

PRE-ANALYSIS PLAN

Restrictive social attitudes inhibiting the adoption of health technologies: Evidence from a Field Study in the Bangladeshi Garment Sector

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***Abstract.** Take-up of new technologies is often very slow, especially in developing countries. While the structure of social networks, information diffusion, and pricing of technologies have been investigated as potential causes, the role of restrictive social attitudes (stigma, social norms and taboos) limiting optimal technology adoption has so far only received scarce attention. Yet, especially in areas of health - such as mental health care, HIV testing and menstrual management - restrictive social attitudes seem to play an important role in limiting people in their adoption of beneficial new technologies. To get a better understanding about how stigma, norms and cultural taboos limit the take up and use of advanced health technologies, we look at the generally stigmatized topic of menstruation in Bangladesh. We conduct a field experiment in a Bangladeshi garment factory to reduce the perceived and experienced stigma, norms and taboos around menstruation by encouraging female factory workers to openly discuss and exchange personal experiences about menstruation in a safe space. We then determine the effect of the discussion on the willingness to pay for and pick-up rates of a new menstrual health technology, an anti-bacterial menstrual underwear.*

1. Study Design

Summary The aim of this field study is to empower the participating women to make socially unconstrained optimal choices about their menstrual hygiene management. In this field study, participants in the treatment group attend discussion sessions aimed at reducing the perceived stigma and cultural taboos surrounding menstruation. The effect of the intervention on take-up and valuation of a new menstrual hygiene product, an anti-bacterial reusable menstruation underwear, is then tested.

Procedure The study proceeds in four stages. First, a baseline survey is conducted via phone, collecting information on current menstrual practices and perceived restrictive social attitudes. Second, half of the participants are assigned to the treatment group. They participate in two interactive discussion groups, where they are guided by experienced facilitators to share their personal experiences regarding menstruation. Third, in a second

phone survey a new menstrual hygiene product, an anti-bacterial menstrual underwear, is introduced and the valuation of this product measured. Finally, most participants are offered to obtain this underwear for free and the pick-up rate is measured.

Treatment groups The study participants are divided into two groups. In the treatment group, participants receive an intervention, while in the control group they do not. The intervention consists of two discussion sessions, lasting around 1h each. Given the restrictions due to the ongoing pandemic, these sessions take place in a hybrid virtual and in-person format. Around 10 to 15 female workers from the garment factory come together in a room at their workplace for a discussion session on menstruation. The aim of this session is to allow the women to exchange their personal experiences with their menstruation and have a safe space to open up and discuss this topic with other women. The sessions are moderated by two professional trainers who join the session virtually via Zoom. Each woman visits 2 sessions about 7 to 10 days apart.

Primary outcome variables The two primary outcome variables in the study are: the willingness to pay for an anti-bacterial menstrual underwear and the pick-up rate of this menstrual underwear if it can be obtained for free from a male shopkeeper in a small store on the factory premises.

The willingness to pay for the menstrual underwear is elicited using a price list. The women are offered a choice between an amount of money or the underwear, which they can pick up from a male shopkeeper at the factory store. The amounts of money offered increase with each choice offered. The willingness to pay is taken to be the amount of money at which the women switch from preferring the underwear to preferring the money. The elicitation is incentivized by actually realizing the choice for a few randomly selected women. This means one of the price levels is picked at random for these women and whichever choice she made at that price level (underwear or money) is realized.

To measure the pick-up rate of the underwear, the majority of the participating women are told at the end of the survey that they can get the underwear for free at the factory store, which is run by a man. The worker ID and time of pick-up is recorded by the shopkeeper. This allows checking that only eligible women pick up the underwear and whether they came to pick it up by themselves or in groups. The proportion of women picking up the underwear in the treatment and control group as well as the individual probability that a women picks up the underwear are the outcome measures.

Secondary outcome variables The three secondary outcome variables in the study are: the willingness to pay for a pack of pads, the change in perceived restrictive social attitudes (social norms, stigma, and taboo) and the outcome of a discrete choice experiment indicating the demand for different characteristics of sanitary pads.

The willingness to pay for a pack of pads (that also needs to be picked up from the male shopkeeper of the factory store) is elicited in the same way as the willingness to pay for the underwear. Participants are given a price list with increasing prices and asked to make a choice between receiving the money and receiving the pack of pads. The switching point is taken as measure for their willingness to pay. The incentivizing mechanism is

identical to the one used for the elicitation of the willingness to pay for the underwear. For the selected women, one of the price levels is picked at random, and whichever choice the woman made at that price level (pads or money) is realized.

This measure is used as a sanity check in two ways: first, to ensure that the change in WTP for the underwear is not an artefact arising from e.g. the treatment group having discussed the underwear specifically, but instead that observed effects hold for all menstrual products and actually reflect a change in underlying attitudes toward menstrual products. Second, given that pads and the underwear are substitutes, it could be that some women prefer pads and so only their demand for pads increases (i.e. the treatment worked, but demand for the underwear is not increasing).

The change in perceived restrictive social attitudes is measured by asking a set of questions on perceived social norms, stigma and taboo both before and after the treatment and comparing the average values for the treatment and control groups. In the baseline survey, perceived social norms are elicited by asking the women 11 questions about their second-order beliefs which behavior other women find socially acceptable, which they answer on a 4-point scale. From this, an index is constructed to determine the perceived strictness of social norms surrounding menstruation generally by taking the average across all questions (a number between 1 and 4). Perceived stigma is elicited by showing the women four statements describing a feeling of being stigmatized during menstruation and asking them how many of the statements they agree to. This number, between 0 and 4, is used as indicator for the perceived stigma, with the women agreeing to more statements indicating that they have a stronger perception of stigma. Perceived taboo is elicited in a similar way, again showing four statements describing the taboo surrounding menstruation and asking the women how many of the statements they agree to. This number between 0 and 4 is taken as the measure of the perceived strictness of taboo, with the women agreeing to more statements indicating that they perceive the taboo as more strict. Both the taboo and stigma measures are based on and adjusted from Heard & Chrisler (1999) and Marván et al. (2005). In the outcome measurement survey, these questions and a subset of the social norm questions are repeated again to determine if the treatment has changed the average responses.

The final secondary outcome is the result of a hypothetical (stated preferences) discrete choice experiment. This method is used to obtain the relative importance of three characteristics of menstrual products: the location where it is purchased (on the factory premises or in a normal shop), its price, and whether it is bought from a male or female shopkeeper. This allows pinpointing the relative value of each of these aspects and will provide a specific measure of the restrictive social attitudes associated with having to obtain menstrual products in a public place observable by a man.

Primary Hypotheses The main objective of this study is to answer the question whether a reduction in the perceived restrictive social attitudes surrounding menstruation increases the willingness to obtain a beneficial new menstrual health technology. The expected channel is a reduction in the women's feeling of shame and their fear of stigma, empowering them to make the optimal choice even if it is publicly observable by men. The treatment should thus lift the social restrictions on optimal choices. Having to pick up the menstrual product from a *male* shopkeeper should be less of a problem for the

women in the treatment group. It is therefore expected that the treatment will increase the women's valuation (WTP) of a menstrual product that needs to be obtained in a public space (the factory store) from a man.

To evaluate this, two main hypotheses are tested:

- (1) Participating in discussion sessions about menstruation increases the willingness to pay for an anti-bacterial menstrual underwear that needs to be picked up from a *male* shopkeeper
- (2) Participating in discussion sessions about menstruation increases the likelihood to pick up a menstrual underwear from a *male* shopkeeper

Secondary Hypotheses The primary hypotheses are based on the assumption that participating in the two discussion sessions actually reduces the perceived stigma, norms and taboos. To evaluate this channel and shed some light on the specific effects the discussion session has on these constraints, the following secondary hypothesis is tested:

- (3) Participating in discussion sessions about menstruation reduces the perceived strictness of the social norms, stigma and taboos surrounding menstruation

To ensure that the outcomes are not merely artefactual, caused by the product under consideration being a novel and unfamiliar anti-bacterial underwear, it is also evaluated whether the treatment has the same effect on a substitute product that is already well-known and available in the market, namely sanitary pads. Thus an additional hypothesis to support the hypothesized channel is the following:

- (4) Participating in discussion sessions about menstruation increases the willingness to pay for a pack of sanitary pads that needs to be picked up from a *male* shopkeeper

Discrete Choice Experiment To understand in more detail the relative importance of different constraints on the women's demand for hygienic menstrual products, a discrete choice experiment is conducted. This allows comparing the importance of one of the most commonly quoted constraints, the budget constraint (price), to the importance of restrictive social attitudes (pick-up from a man) as well as the publicness of the location of purchase (factory store vs. external shop). *Ex ante* we do not take a stance on the expected sizes of effects found in the discrete choice experiment, but treat this as an exploratory analysis shedding new light on the relationship between restrictive social attitudes, price and location. We do, however, expect to see that there is a preference for pick-up from a woman over pick-up from a man.

Sample and Power The experimental study will be conducted with 450 female workers from a Bangladeshi garment factory. Half of them are randomly assigned to the treatment and half to the control group. This is the maximum number of workers the factory is willing to allow participation due to logistical reasons.

Based on a pilot study run in March 2020, the minimum detectable effect size in WTP for the underwear with 225 women in each treatment arm is expected to be around 15.61 BDT (or around 0.18\$), from a baseline WTP of 137.31 BDT (or 1.62\$) with a standard deviation of 58.98. So the minimum detectable effect size is a change in WTP of around 11% or 0.26 standard deviations. The minimum detectable effect size of the WTP for sanitary pads is expected to be very similar in size, though probably on a higher baseline level (since pads are already a well-known product, but the underwear is not). For the proportion of women picking up the underwear, the assumption was made that at baseline around 50-75% will pick up the underwear in the control group (since it is free). Based on this assumption, the minimum detectable effect size will be an increase in this share by 10 to 13 ppt, so going up to 63-85% of women picking it up in the treatment group.

Randomization The participating workers are randomly selected from all the female workers in the garment factory, excluding only trainees (who usually have very high turnover rates). Initially, a sample of 550 women is chosen to be called via phone for the baseline survey. This allows for several women not picking up the phone or not consenting to the study. The list of 550 women will be called and the baseline surveys are stopped once 450 surveys have been conducted. Given that randomization into the treatment and control group occurs only after the baseline surveys are completed, this does not threaten the internal validity of the study, as attrition or non-consenting prior to the randomization does not induce selection bias in the treatment groups.

Randomization into the treatment groups occurs after the baseline survey is completed on the individual level. Randomization is stratified on the menstrual material used at baseline, as elicited in the survey. Comparisons between the (average) individual characteristics of participants in the treatment and control groups are used to test that both groups are balanced across observables.

2. Planned Data Analysis

Outliers and excluded observations For the telephone baseline survey, a non-responding phone number will be called again a few days later. If the phone call is not answered for a second time, the corresponding individual will be dropped out of the sample. Out of a pool of 550 individuals, new individuals are surveyed until 450 surveys are completed. Anyone who does not complete the entire survey is excluded¹. For the experiment, an intention-to-treat design is used, such that anyone assigned to the treatment group is included in the analysis, even if they miss a discussion session. It will, however, be checked *ex post* whether women assigned to the treatment group actually received the treatment, i.e., whether they participated in all the discussion sessions (since their IDs are recorded). The average effect of treatment on the treated is examined as a robustness check. Any drop-outs in the treatment group and control group will be compared to rule out systematic attrition by treatment.

¹ This does not refer to individuals refusing to answer individual questions, but only those for whom completion of the survey is not possible e.g. because they drop out of the study during the survey

During the entire period of study, if there are participants who leave the factory for any reason and therefore cannot continue to participate in the study, a short follow-up (by call or text message) will be conducted to ensure the attrition is not biased.

Main specifications To determine the first main outcome of interest, the difference in the willingness to pay for the underwear between individuals in the control group and individuals in the treatment group due to the treatment, a linear OLS regression is used. The individual willingness to pay for an anti-bacterial menstrual underwear is regressed on a dummy variable indicating the treatment group (0 for control, 1 for treatment) and a set of control variables. The primary specification is therefore

$$y_i = \alpha_i + \beta_1 T_i + \gamma X_i + \varepsilon_i$$

where y_i is the individual willingness to pay in BDT for an anti-bacterial menstrual underwear, T_i is the treatment dummy, X_i is the vector of controls and ε_i is an error term. Robust standard errors are used. To evaluate hypothesis 1, the main outcome of interest will be a two-tailed t-test on β_1 to determine if it is greater than 0. In a robustness check, discussion group fixed effects are added as additional regressor G_i .

To illustrate the results, the average WTP for the treatment and control group will be plotted next to each other in a bar graph, as well as in a histogram showing the distribution of the WTP in both groups to determine if there are differences in the variance as well as the mean. The hypothesis suggests that a rightward shift in the histogram should occur with more mass on higher levels of willingness to pay in the treatment group.

The same specification is also used to evaluate if there was a change in the willingness to pay for sanitary pads. This will address hypotheses 4.

To determine whether there is a difference in the pick-up rate between individuals in the control group and individuals in the treatment group due to the treatment, a Pearson chi-squared test of independence is used to test the null-hypothesis that pick-up and treatment are independent. In addition, the total share of women in the treatment and the control group having picked up the underwear after 1 week and after 3 weeks is plotted in a bar chart and a t-test run to determine if the proportions are significantly different from each other.

To analyze the treatment effect at the individual level, a Probit model is used. The individual likelihood of pick-up is regressed on a dummy variable indicating the treatment group (0 for control, 1 for treatment), the menstrual material used most at baseline, discussion group fixed effects and a set of other control variables. The primary specification is therefore:

$$\Pr(\text{Pickup}_i = 1 | T_i, Z_i, G_i, \mathbf{X}_i) = \Phi(\delta_i + \vartheta_1 T_i + \vartheta_2 Z_i + \vartheta_3 G_i + \vartheta_4 \mathbf{X}_i)$$

where Pickup_i is a binary variable equal to 1 if the underwear was picked up within three weeks² after the treatment, T_i is the treatment dummy, Z_i is a binary variable equal to 1 if the woman indicated in the baseline survey that she frequently uses pads, G_i are group fixed effects, and \mathbf{X}_i is the vector of controls. The regression will first be run with only the treatment dummy T_i as independent variable, and then controls are subsequently added. These results will be presented in a regression table with the coefficients obtained from the different specifications next to each other.

Additionally, a linear probability model with heteroskedasticity robust standard errors will be run as robustness check, using the following specification:

$$\text{Pickup}_i = \alpha_i + \vartheta_1 T_i + \vartheta_2 Z_i + \vartheta_3 G_i + \vartheta_4 \mathbf{X}_i + \zeta_i$$

where Pickup_i is the binary variable equal to 1 if the underwear was picked up within 3 weeks after treatment and 0 otherwise, and ζ_i is the error term. All other variable are as defined above.

To analyze any differences between treatment and control both in the probability of a woman picking up the underwear as well as in the timing when she will pick it up, the results are visualized graphically using a cumulative density function. This will show the cumulative share of women having picked up the underwear for each day after the underwear was made available. It is expected to observe the cdf of the treatment group to lie to the left of the cdf for the control group, indicating that a larger share of women pick up the underwear relatively earlier. Given that the intervention aims at reducing the barriers women face in choosing menstrual products and that the effect is expected to slowly spread through the community, we expect that, as time progresses, also a large majority of the women in the control group will have picked up the underwear, but that it takes them longer to do so.

The analyses described above will provide an answer to hypothesis 2. In addition, the exact time of day when the underwear was picked up by each woman is recorded. This indicates whether the women came in groups or alone, which provides further insights into the behavior of women and whether they talk to each other about the product.

To evaluate hypothesis 3, a differences-in-differences model is used to measure the change in levels of perceived stigma, social norms and taboo before and after the treatment for the treatment and control groups. The specification is the following:

² It is planned that all women in the factory will receive the underwear as of May 28 (World Menstrual Health Day), such that the observation period of pick-up will be truncated on that day. Depending on the exact date the intervention finishes, this will determine the exact length of the observation period.

$$y_i = \alpha_i + \beta_1 T_i + \beta_2 post_i + \beta_3 (T_i \times post_i)$$

where y_i refers to the measure for stigma, norms and taboo, respectively. For stigma and taboo, this is a categorical variable with a value between 0 and 4, for social norms this is a continuous variable between 1 and 4. T_i refers to the treatment dummy, $post_i$ refers to a dummy that equals 1 in the outcome measurement survey and 0 at baseline and $(T_i \times post_i)$ is the interaction effect. The coefficient β_3 is the variable of interest, as it shows whether participants react differently in the outcome measurement survey after having had the treatment compared to the control group. To visualize this result, the differences between the average before and after the treatment are plotted as separate bar graphs for each measure, with one bar each for the treatment and control group.

As robustness check, given that a total of 4 hypotheses are to be tested as described above, standard errors will be adjusted for multiple hypothesis testing using family-wise error rate (FWER) procedures and reported alongside conventional, unadjusted standard errors for comparison.

Control variables In all regression specifications described above, a vector of control variables X_i is included. This vector consists of several covariates including age, marital status, pad use at baseline, religion, education, and number of sons and daughters.

Secondary analyses

Discrete Choice Experiment To better understand the relative importance of the examined restrictive social attitudes compared to a budget constraint, an exploratory analysis using a discrete choice experiment of stated preferences is undertaken.

Three characteristics of a menstrual product, sanitary pads, with several dimensions each are included in the discrete choice experiment: location of purchase (at the factory/ in an external shop), price levels, and gender of the shop keeper (purchasing it from a male shopkeeper/ from a female shopkeeper). The women are presented with consecutive choices, always between two bundles of these dimensions and are asked which they would prefer. Their answers are then used to determine the relative utility derived from each characteristic.

Since a full factorial design will not be feasible, the choice set is constructed as a D-optimal fractional factorial design that is both orthogonal and balanced, following e.g. Mangham et al. (2009).

The results of the discrete choice experiment are analyzed using a conditional logit regression model. Pick-up location and gender of the shopkeeper are included as binary dummy variables, whereas price is included as continuous variable, in order to allow the estimation of the willingness to pay for each of the categorical characteristics. Utility is therefore given by:

$$U_{ij} = \beta_1 L_j + \beta_2 N_j + \beta_3 P_j + \varepsilon_{ij}$$

where L_j is a dummy variable for the location, taking the value 1 for purchase in the factory store and 0 otherwise, N_j is a dummy variable taking the value 1 for pick-up from a man and 0 for a woman, and P_j is the continuous price variable.

Heterogeneity To determine whether the treatment works differently for women who are at baseline already quite liberal toward menstruation and see the prevalent social attitudes as less restrictive, the sample is split into “above median” and “below median” groups on the three dimensions, perceived stigma, perceived social norms and perceived taboos at baseline. Dummy variables are created for each woman indicating whether her measure of perceived stigma, norms and taboos are above or below median. These dummy variables are then interacted with the treatment and these interaction terms added to the main specification described above. In a regression table, the coefficients with and without these interaction terms are compared side-by-side, which allows conclusions to be drawn about the relative importance of these dimensions in determining the treatment effect.

Sanity checks A few of the questions testing the women’s knowledge about menstruation are repeated in the outcome measure survey after the treatment. This allows ruling out the explanation that it has mainly been information updating or new knowledge that led to a change in behavior.

Additionally, a short priming experiment is included at the end of the baseline survey. The women are primed either on stigma, social norms or taboos by two channels: first, the order of the questions measuring these three aspects is varied such that the last section included in the survey is one of these three. In addition, four additional statements are added to the end, emphasizing either stigma, norms or taboos again (always the same as was the last section in the survey). The women are then asked to make a decision in the style of a dictator game, where they can divide 10 BDT between themselves and supporting an organization that promotes education of boys and girls on the topic of menstruation. A control group does not receive the additional priming statements. The aim of this section is to determine whether priming stigma, norms or taboos explicitly has a differential effect on the women’s willingness to contribute to an organization explicitly addressing both boys and girls in their menstrual education campaigns. This should provide some further information about which of the three channels is the most restrictive. In addition, randomizing the order of these three sections removes any anchoring or consistency biases.

Any further analyses not described above will be marked as exploratory in the final paper.

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