Breaking the Silence - Group Discussions, Social Pressure, and the Adoption of Health Technologies

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Abstract

Social pressure and stigma can hinder the adoption of available technologies, especially in the context of 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 around purchasing the products and lower perceived stigma around menstruation in general.

Keywords: Social norms, social pressure, stigma, technology adoption, group discussions, menstrual health management, menstrual hygiene, adverse health behavior
JEL Code: D91, I12, I15, O12

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1 Introduction

Social pressure and stigma can pose an insurmountable obstacle to the adoption of health- and productivity-enhancing technologies and practices, even if they are readily available and affordable. For example, stigma and 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.[1] In most developing countries, the adoption rates of new menstrual absorbents remains low despite their widespread availability on the market. More than 50% of women 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 now 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.[2]. 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 most settings and talking with someone of a different gender about menstrual products might conflict with prevalent social norms. Therefore, women might be facing a trade-off between accessing modern menstrual 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 control trial with female participants in a garment factory in Bangladesh.

[1] This is not just true for developing countries, taboos around publicly discussing menstruation exist in many Western countries, too (Grandey et al., 2020). An example from the popular media for the extent of this taboo is the public debate sparked recently by the release of the Pixar movie "Turning Red", which mentions a 13-year-old girl's start of her period and her need for sanitary pads, and which caused several public complaints deeming the movie inappropriate for children (Moyer, Melinda W. (16.03.2022). "Turning Red" Is a Good Conversation Starter - And Not Just for Girls. *The New York Times*. Accessed on 31.03.2022 at: https://www.nytimes.com/2022/03/16/well/family/turning-red-periods-discussion.html)

[2] 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.

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.[3] Thanks to these efforts, pads are widely available and women are aware of their existence and potential use. However, usage rates have barely increased[4] and unhygienic menstrual management still abounds.[5] We argue that perceived social constraints (rather than availability or affordability constraints) are the 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 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 update both their beliefs about the social norms upheld by their peers, as well as the personal attitudes towards the stigma and taboos associated with menstruation. 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.

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

[4] 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)

[5] 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

When looking at the effect of the treatment on the primary outcomes, we observe an increase in the valuation of sanitary pads and in the take-up rates of new menstrual products. Our results show that 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 experiment (DCE), 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 judgement or social repercussions. We find large and statistically significant changes in our metrics for the described constructs. Using a diff-in-diff 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 literature 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., 2018), 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 this literature 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 2 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 3 we detail the experiment design and our empirical strategy. In section 4 we present and discuss the results. Section 5 concludes.

2 Background: Menstrual Hygiene in Bangladesh

Good menstrual hygiene is an important contributor to the physical, mental and emotional well-being of women[6] (Benshaul-Tolonen et al., 2021; Torondel et al., 2018), and can improve their economic prospects by reducing obstacles to school and work attendance and 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 concerns, including the Millennium Development Goals and the Sustainable Development Goals (Garikipati and Boudot, 2017) and a growing body of literature seeking to understand and improve poor menstrual hygiene has emerged (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.

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

[6]Throughout this paper, we use the term 'girls and women' to refer to all people who menstruate regardless of gender identity.

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 introduction 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 the 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. Moreover, although affordability of pads is named as a concern by around three quarters of women, research studying budget constraints as an obstacle for pad uptake in a study population similar to ours (Bangladeshi garment factory workers) did not find budget to generally be a binding constraint (Czura et al., 2020).[7] Rather than availability and affordability, social image concerns, shame, and stigma around acquiring the product in the market 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 1). The respondents that reported using pads also express fear of being stigmatized when accessing the products. Table 1 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 may restrict women's access to improved menstrual products. In this case, focusing on availability

[7]Moreover, in our setting, the cost of a pack of pads constitutes only around 0.6% of the workers' monthly (gross) wage. The women in our sample earn around 10,000 BDT per month (equivalent to around 115 USD, and slightly higher than the minimum wage of 8,000 BDT per month) and a pack of pads costs around 40-60 BDT. While affordability may thus continue to be a concern and initiatives to subsidize pads can be helpful, pads are not so prohibitively costly as to explain the lack of take-up by around 40% of the women in our sample.

Table 1: 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. Stars indicate whether the difference is significant. As can be seen in column (4), none of the differences are significant. All variables except age, total number of children and years of education, are coded from 0 to 1.

or affordability does not suffice as a strategy to improve menstrual health. In our study, we therefore test an intervention designed specifically to address the social constraints, to reduce the perceived stigma and break 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 concerns posed by the currently available methods. The main advantage 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.

3 Experiment Design

3.1 Sample

We ran our field experiment in a large garment factory in Tongi, a town north of Dhaka in Bangladesh. To select the participants for our study, we randomly selected 600 female employees 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 1 summarizes the timeline of the data collection, as well as which measures were collected at each stage.

Figure 1: Timeline of the data collection

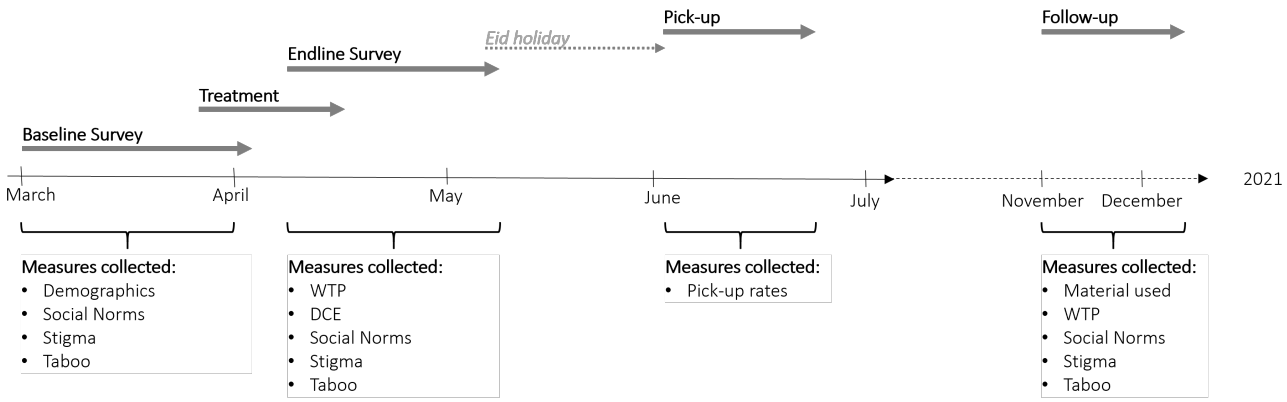


Table 1 reports the means and standard deviations for the demographic characteristics of the final sample of women in the two groups. It shows that our randomization was successful in achieving balanced samples in observables. Our sample consists of women who are on average 26 years old. The large majority are married and have (at least) one child. The participants are slightly more educated than the national average. They have 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 relatively 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[8]

[8]Pearson's correlation coefficient between age and cloth use: 0.18, p-value: 0.00 and between age and pad

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).[9] 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.

3.2 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 belief 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 goal of our intervention was to combine the updating of second-order beliefs about prevalent social norms with a change in personal attitudes and an increase in the level of confidence (reduction of perceived (self-)stigma and taboo).

The treatment consisted of a one hour discussion, where participants were encouraged

use: -0.19, p-value: 0.00; younger women (especially younger than 25) tend to use pads more, older women (especially older than 25) tend to use cloth more. 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 (especially with more than six years of education) tend to use pads more, less educated women (especially with less than six years of education) tend to use cloth more. See Appendix **??** for a graphical analysis of these trends.

[9]The implications for external validity are not clear. On the one hand, our results could be a lower bound if our participants react less to the treatment, because they are already quite open and face fewer restrictive norms and less stigma to begin with. On the other hand, it could be an upper bound if the lower stigma allows them to adjust their behavior more than women in rural areas could, for example, since they face stricter norms. We cannot make any claims about the effect size in the full Bangladeshi population.

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.[10] 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 (Ashraf et al., 2020; Bandiera et al., 2020; Duflo et al., 2015; Buchmann et al., 2018). 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 incorrect beliefs. Instead, we let the group feedback endogenously affect the women's perceptions and let the women 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.[11]

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.[12] 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). 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.[13]

[10] We discussed the inclusion of male facilitators with our implementation partner, but this was considered culturally inappropriate and would have caused great discomfort to the discussion group participants.

[11] We considered and decided against placebo discussions for the control group, because we do not consider the discussion *per se* to be a plausible channel for our observed effect. The women in the factory regularly talk to each other and discussing topics other than menstruation does not appear to us a likely candidate for influencing our very product-specific outcomes of willingness to pay for and pick-up of a menstrual product. In light of this and given strong COVID-related safety concerns and logistical challenges, we deemed the risks from additional placebo group discussions to outweigh the potential benefits to this research study.

[12] 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/

[13] The remote format also enabled the researchers to join a few sessions - with the camera and microphone turned off and displaying the name of the implementation partner as screen name - to ensure that all sessions

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 in 2 out of 15 sessions did technical difficulties arise - 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.

3.3 Outcome variables

3.3.1 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

were conducted in a comparable fashion and to confirm that the sessions were interactive and took place in a relaxed and positive atmosphere.

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.

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.[14] 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 collect on the factory premises, at the factory store (from a male shopkeeper) as soon as the surveys would be completed. To frame this question, we kept the same structure as for the previous one and elicited their WTP for the underwear first.[15]

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 pay-off 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.[16] 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 and so we could maximize the power for this outcome. For

[14]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.

[15]This way, we received some additional information about the distribution of the valuation of this product. However, 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 D1 in the appendix.

[16]The women were only informed that one of their decisions across both WTP exercises would be pay-off relevant, but no specific claims about how this pay-off relevant scenario was to be chosen were made.

seven women, a different pay-off relevant scenario was randomly selected, so they received either an amount of money or a pack of pads. Ultimately, 469 women were eligible to collect the underwear for free. The underwear was made available to collect in June 2021.

3.3.2 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.

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.[17]

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 might treat me or look at me differently").[18] 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.

3.4 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

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

[18]These statements were adapted from a variety of surveys presented in Hennegan et al. (2020)

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.*

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.

4 Results

4.1 Technology Adoption

4.1.1 Willingness to Pay

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 2 shows the regression results.

Table 2: 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. 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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.[19]

[19]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 as a robustness check in the appendix in section A

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.

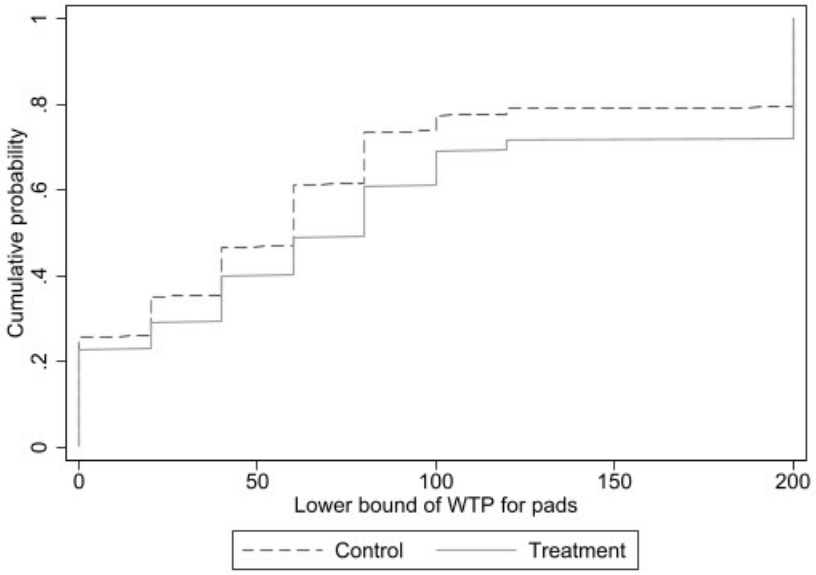
The average increase in WTP of more than 20 BDT suggests that, on average, the WTP in the treatment group shifted up to the next interval. Looking at the distribution of the WTP, we can compare women in each interval of the WTP exercise to determine if they responded differently and we can also compare whether women with a valuation above the market price responded differently to women with a WTP below the market price. Figure 2 shows 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 clear difference between women with a valuation of the pads above or below the market price.

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.

4.1.2 New technology adoption rates

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

Figure 2: 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.

underwear on the intervention dummy. In Table 3 we provide the estimates of the effect of the treatment on the rate of collection of the anti-bacterial menstrual underwear. We can 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.

Figure 3 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.

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

Table 3: Take-up of a New Technology: Anti-bacterial Reusable Underwear

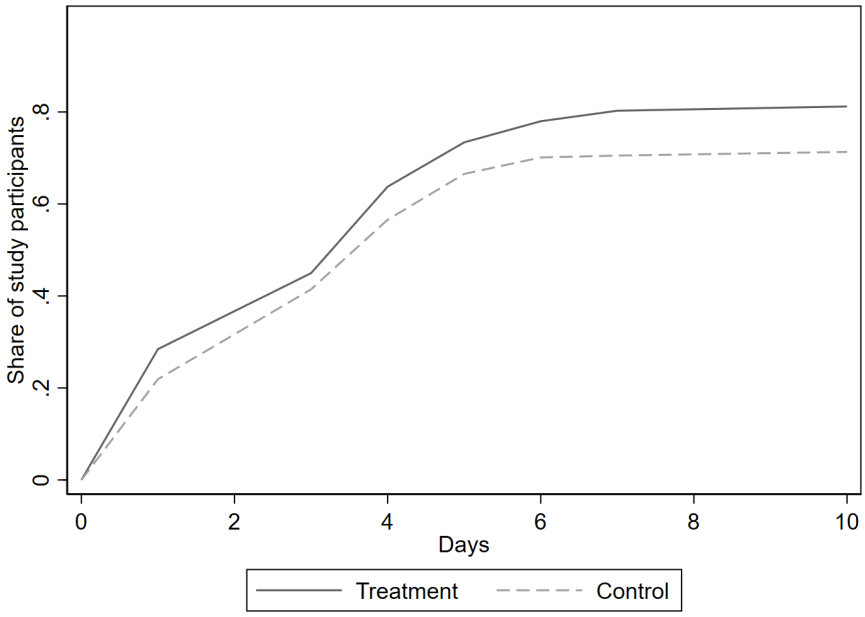
	(1)	(2)	(3)	(4)
	OLS		Probit *(marginal effects)*	
Intervention	0.099**	0.089**	0.099**	0.086**
	(0.04)	(0.04)	(0.04)	(0.04)
Mean dep. var	0.713	0.713	0.713	0.713
Demographic Controls	No	Yes	No	Yes
Observations	469	454	469	454

Notes: Column (1) and (2) report the linear probability model 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. 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, since the demographic control variables of baseline use of pads and cloth are not available for them. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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.

Figure 3: Collection of underwear



Notes: This graph plots the share of participants in the treatment and control group that picked up the menstrual underwear at the factory store from a male shopkeeper. The product was available from the 10th-19th of June 2021.

4.2 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.

4.2.1 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 4 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 4: 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) * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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). Table 5 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 5: 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: The values show the WTP in BDT for avoiding the location being inside the factory (as opposed to an external corner store) and for avoiding a male shopkeeper (as opposed to a female one) for the treatment and control group. Assuming a linear utility function, the WTP is obtained from dividing the regression coefficients of the independent variables *Location inside* and *Male shopkeeper* by the regression coefficient of the independent variable *price*. Robust standard errors are reported in parentheses. The levels of significance indicated by the stars show whether the WTP is significantly different from zero. The significance of the difference in WTP between the treatment and control group is reported in the main text. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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

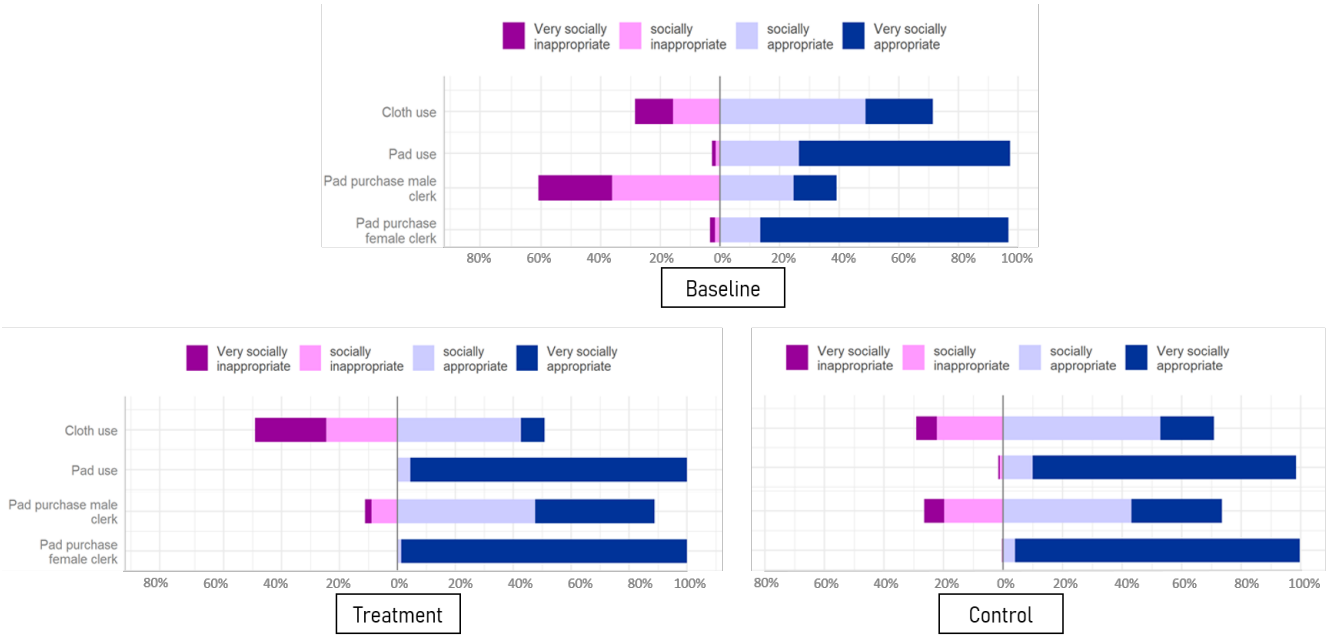
just felt less uncomfortable having to collect the underwear from this specific man, rather then male shopkeepers in general. However, the DCE with its hypothetical scenarios clearly identified the utility of not having to collect the product from any man, combining the male gender also with the scenario of collection outside the factory. Given that the effects of the DCE were observed for the male gender in general, this removes this worry.

4.2.2 Social norms, stigma and taboos

Social norms

The social norms surrounding menstruation were elicited before and after the treatment. Figure 4 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.

Figure 4: Social Norm Elicitation



Notes: The figure depicts the elicitation of the social norms before and after the intervention with answers provided on a 4-point Likert scale (*very socially appropriate, socially appropriate, socially inappropriate, very socially inappropriate*). The top panel depicts the baseline levels, pooling all participants together. The bottom left panel depicts the endline results for the treatment group and the bottom right panel depicts the endline results for the control group. Each bar represents the percentage share of participants choosing each answer.

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.

When looking at the results after the intervention, we observe one switch in modal response: 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. It seems that the discussion allows participants to update their belief about the current social perceptions around the topic. 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 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 4.3. We do not observe further strong changes in the modal responses.

In Table 6 we provide regression results showing the mean ratings for the same social norm measures. The dependent variables have been normalized, such that 0 corresponds to the lowest and 1 to the highest level of social appropriateness. As indicated by Figure 4, we observe a large change in the 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. The discussion did not change beliefs about how appropriate it is to use pads or to acquire them from a woman, both of which were considered very socially appropriate by the majority already at baseline; but it does negatively alter their reported belief about the appropriateness of using menstrual cloth.[20]

Stigma and Taboos

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 7, 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

[20]To account for the potential non-linearity in the reported social norms, we run the regression using an ordered logit model as a robustness check in the appendix. Results are presented in table B3

Table 6: Social Norms - Use and Purchase of Absorbents

	(1)	(2)	(3)	(4)
	Use as absorbent		*Purchase pads from*	
	Cloth	Disposable pads	Male shop-clerk	Female shop-clerk
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 average 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. Beliefs were elicited on a 4-point Likert scale (*very socially appropriate, socially appropriate, socially inappropriate, very socially inappropriate*). The dependent variables are normalized to a range between 0 and 1, with 0 being the lowest level of social appropriateness. *Mean of dep. var* represents the control group mean before the discussion session. *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.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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 7: 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. Dependent variables are measured as the number of statements expressing stigma and taboo that a woman agrees to, out of a total of 4 statements. Dependent variables thus range from 0-4. Columns (1) and (3) report the regression without controls, columns (2) and (4) add demographic controls (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 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. Standard errors clustered at the individual level are reported in parentheses. Columns (2) and (4) do not include 16 pregnant women, since the demographic control variables of baseline use of pads and cloth are not available for them. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.3 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. In this section, we discuss possible explanations and implications of this outcome.

One possibility is the existence of experimenter demand effects, which occur when the participants change their answers to match what they believe the enumerators or experimenters would consider to be the appropriate answer. We sought to minimize this effect with our experiment design. First, for the stigma and taboo measures, the participants were not asked to indicate their agreement with each of the four statements, but rather to indicate with how many statements in total they agreed. Second, we did not ask about their own perceptions of the social norms, but their second-order beliefs about others' (the neighbors') perceptions. Third, the surveys were carried out via phone, reducing the exposure to the enumerators. Lastly, if experimenter demand effects were present, we would expect the respondents to update their answers already at baseline according to what they believe the enumerator would consider appropriate. Overall, we therefore do not expect experimenter demand effects to impact the control group differently from the treatment group or to be the most plausible explanation for the changes observed at endline compared to baseline in the control group.

Another reason for the observed effects on the control group 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.

Finally, another possible explanation is the existence of spillover effects from the treatment to the control group. These spillovers arise when the women in the treatment group discuss the topic of menstruation and 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 8 we provide additional measures of social norms elicited at endline and baseline. We observe that 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.

To measure the extent of spillovers more directly, we re-surveyed 339 of the women in our

Table 8: 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 average perceived social norms regarding washing and drying menstrual cloth and intergenerational discussion of menstruation. Dependent variables are the beliefs about social norms on 1) washing menstrual cloth outside (in the communal laundry area or in a pond) 2) drying menstrual cloth outside in direct sunlight 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 (*very socially appropriate, socially appropriate, socially inappropriate, very socially inappropriate*). The dependent variables are normalized to a range between 0 and 1, with 0 being the lowest level of social appropriateness. *Mean of dep. var* represents the control group mean before the discussion session. *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. The number of observations for columns (1), (2) (3) and (5) is lower as those social norms were only elicited from a randomly selected subset of respondents. Clustered standard errors at the individual level in parentheses for the coefficients.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

study six months after the intervention[21], and asked them directly about their (self-reported) behavior in terms of discussing the underwear with their co-workers. Table 9 shows that, 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, and asked them about their level of knowledge about the study and the menstrual underwear. Table 10 reports their answers. Even though these women had not been part of the study

[21]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. Moreover, this includes a subsample of 291 women who did collect the underwear and 48 women who did not collect the underwear , because they either had a zero WTP for the underwear or won money or pads as part of the WTP lottery.

Table 9: 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 among the study participants. Based on a follow-up survey six months after the intervention. The full follow-up sample consists of 339 women, 182 in the control group, 157 in the treatment group. The upper panel includes responses from 291 women (150 in the treatment and 141 in the control group) who were eligible to collect the underwear after the experiment and did so. The bottom panel includes responses from 48 women (16 in the treatment and 32 in the control group) who were not eligible to collect the underwear after the experiment, because they had a zero WTP (preferred receiving 0 BDT to collecting the underwear) or won money or pads in the WTP lottery. 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. Stars indicate whether the difference between the treatment and control group is significant. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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 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.

Table 10: 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. This sample consists of 59 women surveyed at the six month follow-up who were not previously involved in the study. Standard deviations are reported in parentheses.

4.4 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.[22]

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 measures, willingness to pay for pads and the pick-up rates of the underwear. Table 11 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. This aligns 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.

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

[22]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.

Table 11: 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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 3.1, 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 12 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 12: 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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 13 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 13: 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.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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 14, 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.

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

Table 14: 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.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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.

4.5 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. Since we also observed changes in the control group (due to spillovers and effects of participation in the experiment itself), we investigate to what extent the observed changes in behavior and perceptions of norms, stigma and taboos spread and persist across the treatment and control group six months after the intervention. Specifically, we first look at absorbent use and WTP for pads in the treatment and control group, conditional on having actually collected the underwear. This shows us to what extent providing a new menstrual product as part of a study affects product use and valuation. Second, we compare the perceptions of the norms, stigma and taboos between the treatment and control groups, for both women with and without access the the new menstrual product, to determine if the changes in perceptions persisted and to what extent they spread to the control group.

To do this, we again use the sample of 339 women from our original sample who were re-surveyed six months after treatment, including 182 from the control group and 157 from

the treatment group. 291 women across both groups had access to the underwear and had collected it after the experiment. 48 did not have access to the underwear (they either had a zero WTP or won pads or money in the WTP lottery). In addition, we surveyed 59 women who had not previously been part of the study at all and therefore did not have access to the underwear ("pure control"). The workers in the pure control group were selected randomly from a full list of the remaining factory workers. The follow-up surveys were conducted in November and December 2021.

4.5.1 Absorbents used and WTP for pads

We first evaluate whether 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. Table 15 shows that receiving the free menstrual underwear had a lasting impact on the material used. In the pure control group, 49% of women report using cloth and 61% of women report using pads (in line with the percentages observed for our full sample at baseline of 48% and 60%, respectively, see Table 1). 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.

Table 15: 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)
N	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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We next evaluate whether the intervention had persistent effects on the valuation of

sanitary pads for those women having collected the menstrual underwear.[23] Table 16 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 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 16: 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

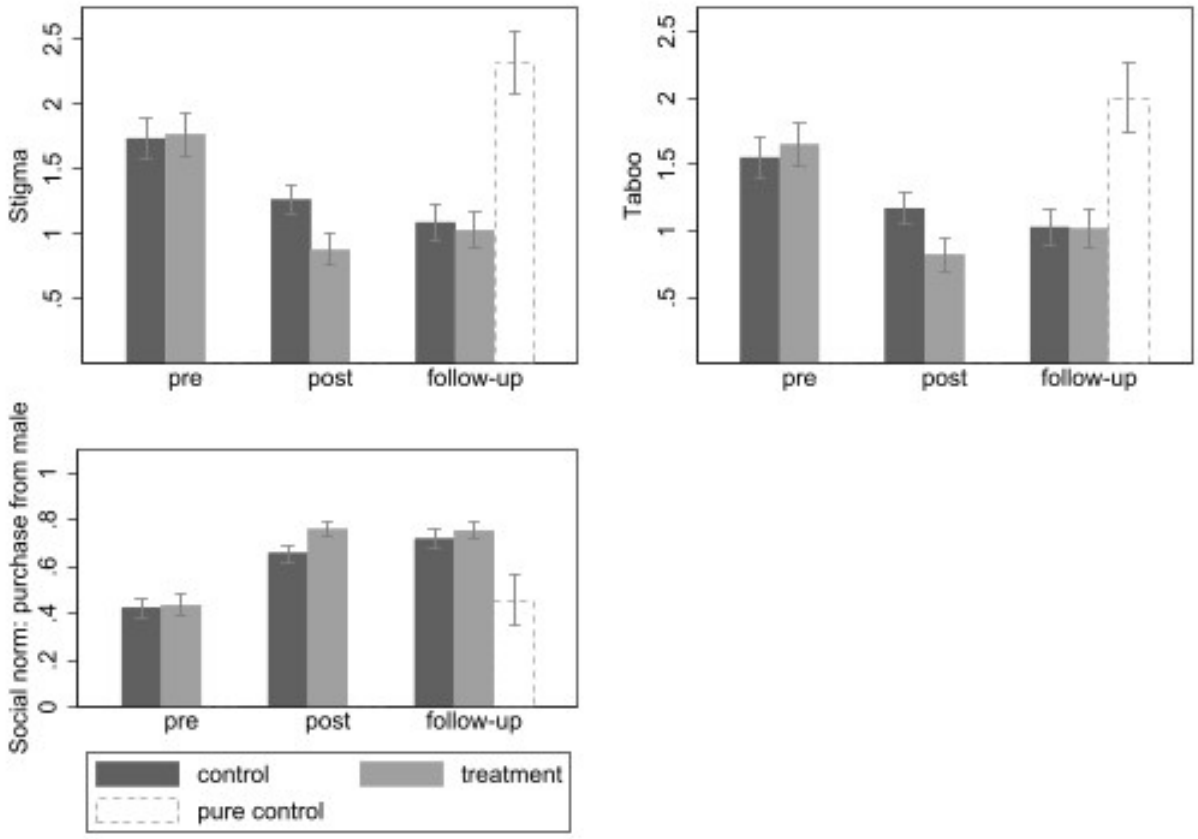
Note: Interval regression of the willingness to pay (in BDT) for disposable menstrual pads to be collected from a male shopkeeper at the factory store for the subset of women who collected the available menstrual underwear. Robust standard errors reported in parentheses. Demographic controls in column (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). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.5.2 Stigma, Taboo and Norms

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 5 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 5). 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 5). 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.

[23]For completeness, we also include the WTP for the menstrual underwear in Appendix Table D2.

Figure 5: Perceived Social Constraints - Persistence of Effects



Notes: The top left panel shows the average stigma level (average number of statements expressing stigma agreed to by the women) for the treatment and control group and a pure control group (not previously part of the study) at baseline, endline and the 6-month follow-up. The top right panel shows the same for the taboo level (average number of statements expressing taboo agreed to by the women). In both cases, higher values mean higher levels of perceived stigma and taboo and it is measured on a scale from 0-4. The bottom panel shows the average level of agreement (standardized between 0 and 1)to the social appropriateness of purchasing pads from a male shopkeeper. Higher values mean the purchase of pads from male shopkeepers is considered more socially appropriate. Error bars represent 95% confidence intervals. The sample includes 339 original study participants who were re-surveyed (182 in the control group, 157 in the treatment group; 291 with access to the menstrual underwear and who collected it, 48 without access to the menstrual underwear) and 59 women in the "pure control" group.

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 5 show, the values of stigma, taboo and social norms measured for the pure control group are very 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 D3 in the Appendix formally confirms the results visible in Figure 5 by showing that there is a significant reduction in average stigma and taboo and a significant increase in the

average perceived appropriateness of buying pads from a male shopkeeper in the follow-up survey compared to the baseline survey, but there is no statistically significant difference between the treatment and control group at the follow-up.

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.

5 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 potential 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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6 Appendix

A 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 A1 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 A1 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 B1 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 A1 provides a general overview of the average characteristics of each group in comparison to each other and the control group.

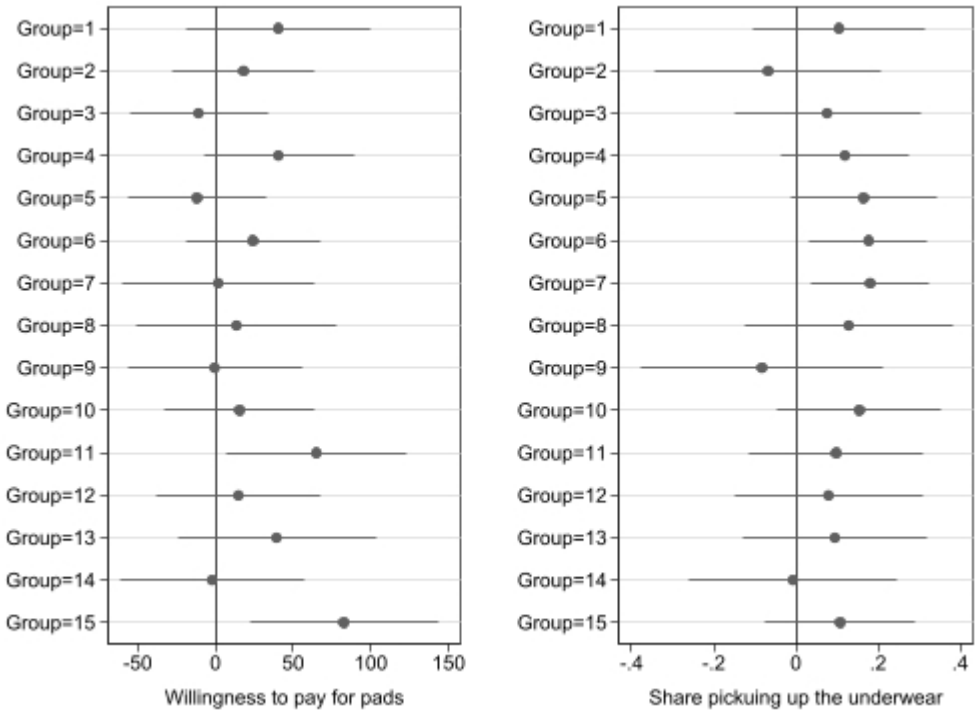
To determine whether these and other factors of the group composition played a role, we regress the average WTP for sanitary pads of each discussion group (average lower bound) and the average probability of product collection of each discussion group on some of the group characteristics. Given the small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

The results are shown in Table A2. 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 A2 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 A3 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 A2 and A3 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 A1: 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 A1: 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

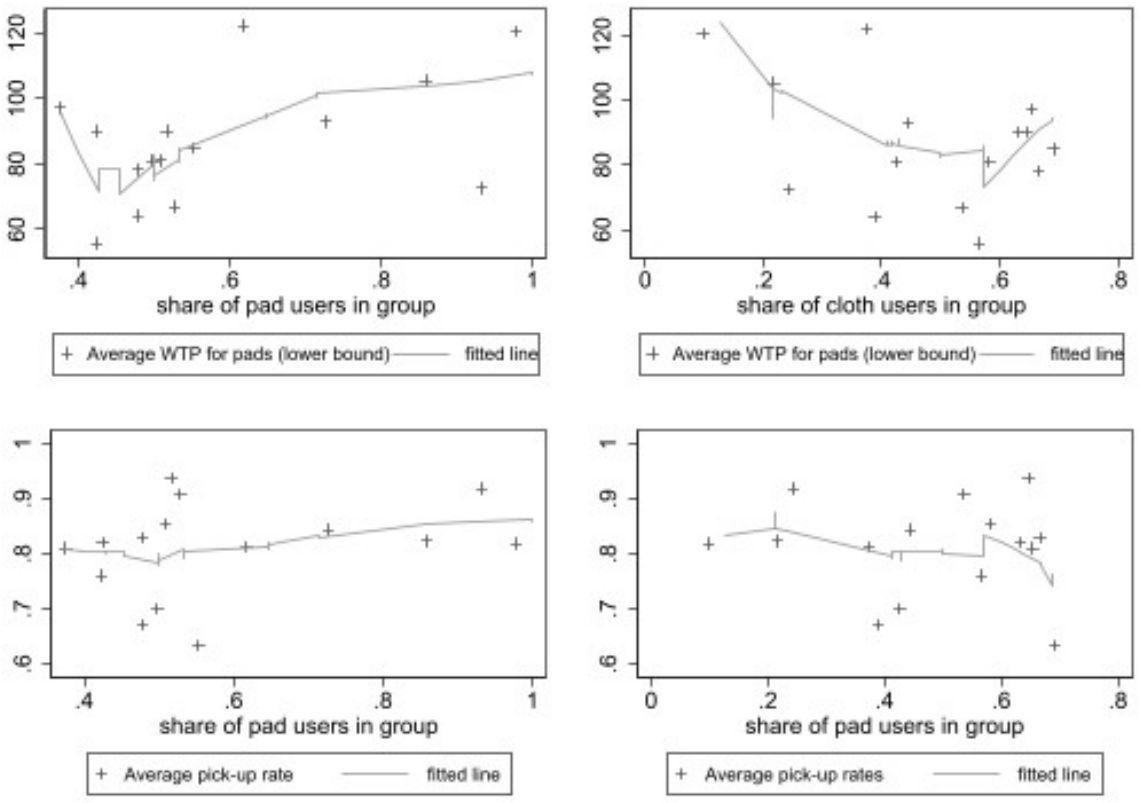
Notes: Arithmetic mean and proportions of group characteristics for different demographic and survey measures at baseline. *Size* includes the number of participants in the specified group. *Cloth users* and *Pad users* reports the proportion of respondents that reported to use said absorbent at baseline, *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 A2: 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

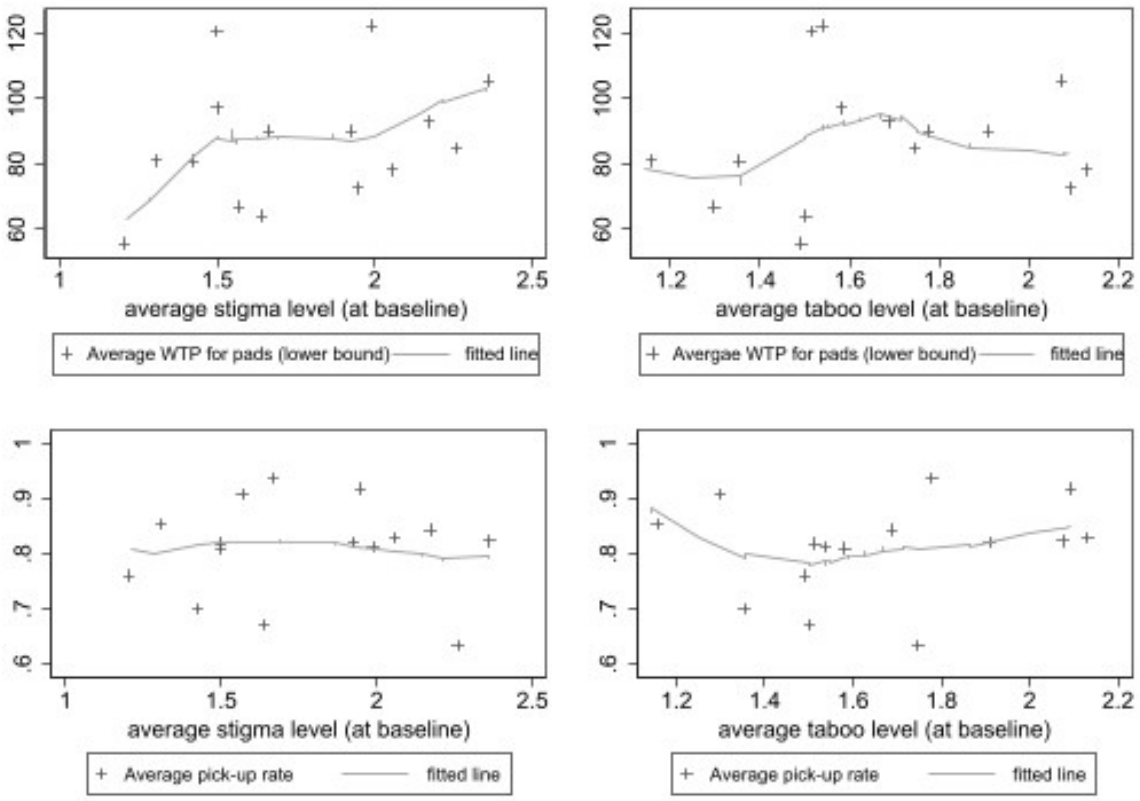
Notes: Column (1) reports results from the regression of the average (lower bound of the) willingness to pay for pads per group on the different group characteristics. Column (2) reports results from the linear probability regression of the average underwear pick-up rate per group on the group characteristics. Share of cloth and pad users is measured between 0 and 1. Standard errors reported in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure A2: 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 A3: 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.

B Robustness checks

B.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 B1: 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. *$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B.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 B2: 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B.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 B3: Social Norms - Ordered Logit Regression Model

	(1)	(2)	(3)	(4)
	Use as absorbent		*Purchase pads from*	
	Cloth	Disposable pads	Male shop-clerk	Female shop-clerk
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.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C Additional Information on the Discrete Choice Experiment

C.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.[24] 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 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).

[24] 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).

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).

C.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).

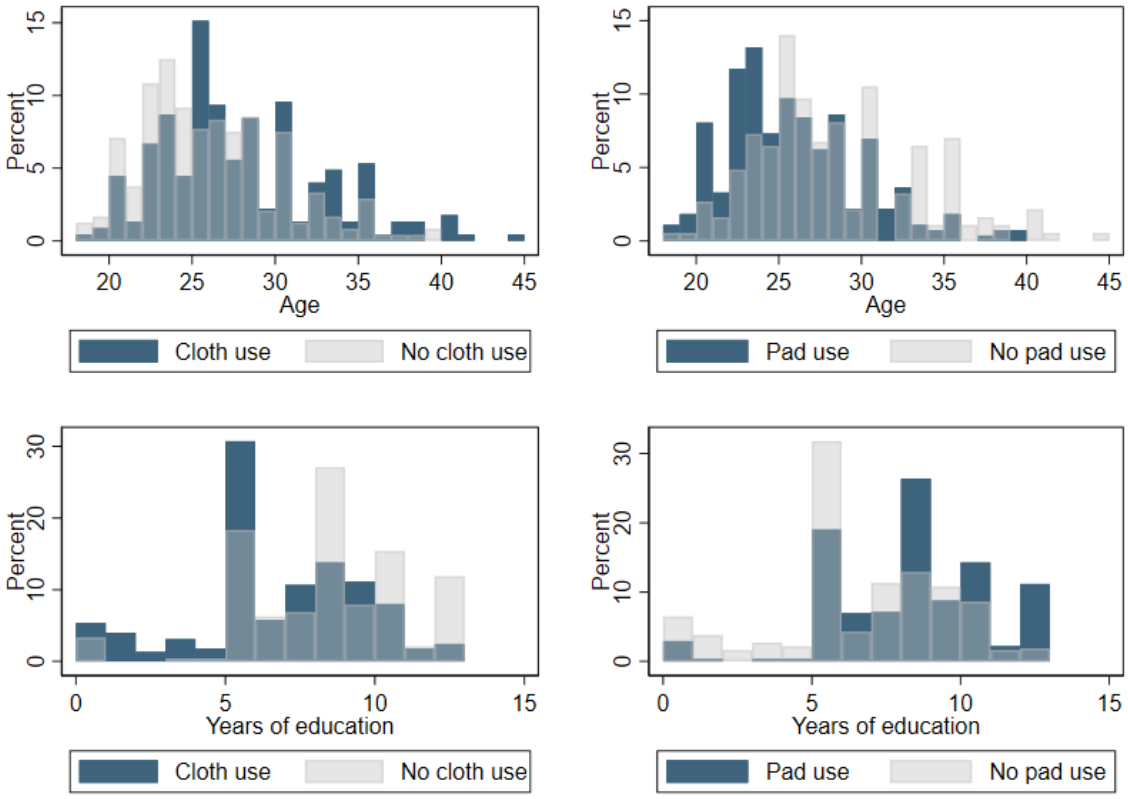
Table C1: Discrete Choice Experiment - Including Control Variables

	(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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

D Additional Figures and Tables

Figure D1: 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 D1: 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.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D2: 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table D3: 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$