

Leveraging Social Media to Enhance Mental Health: A Field Experiment

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Abstract

This paper examines whether social media can be leveraged to improve mental health through exposure to positive psychology content. I implement a cluster-randomized controlled trial involving 1,150 university students from 118 classes in Bangladesh. Classes were randomly assigned to follow Facebook pages posting positive psychology content, neutral Facebook pages, or to a no-exposure control group. The design distinguishes between direct and indirect exposure to the intervention.

On average, the intervention does not significantly affect depression, anxiety, perceived stress, or subjective well-being. However, direct exposure increases kindness by approximately 0.15 standard deviations. Importantly, the

average effects mask substantial heterogeneity. Both direct and indirect exposure are associated with larger reductions in depression, stress, and anxiety among participants with poorer mental health at baseline. Effects also vary with baseline Facebook use, with heavier users experiencing relatively larger reductions in selected adverse mental-health outcomes.

Key-words: Social media, positive psychology, mental health, Facebook, Bangladesh.

JEL: I12, I31, D91.

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1 Introduction

As of 2024, Facebook remains the most popular social media platform, with 3.07 billion users worldwide. A larger proportion of these users are located in low-income, lower-middle-income, or higher-middle-income countries. For example, India has 378.05 million users, Indonesia 119.05 million, Brazil 112.55 million, and Mexico 92.7 million. In fact, among the top 10 countries using Facebook, except for the United States (193.8 million users), the rest fall into the low-income, lower-middle-income, or higher-middle-income countries.^{1 2}

People use Facebook for a variety of reasons. According to a recent study by the Pew Research Center, 93 percent of Facebook users reported that they use the platform to keep up with friends and family. Other common reasons include entertainment (76 percent), connecting with others who share similar interests (74 percent), getting news (37 percent), looking at product reviews and recommendations (37 percent), keeping up with sports and pop culture (36 percent), and following politics and political issues (26 percent).³

Despite some positive aspects of Facebook⁴, there are concerns about its negative effect, very specifically the negative effect on mental health. A body of empirical studies provides evidence of Facebook’s negative impact on mental health. For example, Braghieri, Levy, and Makarin (2022) find that the introduction of Facebook

1. These data were sourced from Statista; for more details, refer to the Figure A2 & Figure A3.

2. For a map of low-income or lower-middle-income countries, refer to the Figure A1.

3. For in detailed report of pew research organization, please refer to appendix

4. For example, it can enhance interpersonal connections (Godard and Holtzman 2024), which promotes happiness and well-being (Chopik 2017). Additionally, it increases political participation (Valenzuela, Correa, and Gil De Zúñiga 2018) and also facilitates resistance in autocratic regimes (Alaimo 2015).

across U.S. colleges led to a negative impact in students' mental health. Brailovskaia et al. (2019) study the clinical inpatients in Germany, comparing those who use Facebook with those who do not. The study result shows that Facebook users exhibit higher levels of depression, social stress, and insomnia compared to non-users. In total, the negative impact of Facebook⁵ on mental health has become a burning issue in recent times.

This study, however, does not analyze the effects of Facebook on mental health. Instead, this study focuses on exploring ways to help people use Facebook in a healthier manner. As mentioned earlier, a body of empirical studies provides clear evidence regarding the negative effect of Facebook on mental health. Given this, policymakers might consider banning or restricting its use. However, these are challenging decisions to implement at a policy level. In this study, I am not focusing on banning or limiting the use of Facebook. Instead, I seek to induce specific components (related to positive psychology) into users' Facebook feeds that could enhance their mental health.

To motivate the experiment, I will begin by the large-scale field experiment conducted by Levy (2021). In this experiment, participants were provided with subscriptions to either a conservative or a liberal news outlet on Facebook. One key finding from the study is that exposure to counter-attitudinal news results in a significant decrease in negative attitudes toward the opposing political party, thus reducing polarization. The study argues that Facebook algorithm could limit counter-attitudinal

5. As well as other social media platforms like YouTube, Instagram, WhatsApp, TikTok, and X (formerly Twitter).

news, thus increasing the polarization.⁶ However, the study also proves that you can alter such polarization by exposing people to counter attitudinal news. Building on the findings of Levy (2021), I argue that exposure to more positive psychology content on Facebook could similarly influence the users, much like exposure to counter-attitudinal news.⁷ Just as participants in the study of Levy (2021) became less polarized after encountering counter-attitudinal news, I argue that individuals exposed to positive psychology content will experience improvements in their mental health.

I am arguing because there is strong empirical support for the positive impact of positive psychology interventions on mental health.⁸ However, almost all of the existing positive psychology interventions required substantial training and administrative effort for implementation. In this paper, I am introducing a large-scale randomized controlled trial that does not require any training and only little administrative effort for implementation is required. I leverage Facebook as a platform for delivering a positive psychology intervention. This eliminates the need for training and other administrative compliance and also ensures the study's high external validity.

6. Similarly, Sunstein (2018) and Settle (2018) argue that social media creates an ideological "echo chambers," which, in turn, increases polarization.

7. To know more of what I refer to as positive psychology content, refer to Appendix 8.2.

8. For example, Shoshani and Steinmetz (2014) run a school-based positive psychology intervention in Israel. In the first stage of the intervention, the teachers received training, and in the second phase, teachers delivered the program in the classroom. The classroom program included various components such as activities, discussions, reading poems and stories, and watching movie clips that are related to positive psychology. The study finds a significant decrease in various mental health parameters, such as distress, anxiety and depression symptoms. A similar positive impact of positive psychology on mental health was also observed in many other settings (see the meta analysis by Carr et al. (2021))

To implement the randomized controlled trial, I focus on students from different universities of Bangladesh.⁹ I recruited a sample of 1,150 participants through university class representatives across different classes. In total, 118 classes from different universities participated in this study. These classes were subsequently randomized into treatment and control conditions.

The randomization was conducted at the class level rather than at the individual level to minimize contamination across experimental conditions. Randomization within the same class could have resulted in spillover effects, whereby students assigned to the control condition might nonetheless have been exposed to treatment-related content through interactions with treated peers. Cluster randomization at the class level substantially reduced this risk.

Participants assigned to the treatment group were instructed to click the “Like Page” button for four specific Facebook pages selected. These pages regularly posted content related exclusively to positive psychology, typically 4–5 posts per day.¹⁰ The links to the four pages were sent directly to participants in the treatment group through the study’s Facebook account.¹¹

Compliance with the intervention was carefully monitored. Participants in the treatment group were required to “Like” all four recommended pages, and compliance was verified by checking participants’ Facebook profiles to confirm that the

9. A detailed description of Bangladesh’s university education system is provided in the Appendix 8.3.

10. I managed these pages using this study’s Facebook account. A detailed list and description of these Facebook pages are provided in the Appendix 8.4.

11. All participants in the baseline survey were asked to provide their Facebook ID name/link and send a friend request to the study’s Facebook account. Subsequently, invitations to “Like” the designated Facebook pages were sent to participants’ inboxes with the assistance of class representatives.

designated pages had been liked.¹²

Participants in the control group were similarly instructed to “Like” four neutral Facebook pages unrelated to positive psychology. In addition, a subset of classes was randomly assigned to a “no-exposure control group” group, in which participants were not instructed to “Like” any Facebook pages.

I estimate the effect of this intervention on different psychosocial outcomes such as depression, anxiety, stress, and well-being, as well as several intermediate outcomes including kindness, laughter, optimism, activities, healthy activities, concentration, and Facebook feed satisfaction. Importantly, I distinguish between direct and indirect exposure to the intervention. Direct exposure refers to participants who themselves followed the recommended positive psychology pages, whereas indirect exposure captures participants who were connected to treated peers within the same class (and received neutral pages) and could therefore be indirectly exposed to positive psychology content through online interactions and sharing behavior.

The results provide limited evidence that exposure to positive psychology content improves the primary psychosocial outcomes. Neither direct nor indirect exposure produces statistically significant effects on depression, anxiety, perceived stress, or subjective well-being. So, the experiment does not provide robust evidence of improvements in the primary psychosocial outcomes. Beyond these outcomes, however, the intervention affects prosocial behavior: participants directly exposed to positive psychology content report higher levels of kindness.

12. Some participants restricted the visibility of their liked pages through Facebook privacy settings. Participants were therefore instructed to adjust their settings using the custom visibility option so that the study’s Facebook account could verify compliance. Additional details are provided in the consent form and appendix.

This paper contributes to several strands of literature. First, it contributes to the growing literature on social media and mental health by shifting the focus away from whether social media is inherently harmful and toward how social media environments can potentially be redesigned to improve well-being. Second, the paper contributes to the literature on positive psychology interventions by introducing a scalable intervention that does not require therapists, classroom instruction, institutional infrastructure, or extensive training. Third, the paper contributes to the broader literature on digital interventions in low-income and lower-middle-income settings, where conventional mental health interventions are often difficult to implement because of resource and institutional constraints.

The remainder of the paper is organized as follows. Section II describes the background. Section III presents the design and data. Section IV discusses the empirical strategy. Section V explains the results. Section VII concludes.

2 Background

2.1 Facebook in Bangladesh

Bangladesh ranks among the top 10 countries in terms of Facebook users. As of 2024, out of a total population of around 165 million¹³, 55.6 million people in Bangladesh, are active Facebook users (see Appendix for details). Although other social media platforms such as YouTube, Instagram, WhatsApp, TikTok, and X (formerly Twitter) are also popular in Bangladesh, Facebook is the most widely used social media platform with the largest user base in the country (see Appendix for details).

In recent years, like many other countries, Facebook has become a vital platform for communication in Bangladesh. It enables people from different parts of the country to easily connect with their friend and family members. The large Bangladeshi working-class diaspora has particularly benefited from this form of communication, which was previously very expensive and less accessible. Facebook has evolved into a political battleground, where political parties and individuals from various ideological groups use the platform to organize and spread their activities. Numerous recent movements, such as the Shahbagh Movement in 2013, and the quota reform movements in 2019 and 2024, showed Facebook’s powerful role in mobilizing people. Additionally, Facebook has become an alternative news source in Bangladesh. It has also been instrumental in helping small-scale business owners in the country to reach a large number of customers at a lower cost.

However, due to the large user base and influence across the social, economic, and

13. To know more about population demographics of Bangladesh, see Bangladesh Bureau of Statistics (2022).

political landscape, there is evidence of Facebook’s negative impact in Bangladesh. Various extremist groups often use the platform to spread misinformation and disinformation, which has led to multiple incidents of violence against minorities (Roy, Singh, and Kamruzzaman 2023). Additionally, cyberbullying and online harassment have also become increasingly common in recent years (Sheikh, Hossan, and Menih 2023). One issue that receives little (or no) attention in the country’s legal and policy framework is Facebook’s impact on the mental health of about one-third of the population, who are active Facebook users.

2.2 Mental health condition in Bangladesh

According to National Institute of Mental Health (2019) survey in Bangladesh (a large-scale study with participants from across the country and all age groups), approximately 17 percent of the adult population (aged 18-60+) reported experiencing some form of mental health disorder. Among the reported disorders, depression and anxiety were found as the most prevalent disorders. The survey also included participants aged 7-17. Among this age group, nearly 14 percent reported having a mental health disorder, with depression and anxiety again being the leading causes. It is important to note that this survey was conducted before the COVID-19 pandemic. Multiple studies have been conducted during the pandemic. These studies indicated a worsening of the mental health situation compared to National Institute of Mental Health (2019) survey in Bangladesh. For example, in a study involving participants aged 15 to 65, Das et al. (2021) found that 38 percent of participants reported experiencing mild to severe depression, while 64 percent reported mild to severe anxiety.

This presence is even higher among students. In a survey among university students in Bangladesh, Faisal et al. (2022) found that during the COVID-19 pandemic, 72 percent of participants reported experiencing depressive symptoms, while 77 percent of participants reported mild to severe anxiety. Other similar studies also found this high prevalence of depression and anxiety among students of different universities and colleges in Bangladesh during the COVID-19 pandemic (see the review paper by Al Mamun et al. (2021)).

There are various factors responsible for the poor mental health situation in Bangladesh. The most commonly discussed factors include lack of awareness, stigma, a severe shortage of mental health professionals, poverty, inadequate mental health infrastructure etc. (Hasan et al. 2021; Koly et al. 2022; M. S. Islam et al. 2021). However, one factor that is less frequently discussed at the policy level is the impact of Facebook (the most popular social media platform of the country). It is important to discuss this issue, considering that one-third of the country's population are active Facebook users. In addition, numerous studies such as Karim et al. (2023), Mamun and Griffiths (2019), M. R. Islam et al. (2021), and Sayeed et al. (2020) also found the negative impact of Facebook on mental health, particularly among young people, who make up the majority of Facebook users in Bangladesh.

2.3 Positive Psychology

This study investigates whether Facebook can be effectively used as a platform to improve the mental health of its users in Bangladesh. Specifically, it examines the impact of increased exposure to positive psychology content within users' Facebook

feeds. The central hypothesis is that such exposure will enhance users' mental well-being, in a manner similar to the findings of Levy (2021), where participants became less polarized after encountering counter-attitudinal news. The rationale for this hypothesis lies in the strong body of empirical evidence supporting the effectiveness of positive psychology interventions in improving mental health outcomes.¹⁴ However, almost all of the existing positive psychology interventions required substantial training and administrative effort for implementation. In contrast, this study introduces a large-scale randomized controlled trial that minimizes both training requirements and administrative burden by leveraging Facebook as the delivery mechanism. This approach not only simplifies implementation but also enhances the external validity of the study.

14. For example, Shoshani and Steinmetz (2014) run a school-based positive psychology intervention in Israel. In the first stage of the intervention, the teachers received training, and in the second phase, teachers delivered the program in the classroom. The classroom program included various components such as activities, discussions, reading poems and stories, and watching movie clips that are related to positive psychology. The study finds a significant decrease in various mental health parameters, such as distress, anxiety and depression symptoms. A similar positive impact of positive psychology on mental health was also observed in many other settings (see the meta analysis by Carr et al. (2021))

3 Design and Data

3.1 Experimental Design

Figure 1 summarizes the experimental design of this study, Figure 2 presents the study timeline, and Figure 3 illustrates the treatment saturation structure within university classes. The experiment consisted of six stages: recruitment and baseline survey, participant selection, cluster randomization, intervention, endline survey, and follow-up survey.

Participant recruitment began on September 1, 2025, with the assistance of 8 initial contacts and 118 university class representatives across different universities in Bangladesh. The recruitment process followed a hierarchical communication structure designed to efficiently disseminate information across a large student population. First, I contacted 8 initial contacts from different universities. These initial contacts subsequently recruited university class representatives from their own institutions and networks. In total, 118 class representatives agreed to assist with the study.

To coordinate recruitment and communication, I first created one central Facebook Messenger group containing the 8 initial contacts. Each initial contact then created separate Messenger groups with the class representatives they recruited, and each class representative subsequently created a Messenger group consisting of interested students from their respective classes. This decentralized communication structure enabled rapid dissemination of recruitment information, survey links, reminders, intervention instructions, and incentive-related announcements. Messages were first distributed through the central Messenger group and then sequentially

forwarded through the representative network to students.

Students from 118 university classes participated in the recruitment process and completed a large-scale baseline survey. The survey collected demographic information, Facebook usage behavior, and validated mental health screening measures, including the PHQ-9 and GAD-7 questionnaires. Participants were also asked to provide their Facebook profile links and send a friend request to the study’s Facebook account. This procedure enabled direct communication with participants during the intervention period and facilitated compliance monitoring.¹⁵

After participant selection, university classes were randomly assigned into one of three study arms: (i) a treatment group exposed to positive psychology Facebook pages, (ii) a neutral-content control group exposed to emotionally neutral Facebook pages, and (iii) a no-exposure control group. Participants assigned to the treatment condition were instructed to “Like” four Facebook pages created specifically for the study that regularly posted positive psychology-related content, including motivational messages, gratitude-focused posts, inspirational stories, and mental well-being content. Participants in the neutral-content control group were instructed to follow four neutral-content pages unrelated to mental health or emotional well-being, while participants in the no-exposure control group were not instructed to follow any pages.

The intervention officially began on October 10, 2025, and continued for approximately three weeks. The endline survey was conducted on November 1, 2025, immediately after the intervention period. A follow-up survey was subsequently con-

15. A detailed description of how the study’s Facebook account operated, including participant communication, intervention delivery, and compliance monitoring procedures, is provided in Appendix 8.4.

ducted on February 16, 2026, approximately three and a half months after the endline survey, in order to examine the persistence of treatment effects over time.

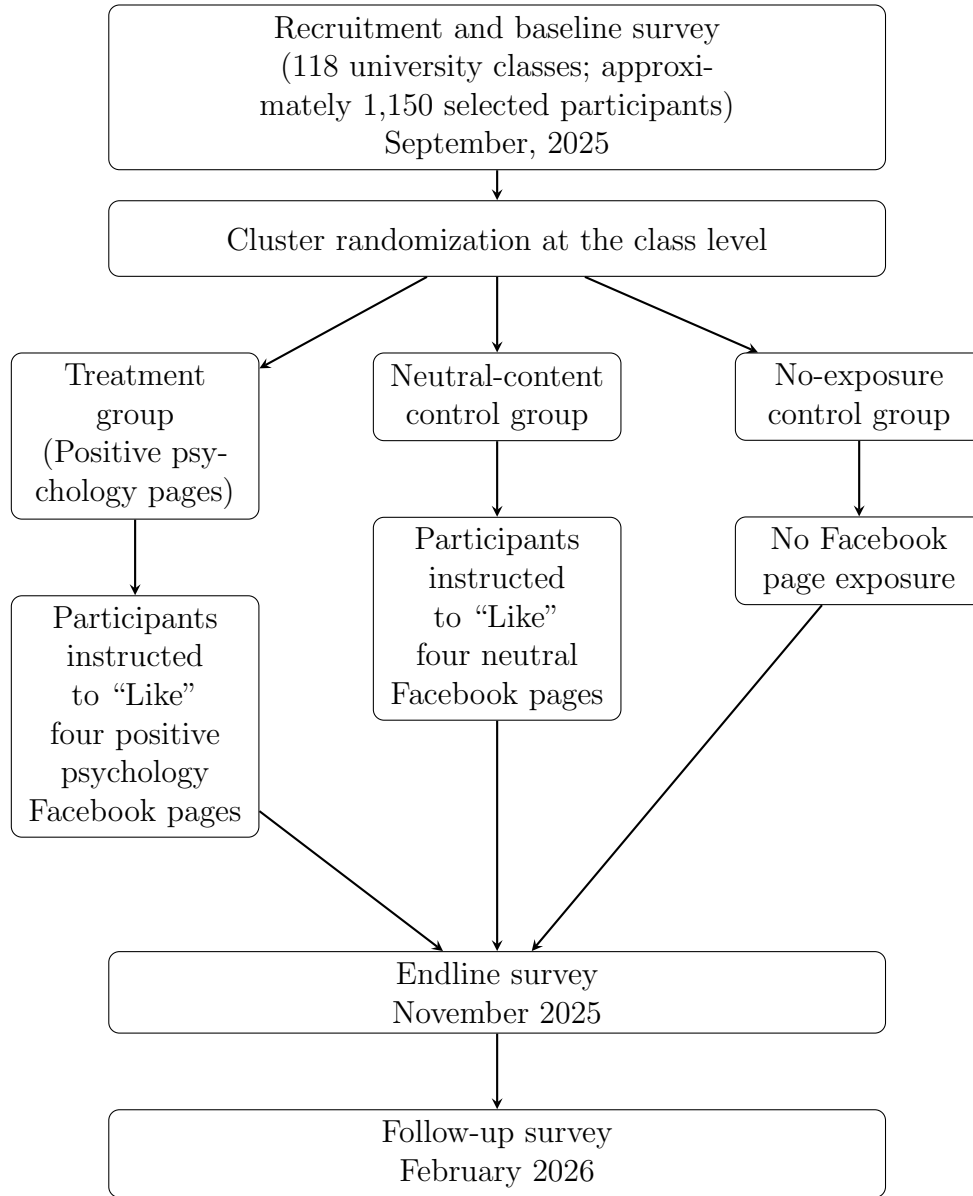


FIGURE 1: EXPERIMENTAL DESIGN

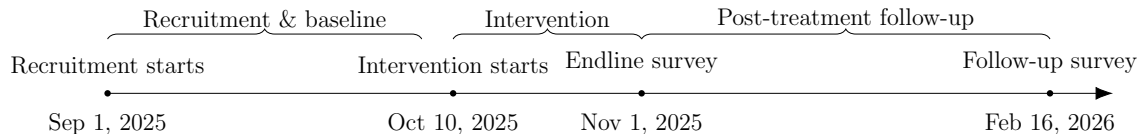


FIGURE 2: TIMELINE OF RECRUITMENT, INTERVENTION, ENDLINE, AND FOLLOW-UP SURVEY

3.2 Randomization

Randomization was conducted at the university class level rather than at the individual level in order to minimize contamination across experimental conditions. Students within the same university class frequently interact with one another both offline and through social media platforms. Individual-level randomization within the same classroom environment could therefore generate substantial spillover effects, as untreated students might still be indirectly exposed to treatment-related content through Facebook interactions, interpersonal discussions, reposting behavior, or algorithmic amplification.

To address this issue, the study implemented cluster randomization at the class level. Entire classes were assigned to one of the three experimental conditions. This design substantially reduced direct cross-group contamination while preserving realistic social interaction structures within classes.

In addition to direct treatment exposure, the experimental design also incorporated variation in treatment saturation within classes. As illustrated in Figure 3, classes differed in the proportion of students exposed to treatment-related content. Some classes experienced low treatment saturation, where only a relatively small proportion of students were exposed to the intervention, while other classes experi-

enced high treatment saturation, where a substantially larger proportion of students were exposed. The no-exposure control classes received no intervention exposure.

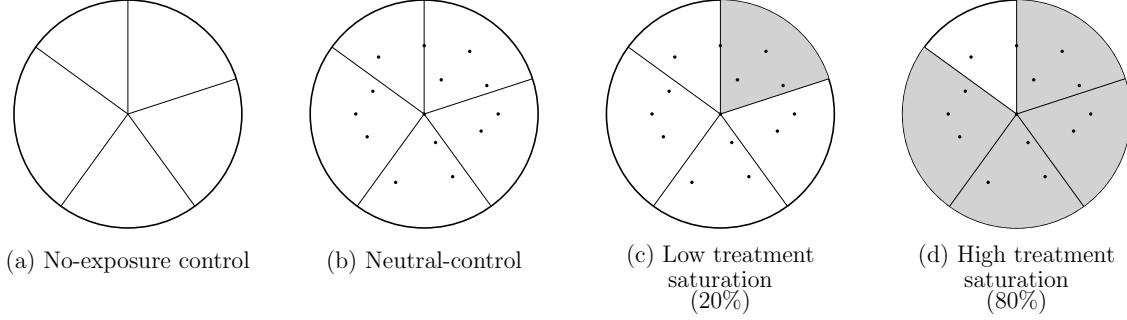


FIGURE 3: TREATMENT CONDITIONS AND SPILLOVER EXPOSURE ACROSS UNIVERSITY CLASSES

This saturation design allows the study to distinguish between *direct treatment effects* and *indirect spillover effects*. Direct effects capture the impact of personally following and consuming positive psychology content. Indirect effects capture the influence of being socially connected to treated peers within the same classroom environment, even among students who may not have directly interacted with the intervention content themselves.

To implement the intervention, I created a dedicated Facebook account named “Optimistic Outlook,” which served as the official study account throughout the experiment. During the baseline survey, participants were instructed to send a friend request to this account. All subsequent communication regarding treatment instructions, reminders, survey links, and compliance monitoring was conducted through Facebook Messenger. Participants who failed to establish contact with the study account within the specified period were excluded from the final study sample because reliable communication during the intervention period could not be ensured.

Participants assigned to the treatment condition received direct Messenger links to four positive psychology Facebook pages and were instructed to “Like” all four pages. These pages posted approximately 4–5 posts per day (per page) throughout the intervention period. Compliance was carefully monitored by manually verifying whether participants had followed the assigned pages.¹⁶ Participants who failed to comply with the treatment instructions were excluded from the final analytical sample.

Participants assigned to the neutral-content control condition similarly received links to four neutral Facebook pages that posted emotionally neutral and non-political content. In contrast, participants assigned to the no-exposure control condition were not instructed to follow any Facebook pages during the intervention period.

Following the three-week intervention period, participants completed the endline survey. The follow-up survey conducted three and half months later enabled the analysis of the medium-term persistence of both direct and indirect treatment effects.

4 Empirical Strategy

The empirical analysis of this study is structured around four main types of effects: the effect on final outcomes, the effect on intermediate outcomes, the saturation effect, and the heterogeneous effect.

16. Some participants restricted the visibility of their liked pages through Facebook privacy settings. Participants were therefore instructed to temporarily modify their privacy settings so that compliance could be verified by the study team.

4.1 Effect on Final Outcomes

The four final outcomes are depression, anxiety, perceived stress, and subjective well-being. Depression is measured using the nine-item PHQ-9, with each item coded from 0 (“not at all”) to 3 (“nearly every day”) and summed to form a score ranging from 0 to 27. Anxiety is measured using the seven-item GAD-7, using the same 0–3 response scale, yielding a total score between 0 and 21. Higher values on both measures indicate worse mental health. Perceived stress is measured using the 10-item Perceived Stress Scale. Responses range from 0 (“never”) to 4 (“very often”); the positively worded items are reverse-coded before summing, producing a score from 0 to 40, with higher values indicating greater stress. Subjective well-being is measured using the five-item WHO-5 Well-Being Index, with responses ranging from 0 to 5 and summed to obtain a score between 0 and 25; higher values indicate better well-being. For the empirical analysis, all four outcomes are standardized to have mean zero and standard deviation one, so estimated treatment effects are reported in standard-deviation units.

These outcomes will also be analyzed using the following regression specification:

$$\begin{aligned} \text{Final Outcomes}_{isc} = & \alpha_b + \beta \text{Direct effects}_{sc} + \gamma \text{Indirect effects}_{sc} \\ & + \delta \text{Final Outcomes}_{isc}^{\text{lag}} + X'_{isc} + \varepsilon_{isc} \end{aligned}$$

where

- $\text{Final Outcomes}_{isc}$ is the post-treatment final outcome of participant i within segment s of class c ,

- $Direct\ effects_{sc}$ is an indicator for segments directly targeted with positive psychology contents
- $Indirect\ effects_{sc}$ is an indicator for segments that are not directly targeted with positive psychology contents
- $Final\ Outcomes_{isc}^{lag}$ is the baseline value,
- X'_{isc} contains control variables,
- α_b are fixed effects for the class-level randomization block,
- ϵ_{isc} are the standard errors. Standard errors will be clustered at the class level.

4.2 Effect on Intermediate Outcomes

The intermediate outcomes capture behavioral and self-reported responses that may reflect channels through which the intervention affects psychosocial well-being. Kindness is measured using a dictator-game allocation in which participants decide how much of 100 Taka to give to an anonymous stranger, with possible allocations of 0, 20, 40, 60, 80, or 100 Taka; higher allocations indicate greater prosocial behavior. Laughter measures participants' self-reported level of laughter over the previous two weeks on a 1–5 scale, with higher values indicating more laughter. Optimism captures participants' outlook toward Bangladesh over the previous two weeks on a five-point scale, ranging from 1 (“nothing in the country is positive”) to 5 (“everything in the country is good”), with higher values indicating a more positive outlook.

Activities measures the number of hours per day spent outside work or study on activities such as hobbies, socializing, household activities, and activities. Healthy activities measures how often during the previous two weeks participants consciously

engaged in and enjoyed healthy activities, such as eating well, exercising, or spending time outdoors, on a scale from 1 (“not at all”) to 5 (“all the time”). Concentration measures self-reported concentration while studying during the previous two weeks on a 1–5 scale, with higher values indicating greater concentration. Finally, Facebook-feed satisfaction measures participants’ satisfaction with their Facebook feed during the previous two weeks on a four-point scale ranging from 1 (“not at all happy”) to 4 (“very happy”). As with the final outcomes, these variables are standardized for the empirical analysis, so treatment effects are reported in standard-deviation units.

The estimated average treatment effect on the above stated outcomes will be estimated using the following regression specification:

$$\begin{aligned} \text{Intermediate Outcomes}_{isc} = & \alpha_b + \beta \text{Direct effects}_{sc} + \gamma \text{Indirect effects}_{sc} \\ & + \delta \text{Intermediate Outcomes}_{isc}^{\text{lag}} + X'_{isc} + \varepsilon_{isc} \end{aligned}$$

where

- $\text{Intermediate Outcomes}_{isc}$ is the post-treatment intermediate outcome of participant i within segment s of class c ,
- $\text{Direct effects}_{sc}$ is an indicator for segments directly targeted with positive psychology contents
- $\text{Indirect effects}_{sc}$ is an indicator for segments that are not directly targeted with positive psychology contents
- $\text{Intermediate Outcomes}_{isc}^{\text{lag}}$ is the baseline value,
- X'_{isc} contains control variables,

- α_b are fixed effects for the class-level randomization block,
- ϵ_{isc} are the standard errors. Standard errors will be clustered at the class level.

4.3 Saturation Effect

This study will estimate the differential effects of positive psychology intervention across class saturation levels using the following form. Saturation effects will be assessed for both intermediate and final outcomes.

$$\begin{aligned}
\text{Intermediate/Final Outcomes}_{isc} = & \alpha_b + \beta_1 \text{ Direct effect in low saturation}_{sc} \\
& + \beta_2 \text{ Direct effect in high saturation}_{sc} \\
& + \gamma_1 \text{ Indirect effect in low saturation}_{sc} \\
& + \gamma_2 \text{ Indirect effect in high saturation}_{sc} \\
& + \delta Y_{isc}^{\text{lag}} + \epsilon_{isc}
\end{aligned}$$

where $(\beta_2 - \beta_1)$ and $(\gamma_2 - \gamma_1)$, respectively, capture the differential direct and indirect effects of positive psychology interventions to the high compared to the low saturation segment.

4.4 Heterogeneity Analysis

To better understand for whom the intervention is most effective, this study will conduct heterogeneity analyses based on three key dimensions: (i) baseline Facebook usage intensity, (ii) baseline mental health status, and (iii) baseline demographic

characteristics.

First, this study will examine heterogeneity based on Facebook usage levels, as the intensity of social media engagement may influence both exposure to the intervention and to its effects. Participants will be grouped into three categories based on their self-reported average daily time spent on Facebook: *highly active users*, *moderately active users*, and *low-activity users*. Second, for the heterogeneity analysis based on baseline mental health status, participants will be categorized into subgroups reflecting *mild*, *moderate*, or *severe* levels of depressive, anxiety and, stress symptoms. Third, this study will explore heterogeneity by baseline demographic characteristics, including *gender*, *monthly household income*, and *academic year*.

These heterogeneous effects will be estimated by interacting each subgroup variable with the treatment assignment indicators (both direct and indirect exposure) in the main regression models.

5 Results

5.1 Engagement with Treatment and Control Content

Table 1 presents the total number of views received by each treatment and neutral-control Facebook page during the intervention period. The treatment pages focused on humorous content, kindness-related posts, positive news from Bangladesh, and practical positive psychology tips. The neutral-content control pages contained emotionally neutral content such as photographs of rivers and forests, historical facts, and weather or climate-related reports. Overall, the table shows that participants

actively viewed both treatment and neutral-content control throughout the intervention period.

Across the four treatment pages, posts accumulated approximately 16,100 views in total. Humorous posts attracted the largest audience (approximately 7,000 views), followed by positive news (approximately 3,600 views), kindness-related posts (approximately 3,000 views), and practical positive psychology tips (approximately 2,500 views). On the other hand, the neutral-content control pages generated approximately 20,000 views in total. River photographs and weather reports each received approximately 6,000 views, while forest images and historical facts each received around 4,000 views. The variation likely reflects differences in the inherent attractiveness of the different types of content.

TABLE 1: VIEWS BY PAGE: TREATMENT VERSUS CONTROL CONTENT

Treatment Group (4 Pages)	
Content Type	Views (approximately)
Humorous posts that evoke laughter (Page 1)	7,000
Kindness-related posts (Page 2)	3,000
Positive news and achievements from across Bangladesh (Page 3)	3,600
Practical tips to help savor positive moments (Page 4)	2,500
Total treatment views	16,100
Neutral-content control group (4 Pages)	
Content Type	Views (approximately)
Photographs of rivers (Page 1)	6,000
Images of forests/trees (Page 2)	4,000
Historical facts (Page 3)	4,000
Weather / climate reports (Page 4)	6,000
Total neutral-content control views	20,000

5.2 Descriptive

Table 2 presents descriptive statistics for the main variables used in the empirical analysis. The study sample consists of 1,150 participants. Participants are relatively

young, with a mean age of 21.7 years and an age range of 18 to 27 years, reflecting the study’s exclusive focus on university students. 63 percent of the sample is female. At baseline, the mean depression, anxiety, and stress scores are 10.28 on a 0–27 scale, 7.74 on a 0–21 scale, and 15.87 on a 0–40 scale, respectively. The mean well-being score is 10.04 on a 0–25 scale.

The table further summarizes a range of intermediate outcomes. These include kindness, measured as the allocation in a dictator game ranging from 0 to 100 Taka; laughter, optimism, healthy activities, and concentration, each measured on a 1–5 scale; activities, measured in hours; and happiness with one’s Facebook feed, measured on a 1–4 scale. Participants report, for example, an average optimism score of 2.28 and an average concentration score of 2.38, while average activities is approximately 2.00 hours. The slightly smaller number of observations for gender reflects missing baseline information for one participant.

For the subsequent empirical analysis, all non-binary outcome variables are standardized to have a mean of zero and a standard deviation of one. Accordingly, unless otherwise indicated, the treatment-effect estimates reported below are expressed in standard-deviation units. This standardization facilitates comparisons of effect sizes across outcomes that are measured on different scales.

Table A1 examines baseline balance across the four experimental groups. Columns (1)–(4) report baseline means for the no-exposure, direct, indirect, and neutral-content groups, respectively, while the remaining columns report differences between each treatment group and the no-exposure group. The treatment groups are generally well balanced on the observed baseline characteristics. The differences are

small relative to the underlying variation in the respective variables, and none of the reported pairwise differences is statistically significant at conventional levels. Overall, the balance results provide no evidence of systematic pre-treatment differences between the experimental groups.

TABLE 2: SUMMARY STATISTICS

Variable	Observations	Mean	Std. Dev.	Min.	Max.
Depression	1,150	10.276	6.298	0	27
Anxiety	1,150	7.735	5.230	0	21
Stress	1,150	18.376	5.619	0	39
Well-being	1,150	10.037	5.945	0	25
Kindness	1,101	30.000	31.606	0	100
Laughter	1,150	3.087	0.973	1	5
Optimism	1,150	2.284	0.913	1	5
Activities	1,150	2.007	1.473	0	10
Healthy activities	1,150	2.683	1.005	1	5
Concentration	1,150	2.384	1.102	1	5
Facebook-feed satisfaction	1,150	2.533	0.696	1	4
Facebook use	1,150	3.314	1.939	0	15
Age	1,150	21.610	1.560	18	27
Female	1,149	0.630	0.483	0	1

Notes: This table reports descriptive statistics for the study sample. Depression, anxiety, stress, and well-being are measured using their respective baseline scales. Kindness is measured as the amount allocated in the dictator game, ranging from 0 to 100 Taka. Laughter, optimism, healthy activities, and concentration are measured on 1–5 scales. Activities is measured in hours. Facebook-feed satisfaction is measured on a 1–4 scale, and Facebook use is measured in hours. Age is measured in years. Female is an indicator equal to one for female participants and zero otherwise. The number of observations differs for gender because of missing baseline information for one participant.

5.3 Baseline results

The first four columns of Table 3 present estimates comparing the direct and indirect treatment groups relative to the neutral-content control group. In this specification, the coefficients capture the effect of treatment exposure compared to individuals who did not receive the intervention but are part of the same experimental environment.

Across these columns, the estimated effects on depression, anxiety, stress, and wellbeing are statistically insignificant, indicating that neither direct nor indirect exposure leads to measurable improvements relative to the neutral-content control group.

The last four columns extend the analysis by comparing the direct treatment, indirect treatment, and neutral-content control group to no-exposure control group, which is not exposed to any aspect of the intervention environment. This specification allows us to assess both treatment effects and any potential changes affecting the neutral-content control group itself. The results provide little evidence of effects on the four primary psychosocial outcomes.

As a robustness check on statistical inference, Appendix Table A2 reports wild-cluster-bootstrap p -values and corresponding 95 percent confidence intervals based on 9,999 bootstrap replications, with resampling conducted at the randomization-cluster level. The bootstrap results closely corroborate the conventional cluster-robust inference.

Overall, the baseline results provide no evidence that the intervention affected depression, anxiety, stress or wellbeing.

TABLE 3: EFFECTS OF THE INTERVENTION ON DEPRESSION, ANXIETY, STRESS, AND WELLBEING

Impacts on Psychosocial Wellbeing								
	Neutral-content Control Group as Reference				No-exposure Control Group as Reference			
	Depression	Anxiety	Stress	Wellbeing	Depression	Anxiety	Stress	Wellbeing
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Direct	-0.059 (0.105)	0.071 (0.099)	-0.059 (0.066)	-0.119 (0.110)	-0.041 (0.068)	-0.015 (0.089)	-0.078 (0.050)	-0.027 (0.083)
Indirect	0.002 (0.107)	0.069 (0.092)	-0.037 (0.069)	-0.092 (0.107)	-0.034 (0.072)	-0.076 (0.082)	-0.054 (0.055)	-0.052 (0.072)
Neutral-content control	–	–	–	–	-0.000 (0.103)	-0.097 (0.091)	-0.016 (0.062)	0.085 (0.121)
No-exposure control					–	–	–	–
Clusters	98	98	98	98	118	118	118	118
Observations	946	946	946	946	1101	1101	1101	1101

Note: The table reports intent-to-treat (ITT) estimates of the effects of the intervention on depression, anxiety, stress, and subjective wellbeing. Columns (1)–(4) compare the direct-treatment and indirect-treatment groups with the neutral-content control group, while Columns (5)–(8) compare the same treatment groups and the neutral-content control group with the no-exposure control group. Coefficients are expressed in standard deviation units. Standard errors, reported in parentheses, are clustered at the randomization-cluster level. The number of clusters and observations is reported at the bottom of the table. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

5.4 Intermediate outcomes

Table 4 reports the estimated effects of the intervention on the intermediate outcomes. Columns (1)–(7) compare the direct and indirect treatment groups with the neutral-content control group. The direct treatment increases kindness by approximately 0.15 standard deviations, and the estimate is statistically significant at the 10 percent level ($\beta = 0.149$, $SE = 0.082$). In contrast, the corresponding effect for the indirect treatment is small and statistically insignificant. Neither the direct nor the indirect treatment has a statistically significant effect on laughter, optimism, activities, healthy activities, concentration, or Facebook-feed satisfaction relative to the neutral-content control group.

Columns (8)–(14) instead use the no-exposure control group as the reference category. Two findings stand out in this comparison. First, individuals in the direct treatment group report higher levels of kindness, with an estimated increase of approximately 0.15 standard deviations relative to the no-exposure control group. The coefficient is statistically significant at the 10 percent level. In contrast, the indirect treatment effect is statistically insignificant, suggesting that improvement in kindness require direct exposure to the positive psychology content. Second, the intervention appears to improve participants’ ability to concentrate. Both the direct and indirect treatment groups exhibit increases in concentration of approximately 0.18 and 0.20 standard deviations, respectively, with both estimates statistically significant at the 10 percent level. This suggests that the effect of concentration may extend beyond those who directly receive the intervention.

However, the statistical significance of the intermediate-outcome results is less robust to alternative inference. As reported in Appendix Table A3, the positive effect of the direct treatment on kindness remains significant under wild-cluster-bootstrap inference. In contrast, the estimated concentration effects for the direct and indirect treatments yield wild-bootstrap p -values of 0.109 and 0.121, respectively, and therefore do not reach conventional significance levels under the bootstrap procedure. The point estimates remain similar, but the weaker bootstrap inference suggests that the evidence for effects on concentration should be interpreted cautiously.

Taken together, the results suggest that the intervention affected only one intermediate outcome. There is no evidence of changes in laughter, optimism, activities, healthy activities, concentration or Facebook-feed satisfaction.

TABLE 4: IMPACTS ON INTERMEDIATE OUTCOMES

	Impacts on Intermediate Outcomes									
	Control Group as Reference					No-exposure Control Group as Reference				
	Kindness	Laughter	Optimism	Activities	Healthy activities	Concentration	Facebook feed satisfaction	Kindness	Laughter	Optimism
Direct	0.149* (0.082)	-0.062 (0.060)	0.073 (0.080)	0.040 (0.084)	-0.095 (0.080)	0.032 (0.096)	0.026 (0.096)	0.132* (0.087)	-0.084 (0.073)	0.096 (0.083)
Indirect	-	-0.049 (0.069)	0.039 (0.078)	0.030 (0.086)	-0.054 (0.076)	0.075 (0.112)	-0.026 (0.089)	-0.045 (0.089)	-0.042 (0.073)	0.203* (0.086)
Neutral-content control	-	-	-	-	-	-	-	0.032 (0.079)	0.059 (0.060)	0.036 (0.098)
No-exposure control	-	-	-	-	-	-	-	-	-	-
Clusters	98	98	98	98	98	98	98	118	118	118
Observations	904	904	904	904	904	904	904	1101	1101	1101

Note: The table reports intent-to-treat (ITT) estimates of the effects of the intervention on intermediate outcomes, including kindness, laughter, optimism, activities, healthy activities, concentration, and Facebook feed. Columns (1)–(7) compare the direct-treatment and indirect-treatment groups with the neutral-content control group, while Columns (8)–(14) compare the same treatment groups and the neutral-content control group with the no-exposure control group. Coefficients are expressed in standard deviation units. Standard errors, reported in parentheses, are clustered at the randomization-cluster level. The number of clusters and observations is reported at the bottom of the table. Statistical significance is denoted by * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

5.5 Saturation effect

Figure 5 presents the estimated treatment effects separately by saturation intensity for both direct and indirect exposure groups. The analysis distinguishes between low-saturation and high-saturation classes in order to assess whether the concentration of treated peers influences the effectiveness of the intervention. The analysis separately reports direct and indirect treatment effects under low- and high-saturation conditions for the four primary psychosocial outcomes: depression, stress, anxiety, and subjective wellbeing. Coefficients are expressed relative to the no-exposure control group, with vertical bars representing 95 percent confidence intervals. Across depression, stress, anxiety, and subjective wellbeing, the estimated coefficients under low- and high-saturation conditions are generally similar, and their confidence intervals overlap substantially. Overall, the results provide limited evidence of meaningful differences between low- and high-saturation environments.

This finding complements recent work on treatment saturation in digital environments. For example, Enríquez et al. (2024) show that the electoral effects of Facebook advertisements depend on the saturation of political information within an electorate, highlighting the importance of treatment intensity in shaping collective outcomes. In contrast, the present results suggest that the mental health benefits of positive psychology content are largely invariant to treatment saturation. One possible explanation is that the intervention primarily operates through individual consumption of positive content rather than social reinforcement.

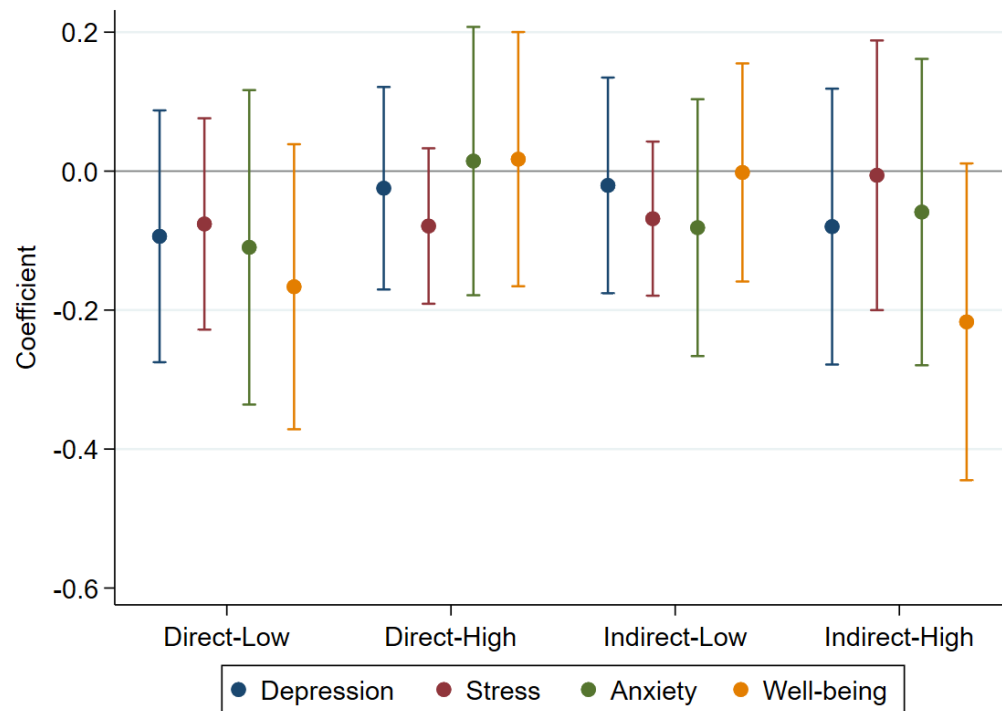


FIGURE 4: ESTIMATED SATURATION EFFECTS OF THE INTERVENTION ON MENTAL HEALTH OUTCOMES

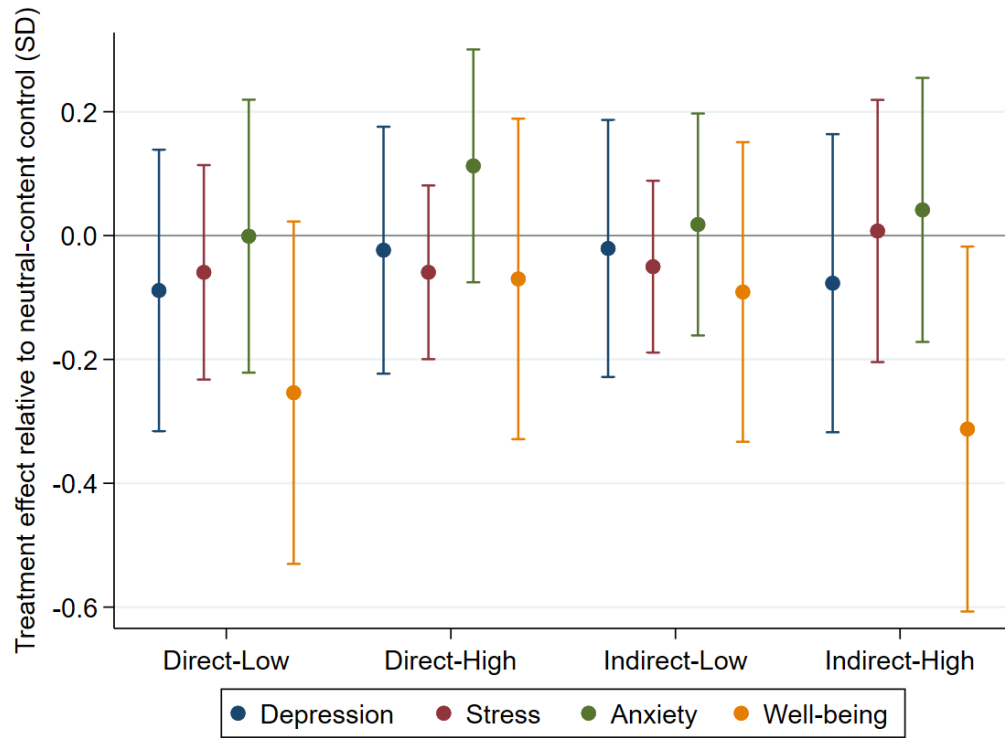


FIGURE 5: ESTIMATED SATURATION EFFECTS OF THE INTERVENTION ON MENTAL HEALTH OUTCOMES

5.6 Heterogeneity

I examine heterogeneity in treatment effects using two alternative reference groups. First, consistent with our main specification, I use the neutral-content control group as the reference category; these results are reported in the Appendix. Second, I use the no-exposure control group as the reference category. The results from the latter specification are presented in the following subsections.

5.6.1 Heterogeneity by Facebook use

Figure 6 examines whether treatment effects vary with participants' baseline intensity of Facebook use. Overall, I find limited evidence of systematic heterogeneity, as the confidence intervals of most interaction coefficients include zero.

For the direct treatment, the interaction between treatment assignment and Facebook use is negative and statistically significant for depression. This suggests that the effect of the direct intervention on depressive symptoms becomes more negative as baseline Facebook use increases. Figure 6 also shows a statistically significant negative interaction for Facebook-feed satisfaction, indicating that heavier Facebook users exposed to the direct treatment report relatively lower satisfaction with their Facebook feeds.¹⁷

For the indirect treatment, the interaction coefficients are generally not statistically distinguishable from zero. An exception is anxiety, for which the interaction with Facebook use is negative and statistically significant. This suggests that the indirect treatment is associated with a relatively larger reduction in anxiety among participants with higher baseline Facebook use.

A similar pattern emerges for the neutral-content control group relative to the no-exposure group. Although most interaction coefficients are statistically indistinguishable from zero, the interactions for depression and anxiety are negative and statistically significant. Thus, among participants receiving neutral Facebook content, higher baseline Facebook use is associated with relatively larger reductions in

17. Figure 6 estimates use the no-exposure control group as the reference category. For the corresponding estimates using the neutral-content control group as the reference category, see Figure A7.

these two adverse mental-health outcomes compared with participants receiving no experimental exposure.

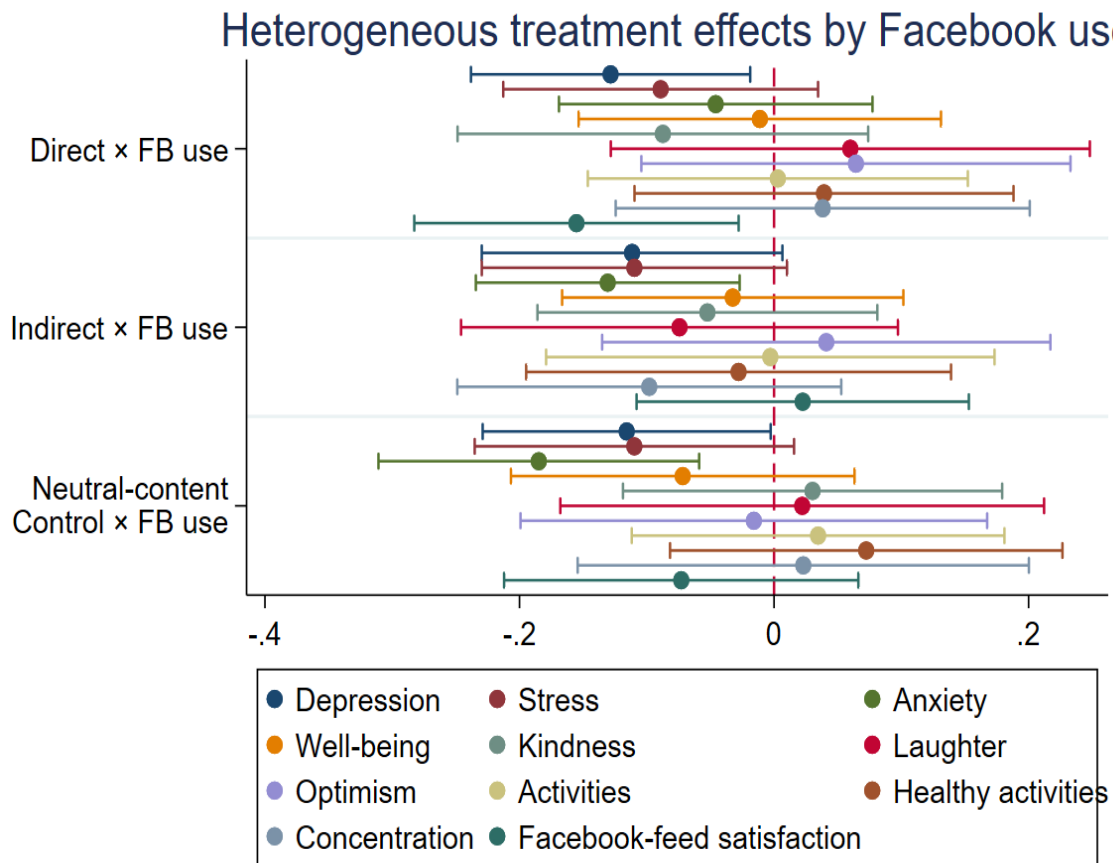


FIGURE 6: HETEROGENEOUS TREATMENT EFFECTS BY FACEBOOK USE

5.6.2 Heterogeneity by baseline mental health

Figure 7 examines whether treatment effects vary with participants' baseline mental health. Overall, the results reveal a relatively consistent pattern of heterogeneity for the mental-health outcomes, while there is little evidence of heterogeneity for the

intermediate outcomes.¹⁸

For the direct treatment, the interaction coefficients for depression, stress, and anxiety are negative and statistically significant. This pattern indicates that the effects of the direct intervention on these adverse mental-health outcomes become more negative as baseline mental-health problems increase. In contrast, the interaction effects for the remaining outcomes are generally statistically indistinguishable from zero.

A similar pattern emerges for the indirect treatment. The interaction coefficients for depression, stress, and anxiety are again negative and statistically significant, whereas the interactions for the remaining outcomes are not statistically significant. This suggests that the effects of the indirect intervention on adverse mental-health outcomes are also stronger among participants with poorer mental health at baseline.

For the neutral-content control group relative to the no-exposure group, the pattern is somewhat weaker. The interaction coefficients for stress and anxiety remain negative and statistically significant, whereas the interaction for depression is no longer statistically significant. The interactions for the remaining outcomes are also generally statistically indistinguishable from zero (except for Concentration, which shows significant negative effect).

Taken together, these results suggest that heterogeneity by baseline mental health is concentrated in the adverse mental-health outcomes. In particular, both the direct and indirect interventions appear to generate larger reductions in depression, stress, and anxiety among participants with poorer mental health at baseline, while there

18. Figure 6 estimates use the no-exposure control group as the reference category. For the corresponding estimates using the neutral-content control group as the reference category, see Figure A7.

is little evidence that baseline mental health systematically moderates effects on the intermediate outcomes.

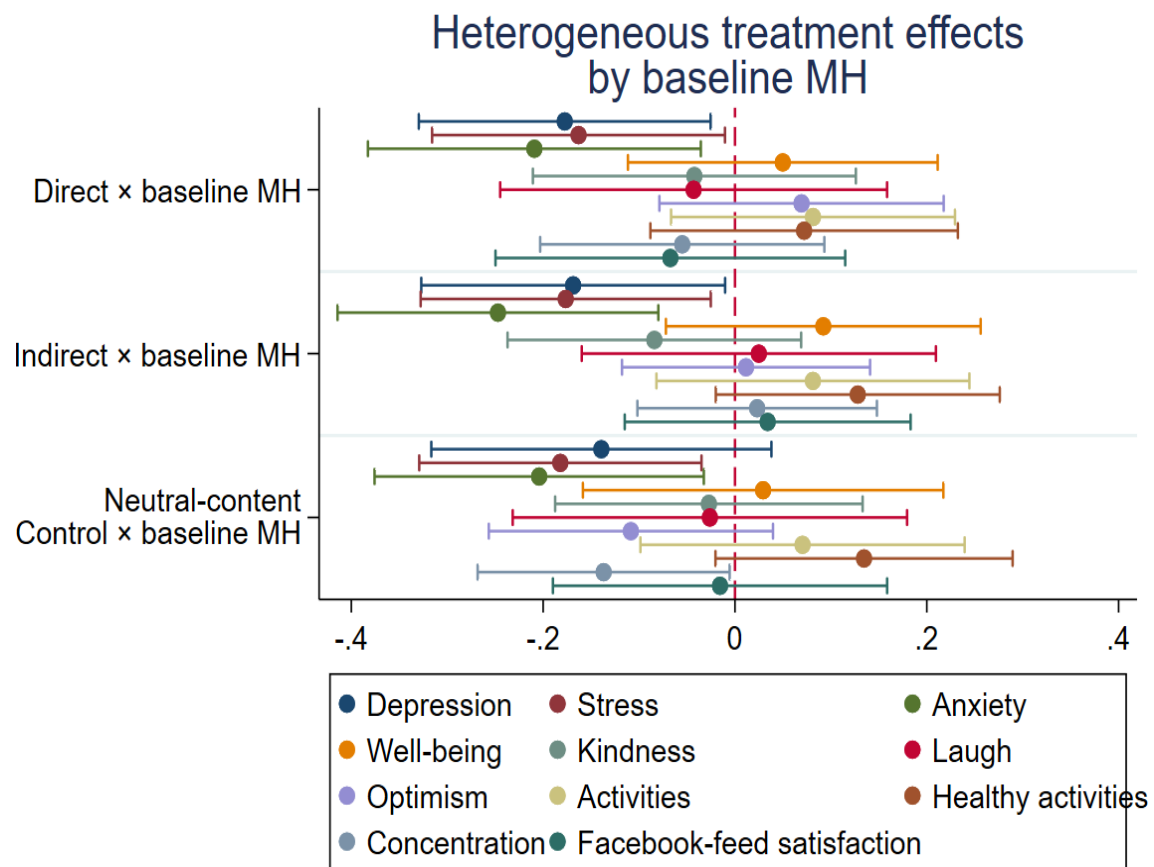


FIGURE 7: HETEROGENEOUS TREATMENT EFFECTS BY BASELINE MENTAL HEALTH

5.6.3 Heterogeneity by gender

Figure 8 examines whether treatment effects differ by gender. Overall, the results provide limited evidence of systematic gender heterogeneity.¹⁹

For the direct treatment, the interaction coefficient for stress is positive and statistically significant, indicating that the treatment effect on stress is less favorable for women, or equivalently, more favorable for men. Among the intermediate outcomes, the interaction coefficient for concentration is negative and statistically significant, suggesting that the effect of the direct treatment on concentration is less favorable for women than for men. The remaining interaction coefficients are not statistically distinguishable from zero.

A qualitatively similar pattern emerges for the indirect treatment with respect to stress and concentration. In addition, the interaction coefficient for well-being is negative and statistically significant, indicating a less favorable effect on well-being for women relative to men. By contrast, the interaction coefficient for Facebook-feed satisfaction is positive and statistically significant, suggesting a more favorable effect for women than for men. The remaining interaction coefficients are statistically insignificant.

Finally, for the neutral-content control group relative to the no-exposure group, none of the interaction coefficients is statistically significant. Taken together, these results suggest that gender heterogeneity is limited to a small number of outcomes and does not exhibit a systematic pattern across the broader set of mental-health

19. The estimates in Figure 8 use the no-exposure control group as the reference category. For the corresponding estimates using the neutral-content control group as the reference category, see Figure A9.

and intermediate outcomes.

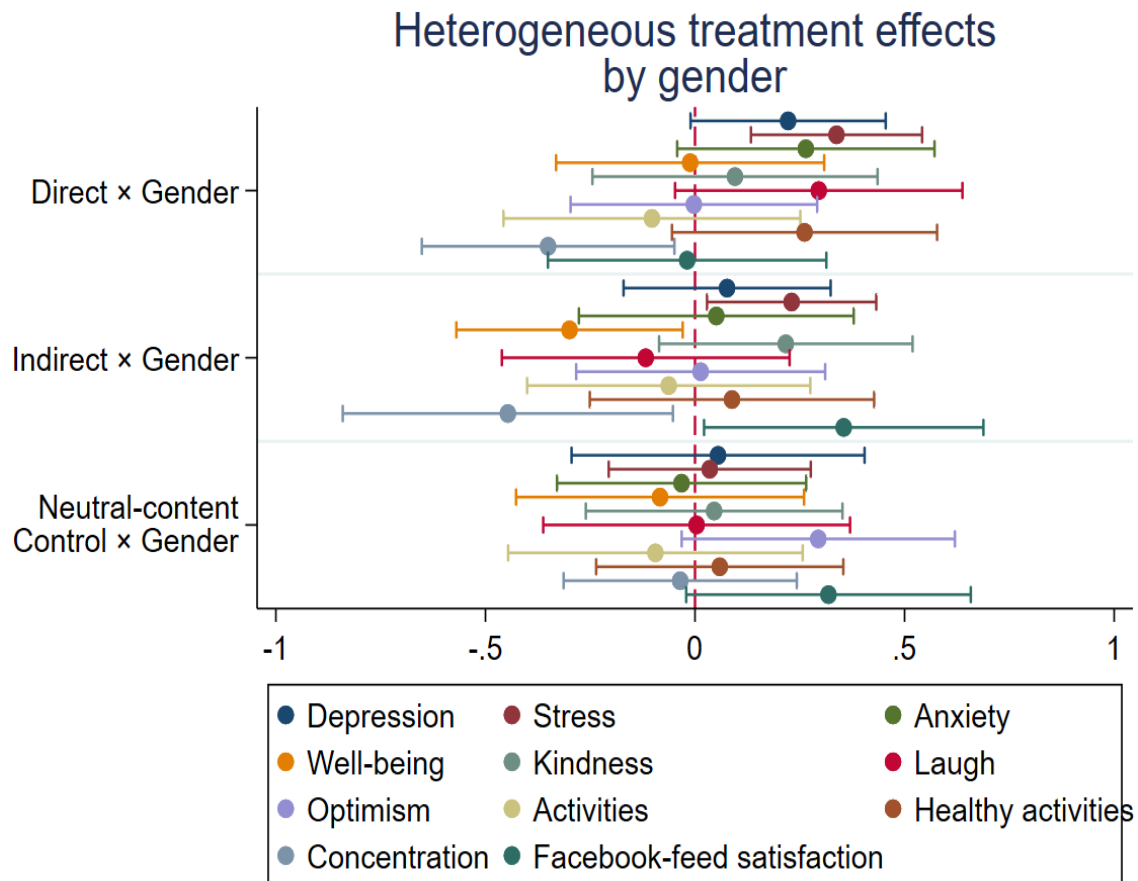


FIGURE 8: HETEROGENEOUS TREATMENT EFFECTS BY GENDER

5.6.4 Heterogeneity by academic year

Table 5 examines whether treatment effects vary across students' academic years. First-year undergraduate students constitute the reference academic-year category, while the no-exposure group remains the reference experimental condition. Thus, the reported interaction coefficients indicate whether the effect associated with a

particular experimental condition differs for students in a given academic year relative to first-year undergraduate students.

For the direct treatment, there is relatively little evidence of heterogeneity in the main mental-health outcomes among second-, third-, and fourth-year undergraduate students. None of the interaction coefficients for depression, stress, anxiety, or well-being is statistically significant for these groups. More pronounced differences emerge among first-year Master's students: the interactions are positive and statistically significant for stress (0.444 SD) and anxiety (0.368 SD), indicating less favorable relative effects on these outcomes compared with first-year undergraduate students. Heterogeneity is more apparent among the intermediate outcomes. In particular, fourth-year undergraduate students exhibit significantly lower relative effects on kindness (-0.873 SD) and concentration (-1.272 SD), but higher relative effects on laughter (0.753 SD), optimism (0.249 SD), and healthy activities (0.315 SD). The direct treatment also produces relatively larger effects on optimism among second-year students and on laughter and activities among third-year students.

For the indirect treatment, academic-year heterogeneity is more pronounced. Among fourth-year undergraduate students, the interaction coefficients are positive for depression (0.416 SD) and stress (0.198 SD), although the latter is significant only at the 10 percent level. The largest differences are observed among first-year Master's students. Relative to first-year undergraduates, the indirect-treatment interactions are strongly positive for depression (0.976 SD), stress (0.520 SD), and anxiety (1.652 SD). The interaction for well-being is also positive (0.712 SD). Since higher depression, stress, and anxiety represent worse mental-health outcomes, these estimates

suggest substantially less favorable relative effects of the indirect treatment for Master’s students on these dimensions. At the same time, substantial heterogeneity is observed in the intermediate outcomes: Master’s students show lower relative effects on kindness (-0.396 SD), optimism (-0.673 SD), and healthy activities (-0.591 SD), but a considerably higher relative effect on Facebook-feed satisfaction (1.138 SD).

For the neutral-content control relative to the no-exposure group, there is comparatively little evidence of heterogeneity among second- and third-year undergraduate students. Differences become more apparent for fourth-year students, for whom the interaction is positive for depression (0.768 SD, $p < 0.10$), negative for kindness (-0.779 SD) and concentration (-0.594 SD), and positive for optimism (0.586 SD) and healthy activities (0.511 SD). The interaction effects for first-year Master’s students in the neutral-content condition could not be estimated because of insufficient variation in this treatment-by-academic-year cell.

Overall, the results suggest that treatment heterogeneity by academic year is concentrated primarily among students in the later stages of their studies, particularly fourth-year undergraduate and first-year Master’s students.

TABLE 5: HETEROGENEOUS TREATMENT EFFECTS BY ACADEMIC YEAR

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Depression	Stress	Anxiety	Well-being	Kindness	Laughter	Optimism	Activities	Healthy activities	Concentration	FB-feed satisfaction
Direct $\times$ 2nd year UG	-0.038 (0.144)	0.197 (0.131)	0.104 (0.186)	-0.074 (0.205)	-0.044 (0.259)	0.033 (0.158)	0.427** (0.200)	-0.003 (0.211)	-0.074 (0.178)	-0.016 (0.226)	0.165 (0.150)
Direct $\times$ 3rd year UG	-0.014 (0.228)	0.095 (0.104)	0.059 (0.217)	-0.152 (0.165)	-0.375 (0.249)	0.500*** (0.176)	0.214 (0.177)	0.664*** (0.155)	-0.026 (0.188)	-0.022 (0.439)	0.334* (0.180)
Direct $\times$ 4th year UG	-0.052 (0.126)	0.094 (0.128)	-0.182 (0.156)	-0.201 (0.199)	-0.873*** (0.170)	0.753*** (0.147)	0.249** (0.124)	0.035 (0.121)	0.315** (0.150)	-1.272*** (0.145)	-0.421 (0.270)
Direct $\times$ 1st year Master's	-0.039 (0.115)	0.444*** (0.065)	0.368*** (0.136)	0.367 (0.491)	-0.485*** (0.124)	0.362 (0.456)	-0.735*** (0.111)	-0.260 (0.297)	0.279 (0.344)	-0.157 (0.163)	0.687*** (0.098)
Indirect $\times$ 2nd year UG	0.179 (0.140)	0.218 (0.132)	0.163 (0.161)	-0.107 (0.150)	0.013 (0.175)	-0.218 (0.161)	0.205 (0.174)	0.325 (0.232)	-0.085 (0.173)	-0.372 (0.255)	0.035 (0.136)
Indirect $\times$ 3rd year UG	0.025 (0.247)	-0.109 (0.158)	0.054 (0.189)	-0.064 (0.191)	-0.244 (0.286)	0.260* (0.151)	0.431** (0.181)	0.531** (0.220)	-0.328** (0.151)	0.401 (0.420)	0.631*** (0.149)
Indirect $\times$ 4th year UG	0.416** (0.162)	0.198* (0.104)	0.266 (0.179)	-0.195 (0.176)	-0.493*** (0.137)	0.204 (0.152)	0.475*** (0.140)	0.598*** (0.156)	0.311** (0.123)	-0.699*** (0.243)	-0.451*** (0.145)
Indirect $\times$ 1st year Master's	0.976*** (0.109)	0.520*** (0.078)	1.652*** (0.126)	0.712*** (0.150)	-0.396*** (0.120)	0.054 (0.098)	-0.673*** (0.113)	-0.127 (0.114)	-0.591*** (0.084)	0.252 (0.185)	1.138*** (0.085)
Neutral control $\times$ 2nd year UG	0.160 (0.151)	0.036 (0.150)	0.111 (0.171)	-0.045 (0.167)	-0.220 (0.178)	0.025 (0.171)	0.146 (0.205)	-0.196 (0.223)	0.092 (0.163)	-0.265 (0.199)	-0.160 (0.169)
Neutral control $\times$ 3rd year UG	-0.156 (0.335)	-0.120 (0.164)	-0.144 (0.262)	0.322 (0.387)	-0.288 (0.245)	0.383 (0.286)	0.344 (0.254)	-0.003 (0.163)	-0.025 (0.177)	-0.169 (0.417)	0.227 (0.225)
Neutral control $\times$ 4th year UG	0.768* (0.430)	-0.098 (0.145)	0.148 (0.159)	-0.079 (0.152)	-0.779*** (0.231)	0.193 (0.160)	0.586** (0.226)	-0.016 (0.247)	0.511** (0.231)	-0.594** (0.231)	-0.420 (0.323)
Neutral control $\times$ 1st year Master's	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Observations	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101	1,101
R-squared	0.270	0.349	0.352	0.250	0.306	0.174	0.242	0.202	0.174	0.162	0.194

Notes: The table reports heterogeneous treatment effects by academic year. The omitted academic-year category is first-year undergraduate students, and the omitted experimental group is the no-exposure control group. The reported interaction coefficients therefore capture differences in treatment effects for the indicated academic-year group relative to first-year undergraduate students. All outcomes are standardized, and each specification controls for the baseline value of the corresponding outcome. Standard errors clustered at the CF level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

6 Conclusion

This study examines whether existing social media platforms can be used to deliver a low-cost and scalable positive psychology intervention. Using a cluster-randomized field experiment among university students in Bangladesh, I distinguish between direct exposure to positive psychology content, indirect exposure through treated peers, exposure to neutral Facebook content, and no assigned content exposure.

The experiment therefore does not support the conclusion that passive exposure to positive psychology content through Facebook is sufficient, by itself, to generate measurable improvements in psychosocial well-being. At the same time, the intervention produces evidence of an effect on prosocial behavior. Participants directly exposed to positive psychology content allocate more to an anonymous recipient in the dictator-game measure of kindness, and this result remains statistically significant under alternative inference. This suggests that even a relatively light-touch social-media intervention may influence specific behavioral outcomes.

From a policy perspective, the intervention is attractive because it can be delivered through an existing digital platform without requiring therapists, classroom instruction, or extensive training. This feature may be particularly relevant in settings where access to conventional mental-health services is limited. At the same time, the results caution against viewing low-cost social-media interventions as substitutes for professional mental-health care. Instead, they may provide a complementary and scalable way of reaching particular groups, especially individuals experiencing greater mental-health difficulties.

Future research could examine whether stronger or longer exposure to positive

psychology content generates larger and more persistent effects, whether alternative types of content are more effective, and whether targeting participants according to baseline mental-health status improves intervention effectiveness.

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8 Appendix

8.1 Figures

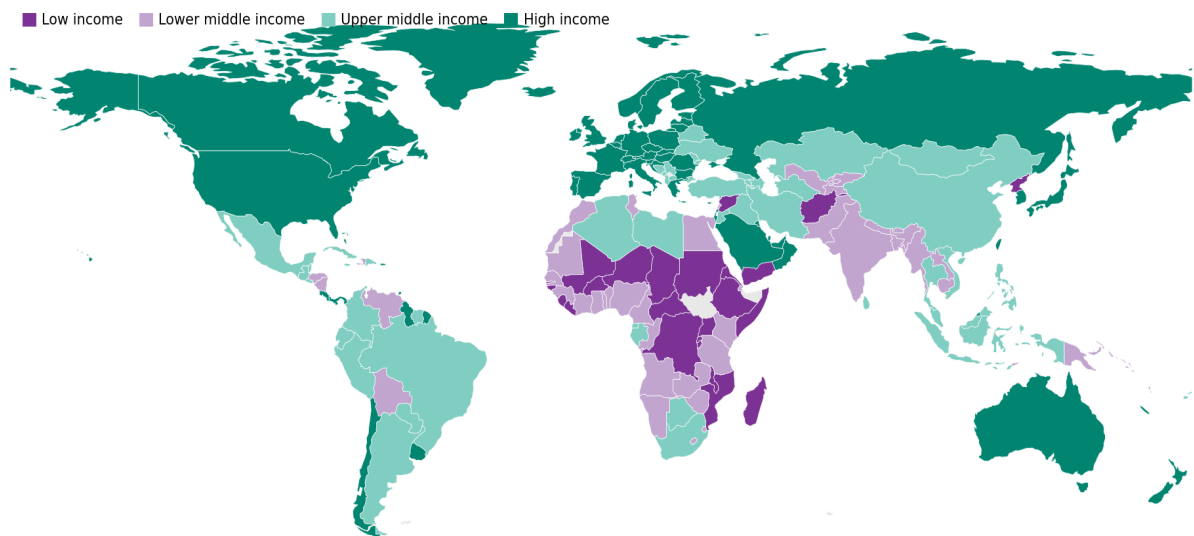


FIGURE A1: THE WORLD BY INCOME AND REGION (WORLD BANK 2025)

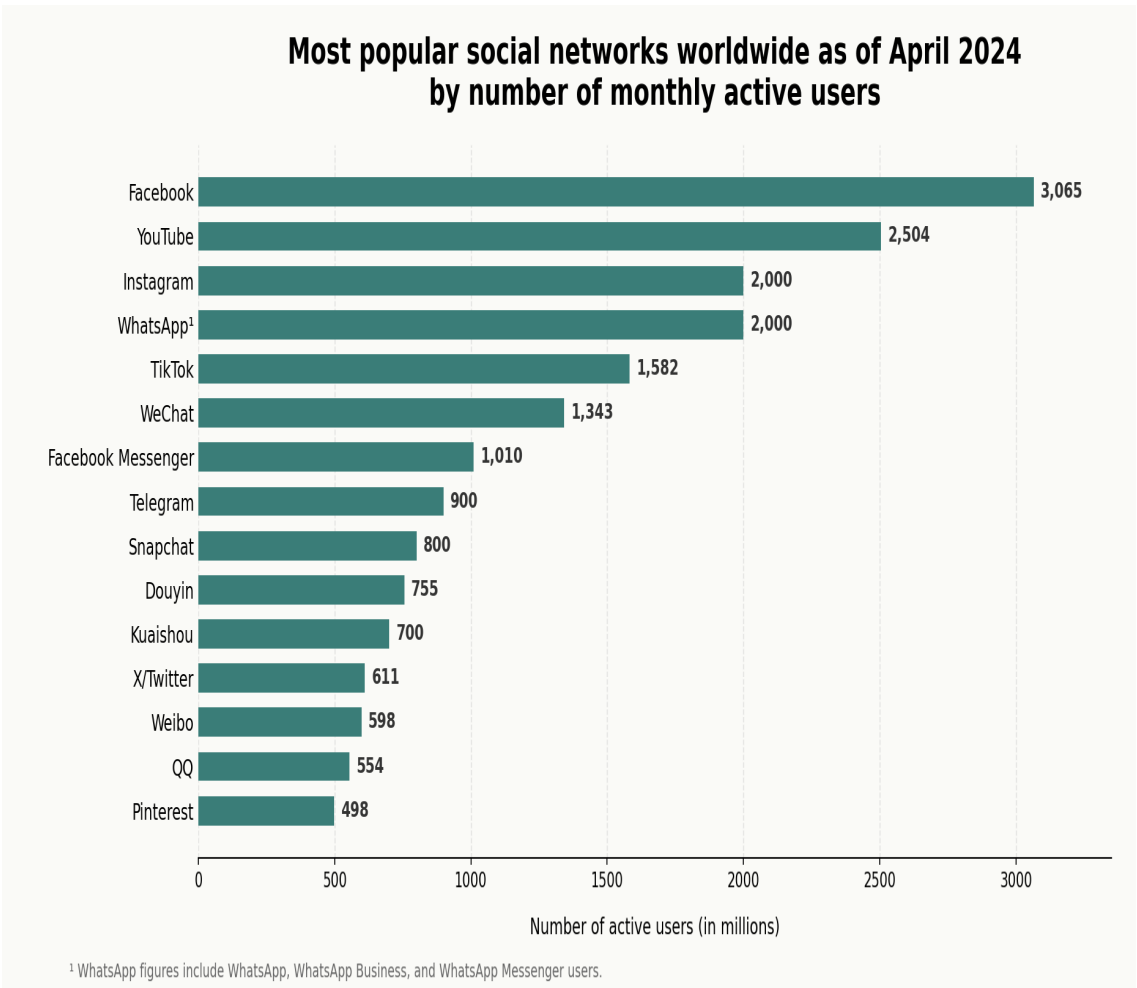


FIGURE A2: SOCIAL MEDIA USE WORLDWIDE (STATISTA 2024B)

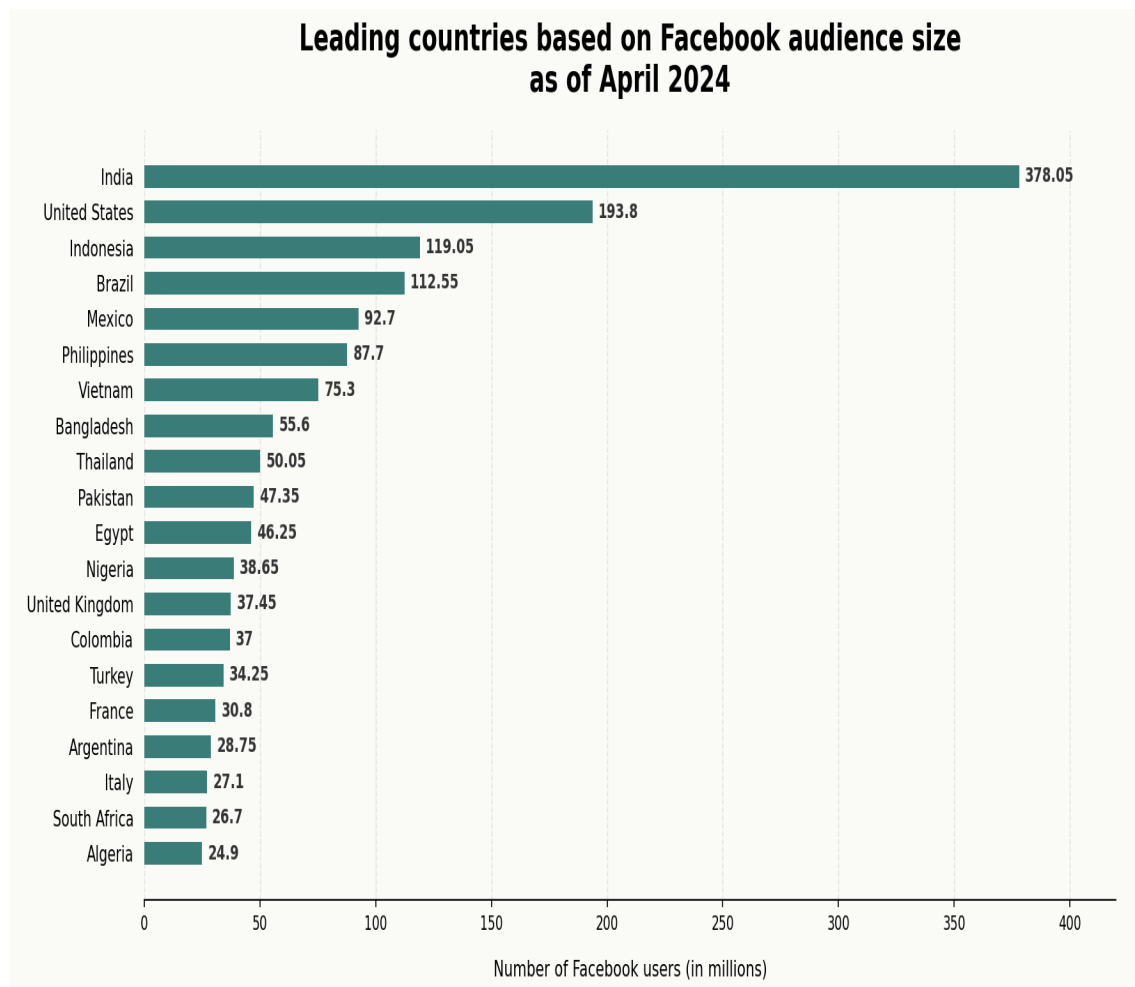


FIGURE A3: FACEBOOK USERS USE BY COUNTRY (STATISTA 2024A)

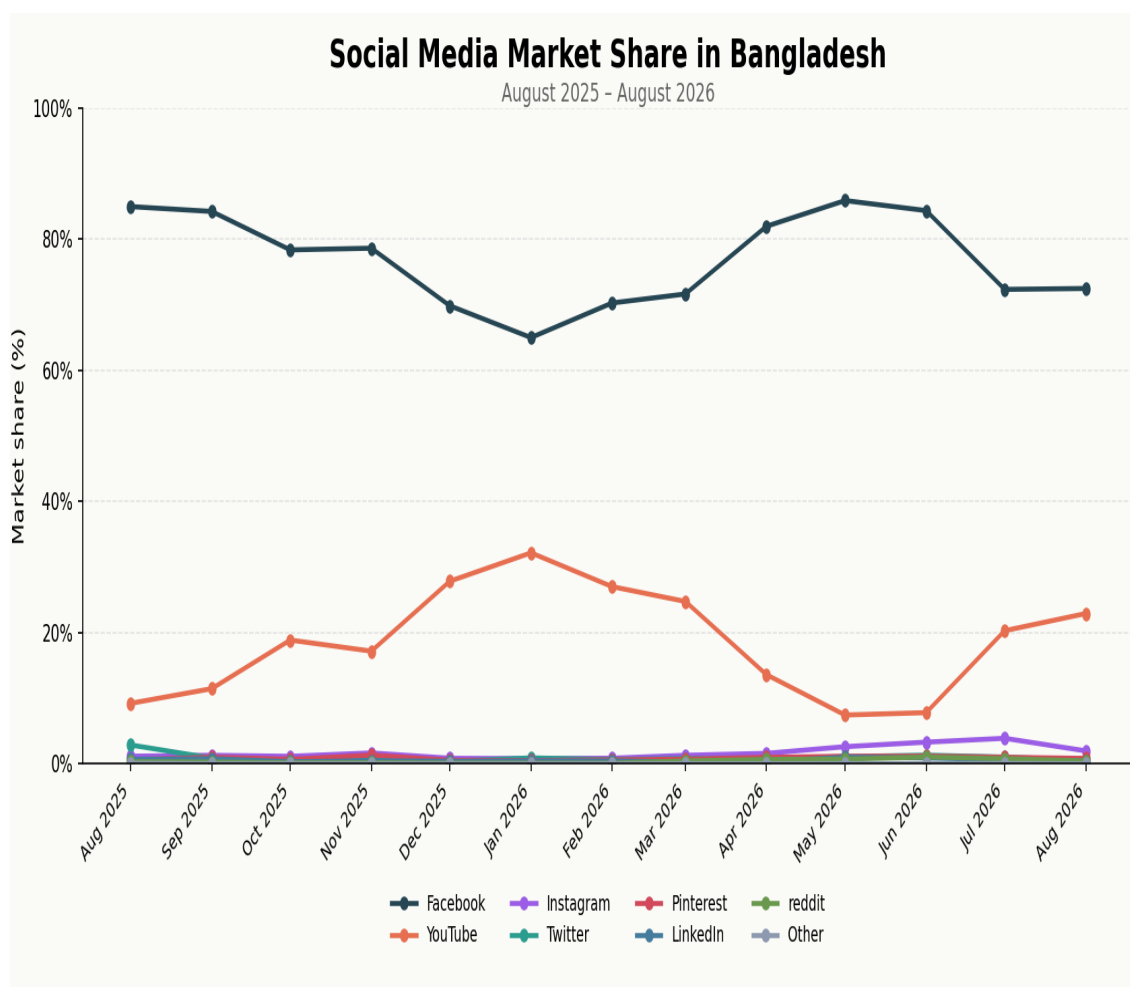


FIGURE A4: SOCIAL MEDIA USERS IN BANGLADESH (STATCOUNTER 2025)

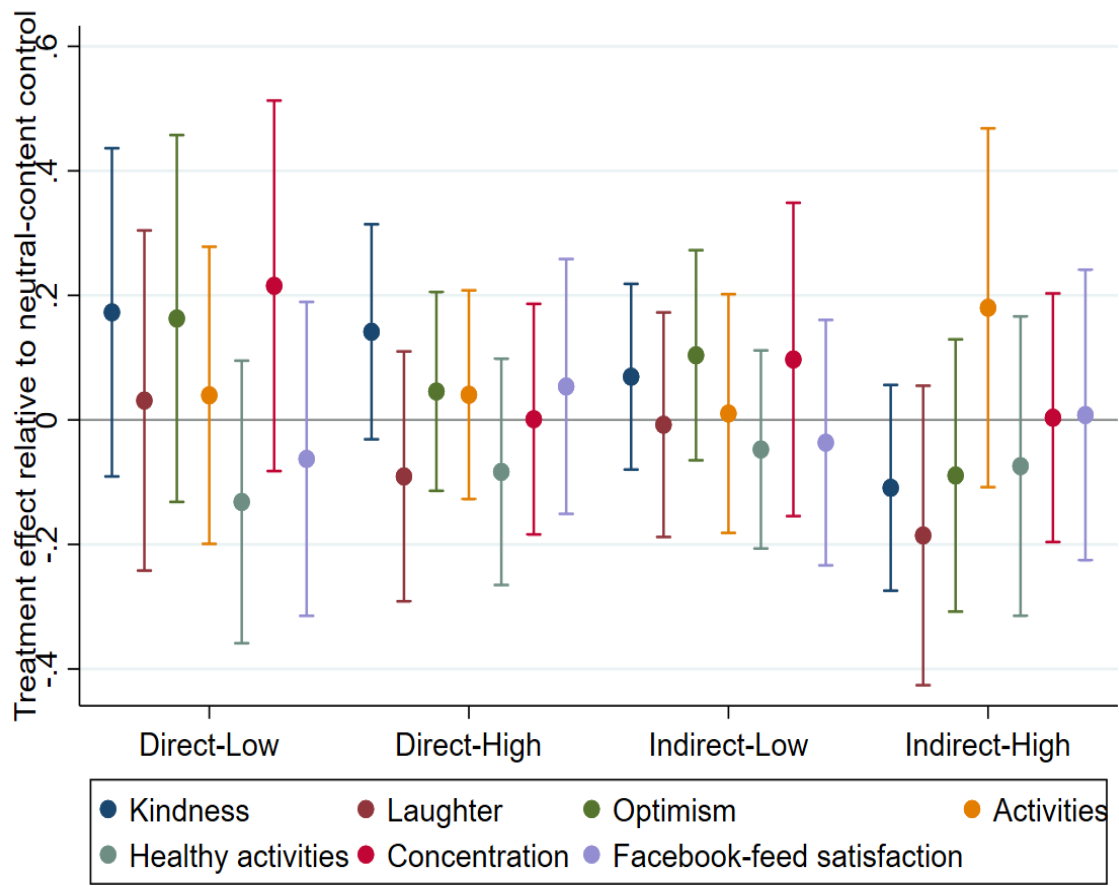


FIGURE A5: TREATMENT EFFECT RELATIVE TO NEUTRAL-CONTENT CONTROL

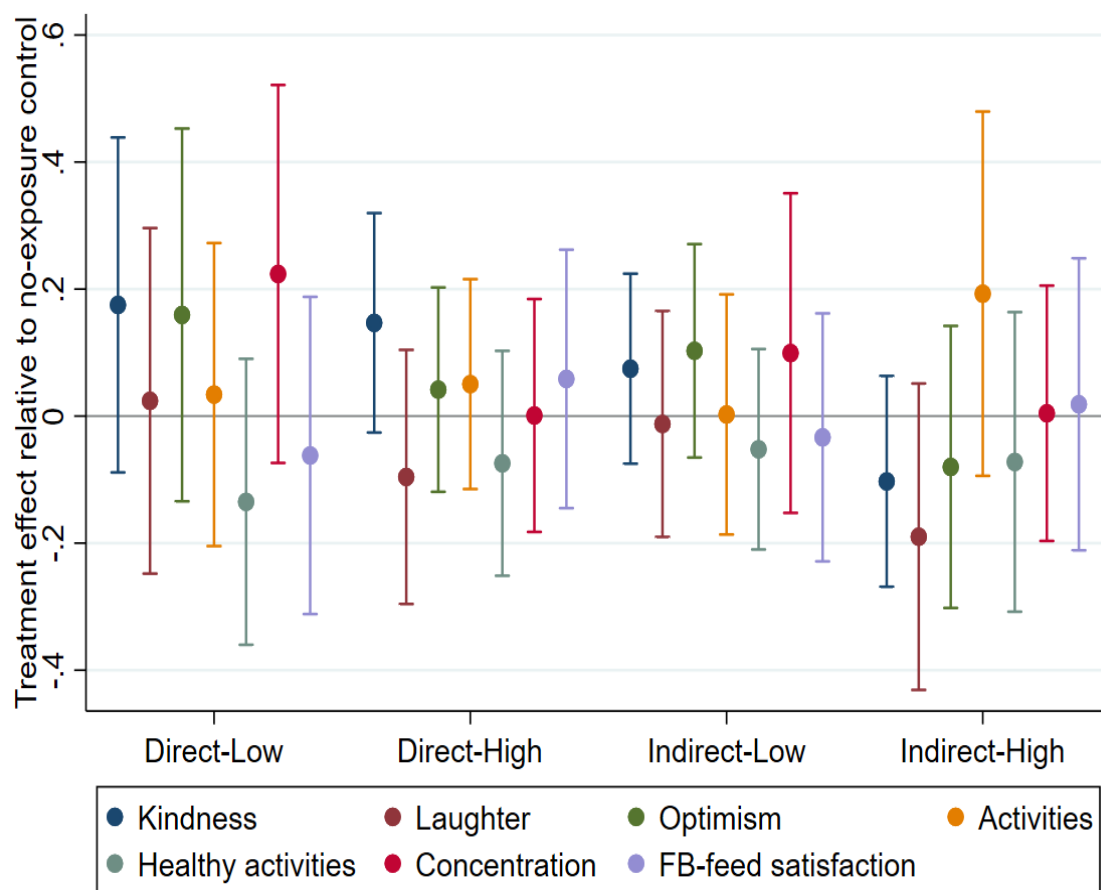


FIGURE A6: TREATMENT EFFECT RELATIVE TO NO-EXPOSURE CONTROL

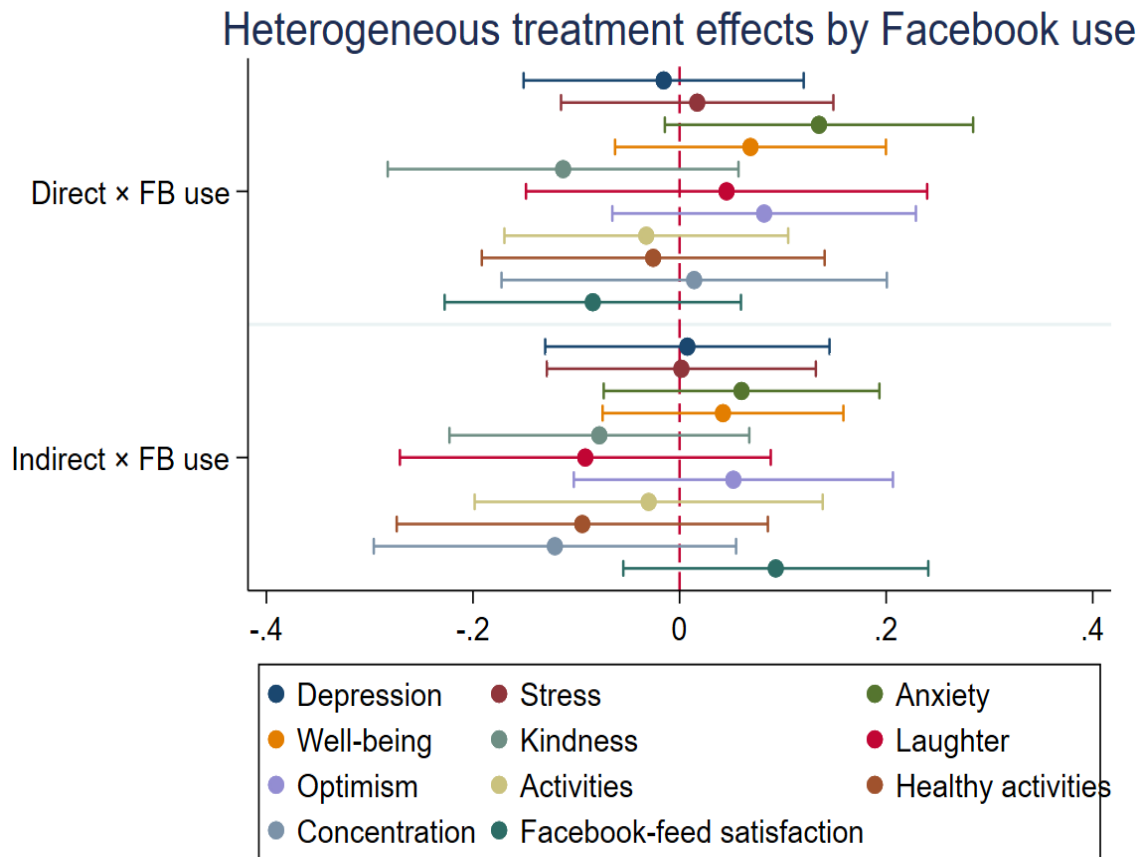


FIGURE A7: HETEROGENEOUS TREATMENT EFFECTS BY FACEBOOK USE

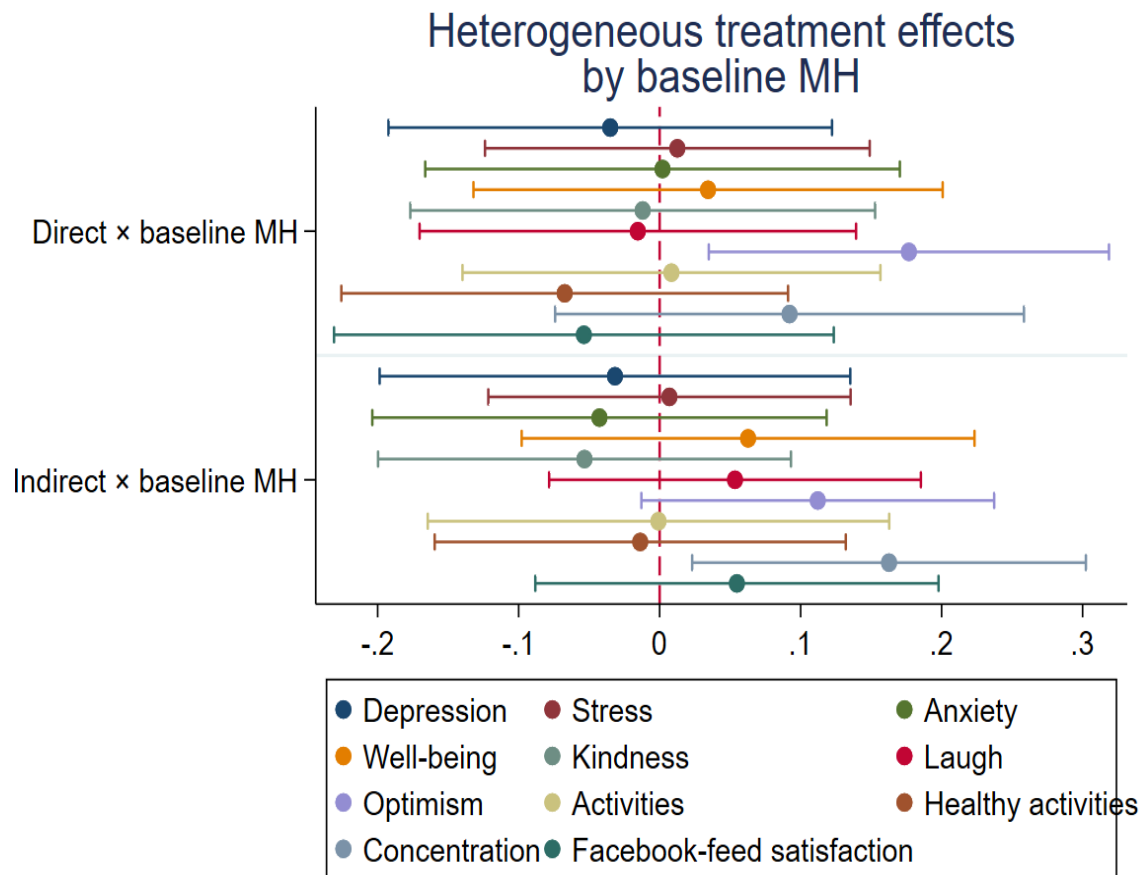


FIGURE A8: HETEROGENEOUS TREATMENT EFFECTS BY BASELINE MENTAL HEALTH INDEX

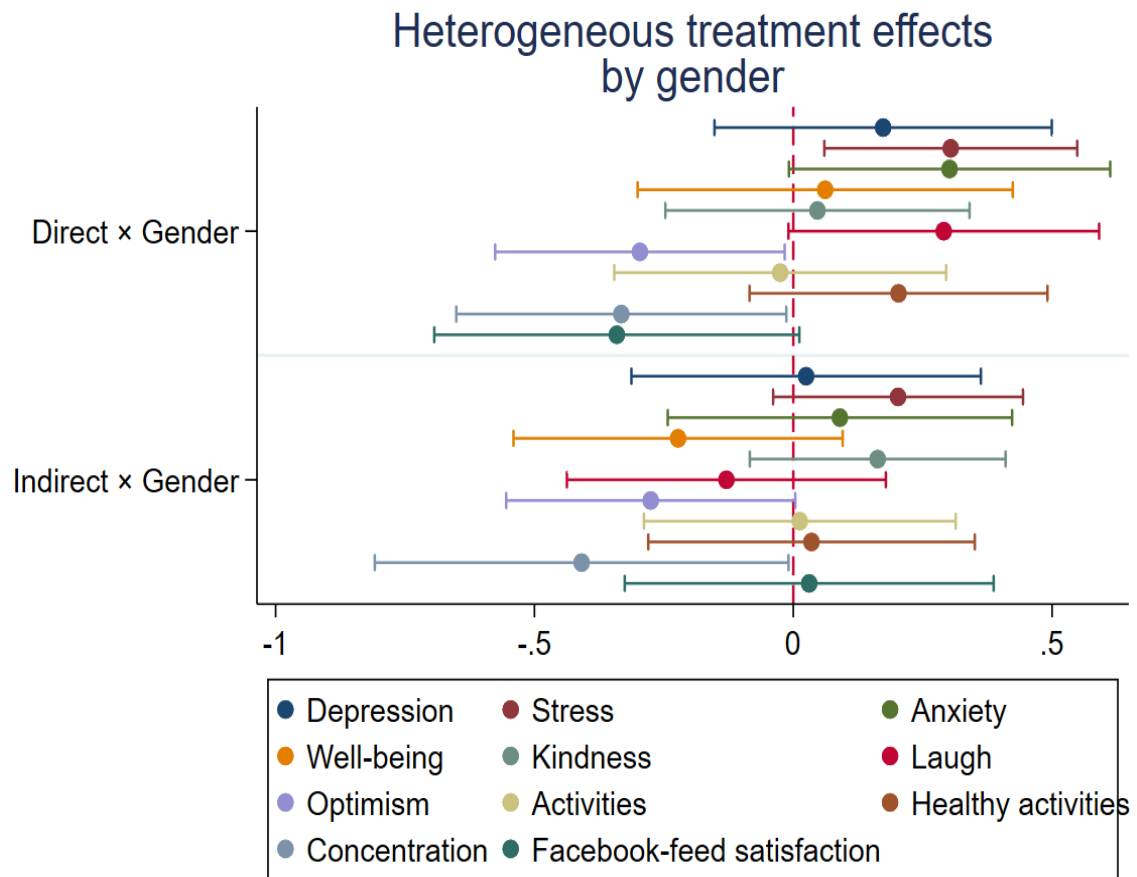


FIGURE A9: HETEROGENEOUS TREATMENT EFFECTS BY BASELINE MENTAL HEALTH INDEX

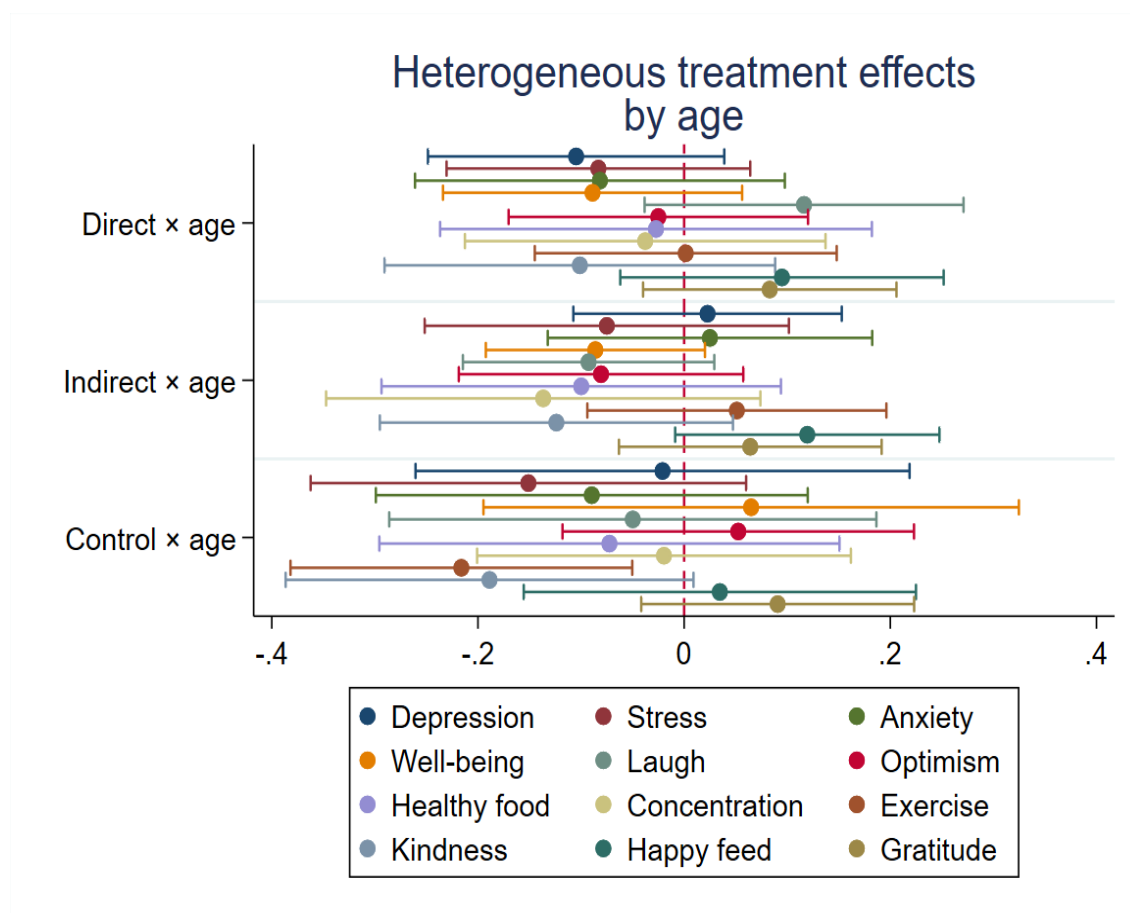


FIGURE A10: HETEROGENEOUS TREATMENT EFFECTS BY AGE

TABLE A1: BASELINE BALANCE ACROSS TREATMENT GROUPS

	Groups				Difference Relative to No-Exposure Control		
	No Exposure	Direct	Indirect	Neutral Content	Direct	Indirect	Neutral Content
	(1)	(2)	(3)	(4)	(2)–(1)	(3)–(1)	(4)–(1)
Depression	10.328 (5.008)	10.590 (9.599)	10.172 (5.832)	10.030 (8.416)	0.261	-0.157	-0.299
Anxiety	7.691 (4.791)	7.933 (7.605)	7.765 (5.910)	7.526 (6.805)	0.242	0.074	-0.165
Stress	18.485 (4.655)	18.638 (6.266)	18.265 (6.775)	18.152 (7.715)	0.153	-0.220	-0.333
Well-being	10.000 (6.163)	10.125 (6.185)	9.729 (8.240)	10.311 (7.174)	0.125	-0.271	0.311
Kindness	0.032 (1.213)	-0.020 (1.159)	-0.061 (1.033)	0.066 (1.691)	-0.052	-0.092	0.035
Laughter	3.157 (1.001)	3.112 (1.169)	3.093 (0.952)	3.007 (1.124)	-0.045	-0.063	-0.150
Optimism	2.343 (0.805)	2.311 (1.221)	2.247 (1.272)	2.258 (1.096)	-0.032	-0.096	-0.085
Activities	2.103 (1.795)	1.902 (2.012)	2.072 (1.624)	1.977 (1.329)	-0.201	-0.031	-0.126
Healthy activities	2.637 (1.002)	2.628 (0.973)	2.747 (1.228)	2.702 (1.445)	-0.009	0.110	0.065
Concentration	2.377 (1.373)	2.372 (1.619)	2.386 (1.728)	2.401 (1.591)	-0.006	0.008	0.023
Facebook-feed satisfaction	2.495 (0.655)	2.522 (0.851)	2.512 (0.910)	2.593 (0.799)	0.027	0.017	0.098
Facebook use	3.391 (2.325)	3.313 (2.374)	3.356 (2.340)	3.218 (2.118)	-0.079	-0.035	-0.173
Age	21.255 (3.396)	21.779 (4.252)	21.789 (4.752)	21.480 (3.568)	0.524	0.534	0.225
Female	0.701 (0.695)	0.683 (1.003)	0.647 (0.863)	0.510 (0.983)	-0.018	-0.054	-0.191
Observations	204	312	331–332	302	516	535–536	506
Clusters	21	32	30	37	53	50	58

Note: This table reports baseline balance across the four experimental groups. Columns (1)–(4) report group means, with standard deviations in parentheses. Columns (2)–(1), (3)–(1), and (4)–(1) report differences in means relative to the no-exposure control group. The pairwise t-tests examine whether the baseline covariates jointly predict assignment to each treatment group relative to the no-exposure control group. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

TABLE A2: EFFECTS OF THE INTERVENTION ON DEPRESSION, ANXIETY, STRESS, AND WELLBEING

	Impacts on Psychosocial Wellbeing							
	Neutral-content Control Group as Reference				No-exposure Control Group as Reference			
	Depression	Anxiety	Stress	Wellbeing	Depression	Anxiety	Stress	Wellbeing
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Direct	-0.039	0.086	-0.059	-0.114	-0.041	-0.015	-0.078	-0.027
	(0.096)	(0.085)	(0.066)	(0.124)	(0.068)	(0.089)	(0.050)	(0.083)
<i>Wild bootstrap p</i>	[0.697]	[0.341]	[0.373]	[0.438]	[0.566]	[0.871]	[0.132]	[0.753]
<i>Wild bootstrap 95% CI</i>	[-0.237, 0.156]	[-0.089, 0.261]	[-0.190, 0.074]	[-0.364, 0.122]	[-0.187, 0.093]	[-0.203, 0.164]	[-0.181, 0.024]	[-0.193, 0.148]
Indirect	-0.034	0.023	-0.037	-0.142	-0.034	-0.076	-0.054	-0.052
	(0.100)	(0.079)	(0.069)	(0.118)	(0.072)	(0.082)	(0.055)	(0.072)
<i>Wild bootstrap p</i>	[0.743]	[0.781]	[0.596]	[0.272]	[0.644]	[0.383]	[0.341]	[0.485]
<i>Wild bootstrap 95% CI</i>	[-0.238, 0.170]	[-0.139, 0.187]	[-0.178, 0.105]	[-0.381, 0.073]	[-0.189, 0.110]	[-0.251, 0.086]	[-0.167, 0.058]	[-0.196, 0.098]
Neutral-content control	–	–	–	–	-0.000	-0.097	-0.016	0.085
					(0.103)	(0.091)	(0.062)	(0.121)
<i>Wild bootstrap p</i>					[0.998]	[0.306]	[0.790]	[0.583]
<i>Wild bootstrap 95% CI</i>					[-0.214, 0.210]	[-0.291, 0.087]	[-0.145, 0.111]	[-0.138, 0.325]
No-exposure control					–	–	–	–
Clusters	98	98	98	98	118	118	118	118
Observations	904	904	904	904	1101	1101	1101	1101

Note: The table reports intent-to-treat (ITT) estimates of the effects of the intervention on depression, anxiety, stress, and subjective wellbeing. Columns (1)–(4) compare the direct-treatment and indirect-treatment groups with the neutral-content control group, while Columns (5)–(8) compare the direct-treatment, indirect-treatment, and neutral-content control groups with the no-exposure control group. Coefficients are expressed in standard deviation units. Cluster-robust standard errors, reported in parentheses, are clustered at the randomization-cluster level. For Columns (5)–(8), wild-cluster-bootstrap p -values are reported in square brackets, with corresponding 95% wild-bootstrap confidence intervals reported below. Wild-cluster-bootstrap inference is based on 9,999 replications with clustering at the randomization-cluster level. Statistical significance in Columns (5)–(8) is based on the wild-cluster-bootstrap p -values and is denoted by * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

TABLE A3: IMPACTS ON INTERMEDIATE OUTCOMES

Impacts on Intermediate Outcomes														
Neutral-content Control Group as Reference					No-exposure Control Group as Reference					Facebook-feed satisfaction				
Kindness	Laughter	Optimism	Activities	Healthy activities	Concentration	Kindness	Laughter	Optimism	Activities	Healthy activities	Concentration	Facebook-feed satisfaction	Facebook-feed satisfaction	Facebook-feed satisfaction
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Direct	-0.149*	-0.062	0.073	0.040	-0.085	0.026	0.102*	-0.084	0.086	-0.045	-0.074	0.180	0.106	
Wild bootstrap p	(0.082)	(0.090)	(0.090)	(0.084)	(0.080)	(0.096)	(0.087)	(0.073)	(0.083)	(0.080)	(0.073)	(0.100)	(0.077)	
Wild bootstrap 95% CI	[-0.019, 0.315]	[-0.243, 0.117]	[-0.091, 0.238]	[-0.130, 0.209]	[-0.257, 0.069]	[-0.172, 0.224]	[-0.030, 0.329]	[-0.228, 0.062]	[-0.074, 0.263]	[-0.236, 0.143]	[-0.224, 0.077]	[-0.048, 0.304]	[-0.051, 0.268]	
Indirect	0.028	-0.049	0.059	0.050	-0.054	-0.026	0.032	-0.070	0.087	-0.045	-0.042	0.203	0.035	
Wild bootstrap p	(0.089)	(0.087)	(0.085)	(0.081)	(0.086)	(0.079)	(0.081)	(0.072)	(0.083)	(0.071)	(0.079)	(0.115)	(0.028)	
Wild bootstrap 95% CI	[-0.110, 0.167]	[-0.224, 0.129]	[-0.099, 0.216]	[-0.147, 0.248]	[-0.207, 0.102]	[-0.212, 0.158]	[-0.127, 0.187]	[-0.208, 0.069]	[-0.088, 0.242]	[-0.256, 0.167]	[-0.183, 0.103]	[-0.053, 0.455]	[-0.081, 0.198]	
Neutral-content control	-	-	-	-	-	-	-0.002	-0.017	0.026	-0.002	0.014	0.126	0.077	
Wild bootstrap p							(0.989)	(0.860)	(0.787)	(0.966)	(0.840)	(0.223)	(0.421)	
No-exposure control	-	-	-	-	-	-	-0.166, 0.158]	[-0.199, 0.165]	[-0.167, 0.222]	[-0.256, 0.114]	[-0.134, 0.165]	[-0.087, 0.327]	[-0.114, 0.269]	
Observations	984	984	984	984	984	984	1101	1101	1101	1101	1101	1101	1101	1101

Note: The table reports intent-to-treat (ITT) estimates of the effects of the intervention on intermediate outcomes, including kindness, laughter, optimism, activities, healthy activities, concentration, and Facebook feed. Columns (1)–(7) compare the direct-treatment and indirect-treatment groups with the neutral-content control group, while Columns (8)–(14) compare the direct-treatment, indirect-treatment, and neutral-content control groups with the no-exposure control group. Coefficients are expressed in standard deviation units. Cluster-robust standard errors, reported in parentheses, are clustered at the randomization-cluster level. For Columns (8)–(14), wild-cluster-bootstrap p -values are reported in square brackets and corresponding 95% wild bootstrap confidence intervals are reported below. Wild-cluster-bootstrap inference is based on 9,999 replications with clustering at the randomization-cluster level. Statistical significance in Columns (8)–(14) is based on the wild-cluster-bootstrap p -values and is denoted by * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

TABLE A4: HETEROGENEOUS TREATMENT EFFECTS BY ACADEMIC YEAR

	(1) Depression	(2) Stress	(3) Anxiety	(4) Well-being	(5) Kindness	(6) Laughter	(7) Optimism	(8) Activities	(9) Healthy activities	(10) Concentration	(11) FB-feed satisfaction
Direct $\times$ 2nd year UG	-0.212 (0.139)	0.152 (0.163)	-0.020 (0.171)	-0.015 (0.212)	0.190 (0.251)	0.014 (0.179)	0.295 (0.185)	0.222 (0.187)	-0.188 (0.165)	0.259 (0.220)	0.325* (0.175)
Direct $\times$ 3rd year UG	0.149 (0.278)	0.221 (0.173)	0.219 (0.292)	-0.466 (0.397)	-0.103 (0.174)	0.118 (0.279)	-0.128 (0.217)	0.698*** (0.183)	-0.009 (0.235)	0.124 (0.268)	0.115 (0.249)
Direct $\times$ 4th year UG	-0.807* (0.425)	0.210 (0.192)	-0.297** (0.143)	-0.135 (0.208)	-0.099 (0.258)	0.541*** (0.196)	-0.349 (0.238)	0.081 (0.246)	-0.209 (0.274)	-0.646*** (0.234)	-0.019 (0.414)
Direct $\times$ 1st year Master's	-1.005*** (0.099)	-0.085 (0.089)	-1.276*** (0.098)	-0.331 (0.489)	-0.070 (0.124)	0.333 (0.460)	-0.097 (0.100)	-0.192 (0.306)	0.909** (0.346)	-0.399* (0.214)	-0.463*** (0.105)
Indirect $\times$ 2nd year UG	0.009 (0.134)	0.170 (0.164)	0.040 (0.150)	-0.055 (0.164)	0.229 (0.156)	-0.229 (0.179)	0.081 (0.171)	0.558** (0.213)	-0.188 (0.161)	-0.095 (0.252)	0.196 (0.168)
Indirect $\times$ 3rd year UG	0.185 (0.295)	0.013 (0.210)	0.198 (0.275)	-0.362 (0.406)	0.026 (0.223)	-0.106 (0.264)	0.088 (0.221)	0.542** (0.236)	-0.308 (0.204)	0.538** (0.236)	0.400* (0.227)
Indirect $\times$ 4th year UG	-0.336 (0.435)	0.322* (0.173)	0.142 (0.170)	-0.129 (0.178)	0.269 (0.242)	-0.003 (0.190)	-0.128 (0.247)	0.621** (0.267)	-0.223 (0.258)	-0.088 (0.302)	-0.050 (0.350)
Indirect $\times$ 1st year Master's	—	—	—	—	—	—	—	—	—	—	—
Observations	904	904	904	904	904	904	904	904	904	904	904
R-squared	0.235	0.300	0.301	0.200	0.265	0.128	0.189	0.142	0.130	0.113	0.156

Notes: The table reports heterogeneous treatment effects by academic year. The omitted academic-year category is first-year undergraduate students. The reported interaction coefficients therefore measure differences in treatment effects for the indicated academic-year group relative to first-year undergraduate students. All outcomes are standardized, and each specification controls for the baseline value of the corresponding outcome. Standard errors clustered at the CF level are reported in parentheses. — indicates that the corresponding interaction coefficient could not be estimated. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

8.2 Positive Psychology and neutral Contents

Each page was designed to deliver distinct streams of positive psychology content. One page posted humorous materials intended to evoke laughter and uplift mood; another focused on acts of kindness, sharing stories and tips that encourage pro-social behavior. A third page highlighted positive news and achievements from across Bangladesh, aiming to cultivate optimism. The fourth page shared psychological facts and practical tips to help participants savor positive moments and enhance everyday well-being. Figure A11 presents examples of positive psychology content used in the intervention.



FIGURE A11: EXAMPLES OF POSITIVE PSYCHOLOGY CONTENT USED IN THE INTERVENTION

On the other hand, participants assigned to the control group were also invited to like and follow four dedicated Facebook pages. These pages were carefully designed to post neutral, emotionally non-targeted content, ensuring that they do not deliver material related to mental health or positive psychology. For example, one page regularly posted photographs of rivers, another posted images of forests/trees, a third page posted historical facts, and a fourth page posted weather/climate reports. Figure A12 presents examples of neutral content used in the intervention.

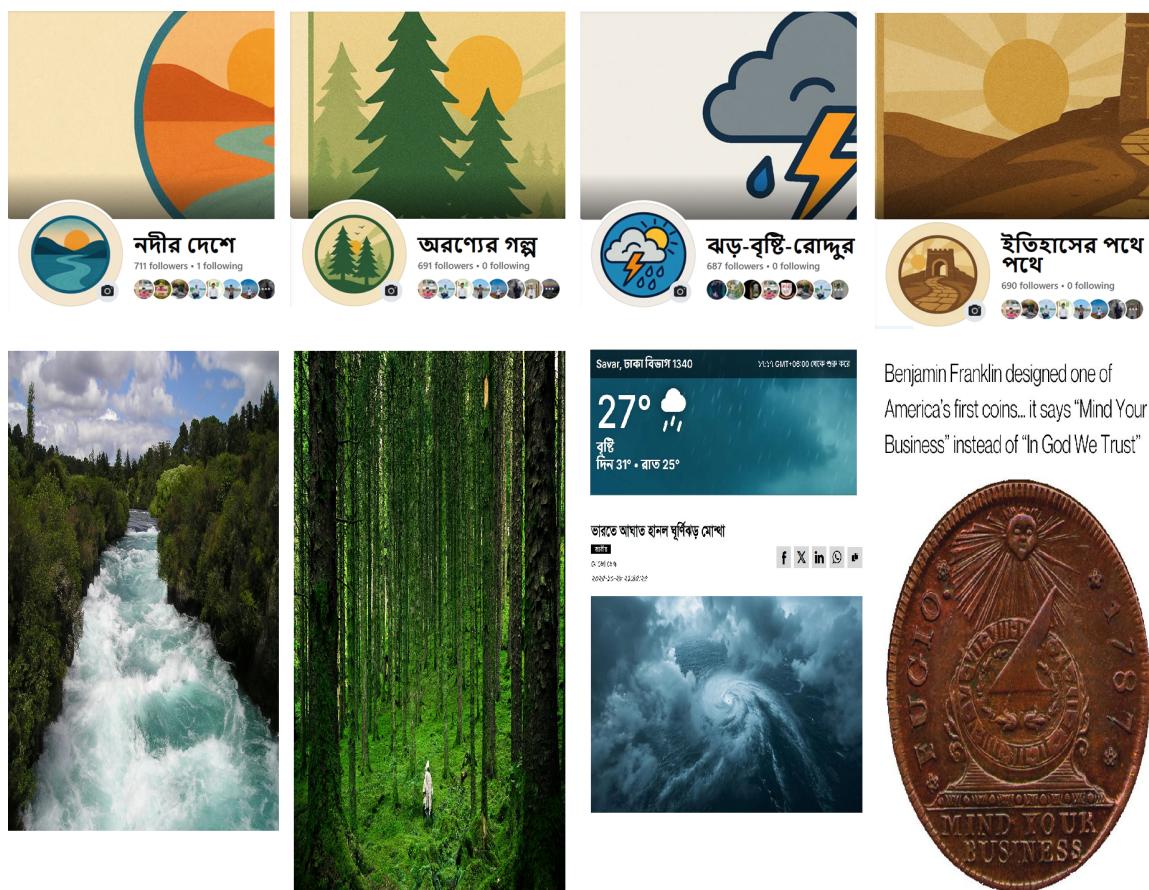


FIGURE A12: EXAMPLES OF NEUTRAL CONTENT USED IN THE INTERVENTION

All content were created by me with the assistance of AI tools such as ChatGPT, Canvas and carefully designed and curated before being posted.

8.3 Bangladesh’s education system

Bangladesh has a large and rapidly expanding higher education system. According to BANBEIS, in 2023 the country had 171 universities, of which 55 were public institutions. University education enrolled 1,069,579 students, with female students accounting for 37.47 percent of total university enrolment (Bangladesh Bureau of Educational Information and Statistics 2023). At the broader tertiary level, Bangladesh’s gross enrolment ratio was 20.18 percent in 2023 (Bangladesh Bureau of Educational Information and Statistics 2023). These figures show that higher education has expanded substantially, but access remains selective relative to the size of the youth population.

The higher education sector includes public universities, private universities, and a large number of colleges. BANBEIS reports 3,341 college-level institutions in 2023, enrolling more than 4.6 million students (Bangladesh Bureau of Educational Information and Statistics 2023). Many colleges are affiliated with the National University, which functions as a major affiliating university and administers degree programs across the country (National University Bangladesh 2026). As a result, university-level and college-level education together form the core of Bangladesh’s post-secondary education system.

Admission into public universities is highly competitive and usually follows completion of the Secondary School Certificate (SSC) and Higher Secondary Certificate (HSC) examinations. Public university admission often depends on institution-specific entrance examinations, while private universities generally rely on prior academic performance and internal admission procedures. This competitive structure

makes university students a relatively selected group within the broader youth population.

University students are also among the most active users of digital communication platforms in Bangladesh. Facebook and Facebook Messenger are widely used for academic communication, including class announcements, sharing lecture materials, coordinating group work, and maintaining peer networks. This makes university students a particularly relevant population for studying Facebook-based interventions.

Universities Included in the Study Recruitment Process The recruitment process covered students from a broad range of public and private universities in Bangladesh. Due to logistical and operational constraints, the study did not recruit from all departments or all student cohorts within these universities. Instead, a subset of university classes and student groups was selected for participation through the study's recruitment network. The participating institutions included:

1. University of Dhaka
2. University of Rajshahi
3. Bangladesh Agricultural University
4. Bangladesh University of Engineering & Technology (BUET)
5. University of Chittagong
6. Jahangirnagar University
7. Islamic University, Bangladesh

8. Shahjalal University of Science & Technology
9. Khulna University
10. National University
11. Bangabandhu Sheikh Mujibur Rahman Agricultural University
12. Hajee Mohammad Danesh Science & Technology University
13. Mawlana Bhashani Science & Technology University
14. Patuakhali Science and Technology University
15. Sher-e-Bangla Agricultural University
16. Chittagong University of Engineering & Technology (CUET)
17. Rajshahi University of Engineering & Technology (RUET)
18. Khulna University of Engineering & Technology (KUET)
19. Dhaka University of Engineering & Technology (DUET)
20. Noakhali Science & Technology University
21. Jagannath University
22. Comilla University
23. Jatiya Kabi Kazi Nazrul Islam University
24. Sylhet Agricultural University

25. Jashore University of Science & Technology
26. Pabna University of Science and Technology
27. Begum Rokeya University, Rangpur
28. Bangladesh University of Textiles
29. University of Barishal
30. North South University
31. Ahsanullah University of Science and Technology
32. American International University-Bangladesh
33. BRAC University
34. Independent University, Bangladesh

check citation

8.4 How the Study’s Facebook Account Operated

To implement and manage the intervention, this study created a dedicated Facebook account named “*Optimistic Outlook*.” This account functioned as the central administrative and communication platform throughout the experiment. The account was used exclusively for research purposes and served several operational roles, including participant communication, intervention delivery, compliance monitoring, and survey coordination. In addition, all Facebook pages used for the intervention were created, administered, and maintained through this account. Only I had login access to the account throughout the study period in order to manage page activities, monitor intervention delivery, and coordinate communication with participants.

During the baseline survey, participants were instructed to provide their Facebook profile name or profile link and send a friend request to the *Optimistic Outlook* account. This step was necessary to establish direct communication channels with participants through Facebook Messenger. Participants who failed to send a friend request within the designated time period were excluded from the final study sample because reliable communication during the intervention period could not be ensured.

The Facebook account was managed manually throughout the experiment. Once participants were connected to the account, they received all study-related instructions directly through Messenger. This included:

- links to baseline, endline, and follow-up surveys,
- reminders regarding survey completion,
- intervention instructions,

- compliance reminders,
- and clarification regarding privacy settings or technical issues.

The account played a central role in delivering the intervention itself. Participants assigned to the treatment and neutral-content control groups received direct Messenger links to the designated Facebook pages containing either positive psychology or neutral content. These intervention pages were operated through the *Optimistic Outlook* account and posted approximately 4–5 posts per day (per page) during the intervention period.

The *Optimistic Outlook* account additionally served as the primary tool for treatment compliance monitoring. Participants in the treatment and neutral-content control groups were instructed to click the “Like Page” button for all assigned pages. Compliance was then manually verified by checking whether the designated pages appeared in participants’ “Liked Pages” section on Facebook.²⁰ Participants who did not comply with the page-following instructions were excluded from the final analytical sample.

Beyond intervention delivery, the account also helped maintain participant engagement throughout the experiment. Reminder messages were periodically sent to reduce survey attrition and encourage continued participation. Since university students in Bangladesh frequently use Facebook Messenger for academic and social communication, this platform provided a highly efficient and low-cost mechanism for large-scale coordination and intervention management.

20. Some participants restricted the visibility of their liked pages through Facebook privacy settings. In such cases, participants were instructed to temporarily adjust their privacy settings using Facebook’s custom visibility settings so that compliance could be verified by the study account.

8.5 Data protection and consent form

Social Media Content Analysis

Principal Investigator:

Sourav Das

University of Kassel, Germany

Email: s.das@uni-kassel.de

Purpose of the Study

Graduate and Master students social media content will be analysed. As you are a Graduate or Master student , therefore you are asking to include in this study.

Procedures

- If participation in this study is agreed upon, the baseline survey should be completed. The survey is expected to take approximately 25–30 minutes to finish. It is recommended that the Facebook ID link is copied prior to starting the survey, as it will be required at a certain point.
- Upon successful completion of the baseline survey, a friend request should be sent to a Facebook ID named “Optimistic Outlook,” (the link will be provided at the end of the survey) which is managed by the principal investigator. The acceptance of the friend request serves as final confirmation of your participation in the study.
- Once the friend request is accepted, links to four Facebook pages will be sent to your inbox. These pages must be liked within 24 hours; failure to comply with this requirement will result in exclusion from the study.
- The pages must not be disliked during the next three-week period. After this time, the decision to keep or dislike the pages will be entirely at your discretion. Additionally, settings for “Optimistic Outlook” must be adjusted for the three-week period to allow verification that the Facebook pages have been liked. Alternatively, you also can send a screenshot of the liked pages as a proof of compliance.
- An endline survey link will be sent to your inbox three weeks later. An additional survey link will be sent three months after that.

- **Risk/Benefit:** No significant risks are anticipated in association with participation in this study. However, some data may be considered sensitive. To address this concern, the data will be anonymized by replacing personal identifiers (e.g., Facebook IDs) with randomly generated codes.
- Upon completion of endline survey, participants will receive 100 tk each. A small financial incentive can also be given for additional survey three months after that.
- It should be noted that your Facebook profile will be scraped immediately after the endline survey. A second scraping will take place 3 months after that.
- **Voluntary Participation and Withdrawal:** Participation is entirely voluntary. Declining to participate or withdrawing from the study at any time is permitted without penalty or loss of benefits.
- **Confidentiality:** Personal data, including Facebook profiles and survey responses, will be kept confidential and used exclusively for research purposes. Data will be anonymized for analysis, and only aggregated results will be included in publications or presentations. Final analysis will commence 4 months after the baseline survey. At that time, all survey data will be fully anonymized, and personal identifiers (such as Facebook ID links) will be replaced with randomly generated numbers.
- Consent will be obtained electronically before you begin any part of the study.

Contact Information

If you have any questions or concerns about this study, you may contact:

- **Sourav Das**, Principal Investigator, University of Kassel, Germany. Email: s.das@uni-kassel.de. If you have any complaints, please contact to **Ethics Review Committee** of Bangladesh Bioethics Society (ERC, BBS) at email secretariate.bbs@gmail.com , phone: +880-1712522627
- **Data Protection Officer**, University of Kassel, 34109 Kassel, Germany. Phone: +49-561-804-7036/-2011, Email: datenschutz@uni-kassel.de
- **Hessian Commissioner for Data Protection and Freedom of Information (HBDI)**, P.O. Box 3163, 65021 Wiesbaden, Germany. Phone: +49-611-1408-0, Email: poststelle@datenschutz.hessen.de

Explicit Consent

I hereby confirm that I have read and understood the information provided about this study. I understand the risk and benefits of this study. Researcher will monitor my facebook (as a facebook Friend) for content analysis. I voluntarily agree to participate and understand that I can withdraw at any time without penanty.

8.6 Survey form

8.6.1 Wellbeing measurement

Wellbeing is measured using the very popular 5-item scale developed by World Health Organization (Topp et al. 2015). Participants were asked how often they had experienced any of the following situations over the past two weeks.

Question	At no time (0)	Some of the time (1)	Less than half of the time (2)	More than half of the time (3)	Most of the time (4)	All of the time (5)
1. I have felt cheerful and in good spirits.						
2. I have felt calm and relax.						
3. I have felt active and vigorous.						
4. I woke up feeling fresh and rested.						
5. My daily life has been filled with things that interest me.						

8.6.2 Depression measurement

Participants' depression level is measured using a 9-item scale developed by Kroenke, Spitzer, and Williams (2001). Participants were asked how often they had been bothered by any of the following problems over the last two weeks.

Question	Not at all (0)	Several days (1)	More than half the days (2)	Nearly every day (3)

1. Little interest or pleasure in doing things.				
2. Feeling down, depressed, or hopeless.				
3. Trouble falling or staying asleep, or sleeping too much.				
4. Feeling tired or having little energy.				
5. Poor appetite or overeating.				
6. Feeling bad about yourself—or that you are a failure or have let yourself or your family down.				
7. Trouble concentrating on things, such as reading the newspaper or watching television.				
8. Moving or speaking so slowly that other people could have noticed. Or the opposite—being so fidgety or restless that you have been moving around a lot more than usual.				
9. Thoughts that you would be better off dead, or thoughts of hurting yourself in some way.				

8.6.3 Anxiety measurement

Participants' anxiety level is measured using a 7-item scale developed by Spitzer et al. (2006). Participants were asked how often they had been bothered by any of the following problems over the last two weeks.

Question	Not at all (0)	Several days (1)	More than half the days (2)	Nearly every day (3)

1. Feeling nervous, anxious, or on edge.				
2. Not being able to stop or control worrying.				
3. Worrying too much about different things.				
4. Trouble relaxing.				
5. Being so restless that it is hard to sit still.				
6. Becoming easily annoyed or irritable.				
7. Feeling afraid as if something awful might happen.				

8.6.4 Stress measurement

Participants' perceived stress level is measured using the Perceived Stress Scale (PSS) developed by Cohen, Kessler, and Gordon (1997). Participants were asked how often they had been bothered by any of the following problems during the past 7 days.

Question	Never (= 0)	Almost never (= 1)	Sometimes (= 2)	Fairly often (= 3)	Very often (= 4)
1. How often have you been upset because of something that happened unexpectedly?					
2. How often have you felt that you were unable to control the important things in your life?					
3. How often have you felt nervous and stressed?					
4. How often have you felt confident about your ability to handle your personal problems?					
5. How often have you felt that things were going your way?					

6. How often have you found that you could not cope with all the things that you had to do?					
7. How often have you been able to control irritations in your life?					
8. How often have you felt that you were on top of things?					
9. How often have you been angered because of things that were outside of your control?					
10. How often have you felt difficulties were piling up so high that you could not overcome them?					

8.6.5 Other Questions

1. **What is your individual income?**
2. **What is your total family income?**
3. **How many total family members do you have?**
4. **How many siblings do you have?**
5. **Your FB Id link**
6. **Name of your CR**
7. **What is your current academic GPA? (on a 4-point scale)**
8. **What is your gender?**

Male

Female

Other

9. **What is your age?**
10. **What is your religion?**

Christianity

Islam

Hinduism

Buddhism

Other (please specify): _____

11. What is your academic year?

1st year Bachelor

2nd year Bachelor

3rd year Bachelor

4th year Bachelor

1st year Master

2nd year Master

12. How many hours do you study daily (donot count the time you spent in lectures)?

13. How many hours do you use Facebook daily?

14. How many FB friends do you have?

15. How many hours do you use other social media daily?

16. How many hours do you engage in social interactions daily?

17. How many times do you visit a mental health practitioner per year?

18. How much do you spend yearly on mental health-related issues?

19. How many hours per day do you typically spend on activities other than work or study (e.g., hobbies, socializing, household chores, exercising)?

20. Did you receive any content similar to the 4 pages you liked?

21. Write some of your activities that you were engaged in last 3 weeks but not before.

22. Additional page related questions to assess potential intermediate effects and detect any experimenter demand effects.

23. Stroop test related questions

24. Political preferences and trust related questions

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