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**What's the bleeding problem?
Policy and attitudes towards sustainable menstrual hygiene materials in India**

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ABSTRACT

Rationale and objective: In a bid to improve menstrual hygiene outcomes in low- and middle-income countries, state and civic society stakeholders have determinedly promoted the take up of disposable or single-use pads, at the neglect of less polluting alternatives. This oversight is problematic as it contributes to the increased burden of waste management, and denies women the right to informed choice. Using an experimental approach, this study examines the effects of exposure to sustainable alternatives compared with single-use pads on women's attitudes to menstrual materials and practices. We test the hypothesis that such exposure positively effects women's preferences and attitudes to more sustainable alternatives versus single-use pads.

Methods: 277 women across ten slums in Hyderabad, Telangana state, India, participated. Using stratified random sampling, women were offered single-use pads or reusable cloth-pads or only information on menstrual materials. Study was facilitated by local NGOs and all interactions were conducted by pairs of women. Women were interviewed before and after program participation about their menstrual practices and beliefs, awareness and preferences regarding menstrual materials. Analysis included Difference-in-Difference Ordinary Least-Squares Regressions and F-tests for equality among conditions.

Results: Primarily, exposure to non-pad conditions (cloth and information) significantly improved preferences and attitude towards less polluting non-pad alternatives and disposal practices versus pad condition (Cohen's d : 0.42 to 0.39; $p < 0.05$). Additionally, we find that awareness of menstrual materials improved across all conditions by an average of two points, but beliefs regarding social taboos surrounding menstruation and materials remain sticky.

Conclusions: Overall, our results suggest that the 'disposable pad culture' is invasive and poses serious challenges to adoption of more sustainable alternatives and disposal practices. Our results also suggest that supporting behavioural shift to sustainable menstrual materials will require innovations focussed on convenience to end-users alongside evidence-based, policy-driven messaging, at a minimum to support awareness of alternative choices.

Key words: Menstrual Hygiene Management (MHM), Menstrual Health, Sustainability, Disposable, Single-use, Reusable, Menstrual Cups, Slums, India.

1. Introduction

Around 1.7 billion girls and women of menstruating age now live in low and middle-income countries (LMICs) (UN, 2019). Their menstrual health was identified as a neglected component of public health systems in LMICs (Sommer et al., 2013a). In response, several LMIC governments designed strategies and policies for adoption of good Menstrual Hygiene Management (MHM). MHM requires the provision of information to educate and normalise understanding about menstruation; water, sanitation and hygiene facilities; supplies such as soap and sanitary materials to hygienically absorb or collect blood; and environmentally-friendly waste disposal (JMP, 2012). Internationally, however, it is noted that one component of MHM – provision or access to sanitary materials – has been favoured in the public policy arena, and this has largely been managed via the pledge to distribute free or discounted disposable sanitary pads to schools mainly due to the tangible nature of such interventions (African Coalition for MHM, 2019).

Disposable sanitary pads generate an estimated global waste of around 480 billion soiled pads annually (van Eijk et al., 2019). Managing menstrual waste is a huge challenge in LMICs, especially in face of unprecedented urbanisation (WHO, 2010). Already some 229 million girls and women of menstruating age in LMICs live in urban slums (UN, 2019) and manage their menses in squalid conditions that are typically lacking in wet waste management systems (Garikipati and Boudot, 2017). Increasing awareness of these conditions have seen the global MHM discourse move to the dual recognition that whilst good menstrual hygiene is central to the health and wellbeing of women, there is an equal and urgent need to reduce the environmental impact of menstrual waste and promote more sustainable materials.

Recent research reflects this shift in the global MHM agenda. While predominant focus has remained on the needs of girls, to enable them to remain in school, there is also recognition of the needs of women across the life-course (Baker et al., 2017; Hennegan and Montgomery, 2016), women in the workplace (Sommer et al., 2018), rural women (Phillips-Howard, 2015) and also for mental health (Caruso et al., 2018). One of the most studied initiative has been the distribution of disposable pads, especially for schoolgirls. Over the last few years, there has been a marked shift towards the study of more sustainable materials like reusable cloth-pads and menstrual cups. For instance, a study from Uganda reports that schoolgirls using reusable pads report less difficulty and disgust with cleaning and changing absorbents and increased absorbent reliability (Hennegan et al., 2016). A study from western Kenya reports that the provision of disposable pads or menstrual cups reduces the exposure to sexual and reproductive harms among schoolgirls with a ~50% lower prevalence of sexually transmitted infections compared with usual practice (Benshaul-Tolonen et al., 2019).

Despite these attempts, there is as yet a lack of consistent effort by state and civic society stakeholders in LMICs to include more sustainable alternatives to disposable pads in their MHM policies and programs. At least partly, this is because we lack an understanding of how promotion of disposable sanitary pads in LMICs has influenced menstrual practices and preferences among women and what it takes to shift behaviour to more sustainable alternatives and indeed whether such a shift is plausible.

1.1. The case of India

Home to over 20% of world's menstruating girls and women, India represents an important case to study these issues (estimated from Census of India, 2011). Like in many LMICs, disposable sanitary pads have dominated the public policy discourse in India (Muralidharan, Patil and Patnaik, 2015). MHM initiatives by the government of India include programmes to improve knowledge of pad usage (Nemade, Anjenaya and Gujar, 2009), the production and

marketing of low cost pads (Sommer et al., 2013b; Venemae, 2014), distribution of subsidized pads in rural areas (Garg, Goyal and Gupta, 2012), free pads to school girls (Sivakami et al, 2019) and the provision of thousands of small incinerators¹ and sanitary pad vending machines in schools (Sommer et al., 2013b; Government of India, 2019).² Most prominent is the government's national flagship programme, Rashtriya Kishor Swasthya Kayakram (RKSK), operating through the National Rural Health Mission (NRHM), which promotes girls' access to disposable pads (Muralidharan, Patil and Patnaik, 2015).³ Disposable sanitary pads are the menstrual product preferred by the state in India, where good MHM has been equated with the promotion of disposable or single-use pads.

Research suggests that ten plus years of public policy push to popularise sanitary pads has resulted in a perceptible shift in MHM practices across India, especially among young girls and urban populations. A systematic review of studies of MHM among schoolgirls in India over 15 years illustrated commercial pad use increased significantly, doubling from 28% to 52% in reported use, with two-thirds of girls in urban environs reporting use (van Eijk, 2016).⁴ While systematic data on MHM practices among the poorest members of society are lacking we can examine community level snapshots from comparative populations. A study from 2001 by Garg, Sharma and Sahay find that just 28% of women from slums in Delhi reported as using disposable pads. Around 15 years later, Garikipati and Boudot (2017) find that 64% women, from comparable populations (slums in Hyderabad), report using pads as their only or main menstrual protection. At least partly, the popularising of disposable pads among very poor urban communities reflects a general increase in disposable incomes and aspirational consumption behaviour.

This has had serious implications for urban waste disposal systems in India which already struggle to meet the needs of a growing population (Myles et al., 2018). A study by Basu (2013) estimates that India produces 5.2 billion soiled pads annually. Our estimate suggests that usage is likely to be closer to 12.24 billion, which translates to 112,800 tonnes of dry waste sent to the landfills annually.⁵ Yet, efforts to popularise sustainable menstrual materials in India lack the backing of the state apparatus,⁶ and remain localised and limited in reach. For example, the promotion of falalin as menstrual material among tribal girls in Gujarat (Shah et al., 2013) and reusable cloth-pad initiatives by organisations like Eco-Femme, Uger, Gramalaya and RealRelief and the experiments with compostable pads by companies like Akkar, Carmesi, Heyday and Saathi among others.

One of the reasons for the reluctance to move away from disposable pads in India has been that many of the alternatives to pads, like tampons and menstrual cups require insertion – which is met (or perceived to be met) with deep resistance owing to the widely prevalent patriarchal

¹ These efforts have continued despite earlier research that highlights emission risks from small-scale incinerators (Batterman, 2004). Also see Elledge et al., (2018).

² Some interventions have focused on improving adolescent reproductive and sexual health and counselling including MHM care, and education that menstruation is a normal physiological process and improving WASH in schools through clean and gender separated toilet facilities and improved water access (Muralidharan, Patil and Patnaik, 2015). However even in these cases the focus has been around promoting pads as the 'preferred' sanitary material.

³ The most recent example of this is the allocation of Rs. 100 crores by the Government of Andhra Pradesh to the distribution of pads to two million adolescent girls (Jayachandran, 2019).

⁴ In tandem, there was an association found between increased availability of sanitary pads and a decrease in absence, however, data were inadequate from the aggregate of studies to determine if other covariates were related, for example, good quality toilets have been shown to curtail absence among schoolchildren in India (Adukia, 2017).

⁵ Estimation details are provided in Appendix A, Box A1.

⁶ The only exception to this has been the recent small scale intervention by the Government of Kerala, under which 5000 menstrual cups were distributed to women on voluntary basis (Bechu, 2019).

taboos against vaginal insertion, especially among unmarried women.⁷ Studies that trials menstrual cups in India are also very rare.⁸ Promoting awareness on correct use of non-insertion alternatives like reusable cloth is also not seen favourably as it is perceived as a step backwards (Garikipati and Boudot, 2017). However, a growing population and rapid urbanisation means India may have little choice than to shift focus from disposable pads and offer women the right to informed choice across the range of menstrual materials. The findings of this study are likely to inform such considerations.

1.2. Study objectives

The primary aim of this study is to examine the effects on women's attitudes towards menstrual materials after they have been exposed to sustainable alternatives compared with disposable pads. Our secondary purpose is to investigate the effect on women's willingness to adapt behaviour, awareness and beliefs about menstrual materials when they are exposed to information on the range of menstrual materials. We use an experimental setup to compare the effect of three conditions: when women are offered single-use pads and information, when they are offered reusable cloth-pad and information and a control group offered only information. We carry out the study in urban slums in Telanagana, India.

The main hypothesis we test is that exposure to non-pad alternatives (conditions that offered reusable cloth-pad and information) will improve women's attitudes to sustainable menstrual materials when compared to pads. We also examined menstrual practices and beliefs among women and carry out an exploratory analysis of our findings.

2. Methods

The analyses reported here use data from an experimental pilot carried out with 277 women from ten slums in Hyderabad, the capital city of Telangana, India. The study design included repeat cross-sectional surveys over six months to quantify the effects of providing women either with single-use pads or reusable cloth pads, compared with usual practice controls (information only) on uptake and women's preferences for menstrual materials and practices. Baseline was carried out mainly from July to September 2017; distribution of menstrual materials was completed by October 2017 and follow-up was from April to May 2018. This project was funded by a GCRF grant 2016/17 (Ref No. 141131). Ethics was approved and overseen by Safa in Hyderabad, India (Ref: Safa0317R) and the University of Liverpool in Liverpool, UK (Ref: RETH000734).

2.1. Study location and partner organisations

We selected to carry out this study in slums of a large and growing urban city as we wanted to explore associated MHM issues in challenging urban settings, like disposal, affordability and public policy penetration. The core research team had previous experience working in Hyderabad, with access to NGOs and other MHM relevant networks. We hence selected slums in Hyderabad as our study location. We then selected two NGOs with strong community presence and experience of working with women from slums, who had the capacity to be

⁷ A small scale-investigations in Kenya notes that girls may insert pads inside their vaginas to prevent them falling out, suggesting that intravaginal practices even when considered culturally taboo could occur for pure practical reasons (Mason et al., 2019).

⁸ We came across just one study from Gujarat with 158 women aged 20 to 50 years that provided menstrual cups and followed them over three cycles. It found they were preferred for comfort, dryness and less odour with 80% reporting ease of insertion and 90% ease of removal, with a few episodes of leakage (Kakani and Bhatt, 2017).

trained and conduct the pilot study: Safa and KGNMT. Additional information about these partner organisations and their role in the study is provided in Appendix A, Box A2.⁹

2.2. Participant selection, sampling and randomisation

In consultation with partner NGOs, ten slums were selected to achieve a mix of slum size, access to amenities and other considerations like safety of enumerators, accessibility etc. Using a mix of municipal records, NGO records and information from women community-leaders, a list of households in the selected slums was prepared. From each of the slum, a random sample of 50 households was created. From this list, we removed households that were known to reside in the slums only intermittently and households that had no women in the age group 18-45 years of age. Using stratified random sampling, the remaining women were allocated to one of the three study conditions. No significant differences were found among conditions on slum location or size at the slum level. Fig. 1 depicts the flow diagram of the study, including enrolment and random allocation.

2.3. Interventions

Two interventions were tested that represented the current use of menstrual materials in India: a single-use pad and re-usable cloth-pad. A selection exercise assessed two products as viable for this study: a single-use pad that required burial to compost ('Single-use' condition) and a re-usable cloth pad with an anti-microbial top layer ('Reusable' condition). Additional information about these products and the selection process is detailed in Appendix A, Box A3.

It also became apparent that awareness of menstrual products other than traditional cloth and disposable pads was lacking. It emerged that just being informed about alternatives might make a difference to women's choice of menstrual materials. We hence opted to have the control group receive information-only ('Inform-only' condition), to understand the differential impact of only providing information on the range of available menstrual protections. After allocation to study conditions, baseline was completed and menstrual materials distributed to pad and cloth-pad groups. All interactions were administered by pairs of women, one of whom was an employee of the partner NGOs. Most individual interviews were carried out in respondent's home, but where women preferred it, they were done in partner NGOs' office.

2.4. Overview of study conditions

There were three study conditions: (1) Single-use arm provided with pads and information on range of menstrual materials, (2) Reusable group were given cloth-pads and information, and (3) Inform-only arm, continued with usual practice and were given information on menstrual materials. The current study analyses the time points directly before for all conditions (baseline), and after the women completed six months of material use (follow-up). Follow-up is used for comparisons between single-use pads to reusable cloth-pads and inform-only. Fig. 1 provides the flow diagram of the study, including the timing of the interventions and follow-up relevant to our analysis.

⁹ Two more NGOs: Streedhan and Kartavya facilitated focus group discussions with participants and sanitation workers. These results are not reported here.

2.5. Data capture

Women participated in one-to-one interviews at household level that lasted approximately one hour each at baseline and at follow-up. We used structured questionnaires that were piloted beforehand during the planning phases to ensure that it was culturally appropriate and relevant to the purpose of this study. The baseline questionnaire generated socio-demographic and menstrual health related variables. There was also room for some open ended answers which constitutes our qualitative analysis.

At both baseline and follow-up, respondents were asked about their preferred menstrual material and their willingness to adopt sustainable menstrual practices. We also included questions on current menstrual practices, awareness and beliefs. Women's preference for sustainable menstrual material is considered primary outcome as changes to these preferences is what we mainly wanted to study post-exposure to sustainable alternatives to disposable pads. Their willingness to adapt menstrual practices, their beliefs about menstrual materials and awareness of alternatives to pads and adaptability of menstrual practices are considered secondary outcomes. All measures used in this study are self-reported by respondents during interviews and have not been validated in any other way. Additional information about the study measures is provided in Appendix A, Box A4.

2.5.1. Primary and secondary outcomes

Our primary outcome is a measure of women's preference for sustainable menstrual materials. This outcome measure was chosen as the main aim of the study was to understand the effect of exposing women to alternatives to single-use pads on their preference for menstrual materials.

We also included three secondary outcomes: women's willingness to adapt menstrual practices in terms of use and disposal; a measure of women's awareness of materials beyond traditional cloth and disposable pad; and a measure of women's beliefs about menstruation and materials, including their beliefs about the need for drying cloth in direct sunlight. These outcomes were chosen because in combination they encompassed women's attitudes towards menstrual materials and practices that are more sustainable than using disposable pads.

Note that, in this study, we measured only change in attitudes, knowledge and belief and not actual behavioural change which is potentially more difficult to achieve, particularly in LMICs (e.g., Paul-Ebhohimhen et al., 2008). Hence, we expected that our hypotheses would hold for our primary outcome and for those secondary outcomes that are not reliant on knowledge alone as women were offered identical information on menstrual materials across conditions.

2.5.2. Covariates

We include a range of socio-demographic and menstrual health related variables as covariates: age, marital status, education level, employment status, head of household, caste, access to private toilet and menstrual material used at baseline. These covariates and their measurements are detailed further in Appendix A, Box A4.

2.6. Sample size

Stratified random sampling was used in this pilot to allocate women to one of the three study conditions: Single-use ($n = 200$), Reusable ($n = 200$) and control Inform-only ($n = 50$). As the main aim of the study was to quantify the effects of exposure to sustainable alternatives to disposable pads, control was kept smaller than the two arms providing menstrual materials. Information on the range of menstrual materials was provided to women across all three conditions. Sample size calculations assumed a 30% increase in preference for sustainable

menstrual materials after exposure to non-pad alternatives thus increasing it from 50% to 65%, requiring a total pop of 386 (193 per arm), providing 85% power with 0.05 alpha. Based on these calculations, we found that our sample size would be adequate.

2.7. Statistical methods

We tested our hypotheses first by comparing the magnitude of difference between exposures to non-pad conditions (Reusable vs. Inform-only) vs. the pad-condition (Single-use) by calculating the effect size using Cohen's term d . We also use Difference in Difference (DID) Ordinary Least-Squares Regression estimations and F -tests for equality. We began by conducting DID regressions for our outcome variables with and without covariates. We then examined the R^2 values to choose the models with the best-fit that explained the largest amount of variance for interpretation and further analysis. In each case, we found that the models with covariates explained more of the variance in the data and provided a better fit.

We investigated the magnitude, direction and significance of the effects for all outcomes from the best-fit models that include covariates to evaluate the effectiveness of non-pad conditions (Reusable + Inform-only) versus pad-condition (Single-use). We first consider each of the conditions separately and then combined the non-pad conditions and consider them jointly. Our results remained fairly robust across the two specifications. So we examined the magnitude and direction of the coefficients for the non-pad interventions \times time interactions (follow-up), which, combined with F -tests for equality, allowed us to compare the effects of each intervention against another. Findings were interpreted to be significant when $p \leq 0.05$ for all outcomes.

All analyses were intent-to-treat, meaning that all women randomised into a study condition were analysed as part of that condition, regardless of whether or not they used the menstrual material they were given as part of their intervention condition.

3. Results

3.1. Study flow and follow-up attrition

Fig. 1 illustrates the flow diagram of the study. Of the 453 women enrolled, resource and logistical constraint meant that 293 (64.67%) could complete the consent process and baseline. Of the 293, 277 (95.56%) were evaluated at six months follow-up and there was no significant difference on the proportion of women evaluated by condition. Of the 131 women consenting in the Pad condition 127 completed the six months follow-up (96.95%), Cloth-pad also included 127 of the 133 who participated (95.49%) and Inform-only included 26 of 29 who participated (89.65%). At analysis, three interviews were excluded as they were incomplete owing to women leaving interviews after they had begun. Women lost to follow-up and analysis did not differ significantly on covariates or outcomes as measured at baseline.¹⁰

¹⁰ Results available from corresponding author on request.

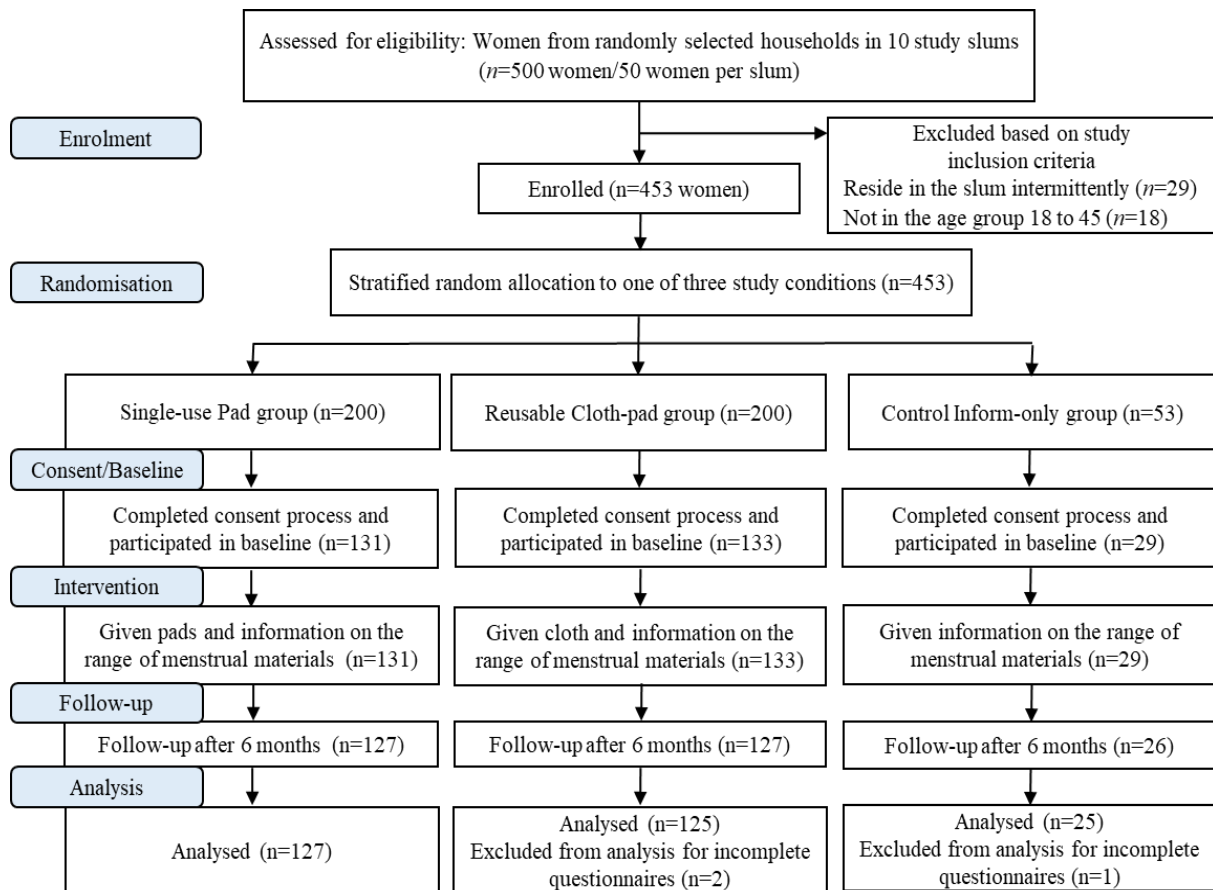


Fig. 1. CONSORT diagram detailing study flow of all relevant aspects and conditions.

3.2. Covariates and outcomes at baseline

Table 1 provides baseline scores on covariates and outcomes, including women’s socio-demographic characteristics. At baseline, women in the full sample were an average of 28 years old ($SD = 7.53$). Most women had some education, with a mean score of 1.58, indicating on average they had attended high school ($SD = 1.14$). Approximately 20% women were in paid employment ($SD = 41\%$) and lived in households typically headed by their husbands or parents with average score of 1.12 ($SD = 0.68$). Seventeen percent were from backward castes, which indicated fewer restrictions on women’s autonomy and mobility in these households ($SD = 0.54$). Sixty percent of women had access to a private toilet ($SD = 49\%$) while remaining used communal facilities. Around 78% women used pads as their only or main menstrual protection ($SD = 42\%$). There is some evidence to suggest that state policy of popularising pad has influenced women. Of the 216 pad users in our sample, 77.31% ($n = 167$) report using pad out of habit or preference, 18.52% ($n = 40$) report social influence and 4.17% ($n = 9$) report being influenced by a government or NGO scheme.

Levene’s F-test for equality of variance is used to check for the effectiveness of our randomisation strategy. We found differences across conditions only on the covariate that measured head of household, suggesting that women with greater decision making agency (living with parents or heading their household) are somewhat over represented in the Reusable condition than Single-use (but not Inform-only). With respect to outcomes, the only difference we found is that women in the control Inform-only group are more willing to adapt menstrual practices than the two product arms.

Two results on outcomes at baseline are worth noting. First, we found that awareness of menstrual materials other than cloth and disposable pads was negligible among women.

Exposure to urban living and education thus far seem to have no impact on this. Twenty six women (9.75%) knew that pads could be made of compostable materials (cotton, banana pulp), but none of them knew of tampons or menstrual cups.

Second, we found that women’s beliefs on menstruation and menstrual materials at baseline reflected cultural taboos and misinformation, with formal education making little difference. Our survey evidence indicated that the beliefs expressed reflected social norms that typically regard menses as “*galeez*” (impure). Women also expressed a sense of “*sharam*” (shame) in drying cloth outdoors. Just over half the sample (54.1%) report sunlight drying, while the rest report drying cloth indoors. This was seen as the “*saahi*” (correct or respectful) thing to do. Moreover, women relied on their social networks for knowledge on menstruation, which is largely considered as outside the purview of formal education. One of our respondents claimed that she knew cloth was inferior to pad because “*My aunt’s friend became infertile because of it and she told us*”.

Table 1.

Baseline scores on covariates and outcome and analysis of variance among conditions

Study variable	Scores for the full sample and intervention conditions				ANOVA
	Full sample	Single-use	Reusable	Inform-only	P-value
<i>Covariates</i>					
Age (years)	28.01 (7.53)	28.39 ^a (6.92)	27.94 ^a (8.09)	26.48 ^a (7.70)	0.505
Education level	1.58 (1.14)	1.56 ^a (1.04)	1.62 ^a (1.20)	1.52 ^a (1.39)	0.865
Employed	0.21 (0.41)	0.20 ^a (0.40)	0.22 ^a (0.41)	0.28 ^a (0.46)	0.649
Head of household	1.13 (0.68)	1.04 ^a (0.62)	1.22 ^b (0.75)	1.12 ^{ab} (0.60)	0.121
Backward caste	0.17 (0.54)	0.18 ^a (0.68)	0.14 ^a (0.34)	0.32 ^b (0.48)	0.289
Private toilet	0.60 (0.49)	0.65 ^a (0.48)	0.58 ^a (0.50)	0.52 ^a (0.51)	0.359
Pad users ⁺	0.78 (0.41)	0.78 ^a (0.42)	0.77 ^a (0.42)	0.84 ^a (0.37)	0.732
<i>Primary outcome</i>					
Preference for sustainable materials	0.43 (0.74)	0.42 ^a (0.73)	0.46 ^a (0.77)	0.32 ^a (0.63)	0.691
<i>Secondary outcomes</i>					
Willingness to adapt menstrual practices	0.55 (0.50)	0.53 ^a (0.50)	0.54 ^a (0.50)	0.76 ^b (0.44)	0.091
Awareness of alternatives to cloth and pad	0.09 (0.29)	0.08 ^a (0.27)	0.10 ^a (0.31)	0.12 ^a (0.33)	0.709
Beliefs about menstruation and materials	1.36 (0.66)	1.40 ^a (0.70)	1.34 ^a (0.63)	1.24 ^a (0.64)	0.470
Number of observations	277	127	125	25	

Note. Scores are presented as Mean (Standard Deviation). Number of observations are given in the last row.

Abbreviations. ANOVA = Analysis of variance.

^{a,b} Values with the same superscripts in the same row are not significantly different at $p \leq 0.05$ for ANOVA and post-hoc tests; different superscripts indicate that the Means are significantly different.

⁺ In our sample, 64.26% ($n = 178$) report using pads only; 13.72% ($n = 38$) report using pad mainly but also cloth and 22.02% ($n = 61$) report using cloth only. All pad users have been combined.

3.3. Analysing product interventions

At the start of the product distribution, the study faced considerable resistance from women who were using disposable pads but were selected to the Reusable condition that provided cloth-pads. Women perceived this as asking them to use an inferior product than what they were used to. Several phrases like, “*pad is better/best*”, “*this is not modern*”, “*I am a city girl*”, and “*stepping into the dark ages*” were used when expressing this opinion. In response to this, product distribution was halted and group sessions were organised where the characteristics of the materials being distributed were discussed and questions answered. This delayed the project but was necessary for smooth running of the interventions. It is also likely to have positively affected the uptake of the products.

Table 2 provides follow-up scores on how women responded to the product conditions. While nearly all the women used the distributed products, approximately 38% ($n = 48$) in

Single-use arm and 21% ($n = 26$) in Reusable arm used it with their usual menstrual protection. We found differences across conditions on all the responses measuring perceptions of distributed products. Perception of convenience to use and wellbeing were significantly better for Single-use, whereas Reusable scored significantly better on reducing menstrual waste.

As the Single-use condition used compostable pads, the magnitude of difference across product conditions on menstrual waste was investigated further. On doing so we found that the way women disposed used pads did not shift at all from behaviour at baseline. Over 98% ($n = 125$) in Single-use threw used compostable pads in the bin as they had done with disposables at baseline. Several women quoted “*adath*” or habit and convenience as reasons for binning compostable pads, but lack of appropriate space was also a significant reason. Just 1.6% ($n = 2$) buried them as required for composting. We found that these women also buried their used menstrual material (disposable pads) at baseline.

Table 2

Scores on use and perception of products distributed in the product conditions (PI and CI).

Variable of interest	Single-use	Reusable	<i>t</i> -test
Used the product distributed	0.98 (0.13)	1.00 (0.00)	1.409
Used in combination with other menstrual materials	0.38 (0.49)	0.21 (0.41)	-3.007**
Convenient to use	0.86 (0.35)	0.54 (0.50)	-5.912***
Contributed to overall wellbeing	0.54 (0.50)	0.39 (0.49)	-2.425*
Helps reduce menstrual waste	0.36 (0.48)	0.62 (0.49)	4.150***
Number of observations	127	125	

Notes. Scores are presented as Mean (Standard Deviation).

Inference. * Indicates difference between Means is significant at 0.10 level, ** at 0.05 level and *** at 0.01 level.

3.4. Analysing outcomes

Table 3 presents that post-intervention scores on our primary and secondary outcomes across conditions and the effect size of non-pad conditions vs. pad condition for all outcomes. We found differences across conditions on all our outcomes at follow-up, suggesting that study conditions worked as intended. Prominently, women in the non-pad conditions (Reusable and Inform-only) were more likely to express a preference for sustainable menstrual materials (Cohen’s d : 0.42, $p = 0.009$) and were more willing to adapt menstrual practices at follow-up (Cohen’s d : 0.39, $p = 0.021$) than women in Single-use condition.

Further, we conduct the DID regression analysis and examination of R^2 values indicated that in all the cases, the model including study covariates explained more of the variance in the data than the model without covariates. Hence, for the remaining of our analyses, we use models that included covariates for all primary and secondary outcomes. Full regressions models, including results on covariates, are presented in Appendix B, Table B1.

Table 4 presents the relevant summary effect sizes when adjusted for covariates, i.e., DID coefficient and significance level for each of the non-pad intervention’s effect versus Single-use, which is the intervention \times time interactions from the regression models. We also present comparisons with significance levels among effect sizes from F-tests for equality.

There was clear support for our main hypothesis that exposure to the two non-pad interventions Reusable and Inform-only have a positive influence on women’s preference for sustainable menstrual materials that were hitherto unknown to them (β : 0.23, $p = 0.049$ and β : 0.55, $p = 0.013$ respectively). The results is robust to combining the two non-pad conditions (Reusable + Inform-only) and comparing with Single-use condition (β : 0.28, $p = 0.020$).

We found good support for our secondary hypothesis that non-pad conditions had a positive influence on women’s willingness to adapt menstrual practices. Results on secondary outcomes suggest that Reusable condition had a positive influence on women’s willingness to adapt menstrual practices (β : 0.17, $p = 0.050$) and that this result remains robust when combined with

Inform-only, the other non-pad group (β : 0.18, $p = 0.046$). With respect to other secondary outcomes, we found no difference across conditions with respect to awareness of menstrual materials, but that Reusable had a greater positive effect on women’s beliefs about menstrual materials than Single-use (β : 0.20, $p = 0.049$) and results remains robust to combining both non-pad conditions (β : 0.20, $p = 0.047$).

Table 3

Follow-up scores on outcomes, post-hoc difference tests and effect size (non-pad vs. pad group).

Study variable	Scores for the full sample and intervention conditions				Cohen’s term d^*	P -value
	Full sample	Single-use	Reusabl e	Inform-only		
<i>Primary outcomes</i>						
Preference for sustainable materials	0.67 (0.85)	0.51 ^a (0.78)	0.78 ^b (0.87)	0.96 ^b (0.93)	0.42	0.009
<i>Secondary outcomes</i>						
Willingness to adapt menstrual practices	0.96 (0.67)	0.85 ^a (0.66)	1.02 ^b (0.68)	1.20 ^b (0.64)	0.39	0.021
Awareness of alternatives to cloth and pad	1.26 (0.58)	1.22 ^a (0.52)	1.30 ^a (0.65)	1.32 ^a (0.56)	0.16	0.520
Beliefs about menstruation and materials	2.19 (0.62)	2.13 ^a (0.67)	2.26 ^b (0.57)	2.20 ^{ab} (0.58)	0.16	0.246
Number of observations	277	127	125	25		

Note. Scores are presented as Mean (Standard Deviation). Number of observations are given in the last row.

* Effect sizes (unadjusted for covariates) are computed using Cohen’s term d (Carson, 2012).

^{a,b} Values with the same superscripts in each row are not significantly different at $p \leq 0.05$ for ANOVA and post-hoc tests; different superscripts indicate that the Means are significantly different.

Table 4.

Summary of Difference in Difference coefficients for non-pad vs. single-use pad condition (intervention \times time interaction) and F-tests for equality among interventions.

	Non-pad intervention conditions		
	Reusable	Inform-only	Reusable + Inform-only
<i>Primary outcomes</i>			
Preference for sustainable materials	0.23*	0.55**	0.28**
<i>Secondary outcomes</i>			
Willingness to adapt menstrual practices	0.17*	0.12	0.18*
Awareness of alternatives to cloth and pad	0.05	0.06	0.05
Beliefs about menstrual materials	0.20*	0.24	0.20*

Note. Positive coefficients indicate that the intervention was more effective compared to the condition in which pads and information were offered to women.

^{a,b} Values with the same superscripts in each row are not significantly different at $p \leq 0.05$ for all outcomes; values with different superscripts differ significantly.

Abbreviations. CI = Cloth and Information. OI = Only Information.

For all outcomes: ** $p < 0.01$, * $p \leq 0.05$

4. Discussion

What are the implications of our results for MHM policy in India and the prognosis for introducing sustainable MHM practices especially among its urban populace? The first significant result is that disposable pads are now the main menstrual material even among marginalised urban communities. In our sample nearly 78% of women report using pads either as the only protection or main menstrual protection. Comparing this to the results from a 2015

survey of similar slums that reported pad usage of around 64% (Garikipati and Boudot, 2017), suggests that pad usage is rapidly gaining ground in urban India, even among women from socio-economically marginalised communities. This suggests that India's MHM policy, which is focussed on the promoting disposable pads has certainly succeeded in ensuring that pads are gaining in popularity and are accessible by even the poorer urban women. Pad users tend to be significantly younger, which further suggests that if status quo continues, pads are likely to fully replace cloth as menstrual materials in urban India in a few years.

One of our significant result is on women's beliefs and awareness of menstrual materials. None of the women in our sample knew of menstrual materials other than single-use pads and cloth. Also, several women in our sample believed that pads are superior to cloth as menstrual protection and that cloth was bad. These beliefs also impacted the product distribution at start of our intervention. Our baseline results suggest that women's knowledge of menstrual hygiene was influenced by anecdotes exchanged in their social circles and they had little access to such information either via formal education or popular media.

These results indicate a serious public policy failure in bringing to women's attention the range of available menstrual materials and in educating them on their correct use (for instance, that cloth requires direct sun light drying) so it does not lead to unfounded beliefs. A biased public policy focus in favour of disposable pads means women have been denied access to information on alternative menstrual materials, which effectively impedes their ability to choose. It is indicative of a public policy failure that effectively denies women the right to informed choice. This lack of awareness is also reflected in the choices women make when asked about their most preferred menstrual materials at baseline. Women express their choice between cloths and pad only, with most preferring what they use already. This policy bias needs correcting. Informing women's choice of menstrual material is not only likely to uphold their right to choice but also reduce the environmental burden caused by menstrual waste.

Our finding on disposal behaviour of used menstrual materials indicates that women prefer discarding these directly in the bin and this behaviour persisted even post-intervention among compostable pad users who were instructed on burial for composting. A staggering 98.4% continued to bin used compostable pads, mainly out of habit, convenience or lack of space. This suggest that even if compostable pads are more acceptable than cloth as an alternative to disposable pads, the requirement of burial for composting may mean they are not suited for an urban environ and lifestyle. Simply throwing away used pads is likely to persist, unless substantive efforts with information provision and training are offered to influence this entrenched behaviour.

Overall, our post-intervention results suggest that there is potential for a shift in attitudes and practice towards sustainable menstrual materials when exposed to non-pad options. Informing women of menstrual materials is likely to influence their choices to a similar extent as providing them with sustainable alternatives to pads. Women in our Reusable and Inform-only exhibited similar kind of preferences at follow-up. Women from Inform-only were somewhat more willing to experiment with materials than other groups – but small sample sizes means that further work is required to understand the true differential impact of providing women with only information about alternatives on menstrual preferences.

Results on secondary outcome regarding willingness to adapt menstrual practices support the primary outcome, in that women in the non-pad conditions were seen to be significantly more willing to adopt sustainable menstrual materials and disposal practices than Single-use condition. Further, our results show that women's knowledge of alternative materials improved across all conditions by an average of two points, suggesting that there is value even in just providing women with information on alternatives.

The final secondary outcome – beliefs regarding menstrual materials – was the most difficult to change from baseline. Culturally, menstruation was associated with taboos, especially with

respect to restriction on girls and women and the information provided by the study seem to have had little impact on these beliefs. Across the countries of south Asia, menstruation invokes strong cultural taboos, where restrictions are placed on menstruating girls and women, including separation of touching, eating, drinking and sharing facilities (Garikipati and Boudot, 2017; Sivakami et al., 2019). A study by van Eijk et al., 2016 in fact suggests that despite an increase in education, knowledge of menstrual health in general and among women has remained low with no evidence of change in the past two decades. Interestingly however, despite having access to the same information on menstrual materials, women in the Single-use condition were significantly more likely to hold the belief that cloth is inferior to pad. Offering women single-use pads may have simply reinforced their original belief that “*pad is best*” causing them to ignore the information given about alternative menstrual materials, as also reflected in their preferences at follow-up.

Overall, there is a need that India’s MHM policy focus shifts away from singularly promoting and subsidising disposable pads to recognising the need for informed choice. Informed choice should not only include awareness on the range of menstrual materials available but also on educating girls and women on correct use. For instance, one of the issues with cloth usage has been lack of direct sun light drying, which is likely to render it unhygienic. Much of the perceived inferiority of cloth is likely to be related to its improper usage.¹¹ State funded campaign for the popularisation of disposable pads has inadvertently fuelled this perception.

4.1. Limitations

This study has two main limitations: first, our final sample sizes are small, especially for the Inform-only condition and second, the challenges of conducting menstrual interventions in India have meant compromising on various aspects of the study.

4.1.1. Sample size

The final sample analysed in the three study conditions were: Single-use ($n = 127$); Reusable ($n = 125$) and Inform-only ($n = 25$). Post-hoc sample size calculations suggest that for an increase of 53% in preference for sustainable menstrual materials after exposure to non-pad alternatives from 51% in Single-use group to 78% in Reusable, our sample provides 99.6% power with 0.05 alpha. Similarly, we can draw comparisons between Single-use and Inform-only groups with 100% power and 0.05 alpha. However, when comparing Reusable group and Inform-only, the actual power is just 58.5%, mainly because these two groups have similar post-intervention results (and distinct to the Single-use pad group). Note that while our results are important, this study is primarily an experimental pilot and hence, caution in interpretation is necessary. We need full scale trials in order to thoroughly examine the idea thrown up by this study that offering women non-pad options, even if it’s just information, influences their preferences for sustainable menstrual materials.

4.1.2. Challenges of conducting menstrual interventions in India

The study was originally planned to test menstrual cups vs. single-use pads. However, menstrual cups were met with considerable opposition from women community-leaders and partner organisations who faced intense opposition for their association with a project that was perceived as promoting a product that required insertion. After much deliberation, the study design was altered to include only non-insertion menstrual materials. This greatly delayed the

¹¹ Torondel et al., (2018) suggest that if women and girls had access to WASH facilities with water, maintained personal hygiene, and were knowledgeable about menstrual hygiene, cloth could offer a sustainable solution for hygienic management of menstruation, irrespective of the availability of sanitary pads.

study which had cascading implications on time and finances. Study was once again delayed at the start of product distribution due to the resistance to cloth-pads. These multiple delays hindered our ability to make multiple visits to recruit all the women enrolled and shortened the time available for the interventions before follow-up from one year to six months. Our experience suggests that, without a public policy campaign, current cultural beliefs in India are likely to impede the adoption of menstrual materials that require insertion.

5. Concluding Comments

The last 15 years have been an exciting time for MHM globally, but especially in the LMICs. Several of them adopted MHM guidelines for the first time with many setting aside budgetary allocations for tangible programmes. Distribution of free or discounted disposable sanitary pads emerged as the preferred policy response mainly because the impact was immediate and visible, justifying state intervention and expenditure. However dramatic increases in urban populations and a large shift in consumption patterns that favour disposables for their convenience and falling prices meant that countries must now reconsider this policy focus. Encouraging outcomes from trials with more sustainable menstrual materials across the developing world have paved the way for this.

India's MHM experience is exemplary of these developments. Efforts to introduce sustainable products in India have, however, remained sporadic and spearheaded by civil organisations. So far, the state has been reticent about pushing the policy boundaries beyond disposable pads. This inertia, at least partly, emanates from the widely regarded success of the pad promoting initiatives. As evidenced by this study, even women from the poorest communities have adopted pads as their primary menstrual protection. But disposable pads pose a significant environmental challenge, especially in places where sustainable disposable mechanism are lacking or underdeveloped. Moreover, there exist other more sustainable alternatives like cloth and menstrual cups that have been shown to be equally, if not more, beneficial to women's health and wellbeing. Trialling these in LMICs is essential to inform policy and practice.

The findings of this study identify an entrenched pad culture in urban India that is likely to pose significant challenges to shifting policy and practices to sustainable alternatives. None of the women in our sample were even aware of sustainable alternatives to disposable pads. *This indicates a serious public policy failure that effectively denies women the right to informed choice.* Our results also suggest that women value the convenience of using and throwing disposable pads and any serious efforts to promote sustainable menstrual products will require innovations focussed on convenience to end-users. Alongside this we will also require evidenced-based, policy-driven messaging, at a minimum to support awareness of alternative choices, but where possible to also include proactive subsidy and promotion of sustainable alternatives. Informing women of the range of menstrual products and their correct use is what can be demanded of MHM policy guidelines as an immediate correction.

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Appendix A: Detailing Estimates, Methods and Measurement

Box A1

Estimating India's menstrual waste burden

An Estimate of India's menstrual waste: Using data from the most recent Census of India (2011), we calculate that around 336 million girls and women in India are 15-49 years of age. NFHS 4 estimates indicate that across India, 36% of menstruating women use sanitary pads (IIPS, 2016). This gives us 121 million pad users. We assume women use 8 pads per cycle on average (allowing for differential usage in urban and rural areas) giving us 1.02 billion pads used every month. PATH waste-loading model gives us the dry mass of each disposable pad as 9.2 gm (Wilmouth, *et al.*, 2013). The resultant weight of India's menstrual waste then is 1.02 billion pads X 9.2 gm per pad = 9400 tonnes per month or 112,800 tonnes annually.

Note: Given that the population data and pad usage estimates are somewhat outdated, this is most likely to be a very conservative estimate of the menstrual waste generated in India. Pad usage in India is increasing rapidly and there is no sure way of accurately estimating current menstrual waste.

Box A2

Facilitating NGOs

- **Safa** is a grassroots social venture. It mainly works with women from ethnic minorities, living in slums in Hyderabad, Telangana. It focuses on education and income generation activities as the ultimate drivers of socioeconomic empowerment. Safa provides its women members with livelihood trainings such as tailoring and embroidery, as well as entrepreneurship opportunities through the sales of its members' handmade products including bags, soft toys, carpets and others. Safa supported the ethics, pilot and planning phases and facilitated the study in six slums. Website: <http://www.safaindia.org/> (accessed on 16.09.2019).

- **KGnMT (Kasturba Gandhi National Memorial Trust)** is a national NGO with 23 branches all over the country. While the Trust mission is to improve the lives of the country's most needy women and children, each branch has some autonomy in deciding their specific remit. Its branch in Hyderabad provides residential and livelihood support to women who have been victims of crimes like trafficking and domestic violence and supports socioeconomic empowerment of women in local slums. KGnMT supported the pilot and planning phases and facilitated the study in four slums. Website: <http://kgnmthd.org/> (accessed on 16.09.2019).

Box A3

Selection process for the sustainable alternatives to disposable pads used in the study interventions

Selection Process: We first developed a list of menstrual products available in India. Following discussions with NGO partners, we excluded products that required insertion and that were not biodegradable. From this shorter list, we managed to procure 15 products. On voluntary basis, ten women residing within KGnMT, who were not part of the final study, were recruited to trial the products. Each of them was given three products to sample. After the completion of at least one menstrual cycle, they were asked to rank each product on three measures:

1. "How comfortable is it to wear?"
2. "How convenient is it to change?"
3. "How well it washes? OR How easy is it to follow the manufacturer recommended decomposing procedure?"

To better understand the ranking, we also carried out informal discussions with the women. The results of this exercise were presented at a research meeting on 11th April, 2017 in Hyderabad, with representatives from partner NGO, where the final selection was made.

The following products were selected for distribution in the two product conditions:

1. Anandi pad, manufactured by Akkar Innovations was selected for the Single-use condition. Anandi pad is averred to be India's first single-use 100% biodegradable pads that disintegrates into natural elements in a compost environment in 90 to 180 days depending on environmental considerations. Website: <https://aakarinnovations.com/anandi/> (accessed on 16.09.2019).

2. Safepad, a reusable cloth pad manufactured by RealRelief was selected for the Reusable condition. Safepad is understood to be designed with a permanently bonded antimicrobial technology that helps reduce vaginal infections caused by *Candida albicans* and other pathogens. Website: <http://www.realreliefway.com/en-us/life-saving-products/health/safepad™/safepad™> (accessed on 16.09.2019).

Box A4

Measurement details for outcome variable and covariates

Primary Outcome: Preference for menstrual materials

1. Preference for sustainable menstrual materials: We developed this outcome using women's response to the following question: "Can you please tell us what menstrual material you prefer most? In answering this question, please think only of your preference and not of other factors like price and availability. You can choose a single menstrual material or if you like, you can choose a combination of materials you prefer". Women who chose a reusable or compostable material (home cloth; manufactured cloth pad; menstrual cup; compostable pad) received two points, those who chose sustainable in combination with disposables (pad; tampons) received one point and those who chose only disposable pads were given no points. The preference for sustainable score ranged from 0-2, with higher score indicating greater preference for sustainable materials.

Secondary Outcomes: Attitude to change, awareness and beliefs

1. Willingness to adapt menstrual practices: This measures women's willingness to adopt sustainable practices in two areas: use and disposal. Responses were noted on three questions: "Would you be willing to try a new menstrual material?", "Would you be willing to pay for safe disposal of your menstrual material?" and "Would you be willing to dig a pit for burial of used menstrual material?" A woman received one point if she answered "yes" to the use question and one point for answering "yes" to either of the disposal questions. Thus, the willingness to adapt score ranges from 0-2, with higher score indicating greater willingness to adapt practices.

2. Awareness of alternatives to cloth and pad: This measures women's awareness of the range of menstrual materials beyond traditional cloth and disposable pad. Women were asked to name or describe all the menstrual material they were aware of. For each menstrual material they named or described other than traditional cloth or disposable pad they were given one point. The knowledge of menstrual materials score ranges from 0 to 4, with higher scores indicating greater knowledge of menstrual materials beyond cloth and pad.

3. Beliefs about menstruation and materials: Beliefs about menstrual materials is measured using the responses women gave to three questions: 1. "Should girls and women continue with their normal activities during their menses?" 2. "Does menstrual cloth need direct sunlight drying after wash?" 3. "If correctly used, can cloth provide equally good menstrual protection as a disposable pad?" A woman received one point for each question she answered "yes". Thus the possible range of scores are 0-3, with higher score indicating more accurate beliefs about menstrual materials.

Covariates:

1. Age: Age is measured in the number of years completed

2. Education level: Women were asked about their level of education and this was later divided into five categories: no education; secondary school; did not finish high school; high school; college; graduate. Therefore education scores range from 0 to 5, with greater score indicating greater education levels.

3. Employed: This variable indicates woman's employment status. This covariate is dichotomous, with 1 indicating that she is employed and 0 indicating that she isn't.

4. Head of household: Women were asked about who headed their household. This variable is scored based on the assumption that woman's ability to bargain for a specific outcome is likely to be influenced by who heads the households in the following ascending order: in-laws other than husband; husband; parents and self. Thus head of household scores range from 0 to 3, with greater scores indicating greater bargaining power.

5. Backward caste: This variable indicates social status of woman's household. This is a dichotomous covariate, with 1 indicating that the household belongs to a backward caste and 0 indicating that it does not.

6. Private toilet: This variable indicates whether the woman has access to a private toilet. A dichotomous covariate, with 1 indicating that she has access to a private toilet and 0 indicating that she does not.

7. Pad users: Women were asked what menstrual material they used. This covariate is dichotomous, with 1 indicating that she used pad and 0 indicating she used cloth. Note that 38 women (13.72%) reported using a combination of pad and cloth. Pad was used during heavy days and cloth during lighter days, indicating that pad was their main menstrual material. Therefore they were considered as pad users. This group is also similar to pad users on all covariates except age (combination users are significantly older than only pad users), but are different to cloth users on a number of covariates. Results available on request.

References for Appendix A

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Appendix B: Supplementary Results Tables

Table B1.

Difference in Difference Ordinary Least Squares Regression Results Including Covariates (Reusable and Inform-only vs. Single-use)

	Primary outcome	Secondary outcomes		
	Preference for sustainable materials	Willingness to adapt menstrual practices	Awareness of alternatives to cloth and pad	Beliefs about menstrual materials
Reusable	0.031 (0.090)	0.025 (0.072)	0.024 (0.058)	-0.049 (0.076)
Inform-only	-0.032 (0.156)	0.253* (0.125)	0.029 (0.101)	-0.096 (0.131)
Time	0.094 (0.089)	0.323*** (0.071)	1.142*** (0.057)	0.724*** (0.075)
Reusable × Time	0.226* (0.110)	0.170* (0.079)	0.050 (0.081)	0.196* (0.096)
Inform-only × Time	0.546** (0.210)	0.117 (0.176)	0.058 (0.141)	0.236 (0.185)
Age (years)	0.004 (0.004)	0.008** (0.003)	0.005* (0.003)	0.014*** (0.004)
Education level	0.030 (0.029)	0.005 (0.023)	-0.029 (0.018)	0.019 (0.024)
Employed	-0.110 (0.079)	-0.104 (0.063)	-0.012 (0.051)	-0.139* (0.067)
Head of household	-0.019 (0.046)	-0.049 (0.037)	0.058* (0.028)	0.006 (0.039)
Backward caste	-0.015 (0.057)	-0.047 (0.046)	0.049 (0.037)	0.134** (0.048)
Private toilet	-0.050 (0.065)	0.023 (0.053)	0.012 (0.042)	0.136* (0.055)
Pad users	-0.888*** (0.082)	0.282*** (0.066)	0.176*** (0.053)	-0.470*** (0.069)
Constant	1.016*** (0.171)	0.133 (0.137)	-0.216* (0.110)	1.245*** (0.144)
Observations	554	554	554	554
R ²	0.243	0.194	0.632	0.398

Note. Standard errors in parentheses.

Abbreviations. ANOVA = Analysis of variance. PI = Pad and Information. CI = Cloth and Information. OI = Only Information.

*** $p \leq 0.001$, ** $p \leq 0.01$, * $p \leq 0.05$

Table B2.

Difference in Difference Ordinary Least Squares Regression Results Including Covariates (Reusable + Inform-only vs. Single-use)

	Primary outcome	Secondary outcomes		
	Preference for sustainable materials	Willingness to adapt menstrual practices	Awareness of alternatives to cloth and pad	Beliefs about menstrual materials
Reusable + Inform-only	0.020 (0.086)	0.063 (0.069)	0.025 (0.055)	-0.057 (0.072)
Time	0.094 (0.089)	0.323*** (0.071)	1.142*** (0.057)	0.724*** (0.075)
Reusable + Inform-only × Time	0.279** (0.111)	0.157* (0.072)	0.052 (0.078)	0.202* (0.100)
Age (years)	0.004 (0.004)	0.008* (0.003)	0.004 (0.003)	0.014*** (0.004)
Education level	0.029 (0.029)	0.003 (0.023)	-0.029 (0.018)	0.020 (0.024)
Employed	-0.107 (0.079)	-0.097 (0.064)	-0.012 (0.051)	-0.140* (0.067)
Head of household	-0.021 (0.046)	-0.053 (0.037)	0.057* (0.028)	0.007 (0.039)
Backward caste	0.020 (0.057)	-0.038 (0.046)	0.049 (0.037)	0.133** (0.048)
Private toilet	-0.052 (0.065)	0.017 (0.053)	0.012 (0.042)	0.137** (0.055)
Pad users ⁺	-0.883*** (0.082)	0.293*** (0.066)	0.176*** (0.053)	-0.471*** (0.053)
Constant	1.022*** (0.171)	0.145 (0.137)	-0.216* (0.110)	1.243*** (0.144)
Observations	554	554	554	554
R ²	0.239	0.186	0.623	0.398

Note. Standard errors in parentheses.

Abbreviations. ANOVA = Analysis of variance. PI = Pad and Information. CI = Cloth and Information. OI = Only Information.

*** $p \leq 0.001$, ** $p \leq 0.01$, * $p \leq 0.05$