Menstrual Stigma and Girls' Outcomes: An RCT Intervention among Schoolgirls in Nigeria

Pre-Analysis Plan

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Abstract

Menstruation poses a challenge to girls in low and middle-income countries. However, little is known about psychosocial constraints facing girls' menstrual experience and the resulting impact. In this study, we propose a Randomised Control Trial (RCT) targeting 880 schoolgirls in Nigeria. Through the RCT intervention, we intend to unpack the economic, knowledge, and psychosocial constraints facing schoolgirls of menstruation age. The intervention proposes three treatments varying exposure to free pad distribution & information, anti-stigma training, and belief correction. Results will reveal whether treatment improves girls' well-being, menstrual-related behaviour, academic outcomes, and socio-emotional skills.

JEL Classification: 112, O15, D91, J13, J24

Keywords: Education, Gender, Health, Menstrual Hygiene, MHM, Stigma

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1 Introduction

Menstruation is a natural and healthy life experience.¹ However, in certain societies, mostly in developing countries, women face restrictive norms and practices surrounding the experience of menstruation. These include: avoidance behaviour or secrecy in communication, prohibition from visiting worship places, restriction on movement during menstruation, or stigmatization. These constraints can affect women, and especially girls, negatively by worsening their mental health and wellbeing, by preventing them from receiving proper information or support to improve their menstrual health and hygiene, and by affecting their scholastic attendance or achievements.

The majority of the existing studies on menstrual health focus on addressing the monetary and knowledge constraints faced by females of menstruation age. The argument behind these studies is that the absence of budget for purchasing sanitary kits and the lack of knowledge on menstrual health and hygiene affect the welfare of menstruating females. Besides studies on adult women in developing countries (Czura et al. 2024), the recent focus has shifted towards adolescent girls who have limited experience with menstruation. For instance, Oster and Thornton (2011) offer menstrual cups for menstrual health management (MHM) to schoolgirls in Nepal in a randomised intervention studying menstruation and school attendance. The authors find that the intervention does not improve school outcomes measured through attendance. A related randomised intervention by Benshaul-Tolonen et al. (2021) in Kenya finds null effects for school attendance but some positive impact on subjective well-being. To the contrary, Agarwal et al. (2022) find that a government programme that provides sanitary pads to schools in India increases examination scores and reduces school dropout among girls in treatment schools. The scarce literature on the effect of providing MHM kits is mixed.

The problems facing healthy menstruation go beyond budgetary and knowledge issues. Other problems such as culturally restricting beliefs surrounding menstruation (Czura & Castro 2025) constitute a third and important challenge: psychosocial constraints. By psychosocial constraints we refer to those social expectations that negatively affect the mind and behaviour of individuals. These can be identified through individual-level emotions, beliefs and behaviour. One typical expression of these psychosocial constraints is stigma, which combines 'labelling' specific persons with a differentiating mark *and* devaluating them, including stereotyping and power asymmetry (Andersen et al. 2022; Arboleda-Flórez 2002).

More recently, menstrual health interventions have been designed to address these psychosocial constraints. Castro and Mang (2022) find that group discussions improves women's willingness to purchase menstrual products from male shopkeepers in rural Bangladesh. The study also finds that women exposed to these discussions update their beliefs surrounding menstrual norms towards less restrictive ones. In another study in rural Madagascar, Macours et al. (2024) find that training selected school girls ("young leaders") to speak openly about menstruation reduces menstrual stigma, and increases the willingness to speak about menstruation among other girls in the treated schools. However, the study also records an increase in bullying in treatment schools and reduced academic performance, particularly among the girls who were trained and

¹ Menstruation is defined as the monthly flow of blood and tissue that is experienced by females starting around the ages of 12 to 16 and ending at menopause.

exposed. There remains much to be understood on the role of interventions that aim to address psychosocial constraints surrounding menstrual health. Specifically, there seem to be two possible consequences of psychosocial constraints, or stigma (Arboleda-Flórez 2002): *self-restraint* as a response to internal forces from self-stigma (e.g., shying away from specific aspirations), vs. *publicity avoidance* as a response to external forces from public-stigma (e.g., avoiding talking about menstruation in public).

In our study, we design a menstrual health intervention among secondary school girls in Nigeria that jointly addresses psychosocial, budgetary and information constraints. We carefully disentangle the separate effects on a wide range of outcomes: behavioural outcomes and wellbeing, as well as academic and socioemotional outcomes. The randomized intervention comprises three treatment arms and a control:

Treatment 1: Base: offers free disposable pads, and MHM information

Treatment 2: Base plus anti-stigma: offers free disposable pads, MHM information plus an anti-stigma training

Treatment 3: Base plus anti-stigma plus norms: offers free disposable pads, MHM information, an anti-stigma training *plus* a norm correction

Control: offers free sanitary kits at the end of the study (delayed treatment).

The longitudinal RCT contains three waves of data collection at the individual schoolgirl level: t_0 is the baseline, t_1 is measured shortly after the intervention, t_2 is measured 2-4 months after the intervention.

2 Experimental Design

In collaboration with *Girls Count Initiative* – a women-focused, registered non-profit organization in Nigeria – we plan to implement a randomised menstrual health intervention (RCT) targeting 880 girls across 60 schools in Ibadan, Nigeria. The pool of schools comprises of both mixed and single sex public schools located in two urban and three peri-urban local government areas of Ibadan, Oyo state. In mixed schools, all interventions / data collections will take place exclusively for girls only. The experiment comprises the following three treatment groups and one control group:

Treatment 1 (T1 Base): Taking place across 15 schools, this treatment will offer free disposable pads and MHM information. The sanitary pads comprise up to three packs of sanitary pads for personal use that will last for up to three months. The MHM information intervention entails a 30 to 40-minute training on menstrual health and hygiene. This training explains the concept of menstruation to girls and teaches them how to manage blood flow and keep themselves clean and healthy during menstruation. We anticipate that these interventions will lift the (short-run) budget and knowledge constraints facing girls during menstruation. This treatment overcomes the budgetary and informational constraints.

Treatment 2 (T2 Base plus anti-stigma): This group comprises 15 schools; participants will be offered free disposable pads, MHM information (like in *T1*) plus an additional anti-stigma

training. The anti-stigma training is a facilitator-led workshop that identifies the local and cultural roots of period stigma in the immediate environment where the participants are situated. The anti-stigma training is a 30 to 40 minutes facilitator-led and interactive workshop that allows girls to talk about the local and cultural roots, causes, and consequences of menstrual stigma. It encourages girls to be vulnerable and to open up on their challenges and experiences during menstruation. The instructor is trained to provide a listening ear to each participant and is encouraged to share her own experiences navigating through menstruation when they were younger. All facilitators are specifically trained by a local youth counselling psychologist. All facilitators (trainers) are women who are fluent in English and the local language(s). We expect that the anti-stigma training will address internal menstrual-related stigma and fear. This treatment overcomes the budgetary and informational constraints as well as psychosocial constraints emerging from *self-restraint*.

Treatment 3 (T3 Base plus anti-stigma plus norm correction): Taking place across 15 schools, participants will be offered free disposable pads, MHM information, anti-stigma training (like in **T2**) plus a norm correction. The norm correction aims at confronting girls' personal attitudes and second-order beliefs (descriptive norms among their peers) during the data collection in t_2 with the true level of attitudes measured in t_1 . During the interview process of t_2 we reveal to girls the true fraction of their peers that endorse open communication on menstruation and other possible behaviours during menstruation, before we ask again about their personal attitudes and behaviours. Hence, we test whether the correction of possibly misperceived public norms will significantly address attitudes regarding menstruation and stigma any differently than in the treatment arm **T2**. This treatment overcomes the budgetary, informational and psychosocial constraints, and correct possibly misperceived social norms. Therefore, **T3** aims at addressing both *self-restraint* and *publicity avoidance*.

Control: offers free sanitary kits at the end of the study.

2.1 Study Implementation

2.1.1 Sampling and Study Intervention

The study will take place across 60 schools using a stratified random sampling approach. A list of schools in two urban and three peri-urban communities in the study location will be compiled and an equal number of schools will be selected at random across each community strata. After the selection of eligible schools, randomization into three treatment and control groups will happen in each stratum. Treatment will take place at the school level, while a representative sample of schoolgirls will be selected to participate in the survey. Schoolgirls will be selected from grades SS1, SS2, and SS3 with a focus on girls aged 14-18. Girls outside this range will be included if they are enrolled in the relevant school grades.

Based on a survey of related literature, a total sample of 650 (i.e. 163 per cluster) can detect a 10% change in school attendance, and physical and emotional well-being from comparable interventions. Anticipating attrition, we target a sample of 880 (i.e. 220, in each of the three treatments and the control group).

The surveys will be collected by a professional local research company. The company will use only female interviewers for their fieldwork. All interviewers are fluent in English and the local language(s). While the survey will be conducted in English, interviewers will help with local languages should language problems arise. All interviewers are trained using the original survey instruments and are thoroughly instructed on the sensitivity of the topic. After the training, a pilot will be conducted with 30 girls to test proper survey flow, good understanding of questions, and survey duration. Interviewers are encouraged to give feedback on the survey after the pilot.

2.1.2 Consent and Distribution of Period Trackers

All schools will be ex-ante contacted to consent to the participation in the intervention and data collection. Once schools have consented, selected participants will receive consent letters for their parents, and will only be admitted into the study following their parent's written confirmation. Following this, participants will receive period trackers. Trackers will help participants track the date and length of their monthly flows and also note any challenges encountered during their monthly cycles. Period trackers have been developed together with the *Girls Count Initiative* to produce a reliable, pretty, adolescent friendly paper-and-pencil tracker. Girls receive the tracker for free as a gift.

2.1.3 Baseline survey

Trained interviewers will be hired to carry out a baseline survey at t_0 , which will be held before the start of the intervention. The baseline survey will collect data on students' sociodemographics, parental and household characteristics, work experience and school attendance, knowledge about menstruation, menstrual experience, availability and rating of school toilet, academic and career aspirations, personality traits, personal attitudes to menstruation, secondorder beliefs (norms) about menstruation, experiences of stigmatization, personal well-being, time and risk preferences, demand for information and cognition.

2.1.4 Intervention

The intervention will be implemented by *Girls Count Initiative* – a non-profit organization based in Ibadan Nigeria. Details on the intervention can be found in section 2 of the proposal. The intervention was jointly designed by the research team, a local psychologist and *Girls Count Initiative*. Focus group discussions were used to assure cultural appropriateness. The NGO conducts specific trainings for their workshop facilitators, who are exclusively female.

2.1.5 Post-Intervention survey

Shortly (about one to two weeks) after the intervention a post-intervention survey will be administered at t_1 to test the short-term change in most study outcomes. Interviewers will also take records of menstrual trackers. At this stage, girls will also receive some monetary compensation for their participation (2000 Nigerian naira), part of which they can voluntarily donate to a girl-focused NGO.

The timeline of the RCT is depicted in Fig. 1.



Figure 1: RCT timeline

2.1.6 Follow-up survey/Academic tests/School data

Two to four months after the intervention (t_2) we will administer a follow up survey, in which we measure medium-run changes in study outcomes. In addition to the standard outcomes, participants will take a standardised test measuring their fluency in English and Mathematics. Interviewers will also take records of menstrual trackers. Data on students' school attendance and academic performance will also be collected from official school records, whenever possible.

3 Data: Outcome measurement

We report a list of outcome variables and explain how the various outcomes will be measured.

3.1 Primary Outcomes:

Wellbeing Outcomes:

Menstrual Stigma: an index calculated based on a girl's responses to a set of four questions about their experience of stigma during menstruation. The questions refer to personal insult experience, avoidance behaviour, or shame. Girls can answer whether they "never", "once in a while", "sometime", "often", or "always" make these experiences.

Subjective Wellbeing: Self-reported well-being scores during last menstruation. Adopted from the WHO-5 well-being index for mental well-being. Also used in Laajaj & Macours (2021).

Personal beliefs: Girls report their personal beliefs about menstruation by answering to three questions between "strongly disagree", "disagree", "uncertain", "agree", and "strongly agree": "Girls should be able to discuss menstruation openly"; "Girls should hide the fact that they are on their periods when they are at school"; "Boys should be allowed to laugh about things related to menstruation". We construct several binary measures for these separate questions taking the value of one

- if girls "strongly agree" or "agree", zero otherwise;
- if girls "strongly agree", zero otherwise;
- if girls "strongly disagree" or "disagree", zero otherwise;
- if girls "strongly disagree", zero otherwise.

We also construct an index from the three questions where answers are summed up according to the following scheme: "strongly disagree = -2", "disagree = -1", "uncertain = 0", "agree = +1", and "strongly agree = +2"

Social norms: Girls are confronted with the same three statements as in personal beliefs and are asked to state how many girls in their class will agree. The instructions are the following: "Here are ten stones representing ten girls in your class. Please, pick some of these stones to represent the number of girls in your class who you feel will agree with the following statements that I am about to read out. The number you leave behind in the bunch represents those that you think will disagree with the statements. For example: if you pick three stones, then it means 3 girls out of ten agree. So, how many girls out of ten (10) in your class will agree with each of these statements?" The resulting number of stones picked by the girls are the second-order beliefs.

Assumed agreement among the girls ranges from 0 (zero stones picked) to 100% (ten stones picked).

Behavioural Outcomes:

Pad Adoption: self-reported pad usage at t_1 / t_2 . Binary response, '1' if individual has used the pads distributed during the intervention and '0' if otherwise. We can also compute dummies for changes in behaviour in pad use, as we collect information on pad use (MHM) in t_0 .

Avoidance behaviour: an index calculated based on a girl's responses to a set of five questions about their avoidance behaviour during menstruation. The questions refer to drying underwear in the sun, avoiding places of worship, speaking to mother, speaking to father, household chores, especially cooking. Girls can answer whether they "never", "once in a while", "sometime", "often", or "always" behave in a certain way.

Demand for private information: interviewers show girls two envelopes with different titles "How Z affects school activities" (Z can be "malaria" or "menstruation") and ask "Which of the two questions would you like to learn more about?" Girls can pick and open the envelope of their choice thus revealing their demand for private information. Binary response, '1' if individual has picked menstruation topic, '0' if otherwise.

Demand for public information: interviewers show girls two envelopes with different titles "Video on Z" (Z can be "malaria fever" or "menstrual pain") and ask "Which of the 2 videos would you suggest we show the class?" Girls can pick the envelope of their choice thus revealing their demand for public information. Binary response, '1' if individual has picked menstruation topic, '0' if otherwise.

Willingness to speak: using the same two envelopes, girls are asked "Which of these two topics would you like to speak about in front of your class?" Girls can pick the envelope of their choice thus revealing their willingness to speak openly. Binary response, '1' if individual has picked menstruation topic, '0' if otherwise.

Speaking with Others: Girls mark the number of times they spoke with a parent, teacher or friend about menstruation in their menstruation tracker. They also indicate P, T or F for speaking with a parent, teacher or friend respectively. We can use this information to measure binary outcomes (whether spoken about menstruation in the last episode) or continuous measure (intensity of speaking).

Prosocial Behaviour: Girls will be asked in t_1 how much money they are willing to donate (to a girl-focused non-profit organization) from a flat participation compensation of 2000 Nigerian naira. The outcome is measured between 0 and 2000 naira. Since girls receive the remainder of the 2000 Nigerian naira, this question is financially incentivized.

Academic Outcomes:

School Attendance: Self-reported number of school days that the student was absent from school in the given school term (past 3-4 months). The relatively short recall period (since start of the school year) will reduce recall bias. If allowed, we will verify self-reported school attendance from the official records of the school. School attendance has been used by several related studies to measure students' academics.

Cognition span test: Girls are asked to repeat numerical numbers with increasing length. Starting from four to 12 digits, we measure how many digits the girls can reproduce correctly after the interviewers read them out once. Cognitive span is the number of correctly reproduced numericals.

Maths test scores in t₂: We define maths test scores as individual students' scores (percentage) from an administered maths test. Maths is a key subject in schools in Nigeria and the world and has been used in several instances to measure academic achievement. The test will be prepared to reflect the current lessons received by the students at the time of the study. The test contains a large number of math problems with increasing level of difficulty, which the girls will subsequently work on in a fixed period of time. The test score is computed as the number of correctly solved maths problems. We can also evaluate the number of attempted (correct and incorrect) maths problems.

English test scores in t_2 : We define English test scores as individual students' scores (percentage) from an administered maths test. English is the language of instruction in Nigeria and is also the official language of the country. A good knowledge of English shows good academic ability. The test will be prepared to reflect the current lessons received by the students at the time of the study. The test contains a large number of English language problems with increasing level of difficulty, which the girls will subsequently work on in a fixed period of time. The test score is computed as the number of correctly solved English language problems. We can also evaluate the number of attempted (correct and incorrect) English language problems.

3.2 Secondary Outcomes

Academic Outcomes

Learning Effort: Teacher's rating of students' motivation to participate in classroom learning on a scale of '1' to '5'. Where '1' is very poor and '5' is excellent. This measure takes into recognition students' completion of assignments, and participation in the class.

Academic aspirations: Academic aspirations are based on students' responses to questions on their academic goals. Students report (i) their personal academic aspirations, (ii) their parents' aspiration for them and (iii) an assessment of what they think they can realistically achieve. Students choose one out of four possible responses: completing the present class, completing senior secondary school, completing higher education and completing postgraduate education. Outcomes can be measures as answers from single questions or from an index of the three questions.

Career aspirations: Students report which career (job/occupation) they personally aspire when they are grown up. Students also report which career their parents aspire for them. Personal career aspirations can be possibly used as predictor for academic achievements. Divergence between personal and parental aspirations can capture traditional gender roles in the household or personal independence.

Socioemotional Outcomes

Conscientiousness: individual ratings of conscientious attitude. Responses are on a scale of 1 to 5, where 1= Strongly Disagree and 5= Strongly Agree. This instrument is one of the popular Big Five personal traits (Fiske, 1995) and has been used in Laajaj & Macours (2021).

Neuroticism: individual ratings of neurotic attitude. Responses are on a scale of 1 to 5, where 1= Strongly Disagree and 5= Strongly Agree. This instrument is one of the popular Big Five personal traits (Fiske, 1995) and has been used in Laajaj & Macours (2021).

Openness: individual ratings of open behaviour. Responses are on a scale of 1 to 5, where 1 = Strongly Disagree and 5 = Strongly Agree. This instrument is one of the popular Big Five personal traits (Fiske, 1995) and has been used in Laajaj & Macours (2021).

Extraversion: individual self-ratings of extraversion. Responses are on a scale of 1 to 5, where 1= Strongly Disagree and 5= Strongly Agree. This instrument is one of the popular Big Five personal traits (Fiske, 1995) and has been used in Laajaj & Macours (2021).

Agreeableness: Self-rated agreeableness. Responses are on a scale of 1 to 5, where 1= Strongly Disagree and 5= Strongly Agree. This instrument is one of the popular Big Five personal traits (Fiske, 1995) and has been used in Laajaj & Macours (2021).

Locus of control: individual rating of how much they feel in control of their lives. Responses are on a scale of 1 to 5, where 1= Strongly Disagree and 5= Strongly Agree. This instrument is abridged from Laajaj & Macours (2021)

Risk Aversion: an index computed from girls' responses to a "coin toss game" (albeit played with little cards) on how much money they are willing to gamble. Girls can choose their favourite lottery among five games. The lotteries are ordered with increased risk levels. We measure the chosen lottery as a measure of willingness to take risks. Girls can indeed throw the card and see their outcome. Payoffs are hypothetical.

Patience: an index computed from participant's responses on a hypothetical question about how much money they are willing to defer so they can receive more in the future. The question is formulated like a multiple price-list where girls can either "receive a payment of 1000 naira now, or *Y* naira in one month", where $Y = \{900; 1100; 1300; 1500; 2000; 2500\}$. We compute the switching point to derive the discount factor of the respondents. We always take the first (i.e., lowest) switching point. We also create dummies for inconsistencies (switching back once, several switches) to be able to control for inconsistencies. We also create a dummy for individuals who always defer the payment (even for 900 naira). As a robustness check, we test whether omitting individuals with inconsistencies changes the results.

Knowledge about and experience of menstruation

Knowledge about menstruation: Girls respond to four questions about menstruation (menstruation is a punishment from God; menstruation is a natural thing; menstruation is a sign that a woman is in the right age to get pregnant; women stop menstruating between the ages of 45 to 60) on a scale from "strongly disagree" to "strongly agree"

Menstrual experience: whether the girl has ever seen her period; how regular her period comes; how long ago her last period was; how long it normally takes (in days); pain during last menstruation episode; materials used during last episode. The menstrual experience questions can be partly verified with the menstruation tracker to account for recall bias (timing, length, pain).

3.3 Control variables

Availability of a school toilet; cleanliness of the school toilet (subjective rating 1-5).

Education of father and mother; whether parents own a car.

Household size; number of siblings; birth order.

Age; religion; ethnicity.

Average hours worked on chores per week; average hours worked for business per week; whether business work is for pay.

4 Study Hypotheses

In Appendix Table A-1 we depict all hypotheses for our research. In the following, we give examples for the most important hypotheses.

Hypothesis 1a: Compared to the control, participants in the "*T1*", "*T2*" and "*T3*" treatment will record improved wellbeing, i.e., higher subjective well-being.

Hypothesis 1b: The effects on wellbeing will be larger, with each progressive treatment from *"T1"* to *"T2"* and *"T2"* to *"T3"* treatment groups.

Hypothesis 2: Compared to the control, participants in the "*T2*" and "*T3*" treatment will record less restrictive attitudes, i.e., personal beliefs, stigma and social norms. We expect no significant differences between Control and "*T1*", as this treatments does not directly address norms and attitudes. Indirect effects might materialize through additional information.

Hypothesis 3: Compared to control, participants in the "*T1*", "*T2*" and "*T3*" treatments will record increased willingness to speak to other peers and greater demand for public information on menstruation. They will demand less private information on menstruation, given that this information was provided across all three treatments.

Hypothesis 4: Compared to control, participants in the "T2" and "T3" treatments will record increased willingness to speak publicly on menstruation (envelope), and less avoidance behaviour. The effects of "T3" are expected to be larger than those of "T2", as "T3" additionally corrects misperceived norms. We anticipate no significant differences between control and "T1" as this treatment does not directly address norms and attitudes. Indirect effects might materialize through additional information.

Hypothesis 5: Compared to control, participants in the "*T1*", "*T2*" and "*T3*" treatment will record higher academic performance.

Hypothesis 6: We anticipate additional positive effects of "*T2*" and "*T3*", beyond "*T1*" for academic outcomes, for which psychosocial constraints and social norms play a significant role such as school attendance, academic aspiration and career aspirations.

Hypothesis 7: Compared to control, participants in the "*T1*", "*T2*" and "*T3*" treatments will record higher knowledge of menstruation.

Hypothesis 8: Compared to control, participants in the "*T2*" and "*T3*" treatments will record improved socio-emotional outcomes Neuroticism and Locus of Control.

5 Empirical Analysis

Initially, we will compare raw mean differences between all treatment groups for each outcome of interest and perform t-tests as well as Mann-Whitney U tests.

5.1 Average Treatment Effects

We plan to test our hypothesis by estimating the average treatment effects for the three treatments "T1", "T2" and "T3" compared to the "control" group. To do this, we will estimate the following equation

$$Y_{ij} = \alpha + \beta_1 T I_j + \beta_2 T 2_j + \beta_3 T 3_j + \Gamma' X_{ij} + \varepsilon$$
⁽¹⁾

Where Y_{ij} is an outcome for student *i* in school *j*, measured at t_1 (short-run effects) or t_2 (medium-run effects); TI_j is a binary variable that is 1 if school is in the "*Base*" treatment and 0 otherwise. While $T2_j$ is 1 if school is in the "*Base plus anti-stigma*" treatment and 0 otherwise and $T3_j$ is 1 if school is in the "*Base plus anti-stigma plus norm correction*" treatment and 0 otherwise. The average treatment effects are represented by β_1 , β_2 , and β_3 . *X* is a vector of controls measured at t_0 that includes pre-determined factors: stratum (i.e., region) fixed effects, the girl's age, parental education, household size or birth order, household wealth, and religion. We will use cluster standard errors at the school level. Since our study evaluates several primary outcomes, we will check robustness to multiple hypotheses testing using Anderson (2008) sharpened q values. To measure behavioural mediating factors (causal mechanisms) we will – in additional analyses – expand the covariate vector *X* with time and risk preferences, as well as Big 5 and locus of control.

Comparing treatment effects for t_1 (short-run) and t_2 (medium-run) outcomes allows an investigation of how lasting effects are over few months.

Furthermore, we will unpack the effects of each additive treatments. For instance, in hypothesis 1B, we expect that $\beta_3 > \beta_2$, and $_2 > \beta_1$.

For some outcomes, for which we do not anticipate an additional effect of the norm correction (only in *T3*), we test for differences between *T2* and *T3*, and pool *T2* and *T3*, if applicable.

To do this, we will estimate the following equation:

$$Y_{ij} = \alpha + \beta_1 C_j + \beta_2 (T2T3)_j + \Gamma' X_{ij} + \varepsilon_{ij}$$
⁽²⁾

where *T2T3* is defined as a joint dummy for treatments *T2* and *T3*. The coefficient β_2 measures the effect of lifting the psychosocial constraint, compared to lifting only the budgetary and information constraints.

5.2 Heterogeneous Treatment Effects

We anticipate sub-group differences among the sample, which could explain outcome differences in the study for a sub-group of participants. This necessitates that we carry out heterogeneous treatment effect analysis. Hence, we will analyse heterogeneous treatment effects related to pre-determined factors such as religion, age, parental wealth, and menstrual clock among others.

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Appendix Table A-1: Overview of hypotheses for the RCT

| | | | | | | T2 /T3 vs. | | |
|------------|--------------------------------|-----------------|----------|-----------------|-----------------|------------|-----------|---------------------------------|
| | Outcomes | Wave | T1 vs. C | T2 vs. C | T3 vs. C | T1 | T3 vs. T2 | Notes |
| Wellbeing | subjective wellbeing | tl (short-run) | pos | pos | pos | pos | pos | |
| | | t2 (medium-run) | pos | pos | pos | pos | pos | |
| | Menstrual stigma | t1 (short-run) | zero | neg | neg | neg | neg | |
| | | t2 (medium-run) | zero | neg | neg | neg | neg | |
| | Personal beliefs | t1 (short-run) | zero | pos | pos | pos | pos | |
| | | t2 (medium-run) | zero | pos | pos | pos | pos | |
| | Social norms | t1 (short-run) | pos | pos | pos | pos | pos | |
| | | t2 (medium-run) | pos | pos | pos | pos | pos | |
| | | | | | | | | |
| Behavioral | Talk to Others | t1 (short-run) | pos | pos | pos | pos | pos | |
| | | t2 (medium-run) | pos | pos | pos | pos | pos | |
| | Envelope: Willingness to speak | t1 (short-run) | zero | pos | pos | pos | pos | |
| | | t2 (medium-run) | zero | pos | pos | pos | pos | |
| | Envelope: private info | tl (short-run) | neg | neg | neg | zero | zero | |
| | | t2 (medium-run) | neg | neg | neg | zero | zero | if information is sustainable |
| | Envelope: public info | tl (short-run) | pos | pos | pos | pos | pos | |
| | | t2 (medium-run) | pos | pos | pos | pos | pos | |
| | Avoidance Behaviour | tl (short-run) | zero | pos | pos | pos | pos | |
| | | | | | | | | if information, anti-stigma and |
| | | t2 (medium-run) | zero | pos | pos | pos | pos | norm correction are sustainable |
| | Pad Usage | t1 (short-run) | pos | pos | pos | zero | zero | |
| | | t2 (medium-run) | pos | pos | pos | zero | zero | |
| | Giving | t1 (short-run) | pos | pos | pos | pos | zero | |
| | | | | | | | | |
| Academic | School attendance | tl (short-run) | pos | pos | pos | pos | zero | |
| | | t2 (medium-run) | pos | pos | pos | pos | zero | |
| | cognition test | t1 (short-run) | zero/pos | zero/pos | zero/pos | zero | zero | |

| | | t2 (medium-run) | zero/pos | zero/pos | zero/pos | zero | zero | | | |
|---|------------------------|-----------------|----------|----------|----------|----------|----------|--|--|--|
| | Maths test score | t2 (medium-run) | pos | pos | pos | zero/pos | zero | | | |
| | English test score | t2 (medium-run) | pos | pos | pos | zero/pos | zero | | | |
| | Learning effort | t2 (medium-run) | pos | pos | pos | pos | zero | | | |
| | Educational aspiration | tl (short-run) | zero | pos | pos | pos | zero/pos | | | |
| | | t2 (medium-run) | zero | pos | pos | pos | zero/pos | | | |
| | Career aspiration | t1 (short-run) | zero | pos | pos | pos | zero/pos | | | |
| | | t2 (medium-run) | zero | pos | pos | pos | zero/pos | | | |
| | | | | | | | | | | |
| Knowledge of Menstruation | | t1 (short-run) | pos | pos | pos | zero | zero | | | |
| | | t2 (medium-run) | pos | pos | pos | zero | zero | | | |
| | | | | | | | | | | |
| Socio-Emotions | Conscientiousness | t1 (short-run) | zero | pos | pos | pos | zero | | | |
| | | t1 (short-run) | zero | pos | pos | pos | zero | | | |
| | Neuroticism | t1 (short-run) | zero | pos | pos | pos | zero | | | |
| | | t2 (medium-run) | zero | pos | pos | pos | zero | | | |
| | Openess | t1 (short-run) | zero | pos | pos | pos | zero | | | |
| | | t2 (medium-run) | zero | pos | pos | pos | zero | | | |
| | Extraversion | tl (short-run) | zero | pos | pos | pos | zero | | | |
| | | t2 (medium-run) | zero | pos | pos | pos | zero | | | |
| | Openess | tl (short-run) | zero | pos | pos | pos | zero | | | |
| | | t2 (medium-run) | zero | pos | pos | pos | zero | | | |
| | Locus of Control | tl (short-run) | zero | pos | pos | pos | zero | | | |
| | | t2 (medium-run) | zero | pos | pos | pos | zero | | | |
| | Risk | tl (short-run) | zero | pos | pos | pos | zero | | | |
| | | t2 (medium-run) | zero | pos | pos | pos | zero | | | |
| | Patience | t1 (short-run) | zero | pos | pos | pos | zero | | | |
| | | t2 (medium-run) | zero | pos | pos | pos | zero | | | |
| *Postive (pos), Negative (neg), Treatment 1(T1), Treatment 2(T2), Treatment 3(T3) | | | | | | | | | | |