

Online Appendix for Menstruation, Sanitary Products and School Attendance

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1 Introduction and Outline

This Appendix provides details and expanded results for our paper, “Menstruation, Sanitary Products and School Attendance: Evidence from a Randomized Evaluation”. In the main paper we present the data and experimental design. Our results show negative, although small, effects of periods on school attendance. We find no significant effect of modern sanitary products on reducing the small effect of periods. In this Appendix, we present several sets of expanded results.

- Section 2 shows additional evidence on the impact of menstruation on schooling. We show effects on time in school and on schooling as measured through random attendance checks. In addition, we show evidence on days surrounding the period, to address the possibility that premenstrual symptoms have a larger effect than the period itself.
- Section 3 shows additional evidence on the impacts of the cup, including impacts on time in school and on attendance measured by random checks as well as evidence on impacts on test scores. We also show IV estimates and treatment-on-treated estimates of the impact of the cup, to address the fact that not all individuals adopted the cup.
- Section 4 estimates whether there are indirect impacts of menstruation, or of the menstrual cup, on attendance through friend externalities.
- Section 5 briefly discusses the impact of the menstrual cup on a number of non-schooling outcomes, including time use and psychological measures.

2 Menstruation and Attendance

Time in School

In addition to the primary attendance measures we use in the paper, we have two other sources

of attendance data. First, for a relatively small number of days, we have data from unannounced visits conducted by study administrators at which attendance was recorded. These visits were randomly assigned between 8:00 am to 3:00 pm and were made two times per month for approximately 10 months. Based on these random attendance checks, girls were recorded present 85 percent of the time, and the visits line up fairly closely (87% match) with the official data. This sample is quite small, however, which limits our ability to make within-individual comparisons and regressions with this data will not include individual-specific fixed effects. Second, in the time diaries, girls report the exact time that they arrived at school and exact time they left. We use these data to construct measures of hours in school, conditional on being there at all; the average of this variable is 5.1 hours. We focus on time in school conditional on attendance since this captures only the intensive margin.

Table 1 shows the impact of menstruation on these variables. The results show no impact of menstruation on either measure. If anything, the random attendance check data has a positive coefficient suggesting periods are *not at all* important. Again, due to the small sample size for this variable and the fact that we cannot use individual fixed effects, we do not think these results are as compelling as our previous results, but they are broadly consistent. The data on time in school shows no evidence of an effect of menstruation on the intensive school margin.

Premenstrual Symptoms and Variation by Menstrual Severity

Although policy discussions primarily focus on school attendance barriers *during* menstruation, it is also possible that premenstrual symptoms (cramps, etc) may limit girls school attendance in the days before menstruation. If this is true, it could lead us to understate the effect of the period. To evaluate this, we define an additional dummy variable which is equal to one on the three days before the girl reports having her period. We estimate the effects on attendance (using all four possible measures) for both the period and our new premenstrual variable simultaneously. These results are shown in Panel A of Table 2. We see no evidence that premenstrual days have lower attendance. Although the evidence is somewhat noisy, there is certainly nothing to indicate these days have lower attendance than others.

A second issue is that our estimates show the impact of the period for the *average* girl, but may understate the impact for the most affected girls. To address this, at least in part, we use information from our baseline survey on severity of cramps during the period. Girls were asked at baseline if they had cramps during their period, and responded “A lot”, “A Little” or “Not at All”. We interact our period indicator with cramp severity and evaluate whether girls who report more significant cramps are more likely to miss school during their period. These results are reported in Panel B of Table 2. We see no evidence that people with worse cramps miss more school during their period. This suggests that we do not see significant effects even for girls who report more symptoms during their period.¹

¹For the subset of period days on which we observe time diaries, we also asked girls if they were having cramps that day. Using the time diary data we can estimate whether girls miss more on days they report having cramps. They do not; the coefficient on period overall is -0.046 (similar to the baseline estimates) and the coefficient on whether or not girls have cramps is 0.019, and is insignificant. This suggests girls are not more likely to miss even on days they report

3 Evidence on Menstrual Cup Impacts

Random Attendance Checks

Table 3 evaluates additional possible impacts of the menstrual cup. We first show the evidence on the impact of the cup as measured by random attendance checks (Columns 1 and 2) and impact of the cup on time in school (Columns 3 and 4). There is no evidence that the cup impacted either of these variables; if anything, the impact is negative in the random checks.

Test Scores

An additional possibility is that, while there is no effect of the cup on attendance or time in school, girls may be more focused when they are there because they do not have to worry about changing their cloth or about leakage. This has been suggested as a possible benefits of modern sanitary products (Kirk and Sommer, 2006). If this is the case, performance in school might increase even if attendance does not. To test this, Columns 5 and 6 of Table 3 estimate the impact of being in the treatment group on test scores, controlling for baseline test scores. Column 5 simply compares test scores between the the two groups after the intervention; there is no impact of being in the treatment group. Column 6 uses a difference-in-difference approach, relying on scores from before the intervention, and also finds no effect. These results help rule out the possibility that we are missing some important effect of the menstrual cup on schooling.

Treatment on the Treated Estimates

As we noted in the paper, adoption of the menstrual cup is not 100%; although the adoption rate of 60% is quite high for a new technology like this, it is possible we are understating the impact of the menstrual cup by showing intent-to-treat estimates which include a large number of individuals who do not use it. There are two ways to change the estimator. One possibility is to simply estimate the treatment-on-treated effects. A second is to instrument for usage with treatment, and report IV estimates. In Table 4 we do both in the official attendance data. This analysis makes use of the fact that we observe whether or not girls in the treatment group actually used the cup.² The estimates look similar. If anything, they are more negative (i.e. less of an effect of the cup) than the intent-to-treat estimates.

4 Indirect Effects: Friend Externalities

The evidence in the paper addresses direct effects of menstruation and of the menstrual cup. Thus far we have not spoken to the possibility of *indirect* effects resulting from friend externalities. We evaluate two possible general equilibrium effects: (1) the possibility that friend menstruation having cramps (results available upon request).

²After the menstrual cups were distributed at the baseline survey a nurse followed up with roughly monthly visits to the school, at which time data was collected about cup usage. During the nurse visit, each girl in the treatment group was asked if she had used the menstrual cup during her period that month. From these responses we coded whether the girls used the cup; in addition, we asked girls at the follow-up survey about cup usage.

increases individual absence and (2) the possibility that the effect of the cup is multiplied by having more friends who own it. These are discussed in turn below.

4.1 Externalities: Menstruation

We begin with the overall effect of the period on attendance. Our estimates above indicate girls are only slightly less likely to attend school on the day of *their* period. However, there may be peer or classroom externalities (see, for example, Kremer et al, *forthcoming*). If girls miss school when their friends miss school, and friends miss during their period, then it is possible that the direct effect of menstruation that we estimate in the paper would underestimate the impact of menstruation overall.

To evaluate this possibility, we use the fact that we observe girls' friends in the study, and we observe periods for those friends. We generate the measure of friendships using the baseline survey. Before the randomization took place, each of the girls was asked to list their three closest friends who were also at the initial meeting. Our primary measure of friendships is total friends, which includes everyone whom the individual lists as a friend and anyone who lists them as a friend. The average girl has 3.8 total friends, with a maximum of 7.

We estimate the same basic equations that we do in the paper but, in addition to a variable indicating whether or not a girl has her period on a given day, we also include a measure of whether any of her friends have their period on that day. We use two measures of friend periods: whether any of the girl's friends has her period (0/1), and the number of friends with their period. Because friends have their periods on some days and not others, we can continue to control for calendar date fixed effects, and the effect of friend periods is identified off of variation across days.³

Panel A of Table 5 shows these results. Columns 1 and 2 focus on the official attendance measure and Columns 3 and 4 on the measure from the time diary. The effect of friends' periods is never significant or large. In the official attendance data, where we have the most observations, the effects are extremely small (having any friend with their period decreases attendance by 0.1 percentage point) and insignificant. The results suggest there are no general equilibrium effects at play in our period results overall: the direct effect of the period, small as it is, is the only one that seems to matter.

4.2 Externalities: Menstrual Cups

Second, we ask whether girls with more friends with the menstrual cup see larger attendance effects. We might imagine that the effect of the cup is multiplicative: if many friends own the cup, they all miss less school on period days and that has larger group effects. Given the results in the previous subsections, this seems unlikely: girls are no more likely to miss during their friends' periods, which makes it unlikely that having more friends with the cup would matter. Nevertheless, this is relatively simple to explore. We take advantage of the fact that there is variation in the

³In practice, in our data, absences in general are correlated across friends (girls are 8 percentage points more likely to be absent when any other friend is absent, even controlling for date). This could be due to girls preferring to miss at the same time, or could be due to girls who are friends living near each other or sharing other characteristics which influence attendance. The relevant question for us here is whether girls miss more during their friends' *periods*, which eliminates many of these possible confounds.

number of friends an individual has with the cup. Because the randomization was done at the individual level, not only were girls randomly allocated the cup, but whether each friend has the cup is also random (this is discussed in more detail in Oster and Thornton (2009)). We can use this variation to estimate whether the impact of the cup is larger for girls with more friends in the treatment groups. Note that it is important in this case that we control for total number of friends; the number of friends in the treatment group is random only conditional on the total.

We run regressions that parallel the evidence on menstrual cup adoption in the paper, but interact the important variable with the number of friends in the treatment group. If the effect is larger for girls with more treatment friends, we should see a larger effect of “Treatment \times Period” for girls with more friends in the treatment group. This analysis is shown in Panel B of Table 5. We see no evidence of indirect effects. Girls with more treatment friends are no more likely to respond to treatment than those with fewer.

5 Non-Educational Effects of Menstrual Cup

We find no direct benefits of being allocated menstrual cups on school attendance. This does not necessarily mean the cup is not valued; here, we briefly summarize some findings from our data on positive cup effects outside of education.

First, the girls appeared to have liked the cup as revealed by high adoption rates. In the follow-up survey 61 percent of the treatment girls reported that they would use the cup in the future and in nurse visits 3 months after the follow-up survey, 61 percent of the treatment girls and 56 percent of the control girls reported using the cup. Survey data reveal that the primary benefits of the menstrual cup were related to increased convenience of menstrual blood management and increased mobility.

Qualitatively, when asked what the good things were about the menstrual cup, treatment girls reported that it was easy to use (31 percent), convenient for walking and cycling (14 percent), that they didn’t need to wash rags (19 percent), and that it was convenient to manage menstrual blood (25 percent).

Our time diary data filled out by the girls throughout the project help to further quantify the convenience of having a menstrual cup. We asked about time use on a number of activities; evidence on the impact of menstruation and the menstrual cup on a subset of these activities is reported in Table 6. On days that girls were menstruating, they spent approximately 24 additional minutes doing laundry (Column 1); this additional time spent was presumably in order to wash menstrual rags. Being given a menstrual cup significantly reduced the amount of time doing laundry on period days. Girls in the treatment group spent 20 minutes less time on laundry than the control girls on period days. Thus, menstrual cups entirely reduced additional time for laundry on days girls were menstruating; this seems likely to be one of the major impacts of the menstrual cup. Although girls cited additional mobility as a benefit of the menstrual cup, we do not see any reduction in time spent working due to the period (Column 2) or any impact of the menstrual cup.

For other outcomes of interest – for example, behaviors reflecting cultural taboos about

menstruation – we did not see any impact of the menstrual cup. Although girls spend approximately 16 fewer minutes cooking (Column 3) and 10 fewer minutes doing religious worship (Column 4) on days when they are menstruating, there was no difference on time allocation towards these activities between the treatment and control girls on period days. Our survey gives insight into why time use on these activities, and others, was not affected by being given a menstrual cup. Girls were asked whether some activities were limited during their period and if so, the reasons why. Religious activities such as doing puja (religious worship) were almost completely eliminated and almost half of the girls completely eliminated household activities related to food and water (cooking rice, eating with family, or fetching water) during a girl’s period. When asked why they did an activity less during their period, the overwhelming response for girls on these activities was “it’s just our culture”. Our questions do not allow us to understand if girls self-impose these cultural restrictions on themselves or if they are due to others in society (such as families members). Our results, however, indicate no effects of modern menstrual products on these type of activities.

Using follow-up survey questions on self-reported symptoms of vaginal discharge, pain urinating, having sores or itching, we see little evidence that the menstrual cups had an effect on gynecological health (either positive or negative). We also find no impact on period-specific symptoms of cramps or PMS. Lastly, we asked a number of questions to elicit self-esteem or empowerment.⁴ For each measure, we find no significant program impact (results available upon request).

References

- Kirk, Jackie and Marni Sommer**, “Menstruation and Body Awareness: Linking Girls’ Health with Girls’ Education,” *Royal Tropical Institute (KIT), Special on Gender and Health*, 2006.
- Kremer, Michael, Edward Miguel, and Rebecca Thornton**, “Incentives to Learn,” *Review of Economic Statistics*, Forthcoming.
- Oster, Emily and Rebecca Thornton**, “Determinants of Technology Adoption: Private Value and Peer Effects in Menstrual Cup Take-UP,” *NBER Working Paper No. 14828*, 2009.

⁴Empowerment statements included: It is wrong to use contraceptives or other means to avoid/delay pregnancy; It is alright for a couple to kiss before marriage if they have decided to marry; A husband should make most decisions in the household; A girl should be married before her first menstruation; Girls and their families should start looking for a husband after they get their first period; Women should not be touched during their monthly period. Individuals were asked if they agreed or disagreed at varying levels and responses were coded from one to five with five indicating more empowerment. Self-esteem statements included: “In the past week, how many times did you: not feel like eating; feel proud of yourself; feel happy; feel ashamed; feel that you were unable to express opinions to others; feel pressure to do something you did not want to do; feel free to say what you wanted to”. Responses were coded as “not at all; Rarely (less than once per week); Some of the time (about 1-2 times per week); Occasionally (3-4 times per week); Most of the time (5-7 times per week); or Don’t know”.

Table 1: *Menstruation and School Attendance: Alternative Measures*

	Random Checks	Time Diary School Hours (Given Time>0)
Period	.027 (.038)	-.039 (.112)
Controls	YES	NO
Individual Fixed Effects	NO	YES
Calendar Date FE	YES	YES
# of Observations	1091	2179
<i>Mean of Dep. Var</i>	<i>0.87</i>	<i>5.078</i>
Estimated impact, 180 day school year	0.37 days	

Standard errors reported in parentheses. *significant at 10% **significant at 5% ***significant at 1%

Notes: This table reports the effect of menstruation on school attendance for alternative measures. Hours in school comes from the time diaries and is limited to days on which the girl reports attending at all. Regression are limited to control girls who do not have access to the menstrual cup. Controls are age, grade, mother's education, work for pay, father's Hindu ethnicity, menses at baseline, and baseline exam score. Estimated impacts over the 180 day school year assume the period occurs on 8% of school days.

Table 2: *Effects of Premenstrual Period, Cramps on Attendance*

Panel A: Premenstrual Period Effects				
	Official Attendance Data	Time Diary Data	Random Checks	Time Diary School Hours (Given Time>0)
Period	-.025** (.0112)	-.046* (.026)	.030 (.038)	-.062 (.118)
Premenstrual Day	-.007 (.012)	-.019 (.028)	.027 (.033)	-.157 (.112)
Controls	NO	NO	YES	NO
Individual Fixed Effects	YES	YES	NO	YES
Calendar Date FE	YES	YES	YES	YES
# of Observations	15,460	4,000	1,091	2,179
Panel B: Interaction with Cramps				
Period	-.037* (.020)	-.079 (.051)	-.071 (.081)	.155 (.222)
Period × “A Little” Cramps	.014 (.027)	.055 (.062)	.125 (.098)	-.271 (.284)
Period × “A Lot of” Cramps	.028 (.034)	.038 (.074)	.139 (.096)	-.174 (.309)
Controls	NO	NO	YES	NO
Individual Fixed Effects	YES	YES	NO	YES
Calendar Date FE	YES	YES	YES	YES
# of Observations	15,460	4,000	1,091	2,190

Standard errors reported in parentheses. *significant at 10% **significant at 5% ***significant at 1%

Notes: This table reports impacts of the premenstrual period on attendance. Premenstrual days are defined as the three days before a girl starts her period. The alternative category in Panel B is “No Cramps”. The level effect of cramps are included in Column (3); in the other columns they are captured by the individual fixed effects.

Table 3: *Effects of Menstrual Cup on Time in School and Test Scores*

	Random Checks		Time Diary School Hours (Conditional on Time>0)		Test Scores	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-0.005 (.023)	-.0016 (.015)	0.070 (.105)		-.013 (.151)	-.023 (.178)
Treatment × Period		-.038 (.052)		-.096 (.179)		
Period		.014 (.038)		-.050 (.114)		
Treatment × After						-.027 (.124)
Controls	YES	YES	YES	NO	YES	NO
Individual Fixed Effects	NO	NO	NO	YES	NO	YES
Calendar Date Fixed Effects	YES	YES	YES	YES	YES	YES
<i>Mean of Dep Var</i>	.86	.86	5.06	5.12	.015	.015
# of Observations	2,217	2,217	3,883	4,442	150	322

Standard errors in parentheses. *significant at 10% **significant at 5% ***significant at 1%

Notes: This table shows the impact of period and period for treatment girls on school attendance, as well as the effect of treatment on test scores. Controls are age, grade, mother’s education, work for pay, father’s Hindu ethnicity, menses at baseline, and baseline exam score.

Table 4: *Treatment-on-treated and IV Results*

	Official Attendance Data	
	Treatment on Treated	Instrumental Variables
Used Cup	-.005 (.016)	-.077 (.076)
Used Cup × Period	-.028 (.023)	-.037 (.036)
Period	-0.022** (.009)	-0.020** (.010)
Individual Fixed Effects	YES	YES
Calendar Date Fixed Effects	YES	YES
Instruments:		In Treatment Group, Treat × Period
Observations	26,518	26,518

Standard errors in parentheses. *significant at 10% **significant at 5% ***significant at 1%

Notes: This table shows our primary results on the effect of the menstrual cup but instead of simply estimating the impact of *owning* the cup, we estimate the impact of *using* the cup on attendance. Column 1 estimates the treatment on treated effect. Column 2 instruments for usage with owning the cup, and for “Used × Period” with “Treat × Period”. This is restricted to the official attendance data because we do not have large enough sample sizes for IV in the other measures.

Table 5: *General Equilibrium Effects*

Panel A: Effect of Period				
	Official Attendance Data		Time Diary Data	
	(1)	(2)	(3)	(4)
Period	-.028*** (.008)	-.028*** (.008)	-.028 (.020)	-.028 (.020)
Any Friend with Period	-.003 (.005)		.004 (.016)	
# of Friends with Period		-.007 (.005)		.005 (.012)
Controls	NO	NO	NO	NO
Individual Fixed Effects	YES	YES	YES	YES
Calendar Date Fixed Effects	YES	YES	YES	YES
# of Observations	31,693	31,693	8,075	8,075
<i>Mean of Dep Var.</i>	<i>0.86</i>	<i>0.86</i>	<i>0.55</i>	<i>0.55</i>
Panel B: Effect of Mooncup				
	Official Attendance Data		Time Diary Data	
	(1)	(2)	(3)	(4)
Treat × Period × # of Treat Friends		.006 (.019)	.049 (.037)	
Treat × Period × # Total Friends		.007 (.013)	-.058 (.045)	
Individual Fixed Effects		YES	YES	
Calendar Date Fixed Effects		YES	YES	
<i>Mean of Dep Var</i>		<i>0.86</i>	<i>0.55</i>	
# of Observations		31,363	8,075	

Standard errors in parentheses. *significant at 10% **significant at 5% ***significant at 1%

Notes: This table reports evidence on possible general equilibrium effects of the period (Panel A) or the menstrual cup (Panel B). Friends are measured at the baseline survey, where girls are asked to list their friends at the meeting. In Panel A friends include all friends in the sample. In Panel B we estimate whether the impact of the cup is different for girls with more friends in the treatment group. Panel B controls for the appropriate interactions: Treatment × Period, Period, Period × # Treat Friends and Period × # Total Friends. The interaction between treatment and number of friends is not included because it's constant within an individual.

Table 6: *Effect of Menstruation, Cup on Non-Educational Time Use*

<i>Hours Spent Doing:</i>	<i>Laundry</i>	<i>Work</i>	<i>Cooking</i>	<i>Puja</i>
Period	.372*** (.070)	.059 (.086)	-.265*** (.062)	-.156*** (.031)
Treatment × Period	-.318*** (.079)	-.016 (.104)	.114 (.018)	.036 (.049)
Individual Fixed Effects	YES	YES	YES	YES
Calendar Date Fixed Effects	YES	YES	YES	YES
# of Observations	8,075	8,075	8,075	8,075
<i>Mean of Dep Var.</i>	<i>0.531</i>	<i>0.471</i>	<i>0.939</i>	<i>0.294</i>

Standard errors in parentheses. *significant at 10% **significant at 5% ***significant at 1%

Notes: This table reports evidence on non-educational time use impacts of menstruation and the menstrual cup, using data from time diaries. “Work” measures number of hours of work in either agricultural or day labor work. “Puja” are religious activities.