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Breaking the silence – Group discussions and the adoption of menstrual health technologies

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ABSTRACT

Stigma can hinder the adoption of beneficial and affordable technologies, particularly in sensitive health areas. Menstruation is a heavily stigmatized biological process, and managing menstruation with dignity and hygiene is a challenge in low-income settings. In this study, we conducted a randomized control trial to explore the impact of discussion-based interventions on breaking the silence around menstruation and shifting practices related to menstrual products. Our findings demonstrate a significant increase in the willingness to pay for well-known menstrual products and in the adoption of novel technologies post-intervention. The key driver of these outcomes is the reduction of menstruation-related stigma at the moment of the acquisition of the technologies.

1. Introduction

Social environments influence people's health decisions - for better and for worse. In particular, social stigma can prevent people from making optimal health choices, even when the optimal choice is readily available and affordable. For example, the fear of stigma may influence an individual's decision to undergo tests for sexually transmitted diseases (Yang et al., 2023), participate in preventative health check-ups (Ghosal et al., 2022), or seek assistance for mental health issues (Shidhaye and Kermode, 2013). This phenomenon is particularly acute in low-income settings, where despite significant investments in making basic health technologies available, the adoption rates are low. It is particularly concerning if stigma prevents vulnerable populations from utilizing simple and inexpensive health technologies.

Despite its frequency and ubiquity, menstruation is a biological process subject to strong levels of stigmatization. In many low-income settings, managing menstruation with dignity and hygiene remains a challenge, and the prevalence of unhygienic practices leads to serious health consequences (Torondel et al., 2018). Previously, it was believed that unsafe menstrual management stemmed entirely from a lack of information and resources. However, despite significant investments in education and access over the past decade, sanitary menstrual strategies are still far from being universally adopted. Moreover, menstruation continues to be stigmatized. Concealment surrounding anything related to periods prevents discussions even in private settings, such as at home between mothers and daughters.

Surveys of menstrual health in low-income contexts continue to show that repurposed menstrual cloth is the most frequent menstrual health management method. This method is not inherently a health hazard if individuals adhere to hygienic maintenance practices. However, the surveys reveal that women often do not wash or dry menstrual cloth properly (Bangladesh Bureau of Statistics, 2020). Trying to conceal the existence of menstruation, individuals avoid using available water sources, washing facilities, or even their home environment to clean their absorbents. Instead, they choose locations that offer privacy but may be unhygienic, like the floors of public toilets. Subsequently, they store these absorbents without drying to avoid displaying menstrual absorbents in public. These practices lead to unsafe materials being used in menstrual health management. Alternative products such as disposable pads would alleviate the washing and drying difficulties and

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eliminate risks associated with unsanitary cleaning processes. However, the question remains why women in these settings are rarely transitioning to these alternative health technologies. The most apparent reasons might seem to be cost and awareness. Yet, even in contexts where pads are both well-known and affordable, their adoption remains low. An underexplored factor is the purchasing process itself. Unlike in higher-income countries, pharmacies and stores in these settings are almost exclusively run by men, and additionally located in public spaces like village squares or busy urban streets. In societies where discussing menstrual health with men is taboo and women seek to conceal their menstruation, this scenario poses a considerable challenge. The stigma thus acts as a barrier to the purchasing process. Women face a trade off: the benefits of improved menstrual hygiene versus the discomfort and potential social cost of buying menstrual products in public, male-dominated environments.

In this paper, we empirically investigate the presence and implications of this trade-off through a randomized controlled trial involving female workers in a garment factory in Bangladesh. Bangladesh represents an ideal context for examining this dynamic. Over the past decade, numerous initiatives by both public and private entities have aimed to improve menstrual hygiene management. These efforts have ensured widespread availability and heightened awareness of disposable pads. Nonetheless, their actual usage remains modest.[1] Moreover, unhygienic menstrual practices are often associated with cloth usage due to social stigma.[2] We hypothesize that stigma significantly hinders the broad adoption of new menstrual products and practices.

We first present observational evidence from our sample highlighting that social concerns are present in women's decisions regarding disposable pad purchases. We surveyed women who exclusively use menstrual cloth to understand their reluctance to switch to pads. A substantial majority (85%) identified the presence of men in stores as a primary reason. Furthermore, we explored prevailing social norms around purchasing practices, finding that 60% of women believe that their peer group perceives buying pads from a male vendor as *socially inappropriate*. This leads us to hypothesize that directly addressing these social concerns may enhance women's adoption of desired menstrual products, even in situations where they must be purchased from a male vendor in a publicly observable location.

To test this hypothesis, we implemented a discussion-based intervention, following recent literature by Dhar et al. (2022) and Ghosal et al. (2022). Women in the treatment group engaged in a one hour discussion session, aimed at breaking the silence surrounding menstruation. These sessions, comprising groups of 15–20 women, encouraged openly sharing and discussing personal experiences and strategies about menstruation. This format was intended to expose the participants to diverse attitudes and perceptions, shedding light on a subject typically shrouded in taboo.

The study evaluates the impact of open discourse on the expected utility of menstrual products using two primary metrics. We first examine the valuation of sanitary napkins, a familiar product already in use by part of our sample. Second, we assess the adoption of a novel product unknown to our participants: an antibacterial reusable menstrual underwear. To reflect real-world conditions, the collection of these products was arranged at a convenience store located within the factory premises, managed by a male vendor and potentially visible to other factory workers. These outcomes are compared to a control group that did not participate in discussions. Additionally, to understand underlying mechanisms, we employed a discrete choice experiment as part of the study's endline survey, varying product's price, shopkeeper's gender, and purchase privacy.

The intervention increased the expected utility of menstrual products. Individuals in the treatment group were willing to pay 25% more than the control group for pads, compared to the control group's average valuation of 90 BDT (around 1 USD). This increase, which represents about half of the market price, indicates a substantial shift in how the participants value this well-known product. Moreover, the increased valuation was not limited to familiar products and it also influenced behavioral changes. The adoption rate for the antibacterial menstrual underwear increased by 14%, from a baseline of a 71% adoption rate in the control group.

We explore two potential channels that could be driving the observed effects: an information channel and a stigma reduction channel. The information channel would suggest that the group discussions, though devoid of formal external information, could have facilitated a form of social learning. Women who used cloth might have obtained insights about specific product features or the general benefits of sanitary napkins from their peers, thereby increasing their valuation of these products. On the other hand, the stigma reduction channel would mean that the intervention helped alleviate stigma surrounding menstruation. By openly discussing menstrual health, women might recognize a shared experience, reducing the perceived and experienced stigma and normalizing the purchase and use of pads. To differentiate between these channels, we conduct a discrete choice experiment that enables us to disentangle the valuation of the product itself from the influence of contextual factors (observability and shopkeeper gender). If the information channel were predominant, we would expect minimal differences between the treatment and the control group on their distaste for specific contextual factors and a large difference in the valuation of the product itself. However, our findings suggest otherwise. The treatment group demonstrates considerably less distaste about buying from male shopkeepers and in public settings. We found no differences in the intrinsic monetary value attributed to the product itself. This suggests that the main channel is a reduction in stigma-related concerns and not the dissemination of information about menstrual products or their features.

To corroborate this further, we conduct an exploratory analysis based on participants' baseline menstrual practices. We segment our willingness to pay metric by cloth users, pad users who typically purchase the pads themselves, and pad users who send someone else (usually their husband) to buy the pads for them. We find that the strongest treatment effect is seen for women who used pads but relied on their husbands to buy them. They show a significant 45% increase in willingness to pay, contrasting with a null effect of the intervention on increasing valuation among women who already purchased pads themselves. The knowledge of the product's features and benefits is similar in both subgroups; however, women who are already buying pads themselves seem to be less elastic to social stigma concerns. The marked difference in valuation among pad-using women, depending on who purchases them, emphasizes the intervention's role in addressing stigma, rather than product awareness.

Our results therefore point towards a plausible stigma reduction channel driving our findings. It is important to acknowledge the inherent complexity in isolating the specific mechanisms behind the observed changes in our study. While our results suggest that the primary driver of these changes is a reduction in stigma, we cannot categorically rule out the influence of an informational channel. The intervention, designed to encourage open discussions about menstrual health, inherently blends informational exchange with stigma reduction. Providing information about menstrual health and products is intrinsically linked to the social stigma associated with these topics. In

[1] Within our sample, 90% of the women reported the availability of a nearby store selling sanitary pads. The Bangladesh National Hygiene Survey (2014) observed that in 2013–2014, approximately 33% of urban women used sanitary pads. The latest survey data indicates some progress among adolescent girls, but minimal change among adult women, with 64% using cloth for menstrual hygiene (Bangladesh Bureau of Statistics, 2020).

[2] As per Bangladesh Bureau of Statistics (2020), less than a third of women manage to wash and clean their menstrual cloth hygienically, and 40% store it immediately after washing, avoiding drying to prevent the display of menstrual cloth.

the absence of distinct treatment arms that could separately evaluate the effects of information provision and stigma reduction, our study cannot perfectly disentangle these intertwined channels.

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, 2018, 2022). On the other hand, projects applying a norm transformation strategy often use media such as TV shows (Jensen and Oster, 2009; La Ferrara et al., 2012; Banerjee et al., 2019; Green et al., 2020) and radio shows (Paluck, 2009; Arias, 2019) to influence the perception of social norms. Our study design is more in line with the second approach, but we do not actively attempt to influence the perceived social norms in any direction.

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.

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 and access to pads, including Garikipati and Boudot (2017); Krenz and Strulik (2019); Czura et al. (2024), and to alternative products like menstrual cups, such as Oster and Thornton (2011). We extend the literature that looks at the role of information and social norms (Castro and Czura, 2021; Czura et al., 2024) by directly addressing the role that stigma plays 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 stigma in hindering the adoption of safer menstrual health management practices. Section 3 details the experiment design and our empirical strategy. Section 4 lays out the theory of change and hypotheses. In Section 5, we present and discuss the results. Section 6 discusses the implications of the study, and Section 7 concludes. The paper closes with Section 8, which discusses various robustness checks.

2. Menstrual hygiene and stigma in Bangladesh

Menstrual hygiene is a key element for the physical, mental, and emotional well-being of women (Torondel et al., 2018; Benshaul-Tolonen et al., 2021). It aids their economic prospects by mitigating barriers to education (Agarwal et al., 2022) and employment (Krenz and Strulik, 2019).[3] Considering that menstruation affects approximately half of the global population for a significant portion of their adult lives, and that across many contexts, managing menstruation with dignity and hygiene remains a significant challenge, advancements in menstrual hygiene management yield substantial economic and humanitarian benefits. Consequently, improving menstrual hygiene has become a focal point in international development initiatives and has spurred a growing body of research dedicated to understanding and ameliorating poor menstrual hygiene. However, maintaining menstrual hygiene remains a challenge in many low-income contexts (Garg et al., 2012; Garikipati and Boudot, 2017; UNICEF, 2019; Czura et al., 2024). A major obstacle to sustainable improvements in menstrual health practices is the presence of cultural taboos and stigma surrounding menstruation (Castro and Czura, 2021).

In low-income countries, cloth is the primary material used for managing menstruation. In Bangladesh, approximately 65% of adult women rely on cloth, often repurposed from an old saree or similar materials (Bangladesh Bureau of Statistics, 2020). These women frequently lack access to private sanitation facilities, hindering their ability to change the cloth regularly, particularly during work hours. Compounding this issue, many women also do not have access to clean water or private spaces to properly wash the used cloth with soap. Instead, they often resort to using unhygienic but private spaces, such as the floors of public toilets, for washing these cloths. Commonly, the washed menstrual cloths are stored immediately without adequate drying, tucked away under mattresses or in cupboards. Such practices pose direct health risks, including urinary tract infections and inflammations, due to the unsanitary conditions of storage and use (Sumpter and Torondel, 2013; Torondel et al., 2018).

Public and private campaigns have worked towards introducing menstrual absorbents that circumvent the limitations of cloth, such as disposable sanitary napkins. The advantage of disposable pads lies in their elimination of the health risks associated with the improper washing and drying of cloth. Despite their widespread availability in Bangladesh, however, adoption rates of disposable pads are modest. Only about 29% of adult women—and 43% of adolescents under 19—report regular use of pads (Bangladesh Bureau of Statistics, 2020).

In the sample of Bangladeshi garment factory workers recruited for this study, 40.5% of women do not use pads as their primary absorbent. Notably, availability is seldomly cited as a barrier to adoption, with 79% reporting easy access to a store selling pads. Instead, the shame, and stigma associated with purchasing pads are the predominant reported obstacles. More than 80% of surveyed women report experiencing discomfort when buying pads due to privacy concerns and the anxiety of being seen, especially when the seller is a man (Table A1 in the online appendix). Additionally, even those who use pads regularly report fear of stigma when acquiring the products. In our sample, 52% of regular pad purchasers resort to covering their faces during purchase to avoid recognition. These survey results underscore that stigma matters for women's access to for-sale menstrual hygiene products. Consequently, our study evaluates an intervention designed to alleviate these social constraints by diminishing the perceived stigma surrounding menstruation.

In recent years, paralleling our research, there has been a significant

[3] A study by the Water Supply Sanitation Collaborative Council (WSSCC) in Bangladesh suggests that an infection caused by using cloth during menstruation leads to 73 percent of women missing work for an average of 6 days a month (WSSCC, 2013).

increase in interventions aimed at addressing the stigma surrounding menstruation by public practitioners and private stackeholders. These efforts have evolved from merely providing information or subsidizing products to actively tackling the stigma and taboos associated with the topic. A robust global movement, symbolized by the hashtag #LetsTalkPERIOD(s), has emerged to normalize menstruation and promote menstrual health. This shift has witnessed considerable progress worldwide in addressing the impact of stigma and taboos on menstrual health.

Public and private entities have adopted creative strategies to break the silence around menstruation, involving collaborations with sports teams and partnerships with influencers. Notable examples include the German Women's football team partnering with o. b. tampons during the 2023 Word Cup and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) using social media and local influencers to reshape discussions in Nepal, Albania, and the Philippines. Additionally, the MenstruAction movement, supported by the German development cooperation, aims to initiate dialogues about menstruation and women's and girls' menstrual needs and rights. This paper seeks to speak to the potential of such campaigns to effectively reduce stigma and achieve lasting change in menstrual health practices.

A distinctive aspect of our approach involves the deployment of two different types of menstrual absorbents. One is the well-established and widely available disposable pads (or sanitary napkins). The other is a novel product not yet available on the market at the time of the study — reusable menstrual underwear. The menstrual underwear, developed and supplied by our project partner Reemi, represents a culturally sensitive and innovative alternative to menstrual cloth or disposable pads. This alternative addresses several cultural, social, and health issues associated with existing methods. Its primary benefit lies in its superior absorbency compared to sanitary pads or cloth, reducing the need for frequent changes throughout the day. Furthermore, it represents a one-time investment, offering long-term use over several years and eliminating the need to repeatedly interact with male shopkeepers. While this underwear also requires washing with soap and drying — a common challenge — the material is fast-drying and anti-bacterial, facilitating easier cleaning and reducing infection risks. As a new product in Bangladesh, the menstrual underwear was unfamiliar to the women in our study. However, given its design tailored to the needs of menstruators like our participants, we anticipated a strong initial demand. The novelty of the product ensured a clear delineation of our treatment effects, as the participants had no prior access to it in the market. This exclusivity allowed us to confidently attribute any observed outcomes directly to our intervention, without the confounding effects of external access to the product.

3. Experiment design

3.1. Sample

Our field experiment was conducted in a large garment factory in Tongi, a town north of Dhaka, Bangladesh. From a pool of 6,000 workers, 600 female employees were randomly chosen to participate in our study, based on a list provided by the factory. The selected participants were contacted on their mobile phones after work hours. Upon obtaining their consent, we administered the baseline survey, continuing our outreach until 485 women agreed to participate. These participants had experienced regular menstruation in the past six months, except for 16 women who reported currently being pregnant. The baseline surveys were conducted in March and April 2021. For their participation, each respondent received 40 BDT in phone credits, approximately equivalent to 0.50 USD and corresponding to the hourly wage rate. Female enumerators conducted the phone surveys to minimize any discomfort participants might feel when discussing menstruation-related topics.

After completing the baseline survey, participants were randomly assigned to either the treatment or control group. The treatment commenced following the completion of the first 100 baseline surveys, thus reducing the time gap between the baseline assessment and the treatment sessions for the treatment group and streamlining the logistical aspects of the study. The treatment group consisted of 227 women, the control group of 258 women. All women assigned to the treatment group participated in the treatment sessions.

The endline survey was conducted with all participants in April and May 2021. Attrition rates were minimal and comparable across both groups: 1.8% in the treatment group (4 out of 227 women) and 1.9% in the control group (5 out of 258 women). The primary reason for attrition was unresponsiveness or switched-off phones during the endline survey calls. Our final sample size for the main analysis comprised 476 women, with 223 in the treatment group and 253 in the control group. Approximately six months post-treatment, in November and December 2021, we re-surveyed 339 women from our original sample (182 from the control group and 157 from the treatment group) to assess the persistence of the effects. The timeline of data collection and the specific measures collected at each stage are graphically summarized in Figures A1, A2 and A3 in the online appendix.

Our randomization process successfully resulted in balanced samples in terms of observable characteristics (see Table A1 in the online appendix). The average age of women in our sample was 26 years. Most were married and had at least one child. Their education level, averaging seven years, was slightly above the national average for women, reflecting the growing trend of young women seeking employment in garment factories after attaining higher education levels (Asadullah et al., 2021; United Nations Development Program, 2022).

The relatively young age and higher education levels in our sample are positively correlated with pad usage.[4] While 60% of our sample reported frequent pad use at baseline, surpassing the national average (Bangladesh Bureau of Statistics, 2020), half also reported frequent use of cloth, indicating that some women use both (e.g., pads on heavier flow days, cloth on lighter days), with a significant proportion not using pads at all.

3.2. Treatment intervention: open discussions about menstruation at the workplace

Our intervention is centered around a simple group discussion. Social interventions aimed at modifying individual behavior often use what Cislaghi and Berkowitz (2021) describe as norm correction strategies. They provide individuals with factual information about the actions and attitudes of others to correct misperceptions (Allcott, 2011; Bursztyn et al., 2020; Dur et al., 2021). In contrast, social psychology perceives social norms not as static beliefs but as part of a dynamic group process (Prentice and Paluck, 2020). In this view, individuals interpret social information within the context of a group, seeking validation and agreement from other group members in their responses. Instead of attempting to alter an individual's perception of group norms in isolation, our intervention seeks to provide an opportunity for real-time validation of social perceptions. This approach aligns with the methods used by Dhar et al. (2022) and Ghosal et al. (2022), who employed group discussions to directly address participants' personal attitudes and perceived (self-)stigma.

The intervention consisted of a one hour discussion session, encouraging participants to openly share their thoughts and experiences

[4] Pearson's correlation coefficient between age and cloth use: 0.18, p-value: 0.00 and between age and pad use: −0.19, p-value: 0.00; younger women tend to use pads more, older women cloth. Pearson's correlation coefficient between education and pad use: 0.19, p-value: 0.00 and between education and cloth use: −0.23, p-value: 0.00; more educated women tend to use pads more, less educated women cloth. See Appendix Figure A4 for a graphical analysis of these trends.

about menstruation. The sessions were led by trained female facilitators. These discussions were intentionally not structured as educational or training sessions. Our aim was to explore the impact of normalizing the topic, not of providing external or formal information. Thus, the discussions were geared towards sharing personal experiences, with minimal information provided by the facilitators, diverging from previous studies that focused on empowering young women and girls through external information provision or specific life skills training (Duflo et al., 2015; Ashraf et al., 2020; Bandiera et al., 2020; Buchmann et al., 2021; Castro and Czura, 2021). Instead, our intervention allowed for the endogenous influence of group feedback on the participants' perceptions. It enabled them to update their beliefs based on the responses they received from other group members, without external validation of these updated beliefs from the experimenters. By offering a positive experience of discussing menstruation, the sessions aimed to alter the women's confidence in talking about the subject, reduce the associated taboo, and lessen the stigma. In contrast, the control group did not engage in any discussions and had no opportunity to openly discuss menstruation. Their interaction with the study was limited to the baseline and endline phone surveys.

The discussion sessions were held during work hours in a conference room at the factory and were moderated by two female facilitators from the implementation partner, Change Associates Ltd.[5] The sessions occurred in March and April 2021, with a total of 15 sessions conducted. Each session had an average of 15 participants (ranging from 13 to 21) and lasted one hour. The format was hybrid, with factory workers present in the conference room and facilitators joining remotely via Google Meet. Post-session, moderators completed surveys to report any incidents, main discussion topics, questions raised, and the overall atmosphere and participation level.

Moderators reported that sessions covered similar topics, including first experiences with menstruation, discomfort during menstruation, discussions about menstruation with children, and the pros and cons of various menstrual products, especially pads. While these core topics were consistent, the emphasis varied, with some sessions focusing more on menstrual products in general, others on pads in particular, and others on how to discuss menstruation with children. 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 feedback indicated minimal technical difficulties, with only 2 of 15 sessions experiencing issues that were quickly resolved. Facilitators unanimously reported enthusiastic participation from the women, with nearly all sessions showing equal engagement from all attendees. This confirms that the intervention was implemented as intended and achieved its objective of fostering open discussions about menstruation in a supportive group setting.

3.3. Outcome variables

3.3.1. Valuation of a well-known menstrual product: disposable pads

Our primary experimental outcome is the women's willingness to pay (WTP) for a familiar menstrual product: disposable pads, also known as sanitary napkins. We specifically measured willigness to pay in a context that mirrors the real-world purchasing environment in Bangladesh, where the majority of vendors are male, and pads are sold in public locations like convenience stores or pharmacies located in busy urban streets or in villague squares. This setup is key to our study as it integrates the public nature of the purchase and the male gender of the seller, which may influence women's decisions to adopt for-sale menstrual technologies due to potential discomfort in such purchasing scenarios.

We measured the willingness to pay using a price list (Anderson et al., 2007), with enumerators describing the conditions under which the menstrual products need to be collected at the factory store. Participants were offered a choice between receiving an amount of money (in phone credits) or the product for free, with the price increasing in fixed intervals. This approach allowes us to capture the willigness to pay as an interval between the last price at which the product was chosen and the first higher price at which the money was preferred. This methodology assumes monotonically increasing preferences with a single switching point.[6] For completeness, we also measured the willigness to pay for the menstrual underwear, but the novelty of the product, participants' unfamiliarity with it, and the elicitation of the metric through a phone survey, was likely to yield noisy estimates; therefore, we focus on the willigness to pay of the known-product. Results for the underwear WTP can however be found in Table R6 in Section 8 of the robustness checks.

The WTP measurements for the disposable pads and the underwear were incentivized together. For each participant, one randomly selected choice was made payoff-relevant. Consequently, the woman received either a specific amount of money or the opportunity to collect the product (either the disposable pads or the menstrual underwear) based on her choice in the randomly selected scenario. 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 realised. To increase the power of our second outcome metric regarding the adoption of a new technology, we skewed the randomization of the payoff-relevant outcome in such a way that for 95% of the women, the choice between 0 BDT and the underwear was selected to be payoff-relevant.[7] Therefore, the majority of women were eligible to pick up the underwear for free. For seven women, a different pay-off relevant scenario was randomly selected and they received either an amount of money or a pack of pads.

3.3.2. Adoption of a novel menstrual technology: antibacterial underwear

The second outcome of our study focuses on the adoption rate of an innovative and previously unavailable product: an antibacterial reusable menstrual underwear. This product's introduction serves as a key component of our research, allowing us to measure the uptake of a novel technology in menstrual hygiene not available outside of our study.[8] During the endline survey, we carefully explained the unique characteristics and benefits of the reusable menstrual underwear to the participants. They were informed that these innovative menstrual products would be available for collection at the factory store during work hours and that they would be dispensed by the male vendor that works there. In total, 469 women from our study sample became eligible to receive the underwear. The distribution of the underwear, scheduled for June

[5] Change Associates Ltd. is a women-led organization in Bangladesh that frequently conducts trainings on health and family planning topics in garment factories.

[6] The first choice is between receiving 0 BDT or getting the product for free. Conditional on the women selecting to receive the product, the offered price is then increased in fixed intervals and the participants are asked to make the choice again between the higher amount of money and the product. This was done in steps of 20 BDT up to 140 BDT and then a jump to a maximum price of 200 BDT (around 2 EUR, or four times the market price of pads). The jump in the interval enabled us to check a very high WTP, while keeping the number of questions asked to a minimum to limit complexity. The WTP is thus recorded as an interval between a lower bound (last price at which the product was chosen) and an upper bound (first price at which the money was chosen).

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

[8] The menstrual underwear used in this study was developed and produced by Reemi, a New Zealand-based NGO. Designed with multiple leak-proof layers on the exterior and an anti-bacterial absorbent layer on the interior, this product represents a significant advancement in menstrual hygiene technology. As of the date of our study, such reusable menstrual underwear was a novel concept and not commercially available in Bangladesh.

2021, was announced via phone call to the participants, and they had a 10-day window to collect the product from the factory store.

This outcome metric is of relevance for several reasons. First, it allows us to assess whether any observed changes in valuation or attitudes towards menstrual products also translate into tangible behavioral changes, such as picking up an available menstrual product. Second, it addresses a key limitation of measuring behavioral impact solely for existing products like sanitary napkins. As pads are readily available in the market, any influence of our intervention on participants' market behaviors, such as an increased propensity to purchase pads, could remain unmeasured within the scope of our study. For example, women might alter their behavior and start buying products at convenience stores near their homes; such changed behavior would go undetected, as these products are available outside of the study. However, by introducing a product exclusively available through the study, like the reusable menstrual underwear, we can more accurately capture the direct impact of the group discussion. In addition, it allows us to shed some light on the underlying channel, because it limits the potential of a pure information channel: if the product is new, none of the women have prior experiences they can share about it and it cannot be discussed during the treatment sessions. Any observed changes in the adoption of a novel product are therefore highly unlikely to be driven through changes in information alone.

3.3.3. Understanding the valuation dynamics through a discrete choice experiment

Discrete choice experiments (DCE) are employed to unravel the value customers assign to different product features. This method involves presenting customers with a series of choices between two sets of product characteristics (e.g., price, color, size). We adopted this approach to separate the direct monetary value attributed to the product from the various contextual factors relating to how the product is obtained. We presented participants with (hypothetical) scenarios for acquiring disposable pads, varying the purchase's visibility (publicly on the factory premises vs. an external shop), the shopkeeper's gender (male vs. female), and price levels (30, 40, 50 or 60 BDT). Women made choices between two bundles of these attributes in consecutive scenarios, providing insights into the relative utility derived from each attribute and their willingness to pay a premium for facing preferred conditions. Detailed theoretical details on how we constructed the choice sets are provided in the online appendix in Subsection B.

The rationale for integrating this discrete choice experiment into our study was to disentangle the information and stigma channels as drivers of our results. Creating separate treatment arms to isolate these factors is exceptionally complex. Discussions, information provision, or product distribution might affect both information levels and stigma. As detailed in subsection 3.2, our intervention was consciously structured to primarily address the stigma associated with menstruation without introducing external information. Despite this, participants could still exchange knowledge about product features during the discussion sessions, contributing not only to the topic's normalization but also to increased knowledge of some participants. The discrete choice experiment allows us to explicitly separate the value attributed to contextual factors, i.e. purchasing the product from a male vendor and picking it up in a more public place, from the value attributed to the product itself. While the willingness to pay encompasses both the valuation of the product itself and the context of acquisition together, the discrete choice experiment disentangles these different dimensions.

3.3.4. Supplementary survey measures as corroborative evidence

To complement the discrete choice experiment, we collected additional survey measures to support and contextualize the findings derived. These measures focus on perceived social norms and stigma and will be used as supportive evidence to underscore our main outcomes.

Social norms, the informal rules indicating socially acceptable actions, consist of empirical expectations about others' actual behavior (descriptive norms) and normative expectations about others' perceptions and beliefs (injunctive norms) (Bicchieri and Dimant, 2019). In our study, we specifically elicited an injunctive social norm related to the purchase of menstrual products from a male vendor. To capture societal perspectives rather than personal feelings towards this norm, we utilized a vignette study. Participants were presented with the scenario featuring a woman similar to themselves during menstruation and were asked about the anticipated reaction of the woman's neighbors to this woman buying pads from a male vendor. For this scenario, respondents indicated whether they expected neighbors to find the behavior very socially inappropriate, socially inappropriate, socially appropriate, or very socially appropriate.

Additionally, we assessed changes in perceived stigma. Beyond influencing second-order beliefs about others' perceptions, we anticipated that the discussions would impact feelings of shame, embarrassment, and stigma related to menstruation. To gauge perceived stigma, participants were asked about their agreement with a set of four statements, each expressing a different aspect of stigma, such as concern over being treated differently if their menstrual status was known *(i.e. i) women should hide any evidence of menstruation, ii) if someone would know that I am menstruating they might treat me or look at me differently*).[9] Rather than reporting their level of agreement with each statement individually, participants reported the total number of statements they agreed with. Our scale from 0 to 4 reflects the intensity of perceived stigma.

Alongside these measures, demographic variables were collected including age, religion, marital status, number of children, and frequency of menstrual product use at baseline. The exact survey questions for baseline and endline are available in the online appendix.

4. Theory of change and hypotheses

Our study's theory of change posits that open discussions about menstruation in peer settings can significantly alter individual perceptions and attitudes towards menstrual health and the expected utility of menstrual products, resulting in lasting behavioral change. We hypothesize that there are two potential channels driving the transformative effect.

The first channel involves reducing the social stigma surrounding menstruation. We postulate that group discussions foster comfort and openness in talking about menstruation among participants. This leads to a reshaping of both personal and collective norms regarding menstruation, enabling women to perceive menstruation as a natural process and normalizing the act of purchasing menstrual products. The stigma associated with menstruation, often deeply rooted in cultural and societal norms, extends beyond personal discomfort to reflect broader societal attitudes that treat menstruation as a shameful and secretive matter. The intervention provides participants with a safe space to openly discuss menstruation, thus normalizing the subject. This may shift perceptions about others' disapproval regarding buying and using these products, as well as reduce personal feelings of shame when doing so. This can help normalize purchasing behaviors, even if some discomfort persists in interactions with male vendors.

The discourse generated in the group discussions is therefore expected to mitigate the discomfort associated with menstruation and menstrual health management and reduce the stigma. This should manifest in reduced concerns about buying products either from male shopkeepers or in public, or both, and result in a higher expected utility of the product, as proxied by the valuation measured as the willingness to pay.

Hypothesis 1. *Participation in discussion sessions about menstruation leads to increased expected utility of period-specific menstrual products,*

[9] These statements were adapted from various surveys, as detailed in Hennegan et al. (2020).

driven by a decrease in the social stigma associated with...

Hypothesis 1a. *... purchasing menstrual products in public.*

Hypothesis 1b. *... purchasing menstrual products from a male vendor.*

To compare the level of discomfort related to the shopkeeper's gender and the public nature of the purchase between control and treatment groups, we use the results from the discrete choice experiment. To confirm this hypothesis and its sub-hypotheses, we would need to observe reduced discomfort for the treatment group associated with purchasing the pads in a more public setting (inside the factory) (to confirm Hypothesis 1a), and a reduced discomfort associated with purchasing the pads from a male vendor (to confirm Hypothesis 1b). In other words, the control group needs to be willing to pay a higher premium to avoid a male vendor and to avoid a more public place compared to the treatment group.

The second channel through which the group discussion could increase the valuation of menstrual products is through an information and awareness channel. Participants could share and learn about various aspects of menstrual products from their peers. The discussions might reveal less-known information about product varieties, usage techniques, disposal methods, and even cost-effective purchasing options. Such detailed knowledge can shift the participants' valuation from a purely cost-based perspective to a value-based one, where they appreciate the full spectrum of benefits offered by these products. Consequently, we would observe an increase in the value attributed to this product, completely unrelated to stigma or the social dimension of the purchase, purely driven by this enriched awareness and understanding.

Hypothesis 2. *Participation in discussion sessions about menstruation leads to an increased expected utility of period-specific menstrual products, driven by an enhanced understanding of the products' features and benefits, acquired through interactive peer discussions. This elevated awareness influences the perceived monetary value of menstrual products, independently of any changes to the social dimension of the purchase.*

The DCE allows us to compare the monetary valuation attributed to disposable pads independently of the contextual factors by the treatment and control group. To confirm this hypothesis, we would need to observe a greater intrinsic value attributed to the diposable pads by the treatment group, such that the treatment group would be willing to pay a higher price for the pads regardless of contextual factors, i.e. holding the vendor's gender and the pickup location constant.

Hypotheses 1 and 2 are not mutually exclusive, and may in fact very well be true at the same time. The intervention can lead to a decrease in stigma surrounding menstruation, and also increased awareness of the characteristics of menstrual products simultaneously. This outcome would be evident from observing an increase in the monetary value of menstrual products and a decrease in the social stigma surrounding menstruation as a result of the intervention. We would expect statistically significant differences in all measured attributes of the discrete choice experiment between the treatment and control groups. This would confirm both Hypotheses 1 and 2, demonstrating that the intervention operates effectively through two simultaneous channels.

5. Results: the effects of discussing menstruation openly

In this section, we present our experimental findings. The results show a notable increase in the valuation of period-specific menstrual products among women who participated in the discussion sessions. Alongside this, we observe a tangible behavioral change: women in the treatment group have a larger propensity to adopt a new menstrual technology. Additional metrics shed light on the underlying mechanisms, suggesting that the changes observed are predominantly influenced by a decrease in purchasing-related stigma and not by increased awareness of the products gained through the discussions. Notably, women in the treatment group show less apprehension regarding the public nature of their purchases and the male gender of the vendor.

5.1. Collective discussions: a pathway to greater menstrual health technology adoption

In this section, we show how group discussions influence participants' valuation of menstrual health products and their adoption rates. We compare the willigness to pay for sanitary napkins and the collection rates for menstrual underwear between the control and treatment groups. We employ an interval regression of the willigness to pay on the intervention dummy, and use a linear probability model to regress the pick-up rates of menstrual underwear on the intervention dummy. Table 1 presents these findings, with Column (1) detailing WTP results and Column (2) showing pick-up rates.

The results in Column (1) of Table 1 show that women in the control group have an average willigness to pay of approximately 91 BDT for a pack of sanitary napkins. In comparison, the treatment group exhibits an average increase of about 23 BDT, exceeding in 25% the control mean. This significant difference at the 5% level, combined with the substantial magnitude of the increase, indicates a considerable treatment effect.[10] These results remain robust when including demographic controls, controls regarding menstrual practices, and also stigma and social norm controls (see Table R1 in Section 8 on Robustness Checks).

The observed average increase in WTP of over 20 BDT implies a significant shift in the treatment group's valuation, moving up to the next WTP interval. An analysis of the WTP distribution shows how women in different valuation intervals reacted to the intervention. Furthermore, it provides insights into whether the responses of women with valuations above the market price differed from those with valuations below it. As illustrated in Fig. 1, the impact of the intervention was consistent across the entire distribution. For every lower bound value of WTP (the maximum amount where a woman preferred pads over money), the cumulative distribution function for the treatment group consistently falls below that of the control group, indicating a comprehensive shift in valuation. The treatment group's WTP distribution exhibits first-order stochastic dominance over the control group. Up until the 80–100 BDT range, the control group sees larger increments, signifying a greater proportion of women at each lower valuation interval. The analysis reveals no significant difference in responses between women whose valuation of pads was above or below the market price.

Column (2) of Table 1 reveals a powerful behavioral impact of the

Table 1
Effect on valuation and adoption of menstrual products.

	(1)	(2)
	WTP sanitary napkins	Pick-up reusable underwear
Intervention	22.982**	0.099**
	(8.98)	(0.04)
Mean of dep. var	90.620	0.713
Observations	476	469

Notes: Column (1) reports interval regression estimates for WTP (in BDT) for sanitary napkins. Column (2) presents linear probability regression (OLS) results for the collection of underwear at the factory store from a male shopkeeper. *Mean of dep.var.* indicates the control group's results. Robust standard errors in parentheses. Stars denote significance levels: **p < 0.05.

[10] This effect is noteworthy, especially given the already high baseline WTP in our sample, which is 50–100% higher than the market price of pads. This might stem from several factors, including perceived quality differences in pads provided in the market compared to our study, the experimental framing of our WTP elicitation, and the unique financial autonomy provided to the women in our study compared to their typical household budgetary constraints.

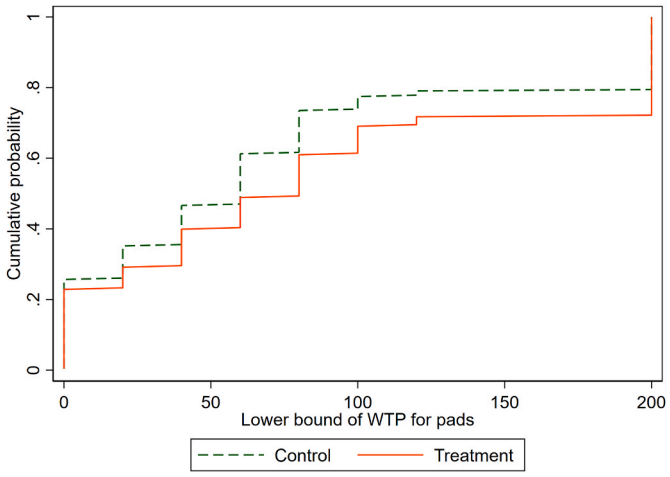

Fig. 1. Cumulative Distribution of the Willingness to Pay.
Notes: The figure shows the cumulative distribution function of the share of participants indicating each lower bound for the willingness to pay for sanitary pads. WTP was elicited in 20 BDT intervals, ranging from 0 to 120 BDT and at 200 BDT.

intervention. The treatment led to a 14% increase in the collection rates of antibacterial menstrual underwear. This increase in collection rates is both significant and sizeable, with about 71% of women in the control group and 81% in the treatment group picking up the product.

Fig. 2 graphically represents the proportion of women in the treatment and control groups who collected the underwear. The cumulative distribution function illustrates that the treatment group's collection rates were consistently higher than the control group's.

Our results are not driven by a specific combination of group characteristics or by some group discussions where the intervention was exceptionally effective. To substantiate this, we conduct additional analysis of group composition and treatment effects, detailed in subsection 8.2 on Robustness Checks. Our findings indicate that the precise composition and characteristics of the discussion groups do not play a pivotal role in determining the effectiveness of the treatment. Furthermore, we demonstrate the robustness of our results by excluding potential outliers (Table R3) and by incorporating enumerator fixed effects (Table R2).

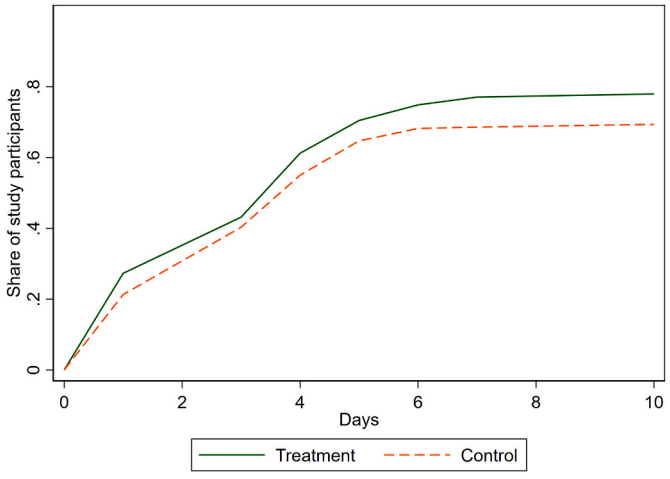

Fig. 2. Collection of underwear over time.
Notes: Proportion of participants in the treatment and control groups collecting the menstrual underwear at the factory store from a male shopkeeper. Availability period: 10th-19th June 2021.

5.2. Understanding the drivers: a reduction in purchase-related concerns

In this section, we explore the mechanisms driving the observed changes in product valuation and adoption. Specifically, our analysis seeks to differentiate between two key mechanisms: information transmission and stigma reduction. The first mechanism, information transmission, hypothesizes that the group discussions provided a platform for women to share knowledge about menstrual products, particularly sanitary napkins. This mechanism suggests that women who were previously unaware or had limited knowledge about the benefits and features of these products gained new information through peer interactions. This enhanced understanding, in turn, could lead to a higher expected utility from these menstrual products.

Conversely, the second mechanism, stigma reduction, posits that the discussions helped in breaking down the social barriers and stigmas associated with menstruation. This mechanism is grounded in the idea that open conversations can normalize the topic, reduce feelings of embarrassment or shame, and in turn, influence women's behaviors towards accessing period-specif products, especially in public or male-dominated spaces.

The information channel is a plausible explanation for the increase in valuation of disposable pads. Although all women in the factory know about the existence of disposable pads, those who use them regularly might have enhanced knowledge about their features, a level of understanding that women who exclusively use cloth may not possess and this information could flow from one to another in the discussions. In the case of menstrual underwear, an information channel explaining the differences in adoption rates is less plausible. None of the women had any prior knowledge of this product; it is a novel item they had neither seen nor used before. The underwear was only introduced and mentioned to the participants after the discussion sessions, meaning its features and attributes were not part of the discussion.

However, this argument alone cannot completely rule out an information channel. Participants might have acquired new information about menstruation in general, such as the negative health consequences of using unhygienic cloth, which may influence their decision to switch from cloth to other products. Given that the adoption of menstrual underwear presents a less clear avenue with limited scope for detecting information channels, we focus our analysis on the increased valuation of sanitary napkins and turn to the results of the discrete choice experiment.

5.2.1. Discrete choice experiment: a shift in attitudes towards public purchasing and male interactions

In our study, the discrete choice experiment plays a key role in quantitatively disentangling the multifaceted aspects of product valuation. Specifically, the DCE allows to independently measure three key dimensions: the role of the vendor's gender, the role of the public visibility of the purchase, and the intrinsic valuation of the menstrual products on itself. Our previous measure of willingness to pay inherently combined these factors, making it challenging to isolate the direct value of the product from the conditions under which it was purchased. The DCE, by providing exogenous variation in these attributes, enables us to parse out the individual contribution of each aspect to the overall product valuation. The DCE thus serves as a tool to test the hypotheses and theories of change outlined in Section 4. If we observe a change in the value attributed to shopkeeper gender and/or purchase location, this provides compelling evidence for hypothesis 1. If we observe a change in the value attributed to the product itself, this provides compelling evidence for hypothesis 2. If we observe a change in all three dimensions, then both 1 and 2 would be correct at the same time. Therefore, the DCE will allow us to determine if the intervention's impact was predominantly driven by alleviating social stigmas, fostering informational exchanges among participants, or a combination of both.

Table 2 presents the findings from the conditional logit model. In this model, the coefficients signify the change in the log odds of selecting a

Table 2
Discrete choice experiment - conditional logit model.

	(1)	(2)
	Utility level	
Location inside	−0.384***	−0.592***
	(0.09)	(0.14)
Male vendor	−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 vendor		0.590***
		(0.14)
Intervention*Price		0.023
		(0.02)
Observations	3,808	3,808
Participants	476	476

Notes. This table presents the results of a conditional logit regression analysis from a discrete choice experiment, focusing on the utility of sanitary pads. Column (1) displays the basic model, assessing the utility change associated with the product's location of collection (inside the factory vs. outside), the gender of the shopkeeper (male vs. female), and the price. Column (2) extends the model to include interaction effects between these attributes and the intervention. The dependent variable is the stated utility for each choice set, captured in a binary outcome (choice/non-choice) for each option. Standard errors, reported in parentheses and clustered at the individual level. Stars denote significance levels: *p < 0.10, **p < 0.05, ***p < 0.01.

particular option, which in our case relates to the utility derived from various conditions of menstrual product acquisition. The coefficients, while not directly interpretable in their magnitudes, provide essential insights through their signs and relative sizes. Column (1) shows that attributes like higher prices, male vendors, and less private collection locations are associated with a decrease in utility, with the effect being most substantial for the vendor's gender. This indicates a notable general aversion among participants to purchasing from male shopkeepers and in less private settings. Column (2) incorporates interaction terms with the treatment and reveals a significant shift in how participants in the treatment group derive utility from the specific conditions. The positive signs on the interaction terms with shopkeeper gender and purchase location suggest that the intervention has made these previously aversive conditions less so. Women in the treatment group derive a substantially lower disutility from collecting pads from a male shopkeeper in a more public location than women in the control group. In contrast, the treatment does not significantly alter the utility associated with the price. This means women in the treatment group are deriving the same amount of disutility from a higher price of the pads as women in the control group. They are not willing to pay a higher price for a pack of pads *per se*, when purchasing conditions are held constant.

To allow for better interpretation of the coefficients, in Table 3 we quantify the marginal willingness to pay for each attribute. This expresses the monetary value participants assign to avoiding specific purchasing conditions, i.e. the premium they are willing to pay in order to buy from a female vendor and a more private location. The willingness to pay to avoid male vendor or more public collection locations is substantially lower in the treatment group, by about 23% (from 10.44 to 8.04 BDT) and 62% (from 3.52 to 1.34 BDT) respectively. Women in the treatment group are therefore willing to pay a lower premium than women in the control group to buy pads from a woman or in a location that provides privacy.

Taken together, our evidence suggest that hypothesis 1 is the most plausible explanation for our results and that we can rule out hypothesis 2 as the main driver. Both parts of hypothesis 1 — reduced stigma associated with purchasing pads in public and from a male vendor — are affected by the discussion and seem to be mechanisms affecting our results, but we do not observe that the product is becoming more

Table 3
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 vendor	
- Control	10.442***
	(0.73)
- Treatment	8.024***
	(0.82)
Observations	3,808
Participants	476

Notes: This table presents the estimated WTP to avoid specific attributes in the purchase of menstrual products, measured in BDT. The WTP is calculated based on the results of a conditional logit model from a discrete choice experiment. The model evaluates the utility trade-offs associated with various attributes of the product's acquisition process, including the location of collection (inside the factory vs. outside) and the gender of the shopkeeper (male vs. female). The WTP estimates are derived by dividing the coefficients for 'location inside' and 'male shopkeeper' by the coefficient for 'price' from the conditional logit model. Standard errors, reported in parentheses, are clustered at the individual level. Stars denote significance levels: *p < 0.10, **p < 0.05, ***p < 0.01.

desirable *per se* after the discussion once we control for the social dimension of the purchase.

This analysis underscores a broader attitudinal shift facilitated by the intervention. The reduction in social apprehensions regarding the gender of the shopkeeper and the privacy of the transaction suggests a decline in stigma surrounding menstrual product purchases.

5.2.2. *Exploratory analysis: differential impact on women's valuation based on purchasing autonomy and baseline social dynamics*

This subsection focuses on the nuanced impacts of our intervention on distinct groups of women, differentiated by their initial menstrual product usage, purchasing habits, and baseline levels of stigma. Our objective is to offer exploratory insights that complement the results from the discrete choice experiment. Specifically, we focus on examining how the intervention affected differently the valuation women place on menstrual products depending on their autonomy in purchasing these products and their initial feelings surrounding menstrual health. Table 4 presents interval regression results for the willingness to pay for disposable pads, disaggregated by three distinct categories of participants. The first category, *Cloth Users*, includes those participants who exclusively use cloth as menstrual absorbents. The second category, *Pad Users who Do Not Buy Themselves*, comprises participants who use

Table 4
Willingness to pay by baseline use and access of menstrual absorbent.

	(1)	(2)	(3)
	Cloth User	Sanitary Napkin User	
		Do Not Buy Herself	Buy Herself
Intervention	26.22**	41.24***	5.38
	(10.62)	(11.23)	(14.41)
Mean dep. var	84.55	90.80	107.51
Observations	168	157	112

Notes: This table presents interval regression results for willingness to pay for sanitary napkins, split into three categories based on baseline product usage. Column (1) shows results for women who only use cloth as an absorbent at baseline, Column (2) for women who use pads but do not purchase them themselves, and Column (3) for women who both use and purchase pads themselves. The intervention coefficients, with robust standard errors in parentheses, measure the change in WTP due to the intervention. Mean dependent variable values indicate the average WTP in the control group for each category. Stars denote significance levels: *p < 0.10, **p < 0.05, ***p < 0.01.

sanitary napkins but report not purchasing them themselves. In the majority of these cases (81.47%), it is the husband who goes to the store to buy these products. The final category, *Pad Users who Buy Themselves*, consists of participants who not only use pads but also personally go to the store and make the purchase. This categorization enables an assessment of how the intervention's impact varies among women with different levels of exposure and autonomy in purchasing menstrual products.

Column (1) reports the results for *Cloth Users*. Post-intervention, this group shows an increased willingness to pay for sanitary napkins, suggesting a growing appreciation for a product they previously did not use. This shift in valuation among participants who previously did not use menstrual products does not conclusively support or discredit any of the hypotheses, as it could be influenced both by increased knowledge and awareness of the product and/or a reduction in the social stigma associated with its purchase.

The most insightful finding comes from comparing the results in Column (2) and (3). Both columns include women already using sanitary napkins, who are therefore familiar with their features and functionality. They differ only in the exposure they have had to the social aspects of purchasing the product, because women in column (2) do not buy the pads themselves, while women in column (3) do. It can be seen in Column (2) that for *Pad Users who Do Not Buy Themselves*, willigness to pay increases by 45% (41.24***) after the treatment compared to the control group mean. In contrast, for *Pad Users who Buy Themselves*, there is no significant change in valuation after the intervention. Since both groups are equally familiar with pads, the intervention's significant effect for women not buying pads themselves suggests that the reduction in social stigma around the purchase is a more plausible channel than changes in information, in line with Hypothesis 1 and in contrast to Hypothesis 2. The increase in valuation likely stems from either a direct normalization of the topic or an awareness that a significant portion of their colleagues personally purchase pads.

Finally, we examine survey metrics of social norms and stigma to gain deeper insights into the different treatment effects for subgroups of participants. These metrics provide additional suggestive evidence to support our findings. To assess social concerns, we used two key survey metrics: one measuring stigma levels and another eliciting second-order beliefs about the social appropriateness of *buying sanitary napkins from male vendors*. These metrics help us understand how our intervention might have affected our sample differently depending on their starting stigma and social norm perceptions.

First, in Table 5 Columns (2)–(4) we split the sample into terciles by their baseline level of stigma - measured as the number of statements expressing stigma they agreed to at baseline (out of four). We find that the increase in valuation is mainly driven by women with higher baseline levels of stigma. Participants with more intense feelings of shame about menstruation — seeing it as a matter to be hidden, regarding it as unclean, and expressing significant concern about others becoming aware of their menstrual status — are the ones who show the most pronounced increase in their willingness to pay for sanitary pads after participating in the discussion sessions. This pattern suggests that the open discussion had a meaningful impact in addressing the deeper layers of psychological and social discomfort associated with menstruation. For the participants in the high stigma tercile, the increase in willingness to pay is statistically significant at the 1% level and represents an increase of 67% compared to the control group mean. In contrast, for the low and middle terciles, the willigness to pay after treatment is not statistically significantly different from the control group, and the magnitude of increase is smaller, at 15% and 9% respectively.

Secondly, in Columns (5)–(6) of Table 5 we look at the effect of the intervention based on whether participants believed at baseline that others viewed purchasing pads from male vendors as socially appropriate versus socially inappropriate. Here, the differential responses based on women's baseline perceptions do not offer a clear direction. A stigma channel would suggest that the increase in valuation would be driven largely by those participants who believed that their peer group sanctions buying disposable pads from men as socially inappropriate. We observe in our data that actually both subgroups experienced an increase in valuation. Women who believed others viewed buying from male shopkeepers as socially inappropriate exhibited a notable, albeit marginal, increase of 21% in valuation compared to the control group. The increase in valuation among women who initially considered buying pads from men to be considered appropriate is of a larger magnitude (31%). Overall, the treatment was effective regardless of initial perceptions of social norms.

These last results should be interpreted within the context of their exploratory nature. They offer suggestive evidence on the interplay between social norms, stigma, and menstrual product valuation, but are not conclusive. The variations in responses, influenced by both stigma and social norm perceptions, highlight the complexity of these factors in shaping women's health-related decisions.

6. Discussion

This discussion section is dedicated to a critical examination of the nuances and complexities inherent to any attempts to disentangle the mechanisms underlying our observed effects, as well as an exploration into any spillover effects and the lasting impacts of this intervention.

It is important to acknowledge the inherent complexity in isolating the specific mechanisms behind the observed changes in our study. While our results suggest that the primary driver of these changes is a reduction in stigma and social concerns, we cannot categorically rule out the influence of an information channel. The intervention, designed to encourage open discussions about menstrual health, inherently blends informational exchange with stigma reduction. Providing information about menstrual health and products is intrinsically linked to the social stigma associated with these topics. In the absence of distinct treatment

Table 5
Willigness to pay by stigma and social norm baseline levels.

	(1)	(2)	(3)	(4)	(5)	(6)
		Terciles of Stigma			Buying Pads from Male Vendor	
	Full Sample	Low	Middle	High	Inappropriate	Appropriate
Intervention	22.98***	15.51	7.90	55.09***	17.28*	34.76**
	(6.34)	(14.04)	(14.87)	(18.87)	(10.05)	(17.70)
Mean dep. var	90.62	99.15	87.78	81.17	80.64	109.23
Observations	476	199	151	124	288	186

Notes: This table presents interval regression results for willingness to pay for sanitary napkins. The analysis is divided into subgroups based on terciles of the stigma index (Low, Middle, High) and perceptions of the social appropriateness of buying pads from male clerks (Inappropriate, Appropriate). Columns (2)–(4) present the results for the stigma index terciles, this index is derived from participants' agreement with statements about menstruation-related stigma, ranging from 0 (no agreement) to 4 (agreement with all statements). Columns (5)–(6) report the perceived social appropriatedness of buying from male clerks, the social norm measure reflects second-order beliefs and not own opinions. Robust standard errors are in parentheses. The mean dependent variable indicates the average WTP for the control in each subgroup. Stars denote significance levels: *p < 0.10, **p < 0.05, ***p < 0.01.

arms that could separately evaluate the effects of information provision and stigma reduction, our study could not completely disentangle these intertwined channels. This limitation highlights a key area for future research, where studies with a more segmented intervention design could offer deeper insights into the relative contributions of information dissemination and stigma alleviation in changing menstrual health practices and perceptions.

A second matter of particular interest in this discussion concerns the outcomes derived from the additional metrics included in the survey to assess changes in stigma and social norms. We presented participants with four scenarios exemplifying typical situations of stigma, and asked them to specify the number of scenarios they agreed with. For example, the scenarios include statements such as *"Women should hide any evidence of menstruation"* and *"I worry about stains or odor during menstruation, because others might realize I am menstruating"*.

In Table 6, we present the regression results derived from the measure of stigma, utilizing a difference-in-differences regression framework. The findings indicate that the intervention significantly reduced the perceived stigma associated with menstruation. Initially, women agreed on average with 1.8 out of 4 stigma-related statements. Post-treatment, this agreement dropped to approximately 0.9 in the treatment group, a significant change at the 1% level. Interestingly, we also noted a change in the control group, with an endline agreement of around 1.3.

The observed changes in the control group could stem from two primary factors. The first is the potential spillover effect from the treatment group to their peers in the factory, thereby influencing the control group as well. The second is an indirect effect caused by the factory management making menstrual underwear available in the factory, which might have normalized access to menstrual products and the overall stigma around menstruation.

To gain further insights into these dynamics, we capitalized on an opportunity six months post-intervention when our research partner conducted a follow-up survey on those study participants that had collected the underwear. This survey aimed to understand the usage and opinions of the participants regarding the products. We included in the follow-up survey a *pure control group* of 59 women who had not been part of the original survey.[11]

The first observation we made was regarding the menstrual absorbents used by the pure control group, which closely mirrored the baseline usage. Table 7 shows that approximately 60% of them use sanitary napkins, while 53% rely on cloth. This pattern of usage is statistically significantly different from that of the study participants at endline and similar to their baseline level. Consequently, we do not observe any direct spillover effect from the treated participants across the factory in terms of changes in the menstrual products women use.

Secondly, the levels of stigma and social norms (appropriatedness of buying pads from a male vendor) over time areare depicted in Fig. 3. The graphical depiction shows that the metrics for the pure-control group closely mirror the baseline values. This consistency offers another piece of suggestive evidence, pointing to the lack of widespread spillover effects from the treatment across the factory to the rest of the female garment workers. Therefore, a more likely explanation for the changes noted in the control group in Table 6 is the direct impact of the garment factory leadership's initiative to make menstrual products available within the factory store and notifying the women directly on their phone (due to the survey) of their availability. This move presumably shifted the women's perceptions about the social acceptability of obtaining these products.

As of January 2024, the outcomes of our research project are evidenced by the pick-up of over 4000 pairs of reusable underwear by women in the collaborating factories provided by the partner NGO. The factories, previously silent on the complexities of menstrual management, have adopted proactive measures to facilitate discussion on this topic. Regular announcements over the factory's loudspeakers now promote a culture of open dialogue about menstrual health, effectively challenging the stigma traditionally associated with menstruation. This strategic communication initiative has helped ensuring widespread awareness and understanding of menstrual health, thereby fostering a workplace environment that acknowledges and supports the menstrual well-being of its predominantly female workforce. This achievement reflects a crucial advancement in making menstrual health options more accessible and aligns with the aims of improving overall menstrual health management.

7. Conclusion

In this paper, we report findings from a field experiment involving 476 women in a garment factory. Our results demonstrate that engaging in open discussions about menstruation, a stigmatized topic, significantly enhances the expected utility of both familiar and innovative menstrual products. Participation in these dialogues led to a notable increase in the willingness to pay for sanitary pads, which needed to be collected from a male vendor in a public store. The average valuation increased by more than 25% (from approximately 91 BDT to about 113

Table 6
Perceived stigma levels.

	Stigma
Endline	−0.493***
	(0.09)
Intervention	0.008
	(0.11)
Endline*Intervention	−0.394***
	(0.13)
Mean of dep. var	1.758
Observations	475

Notes: Difference-in-differences estimation (OLS) of the treatment effect on perceived stigma. *Mean of dep. var* represents the control group mean before the discussion session. *Endline* is a dummy equal to 1 at endline and 0 at baseline. *Intervention* is a dummy equal to 1 if the respondent belongs to the treatment group and 0 to the control. Standard errors clustered at the individual level are reported in parentheses. Stars denote significance levels: *p < 0.10, **p < 0.05, ***p < 0.01.

Table 7
Reported material used at six-month follow-up.

	(1)	(2)	(3)	(4)	(5)
	Sample *(Share)*			Difference	
	Pure-control	Control	Treatment	T-Pure Control	T-Control
Cloth or fabric	0.53	0.23	0.22	−0.31**	−0.01
	(0.50)	(0.42)	(0.42)	(0.07)	(0.05)
Disposable pads	0.58	0.68	0.68	0.10	0.00
	(0.50)	(0.47)	(0.47)	(0.08)	(0.05)
Observations	59	150	141		

Notes. 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 denote significance levels: *p < 0.10, **p < 0.05, ***p < 0.01.

[11] These workers were randomly selected from a complete list of the remaining factory workers.

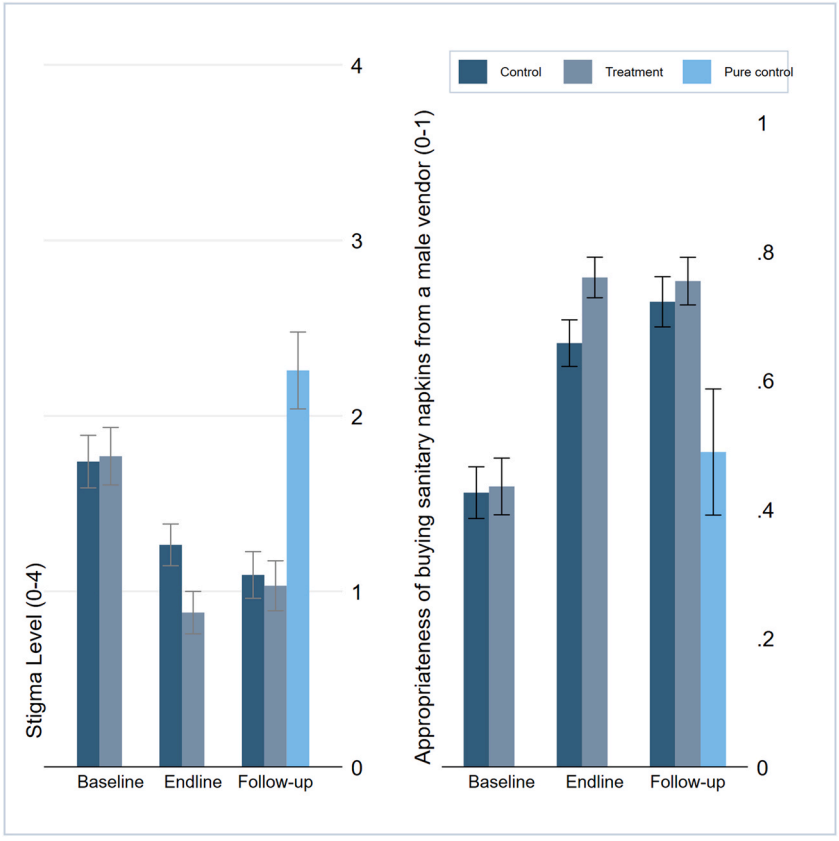

Fig. 3. Perceived Stigma and Social Norms over time.
Notes: The left panel shows the average stigma level for the treatment and control group and the pure control group at baseline, endline and the 6-month follow-up measured on a scale from 0 to 4. The right panel shows the perceived appropriateness of purchasing pads from a male vendor, on a scale from 0 (very socially inappropriate) to 1 (very socially appropriate). Error bars represent 95% confidence intervals.

BDT). Additionally, we observed an increase of around 14% in the take-up rates of the anti-bacterial menstrual underwear (from approximately 71% to about 81%).

We investigated two potential factors influencing the observed effects: an information channel and a stigma channel. The information channel hypothesized that group discussions enabled social learning, where women learned about the benefits of disposable pads from peers, thereby increasing product valuation. Conversely, the stigma reduction channel posited that open discussions about menstruation reduced perceived stigma and normalized the purchase of menstrual products. To discern between these channels, we conducted a discrete choice experiment focusing on product valuation and the impact of contextual factors like observability and vendor's gender. Our findings indicate that the stigma reduction channel was more influential. The treated participants showed less distaste about purchasing from male vendors or in less private settings, while the control group valued more privacy and female shopkeepers. Importantly, we observed no significant difference in the intrinsic value placed on the product itself between the groups. This implies that the primary effect of our intervention was reducing stigma-related concerns, rather than disseminating specific information about menstrual products.

This study offers important insights for policymakers. We propose an effective, light-touch intervention that capitalizes on women's own knowledge and their exchange of ideas and experiences, thereby eliminating the need for external skills or knowledge. We observed significant interest and eagerness among the women to actively engage in discussions and share their personal experiences. Our results suggest that the suboptimal equilibrium limiting women's opportunities to discuss menstruation is fragile and can be changed. This indicates a promising potential for large-scale implementation of such interventions, akin to recent initiatives by public practitioners. Efforts like those made by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), using social media and local influencers to reshape discussions around menstruation and destigmatize the topic in countries like Nepal, Albania, and the Philippines, could prove very effective. These approaches do not necessitate the involvement of every menstruator in a formal discussion group. Simple encouragements to openly discuss this topic and the provision of a safe space for doing so may be sufficient, potentially leading to significant positive impacts on the adoption of health- and productivity-enhancing technologies. Furthermore, our findings highlight that the male gender of vendors is a major barrier; thus, exploring alternative distribution channels that bypass this issue could be highly effective. Such options could include installing vending machines in women's restrooms or offering menstrual products in the factory's health center, a more private setting typically staffed by female nurses.

8. Robustness checks

This section summarizes a series of robustness checks designed to test the resilience of our primary results against different model specifications and assumptions. We first examine the effects of including a comprehensive set of control variables in our primary specifications. Such controls account for potential confounders that might otherwise bias our estimates. We then extend the analysis by considering the composition and characteristics of the discussion groups, which allows to explore whether and how group dynamics might influence the treatment effects observed. Lastly, we include the results for the reusable

underwear WTP. Thought this additional tests, we document that our estimated effects remain robust and unchanged.

8.1. Main specification with controls and enumerator FE

Table R1
Valuation with different type of controls.

	(1)	(2)	(3)	(4)
	Willigness to pay for sanitary napkins			
Intervention	22.32***	22.48*	23.49***	22.60*
	(6.36)	(8.94)	(8.93)	(8.96)
Demographic Controls	Yes	No	No	Yes
Behavior Controls	No	Yes	No	Yes
Stigma Controls	No	No	Yes	Yes
Observations	476	476	476	476

Notes: This table reports the interval regression coefficients of willingness to pay (in BDT) for disposable menstrual pads. The estimation is presented with four different set of controls according to baseline levels of the control variables: (1) Demographic controls (age, religion, years of educ, marital status, and number of children), (2) Menstruation-related variables (use of cloth, use of pads, pregnancy), (3) Stigma index and social norm from buying pads from a male vendor, and (4) All combined. Robust standard errors are shown in parentheses. Stars denote significance levels: *p < 0.10, **p < 0.05, ***p < 0.01.

Table R2
Willingness to pay and collection rates - enumerator fixed effects.

	(1)	(2)	(3)	(4)
	WTP pads		Pick-up rates	
Intervention	22.76**	21.72**	0.08**	0.10**
	(9.34)	(9.12)	(0.04)	(0.04)
Demographic Controls	Yes	Yes	Yes	Yes
Enumerator Fixed Effects	No	Yes	No	Yes
Observations	476	476	469	469

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. Stars denote significance levels: *p < 0.1, **p < 0.05, ***p < 0.01.

8.2. 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 check whether 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 level at baseline for each group. This allows 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 implementations.

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 R1 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 R1 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 R3. This does not

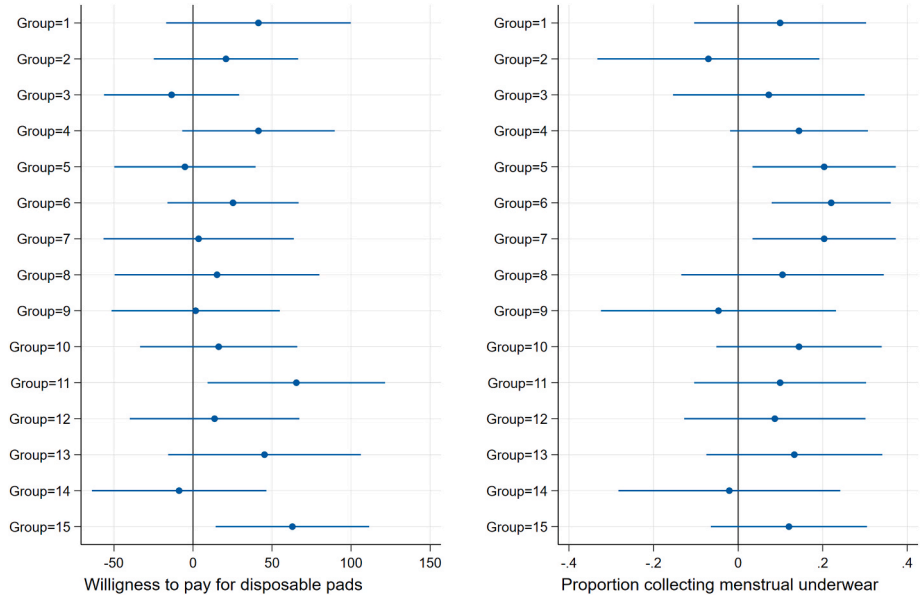

Figure R1. Treatment Effects by Discussion Group
Notes: The left panel plots the regression coefficients obtained from the interval regression of the WTP for sanitary pads on a set of 15 dummy variables indicating participation in the discussion groups (including demographic controls). The right panel plots the regression coefficients obtained from the linear probability regression of the collection probability on the same set of dummy variables. 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.

greatly change the magnitude of the treatment effects or the interpretation of our results.

Table R3
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)
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. Columns (3) and (4) report the linear probability of the collection of the underwear. 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. Stars denote significance levels: *p < 0.1, **p < 0.05, ***p < 0.01.

Looking at the composition of groups 11 and 15, 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. Table R4 provides a general overview of the average characteristics of each group in comparison to each other and the control group.

Table R4
Group summary characteristics.

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

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* reports the group average on perceived stigma, measured on a scale from 0 to 4 (being 0 the lowest level of perceived stigma).

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.

Table R5
Group composition effects.

	(1)	(2)
	WTP for pads	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. Stars denote significance levels: *p < 0.1, **p < 0.05, ***p < 0.01.

The results are shown in Table R5. 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 R2 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. This could indicate that the treatment is effective in the face of higher stigma levels and has more bite when women are initially constrained. The scatter plot in Figure R3 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 appears to be positively related with higher collection rates, the scatter plots in Figures R2 and R3 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.

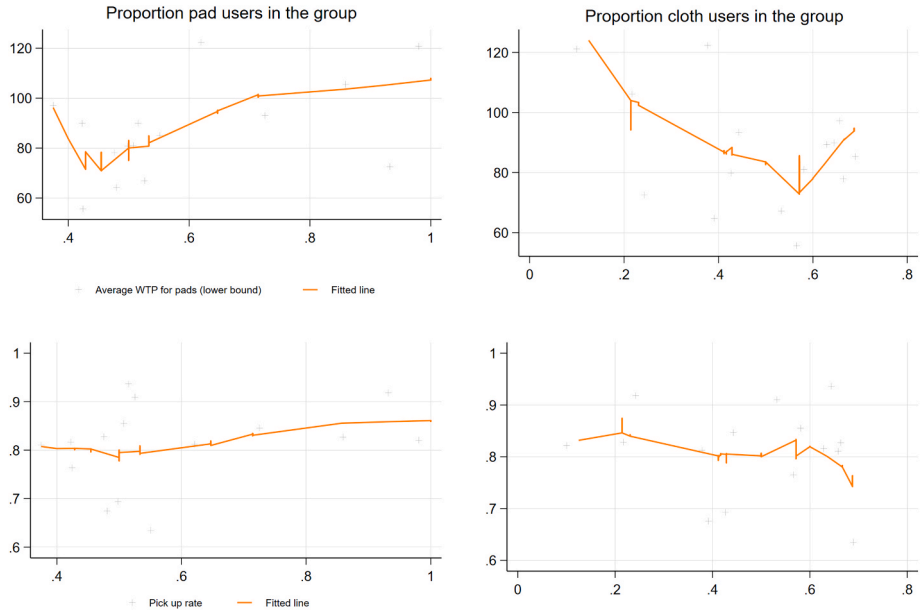

Figure R2. Relationship of the Share of Pad and Cloth Users and Group-Level Outcomes
Notes: The four plots show the average lower bound of the WTP (top panels) and average pickup rates (bottom panels) for each of the 15 discussion groups, plotted against the share of pad users in each group (left-hand 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.

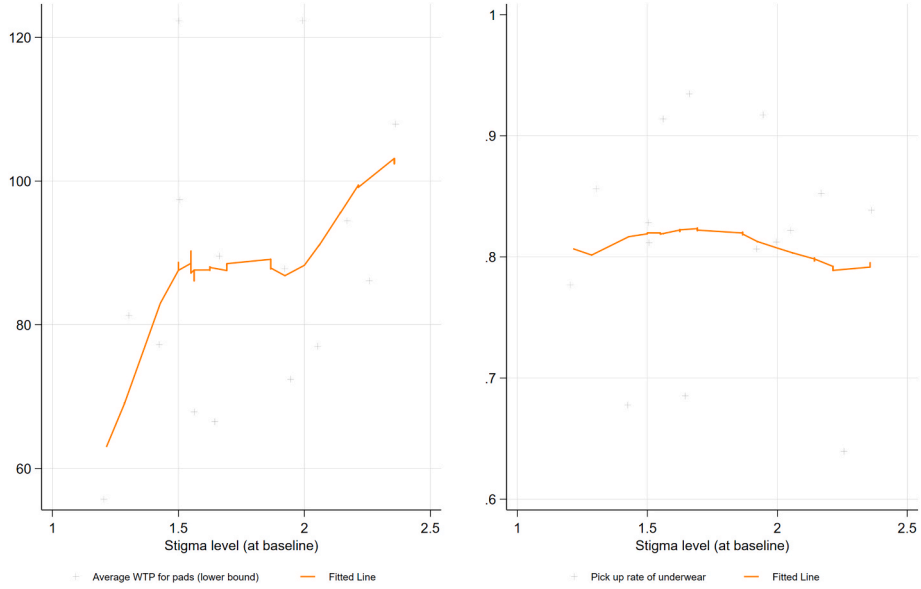

Figure R3. Relationship of Stigma and Group-Level Outcomes
Notes: The plots show the average lower bound of the WTP (left panel) and average pickup rates (right side panel) for each of the 15 discussion groups, plotted against the share of pad users in each group and the share of cloth users in each group. 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.

8.3. Willingness to pay for menstrual underwear

Table R6
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)
Mean Dep. Var	873.187	349.941	93.590	10.775
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. 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. Stars denote significance levels: **p < 0.05.

CRediT authorship contribution statement

Silvia Castro: Conceptualization, Data curation, Funding acquisition, Investigation, Software, Supervision, Validation, Visualization, Writing – review & editing. **Clarissa Mang:** Formal analysis, Project administration, Resources, Software, Writing – original draft.

Data availability

The data has been deposited at the LMU-ifo Economics & Business Data Center.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jdeveco.2024.103264.

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