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Breaking the Silence: Group Discussions, and the Adoption of Welfare-Improving Technologies

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By Silvia Castro and Clarissa Mang*

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Social pressure and stigma can hinder the adoption of available technologies, especially for sensitive health issues. We run a field experiment on the take-up of menstrual products in Bangladesh and test a discussion-based intervention. We vary participation in group discussions designed to break the silence around menstruation, where participants share their personal experiences. We find positive effects on the willingness to pay for a known menstrual product (sanitary pads) and on the adoption of a new technology (anti-bacterial menstrual underwear). Our results show changes in restrictive social norms

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around purchasing the products and lower perceived stigma around menstruation in general.

Social environments influence people's health decisions - for better and for worse. In particular, social pressure sometimes prevents people from making appropriate health choices. We observe this, even when these choices are readily available and affordable. For example, fear of negative social repercussions can influence an individual's decision of accessing contraception (Håkansson et al., 2018), getting tested for sexually transmitted diseases such as HIV (Yang et al., 2021), seeking help for substance addiction or mental health issues (Shidhaye and Kermode, 2013), or even wearing a face mask during a global pandemic (Kwon, 2022). These effects can be more acute in developing countries, where a lack of education and misinformation may exacerbate prejudices and the stigmatization of certain health conditions.

One condition subject to especially strong levels of stigmatization and strict taboos is female menstruation. In most developing countries, the adoption rates of modern menstrual absorbents remains low despite their widespread availability on the market. A large share of women continue to use traditional methods and rely on inadequate materials such as old cloth, cotton wool, leaves or ash to manage their menstrual flow (Sumpter and Torondel, 2013; Van Eijk et al., 2016; Kuhlmann et al., 2017). Perceived social constraints might play an important role in hindering access to the available alternatives. These constraints can take various forms. The taboo around the topic exacerbates misinformation and prejudices, preventing public discussions and knowledge sharing, limiting discussions in classrooms and even at home within families.[1] Moreover, access to pads could be restricted through social image concerns and the fear of being stigmatized, if women worry about other customers being present and observing them when buying pads in a convenience store or pharmacy. Such stores and pharmacies are operated almost exclusively by men in many settings and talking with someone of a different gender about menstrual products might conflict with prevalent social norms. Therefore, women

[1] According to the Bangladesh Bureau of Statistics (2020), in Bangladesh only 30% of women hear about menstruation before reaching menarche. In our sample, 2.3% of the women learned about menstruation at school. Less than half learned about it from their mother and 19.6% did not know about menstruation at all before they experienced their first period.

might be facing a trade-off between accessing menstrual hygiene products and experiencing a large social cost, where they fear stigmatization, experience discomfort about mentioning a taboo topic, or worry about conflicts with the prevalent social norms.

In this paper, we test for the existence and the implications of this trade-off using a randomized controlled trial with female participants in a garment factory in Bangladesh. Bangladesh is a natural place to study this trade-off. Over the last ten years, there have been numerous efforts by public and private practitioners to improve menstrual hygiene and to increase the use of sanitary pads among women in Bangladesh.[2] Thanks to these efforts, pads are widely available and women are aware of their existence and potential use. However, usage rates have barely increased[3] and unhygienic menstrual management still abounds.[4] We argue that perceived social constraints are a key obstacle to the widespread adoption of the available new products and practices.

We first provide observational evidence that women are affected by social concerns when considering to acquire sanitary pads. We conducted a survey asking women who use menstrual cloth as their only absorbent for the main reason to not switch to pads. The vast majority (85%) report the presence of men in the store as the main reason. Second, we measure the current social norms related to the purchase of the product. The majority of women believe that it is perceived by their peer group as *socially inappropriate* to purchase pads from a male shop clerk (60%). We hypothesize that addressing these social beliefs directly will increase the women's valuation (i.e. their willingness to pay) as well as their take-up rates of modern menstrual products, even if the products have to be obtained from a male shopkeeper in a publicly observable

[2]In our sample, 90% of the women report to have a store close to home where sanitary pads are sold.

[3]The Bangladesh National Hygiene Survey (2014) documents that in 2013-2014, around 33% of women in urban areas used sanitary pads. The latest wave of the survey shows some improvement among adolescent girls, but hardly any changes for adult women, of whom 64% used cloth for menstrual hygiene management (Bangladesh Bureau of Statistics, 2020)

[4]According to the Bangladesh Bureau of Statistics (2020), less than one-third of the women were able to hygienically wash and clean the menstrual cloth that they use, 40% of them directly stored it after washing (without drying it) to avoid any display of menstrual cloth.

location.

To test this hypothesis, we implement a discussion-based intervention, following recent literature such as Dhar et al. (2022) and Ghosal et al. (2022). The women randomly allocated to our treatment group participate in a one-hour discussion session with the aim to break the silence around menstruation. They come together in groups of 15-20 women and are encouraged by two trained facilitators to openly share and discuss their personal experiences with their menstruation and with menstrual health management. The discussion allows the participants to observe the attitudes and perceptions of their peers regarding menstruation and to discuss about a topic that is normally taboo. As our primary outcomes, we use an incentivized willingness to pay exercise to measure the women's valuation of sanitary pads, and register their collection rates of a novel menstrual product, an antibacterial reusable menstrual underwear that is not yet available in the market in the country. We compare the outcomes to the willingness to pay and collection rates of a control group, who did not participate in any discussion sessions. To mimic market conditions, the products need to be picked up from a male shopkeeper in a convenience store on the factory premises, where other customers may be present.

We observe an increase in the valuation of sanitary pads and in the take-up rates of the new menstrual underwear. The treatment significantly increases the women's willingness to pay for sanitary pads by more than 25% compared to the control group's average valuation at 90 BDT ($\sim$ 1 USD). This increase corresponds to about 50% of the market price of pads (around 40-60 BDT). Second, it increases the adoption of anti-bacterial menstrual underwear. The take-up rates increase by 14% for the treatment group when compared to a 71% adoption rate of the control group.

To explore the potential mechanisms underlying our results and understand the effect of the group discussions on perceived social constraints, we collected several additional secondary measures. First, using a discrete choice exercise (DCE) elicited at endline, we document that there are no differences between the control and treatment group in the perceived value-for-money of the products. Rather, the groups differ in how much they are affected by the

circumstances under which the products are collected (gender of the shopkeeper and location). The women in the treatment group are less concerned by both the male gender of the shopkeeper and low levels of anonymity when making the purchase on factory premises. The respondents who did not participate in the discussion groups, are willing to pay on average 23% (2.4 BDT) more to avoid purchasing pads from a male shopkeeper. Similarly, they are willing to pay 62% (2.2 BDT) more than the treatment group to avoid acquiring the pads on the factory premises, where their peers might see them. Therefore, we do not attribute the differences in our outcome measures to changes in the perceived material value of the sanitary pads, or purely to a social learning effect in the discussion groups.

In a further analysis, we compare changes in explicit measures of perceived stigma, taboos and second-order beliefs about the prevailing social norms across the treatment and control group. We define stigma as the shame and fear of being "found out" that a woman experiences when menstruating, and taboo as the discomfort a woman feels when menstruation is discussed in a conversation she is a part of. We refer to social norms as the (unwritten) rules one expects everyone else to consider "the right thing to do", i.e. injunctive norms (Bicchieri, 2016). We expect our treatment to directly affect the social constraints in two ways: it allows the women to update their second-order beliefs about the other women's perceptions of the social norms, and it reduces the perceived stigma and taboo through a positive experience of discussing menstruation openly and safely without fear of judgment or social repercussions. We find large and statistically significant changes in our metrics for the described constructs. Using a difference-in-differences regression, we observe a significant reduction in the strength of the perceived stigma and taboo around the topic. Looking at changes in the modal responses to the social norm elicitation, we document changes in the majority's reported beliefs about how society around them perceives purchasing pads from a male shopkeeper, the modal answer switches from *socially inappropriate* to *socially appropriate*. These changes are persistent six months after the intervention.

With this field experiment, we contribute to the growing body of litera-

ture on three separate but closely intertwined approaches to advance health- and productivity-enhancing behavior, especially of women in low-income contexts. First, many papers have sought to directly affect the perception of social norms. This literature on social norms builds on the seminal works by Bicchieri and Dimant (2019) and Krupka and Weber (2013), who have shaped the debate by providing concise and actionable definitions and ways to measure social norms. Addressing the perception of social norms usually takes one of two forms, a norm correction strategy or a norm transformation strategy (Cislaghi and Berkowitz, 2021). Researchers using the first strategy correct misperceptions by providing factual information about others' actual behaviors and beliefs about various social norms, for example regarding female labor force participation (Bursztyn et al., 2020), savings decisions (Dur et al., 2021), energy consumption (Allcott, 2011), and salary disclosure (Cullen and Perez-Truglia, 2022, 2018). On the other hand, projects applying a norm transformation strategy often use media such as TV shows (Banerjee et al., 2019; La Ferrara et al., 2012; Jensen and Oster, 2009; Green et al., 2020) and radio shows (Paluck, 2009; Arias, 2019) to influence the perception of social norms. Second, a range of interventions has sought to directly address personal attitudes toward certain (health) practices and behaviors, such as open defecation (Gauri et al., 2018) and intimate partner violence (Gupta et al., 2013; Abramsky et al., 2014; Pulerwitz et al., 2015). These studies usually use a mixture of information campaigns, direct education, and group discussions to achieve the change in personal attitudes. To address attitudes on gender equality in particular, some studies have shown that exposure to women in male-dominated areas, such as the military (Dahl et al., 2020) or local politics (Beaman et al., 2009) can successfully change attitudes toward gender equality rooted in traditional gender norms. Third, our paper builds on work done seeking to empower women, which has usually taken the form of educating young women and school girls directly on health-related issues, teaching them specific negotiation, self-efficacy or general life skills (Ashraf et al., 2020; Bandiera et al., 2020; Duflo et al., 2015; Buchmann et al., 2021), and exposing them to successful female role models (Porter and Serra, 2020).

Our paper is most closely related to the work by Ghosal et al. (2022) and Dhar et al. (2022). Ghosal et al. (2022) use a discussion-based intervention with sex workers in Kolkata to re-shape the women's self-image and reduce their self-stigma. They find that this has positive effects on both their savings behavior and their preventive health behavior, increasing the number of doctor visits for routine health checks. Dhar et al. (2022) run a discussion-based intervention with high school students to directly address their gender attitudes and reduce their support for restrictive gender norms. They show that the intervention increases attitudes supportive of gender equality, promotes (self-reported) gender-equal behavior and raises the number of girls submitting a college application. Similarly to these papers, we use discussion-based interventions to promote endogenous changes in social norm perceptions, personal attitudes and empowerment, without relying on the external provision of any additional skills or knowledge, to achieve productivity- and health-enhancing behavior.

Lastly, we add to the literature on female (menstrual) health as an important aspect of public health provision and an important contributing factor in female labor force participation, productivity and human capital accumulation. We build on the previous literature that focuses on improving the affordability of and access to pads, including Garikipati and Boudot (2017); Czura et al. (2020); Krenz and Strulik (2019), and to alternative products like menstrual cups, such as Oster and Thornton (2011). We extend the literature that looks at the role of information and social norms (Czura et al., 2020; Castro and Czura, 2021) by directly addressing the role that social constraints play in hindering access to improved menstrual products, which has limited the success of many previous projects without having been explicitly addressed.

This paper is structured as follows: in section 1 we describe the background of the study and present survey evidence for the important role of social restrictions in hindering access to advanced menstrual products. In section 2 we detail the experiment design and our empirical strategy. In section 3 we present and discuss the results. Section 4 concludes.

1 Menstrual Hygiene in Bangladesh

Good menstrual hygiene is an important contributor to the physical, mental and emotional well-being of women (Benshaul-Tolonen et al., 2021; Torondel et al., 2018), and can improve their economic prospects by reducing obstacles to school and work attendance and improving productivity during menstruation (Benshaul-Tolonen et al., 2021; Krenz and Strulik, 2019; Czura et al., 2020). Given that around half the world's population is affected by menstruation throughout most of their adult lives, and improvements in menstrual hygiene can create benefits in both economic and humanitarian terms, it is not surprising that better menstrual hygiene management is increasingly addressed at the forefront of international development, including the Millennium Development Goals and the Sustainable Development Goals (Garikipati and Boudot, 2017), and a growing body of literature is seeking to understand and improve poor menstrual hygiene (Van Eijk et al., 2016). Yet, maintaining menstrual hygiene continues to be a challenge in many developing countries (Garg et al., 2012; Garikipati and Boudot, 2017; UNICEF, 2019; Czura et al., 2020). One large impediment to achieving sustainable improvements in menstrual health practices are potentially restrictive social constraints - stigma, taboos and social norms - around menstruation (Castro and Czura, 2021).

The main material used as a menstrual absorbent in developing countries is cloth. In Bangladesh, around 65% of adult women use old cloth, re-purposed from an old saree or similar material (Bangladesh Bureau of Statistics, 2020). Women frequently do not have access to private sanitation facilities to change the cloth regularly, especially at work. They also often lack access to clean water or privacy to wash used cloth properly with soap, and use facilities that are private but unhygienic such as the floor of public toilets (Sumpter and Torondel, 2013). Many women store their washed menstrual cloth immediately without drying it, either under their mattress or in cupboards. These practices can have direct health consequences in the form of urinary tract infections (UTI) and inflammations (Sumpter and Torondel, 2013; Torondel et al., 2018).

Public and private campaigns to address these practices facilitated the in-

troduction of modern absorbents, in particular disposable sanitary pads, in many developing countries, including Bangladesh. Disposable pads do not need to be washed or dried, eliminating the potential health risks from improper washing and drying. Despite the current wide availability of disposable pads in Bangladesh, take-up rates remain low, with only around 29% of adult women (and 43% of adolescents younger than 19) reporting using pads regularly (Bangladesh Bureau of Statistics, 2020).

Many initiatives have been launched to improve access, increasing the availability of pads in local markets and subsidizing them. These strategies often overlook the relevance of social norms and cultural perceptions of the target population. In our sample, 40.5% of the women do not use pads as main absorbent. Availability is, however, not a major reason cited for the lack of adoption, with 79% indicating that there is a store selling pads near their home. Rather than availability and affordability, social image concerns, shame, and stigma around acquiring the product are named most frequently as the greatest obstacle to using pads regularly. More than 80% of women report feeling uncomfortable going to a store to purchase the product due to the lack of privacy and the risk of being seen, and because they have to buy them from a male shopkeeper (Table A1 in the appendix). The respondents that reported using pads also express fear of being stigmatized when accessing the products. Table A1 shows that 52% of the respondents who purchase pads regularly cover their face while doing so to avoid being recognized.

The evidence presented in this section suggests that social pressure and stigma restrict women's access to improved menstrual products. In our study, we therefore test an intervention that aims to address the social constraints, by reducing the perceived stigma and breaking the taboo around menstruation.

One key feature of our design is the use of two different types of absorbents. One well-known and already available (pads) and one completely new and with impending entry in the market (reusable menstrual underwear). The menstrual underwear used in this study, designed and provided by our project partner Reemi, is a culturally appropriate and modern alternative to cloth or sanitary pads that circumvents many of the cultural, social and health con-

cerns posed by the currently available methods. The main advantage of the product is that it is more absorbent than sanitary pads or cloth and does not need to be changed as frequently during the day. Moreover, it does not need to be purchased regularly: it is a one-off purchase that can be re-used for many years. Although the underwear also needs to be washed with soap and dried, which often constitutes a challenge, it is made from a fast-drying and anti-bacterial material that is easy to wash and dry and reduces the risk of infection. The menstrual underwear is a new product that has not been previously available in Bangladesh and that the women are unfamiliar with. Nevertheless, since its design has been tailored to women like our study participants, the underwear constitutes a beneficial and desirable alternative for the women and we expected demand to be high for this product at baseline. Using a new product not available in the market, allows for a clean identification of our treatment effects. The participants cannot purchase the product elsewhere and, therefore, we can be sure that our metrics are not affected by participants accessing the product through other channels

2 Experiment Design

2.1 Sample

We ran our field experiment in a large garment factory in Tongi, a town north of Dhaka in Bangladesh. 600 female employees were selected randomly as participants for our study, out of all 6000 workers, from a list provided by the factory. The participants were called after work hours on their mobile phones. After receiving consent from the participants, we administered the baseline survey. We continued to call workers until we reached 485 women who agreed to be part of our study and reported having experienced their menstruation regularly in the past 6 months (16 women who reported to be pregnant were also included in the study). The baseline surveys were run in March and April 2021. Each participant received 40 BDT in phone credits as compensation for their participation (around 0.50 USD, corresponding approximately to the

hourly wage rate). All enumerators conducting the phone survey were female to reduce the participants' discomfort when discussing menstruation.

Upon completing the baseline survey, each participant was randomly allocated into either the treatment or control group. Treatment started to be administered after the first 100 baseline surveys were completed. This prevented large time dispersion between the baseline survey and the participation in the discussion for the treatment group and simplified the logistics. 227 women were randomized into the treatment group (100% attended the treatment sessions) and 258 into the control group.

After the treatment, all workers were called again for the endline survey. This survey was run in April and May 2021. Attrition rates were very small and similar across groups, at 1.8% in the treatment group (4 out of 227 women) and 1.9% in the control group (5 out of 258 women). The reason for attrition was that some phones were turned off or not answered when they were called for the endline survey. Our final sample size for the main analysis is 476 women, 223 in the treatment group and 253 in the control group.

Finally, around half a year after the treatment, we re-surveyed 339 women from our original sample (182 from the control group, 157 from the treatment group) in November and December 2021 to measure persistence of the effects. Figure A1 in the appendix summarizes the timeline of the data collection, as well as which measures were collected at each stage.

Our randomization was successful in achieving balanced samples in observables (see Table A1 in the appendix). The women in our sample are on average 26 years old. The large majority are married and have (at least) one child. They are slightly more educated than the national average, having had seven years of education on average, around one and a half years more than the national average for women (United Nations Development Program, 2022). This is not surprising, given that jobs in garment factories are seen as good prospects for young women in Bangladesh and a recent trend has actually seen women staying in school longer to qualify for these jobs and provide for their families (Asadullah et al., 2021). The women in our sample thus represent the new and growing group of better educated female garment workers.

A relatively young age and high levels of education are positively correlated with pad use[5] and may explain why 60% of our sample report using pads frequently at baseline, which is above the national average of 29% for adult women (Bangladesh Bureau of Statistics, 2020). Nevertheless, half the women still report using cloth frequently as well, indicating that some women use both (for example using pads for days with heavier flow and cloth for days with less heavy flow) and many women still are not using pads at all.

2.2 Treatment

Our simple discussion group intervention is the main novelty of this research project. Until now, interventions in Economics seeking to change behavior through social norms have mainly used what Cislaghi and Berkowitz (2021) call norm correction strategies, providing individuals with factual information about what others are doing or what they approve or disapprove of, to correct misperceptions and motivate them to do the same (Allcott, 2011; Bursztyn et al., 2020; Dur et al., 2021). However, social psychology understands social norms not as static beliefs, but as part of an ongoing group process (Prentice and Paluck, 2020). Individuals process social norm information in a dynamic group environment, performing reality checks by looking to other group members. They observe whether other group members express agreement with a message in their words or actions. Many of the interventions implemented in Economics until now (Allcott, 2011; Bursztyn et al., 2020; Dur et al., 2021), have sought to change an individual's beliefs about a group norm individual by individual, without allowing for the real-time reality check of the information provided by the researchers. Our intervention was designed to recognize the dynamic dimension of the belief updating process. We used a group setting, a light-touch and simple treatment allowing for discussion and real-time be-

[5]Pearson's correlation coefficient between age and cloth use: 0.18, p-value: 0.00 and between age and pad use: -0.19, p-value: 0.00; younger women tend to use pads more, older women cloth. Pearson's correlation coefficient between education and pad use: 0.19, p-value: 0.00 and between education and cloth use: -0.23, p-value: 0.00; more educated women tend to use pads more, less educated women cloth. See Appendix Figure A2 for a graphical analysis of these trends.

lief updating. In this, our approach is similar to that of Dhar et al. (2022) and Ghosal et al. (2022), who use group discussions to directly address the participants' personal attitudes and perceived (self-)stigma.

The treatment consisted of a one hour discussion, where participants were encouraged to share their thoughts and experiences with menstruation and to talk openly about issues surrounding menstruation. The discussions were moderated by two trained female facilitators. The sessions were explicitly designed to not be education or training sessions, unlike previous studies aiming to empower young women and girls through the external provision of improved information or specific life skills (Castro and Czura, 2021; Ashraf et al., 2020; Bandiera et al., 2020; Duflo et al., 2015; Buchmann et al., 2021). Instead, it focused on sharing personal experiences and experiencing the opportunity to talk openly about the topic. Our intervention therefore goes beyond the information-provision or education treatments that externally correct the women's misperceptions or beliefs. Instead, we let the group feedback endogenously affect the women's perceptions and allow the participants to update their second-order beliefs and personal attitudes based on the verbal and non-verbal feedback they receive from the other women in the group, without external feedback on the truth of the updated beliefs from the experimenters. By providing the women with a positive experience of discussing menstruation without any social repercussions, the discussions were also intended to boost the women's confidence to talk about the topic, reduce the taboo and lessen the stigma associated with menstruation. The control group, in contrast, did not participate in any discussions and did not have the opportunity to discuss menstruation openly. Except for the baseline and the endline survey, there was no further interaction with the control group. The sessions took place during work hours in a conference room at the factory. They were moderated by two facilitators from the implementation partner Change Associates Ltd.[6] The sessions were run in March and April 2021. A total of 15 sessions were run with an average of 15 participants per session (min: 13 and max: 21).

[6]A women-led organization in Bangladesh frequently delivering training on topics of health and family planning in Bangladeshi garment factories: http://www.change-bd.org/

Each session lasted for one hour. The sessions were conducted in a hybrid format, with the factory workers being present physically in the conference room and the facilitators joining remotely via Google Meet. At the end of each session, the moderators completed a short survey to report any incidents such as technical difficulties, as well as the main topics discussed, main questions that came up and the overall atmosphere and level of participation. This allows us to ensure that the format and content of all sessions were comparable.

All 15 sessions were reported by the moderators to have covered very similar topics, including the first experiences with menstruation (15), issues or problems during the menstruation (15), feeling uncomfortable during menstruation (15), whether and how to discuss menstruation with children (15), and the availability and pros and cons of different menstrual products (14), particularly pads (14). While the sessions covered these same basic topics, there was some variation in which of these topics was discussed the most. The most discussed topics included menstrual products in general (4), pads in particular (4) and how to discuss menstruation with children (3). The women attending the discussions exchanged personal experiences and the group *collectively* did not receive any new information, but current knowledge and experiences were shared within the group.

The post-session surveys indicate that there were no major technical difficulties (only 2 of 15 sessions experienced technical difficulties - mainly sound issues - but they were swiftly resolved). All facilitators reported that the women were not constrained by the remote format and they unanimously agreed that the women were eager to share their experiences. Moreover, it was reported that in all but one session all women engaged in the discussion equally. We are thus confident that the treatment was implemented as intended.

2.3 Outcome variables

2.3.1 Primary outcome variables

The first experimental outcome is the women's willingness to pay (WTP) for a modern menstrual product that they know well: disposable sanitary pads. In

our experiment, we measure the WTP for pads when obtaining them from a male shopkeeper in a small store on the factory premises. The male gender of the shopkeeper is an important design element of our study as this mirrors the real world, since practically all shopkeepers in Bangladesh are male. This may prevent women from adopting advanced menstrual products, because of the discomfort associated with buying products from a male shopkeeper. A second dimension is that the product needs to be picked up at the factory store, a rather public place where the women might be observed by their colleagues.

We measure the willingness to pay using a price list (Anderson et al., 2007). The enumerators first describe the conditions under which the menstrual products can be picked up at the factory. They then offer the women a choice between receiving an amount of money (in phone credits) or receiving the product for free. The first choice is between receiving 0 BDT or getting the product for free. Conditional on the women selecting to receive the product, the offered price is then increased in fixed intervals and the participants are asked to make the choice again between the higher amount of money and the product. This was done in steps of 20 BDT up to 140 BDT and then a jump to a maximum price of 200 BDT (around 2 EUR, or four times the market price of pads). The jump in the interval enabled us to check a very high WTP, while keeping the number of questions asked to a minimum to limit complexity. The WTP is thus recorded as an interval between a lower bound (last choice where the product was chosen) and an upper bound (first choice where the money was chosen). It was assumed that preferences are monotonically increasing with a single switching point, such that once a woman had decided to take the money rather than the product, no additional choices with higher monetary amounts were offered. The women knew in advance that they would face several choices between an amount of money and the product, but did not know how many choices there would be in total or the increment of each subsequent offer. We also measured the willingness to pay for the underwear following the same structure, however, this is not part of our main outcomes. The WTP for this product is a very noisy measure, as the women had never seen the product and it is not discussed in the discussion sessions. We present

the results of the willingness to pay measure for the underwear in Table A2 in the appendix.

The WTP elicitations for the sanitary pads and the underwear were incentivized together, so one of the choices from either the WTP exercise for the pads or the WTP exercise for the underwear was randomly selected to be payoff relevant for each woman. The woman then received whatever her choice had been in the randomly selected scenario, i.e. either an amount of money or the opportunity to collect the product. The participants could only receive either the pads or the underwear, but not both. The women knew that only one of the choices they made between money and either of the products would be payoff-relevant. Since we are mainly interested in the women's adoption of a new technology, we skewed the randomization of the payoff-relevant outcome in such a way that for 95% of the women, the choice between 0 BDT and the underwear was selected to be payoff-relevant.[7] This way we ensured that the vast majority of women with a non-zero willingness to pay for the underwear were actually eligible to pick it up (our second outcome metric). For seven women, a different pay-off relevant scenario was randomly selected, so they received either an amount of money or a pack of pads.

The second primary outcome of interest is the rate of take-up of a novel product not available before: reusable menstrual underwear. The use of a new absorbent makes it possible to measure take-up of a completely new technology that is not otherwise available.[8] The characteristics of the product were explained to the participants during the endline survey call and they were informed that the underwear would be available to be collected on the factory premises, at the factory store (from a male shopkeeper) as soon as the surveys would be completed. Ultimately, 469 women were eligible to collect the underwear for free. The underwear was made available to collect in June 2021.

[7]The women were informed that one of their decisions across both WTP exercises would be pay-off relevant, but not how this was chosen.

[8]The menstrual underwear was developed and produced by our project partner Reemi, a New Zealand-based NGO. The underwear consists of several leak-proof layers on the outside and an anti-bacterial absorbent layer on the inside. At the date of the study, reusable menstrual underwear was not available in Bangladesh.

2.3.2 Secondary outcome variables

To understand the mechanisms underlying our results, we carried out a discrete choice experiment (DCE). The DCE allows us to address two design concerns. First, it helps us to disentangle whether the treatment is affecting the attitudes toward collecting the product from a man or a social image concern for being observed by peers while collecting the menstrual product. Second, it helps us to measure any changes in the perception of the value-for-money attributed to the menstrual absorbents, potentially arising from a social learning channel. We can thus disentangle how the discussion session affected the perception of restrictive social constraints preventing access to menstrual products from changes in the material value the women assign to the menstrual products after discussing them with their peers. The choices made in the DCE are hypothetical and are completely distinct from the WTP exercise. Our DCE design is based on similar DCEs in the project by Czura et al. (2020).

A DCE is normally used to disentangle the value customers place on different product features. This is achieved by presenting customers with a series of hypothetical choices between two different sets of characteristics of a product (e.g. price, color, size, etc.). We use this same mechanism to disentangle not the value of product characteristics, but the importance of different aspects of the conditions under which the product is obtained. Specifically, we present women with several options for how to obtain a pack of sanitary pads. The dimensions included in the discrete choice experiment are the location of purchase (at the factory/in an external shop), price levels (30BDT, 40BDT, 50BDT, 60BDT), and gender of the shopkeeper (purchasing it from a male shopkeeper/from a female shopkeeper). The women are presented with consecutive choices, always between two bundles of these dimensions and are asked which they would prefer. Their answers are then used to determine the relative utility derived from each characteristic and the willingness to pay to have one or the other. The price attribute gives us an estimate of the differences in material valuation of the product, the location gives us an estimate of the preference for a more public (at the factory) or more anonymous (outside

the factory) location and the sex of the shopkeeper measures the relevance of having a male shopkeeper.

In addition to the DCE, we obtained detailed measures of perceived norms, stigma and taboos to determine their role in driving the changes observed in the primary outcomes. Social norms are the informal rules that indicate which actions are socially acceptable. They consist of both empirical expectations (what I expect others to do, descriptive norms) and normative expectations (what I expect others to approve of or to think one ought to do, injunctive norms) (Bicchieri and Dimant, 2019). We elicit the injunctive social norms around the use and purchase of different menstrual products. To capture not the internal feeling toward the norm but the societal perspective, we measure norms using vignette studies. We give the respondents a vignette of a woman like themselves who is menstruating and ask them about the expected response of that woman's neighbors to certain actions (such as discussing menstruation with her son or daughter or buying pads). For each scenario, the respondents could say whether they expect the neighbors would find a certain behavior very socially inappropriate, socially inappropriate, socially appropriate or very socially appropriate. In the baseline survey, all participants were asked to judge 11 such vignettes. To reduce the length of the survey as much as possible and limit cognitive fatigue of the participants, we repeated the norm elicitation in the endline survey for only 7 questions. 5 of those 7 questions were the same for all participants, while the remaining 2 were randomly selected.[9]

We also measure changes in perceived stigma and taboos. Apart from affecting second-order beliefs, we expect the discussions to have a direct effect on perceived secrecy (taboos) and feelings of shame and embarrassment (stigma) around the topic. We included questions to measure changes in such perceptions. To measure the perceived stigma, we asked the participants how many statements from a list of 4 they agree with, with the statements expressing fear of stigmatization (e.g. "If someone knew that I am menstruating they

[9]The probabilities of the randomized social norm being asked again were not the same for all questions. The number of full-panel observations therefore varies across social norms.

might treat me or look at me differently").[10] To encourage truthful replies, we did not ask about their agreement with each individual statement, but only for the total number of statements they agree with. Our scale from 0-4 measures the number of statements agreed with, with higher values reflecting stronger perceived stigma. Taboos were measured in the same way with the four statements expressing a reluctance to discuss menstruation (e.g. "I would feel embarrassed to talk about menstruation with my family"). We randomized the order of the social norms, taboos and stigma measures to avoid any anchoring or internal consistency effects.

In addition to the main outcomes of interest, we collected demographic variables to serve as control variables. These included age, religion, marriage status, number of children, and menstrual products used frequently (for two or more days each period) at baseline.

2.4 Hypotheses

Our main question of interest is whether the discussion sessions described above had an effect on the willingness to pay for modern menstrual absorbents, if they had to be picked up from a man on the factory premises. The expectation is that the willingness to pay captures not just the valuation of the product itself, but also of the conditions under which the product is acquired. We expect the women to factor in that they have to collect the product from a man and that there might be peers nearby, when declaring their willingness to pay. The participants in the treatment group are expected to have updated their beliefs about how other women in the factory feel about purchasing menstrual absorbents in this situation, as a part of the sample does purchase these products regularly. We therefore expect them to be less restrained by perceived social pressure and stigma. Our first hypothesis is:

Hypothesis 1 *Women participating in discussion sessions about menstruation have a higher willingness to pay for sanitary pads which have to be obtained from a male shopkeeper on the factory premises.*

[10] The statements were adapted from various surveys presented in Hennegan et al. (2020)

We estimate the effect of the intervention on the WTP for pads by regressing WTP on the binary treatment variable using a standard OLS regression.

Second, we are interested in the pick-up rates of the anti-bacterial menstrual underwear. Once the new product becomes available, we also expect the women in the treatment group to be more willing to actually go and collect it. After the discussion with their peers and seeing how other women also access modern sanitary products on a regular basis, their beliefs about the level of appropriateness and the feeling of shame associated with collecting the products might have changed. The next hypothesis is:

Hypothesis 2 *Women participating in discussion sessions about menstruation are more likely to collect the free menstrual underwear from a male shopkeeper on the factory premises.*

We estimate the causal effect of the treatment on collection of the underwear using a linear probability model. We also run a probit model to compare the coefficients on the marginal effects obtained from the probit with the estimations obtained from the linear OLS regression.

Turning to our secondary outcomes, we expect to see a change in the perceived stigma, taboos and strictness of some social norms. The discussions are intended to break the silence on the subject of menstruation, and also allow participants to observe the attitudes and experiences of their peers about menstrual hygiene management. We expect that women will feel less uncomfortable and embarrassed about the topic if we offer them a positive experience discussing it openly with other women. Moreover, we expect the social attitudes towards menstruation to be less restrictive than what the women believed, as the ability to test what the social group thinks about the topic is usually hampered by taboos. Women do not often discuss the topic, therefore, they infer more restrictive social attitudes from the lack of discussion than actually exist. After the intervention, they are expected to hold an updated view of what their reference group thinks about the topic. Our third hypothesis is:

Hypothesis 3 *Participating in discussions about menstruation reduces the*

perceived strictness of the social norms, stigma and taboos surrounding menstruation.

To test this last hypothesis we use a difference-in-differences estimation.

3 Results

3.1 Technology Adoption

The first question that we aim to answer is whether the group discussions had an effect on the participants' valuation of sanitary pads when collected from a man on the factory premises. To do this, we run an interval regression of the willingness to pay for pads on the intervention dummy. Table 1 shows the regression results.

Table 1: Willingness to Pay for Disposable Pads

	(1)	(2)
	WTP Disposable Pads	
Intervention	22.982	22.760
	(8.98)	(9.34)
Mean of dep. var	90.620	90.620
Demographic Controls	No	Yes
Observations	476	460

Notes: Interval regression of the willingness to pay (in BDT) for disposable menstrual pads collected from a male shopkeeper at the factory store on a treatment dummy. Robust standard errors reported in parentheses. *Mean of dep.var.* reports the mean in the control group. Demographic controls in column (2) include age, years of education, marital status, number of children and baseline use of pads and cloth (as dummies). Column (2) does not include 16 pregnant women, since the demographic control variables of baseline use of pads and cloth are not available for them.

Column (1) shows the effect of the treatment without any controls. Column (2) adds demographic controls, which does not affect the magnitude of the point estimates or the level of significance. On average, the women in the control group were willing to pay around 91 BDT for a pack of 4 sanitary pads. The treatment group was willing to pay on average around 23 BDT

more. This constitutes an increase of more than 25% evaluated at the control mean. This difference is significant at the 5% level and substantial in size.[11]

The market value of a pack of pads is around 40-60 BDT. This suggests that the treatment effect is quite substantial, increasing the WTP for a pack of pads by around half the market price. At the same time, this shows that our sample has an unusually high baseline WTP that is around 50-100% higher than the market price of pads. This is most likely driven by a combination of factors. First, women may have held the biased belief that pads provided by Western researchers may be of a better quality than average pads available in the market. Second, the framing of our WTP elicitation may have played a role. We ask women to forfeit a future monetary gain as opposed to having to give away money they already own, so it could be that loss aversion causes a lower WTP in the market compared to our experiment. Lastly, control over the household budget in Bangladesh typically lies with the husband, who had no control over the money offered to the women in our experiment. It could therefore well be that women would have a higher willingness to pay for sanitary pads also in the market, but cannot express this because they do not have full control over the household budget. In our experiment, the money constituted a windfall gain to the household income that the woman had full control over, which could explain their higher WTP for pads than is seen in the market.

The average increase in WTP of more than 20 BDT suggests that, on average, the WTP in the treatment group shifted up to the next interval. Looking at the distribution of the WTP, we can compare women in each interval of the WTP exercise to determine if they responded differently and we can also compare whether women with a valuation above the market price responded differently to women with a WTP below the market price. Figure 1 shows

[11] All of our results use robust standard errors for calculating the level of significance, clustered at the individual level. We are not clustering standard errors on the group level, because random assignment to the treatment group occurred on the individual level. To ensure that our results are not driven by anything specific to particular discussion groups, we estimate and plot the treatment coefficients for each group separately in the appendix in section B

that the effects were similar across the whole distribution: for each value of the lower bound of the WTP (the last value at which a woman preferred the pads over the money), the cumulative distribution function of the treatment lies below the control group. The distribution of the WTP of the treatment group first order stochasitcally dominates the distribution of the control group. For most discrete steps in the cdf up until 80-100 BDT, the jump in the control group is larger, indicating that there is a larger share of women in the control group for each interval below 80-100 BDT. There is no significant difference between women with a valuation of the pads above or below the market price.

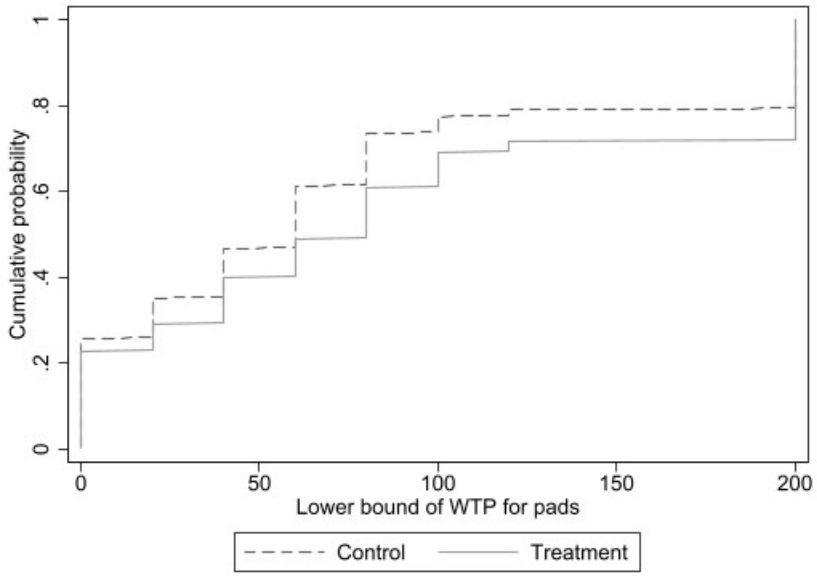

Figure 1: Cumulative Distribution of the Willingness to Pay

Notes: Cumulative distribution function of the share of participants reporting a given lower bound (last monetary amount at which the product was preferred over the money) for the willingness to pay for the sanitary pads. WTP was elicited in intervals of 20 BDT between 0 and 120 BDT and at 200 BDT.

This result provides significant evidence for Hypothesis 1 and shows that this type of intervention can increase women's valuation of modern menstrual products when they are supplied by a male shopkeeper at a fairly public location.

The second question that we aim to answer is whether the intervention leads to a higher take-up of a completely new technology, re-usable menstrual underwear. To do this, we regress (using a linear probability model and a probit model) the pick-up rates of the menstrual underwear on the intervention dummy. In Table 2 we provide the estimates of the effect of the treatment on the rate of collection of the anti-bacterial menstrual underwear. We observe that the discussion led to an increase in the rates at which women collected the new product of 14%, evaluated at the control mean. While around 71% of women from the control group picked up the underwear, this rose to around 81% for women in the treatment group. The results are large and significant at the 5% level. Columns (2) and (4) add demographic controls to the regression.

Table 2: Take-up of a New Technology: Anti-bacterial Reusable Underwear

	(1)	(2)	(3)	(4)
	OLS		Probit *(marginal effects)*	
Intervention	0.099	0.089	0.099	0.086
	(0.04)	(0.04)	(0.04)	(0.04)
Mean dep. var	0.713	0.713	0.713	0.713
Demographic Controls	No	Yes	No	Yes
Observations	469	454	469	454

Notes: Column (1) and (2) report the linear probability regression (OLS) of the collection of the underwear at the factory store from a male clerk. Columns (3) and (4) report the marginal effects from a probit regression. Robust standard errors reported in parentheses. *Mean of dep.var.* reports the mean in the control group. The differences in the number of observations between WTP and collection rates are due to seven participants winning money or pads in the WTP lottery instead of the underwear. Columns (2) and (4) do not include 15 pregnant women

Figure 2 depicts graphically the share of women in the treatment and control group who collected the underwear. Half of the women went to pick it up within the first 3 days. It can be seen that the share of women in the control group collecting the underwear remains consistently below the share in the treatment group, so the function for the treatment group again first order stochastically dominates the function for the control group. By the end of the collection period, 71% of the participants in the control group and 81% of the participants in the treatment group had collected the product.

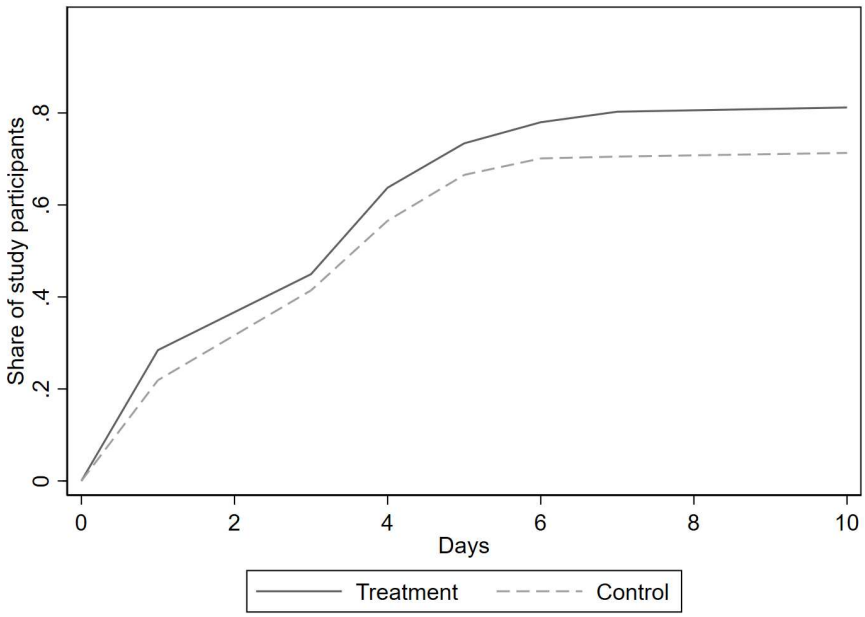

Figure 2: Collection of underwear

Notes: Share of participants in the treatment and control group picking up the menstrual underwear at the factory store from a male shopkeeper. The product was available from the 10th-19th of June 2021.

Similarly to the high WTP for sanitary pads in the control group, we also observe that the control group already has a very high baseline propensity to collect the underwear. One reason could be that the women have never seen the underwear and may just be curious to see and try this new product. More importantly, however, as described above, the underwear does address several of the women's needs, such as providing a comfortable method that does not need to be changed frequently and reduces the risk of infections. A relatively high baseline demand for the product was therefore expected.

Overall, our results strongly support Hypotheses 1 and 2 and show that the one-hour discussion on menstruation led to an increase in the women's valuation of the menstrual products and increased their take-up of the novel hygienic menstrual underwear.

3.2 Mechanisms

To better understand the mechanisms that might be driving the effect of our intervention, we first provide the results from a discrete choice experiment, and then we provide measures for social norms, stigma and taboos.

3.2.1 Discrete Choice Experiment

Our results have shown that women who were part of the discussion groups were willing to pay more for modern menstrual products and took up a new and modern absorbent in a higher proportion. The discrete choice experiment can help us disentangle to what extent these results are driven by changes in the women's attitude toward collecting the underwear from a male shopkeeper as opposed to their attitude toward potentially being observed by peers when doing so. Moreover, it allows us to determine whether the intervention is changing the value-for-money attributed to the product by the women.

Table 3 shows the results of the conditional logit estimation. While the magnitudes of the coefficients do not lend themselves to direct interpretation, we can draw conclusions from their signs and relative sizes. The negative sign of all coefficients in column (1) indicates that disutility is derived on average from each of these characteristics. A higher price, purchasing from a male instead of a female shopkeeper, and collecting the product at a location inside the factory (where there is less anonymity) produce disutility. The coefficient on the gender of the shopkeeper is the largest, carrying the highest disutility. Column (2) introduces interaction effects of each characteristic with the treatment. As hypothesized, the coefficients on the interaction effects are positive, so picking up the underwear from a man or in the less anonymous location creates less disutility for the treatment group. Lastly, we observe that the intervention has no effect on the price that the participants associate with the product, as there is no difference in the valuation of this attribute between control and treatment group. Therefore, we conclude that, at endline, our treatment and control groups differ in their concerns about picking up the product at a public location, and from a male shopkeeper, but they do not

differ in how they perceive the value of the product.

Table 3: Discrete Choice Experiment - Conditional Logit Model

	(1)	(2)
	Utility Level	
Location inside	-0.384	-0.592
	(0.09)	(0.14)
Male shopkeeper	-1.452	-1.753
	(0.07)	(0.10)
Price	-0.154	-0.168
	(0.01)	(0.01)
Intervention*Location inside		0.396
		(0.18)
Intervention*Male shopkeeper		0.590
		(0.14)
Intervention*Price		0.023
		(0.02)
Observations	476	476

Note: Dependent variable: utility of sanitary pads. The coefficients from the conditional logit regression show changes in utility with changes in the different attributes of the pads adoption process: location inside the factory vs. a local store, male vs. female shopkeeper, and increasing price (from 30 to 60 BDT)

We interpret this as suggestive evidence that the main channel driving the results is not pure information transmission or a social learning mechanism. It could have been argued that the women have not changed their perceptions of the social norms or stigma at all, but simply received new information about pads, such as learning about their existence for the first time or receiving new factual information about the cost-benefit-ratio of using pads. In that case, we would have expected the treatment to alter the perceived value-for-money of the products. However, we observe differences only in the attitudes towards the collection of the product. Taken together with the large and significant increase in the pick-up rate of the menstrual underwear, which was not mentioned in the discussion sessions at all and so cannot have been subject to a pure social learning mechanism, this shows that our treatment worked through a different channel than a pure information treatment.

To interpret the size of the effect in monetary terms, we construct the marginal willingness to pay for each characteristic from our data (Lancsar

et al., 2017). Given the linear model assumption, the marginal willingness to pay can be obtained by dividing the coefficients on the characteristic of interest by the coefficient on the price. Table 4 shows the willingness to pay calculated from the coefficients for the treatment and control groups. Women in the control group are on average willing to pay 10.4 BDT more to avoid having a male shopkeeper. This is reduced by around 23% to 8 BDT for the treatment group. Women in the control group would also be willing to pay 3.5 BDT more to avoid collecting the pads inside the factory. This is reduced by around 62% to 1.3 BDT in the treatment group. A two-tailed t-test comparing the control group's and the treatment group's average WTP for both the female shopkeeper and the outside location of collection reveals that the differences between treatment and control group are statistically significant at the 5% level ($p = 0.02$ in each case). This shows that the treatment reduced the women's concerns about collecting the menstrual products from a male shopkeeper and their concern about being seen by co-workers when doing so.

Table 4: Discrete Choice Experiment - Willingness to Pay

	Willingness to pay to avoid the attribute (in BDT)
Location inside	
- Control	3.523
	(0.63)
- Treatment	1.349
	(0.72)
Male shopkeeper	
- Control	10.442
	(0.73)
-Treatment	8.024
	(0.82)
Observations	476

Notes: WTP in BDT for avoiding the location being inside the factory and for avoiding a male shopkeeper for the treatment and control group.

This also shows that it was not a shift in the women's attitude toward the specific male shopkeeper from whom they had to collect the underwear. The women might have expected the male shopkeeper to be aware of the study taking place in the factory or he might have even been briefed by the

experimenters when they deposited the menstrual underwear in his store to make it available for collection; in this case, it could have been that the women just felt less uncomfortable having to collect the underwear from this specific man, rather then male shopkeepers in general. However, the DCE with its hypothetical scenarios clearly identified the utility of not having to collect the product from any man, combining the male gender also with the scenario of collection outside the factory. Given that the effects of the DCE were observed for the male gender in general, this removes this worry.

3.2.2 Social norms, stigma and taboos

The social norms surrounding menstruation were elicited before and after the treatment. Figure 3 shows the share of participants rating each behavior on a 4-point Likert scale ranging from *very socially inappropriate* (1) to *very socially appropriate* (4). We depict the appropriateness of using different products and of purchasing them from female or male shopkeepers. The menstrual methods commonly used during menstruation (namely pads and cloth) were directly discussed in the discussion sessions.

In analyzing social norms, we focus on the modal response, the answer the majority of participants give. At baseline, using disposable pads is perceived by the participants as very socially appropriate in their social group. Therefore, in this setting, we do not observe a norm restricting the use of modern menstrual technologies as such. However, when we look at norms related to the collection of the product, we can see that purchasing pads from a male shopkeeper is seen as socially inappropriate by the majority. As almost all convenience stores and pharmacies are run by men in Bangladesh, this indicates that there is a behavioral rule restricting the take-up of menstrual products.

After the intervention, purchasing sanitary pads from a male shopkeeper updates from being viewed as *socially inappropriate* to *socially appropriate* by the majority. The switch is of a large magnitude for the treatment group. We can observe a similar change also in the control group, though of a much smaller magnitude. This might partly explain why such a high share of participants from the control group picked up the product. This finding suggests that some

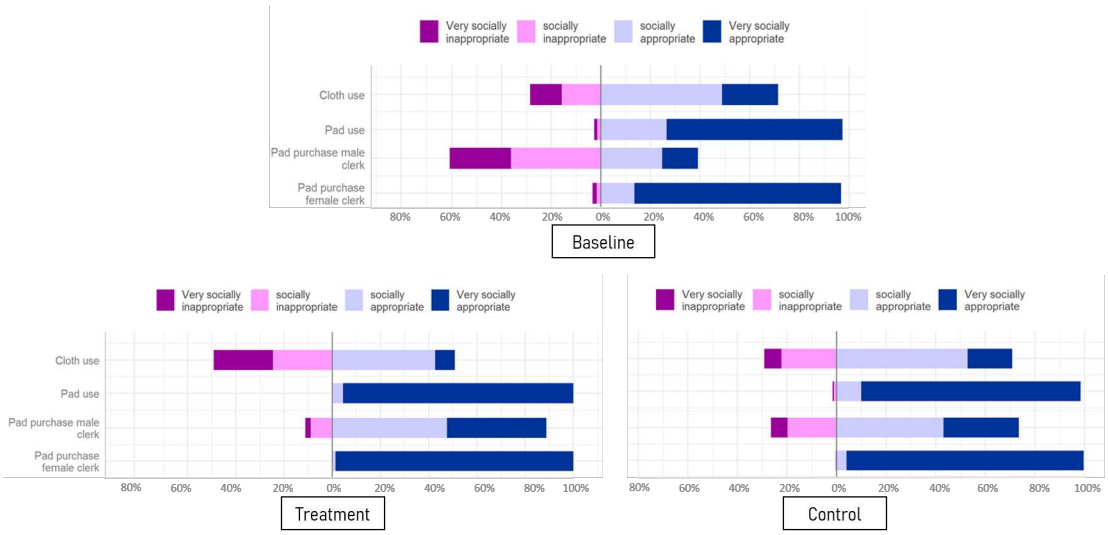

Figure 3: Perceived Social Norms

Notes: Perceived social norms before and after the intervention on a 4-point Likert scale. The top panel pools all participants. The bottom left panel depicts the endline results for the treatment group, the bottom right panel for the control group.

changes occurred also in the control group and possibly points towards the existence of spillover effects. We discuss possible explanations and implications of this finding in detail in Section 3.3. We do not observe further strong changes in the modal responses. In Table A3 in the appendix, we provide regression results for the mean ratings for the same social norm measures. In line with Figure 3, we observe a large change in the average perceived social appropriateness of purchasing pads from a male shopkeeper for both the control and treatment group, with the change being 15% larger for the treatment group.

In addition to the effects on second-order beliefs about social norms, we expect the intervention to also have affected personal attitudes towards the stigma and taboo, as women had positive experiences of discussing menstruation confidently with each other without negative social repercussions. In Table 5, we provide the regression results from our measures of stigma and taboo. We use a difference-in-differences regression framework. The results show that the intervention reduces the perceived stigma and taboos associated

with menstruation to a large extent. While women agreed on average to 1.8 out of 4 stigma-related statements and to 1.6 out of 4 taboo-related statements at baseline, women in the treatment group only agree to about 0.9 and 0.8 of these statements after the treatment, respectively (results are significant at the 1% level). However, we also observe an effect on the perceived levels of stigma and taboo for the control group, with women in the control group agreeing to around 1.3 and 1.2 statements in the endline survey, respectively. This again suggests that changes occurred in the control group as well, possibly reflecting spillover effects. This is discussed in the next section.

Table 5: Perceived Stigma and Taboos

	(1)	(2)	(3)	(4)
	Stigma		Taboo	
Endline	-0.493	-0.498	-0.394	-0.385
	(0.09)	(0.09)	(0.08)	(0.08)
Intervention	0.008	-0.006	0.086	0.060
	(0.11)	(0.12)	(0.12)	(0.12)
Endline*Intervention	-0.394	-0.408	-0.434	-0.446
	(0.13)	(0.14)	(0.12)	(0.12)
Mean of dep. var	1.758	1.758	1.567	1.567
Demographic Controls	No	Yes	No	Yes
Observations	475	459	475	459

Notes: Difference-in-differences estimation (OLS) of the treatment effect on perceived stigma and taboo. Columns (1) and (3) report the regression without controls, columns (2) and (4) add age, years of education, marital status, number of children and reported use at baseline of sanitary pads and cloth. *Mean of dep. var* represents the control group mean before the discussion session. *Endline* is a dummy equal to 1 at endline and 0 otherwise. *Intervention* is a dummy equal to 1 if the respondent belongs to the treatment group and 0 otherwise. Standard errors clustered at the individual level are reported in parentheses.

3.3 Spillover effects

The difference-in-differences analyses of the stigma, taboos and norms revealed not only significant changes in the treatment group compared to the control group, but also changes over time in the control group.

One reason for this could be unintended treatment effects resulting from the phone surveys as well as a perceived implicit endorsement of menstrual

health as important issue by the factory through our experiment. Our treatment intervention largely consists of providing the participants with a safe space to talk about menstruation and to update their beliefs about how others perceive the topic. To some extent, the interviews with the enumerators fulfill a similar function, as they also provide women with the opportunity to talk with someone about menstruation openly without fear of social repercussions. This might explain observed effects for the control group in the same direction, but of a lower magnitude than our treatment effect. Moreover, as discussed by Tankard and Paluck (2016), institutional signals provide an important source of information about social norms. The women in our study were aware that the factory had approved our research, which may have served as an institutional signal about the social acceptance of menstruation as important health concern. Thus, participation in the experiment may have had a similar, albeit smaller, effect as our intervention. This would indicate that the current *status quo*, in which the silence and taboos around menstruation restrict women, is weak and that even providing women with short opportunities to exchange experiences with one other person (e.g. the enumerator) and an official sanctioning of menstruation as important health topics by relevant institutions can already have large effects. We take this as encouraging sign for a large potential for scaling up our intervention.

Another reason could be the existence of spillover effects from the treatment to the control group. These spillovers arise when the women in the treatment group share what they discussed in the treatment sessions with the women from the control group. To test for spillover effects, we first check whether the changes in perceived social norms in the control group occur only for those social norms explicitly discussed in the treatment groups or along the whole spectrum of related social norms. Second, we asked the women directly about the extent to which they discussed the menstrual underwear and the study with their co-workers six months after the treatment.

In Table 6 we provide additional measures of social norms elicited at endline and baseline. There are no statistically significant changes for the control group in the average perceptions of the two norms related to hygienic drying

and washing of cloth in columns (1) and (2). This is a topic that was not discussed in the treatment sessions directly. However, we do observe significantly different answers in the average perception of norms on intergenerational communication about menstruation in columns (3), (4) and (5). This was one of the most discussed topics in the discussion sessions. This points towards spillover effects from the treatment group to the control group, since the changes occurred only for topics explicitly discussed in the discussion sessions.

Table 6: Social Norms - Hygienic Management and Intergenerational Communication

	(1)	(2)	(3)	(4)	(5)	(6)
	Hygienic management - Cloth		*Menstruation is explained*			
	Washing	Drying	to daughter by...		to son by...	
	in laundry facilities	under sunlight	Father	Mother	Father	Mother
Endline	-0.03	0.05	0.05	0.04	-0.05	0.03
	(0.02)	(0.05)	(0.02)	(0.01)	(0.02)	(0.02)
Intervention	0.00	-0.05	0.03	-0.05	0.05	0.04
	(0.03)	(0.05)	(0.03)	(0.02)	(0.04)	(0.02)
Endline*Intervention	0.07	0.23	0.11	0.05	0.07	0.15
	(0.04)	(0.07)	(0.04)	(0.02)	(0.04)	(0.03)
Mean of dep. var	0.11	0.28	0.07	0.95	0.17	0.18
Observations	125	125	218	475	218	475

Note: Difference-in-differences estimation (OLS) of the treatment effect on perceived social norms regarding (1) washing menstrual cloth in a communal area (2) drying menstrual cloth outside (3) the father discussing menstruation with his daughter (4) the mother discussing menstruation with her daughter and (5) and (6) are the equivalent for sons. Beliefs were elicited on a 4-point Likert scale and are normalized to a range between 0 and 1. *Mean of dep. var* represents the control group mean before the discussion session. *Endline* is a dummy equal to 1 at endline and 0 otherwise. *Intervention* is a dummy equal to 1 if the respondent belongs to the treatment group and 0 otherwise. Clustered standard errors at the individual level in parentheses for the coefficients..

To measure the extent of spillovers more directly, we re-surveyed 339 of the women in our study six months after the intervention[12], and asked them directly about their (self-reported) behavior in terms of discussing the un-

[12]The follow-up surveys were conducted in November and December 2021. Not all study participants could be reached by phone for the follow-up survey. The follow-up sample includes 182 women from the control and 157 from the treatment group. 291 of these women did collect the underwear , because they either had a zero WTP for the underwear or won money or pads as part of the WTP lottery.

derwear with their co-workers. Among the women from the treatment and control group who collected the underwear after the experiment, 82% from the control group and 87% from the treatment group report having discussed the menstrual underwear with others, mostly with their co-workers (97-98%). In addition, of those women who did not themselves collect the underwear, almost everyone knows someone who did pick it up (91-94%) and 59% of women in the control group and 88% of women in the treatment group had a co-worker share their experiences with the underwear with them.

We also surveyed 59 workers who had not previously participated in the surveys at all ("pure control")[13], and asked them about their level of knowledge about the study and the menstrual underwear. Even though these women had not been part of the study and had not been eligible to pick up the menstrual underwear themselves, 72% report being aware that the study had happened and 63% report knowing someone who went to collect the menstrual underwear. Moreover, more than half of the women report having discussed the topic of menstruation with at least one co-worker since the experiment. These results are summarized in tables Table A4 and A5 in the appendix.

These high rates of discussion between women in the treatment and control groups, as well as with women not part of the study, indicate that many of the women shared their experiences of the study and the menstrual products they received with each other. This makes it very plausible that our outcome measures picked up some spillover effects from the treatment to the control group. For the purpose of our intervention, this is reassuring. It indicates that the women felt more confident to discuss menstruation after the treatment and that providing opportunities to freely talk about menstruation and making new and advanced menstrual products available can have significant knock-on effects for women who are not directly involved. If this interpretation is correct, we underestimate the overall effectiveness of our treatment.

[13]These workers were selected randomly from a full list of the remaining factory workers.

3.4 Persistence of Effects

Our results have shown that the discussion sessions changed the perceptions and behavior of the treatment group shortly after the intervention. The remaining question is how these changes develop over time.

We again use the sample of 339 women from our original sample who were re-surveyed six months after treatment and the 59 women who had not previously been part of the study. We find that collecting new menstrual underwear had a lasting impact on the materials women use frequently (for two days or more during a period) to manage their menstruation. In the pure control group, 49% of women report using cloth and 61% of women report using pads (in line with our full sample at baseline, see Table A1). In contrast, only 23% of our study participants with access to the menstrual underwear reported still using cloth, both in the treatment and control group, a reduction by half. Pad use increased by around 13%. 79-82% of women report frequently using the menstrual underwear they had collected. There is no difference between the absorbents used by the treatment and the control group after six months. This suggests that being given access to a modern menstrual underwear and participation in the study itself led to persistent changes in material use. These results are summarized in Table A6 in the appendix.

We next evaluate whether the intervention had persistent effects on the valuation of sanitary pads for those women having collected the menstrual underwear.[14] Table 7 reports the regression results. The average WTP in the control group is much higher than it was right after the intervention, with an average WTP of 123 BDT for a pack of four pads (compared to 91 BDT at the endline survey). Women in the treatment group directionally have a lower willingness to pay for the pads, but this difference is not statistically significant. It could be that women in the treatment group are now more likely than women in the control group to obtain their pads elsewhere, such as a corner store or pharmacy. In absolute terms, however, the WTP for the treatment group is very similar to what it was in the endline survey (110 BDT

[14]For completeness, we also include the WTP for the menstrual underwear in Appendix Table A7.

at the six-months follow-up compared to 113 BDT at the endline). Overall, receiving the free menstrual underwear and participating in the study thus had persistent effects on the valuation and use of modern menstrual products.

Table 7: Valuation of Pads at Six-month Follow-up

	(1)	(2)
	WTP for pads	
Intervention	-11.532	-12.970
	(9.45)	(9.09)
Mean of dep. var	123.379	123.379
Demographic Controls	No	Yes
Observations	291	291

Note: Interval regression of the willingness to pay (in BDT) for disposable menstrual pads to be collected from a male shopkeeper at the factory store for the subset of women who collected the available menstrual underwear. Robust standard errors reported in parentheses. Demographic controls in column (2) include age, years of education, marital status, number of children and use of pads, cloth and menstrual underwear at the six-month follow-up (as dummies).

Lastly, we determine whether the intervention had a lasting effect on the perceived stigma, taboo, and the social norm on purchasing pads from a male shopkeeper. Figure 4 shows that the effects are indeed persistent over six months, and average levels of stigma and taboo are significantly lower at the six-month follow-up than they were at baseline (top panels of Figure 4). Similarly, the action of purchasing pads from a male shopkeeper is seen as substantially more socially appropriate at the six-month follow-up compared to the baseline (bottom panel of Figure 4). It also shows that the difference between the treatment and control group observed directly after the intervention diminishes over time. After six months, there is no difference between the two groups that took part in the experiment, in line with the effects on product use and valuation.

This allows us to rule out that the changes observed in the control group reflect a time trend independent of our intervention by looking at the pure control group. As the dashed bars in each panel of Figure 4 show, the values of stigma, taboo and social norms measured for the pure control group are very

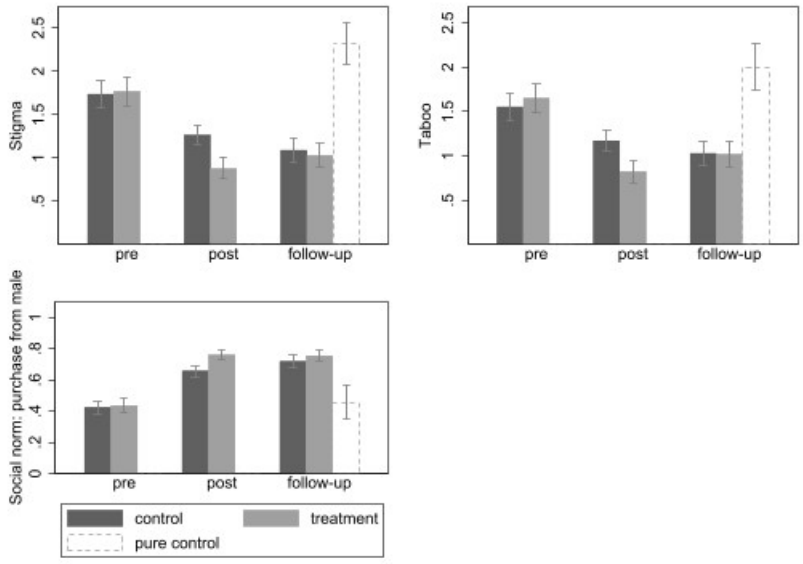

Figure 4: Perceived Social Constraints - Persistence of Effects

Notes: The top left panel shows the average stigma level for the treatment and control group and the pure control group at baseline, endline and the 6-month follow-up. The top right panel shows the same for the taboo level. Both are measured on a scale from 0 to 4. The bottom panel shows the perceived appropriateness of purchasing pads from a male shopkeeper, on a scale from 0 to 1. Error bars represent 95% confidence intervals.

similar to the original baseline values of our study participants. This means there was no general reduction in social constraints outside of the experiment. Table A8 in the Appendix formally confirms the results visible in Figure 4.

Overall, this supports the idea that participation in the study itself has started to break the silence, encouraging discussions between the women and spillovers across the treatment and control group, leading to substantial and lasting effects on the perceived social constraints of stigma, taboos and social norms even six months after the intervention.

4 Conclusion

In this paper, we present results from a field experiment with 476 women in a Bangladeshi garment factory and show that open discussions about the

stigmatized topic of menstruation increases the valuation and take-up of both known and novel menstrual products: sanitary pads and re-usable menstrual underwear. Participating in discussions that break the silence surrounding menstruation increased the willingness to pay for sanitary pads that had to be collected from a male shopkeeper on factory premises by more than 25% (from around 91 BDT to around 113 BDT), and take-up rates of a novel menstrual underwear by around 14% (from around 71% to around 81%).

We also shed some light on the potentially underlying mechanisms. We hypothesize that social pressure, arising from social norms, stigma, and taboos, might play a role in preventing the adoption of these affordable and available health-enhancing technologies and that our intervention directly addresses them. Using a discrete choice experiment, we show that the intervention did not modify the value-for-money that study participants attribute to the modern absorbents, but rather that barriers related to shopkeeper gender and social image concerns were reduced. After the discussion, women were less concerned about obtaining the menstrual material from a male shopkeeper and of being seen accessing the new products in the factory. We see that open discussion reduces the perceived restrictiveness of social norms directly related to the collection of products in the store, as well as affecting personal attitudes towards the stigma and taboos around menstruation in general. These effects are still visible after six months.

With this study we provide important insights for policy makers. We propose a very light-touch intervention, which relies on an endogenous process of updating second-order beliefs regarding the prevalent social norms and a reduction in perceived stigma and taboo. It builds on the women's own knowledge and own exchange of ideas and experiences without the need for external skill or knowledge provision. We encountered great interest and eagerness from the women to actively engage in these discussions and to share their personal experiences with each other, resulting in persistent changes in the perceptions of norms, stigma and taboo and continued discussions among the women. Taken together with the observation that the perceived stigma, taboo and norms also shifted in the control group due to spillovers and the discussions with the

enumerators having a similar effect to our treatment, this suggests that the sub-optimal equilibrium limiting women's opportunity to discuss menstruation is weak and can be altered. We take this as encouraging sign of the potential of a large-scale implementation of such an intervention, which would not need to involve every single worker in a formal discussion group. Nudges to discuss this topic openly and the provision of a safe space to do so may already be sufficient and have large and positive effects on the adoption of health- and productivity-enhancing technologies. Alternatively, as the results point towards the male gender of the shopkeeper as one of the main obstacles, alternative distribution channels that circumvent this constraint could be very effective, such as vending machines in women's restrooms or selling menstrual products in the factory's health center (a more private location, often staffed by mainly female nurses).

Several important questions to address the remaining obstacles to the achievement of wide-spread optimal menstrual hygiene management need to be left to future research. One unexplored avenue is the role of men. Since men are often in charge of the household budget and are often sent by their wives to purchase the pads for them, addressing the men's perception of restrictive social constraints provides a promising avenue for future research, as demonstrated also in Bursztyn et al. (2020). Moreover, given our findings about the existence of spillovers, future research could identify whether there are any particular change makers or opinion leaders that should be targeted to achieve an optimal spread through the women's network. Yet, our study has shown that a crucial step toward providing all women with hygienic menstrual health technologies lies in supporting women to openly engage with the topic and thus overcome the social pressure and stigma otherwise limiting their access to affordable and available health technologies.

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5 Appendix

A Additional Figures and Tables

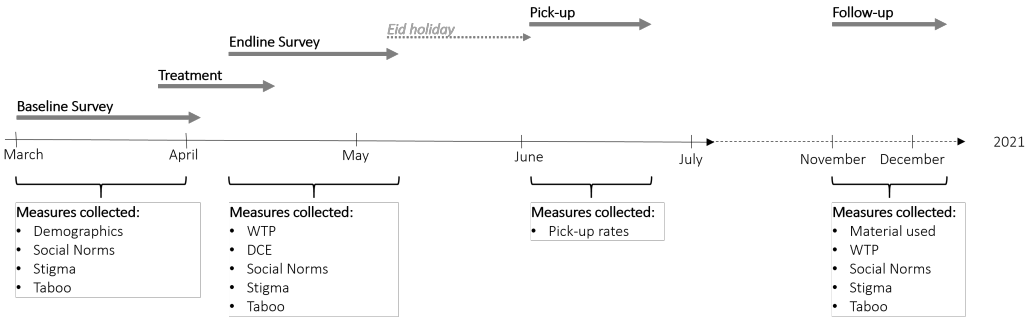

Figure A1: Timeline of the data collection

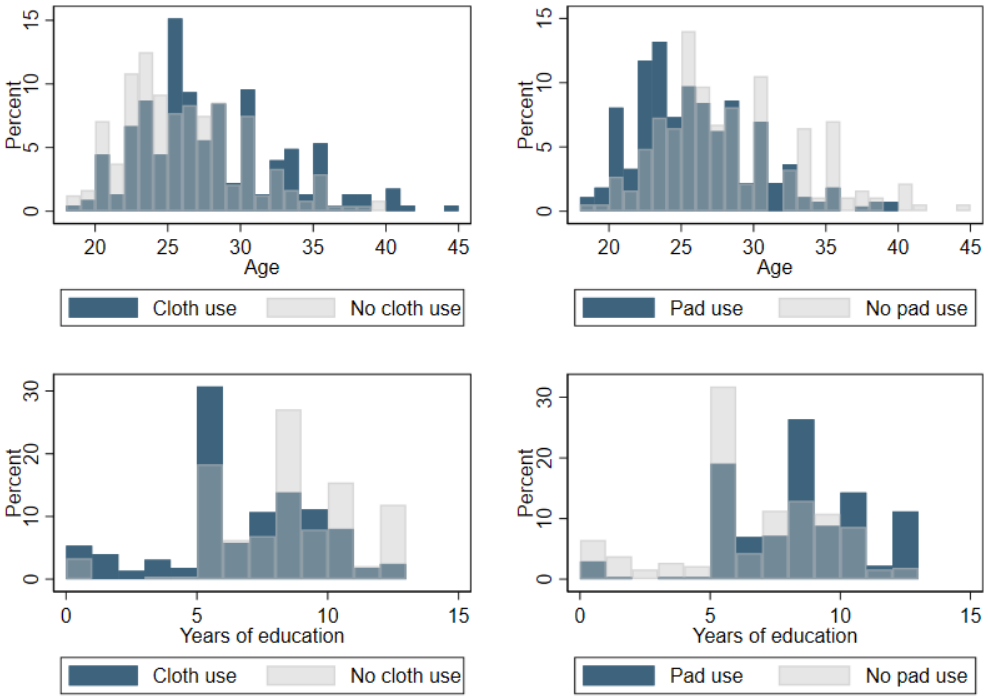

Figure A2: Distribution of Baseline Absorbent Used by Age and Education

Notes: Histograms showing the percentage share of women reporting to use cloth frequently (blue bars in left-hand panels) and reporting to use pads frequently (blue bars in right-hand panels), split by age (top panels) and years of education (bottom panels). Grey bars indicate women responding that they do not use the respective materials frequently.

Table A1: Descriptive statistics

	(1)	(2) Mean	(3)	(4) Difference
	Full Sample	Control	Treatment	T-C
Age	26.48	26.60	26.34	-0.25
	(4.68)	(4.63)	(4.75)	(0.43)
Muslim religion	0.98	0.98	0.98	-0.00
	(0.13)	(0.12)	(0.13)	(0.01)
Married	0.85	0.87	0.82	-0.05
	(0.35)	(0.33)	(0.38)	(0.03)
Total number of children	1.01	1.04	0.98	-0.07
	(0.84)	(0.87)	(0.80)	(0.08)
Years of education	7.11	7.05	7.17	0.11
	(2.87)	(2.92)	(2.82)	(0.26)
Non-pregnant	0.97	0.96	0.98	0.02
	(0.18)	(0.20)	(0.15)	(0.02)
Menstrual absorbent				
Cloth or fabric	0.48	0.49	0.48	-0.01
	(0.50)	(0.50)	(0.50)	(0.05)
Disposable pads	0.60	0.60	0.59	-0.01
	(0.49)	(0.49)	(0.49)	(0.05)
Reasons to not take-up pads				
Uncomfortable in a store due to a lack of privacy	0.85	0.86	0.83	-0.03
	(0.36)	(0.34)	(0.38)	(0.05)
There is no store nearby	0.21	0.22	0.20	-0.01
	(0.41)	(0.41)	(0.40)	(0.06)
Behavior when buying pads				
Cover face for anonymity	0.52	0.48	0.57	0.10
	(0.50)	(0.50)	(0.50)	(0.09)
Visit store far away to avoid recognition	0.16	0.15	0.18	0.02
	(0.37)	(0.36)	(0.38)	(0.07)
Discomfort if men present in store	0.74	0.71	0.79	0.08
	(0.44)	(0.46)	(0.41)	(0.08)
Discomfort if women present in store	0.03	0.02	0.04	0.02
	(0.16)	(0.12)	(0.20)	(0.03)
Husband buys the pads	0.47	0.46	0.47	-0.01
	(0.50)	(0.50)	(0.50)	(0.06)

Note: Baseline summary statistics of participant characteristics. For columns (1), (2), and (3) the standard deviation is reported in parentheses. Column (4) reporting the difference shows the coefficient of a simple regression of the variable on a treatment group dummy with robust standard errors. None of the differences are significant. All variables except age, total number of children and years of education, are coded from 0 to 1.

Table A2: Valuation of Underwear at Endline

	(1)	(2)	(3)	(4)
	WTP underwear			
	Full sample		*Without always takers*	
Intervention	68.200	50.122	77.469	71.525
	(67.76)	(68.54)	(30.47)	(29.89)
Constant	873.187	349.941	93.590	10.775
	(59.43)	(291.30)	(18.71)	(115.50)
Demographic Controls	No	Yes	No	Yes
Observations	476	460	106	102

Notes: Interval regression of the WTP (in BDT) at endline for the reusable menstrual underwear from a male shopkeeper at the factory store. Demographic controls in columns (2) and (4) include age, years of education, marital status, number of children and baseline use of pads and cloth (as dummies). Columns (3) and (4) exclude from the regression participants with a perfectly inelastic demand (i.e. who still preferred the underwear at the maximum price of 500 BDT). Robust standard errors reported in parentheses.

Table A3: Average Beliefs about Social Norms around Use and Purchase of Absorbents

	(1)	(2)	(3)	(4)
	Use as absorbent		*Purchase pads from*	
	Cloth	Pads	Male	Female
Endline	-0.01	0.07	0.23	0.05
	(0.04)	(0.01)	(0.02)	(0.01)
Intervention	-0.00	0.00	0.01	-0.00
	(0.06)	(0.02)	(0.03)	(0.02)
Endline*Intervention	-0.15	0.03	0.10	0.02
	(0.07)	(0.02)	(0.03)	(0.02)
Mean of dep. var	0.61	0.89	0.43	0.93
Observations	132	475	475	475

Notes: Difference-in-differences estimation (OLS) of the treatment effect on perceived social norms regarding (1) using cloth as absorbent , (2) using disposable pads as absorbent, (3) buying pads from a male shopkeeper, (4) buying pads from a female shopkeeper. Beliefs were elicited on a 4-point Likert scale and are normalized to a range between 0 and 1. *Mean of dep. var* represents the control group mean before the discussion session. *Endline* is a dummy equal to 1 at endline and 0 otherwise. *Intervention* is a dummy equal to 1 if the respondent belongs to the treatment group and 0 otherwise. Clustered standard errors at the individual level are reported in parentheses.

Table A4: Discussion with Peers about the Experiment

	(1) Control	(2) Treatment	(3) Difference T-C
Participants that collected underwear			
Discussed menstrual underwear with others	0.83	0.87	0.05
	(0.38)	(0.33)	(0.04)
... with co-workers	0.97	0.98	0.01
	(0.17)	(0.13)	(0.02)
...with female relative	0.40	0.46	0.06
	(0.49)	(0.50)	(0.06)
... with husband	0.18	0.22	0.04
	(0.38)	(0.42)	(0.05)
Participants that did not collect underwear			
Know someone who picked up product	0.91	0.94	0.03
	(0.30)	(0.25)	(0.08)
Co-worker shared experience with product	0.59	0.88	0.28
	(0.50)	(0.34)	(0.12)

Note: Self-reported behavior regarding the discussion of the menstrual underwear. For columns (1) and (2), standard deviations are reported in parentheses. Column (3) reports the coefficient of a simple regression of the variable on the treatment status, with robust standard errors reported in parentheses.

Table A5: Pure Control - Discussion with Peers about the Experiment

	Pure control
Know about the study	0.72
	(0.45)
Know someone who picked up the underwear	0.63
	(0.49)
Discussed menstruation with co-workers	0.54
	(0.50)

Note: Self-reported knowledge of the experiment and level of discussion with other co-workers about menstruation for the pure control group. Standard deviations are reported in parentheses.

Table A6: Reported Material Used at Six-month Follow-up

	(1)	(2)	(3)	(4)	(5)
	Sample *(Share)*			Difference	
	Pure-control	Control	Treatment	T-PC	T-C
Cloth or fabric	0.49	0.23	0.23	-0.26	0.00
	(0.50)	(0.42)	(0.42)	(0.07)	(0.05)
Disposable pads	0.61	0.69	0.69	0.08	0.00
	(0.49)	(0.47)	(0.46)	(0.07)	(0.05)
Menstrual underwear		0.79	0.82		0.02
		(0.41)	(0.39)		(0.05)
Observations	59	150	141		

Note: Share of women reporting to use each material frequently at the six-month follow-up, conditional on having collected the product. For the pure control group, the menstrual underwear had not been made available. For columns (1), (2), and (3), standard deviations are reported in parentheses. Columns (4) and (5) reports the coefficient of a simple regression of the variable on the treatment status comparing the treatment group to both control groups, the pure control group and the experiment control group. Robust standard errors reported in parentheses. Stars indicate whether the difference between the treatment and control group is significant.

Table A7: Valuation of a Second Underwear at Six-Month Follow-up

	(1)	(2)	(3)	(4)
	WTP for a second set of underwear			
	Full sample		*Without always takers*	
Intervention	94.722	83.244	81.892	72.474
	(67.88)	(56.21)	(31.95)	(32.97)
Constant	741.021	1006.098	149.922	429.044
	(58.19)	(242.19)	(21.94)	(137.28)
Demographic Controls	No	Yes	No	Yes
Observations	291	291	73	73

Notes: Interval regression of the WTP (in BDT) at six-month follow-up for the reusable menstrual underwear from a male shopkeeper at the factory store. Sample includes 291 women who had already collected the first underwear directly after the experiment, so this indicates the WTP for an additional, second underwear. Demographic controls in columns (2) and (4) include age, years of education, marital status, number of children and baseline use of pads and cloth (as dummies). Columns (3) and (4) exclude from the regression participants with a perfectly inelastic demand (i.e. who still preferred the underwear at the maximum price of 500 BDT). Robust standard errors reported in parentheses.

Table A8: Perceived social constraints at the six-month follow-up

	(1) Stigma	(2) Taboo	(3) Norm
Follow-Up	-0.687	-0.563	0.282
	(0.12)	(0.12)	(0.03)
Intervention	-0.073	0.080	0.005
	(0.14)	(0.14)	(0.04)
Intervention*Follow-Up	0.030	-0.068	0.024
	(0.17)	(0.18)	(0.04)
Mean of dep. var	1.834	1.652	0.424
Demographic Controls	Yes	Yes	Yes
Observations	337	337	337

Notes: Difference-in-differences regression coefficients of the perceived stigma (column 1), taboo (column 2) and the social norms on purchasing pads from a male shopkeeper (column 3, standardized between 0 and 1) on the treatment, comparing reported values six months after the treatment with the baseline. *Mean of dep. var* represents the control group mean before the discussion session. *Follow-Up* is a dummy equal to 0 for measures elicited in the baseline survey and 1 in the six-months follow-up survey. *Intervention* is a dummy equal to 0 if the respondent belongs to the control group and 1 if she belongs to the treatment group. Robust standard errors are reported in parentheses.

B Discussion Group Composition

To learn more about how the discussions affected the women in the treatment group, we explore the treatment effect for each discussion group separately. This allows us to ensure that the treatment worked in a similar manner for all women in all treatment groups and to rule out effects driven by outliers. Second, we can evaluate if the size of the treatment effect depends on specific discussion group characteristics. We look at differences in group size, the share of pad users and cloth users, the average age and education level, and the average stigma and taboo levels at baseline for each group. This allows us to examine if any characteristics of the discussion groups are more predictive of success than others to provide lessons for designing discussion groups in future studies or program implementation.

We first regress the WTP for sanitary pads and the probability of product collection on a set of 15 dummy variables, one for each of the 15 discussion

groups. The base category consists of the women in the control group. Figure B1 plots the regression coefficients by group for the WTP for sanitary pads (left) and the probability of product collection (right). The figure shows a positive treatment effect on WTP in the majority of treatment groups (though given the small sample sizes of around 15 participants per group, the confidence intervals are wide and the treatment effects not statistically significant for each individual group). The effect of the treatment on the collection of the menstrual underwear is more consistently positive, with most groups showing a higher average collection rate than the control group. Figure B1 also shows that two groups experienced a very large treatment effect on the WTP, groups 11 and 15. To ensure that our results are not only driven by these two groups, we re-run our main regression excluding these groups as a robustness check. The results can be seen in Table C1 in the appendix on robustness checks. This does not greatly change the magnitude of the treatment effects or the interpretation of our results.

Looking at the composition of groups 15 and 11, it is interesting to note that both groups were among the largest groups, with 20 and 17 participants, respectively. Moreover, in group 15 all women were using pads already at baseline (not counting 4 pregnant women also included in this group). Table B1 provides a general overview of the average characteristics of each group in comparison to each other and the control group.

To determine whether these and other factors of the group composition played a role, we regress the average WTP for sanitary pads of each discussion group (average lower bound) and the average probability of product collection of each discussion group on some of the group characteristics. Given the small number of groups, this analysis lacks statistical power and should be interpreted as only indicative of directional effects.

The results are shown in Table B2. Being in a discussion group with a higher share of cloth users appears to have a negative effect on the WTP, a more negative effect than being in a group with a higher share of pad users. The scatter plot in Figure B2 suggests that, if anything, there is a weakly positive relationship between the share of pad users and WTP and a weakly

negative relationship between the share of cloth users and WTP. Neither share has an effect on collection rates. Second, being in larger groups with on average younger colleagues seems to increase WTP, though these coefficients are of a very low magnitude. Moreover, the WTP of women in a discussion group with a higher average level of perceived stigma at baseline is higher after the treatment, while those groups with a stricter perception of the taboo at baseline have a lower WTP. This could indicate that the treatment is effective in the face of higher stigma levels and has more bite when women are initially constrained. However, effectiveness of the treatment is hindered by a strong perceived taboo, because the women may be less likely to open up and share their experiences. The scatter plot in Figure B3 shows this relationship in more detail.

For the probability of product collection, in contrast, there seems to be no difference between having many cloth users or many pad users in the group. Group size, age and education also have no effect. While lower baseline stigma and higher baseline taboos appear to be positively related with higher collection rates, the scatter plots in Figures B2 and B3 suggest that these effects are not statistically or economically significant.

Overall, these results suggest that the exact group composition and characteristics of the discussion groups do not play a decisive role in determining the treatment effectiveness. We will need to leave it to future research to explore the marginal benefits of further design elements of the discussion groups, such as reducing or extending the time of the discussion or varying the exact content.

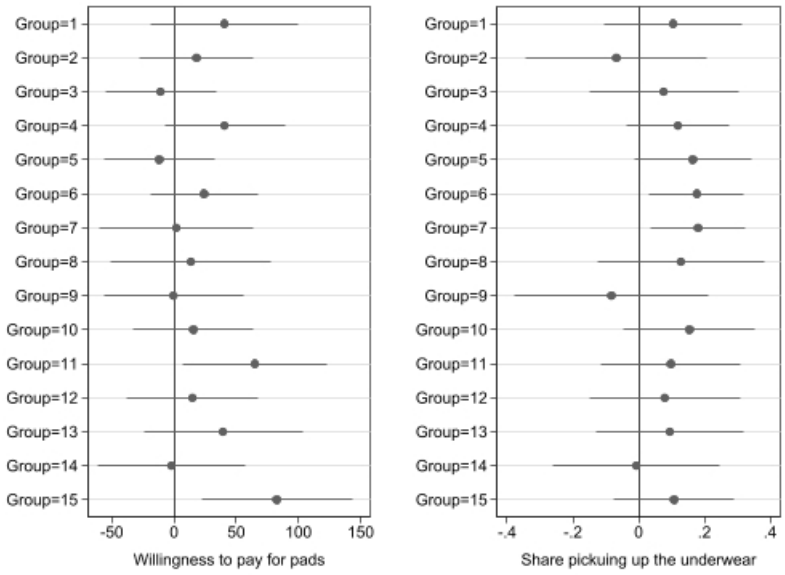

Figure B1: Treatment Effects by Discussion Group

Notes: The left panel plots the regression coefficients obtained from the interval regression of the WTP for sanitary pads on a set of 15 dummy variables indicating participation in the discussion groups (including demographic controls). The right panel plots the regression coefficients obtained from the linear probability regression of the collection probability on the same set of dummy variables (and demographic controls). The dots represent the mean effect of being assigned to a given discussion group on the WTP (left) and product collection (right). The bars represent 95% confidence intervals. The base category is the control group.

Table B1: Group Summary Characteristics

	(1) Size	(2) Cloth users	(3) Pad users	(4) Age	(5) Education	(6) Knowledge	(7) Stima	(8) Taboo
Control	258	0.50	0.61	26.59	7.06	0.77	1.74	1.55
Group 1	16	0.69	0.38	24.75	6.56	0.72	1.56	1.63
Group 2	15	0.67	0.53	27.13	6.60	0.69	2.21	1.60
Group 3	14	0.57	0.43	30.07	5.00	0.77	1.21	1.50
Group 4	21	0.43	0.71	27.71	7.23	0.78	2.14	1.67
Group 5	13	0.23	0.92	25.08	8.69	0.78	1.92	2.07
Group 6	16	0.63	0.50	25.94	7.43	0.76	1.63	1.75
Group 7	12	0.50	0.50	26.92	8.50	0.81	1.50	1.25
Group 8	11	0.64	0.45	25.81	5.91	0.77	2.00	2.09
Group 9	14	0.43	0.50	24.71	9.64	0.82	1.43	1.36
Group 10	14	0.57	0.50	26.56	6.14	0.82	1.29	1.14
Group 11	17	0.41	0.65	27.41	5.88	0.78	2.06	1.59
Group 12	15	0.60	0.40	28.60	7.07	0.74	1.87	1.87
Group 13	14	0.21	0.86	23.64	8.64	0.77	2.36	2.07
Group 14	13	0.42	0.50	25.85	7.15	0.82	1.69	1.54
Group 15	20	0.13	1.00	24.40	8.00	0.83	1.55	1.55
Total Average	144.95	0.48	0.60	26.47	7.13	0.77	1.75	1.59

Notes: Arithmetic mean and proportions of group characteristics for different demographic and survey measures at baseline. *Size* includes the number of participants in the specified group. *Cloth users* and *Pad users* reports the proportion of respondents that reported to use said absorbent at baseline, *Age* reports the average age, *Education* reports the average years of schooling, *Knowledge* represents the proportion of questions that participants answered accurately regarding biological functions of menstruation, *Stigma* and *Taboo* report the group averages on perceived stigma and taboo, measured on a scale from 0-4 (being 0 the lowest level of perceived stigma)

Table B2: Group composition effects

	(1) WTP for pads	(2) Pickup of underwear
Share cloth users in group	-34.610	0.422
	(73.11)	(0.64)
Share pad users in group	-19.245	0.539
	(66.00)	(0.53)
Number of group members	4.388	-0.002
	(1.71)	(0.01)
Average age	-6.319	0.009
	(2.66)	(0.02)
Average education	-5.999	0.011
	(4.47)	(0.03)
Average stigma at baseline	23.876	-0.136
	(16.56)	(0.14)
Average taboo at baseline	-11.522	0.097
	(17.60)	(0.18)
Constant	235.687	0.085
	(150.69)	(0.80)
Observations	15	15

Notes: Column (1) reports results from the regression of the average (lower bound of the) willingness to pay for pads per group on the different group characteristics. Column (2) reports results from the linear probability regression of the average underwear pick-up rate per group on the group characteristics. Share of cloth and pad users is measured between 0 and 1. Standard errors reported in parentheses.

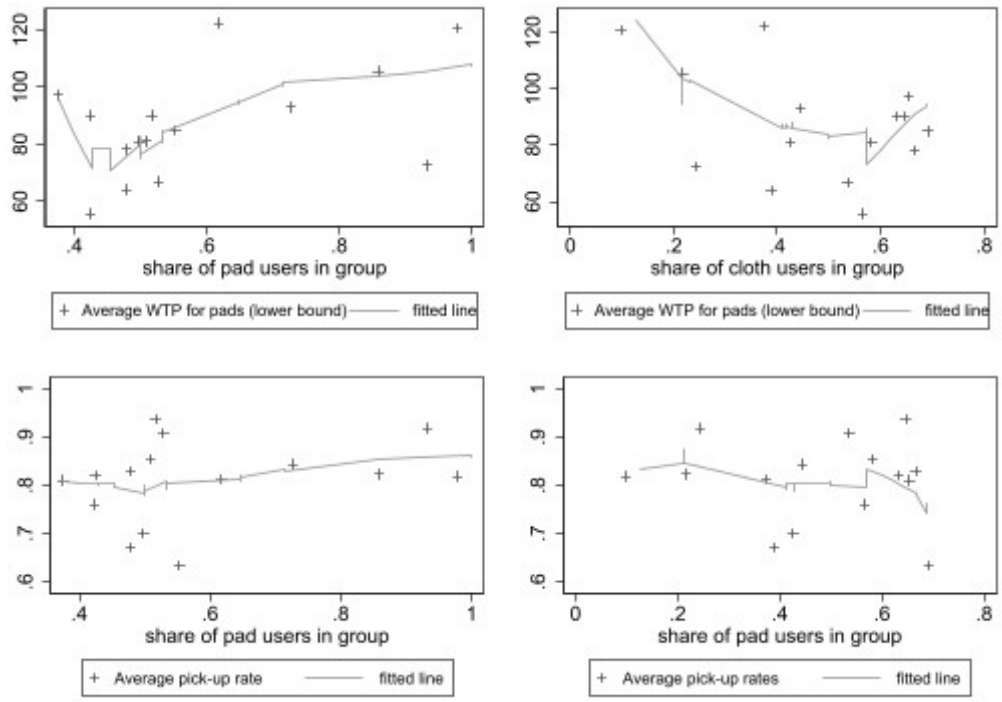

Figure B2: Relationship of the Share of Pad and Cloth Users and Group-Level Outcomes

Notes: The four plots show the average lower bound of the WTP (top panels) and average pickup rates (bottom panels) for each of the 15 discussion groups, plotted against the share of pad users in each group (left-hand panels) and the share of cloth users in each group (right-hand panels). Pad users are defined as women reporting using pads frequently (2 days or more during a period) at baseline, cloth users are defined as women reporting using cloth frequently (2 days or more during a period) at baseline. The lower bound of the WTP is the last value at which a woman preferred the product over the money. The line of best fit is drawn as smoothed locally weighted regression line.

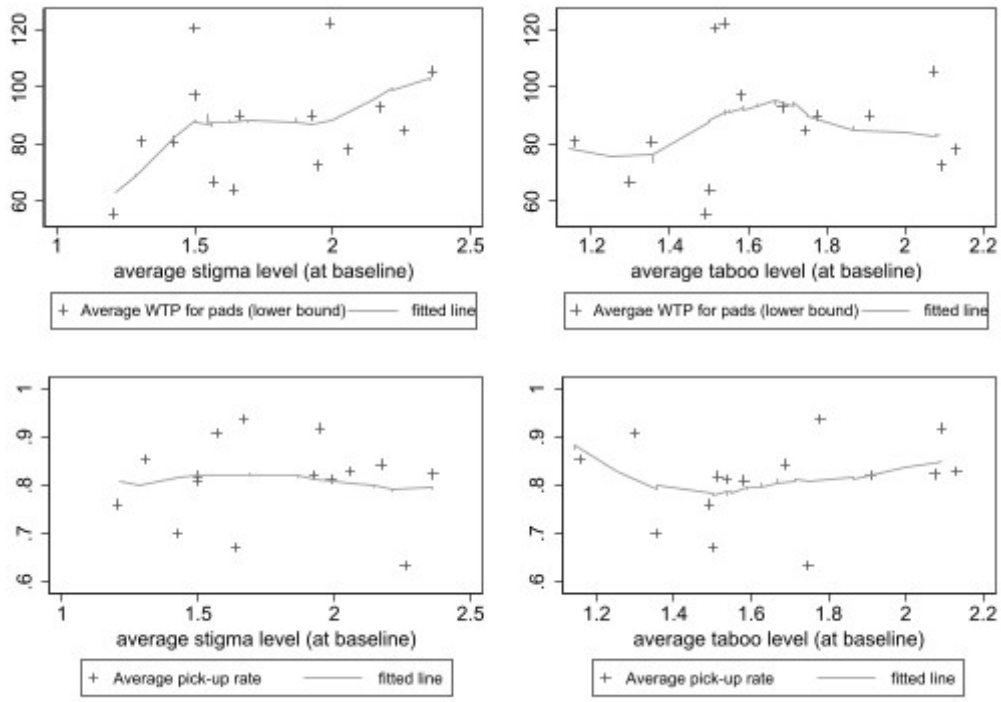

Figure B3: Relationship of Stigma and Taboo Variables and Group-Level Outcomes

Notes: The four plots show the average lower bound of the WTP (top panels) and average pickup rates (bottom panels) for each of the 15 discussion groups, plotted against the share of pad users in each group (left-hand panels) and the share of cloth users in each group (right-hand panels). Pad users are defined as women reporting using pads frequently (2 days or more during a period) at baseline, cloth users are defined as women reporting using cloth frequently (2 days or more during a period) at baseline. The lower bound of the WTP is the last value at which a woman preferred the product over the money. The line of best fit is drawn as smoothed locally weighted regression line.

C Robustness checks

C.1 Excluding discussion groups 11 and 15

We re-run our main regression excluding discussion groups 11 and 15 in turn, to rule out that our results are driven by these two groups with exceptionally high treatment effects.

Table C1: Willingness to Pay and Collection Rates - Reduced Group Sample

	(1)	(2)	(3)	(4)
	WTP for pads		Pickup of underwear	
Intervention	18.817	18.455	0.088	0.087
	(9.39)	(9.42)	(0.04)	(0.04)
Constant	82.339	87.923	0.386	0.412
	(39.28)	(39.50)	(0.17)	(0.17)
Excluded Group	*11*	*15*	*11*	*15*
Demographic Controls	Yes	Yes	Yes	Yes
Observations	443	445	438	439

Notes: Columns (1) and (2) report the willingness to pay (in BDT) for disposable menstrual pads from a male shopkeeper at the factory store. Columns (3) and (4) report the linear probability of the collection of the underwear from a male shopkeeper at the factory store. Even columns exclude discussion group 15 from the analysis, odd columns exclude discussion group 11 from the analysis. Demographic controls include age, years of education, marital status, number of children and baseline use of pads and cloth (as dummies). Robust standard errors reported in parentheses.

C.2 Enumerator Fixed effects

To make sure that our results are not driven by systematic differences based on who conducted the survey, we repeat our main regressions including enumerator fixed effects.

Table C2: Willingness to Pay and Collection Rates - Enumerator Fixed Effects

	(1)	(2)	(3)	(4)
	WTP pads		Pick-up rates	
Intervention	22.760	21.720	0.089	0.101
	(9.34)	(9.12)	(0.04)	(0.04)
Constant	94.220	52.281	0.413	0.262
	(39.49)	(40.10)	(0.17)	(0.18)
Demographic Controls	Yes	Yes	Yes	Yes
Enumerator Fixed Effects	No	Yes	No	Yes
N	460	460	454	454

Notes: Columns (1) and (2) report the regression coefficients (OLS) of the intervention on the WTP for pads, with and without enumerator fixed effects. Columns (3) and (4) report the linear probability regression of the collection of the underwear with column (4) adding enumerator fixed effects. Differences in the number of observations between WTP and collection rates are due to six participants winning money or pads in the WTP lottery instead of the underwear. Robust standard errors are reported in parentheses.

C.3 Analysing social norms using an ordered logit regression model

To account for any potential non-linearities in our social norms measure, which was elicited using a 4-point Likert scale, we re-run the difference-in-differences regression using an ordered logit model instead of OLS. While the size of the coefficients does not have a direct economic interpretation, these results confirm that the direction of the effect is the same as when estimated with OLS. Moreover, the levels of significance are the same for the coefficients on endline and even higher for the coefficients on the interaction term. This suggests that, if anything, OLS is underestimating the effect of the treatment on the probability of an individual switching to a more socially appropriate category.

Table C3: Social Norms - Ordered Logit Regression Model

	(1)	(2)	(3)	(4)
	Use as absorbent		*Purchase pads from*	
	Cloth	Disposable pads	Male	Female
Endline	-0.146	1.206	1.352	1.536
	(0.24)	(0.23)	(0.15)	(0.34)
Intervention	-0.017	0.089	0.022	0.040
	(0.36)	(0.20)	(0.18)	(0.25)
Endline*Intervention	-0.828	0.936	0.568	1.163
	(0.43)	(0.42)	(0.21)	(0.69)
Observations	132	475	475	475

Notes: Ordered logit estimation of the treatment effect on perceived social norms regarding absorbent use and pad purchase. Dependent variables are the beliefs about social norms on 1) using reusable cloth as an absorbent during menstruation, 2) using disposable pads as an absorbent during menstruation 3) buying pads from a male shopkeeper, and 4) buying pads from a female shopkeeper. Dependent variables were elicited on a 4-point Likert scale (*very socially appropriate, socially appropriate, socially inappropriate, very socially inappropriate*). *Endline* is a dummy equal to 0 for measures elicited in the baseline survey and 1 in the endline survey. *Intervention* is a dummy equal to 0 if the respondent belongs to the control group and 1 if she belongs to the treatment group. In column (1) the number of observations is lower as some social norms were only elicited from a randomly selected subset of respondents to reduce the length of the survey. Clustered standard errors at the individual level are reported in parentheses.

D Heterogeneity Analysis

In this section, we conduct exploratory analyses to understand if some individual characteristics of participants correlate with the effectiveness of treatment, or if the intervention affects different subgroups of the sample in different ways. To do this, we split our sample into several subgroups. We investigate whether the treatment differs by material used at baseline, age, education and level of perceived stigma at baseline.[15]

Material used at baseline To determine the effect by material used at baseline, we split our sample into three groups and look at our main outcome

[15]In this section, we are splitting the sample according to observables that were not conditioned on in the treatment randomization. We cannot be confident that the randomization has fully balanced the unobservables along these strata. The analysis is, therefore, descriptive and results should be interpreted with caution.

measures, willingness to pay for pads and the pick-up rates of the underwear. Table D1 shows that the intervention increases the valuation of pads mainly for those women, who were already using pads but would not purchase them themselves at the store. In contrast, the intervention has a limited effect on those women already purchasing the product themselves, and only a marginally significant effect on those women not using pads at all at baseline. This is in line with the hypothesis of the existence of a binding social constraint. The intervention had no effect on the valuation of the product for those women previously not affected by the social constraint (as they were already purchasing pads themselves or were not using the product). In contrast, those women who relied on others (mostly their husband) to have access to pads have a more than 45% higher valuation after the intervention compared to the control group.

Table D1: WTP and Collection Rates by Baseline Adoption of Absorbent

	(1)	(2)	(3)	(4)	(5)	(6)
	WTP pads			Pick-up Underwear		
	Cloth Users	*Pad Users*		*Cloth Users*	*Pad Users*	
		Do Not Buy	Buy		Do Not Buy	Buy
Intervention	26.22	41.24	5.38	0.18	0.00	0.09
	(15.04)	(15.91)	(20.42)	(0.06)	(0.06)	(0.08)
Mean dep. var	84.55	90.80	107.51	0.69	0.82	0.71
Observations	168	157	112	166	155	110

Notes: Column (1) - (3) report the interval regression coefficients of the willingness to pay (in BDT) for disposable menstrual pads from a male shopkeeper at the factory. Columns (4) - (6) report the linear probability model (OLS) results for the collection of the underwear. The sample is split in three: *Cloth Users* includes the respondents that only used cloth as an absorbent at baseline, *Pad Users: Do Not Buy* includes the respondents that report to use pads but do not purchase them themselves, *Pad Users: Buy* includes the respondents that report to use pads and report to buy them at the store. *Mean dep.var* represents the mean value for the control group. Robust standard errors are reported in parenthesis.

Regarding take-up of the new menstrual underwear, the intervention has the largest effect for women who were exclusively using cloth at baseline. For pad users, especially those who do not buy the pads themselves, we observe a precisely estimated null effect of the treatment. However, pick-up rates in this

demographic group are already very high in the control group (above 80%). We could speculate here that the intervention is particularly useful for those participants who switch from traditional to modern products and who need to go to a store to collect a menstrual product from a male shopkeeper for first time in their life.

Age As mentioned previously in section section 2.1, material use at baseline correlates with age, with women older than 25 being more likely to use cloth and women younger than 25 being more likely to use pads. We therefore examine whether differential treatment effects occurred in these age brackets. As Table D2 shows, the results are mostly driven by the younger women, for whom the treatment has a much stronger effect on both the willingness to pay and the probability of collecting the menstrual underwear. The treatment effect on the WTP for women older than 25 is only about one quarter of the effect for women younger than 25 (and is not statistically significantly different from 0).

Table D2: Heterogeneity by Age

	(1)	(2)	(3)	(4)
	WTP for pads		Pickup of underwear	
	> 25 years	≤ 25 years	> 25 years	≤ 25 years
Intervention	8.940	37.094	0.052	0.148
	(12.83)	(12.48)	(0.05)	(0.06)
Mean dep. var	96.582	84.110	0.737	0.686
Observations	244	232	242	227

Notes: Column (1) and (2) report the interval regression coefficients of the willingness to pay (in BDT) for disposable menstrual pads. Columns (3) and (4) report the linear probability model (OLS) results for the collection of the underwear. The sample is split by age into those women older than 25 in columns (1) and (3) and those 25 or younger in columns (2) and (4). *Mean dep.var* represents the mean value for the control group. Robust standard errors are reported in parentheses.

Education Similarly to age, education is also correlated with material use at baseline, with those women having more than six years of education being

more likely to use pads and those women with six or fewer years of education being more likely to use cloth at baseline. We therefore test whether a similar difference is observable in the effectiveness of the treatment. As Table D3 shows, it is mainly the more educated women who respond to the treatment, with the treatment effect on the willingness to pay being around three times greater for women with more than six years of education than for those women with fewer than six years of education. The differences are much less pronounced for the pick-up rates. While there is a small difference in the level of significance, the coefficients for both groups have a very similar magnitude (though the level of pick-up in the control group is already somewhat higher for women with more than six years of education).

Table D3: Heterogeneity by Education

	(1)	(2)	(3)	(4)
	WTP for pads		Pickup of underwear	
	> 6 years of education	≤ 6 years of education	> 6 years of education	≤ 6 years of education
Intervention	30.605	11.161	0.095	0.103
	(11.37)	(14.54)	(0.05)	(0.07)
Mean of dep. var	87.208	95.635	0.740	0.673
Observations	285	191	283	186

Notes: Columns (1) and (2) report the interval regression coefficients of the willingness to pay (in BDT) for disposable menstrual pads. Columns (3) and (4) report the linear probability model (OLS) results for the collection of the underwear. The sample is split by level of education into those women with more than six years of schooling in columns (1) and (3) and those with six or fewer years of schooling in columns (2) and (4). *Mean dep.var* represents the mean value for the control group. Robust standard errors are reported in parentheses.

Stigma levels at baseline Lastly, we look at the effect of stigma measures at baseline to determine if those women already more open and engaged with the topic at baseline respond more, or if the treatment is more effective for those women previously holding a more restrictive view. As can be seen in Table D4, it is those with higher levels of baseline stigma who respond most to the treatment. The treatment effect on the willingness to pay is around twice as high for women who previously agreed to more statements about feeling

uncomfortable when buying pads, or feeling like they are being stigmatized or judged if someone notices they are menstruating. Regarding the probability of collecting the underwear, there is no difference in magnitude or significance of the treatment coefficients based on stigma levels.

Table D4: Heterogeneity by Stigma Levels

	(1)	(2)	(3)	(4)
	WTP for Pads		Pickup of Underwear	
Stigma level:	Above median	Below median	Sbove median	Below median
Intervention	28.535	15.511	0.094	0.107
	(11.65)	(14.04)	(0.05)	(0.06)
Mean of dep. var	84.253	99.147	0.706	0.722
Observations	277	199	273	196

Notes: Columns (1) and (2) report the interval regression coefficients of the willingness to pay (in BDT) for disposable menstrual pads. Columns (3) and (4) report the linear probability model (OLS) results for the collection of the underwear. The sample is split by level of stigma measured at baseline, into those women with more than the median level of perceived stigma at baseline in columns (1) and (3) and those with the median or a lower level of perceived stigma at baseline in columns (2) and (4). *Mean dep.var* represents the mean value for the control group. Robust standard errors are reported in parentheses.

Overall, the heterogeneity analysis paints a consistent picture of the target group most likely to benefit from the discussion group intervention: product valuation responds most for younger and more educated women, who are already willing to use pads to begin with, but are constrained in doing so because of a high level of perceived stigma (and therefore often do not buy the pads themselves). These women benefit the most from the treatment, because these are also the women most constrained by the restrictive social attitudes.

When it comes to trying out and adopting the new technology of menstrual underwear, on the other hand, there are fewer differences between the different subgroups of women. Cloth users and younger women are more willing to test this new method, but overall we found that all women were keen on this new technology.

E Additional Information on the Discrete Choice Experiment

E.1 Constructing the Choice Sets

The method of the DCE is based on random utility theory (Pérez-Troncoso, 2020). The assumption is that individuals receive utility not from the product itself, but from the characteristics, such that the total utility received depends on the combination of characteristics and a random additional term. The utility is thus given by

$$V_{isj} = A'_{isj}\delta + \epsilon_i$$

where V_{isj} is the utility of individual i gained by choosing alternative j in scenario s. A_{isj} is a vector of the attributes and δ is the vector of coefficients. Assuming a linear relationship, the total utility is a linear combination of the utility obtained from each individual characteristic plus the random utility term ϵ_i.

To construct the choice set, using a full-factorial design was not feasible. With three different attributes that have either two or four levels each, there are $2 \times 2 \times 4 = 16$ possible scenarios. This results in $(16 \times 15)/2 = 120$ different comparison scenarios. This is clearly too many to test them all. Instead, we follow the standard procedure as discussed in Mangham-Jefferies et al. (2009) and construct a fractional factorial design that is orthogonal, balanced and maximizes the D-efficiency.[16] We use the existing features of SPSS to construct the choice set fulfilling all of these criteria: Using the inbuilt SPSS orthogonal design feature, we determine that a minimum of eight choice sets is needed to achieve an efficient design. Subsequently, we let SPSS generate eight choice scenarios using the inbuilt "choice design" feature, which fulfil the above criteria. This results in eight scenarios in which the participants need

[16] Orthogonal means that the linear parameter estimates are uncorrelated, so the different attributes are independent of each other. A balanced design means each attribute level occurs equally often. A D-efficient design minimizes the size of the variance-covariance matrix given a prior for δ (Mangham-Jefferies et al., 2009).

to choose between two alternatives.

In our analysis of the DCE data, we closely follow Lancsar et al. (2017). The coefficients of interest are estimated using the following model:

$$V_{isj} = \alpha_j + A'_{isj}\delta + Z'_i\gamma_j$$

A_{isj} is the vector of characteristics, where price is estimated as continuous variable and location and shopkeeper gender as dummy variables. Z_i is a vector of case-specific variables that are included as controls (age, education, marital status, and baseline material used). We use a conditional logit model (McFadden's Choice Model, McFadden (1974)) to estimate the coefficients of interest. Our DCE design uses unlabelled alternatives, i.e. the options are defined entirely by the different characteristics and there is no additional name or label to the set of characteristics containing any additional information. Therefore, we estimate the model without alternative-specific constants, since we would expect that there is no difference in the utility obtained from Option 1 or Option 2 if they have the same characteristics (there is no constant utility obtained from choosing either Option 1 or Option 2 independent of the characteristics). In order to determine the effect of the treatment on the evaluation, we add interaction effects of the treatment with each characteristic. These steps allow us to finally determine the willingness to pay (in BDT) of the participants in the treatment and control group to avoid having a male shopkeeper (as opposed to a hypothetical female one) and to avoid collecting the underwear on the factory premises (as opposed to a more anonymous external corner store).

E.2 Including Demographic Controls

To ensure our results are not driven by any demographic factors, we include case-specific variables as demographic controls. These include age, education, marital status, and baseline material used. They enter the regression as interaction term with each product characteristic (shopkeeper gender, location and price).

Table E1: Discrete Choice Experiment - Including Control Variables

	(1) Utility
Location inside	-0.253
	(0.69)
Male shopkeeper	-2.252
	(0.59)
Price	-0.050
	(0.06)
Intervention*Location inside	0.385
	(0.18)
Intervention*Male shopkeeper	0.581
	(0.14)
Intervention*Price	0.020
	(0.02)
Age*Location inside	-0.011
	(0.02)
Age*Male shopkeeper	0.013
	(0.02)
Age*Price	-0.002
	(0.00)
Education*Location inside	-0.014
	(0.03)
Education*Male shopkeeper	0.029
	(0.02)
Education*Price	-0.004
	(0.00)
Married*Location inside	-0.203
	(0.21)
Married*Male shopkeeper	-0.205
	(0.22)
Married*Price	-0.051
	(0.02)
Pad user*Location inside	0.235
	(0.24)
Pad user*Male shopkeeper	0.098
	(0.20)
Pad user*Price	0.011
	(0.02)
Cloth user*Location inside	0.139
	(0.22)
Cloth user*Male shopkeeper	0.094
	(0.21)
Cloth user*Price	0.013
	(0.02)
Observations	476

Notes: Conditional logit regression on the utility of sanitary pads including the different attributes of the pads used in the DCE (price, gender of the shopkeeper, and location) and a series of demographic controls. Clustered standard errors at the individual level in parenthesis.

F Survey

In this section, we present a summary of the structure and reading flow of surveys involved in this experiment. These include the baseline survey, endline survey, education session survey, follow-up survey and the pure control survey.

F.1 Baseline Survey

The baseline survey is conducted before the treatment is administered. It collects demographic information about the participants and questions participants about their pre-treatment usage of menstrual products, knowledge about menstruation, opinions about menstrual education and perceived social norms, stigma and taboos surrounding menstruation.

F.1.1 Enumerator questions

Female enumerators carry out the surveys over the phone in Bangladeshi. Before the beginning of each phone call, the enumerators are asked to note their own names, the phone number of the worker they are calling, if the call is a first attempt, second attempt or a scheduled follow-up, and if the worker answers the call. Phone calls beyond a second unsuccessful attempt are not conducted.

F.1.2 Introduction and consent

If the worker answers their phone call, the enumerator introduces themselves and let the worker know that they are calling on behalf of a group of researchers from Germany, who are collaborating with their employer. They check whether the worker name and ID provided by the company matches the individual on the call and whether this is still their current place of employment.

Workers are then invited to take part in the survey. They are told this will take 15-20 minutes, that there will be either one or two follow-up calls in the future, and that they might be required to take part in two information sessions at their place of work. Workers are ensured of the confidentiality of

their responses and informed that they will received 40 BDT of phone credit for their participation.

If the worker consent to participate, they are asked if their current phone number is acceptable for future calls and if they want to receive the phone credits to their current phone number. Participants are also asked if they are currently available for the survey, or if they would like to reschedule the call. The enumerator once again reasserts that their responses will remain confidential from their employer and notes the importance of truthful responses from the participant.

Participants are then asked demographic questions, consisting of their age, religion, marital status, the number of sons and daughters they have, the ages of all their children and the number of school classes they completed.

F.1.3 Menstruation and absorbents

Participants are asked questions about what menstrual products they think their female co-workers use, as well about their own menstruation.

1. *When you think about the other women at the factory (not yourself), what material do you think that they use the most as absorbent during their menstruation?* Cloth or fabric / Disposable pads / Reusable underwear or pads / Paper or tissues / No absorbent / Other (please specify).

2. *In the last 6 months, have you had your menstruation?* Yes / No

3. (If answered 'No' for question 2) *Why have you not had your menstruation?* Injection / Pregnant / Irregular / Menopause / Other (please specify).

Those who have not experienced menstruation in the last six months are thanked for their participation and not asked any further questions, unless the reason for their lack of menstruation is pregnancy. The other participants are asked further questions about their use of menstrual products.

4. *Now we would like to know more about what material you frequently use as absorbent during your menstruation. Think about the material you have used for the last 6 months. We are only interested in methods used frequently or*

very frequently (i.e. what you use for 2 days or more during menstruation). Have you used the following materials frequently in the last 6 months? Yes / No

(a) *Cloth or fabric*

(b) *Disposable pads*

(c) *Reusable pads or underwear*

(d) *No absorbent*

5. (If answered 'No' for question 4b) *You have indicated that you lately have not used disposable pads (or not often). We would like to learn more about this to understand the preferences of Bangladeshi women. We will ask you a series of questions, please indicate whether you agree or disagree with the following statements.* Agree / Disagree

   (a) *You are uncomfortable buying pads in a store due to a lack of privacy because there is usually men around*

   (b) *There is no store that sells pads nearby*

   (c) *Pads are too expensive for you*

   (d) *You are happy with the method that you are using and see no need to switch*

   (e) *You have never thought about switching menstrual products before*

   (f) *You started with cloth and got used to it*

   (g) *Pads are not comfortable to wear*

   (h) *Pads are not easy to dispose of because there is not available specific waste disposal for them*

   (i) *I don't think that pads work well*

   (j) *I don't think that buying pads is socially appropriate/acceptable*

   (k) *I don't think that using pads is socially appropriate/acceptable*

6. (If answered 'Yes' for question 4b) *You have indicated that you have used disposable pads frequently in the last 6 months. If you need to buy new pads, do you usually buy them yourself?* Yes / No

7. (If answered 'No' to question 5) *If you do not buy the pads yourself, who usually provides you with new pads?* My husband / A female friend / My mother / Another female relative / Other (please specify)

8. (If answered 'Yes' for question 4b and 'Yes' for question 5) *When you buy new pads, do you do any of the following things at the time of purchase? Which of the following do you do?* Agree / Disagree

   (a) *You cover your face (fully or partially) at the time of the purchase to provide anonymity*

   (b) *You go to a store far away from home where nobody knows you to buy the pads*

   (c) *When you purchase pads, you feel uncomfortable if there are men around the store*

   (d) *When you purchase pads, you feel uncomfortable if there are women around the store*

9. (If answered 'Yes' for question 4b) *We would like to know how you started using pads. Who recommended pads to you that made you decide to use them?* (A friend / My mother / My husband / Another female relative (enter other person / A teacher at school / The doctor recommended it to my husband / The doctor recommended it to me / Commercial or advertisement / A store clerk recommended it / Other (please specify)

10. *You have indicated that you now use pads. We would like to know what the first method was that you ever used. What did you use when you had your first period?* Cloth or fabric / Disposable pads / Reusable underwear or pads / Paper or tissues / No absorbent / Other (please specify).

F.1.4 Menstruation Knowledge

In the next part of the survey, we ask questions to gauge participants' levels of knowledge about menstruation. Participants are also asked about their opinions on their children's level of knowledge surrounding menstruation, as well as their opinions about menstrual education for children of both genders.

11. *Please indicate if you think the following statements are true or false.*

    (a) *Menstruation is a process of eliminating toxic blood from the body*

    (b) *Menstruation is an illness*

    (c) *Menstruation is a curse*

    (d) *Pads can absorb more blood than cloth*

    (e) *Menstruation is a biological process related to fertiliy and childbearing*

    (f) *Using pads does not reduce the risk of urinary infections compared to cloth*

    (g) *Menstrual cloth does not need to be dried after washing, it can be directly stored*

12. *How did you learn/hear about menstruation for the first time (when you were a teenager)?* From my mother / From another female relative / From my father / I learned about it by surprise the first time that I menstruated / From a friend / From a co-worker / At school / Other (please specify)

13. *In your opinion, what is the best way for girls to learn about the topic of menstruation?* In school / From their mother / From another family member / Through their own experience / From friends / From TV or advertisement / Other (please specify) / I don't have an opinion about it

14. *In your opinion, what is the best way for girls to learn about the topic of menstruation?* In school / From their mother / From another family member / They shouldn't learn about it at all, because it doesn't affect them / From friends / From TV or advertisement / Other (please specify) / I don't have an opinion about it

15. *Do you think your daughter(s) knows about menstruation?* Yes / No

16. (If answered 'Yes' for question 15) *How do you think they learned about it?* You explained it / Another relative explained it / Learned by own experience / Learned about it from a teacher at school / Learned about it from friends / Learned about it from TV and advertisement / Not sure / Other (please specify)

17. *Do you think your son(s) knows about menstruation?* Yes / No

18. (If answered 'Yes' for question 17) *How do you think they learned about it?* Same options as question 16

F.1.5 Social Norms, Stigma and Taboo Surrounding Menstruation

Participants are asked a series of questions to measure social norms, stigma and taboo surrounding menstruation. The order in which we ask the questions is randomized to avoid any anchoring or internal consistency effects.

Social Norms

To elicit injunctive social norms surrounding the use and purchase of menstrual products, participants are presented with a vignette of a woman like themselves who is menstruating, and asked about how socially appropriate her neighbours would find certain actions: very socially inappropriate / socially inappropriate / socially appropriate / very socially appropriate.

19. *Think of a woman who is very similar to you, called Romana. She lives in Gazipur and works at Hoplun. She lives in a neighbourhood similar to yours with her husband, a 10-year-old son and a 12-year-old daughter. She is muslim. She woke up today and noticed that it is the first day of her monthly period. Think about the other women that know Romana and are her neighbours. What do you think how socially acceptable would they find it if Romana did the following things during her menstruation. The answer options are: very socially inappropriate, socially inappropriate, socially appropriate or very socially appropriate. For example, if i say "she fasts in Ramadan during her menstruation", one common answer to this is socially inappropriate or very socially inappropriate because during the days of menstruation in Bangladesh women do not consider that it is appropriate to fast. Remember that I am not asking about your opinion, but think about what Romana's neighbours will think and tell me what they would say.*

    (a) *She uses cloth to manage her menstruation*

    (b) *She uses pads to manage her menstruation*

    (c) *She prays during her menstruation*

(d) *She goes to a shop and purchases pads from a male clerk*

(e) *She goes to a shop and purchases pads from a female clerk*

(f) *She washes menstrual cloth outside (in the communal laundry area of the neighbourhood or in the pond)*

(g) *She dries her menstrual cloth outside in direct sunlight*

(h) *Romana's husband explains to her daughter about menstruation and hygienic menstrual practices*

(i) *Romana's husband explains to her son about menstruation*

(j) *Romana explains to her daughter about menstruation and hygienic menstrual practices*

(k) *Romana explains to her son about menstruation*

Stigma

To measure perceived stigma surrounding menstruation, enumerators read a list of four statements expressing fear of stigmatization, and the participant is be asked how many they agree with. Participants are not asked precisely which ones they agree or disagree with, to encourage truthful replies.

20. (a) *Women should hide any evidence of menstruation*

(b) *Menstruation is something unclean*

(c) *I worry about stains or odour during menstruation, because others might realize I am menstruating*

(d) *If someone would know that I am menstruating they might treat me or look at me differently*

Taboo

To measure taboos surrounding menstruation, enumerators read a list of four statements expressing reluctance to discuss menstruation, and the participant is be asked how many they agree with. Similarly, participants were asked state how many of the listed people, without naming which ones, they sometimes talk to about menstruation.

21. (a) *I would feel embarrassed to talk about menstruation with my family*

    (b) *I would feel embarrassed if they talked about menstruation on the TV or on the radio*

    (c) *I would feel embarrassed to ask advice about menstrual products from a teacher, a doctor or a health officer at the factory*

    (d) *I prefer not to talk about menstruation with anyone*

22. *How many of the following people do you sometimes talk to about menstruation? We are only interested in the total number, so just answer 0,1,2,3,4 or 5. We do not need to know who you talk to in particular. Do you sometimes talk to:*

    (a) *One of your female coworkers*

    (b) *One of your male coworkers*

    (c) *Your husband*

    (d) *Your daughter* (only an option if the participant has a daughter)

    (e) *Your doctor*

    (f) *Your line manager*

F.1.6 Priming Questions for the Experiment

Participants are asked the following question to prime them for the experiment. Participants are presented with several statements, grouped by their relevance to measuring social norms, stigma and taboo surrounding menstruation. They must say whether they agree or disagree with the statement.

23. **Social norms questions**

    (a) *I think most Bangladeshi adults find it socially acceptable if a woman uses pads*

    (b) *I think most Bangladeshi adults find it socially unacceptable if a woman goes to a store to buy pads from a male shopkeeper*

    (c) *I think most Bangladeshi adults believe daughters should not learn about menstruation from their mothers but from personal experience*

(d) *I think most Bangladeshi adults find it perfectly socially acceptable to hang washed menstrual cloth outside to dry*

24. **Stigma questions**

    (a) *I feel like people who watch me buy menstrual products in a store might think less of me*

    (b) *I would feel ashamed to hang my menstrual cloth outside even if it is clean*

    (c) *I feel dirty when I have my period*

    (d) *I try to keep my period secret*

25. **Taboo questions**

    (a) *I would not discuss my menstruation with my father*

    (b) *I would feel uncomfortable to ask my line manager about period products*

    (c) *Discussing menstruation with my daughter would be uncomfortable for me*

    (d) *If others discuss their menstruation in front of me it makes me feel uncomfortable*

Finally, all participants were asked if they would like to donate some money to an organisation focused on educating boys and girls about menstruation, or if they would prefer to receive this money themselves. They were able to specify how much of a lump-sum of 10 BDT would go to themselves, and how much to the organisation.

26. *As we mentioned before, you will receive 40BDT in phone credits as compensation for your time. Now in addition, we have some extra money available, 10BDT. We plan to give half of this to you, so you receive 5BDT extra. The other 5BDT we plan to give to an organization which works to educate underprivileged boys and girls about menstruation. Any money we give to them will help to support an education program which educates boys and girls together in schools in Dhaka. However, it is up to you how much of the money we give to them and how much we give to you. You can freely decide. If you do*

nothing, we will keep it at 5BDT for you and 5BDT for the program. Or you can decide to keep more yourself or give more to the program. You can either give 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10BDT to the program. You will receive the remainder. Would you like to change how the money is split? Yes / No

27. (If answered 'Yes' to the question above) *How much of the 10BDT would you like to give to the program?*

F.2 Endline Survey

The endline survey is conducted after the treatment group has participated in the education sessions and measures the effect of the treatment. It questions participants again on their perceived social norms and the stigma and taboo they feel surrounding menstruation. It also includes willingness to pay elicitation for sanitary pads and a new menstrual product, as well as a discrete choice experiment to disentangle the effects of how having a male shopkeeper and the location of the store selling menstrual products affects their valuation.

F.2.1 Enumerator Questions and Introduction

The endline survey begins with questions for the enumerator conducting the survey. They report who is conducting the survey and the name, phone number and worker ID of the person they are calling.

If the participant answers the phone call, the enumerator proceeds to introduce themselves and remind them that they have spoken over the phone a few weeks previously for a survey on female health. The enumerator then asks for the participant's consent to ask some further questions, which they approximate will take 15 minutes.

After receiving consent from the participant, enumerators remind them of the confidentiality of their responses and the importance of answering truthfully.

F.2.2 Menstruation Knowledge, Social Norms, Stigma and Taboo

Participants are first re-asked the menstruation knowledge question from the baseline survey (question 11). They are then re-asked the social norm, stigma and taboo elicitation questions from the baseline survey (questions 19 - 22). The order of these questions is once again randomised to to avoid any anchoring or internal consistency effects. To limit the length of the survey and reduce cognitive fatigue, only seven of the eleven vignettes are asked. Five of the vignettes are the same for all participants, while the last two are randomly selected across participants.

F.2.3 Discrete Choice Experiment

As part of the discrete choice experiment (DCE) to disentangle the value customers place on different product features, participants are presented with a series of hypothetical choices between two different options. These options specify two different sets of conditions under which a product can be obtained. There are three different conditions, which are varied across questions, namely (1) the location of purchase, (2) the price of the product and (3) the gender of the shopkeeper. Enumerators first explain the choices with which the participant will be presented and then present eight different choices, where the participant must select whether they prefer option 1 or option 2.

In this section of the survey we want to try and understand what is important to you when you buy sanitary pads. If you do not usually buy sanitary pads, that is OK. Just answer as you think you would feel if you were to go to a store to buy sanitary pads for the first time. I will present you with two different options how to obtain a pack of four sanitary pads and then ask you tell me which you prefer. You will see that each option has advantages and disadvantages. Consider both options and then tell me which you think is better. The options are always about obtaining a pack of four sanitary pads. There will be eight such decisions in total, in each of the eight cases the options are slightly different. Therefore, please pay close attention to the different options I describe.

1. (a) *Buying the sanitary pads from a* ***male*** *store keeper in a* ***store inside Hop Lun*** *for* ***30 BDT.***

(b) *Buying the sanitary pads from a* ***female*** *store keeper in a* ***store in your neighbourhood*** *for* ***50 BDT.***

2. (a) *Buying the sanitary pads from a* ***male*** *store keeper in a* ***store in your neighbourhood*** *for* ***60 BDT.***

   (b) *Buying the sanitary pads from a* ***female*** *store keeper in a* ***store inside Hop Lun*** *for* ***50 BDT.***

3. (a) *Buying the sanitary pads from a* ***female*** *store keeper in a* ***store inside Hop Lun*** *for* ***60 BDT.***

   (b) *Buying the sanitary pads from a* ***female*** *store keeper in a* ***store in your neighbourhood*** *for* ***40 BDT.***

4. (a) *Buying the sanitary pads from a* ***female*** *store keeper in a* ***store in your neighbourhood*** *for* ***30 BDT.***

   (b) *Buying the sanitary pads from a* ***female*** *store keeper in a* ***store inside Hop Lun*** *for* ***40 BDT.***

5. (a) *Buying the sanitary pads from a* ***female*** *store keeper in a* ***store inside Hop Lun*** *for* ***30 BDT.***

   (b) *Buying the sanitary pads from a* ***male*** *store keeper in a* ***store in your neighbourhood*** *for* ***40 BDT.***

6. (a) *Buying the sanitary pads from a* ***male*** *store keeper in a* ***store inside Hop Lun*** *for* ***50 BDT.***

   (b) *Buying the sanitary pads from a* ***female*** *store keeper in a* ***store inside Hop Lun*** *for* ***60 BDT.***

7. (a) *Buying the sanitary pads from a* ***male*** *store keeper in a* ***store inside Hop Lun*** *for* ***30 BDT.***

   (b) *Buying the sanitary pads from a* ***female*** *store keeper in a* ***store inside Hop Lun*** *for* ***40 BDT.***

8. (a) *Buying the sanitary pads from a* ***male*** *store keeper in a* ***store inside Hop Lun*** *for* ***50 BDT.***

   (b) *Buying the sanitary pads from a* ***female*** *store keeper in a* ***store in your neighbourhood*** *for* ***30 BDT.***

F.2.4 Willingness to Pay

We measure participants' willingness to pay (WTP) for sanitary pads and a new menstrual underwear using a price list. The enumerators offer the participant a choice between receiving an amount of money (in phone credits) or receiving the product for free. If the participant chooses to receive the product, the offered price is then increased in fixed intervals and the participants are asked to make the choice again between the higher amount of money and the product.

In this section of the survey, I will present you with two different options: you can either choose to receive an amount of money or a menstrual product for free. Please tell me which of the two options you prefer. The amount of money is different in each choice and there are different menstrual products available, so pay close attention to the options. Always tell me whether you would prefer to receive the money or the free menstrual product.

The WTP elicitations for the sanitary pads and the underwear are incentivized together, so one of the choices from either the WTP exercise for the pads or the WTP exercise for the underwear was randomly selected to be payoff relevant for each woman. The enumerators informed the participant that they will receive whatever their choice will be in one of the scenarios, which will be randomly selected.

At the end of the entire survey, a computer will randomly select one of these choices. Whatever you said you prefer for this choice, the money or the menstrual product, will be yours. You should therefore always respond truthfully which you prefer, the money or the free menstrual product, because you may end up getting what you chose.

The enumerators then describe the conditions under which the menstrual products can be picked up at the factory, emphasising that the product would have to be collected from a male shopkeeper.

Both the money and the menstrual product will not be made available immediately. Instead, you will receive it once we have finished all the surveys. This might take some time (up to 3 weeks). If you choose the money, it will be transferred to

your phone in the form of phone credits. If you choose the menstrual product, you will be able to pick it up at one of the small stores at Hop Lun. There will be a man in the store giving you the product. We will give this man a list and your worker ID will be on it if you select the free menstrual product, so you will need to tell the man in the store that you want to pick up the menstrual product and he will give it to you.

Sanitary Pads

Participants were first asked about their willingness to pay for sanitary pads.

- *Would you prefer to receive a pack of four pads from a man or [X] BDT?* (Pack of pads / Money)

Participants are first offered a choice of either a pack of four sanitary pads or 0 BDT. If the participant chooses to receive the pads, the offered price is then increased in intervals of 10 BDT up to 100 BDT, then in intervals of 20 BDT up to 200 BDT. We assume that preferences are monotonically increasing with a single switching point, so enumerators offer no additional choices with higher monetary amounts after the participant chose the monetary alternative instead of the product. The women knew in advance that they would face several choices between an amount of money and the product, but did not know how many choices there would be in total or the increment of each subsequent offer.

New Menstrual Underwear

This is then repeated for the new menstrual underwear, with participants first being told about the product and its features.

In the last question, we are offering you a new menstrual product for free: a menstrual underwear. This menstrual underwear was developed especially for the needs of Bangaldeshi women like you. I will tell you a little bit about the product now before we start the next section of the survey where you can select if you want to receive one for free.

- *The menstrual underwear looks and feels just like regular underwear, but you can wear it during your menstruation to absorb the blood*

- *It works like pads, but absorbs as much as 2 pads, so you can go for many more hours without changing it*
- *It is leak proof and has a layer to prevent leakage*
- *It is fast-drying, so it will not feel wet*
- *It is anti-bacterial, so it kills bacteria and reduces the risk of infection*
- *Before using it again, you need to wash and dry it, but it dries very fast*
- *It will last for at least 1 year or longer and you can use it every time again*
- *It is black on the outside (anti-bacterial fabric on the inside is blue)*

You now always have the choice between receiving some money and receiving the menstrual underwear I just described to you, which you will be able to pick up from a male shopkeeper at the store in the factory. For the following choices, please tell me whether you prefer the free underwear or the money.

Questions begin with a choice of either the menstrual underwear or 0 BDT. The question is then repeated with 40 BDT, 50 BDT, 60 BDT, 80 BDT, 100 BDT, 120 BDT, 150 BDT, 160 BDT, 200 BDT, 240 BDT, 250 BDT, 280 BDT, 300 BDT, 320 BDT, 350 BDT, 360 BDT, 400 BDT, 440 BDT, 450 BDT, 480 BDT and 500 BDT. Once the participant chooses the monetary alternative over the menstrual product, the enumerator does not continue with further questions.

At the end of the survey, the one of the questions is randomly selected for each participant. The participant was then informed that they will get their specified preference out of the two choices provided in the question and instructions for either how they will receive this, or how they can collect this.

F.3 Education Session Survey

After each education session, moderators complete a survey to report any incidents such as technical difficulties and to note the main topics discussed, the main questions which arose and the overall atmosphere and level of participation.

F.3.1 Introduction

In the first part of the survey, the moderators are asked to report basic information about the session. This consists of the date and time of the session, who the moderator of the session is, the number of attendees and whether this is the first or second session in which the workers participated.

F.3.2 Atmosphere

Moderators are then asked about the atmosphere of the education sessions. For each question, the moderator selects a response from a four-point scale: completely disagree, disagree, agree, completely agree.

1. *The session went well.*
2. *There were no technical difficulties (no internet problems, good audio quality, etc.)*
3. *The women were not constrained by the remote format and felt comfortable to speak up.*
4. *The women were all equally active and participated to the same degree.*
5. *The women were eager to share their personal experiences about their menstruation.*
6. *One or two women clearly dominated the discussions.*
7. *I have the feeling the discussions between the women will continue also outside the session.*

F.3.3 Topics discussed

In the final part of the education session survey, moderators are asked about the topics discussed in the sessions and their frequency. This involves both multiple choice and open-ended questions.

1. *Which of the following topics were discussed in the session?*

(a) *Menstrual absorbents in general*

(b) *Pads in particular*

(c) *First experiences with menstruation as teenager*

(d) *Issues or problems with menstruation today*

(e) *Feeling uncomfortable with menstruation*

(f) *Discussing menstruation with children*

(g) *Health*

(h) *Other*

2. *Which of these topics did the group spend the most time on discussing?*

   (a) *Menstrual absorbents in general*

   (b) *Pads in particular*

   (c) *First experiences with menstruation as teenager*

   (d) *Issues or problems with menstruation today*

   (e) *Feeling uncomfortable with menstruation*

   (f) *Discussing menstruation with children*

   (g) *Health*

   (h) *Other*

3. *What were the most frequent questions, comments or concerns of the women?*

4. *Do you have any other comments about the education session?*

F.4 Follow-up Survey

We conduct a follow-up survey six months after the endline survey to measure the persistence of the effects of the treatment.

F.4.1 Enumerator questions and Introduction

The follow-up survey begins with the same questions for the enumerator as in the endline survey, collecting basic information about the call and participant. If the participant answers the phone call, the enumerator proceeds to introduce themselves and remind them that they have spoken over the phone a few weeks previously for a survey on female health. The enumerator then asks for the participant's consent to ask some further questions.

F.4.2 Willingness to pay

If the participant provides consent, the enumerator then begins by re-asking questions about the participant's willingness to pay for sanitary pads and the new menstrual underwear, following same format as the endline survey. It is re-emphasised that the shopkeeper from which products must be collected is male and that their choice is incentivized. Enumerators explain the task as in the endline survey and repeat the information about the new menstrual underwear. The structure of the monetary alternatives offered remains the same.

F.5 Pure Control Survey

F.5.1 Enumerator Questions and Introduction

Along-side the follow-up survey, we conduct a pure control survey of 59 workers who did not participated in any of the previous surveys, asking them some of the same questions to determine their menstrual knowledge and perceptions of social norms regarding female menstruation, as well as about their knowledge of the study.

Before each survey, enumerators reported who they were and the phone number and worker ID of the person they were calling. If the worker answered the phone call, the enumerator introduced themselves and let the worker know that they were calling on behalf of a group of researchers from Germany, in collaboration with their from whom they received their phone number. They

were informed that the survey concerned women's health and that some of their co-workers had already been surveyed last year.

Workers were then asked for their consent to participate in the survey, which they were told this would take around 15 minutes. If the worker consented, enumerators assured them of the confidentiality of their responses and informed them of the importance of answering truthfully. The participants were then asked the same demographic questions as in the baseline survey.

F.5.2 Menstruation and absorbents

Participants were asked the same questions about menstruation and absorbents as in the baseline survey, up to question 4. Additionally, they were asked some questions to help us determine the spillover effects of the experiment onto other workers at the factory.

- *Last year, we surveyed some of your coworkers and a few of them also participated in a training. Do you know anyone who participated in our survey or in the training?* (Yes / No)
- *Some workers received a reusable menstrual underwear after the training. Do you know anyone who received a free reusable menstrual underwear?* (Yes / No)
- *In the last 6 months, have you talked about the topic of menstruation with any of your coworkers?* (Yes / No)

F.5.3 Menstruation Knowledge and Social Norms

To determine the knowledge of the participants on the topic of menstruation, as well as their perceptions of the social norms surrounding it, participants were asked questions 11 and 19 - 22 from the baseline survey.

G Referee answers

Table E2: WTP with resticted sample

	(1)	(2)	(3)
		WTP Disposable Pads	
Intervention	22.982**	22.954**	22.760**
	(8.98)	(9.33)	(9.34)
Constant	90.620***	92.591***	94.220**
	(6.23)	(6.57)	(39.49)
Constant	4.537***	4.559***	4.554***
	(0.04)	(0.04)	(0.04)
Demographic Controls	No	No	Yes
Restricted sample	No	Yes	Yes
N	476	460	460

Notes: Using the same sample in column (2) as in (3), i.e. without pregnant women

Table E3: Pickup with restricted sample

	(1)	(2)	(3)	(4)	(5)	(6)
		OLS		Probit *(marginal effects)*		
Intervention	0.099**	0.084**	0.089**	0.099**	0.085**	0.086**
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Constant	0.713***	0.733***	0.413**			
	(0.03)	(0.03)	(0.17)			
Demographic Controls	No	No	Yes	No	No	Yes
Restricted sample	No	Yes	Yes	No	Yes	Yes
Observations	469	454	454	469	454	454

Notes: Using the same sample in column (2) as in (3) and in (5) as in (6), i.e. without pregnant women

Table E4: Change in Knowledge

	(1) Pads absorb more blood	(2) Pads reduce infection (reverse)	(3) Cloth needs to be dried (reverse)
Endline	0.044*	-0.040*	-0.008
	(0.03)	(0.02)	(0.01)
Intervention	0.003	-0.043	0.019
	(0.03)	(0.03)	(0.01)
Endline X Intervention	0.075**	-0.028	-0.019
	(0.04)	(0.03)	(0.01)
Constant	0.841***	0.115***	0.008
	(0.02)	(0.02)	(0.01)
Observations	473	476	476

Notes: Change in knowledge about pads, (1) Pads can absorb more blood than cloth, (2) Using pads does not reduce the risk of urinary tract infections compared to cloth, (3) Menstrual cloth does not need to be dried after washing it, but can be directly stored.