Improving school attendance for adolescent girls - Evidence from a policy experiment in Delhi's public schools

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Despite substantial progress in education, gender gaps persist, especially at the secondary level. We analyze the role of free provisioning of gender-specific inputs in bringing adolescent girls to school using data from the Delhi government's sanitary napkin distribution scheme. Girls in grades 6-9 show statistically significant daily attendance gains of between 1.82 to 2.64 percentage points (0.13 to 0.20 standard deviations) as compared to boys. These are the grades at which girls are most likely to experience puberty. During scheme years, we find that 5-7 additional girls are present in a typical secondary school grade on any given day (average grade size of 265 students). Program impact is positively related to per capita scheme expenditure. Identification relies on comparing girls and boys in the same grade across single sex schools that share a school building using a difference-in-differences (DID) specification. Further, we find that primary grades (1-5) do not record any attendance gains during the same period.

JEL codes: H42, I2, J16

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1 Introduction

According to UNESCO Institute for Statistics, the global gross enrolment ratio (GER) at the secondary level was around 76% as against 104% at the primary level in 2016. Girls have a slightly lower GER than boys at the secondary level and the worst cases of gender disparity at this stage also turn out to be at their expense (UNESCO, 2015). Female secondary education has several immediate and intergenerational benefits, including improved cognitive ability, lower disease risk, reduced teenage births, older age at marriage and lower child mortality (Patton et al., 2016). International policy initiatives have focused a great deal on removing barriers to female schooling through transfers and investments of various kinds.[1] Of these, school construction (Duflo, 2001), providing (sex-specific) sanitation at school (Adukia, 2017) and conditional cash/kind transfers addressing budget and commuting concerns (Schultz (2004); Chaudhury and Parajuli (2007); Khandker et al. (2003); Muralidharan and Prakash (2017)) have proven effective at increasing female secondary school enrolment.

Arguably, overall school engagement cannot be captured by enrolment alone, regular attendance would also play an important role. It would, thus, be of immense value to identify concrete (possibly female-specific) inputs that governments could provide to ensure better secondary school attendance for girls. While female targeted conditional scholarships have been successful in promoting attendance (Filmer and Schady, 2008), evidence of such impact from in-kind transfers has been mixed so far. Montgomery et al. (2016) find significant impact on school attendance by providing combinations of reusable sanitary pads and puberty education using a cluster quasi-randomized control trial conducted across 8 schools in rural Uganda form 2012-14. Results indicate that the control group had a 17 percentage point lower attendance as compared to any treatment group. However, the study suffered from high attrition. Oster and Thornton (2011) assess the impact of improved sanitary products on school absence for 200 schoolgirls in Nepal and find no significant benefits from randomized access to menstrual cups. This study ran for just a little over a year, which may not be a long enough time-frame to see results for an invasive intervention like a menstrual cup. Moreover, in this sample, girls were hardly skipping school during their period to begin with (0.4 days in a 180 day school year). The Indian context may be quite different with a government report on Menstrual Hygiene Management (MHM) claiming that 60% of girls miss school on account of menstruation (Government of India, 2015).

This paper provides evidence that gender specific inputs can improve attendance for adolescent schoolgirls. The state government of Delhi, India ran a program to distribute a packet of free sanitary napkins to all girls enrolled in secondary grades (6-12) in the state's public schools between December, 2011 and November 2016 - the Kishori scheme. Our sample consists of 52 pairs of single sex schools (with grades upto 12) that share a school building such that the girls school is held in the morning shift and boys in the afternoon. Impact is identified using a difference-in-differences (DID) specification with boys of the same grade in the same school building as a control group for girls. Matching using building fixed effects allows us to control for unobserved heterogeneity across student populations at various school locations. It also helps account for overall building-level infrastructural improvements (if any) that could have raised attendance for all students, irrespective of gender. We require parallel trends in attendance for girls and boys before the scheme for DID estimates to be unbiased. Combining scheme data with daily aggregate attendance at the grade level over a period of 9 academic sessions (2008-16), we find

[1] Barriers to female schooling include traditional childbearing roles, early marriages, restrictions on mobility, preference for male schooling, inadequate sanitation facilities at school, amongst others.

positive and significant scheme impact for girls in grades 6-9. Daily attendance of girls in these grades went up by 1.82 to 2.64 percentage points (0.133 to 0.201 standard deviations) while the scheme was in operation. Further, we show that scheme impact is positively related to scheme intensity as measured by per capita expenditure under the scheme and is significant for grades 6-8. Girls in these grades are likely to be in the initial stages of puberty and therefore benefit most from such a program. By that logic, girls in lower grades (upto 5) should not experience significant attendance gains during this period and our results confirm this. The primary mechanism of impact is likely to be access to an input that may have been beyond the budget set of most beneficiaries. Additionally, a secondary mechanism may be the creation of a more sensitive school environment by fostering support networks involving teachers and students. We have anecdotal evidence for these hypotheses.

We contribute to the literature by establishing that access to inputs relevant to adolescent girls can indeed achieve significant improvement in attendance using a large dataset of daily attendance from administrative records. Our data tracks all public schools in the state that share a school building and have grades upto 12 (104 schools) over a 9 year period. This is an improvement over previous studies that suffered from issues like small sample size, short duration, high attrition and sample selection. While changing attitudes and norms may be the substantive goal, our study shows that there are low hanging fruit that can be targeted in the short run to achieve better female attendance at the secondary level.

The rest of the paper is organized as follows. The next section provides background on the Kishori scheme and describes our data. Section 3 details the empirical strategy and results. Section 4 discusses the findings and possible mechanisms of impact. Section 5 concludes.

2 Data and Background

2.1 Kishori scheme

In December 2011, the Delhi government implemented the Kishori scheme in the state's public schools to improve the level of menstrual hygiene amongst adolescent girls. The scheme mandated that all girls from grades 6-12 would receive a free packet of ten sanitary napkins every month. It is estimated that upto 800,000 girls may have benefitted from this endeavour with the government spending around 148 million rupees to implement the scheme in 2014 (Government of NCT of Delhi, 2016). The scheme operated in all government schools in the state until November, 2016 when it was withdrawn abruptly, possibly due to bureaucratic issues (Hindustan Times, 2017).

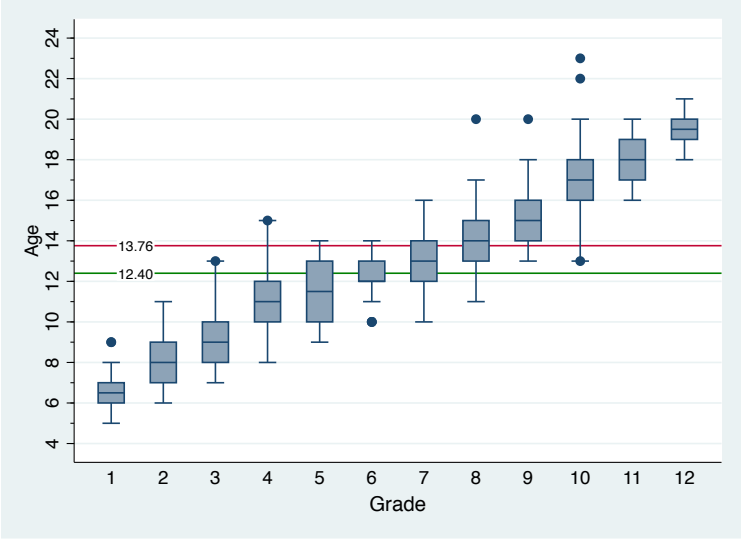
While the primary goal was improved menstrual hygiene, the Chief Minister of Delhi also recognized potential scheme benefits to overall school engagement through greater presence in classes and participation in sports while launching the scheme (Hindustan Times, 2011). The government ran a training and sensitization program for teachers and staff who were to implement the program across the state. Each school assigned a faculty member to oversee the overall functioning of the scheme including maintaining records of stock delivery and ensuring distribution. Every month, students collected these napkins in

person from a central location in the school.[2]

Ten sanitary napkins may not have been enough to get through a whole period but they would have reduced the financial burden of buying pads to some extent. Since the market price of a similar packet could range between Rs. 30-80, some families may not have had access altogether in the absence of the transfer. As per government expenditure figures mentioned above, the state spent about Rs. 15 on each packet.[3] While the quality of these napkins was not identical to high-end market options, they were upto reasonable standards.

Estimates of the average age at menarche range between 12.40 and 13.76 years for the population of interest (Khadgawat et al. (2016) and Pathak et al. (2014)). Using data from the second round of the India Human Development Survey (IHDS), we construct age distributions for students enrolled at various levels of education in government institutions in Delhi at the time of the survey (2011-12). Figure 1 displays these distributions along with the two estimates of mean menarcheal age. We find that female students are aged between 10-24 years in grades 6-9 (Table 4 in Appendix). This range includes our estimates of average age at puberty. Grades 6-9 may, therefore, be when girls are most likely to be struggling with the onset of menstruation, making Kishori especially apt for this group.

Figure 1: Age distribution for female students by grade



Notes: Data for females enrolled in government institutions in Delhi at the time of the survey from IHDS-II (2011-12). Lines at 12.40 and 13.76 years represent two estimates of mean menarcheal age for the relevant population.

2.2 Data sources

Attendance data for this analysis is sourced from the digital records of the Department of Education (DOE), Delhi and is available daily for each grade in a school. Limited school characteristics like gender

[2]Teachers report that distribution could be carried out over a period of a few days to cover all girls as and when they were present in school.

[3]Obtained by dividing annual expenditure by enrolment and number of months of scheme operation in the year.

(girls/boys/coeducational), district, zone, building code and shift are mentioned as well. Further, we augment school characteristics using data from the District Information System for Education (DISE) that uses nationally standardized variables and definitions. This database includes school-level information on classrooms, toilets, boundary wall, medical checkup, teachers, disadvantaged group students and select academic outcomes.

Schools record attendance for all enrolled students in physical attendance registers and are required to communicate certain aggregate figures to the DOE everyday. Attendance is recorded in four categories - present, absent, on leave or 'name struck off' (NSO). The difference between being absent and on leave is that the latter involves a prior application. The NSO tag is given to a student after a prolonged absence when the school considers him/her off the rolls. Schools report aggregate numbers of students in each attendance category at the grade level.

Expenditure under the Kishori scheme is available at the school level in annual and monthly datasets. As mentioned previously, the scheme was officially launched in December 2011 across the state. However, it may have become fully operational at different points in time in each school. This possible variation in scheme implementation is of interest to our analysis. While the annual dataset begins in 2011, monthly data began to be recorded only in January, 2013. Since this skips the relevant period (December, 2011 to December 2012) where the scheme was in the process of getting established, we are unable to use available monthly information.

The annual dataset records financial outlay under the scheme in terms of allotted, sanctioned and disbursed amounts. Allotments are likely to be based on the number of girls in the school. Of this amount, a certain fraction may actually be sanctioned, of which a portion may be disbursed or spent. While the disbursed amount would have been ideal for analysis, it has not been recorded accurately since the DOE did not make it mandatory to report these figures. Almost half the relevant observations have a default zero entry. Therefore, we focus on the sanctioned amount in the following sections.

2.3 School and variable description

Our attendance dataset spans 9 academic sessions from 2008 to 2016.[4] Of the 1001 DOE schools that existed during this period, our analysis focuses primarily on 104 single sex schools that have grades 1-12 and share a school building (Type 1 schools). This allows us to assess scheme impact at both primary and secondary grades. We have to disregard coeducational schools as they do not record gender-wise attendance data. Moreover, program effects could be quite different in a mixed gender context. Our chosen 52 pairs of schools are such that the girls school is held in the morning shift and the boys school in the evening. Male and female students who share a building have access to common infrastructure. Table 1 lists pre-scheme school characteristics (2009/10 as per data availability) and they appear similar across girls and boys schools.[5] Students in paired schools are also likely to come from the same catchment areas. Therefore, characteristics including family composition, socio-economic status and living conditions are likely to be similar within and possibly different across pairs. Accounting for

[4] Academic sessions in Delhi start in April of one calendar year and end in March of the next.

[5] Note that the faculty in girls schools is almost exclusively female and vice-versa for boys schools.

the shared building helps control for this unobserved heterogeneity in student populations across school locations. A full description of other types of schools can be found in Table 5 (Appendix).[6]

Table 1: Pre-scheme school characteristics

Year		Girls			Boys		
	Variable	N	Mean	Std. Dev.	N	Mean	Std. Dev.
2010	Classrooms	51	27.78	9.76	46	27.13	10.72
	Classrooms in good condition	51	11.12	11.79	46	12.93	11.61
	Classrooms in good condition per 100 students	51	0.57	0.62	46	0.73	0.71
	Medical checkup	51	0.43	0.5	46	0.43	0.5
	Boundary wall	51	0.92	0.27	46	0.87	0.34
	Toilets (gender-specific)	51	13.33	9.24	46	11.67	9.08
	Toilets per 100 students	51	0.69	0.56	46	0.69	0.64
	Teachers	51	28.1	9.56	46	24.48	10.24
	Percentage female teachers	51	91.37	16.29	46	3.44	4.88
	Teachers per 100 students	51	1.37	0.4	46	1.3	0.4
	Disadvantaged group students (grades 1-8)*	51	173.04	128.53	46	140.8	114.15
	Percentage of disadvantaged group students	51	17.34	10.19	46	14.4	10.27
2009	Percentage failing (grades 1-8)	50	3.18	3.06	46	2.9	5.97
	Percentage passing grade 5 exam	43	99.32	3.13	34	99.95	0.29
	Percentage scoring more than 60pc in grade 5 exam	43	56.37	21.3	34	41.18	20.4
	Percentage passing grade 8 exam	48	80.37	13.16	43	80.52	19.54
	Percentage scoring more than 60pc in grade 8 exam	48	19.83	12.78	43	19.59	15.14

1. Data from school-level District Information System for Education (DISE) and author's calculations using school enrolment from DOE attendance database

2. Data reported for those available of 104 Type 1 schools (with grades 1-12 and shared school building)

* Includes students belonging to scheduled castes (SC), scheduled tribes (ST) and other backward classes (OBC)

Mean enrolment[7] for all grades is around 183 students, but it is substantially higher for secondary grades at about 260 students.[8] Girls have marginally higher enrolment than boys at all grades. For analysis, our outcome variable is the percentage of the class that is present on a particular day - present_percent $= \frac{\text{present}}{(\text{present} + \text{absent})} \times 100$. The denominator accounts for the the number of students present as well as those who are missing without prior notice. We are omitting the categories NSO and 'on leave'.[9] The daily values of present_percent are averaged to get a value representing a typical day in the month. While these schools have an overall mean attendance rate of 79%, girls schools do better than boys schools at every grade. The average attendance gap is around 7 percentage points in favour of girls. Table 6 (Appendix) summarizes these patterns. The gap seems to narrow slightly grade 10 onwards when skipping school may become more costly on account of national-level Board examinations in grades 10 and 12.

[6]There are 82 pairs of schools that share a building but have only secondary grades (Type 2 schools). We present results from these later in the paper.

[7]Enrolment is defined as the number of children present, absent and on leave.

[8]There is a jump in enrolment across primary and secondary grades. Since certain other public schools terminate at the primary level, their students get channelled into DOE schools thereafter.

[9]We focus on the impact of the scheme on unplanned leave as period related absences are most likely to fall in this category.

Financial details from the Kishori scheme help us define a scheme intensity variable to identify the timing of scheme implementation across schools. We use the monthly sanctioned amount for each girl as a measure of scheme intensity - sanctioned amount per capita:

$$\text{sanction\_pc} = \begin{cases} 0 & \text{before December, 2011} \\ \dfrac{\text{annual sanction}}{\text{enrol\_girl} \times \text{num\_months}} & \text{December, 2011 - November, 2016} \end{cases}$$

We consider monthly amounts to account for the fact that the scheme is operational for only 4 months (December to March) in 2011, 12 months in the following years and 8 months in 2016. In 2011, mean sanctioned amount per month is Rs. 8 per girl. The following years have substantially higher average sanctions ranging from Rs 13-17 for 2012-16. Moreover, sanction_pc is more variable in 2011 as compared to subsequent years (Table 7 in Appendix). This indicates that there were differences in scheme implementation across schools when the program was first launched. We make use of this in our estimation strategy.

3 Estimates of scheme impact

3.1 Empirical framework

To examine scheme impact at each grade, we consider girl-boy differences in average daily attendance before and after the scheme was launched using a DID model for each grade, as below:

$$\begin{aligned} \text{present\_percent}_{it} = \alpha + \beta_1 \text{girl}_i + \beta_2 \text{kishori}_t + \beta_3 (\text{girl}_i \times \text{kishori}_t) \\ + \sum_b \lambda_b \text{bldg\_id}_{ib} + \sum_s \eta_s \text{session}_{ts} + \sum_m \gamma_m \text{month}_{tm} + \epsilon_{it} \end{aligned} \tag{1}$$

where $\text{present\_percent}_{it}$ is the attendance in school i at time t and girl_i is an indicator for a girls school. Variable kishori_t is an indicator for observations between December, 2011 and November, 2016 when the scheme was in operation. The session_{ts} and month_{tm} are a set of dummies capturing time fixed effects while bldg_id_{ib} are dummies for building fixed effects.[10] For each grade we subtract the average attendance of girls (boys) before the scheme from their average attendance after the scheme - the first difference. We get the second difference subtracting first difference of boys from that of girls. This is equivalent to the difference in the gender attendance gap before and after the scheme. Our estimate of interest are β_3 from each grade - they capture additional attendance in girls schools during the scheme period as compared to levels before the scheme. The identifying assumption is that the gender difference in attendance would have remained the same in the absence of the scheme.

[10]The subscripts s, m and d take the following values: s = [2008,2016]; m = [1,12]; b =[1,52].

Additionally, to account for the possibility that scheme implementation may have varied across schools, we incorporate sanction_pc$_{it}$ as a measure of scheme intensity. Observations from both girls and boys schools from a particular building may be accorded the same value of sanction_pc for all grades to help account for potentially confounding unobserved building-level infrastructural improvements that were correlated with scheme expenditure. Scheme intensity is therefore considered to be a building level characteristic. Model 2 describes the specification.

$$\begin{aligned}\text{present\_percent}_{it} = \alpha + \beta_1 \text{girl}_i + \beta_2 \text{sanction\_pc}_{it} + \beta_3 \text{girl}_i \times \text{sanction\_pc}_{it} \\ + \sum_b \lambda_b \text{bldg\_id}_{ib} + \sum_s \eta_s \text{session}_{ts} + \sum_m \gamma_m \text{month}_{tm} + \epsilon_{it}\end{aligned} \tag{2}$$

We are interested in grade-wise β_3 coefficients that indicate the additional attendance in girls schools for every extra rupee of per capita expenditure under the scheme.

3.2 Results

Before presenting results from the specifications discussed in the previous section, we explore the validity of the parallel trends assumption for the pre-scheme period. Evidence in favour of this builds a case for unbiased estimates of program impact using the DID approach. We make use of a specification like model 2 except that sanction_pc is replaced by a continuous time variable capturing months in chronological order (April, 2008 to March, 2011). Table 8 (Appendix) lists these results. The insignificance of the interaction term of (girl $\times$ time) at all grades implies we cannot reject the possibility of parallel trends in the outcome variable (present_percent) across genders in the absence of the program, thereby validating our estimation strategy.

For model 1, Table 2 details regression results. Grades 6-9 show positive and significant scheme impact ranging between 1.82 and 2.64 percentage points as evident from the coefficients for girl$_i \times$kishori$_t$ (β_3).[11] Figure 2 graphs the relevant interaction coefficients (with 90% confidence intervals). Impact peaks at grade 8 with a 2.64 percentage point attendance gap between girls and boys controlling for before scheme differences. On average, when the Kishori scheme was operational, present percentage was about 2.64 percentage points (0.201 standard deviations) higher in grade 8 for girls schools after controlling for boys' attendance. Moreover, estimated β_3 coefficients are insignificant for grades 1-5. Multiplying β_3 with relevant average grade size we find that between 5-7 additional girls from grades 6-9 were present in a typical school on any given day while the scheme was operational (Table 9 in Appendix).[12]

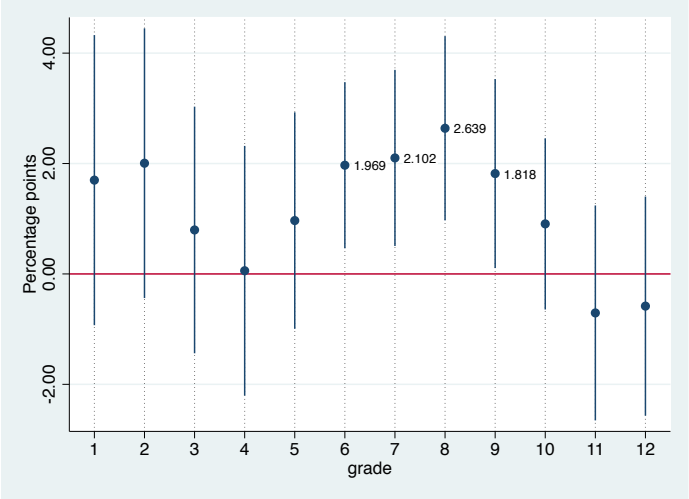
For model 2, Table 3 details regression results and Figure 3 graphs the coefficients of girl$_i \times$sanction_pc$_{it}$ (β_3). Differential slope coefficients for grades 6-8 are positive and significant indicating that increased expenditure under the scheme results in attendance gains for girls in these grades. As before, grade 8

[11] The respective grade-wise standardized coefficients for grades 6-9 with standard deviation of attendance in parentheses are as follows: 0.153 (12.90); 0.161 (13.08); 0.201 (13.10); 0.133 (13.66).

[12] Relevant grade size for these figures is the average number of girls present or absent, given the definition of the outcome variable. For secondary grades, this is 265 girls.

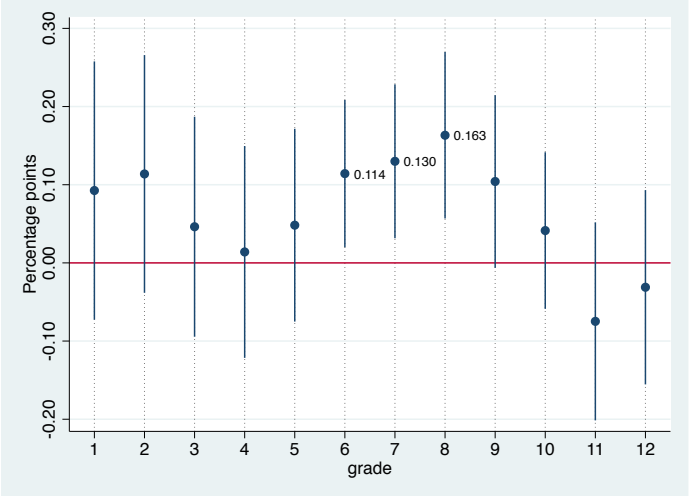
shows maximum impact with a differential increase of 0.163 percentage points in attendance for girls over boys with every additional rupee spent per capita. Again, coefficients for grades 1-5 are insignificant. Using mean values of per capita scheme expenditure for each session, we can estimate impact for the average girls school for each relevant grade. On any given day, between 3-8 additional girls from grades 6-8 are present in a typical school during the tenure of the scheme (Table 10 in Appendix).

Figure 2: Scheme impact using DID



Notes: Coefficients of (girl × kishori) from estimating equation (1) for Type 1 schools are plotted by grade with 90% confidence intervals. Table 2 presents complete regression results.

Figure 3: Scheme impact using scheme intensity



Notes: Coefficients of (girl × sanction_pc) from estimating equation (2) for Type 1 schools are plotted by grade with 90% confidence intervals. Table 3 presents complete regression results.

So far, we have focussed exclusively on single sex schools with grades 1-12 that share school buildings (Type 1 schools from Table 5) to estimate DID impacts at both primary and secondary grades. However, there is another sizeable category of schools (Type 2) that cover grades 6-12 only. Amongst this group, we can identify 82 pairs of single sex schools that share a building. While grade-wise results cannot be directly compared across the two school categories, we can apply the same identification strategy to Type 2 schools as well. We find significant scheme impact only at grade 8 under both specifications (Tables 11 and 12 in Appendix).

4 Discussion

There are two major results from our analysis - (i) Grades 6-9 experience positive and significant gains in female attendance during scheme operation and impact is positively related to per capita scheme expenditure for grades 6-8, (ii) lower grades (1-5) do not show any improvement in attendance during the same period.

As depicted in Figure 1, girls in grades 6-9 are most likely to be transitioning through puberty. We find positive and significant scheme impact at these grades. Since younger girls did not benefit directly from free sanitary napkin distribution, their attendance is unlikely to respond to the Kishori scheme and our results confirm this. Also, there is no scheme impact at higher grades (10-12) where most, if not all, girls are likely to be past puberty. Older girls are perhaps more equipped to manage periods and the provision of free sanitary napkins may not appreciably affect their attendance even if it raises comfort levels in general. Moreover, the cost of missing school may be higher at senior grades given the demands of the curriculum and subsequent national-level Board examinations. Results from Type 2 schools are weaker than those from our main sample of Type 1 schools, with significant scheme impact at grade 8 only. Since all students in these schools transfer from different primary schools, attendance may be more erratic in general thereby diluting scheme benefits.[13]

Access to free sanitary products may positively impact female attendance by alleviating a budget constraint that limits access to pads. This may be important for school attendance if other alternatives (cloth pads) have to be changed more frequently and do not last through the school day, especially when school infrastructure is inadequate - lack of water, privacy or disposal facilities. Also, formally recognizing menstruation as an issue may be important for its own sake as well. First, it could give girls a platform to form peer support groups to share common problems and help each other cope. Second, it is likely that at least some kind of information exchange would take place between students and teachers on practical and scientific aspects of menstruation. Anecdotal evidence suggests that most schools had informal talks with girls at the time of napkin distribution. A few may have had more structured sessions as well.

Conversations with teachers corroborate the above hypotheses. The teachers implementing the Kishori scheme at schools in East Delhi had the following to say about the program when interviewed in May, 2016: "Before the scheme, girls used cloth but now most use pads. They come from large families and often don't have the money to spare for pads. Although, one packet is not enough, they manage. Girls

[13] Overall attendance in Type 2 schools is lower than that of Type 1 at every grade.

Table 2: Scheme impact using DID estimates

dependent variable = present_percent	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
Girl	7.152***	6.655***	6.644***	6.809***	5.576***	6.147***	7.206***	7.312***	8.105***	6.744***	6.727***	6.292***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Kishori	0.084	-0.271	1.054	1.283	0.958	-1.028	-0.529	-1.455*	-1.183	2.396***	0.513	0.263
	(0.952)	(0.821)	(0.346)	(0.200)	(0.311)	(0.240)	(0.524)	(0.097)	(0.144)	(0.003)	(0.613)	(0.819)
Girl × Kishori	1.699	2.005	0.797	0.058	0.967	1.969**	2.102**	2.639**	1.818*	0.906	-0.706	-0.583
	(0.284)	(0.175)	(0.553)	(0.966)	(0.413)	(0.033)	(0.032)	(0.011)	(0.081)	(0.332)	(0.546)	(0.625)
Constant	89.684***	87.907***	87.652***	86.741***	88.524***	91.314***	87.832***	87.218***	82.820***	85.063***	70.355***	84.022***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Building FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,368	7,292	7,193	7,154	7,077	8,430	8,365	8,374	8,368	8,313	8,084	7,927
Adj. R square	.419	.412	.404	.391	.392	.485	.531	.522	.529	.37	.448	.281

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

1. Data from DOE attendance database (2008-16) used to estimate equation (1) for Type 1 schools
2. Time FE: session, month
3. Clustering is at the building id level

Table 3: Scheme impact using scheme intensity

dependent variable = present_percent	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
Girl	7.310***	6.800***	6.696***	6.725***	5.718***	6.278***	7.273***	7.389***	8.240***	6.923***	7.000***	6.231***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sanction_pc	-0.069	-0.052	0.074	0.178	0.079	0.005	0.033	-0.040	0.020	0.183***	-0.034	-0.007
	(0.573)	(0.620)	(0.442)	(0.114)	(0.356)	(0.948)	(0.623)	(0.553)	(0.771)	(0.008)	(0.675)	(0.940)
Girl × sanction_pc	0.093	0.114	0.046	0.014	0.048	0.114**	0.130**	0.163**	0.104	0.041	-0.075	-0.031
	(0.352)	(0.216)	(0.584)	(0.863)	(0.515)	(0.047)	(0.031)	(0.013)	(0.120)	(0.492)	(0.327)	(0.676)
Constant	89.513***	87.769***	87.588***	86.817***	88.411***	91.264***	87.802***	87.188***	82.790***	84.909***	70.180***	84.048***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Building FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,368	7,292	7,193	7,154	7,077	8,430	8,365	8,374	8,368	8,313	8,084	7,927
Adj. R square	.419	.412	.404	.391	.391	.485	.531	.522	.529	.37	.448	.281

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

1. Data from DOE attendance database (2008-16) and Kishori annual expenditure database (2011-16) used to estimate equation (2) for Type 1 schools
2. Time FE: session, month
3. Clustering is at the building id level

come to collect pads regularly now and also share their problems. We start awareness sessions with girls from class 6." Regarding the benefits from such sessions, another teacher said "There has been a change in the mindset of teachers who used to hide the issue earlier." These initiatives would make it easier for girls to manage periods while in class, thereby promoting female attendance and engagement. A newspaper report quotes the vice principal of a government school in Delhi in giving credit to the scheme for helping girls "maintain personal hygiene, kept them [girls] regular in school, and eased the financial burden of some really poor families." Teachers would send girls home when on their period, prior to the introduction of the scheme. They may have had to revert back to this practice owing to the current non-functionality of the program (Hindustan Times, 2017).

5 Conclusion

Secondary school attendance for girls may be erratic for many reasons. It, therefore, becomes important to establish if gender-specific transfers from governments have a role to play in making girls more regular at school. The Delhi government's Kishori scheme grants the opportunity to study the impact of a free sanitary napkin distribution program on female school attendance. Using a DID specification, we find that the program significantly benefitted girls in grades 6-9 and scheme impact was positively associated with per capita expenditure. For the average girls school, this translates into 5-7 additional girls present in the relevant grades on any given day while Kishori was implemented (2011-2016). Most girls are likely to get their first period in these grades and probably struggle with a new set of constraints. It is valuable to learn that provision of free sanitary napkins and a more supportive school environment can help ease the transition and result in higher school attendance. These are likely to be formative years when ensuring engagement in school is critical in determining future life trajectories. We do not find any significant scheme impact at primary grades where a majority of girls are in the pre-pubertal stage. Girls in these grades benefitted neither directly nor indirectly from program-related changes taking place at the school-level.

Complementary initiatives such as regular information sessions for both girls and boys could further help foster support groups and prepare children better for future years. The Delhi government had taken some positive steps in this direction by organizing 'period talks' with girls through NGOs (NDTV, 2017).

6 Appendix

Table 4: Age distribution for female students by grade - IHDS

Grade	Mean	Std. Dev.	Min	Median	Max
1	6.22	1.80	4	6	11
2	8.07	1.39	6	8	12
3	9.00	1.52	7	9	13
4	9.88	1.45	7	10	13
5	11.24	1.34	9	11	14
6	12.16	1.32	10	12	15
7	13.03	1.47	11	13	19
8	13.80	1.67	11	14	18
9	15.71	2.89	12	15	24
10	16.31	1.94	13	16	21
11	17.52	1.93	14	17	23
12	20.40	5.37	18	18	30
All	12.39	4.17	4	12	30

1. Data from India Human Development Survey II (2011-12)
2. Table based on females enrolled in government institutions in Delhi at the time of the survey

Table 5: School types by gender and range of grades (2008-16)

Type	Grades	Building	Girls	Boys	Coed	Total
Type 1	1 to 12	All	219	117	66	402
		Shared	(52)	(52)		(104)
Type 1a	1 to 10	All	4	4	3	11
Type 2	6 to 12	All	152	227	57	436
		Shared	(82)	(82)		(164)
Type 2a	6 to 10	All	35	42	23	100
Type 3	Others	All	17	17	18	52
	Total		427	407	167	1001

1. Data from DOE attendance database for (2008-16)
2. Table displays number of schools in each category
3. Schools with shared buildings are a subset of all schools in a particular category

Table 6: Mean enrolment and present percentage for sample schools (2008-16)

Grade	Enrolment			Present percentage		
	Boys	Girls	All	Boys	Girls	All
1	48	64	57	71	79	75
2	49	65	58	73	81	77
3	51	65	59	76	83	80
4	54	66	60	78	84	82
5	56	67	62	80	85	83
6	255	284	270	74	82	78
7	260	288	274	74	82	78
8	260	292	276	74	82	78
9	313	328	321	74	83	79
10	211	246	229	78	85	82
11	230	252	241	73	79	76
12	183	229	207	75	81	78
Primary (1-5)	52	65	59	76	82	79
Secondary (6-12)	245	275	260	75	82	79
All grades (1-12)	173	191	183	75	82	79
No. of schools	52	52	104	52	52	104

1. Data aggregated from DOE attendance database (2008-16)
2. Sample schools are those with grades 1-12 and shared building (104 schools)
3. Enrolment is defined as no. of students present + absent + leave
4. Present percentage is defined as $\frac{\text{present}}{(\text{present + absent})} \times 100$

Table 7: Monthly sanctioned amount per girl by session (2011-16)

Session	N	Mean	Std. Dev.
2011	50	8.28	3.25
2012	51	13.36	2.70
2013	51	15.69	1.39
2014	52	16.77	2.69
2015	52	16.46	1.91
2016	49	16.76	1.97
All	305	14.57	3.85

1. Data aggregated from Kishori annual expenditure database (2011-16)
2. Variable is annual sanctioned amount divided by female enrolment in grades 6-12, adjusted for number of months of scheme operation in the session
3. Data missing for 1-3 out of 52 girls schools in some sessions

Table 8: Testing the parallel trends assumption (2008-10)

	dependent variable = present_percent											
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
Girl	4.648*	4.118*	3.895*	3.720	3.523*	6.408***	7.764***	5.656***	7.547***	4.779***	8.108***	6.608***
	(0.064)	(0.074)	(0.090)	(0.132)	(0.066)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
time	-0.215**	-0.192***	-0.194***	-0.163**	-0.135**	-0.022	-0.031	-0.179***	-0.092*	-0.116**	-0.071	-0.038
	(0.015)	(0.003)	(0.007)	(0.039)	(0.024)	(0.668)	(0.575)	(0.001)	(0.061)	(0.012)	(0.141)	(0.538)
Girl × time	0.028	0.057	0.072	0.080	0.041	-0.064	-0.074	0.029	-0.024	0.025	-0.096	-0.066
	(0.764)	(0.443)	(0.348)	(0.322)	(0.526)	(0.278)	(0.246)	(0.651)	(0.687)	(0.666)	(0.127)	(0.341)
Constant	94.497***	95.130***	96.136***	95.998***	96.171***	89.281***	88.947***	90.403***	88.129***	87.031***	84.736***	86.466***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Building FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,220	2,206	2,193	2,199	2,201	2,686	2,627	2,642	2,630	2,599	2,525	2,515
Adj. R square	.346	.338	.329	.311	.304	.24	.268	.247	.263	.255	.208	.231

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

1. Data from DOE attendance database used to test for a differential time trend for girls in the pre-scheme period (2008-10)

2. The variable time captures a time trend starting in April, 2008 and increasing by one unit for every subsequent month till March, 2011

3. Clustering is at the building id level

Table 9: Grade-wise impact for a typical girls school using DID

Grade	β_3	Grade size	Impact
6	1.969**	275.39	5.42
7	2.102**	275.04	5.78
8	2.639**	269.28	7.11
9	1.818*	328.07	5.96

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

1. Table lists scheme impact using coefficients of (girl × kishori)

from estimating equation (1) for Type 1 schools

2. Presenting results for grades with significant coefficients only

3. Coefficient × grade_size × $\frac{1}{100}$ = additional number of girls present per day

4. Grade size is average number of girls present or absent

during the scheme period (2011-16)

Table 10: Grade-wise impact for a typical girls school using scheme intensity

Grade	β_3	Grade size	2011 (mean = 8)	2012 (mean = 13)	2013 (mean = 16)	2014 (mean = 17)	2015 (mean = 16)	2016 (mean = 17)
6	0.114**	275.39	2.51	4.08	5.02	5.34	5.02	5.34
7	0.13**	275.04	2.86	4.65	5.72	6.08	5.72	6.08
8	0.163**	269.28	3.51	5.71	7.02	7.46	7.02	7.46

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

1. Table lists scheme impact for a typical girls school using coefficients of (girl × sanction_pc) from estimating equation (2) for Type 1 schools

2. Presenting results for grades with significant coefficients only

3. Coefficient × grade_size × mean sanction_pc × $\frac{1}{100}$ = additional number of girls present per day in a particular session

4. Mean sanction amounts per capita mentioned in brackets for each session

4. Grade size is average number of girls present or absent during the scheme period (2011-16)

Table 11: Scheme impact for Type 2 schools using DID

	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
Girl	6.538***	8.021***	8.316***	8.553***	7.130***	7.551***	6.337***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Kishori	-0.998	-0.768	-1.250**	-0.421	2.833***	1.382*	-0.100
	(0.108)	(0.220)	(0.046)	(0.478)	(0.000)	(0.093)	(0.920)
Girl × Kishori	0.877	0.976	1.692*	1.553	0.323	-0.871	0.603
	(0.361)	(0.300)	(0.069)	(0.112)	(0.709)	(0.459)	(0.606)
Constant	82.028***	76.240***	75.767***	71.138***	78.969***	55.772***	73.153***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Building FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,305	13,206	13,214	13,161	13,020	11,140	10,548
Adj. R square	.487	.562	.558	.563	.429	.501	.356

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

1. Data from DOE attendance database (2008-16) used to estimate equation (1) for Type 2 schools
2. Time FE: session, month
3. Clustering is at the building id level

Table 12: Scheme impact for Type 2 schools using scheme intensity

	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
Girl	6.718***	8.182***	8.433***	8.562***	7.325***	7.850***	6.459***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sanction_pc	-0.036	-0.014	-0.074	0.027	0.244***	0.085	0.092
	(0.577)	(0.834)	(0.287)	(0.695)	(0.000)	(0.327)	(0.345)
Girl × sanction_pc	0.038	0.047	0.097*	0.100	0.002	-0.083	0.027
	(0.532)	(0.433)	(0.100)	(0.109)	(0.967)	(0.267)	(0.709)
Constant	81.941***	76.155***	75.708***	71.125***	78.747***	55.575***	73.093***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Building FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,305	13,206	13,214	13,161	13,020	11,140	10,548
Adj. R square	.487	.562	.558	.564	.428	.501	.356

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

1. Data from DOE attendance database (2008-16) and Kishori annual expenditure database (2011-16) used to estimate equation (2) for Type 2 schools
2. Time FE: session, month
3. Clustering is at the building id level

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