

[3] We do not report the fraction of Scheduled Tribes, the other officially recognized disadvantaged group, since there are hardly any such households either in the wards in which the schools are located or in the schools themselves.

their observable school characteristics are also comparable. Admittedly, the set of observable characteristics we have are limited which is why our empirical models control for child-level fixed effects. We now turn our empirical specifications. The samples used for different parts of our analysis are summarized in Table A2.

3.2 Empirical Specifications

Our main model is:

$$A_{ijm} = \alpha_0 + \alpha_1 * Sept + \alpha_2 Treat_j * Sept + \mu_i + \epsilon_{ijm} \tag{2}$$

where A_{ijm} is the attendance rate for child i in school j for month m. We use attendance rates for the months of April and September 2003, with April as the base month. The attendance rate for each month is computed as the number of days a child attends school in the month over the total number of school days in that month. *Sept* is an indicator for the month of September and $Treat$ is an indicator for Phase 1 schools which constitute our treatment group and transitioned to cooked meals in July and August 2003. The child fixed-effect μ_i captures time-invariant factors that affect attendance rates child i and ϵ_{ijm} is an idiosyncratic error term. When we use attendance data for the year 2003, α_2 is the difference-in-difference (DID) estimate of the impact of the cooked meal program.

Although the phased implementation of the program is plausibly exogenous, we cannot be certain that there are unobservable, time varying school characteristics that may have influenced both the timing of the meals and attendance rates . To address this concern, we look at changes in attendance rates between April and September 2002 for cohorts in the same grades of the same schools in 2002. To do so we restrict our sample to equivalent grades in 2002 and 2003 in our sample of 19 schools. Analyzing data for 2002 allows us a more stringent test of our program effect - if we find larger attendance gains in treatment schools in 2002, before the program was initiated, it is likely that some of the program effect we estimate in 2003 is driven by different attendance trends for schools in the treated and control sample. As we see in the next section, this was not the case.

The literature on mid-day meals suggests heterogenous impacts by grade and gender. We investigate these by estimating (2) separately by gender and grade. The grade regressions are restricted to the sample of 13 schools with complete attendance data in 2003. As mentioned above, attendance rates for April are difficult to compute for grade 1 children because we are often unsure of the exact enrollment date for these children. This is not true for higher grades since most children are already enrolled and are promoted from the previous year. To avoid errors or measurement, we restrict ourselves to data from grades 2 through 5.[4] We also estimate (2) separately for our sample of girls and boys. We are however limited in our ability to identify gender effects because our school sample has only two co-educational schools. For the rest, the girls schools are in the first half of the day while the boys attend afternoon shifts. This confounds gender effects with those of meal timing.

To examine the effects of differences in content of the cooked meals, we estimate a variant of (2) using attendance changes between April and December rather than September 2003 since all schools had the cooked meals by December. We now split the school sample based on the frequency of receiving two-item menus in the 30 days immediately following the introduction of the cooked meal program. The indicator for treatment now refers to the group of schools in which two-item menus were served more often than the median proportion of school days in our sample of 14 schools for which we had meal records.

4 Results

4.1 Average attendance changes

Table 2 shows changes in average attendance rates for schools in the treatment and control groups for the years 2002 and 2003. Prior to the introduction of cooked meals, in April 2002, the average attendance rate for the treatment schools was slightly lower but both treatment and control schools had an equivalent increases of .06 between April and September 2002. In contrast, between April and September 2003, attendance gains in control schools were similar to the previous year (0.07) while treatment schools had a much larger increase (0.11). The additional gain of 4 percentage points made by the treatment schools in 2003 suggests a sizeable

[4] The inclusion of grade 1 does not change our basic results and these estimates are available on request.

impact of the cooked meal program.

We now turn to estimates of (2) for the two years, 2002 and 2003. In columns 1 and 2 of Table 3 we restrict our sample to include only those grades in our sample of 19 schools for which we have attendance data for both 2002 and 2003 in order to examine whether the observed treatment effect is simply capturing differences in attendance trends across these two sets of schools. Our sample consists of 1591 students in 2003 and 1564 in 2002 respectively. Our observations are double this number because we collect attendance data for both April and September for each student. From Column 1 we see that the new program resulted in an estimated increase in student attendance of 2.7 percentage points. Column 2 provides us with the results of a placebo test because we estimate the same model and for the same grades, but with the attendance rates of 2002 as the dependent variable. Our main coefficient of interest $Treat \times Sept$ is close to zero (though imprecisely estimated), suggesting that attendance trends in treatment schools were similar to those in control schools before the program came into effect.

Each student, at the time of admission, is identified by a unique enrollment number. We use this to match attendance records in 2002 and 2003 and construct a panel of students who were in the same school for both years. Since students rarely switch sections we were able to track almost all students by following the same section across grades over the two years. However, we lose 3 schools for which we could not obtain the attendance records of the relevant grades in 2002. Thus Column 3 shows estimates from (2) but restricts the sample to a balanced panel of 827 students who were enrolled through April 2002 to September 2003. The estimate of 3.1 percentage points is slightly higher than the estimated effect in Column 1. Once again, we do not see similar effects for 2002 (Column 4) suggesting that the changes in 2003 are indeed attributable to the new meals. These estimates can be interpreted as measuring the impact of the program at the *intensive* margin by focussing on those already in the system.

4.2 Grade, gender and timing

To examine differences in treatment effects by grade, we estimate (2) for a restricted sample of schools with attendance data for grades 2 through 5 in 2003. These data are complete for 13 schools. In spite of the smaller number of schools in our sample, we have 1791 students because we are not conditioning on the availability of data for the same grade in 2002. Estimates by grade are in Table 4. The average treatment effect for this sample is 4.1 percentage points. The highest effect of 7.2 percentage points is for second grade. This declines for higher grades and disappears by grade 5. As with other studies in this literature, we find that the attendance younger children are most influenced by the new transfers.

Table 5 compares impact by gender. We find a positive effect of the meals only on girls (Columns 1 and 2). This gender effect, however, is confounded with the effect of meal timing in our sample. Most MCD schools run in two shifts - morning and afternoon. Schools for girls and co-educational schools both operate in the morning and end between noon and 1 p.m. while many of the schools for boys operate in the afternoon, from 1 p.m to 6 p.m., in the same buildings. Columns 3 and 4 show meal effects only for morning schools. In the last column we restrict the sample to schools that operate in the morning and interact the treatment indicator with gender for students in these schools. We find no systematic difference in the impact for boys and girls. These coefficients are however difficult to estimate precisely given our small sample of boys in morning schools. We have a total sample of 303 boys, of which 116 are in the treated schools. Our results on gender may therefore simply reflect timing of the meals. It is possible that a meal served in the late afternoon, around 3.00 PM, is less attractive than one served in the middle of the morning, around 10.30 AM. Since morning classes begin early in the day, students may not be able to eat a full meal at home before coming to school, unlike students in the afternoon shifts. This was the initial rationale behind the school breakfast program in the United States.

4.3 Meal Menus

When cooked meals were first introduced in 2003, the MCD listed 16 permissible menus. These included very simple and relatively cheap items such as sweet and salty porridge as well as more elaborate two-item menus, which combined rice or wheat bread with vegetables and pulses. Besides offering greater variety, the two item menus may have been more appetizing and nutritionally balanced. From the mid-day meal register, we find that two-item menus were provided about 22% of school days in the 30 days after starting cooked meals.[5] There is considerable variation across schools in the percentage of days with two-item menus. We do not have detailed information on the meal providers in 2003 but conjecture that this variation reflected differences in provider goals, financial capacity and physical infrastructure.

[5] On average, schools served a one item meal on 73% and ready-to-eat snacks on 2% of school days in a month. There was no distribution of meals on the remaining 3% of school days.

School records with menu information for each school day were available for 14 of our 19 schools. For this sample, we compare changes in attendance between April and December 2003 with the *treatment* group consisting of schools in which two-item menus were served for more than the median proportion of school days in the full sample, the rest acting as a control group. We see from Column 1 in Table 6, that average attendance rates were 2.3 percentage points higher in schools where two-item menus were more frequent.

4.4 Enrollment Effects

Our data are not well suited to estimating the impact of the meal program on enrollment because, unlike attendance, monthly enrollment data is not systematically recorded. The mid-day meal register does mention daily enrollment in addition to attendance and menu details. We use these figures for the period before and after the change in the meal program to ask whether enrollments went up substantially in the period immediately following the introduction of cooked meals. Since the MCD schools typically enroll students only until the end of August each year, we can only use Phase 1 schools for this analysis.

The mid-day meal registers for 13 of the 14 schools used for our menu analysis had these enrollment figures. We now include grade 1. Of these, 5 are Phase 1 schools. We tried to obtain daily enrollment for 30 days preceding and following the transition to cooked meals. The actual number of school days corresponding to this depended on number of holidays around the date of introduction of school meals. The minimum number of days for which we have enrollment data when ready-to-eat snacks were provided is 12 days while the number of days after cooked meals were introduced is 15. We decided to use a uniform window for each of the 5 schools and so use enrollment data for 27 days for each grade in these schools, giving us 135 observations per grade or a total of 675 observations for all 5 grades combined.

We estimate the following model for daily enrollment:

$$E_{gjd} = \delta_0 + \delta_1 Treat_{jd} + \phi_j + \upsilon_{gjd} \tag{3}$$

where E_{gjd} is the number of students enrolled in grade g in school j on school day d. $Treat_{jd}$ is an indicator for all school days with cooked meals in school j, ϕ_j are school-fixed effects. The change in enrollment resulting from the new meal program is given by δ_1. Since meals were not introduced on the same date everywhere, our data covers a different set of days for each school and we can estimate only a single difference model.

Table 7 presents our results. Column 1 shows the estimate for all grades combined and subsequent columns grade-wise estimates. Daily enrollment increased by 6.83 students on average and in grade 1 by more than 27 students. The effect diminishes monotonically by grade and we see no effect on grades 4 and 5. Our results, though suggestive, indicate that the program transition attracted younger children to schools. The effects are also shown in Figure A1 in the Appendix.

4.5 Potential Mechanisms

All our results point to improved rates of school participation, particularly for younger children, following the transition to cooked meals in public primary schools. We believe that there are two principal mechanisms underlying these results. First, the move to cooked meals improved the implementation of the transfers by reducing leakages and better matching them to actual attendance. Second, the meals may have attracted children to school because of their regularity, taste and nutritive value.

There are several reasons why cooked meals may have raised the level of transfers and better linked them to school participation. Prior to the cooked meals, biscuits and other snacks were typically procured by the school teachers for several weeks at a time, using funds released by the MCD. Delays in receiving funds and difficulties in finding staff to procure the snacks would often lead to interrupted distribution. The cooked meals shifted the responsibility of provision away from schools to specialized providers. Also, since meals are prepared daily, their supply can better match attendance. They are also less portable and easier to monitor, leading to fewer leakages through corruption. For the 13 of the 19 schools in our sample for which we have information on the frequency of distribution around the time of the transition, the percentage of school days with no distribution was 50 percent lower under the cooked meal program. This is consistent with data from the Nutrition Foundation of India (Sharma et al., 2006) and other qualitative studies (Khera, 2006) of the mid-day meal program.

We obtained detailed data on costs of the program under both regimes and these figures are presented in Table 8. The new meals came with clearly specified nutritional norms of 300 calories and 8-12 grams of proteins per meal. The grain content of the meal was provided by the state and this was increased from 75 to 100 grams of wheat per meal to meet the new norms. Since this was transferred from grain warehouses of the government and not purchased at market prices, the associated increase in cost was marginal.[6] Under the cooked meal program providers were reimbursed at the rate of Rs. 2.35 per child per day for expenditures incurred on meal ingredients other than grains. These include vegetables, spices, fuel, transportation and wages paid for meal preparation and distribution. This was similar to the per child per day cost under the ready-to-eat regime. In fact, during 2002-04 the real cost of the program was unchanged as indicated by Table 8. With comparable program expenditures, the nutritive value of the meals improved due to higher nutritional norms and their stricter monitoring.

As regards parents and child preferences, a hot cooked meal is more likely to be viewed as nutritionally adequate compared to biscuits and other snacks. The announcement of the nutritional norms by the government under the cooked meal regime is likely to have reinforced this perception and raised expected benefits from the program for MCD students, a large fraction of whom are children of migrant labor and informal sector workers in Delhi (De et al., 2005). In addition, our results on one versus two-item menus suggest that students did respond to more wholesome, better tasting meals.

The reason for larger effects among younger children could be that the meal provided forms a larger proportion required daily calorie intake for them (Afridi, 2011). The attendance decision of these children could also be more sensitive to transfers for other reasons. For example, a child in grade 5 may care much more about school quality than small transfers of food, whereas a child entering school may be attracted by a meal. In terms of our framework in Section 1, the density of the cost distribution is higher for young children at the point at which the daily benefits from attending equal daily costs. The absence of detailed student and household level information during the transition prevents us from a quantitative attribution of the overall effect to these various factors. Nevertheless, our results show that school programs that are more effective in delivering the transfer and are better aligned with the needs of the recipient are likely to provide greater benefits relative to costs.

[6] The cost increase was approximately Rs. 0.11, or less than 5% per child per day.

5 Conclusion

This paper examines whether fiscally neutral changes in the design of a school feeding program can have substantial effects on student participation rates. We find that changes in meals that make them more nutritious, easier to monitor, and timed to better match student eating schedules can be a cheap and effective way of raising primary school attendance rates, especially for lower grades.

Our results align with the existing literature on the effects of school meals, and school subsidies more generally, on student participation rates. However, we are better able to look at the effects of design because the transition to cooked meals was not accompanied by significant cost changes. These findings are especially relevant in the Indian context, where the transition to cooked meals and then to their improved and regulated quality is yet to be completed in most parts of the country. Moreover, we find that the impact of the meals is substantial even through initial attendance rates were high relative to the national average of 65% (Educational Consultants India Limited, 2007). Therefore, our estimates may well be a lower bound on the potential impact of this type of programmatic change on school participation.

Our research has two main implications for policy. First, school subsidies can be an important policy instrument for making regular schooling more desirable. Second, greater attention to the design and quality of transfer programs can yield higher returns within constrained budgets. The nature of our data limit our ability to fully understand the impact of program design on enrollment. We also have no direct measures of child health or learning. We hope to address some of these questions in future work.

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FIGURE 1: SCHOOL TRANSFER AND ATTENDANCE GAINS FOR VARYING COSTS

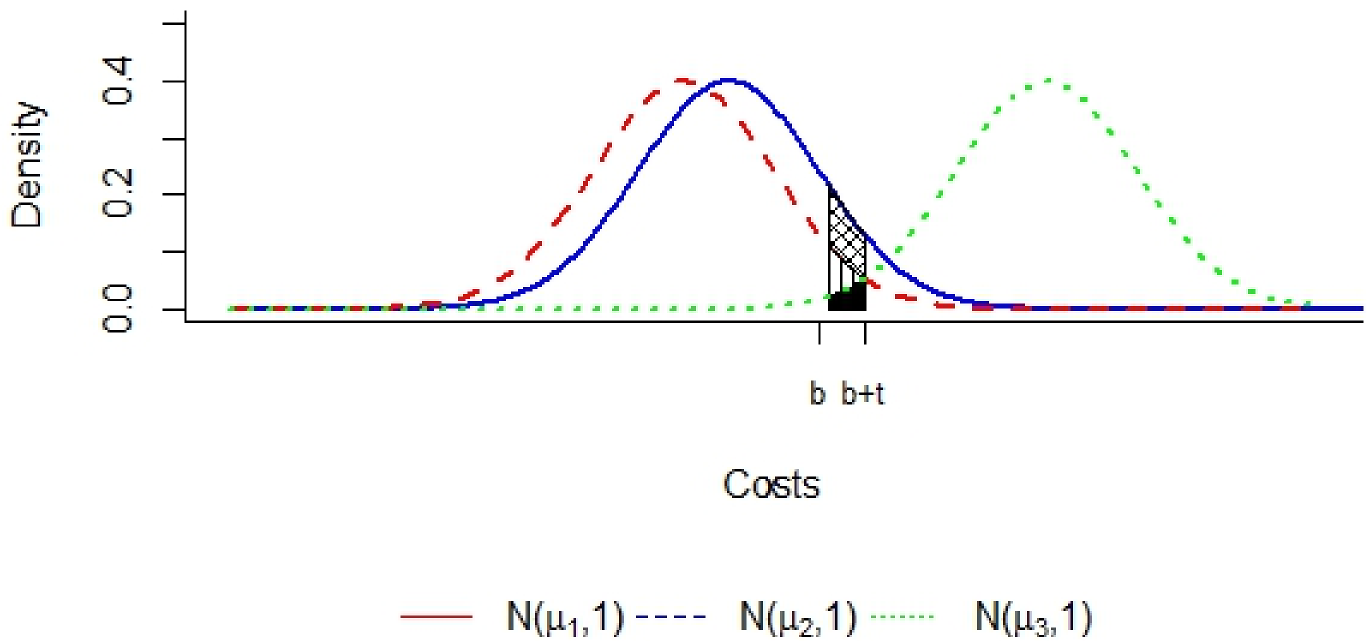

FIGURE 2: SAMPLED SCHOOLS IN THE CENTRAL MCD ZONE

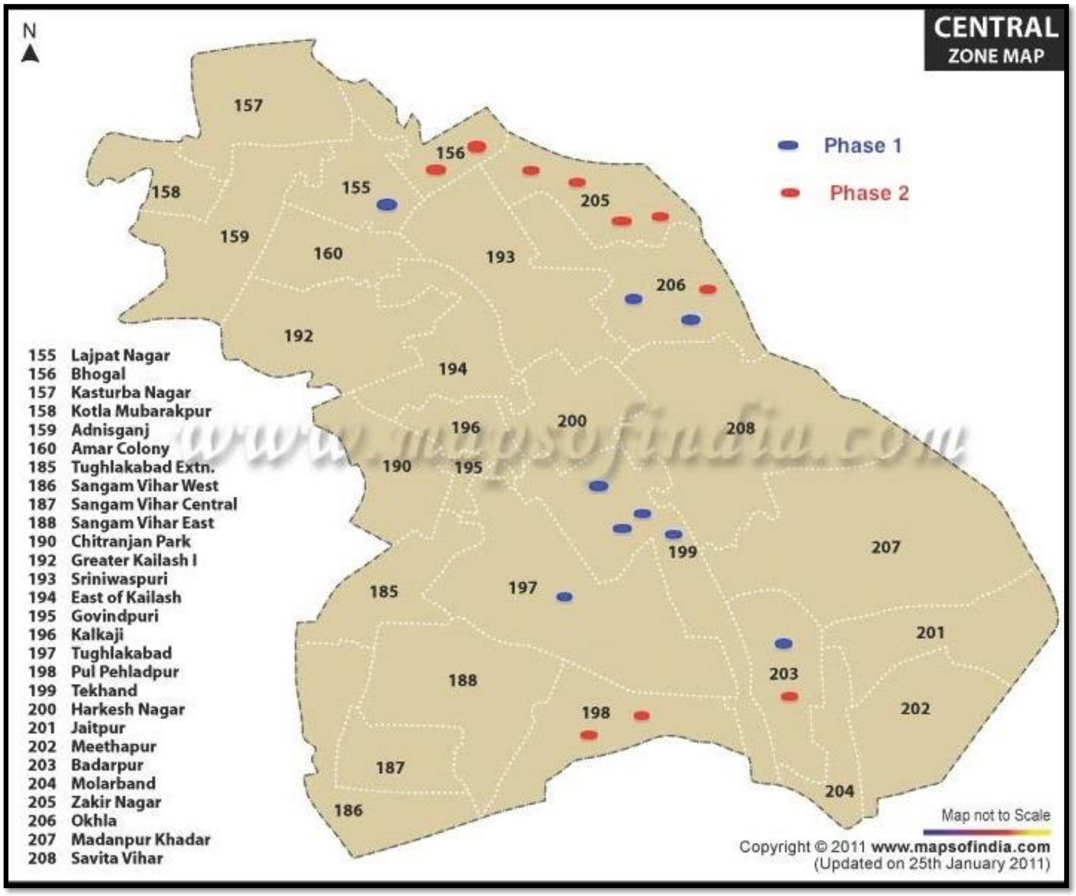

TABLE 1: DESCRIPTIVE STATISTICS, BY TREATMENT.

	All	Control	Treat	Difference
	(1)	(2)	(3)	(4)=(3)-(2)
Neighbourhoods				
Literacy rate	0.79	0.81	0.77	-0.03
	(0.014)	(0.007)	(0.027)	(0.027)
Male literacy rate	0.86	0.87	0.85	-0.02
	(0.008)	(0.003)	(0.016)	(0.016)
Female literacy rate	0.69	0.72	0.66	-0.06
	(0.025)	(0.016)	(0.048)	(0.049)
Proportion of scheduled castes	0.13	0.12	0.14	0.02
	(0.018)	(0.022)	(0.030)	(0.037)
Schools				
Attendance in April 2003	0.79	0.81	0.78	-0.03
	(0.018)	(0.027)	(0.026)	(0.037)
Proportion of girls in April 2003	0.62	0.50	0.76	0.26
	(0.107)	(0.166)	(0.126)	(0.212)
Distance from provider in 2003	4.57	4.44	4.71	0.27
	(0.904)	(1.225)	(1.413)	(1.861)
School infrastructure score	4.83	4.78	4.89	-0.11
	(0.121)	(0.222)	(0.111)	(0.248)
Number of schools	19	10	9	

Notes: The top panel of the table is based on data from the Census of India, 2001. Schools are matched to the census wards in which they are located. Attendance and gender composition is for the sample of 19 schools and the grades described in the text. Grade 1 is excluded. The school infrastructure score is the number of facilities present out of the following 5 facilities in April 2003 - library, computer room, playground, drinking water and toilets. School infrastructure data are missing for one control school. The proportion of Schedules Tribes is close to zero and not reported.

Standard errors are in parenthesis.

None of the differences between treatment and control schools are statistically significant at conventional levels.

TABLE 2: ATTENDANCE RATES AND CHANGES, BY TREATMENT.

	Control (1)	Treatment (2)	Difference (3)=(2)-(1)
(A) Δ 2002	0.06	0.06	0
	(0.008)	(0.010)	(0.013)
Mean attendance in April 2002	0.81	0.79	
	(0.073)	(0.087)	
(B) Δ 2003	0.07	0.11	0.04***
	(0.008)	(0.009)	(0.012)
Mean attendance in April 2003	0.80	0.78	
	(0.086)	(0.063)	
Difference (B)-(A)	0.01	0.05***	0.04***
	(0.011)	(0.014)	(0.018)

Notes: The sample consists of grades in 19 schools (10 control and 9 treatment) for which attendance data were available for 2002 and 2003. Attendance rates are calculated by averaging over all enrolled students in grades 2-5 in the relevant month.

Standard errors in parentheses.

*p<0.1; **p<0.05; ***p<0.01 .

TABLE 3: AVERAGE TREATMENT EFFECT, REGRESSION ESTIMATES.

Dependant Variable: Attendance in year	2003	2002	2003	2002
	(1)	(2)	(3)	(4)
Treat × Sept	0.027**	0.006	0.031*	0.007
	(0.012)	(0.011)	(0.016)	(0.015)
Sept	0.073***	0.047***	0.081***	0.066***
	(0.008)	(0.007)	(0.012)	(0.009)
Constant	0.816***	0.844***	0.815***	0.845***
	(0.003)	(0.003)	(0.004)	(0.004)
Student fixed effects	Y	Y	Y	Y
No. of schools	19	19	16	16
No. of students	1591	1564	827	827
R^2	0.121	0.047	0.149	0.094
Observations	3182	3128	1654	1654

Notes: Columns 1 and 2 are based on the sample of those grades in the 19 schools for which attendance records were available for 2002 and 2003. Column 1 shows the estimates for the cohort of 2003 while column 2 does the same for cohort of 2002. Columns 3 and 4 show the estimates in 2003 and 2002 respectively for the panel of 827 students who were present from April 2002 to September 2003. These 827 students were from 16 of the 19 schools.

Standard errors clustered at student-level in parentheses.

*p<0.1; **p<0.05; ***p<0.01 .

TABLE 4: EFFECT OF SCHOOL MEALS BY GRADE

Dependant Variable: Attendance of grade	2 to 5	2	3	4	5
	(1)	(2)	(3)	(4)	(5)
Treat × Sep	0.041***	0.072***	0.044**	0.040**	0.013
	(0.011)	(0.023)	(0.020)	(0.020)	(0.023)
Sep	0.047***	0.009	0.032**	0.044***	0.103***
	(0.007)	(0.014)	(0.014)	(0.015)	(0.016)
Constant	0.841***	0.841***	0.846***	0.848***	0.830***
	(0.003)	(0.006)	(0.005)	(0.005)	(0.006)
Student fixed effects	Y	Y	Y	Y	Y
No. of schools	13	13	13	13	13
No. of students	1791	438	476	456	421
R^2	0.087	0.055	0.072	0.086	0.174
Observations	3582	876	952	912	842

Notes: The sample uses students enrolled in April and September of 2003 from 13 schools for which we could obtain attendance records of that year for grades 2 to 5.

Standard errors clustered at student-level in parentheses.

*p<0.1; **p<0.05; ***p<0.01

TABLE 5: EFFECT OF SCHOOL MEALS BY GENDER AND SCHOOL SHIFT

Dependant Variable: Attendance by	Gender		School shift		
	Boys	Girls	Afternoon	Morning	Morning
	(1)	(2)	(3)	(4)	(5)
Treat × Sep	-0.007	0.020*	-0.008	0.030***	0.020*
	(0.019)	(0.011)	(0.025)	(0.011)	(0.011)
Sep	0.077***	0.078***	0.111***	0.059***	0.078***
	(0.011)	(0.008)	(0.012)	(0.008)	(0.008)
Boy ×Treat ×Sep					0.033
					(0.031)
Boy × Sep					-0.092***
					(0.020)
Constant	0.823***	0.816***	0.785***	0.830***	0.830***
	(0.004)	(0.003)	(0.005)	(0.003)	(0.003)
Student fixed effects	Y	Y	Y	Y	Y
No. of schools	8	14	5	14	14
No. of students	848	1405	545	1708	1708
R^2	0.078	0.145	0.159	0.104	0.119
Observations	1696	2810	1090	3416	3416

Notes: The sample consists of 19 schools including 3 schools that enrol both boys and girls. All grades of the 19 schools for which attendance records of 2003 were available are included.

Standard errors clustered at student-level in parentheses.

*p<0.1; **p<0.05; ***p<0.01

TABLE 6: EFFECT OF SCHOOL MEALS BY MEAL TYPE

	(1)
Treat × Dec	0.023*
	(0.01)
Dec	0.081***
	(0.01)
Constant	0.827***
	(0.003)
Student fixed effects	Y
No. of schools	14
No. of students	1481
R^2	0.13
Observations	2962

Notes: The variable of interest is *Treat* which indicates if a school received two-item meals more than the sample median percentage of days of two-item meals.

Standard errors clustered at student-level in parentheses.

*p<0.1; **p<0.05; ***p<0.01

TABLE 7: EFFECTS ON ENROLMENT, BY GRADE

Dependant Variable: Enrolment in grades	1 to 5	1	2	3	4	5
	(1)	(2)	(3)	(4)	(5)	(6)
Treat	6.83***	27.25***	3.18***	2.73***	0.58	0.43
	(1.484)	(3.096)	(0.642)	(0.351)	(0.383)	(0.272)
Constant	60.81***	32.08***	72.00***	72.30***	76.95***	64.37***
	(1.843)	(2.308)	(0.479)	(0.262)	(0.286)	(0.203)
School fixed effects	Y	Y	Y	Y	Y	Y
No. of schools	5	5	5	5	5	5
No. of grade × days	675	135	135	135	135	135
R^2	0.766	0.938	0.996	0.999	0.984	0.998

Notes: The sample is restricted to 5 of the 9 Phase 1 schools for whom enrolment records were obtained. The variable of interest is *Treat* which takes value 1 for school days when cooked meals were provided and 0 when ready-to-eat snacks were distributed.

Standard errors clustered at student-level in parentheses.

*p<0.1; **p<0.05; ***p<0.01

TABLE 8: DAILY COST PER CHILD OF THE SCHOOL MEAL PROGRAM (IN RUPEES)

	Costs	Ready-to-eat Snacks 2002-03	Cooked Meals 2003-04
	Federal Costs		
1	Payment to FCI for food grains	0.31	0.41
2	Transportation subsidy to provider	0.0378	0.05
	Delhi Government Costs		
3	Cost of cooking (paid to service providers)	2	2
	Total nominal cost (1+2+3)	2.3478	2.46
	Total real cost (WPI)	2.3478	2.3327
	Total real cost (CPI)	2.3478	2.3736

Source: Data obtained via official communications from the Ministry of Human Resource Development (via Letter No- D-186 DDE/MDM(HQ)/11); wholesale price index (WPI) and consumer price index (CPI) for Delhi obtained from the Annual Report of the Planning Commission of Delhi.

Notes: FCI - Food Corporation of India. Transportation subsidy to provider per child per day= Transport subsidy per gram x food grain allocation per child per day.

Appendix

FIGURE A1: ENROLMENT EFFECTS, BY GRADE

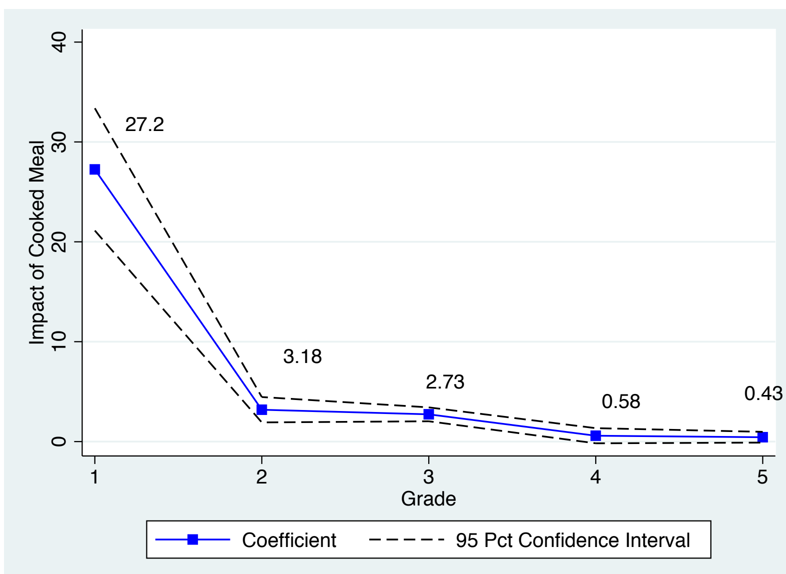

TABLE A1: DEMOGRAPHICS OF THE SAMPLED ZONE AND DELHI

	Delhi (Urban)	MCD Central Zone
Total literacy	0.82	0.82
Male literacy	0.87	0.88
Female literacy	0.75	0.74
Scheduled caste	0.17	0.16
Occupation of main worker		
Cultivators	0.002	0.002
Agricultural labor	0.001	0.002
Household industry	0.03	0.02
Others	0.97	0.98

Notes: Data aggregated from ward level statistics from Census, 2001. Main workers are defined as those household members who spend the most time working for income. Household industry is defined as small scale businesses run by members of the household within its precincts. 'Others' primarily includes salaried workers and those engaged in services sector .

TABLE A2: DESCRIPTION OF SAMPLES USED IN ANALYSIS

		Schools	Students	Description
1	Main sample	19	1591	Schools with data for the same grades in 2002 and 2003
2	Student panel	16	827	Fixed student cohort
3	Grade analysis	13	1791	Schools with data for all grades in 2003
4	Menus	14	1481	Schools with daily menu data