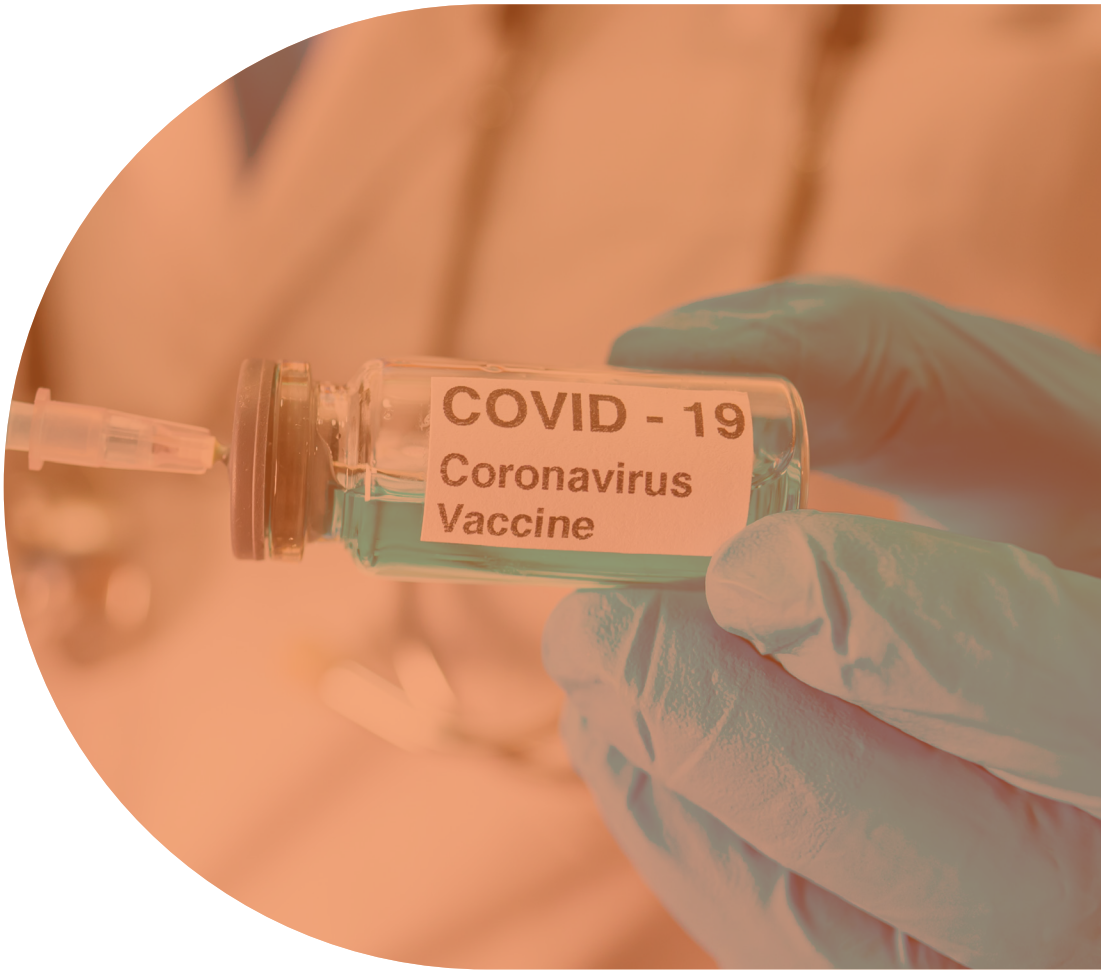
SMS Campaign to Increase COVID-19 Vaccine Take Up in Tanzania



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Abstract

Empathy and self-interest vary in their effects on health, socioeconomic, and political outcomes. We study their impact on COVID-19 vaccination rates in the context of high vaccine hesitancy. Using a randomized placebo-controlled trial, we evaluate an SMS campaign targeting Tanzanian mobile-phone subscribers with two different messages aimed at increasing vaccine Take Up. We hypothesize different mechanisms by which Tanzanians may be induced to agree to get a COVID-19 vaccine: (1) altruism for others (empathy); and (2) COVID-19's long-term health impacts (Self-Interest). A placebo group of mobile subscribers received an SMS unrelated to these interventions. Our study contributes to the literature on the social science of persuasion, specifically regarding persuading adults to accept health interventions. We found no indication of a positive impact three weeks after sending the messages. Additionally, we find no evidence of heterogeneous effects based on age, gender, employment status, or urban residency, indicating that our two treatments had relatively consistent effects across different groups. The observed null results may reflect the significant combined effort made by the Tanzania government and other stakeholders to increase vaccination uptake in the country.

JEL:

Keywords: COVID-19 vaccine, Randomized placebo-controlled trial

SSRN Subjects:

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I. Introduction

The severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2) of 2019, commonly known as COVID-19, had contributed to 7.02 million deaths worldwide as of January 21, 2024 (see "Daily and Total," 2024). Deaths in Africa constitute less than 4% of this figure.[1] Even adjusting for excess mortality, Africans have largely been spared from COVID-19-related mortality relative to other regions. The then-President of Tanzania, His Excellency Dr. John Magufuli, during the start of the pandemic, infamously argued against wearing masks, refused and discouraged vaccination against COVID-19, and generally denied the dangers of the pandemic (Makoni, 2021).

After the death of President Magufuli in March 2021 and after then-Vice President Samia Suluhu Hassan assumed the presidency, the Government of Tanzania procured, launched, and encouraged vaccinations against COVID-19 (Mfinanga et al., 2023). President Samia's task was daunting as she had to reverse the prevailing vaccine hesitancy that had previously been built in the community (Wollburg et al., 2023). Despite concerted efforts by the Government and other actors, Tanzanians were almost caught up with the rest of the world. Although globally, two-thirds (67%) of individuals were fully vaccinated as of February 2nd, 2024, over 60% of Tanzanians were also fully vaccinated as of March 12, 2023 (see "Daily and Total," 2024). COVID-19 vaccine hesitancy, at the start of the pandemic, was highest among Tanzanian adolescents (Wang et al., 2022). This was a group typically willing to accept experimental science on vaccines (Mbunda et al., 2014). Medical professionals, also typically strong proponents of health-seeking behaviors, were important in driving COVID-19 vaccine hesitancy in Tanzania (Konje et al., 2022). Sociopolitical factors were also important and, in particular, the shifts in signaling by national-level political leaders (Yamanis et al., 2023; Mtenga et al., 2023). Women (Msuya et al., 2023) were also positively correlated with higher vaccine hesitancy.

Research in behavioral economics, political science, and psychology has highlighted empathy and time-discounting as potential explanations for variation in individuals' private investments in public goods with positive externalities such as

[1] Actual deaths in Africa by January 21, 2024, were 259,073 or 3.69% of global deaths.

vaccines ((Kim, 2023); Hortal, 2022; Hudson et al., 2023; Bor & Simonovits, 2021; Gross & Wronski, 2021; Tsutsui, Benzion & Shahrabani, 2016; Meier & Sprenger, 2010; DellaVigna, 2009; Chapman & Coups, 1999). Specifically, Pfattheicher, Böhm, and Petersen (2022) found that, in addition to knowledge and beliefs regarding the potential of COVID-19 vaccines to provide herd immunity, empathy for those most vulnerable to infection also increased intent to vaccinate (Vicario et al., 2024; Pfattheicher, Böhm & Petersen, 2022). Empathy among vaccine-hesitant individuals has also been shown to increase intentions to vaccinate against COVID-19 (Abroms et al., 2024). Having a collectivist culture that promotes empathy for others has also been shown to reduce vaccine hesitancy (Leonhardt & Pezzuti, 2022). Given that Tanzania has been argued to have successfully generated collectivist social norms from the nation-building efforts of its founding President, *Mwalimu*[2] Julius Nyerere (Miguel, 2004), we should thus expect empathy to be effective in reducing vaccine hesitancy.

In other research, time preferences are important in increasing intentions to vaccinate and reducing hesitancy more generally (Freitas-Lemos et al., 2023). Specifically, the more individuals value their future, the more likely they were to be less vaccine-hesitant, more likely to intend to vaccinate, and were more likely to have vaccinated early when COVID-19 vaccines first became available (Halilova et al., 2022; Strickland et al., 2022; Hortal, 2022; Guo & Cao, 2021).

We report results from a randomized placebo-controlled experiment in Tanzania that tested the effects of empathy and long-term health impacts (self-interest) on vaccination-related outcomes. From a nationally representative sample of Tanzanians, we used data on 17,209 respondents across three experimental arms with two treatments and a placebo. Treatments were delivered to all 17,209 Tanzanians, but budget constraints meant that we were able to collect outcome data on only about 12,000 respondents. Of these, about one in five were able to recall the content of the messaging correctly and thus constitute our main estimating sample. Although one may worry that this sample of individuals may be non-random, we show in balance tests in the appendices that their inclusion preserves the experimental integrity. We found no

[2] *Mwalimu* means "teacher" in KiSwahili.

indication of a positive impact on vaccination-related outcomes three weeks after sending both the Empathy and Self-Interest Treatments.

II. Context

We delivered and tested an information intervention designed to address COVID-19 vaccine hesitancy and increase vaccination rates. The intervention targeted a nationally representative sample of respondents from Ipsos Tanzania's database,3 intending to promote empathy for others and highlight the long-term health impacts of COVID-19 as a means of incentivizing vaccine uptake. The first treatment arm, which we called Empathy, comprised respondents who received an SMS message that implored them to consider the relatively higher chance that unvaccinated Tanzanians may infect people most vulnerable to infection, potentially leading to their mortality. The second, which we called Self-Interest, included respondents who were reminded of the potentially adverse long-term health effects of infection, especially multiple infections. A placebo SMS message implored respondents to reject early and forced marriage. Messages were sent out from November 30, 2022, to April 30, 2023. To collect outcome data, we called respondents starting approximately three weeks after the end of the treatment. We used an OLS estimator to compare outcomes between treatment arms and the placebo arm, and this constituted the identification of the effects of Empathy and Self-Interest. We did not conduct a baseline survey because we used the Ipsos database of nationally representative Tanzanians whose consent had already been obtained for future research purposes.

The initial sample size for the intervention was 17,209, with an average respondent age of 33. Of the respondents, 88% had completed at least primary education, 51% were women, and 58% were married. Only 36% of the sample were

[3] Ipsos Tanzania is a branch of Ipsos, a global market research and consulting firm. They specialize in gathering and analyzing data to provide insights into consumer behavior, public opinion, and market trends. In Tanzania, Ipsos conducts surveys, polls, and other types of research to help businesses, governments, and organizations make informed decisions based on reliable data.

urban residents. The full set of summary statistics is shown in Appendix Table B1. It is worth noting that the statistics regarding vaccine trust and COVID-19 mitigation measures were only available for a subsample of 4,766 respondents. In this subsample, only 30% of the respondents reported trusting the COVID-19 vaccine. In terms of COVID-19 prevention, 47% of the subsample reported practicing handwashing, while 60% reported wearing masks. Additionally, 18% of the subsample reported relying on prayer or local solutions, such as steaming.

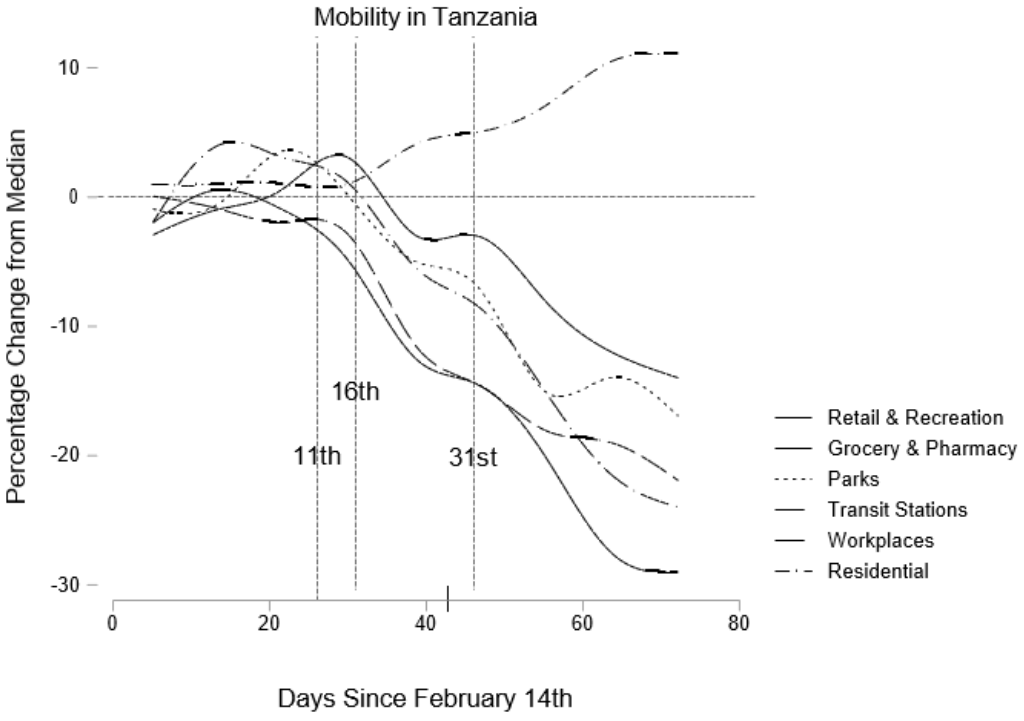
III. Conceptual Framework

Tanzania's former President Magufuli and his government initially followed trends globally of closing schools and universities, restricting public mobility through short-lived "lockdown" strategies, and encouraging mask-wearing, social distancing, and hand-sanitizing. From May 2020 through March 2021, Tanzania remained an outlier even in Africa where lockdowns were not completely enforced as they were in other regions (Haider et al., 2020). The government argued that, with a large informal economic sector, dependence on tourism, and average low incomes, Tanzanians could not afford to be locked down in their homes. This was not unlike economic arguments that low-income countries such as Tanzania should not mimic high-income countries' strategies against COVID-19 (von Carnap et al., 2020). However, because other countries, including Tanzania's neighboring countries, closed their borders, and international flights into the country ceased, Tanzania's economy nevertheless slowed, including especially its tourism sector (Henseler, Maisonnave & Maskaeva, 2022). His Excellency President Magufuli, however, went further in 2020 and early 2021 when he began discouraging mask-wearing and vaccines (Makoni, 2021). In particular, President Magufuli was quoted in January 2021, about two months before his death in March of that same year, as saying, "You should stand firm. Vaccinations are dangerous. If the White man was able to come up with vaccinations, he should have found a vaccination for AIDS by now; he

would have found a vaccination for tuberculosis by now; he would have found a vaccination for malaria by now; he would have found a vaccination for cancer by now" (Makoni, 2021).

Following President Magufuli's death and the ascension to the presidency of Madam Samia Suluhu Hassan, the Tanzanian government reversed many of her predecessor's COVID-19 policies. President Samia quickly began publicly wearing a mask, which prompted many in her government to do the same. Indeed, analysis by a local NGO, Twaweza, showed that this policy reversal did increase mask-wearing by senior leaders in government. Specifically, their analysis showed that initially (February-July 2020), 76% of publicly photographed senior government leaders wore masks, which then declined to just less than 2% in the middle period (July 2020-February 2021).

Figure 1: Mobility in Tanzania from 11-30 April 2020



Note: This figure maps Tanzanians' mobility from February 14, 2020, through April 30, 2020, compared to a median reference period. Data come from Google's mobility data. Find more details here: https://www.google.com/COVID-19/mobility. Specifically, this graph showed Tanzanians' responses to several key dates; the World Health Organization's proclamation that COVID-19 was a pandemic (March 11, 2020), the first confirmed case in Tanzania (March 16, 2020), and the first confirmed death in Tanzania (March 31, 2020). Over time, Tanzanians became more sedentary (stayed at home) while disengaging from public spaces (reduced occupying of parks, transit stations, workplaces, retail and recreation areas, and groceries and pharmacies).

Mask-wearing by government officials then increased to 92% from President Magufuli's death in March 2021 through July 2021 (Figure 2).[4] Tanzania has both a strong presidential system, not unlike that of the United States, and is also a hegemonic party state, making presidential rhetoric and behavior akin to policy directives. When President Samia began wearing masks and was publicly vaccinated in July 2021, it encouraged senior government leaders, including the then-Minister of Health (who had, under President Magufuli been a vaccine-skeptic) along with many other eligible Tanzanians to get vaccinated. President Samia's vaccination marked the beginning of 'the first batch of COVID-19 vaccinations after Tanzania joined the COVAX initiative, though early vaccination rates were slow to increase, especially among women, who may have had fertility concerns (Yussuph, Al-Beity & Anaeli, 2023).

Figure 2: Proportion of Tanzania's Leaders Photographed Wearing Facemasks

Note: Twaweza's analysis showed publicly photographed senior government officials followed signaling from both President Samia and her predecessor, President Magufuli, on whether to wear masks in public. Dates on the x-axis are in DD/MM/YY format.

In this context, we sought and secured funding from the Partnership for Economic Policy (PEP-NET) to test cost-effective reminder treatments to encourage COVID-19 vaccinations in Tanzania. Data on COVID-19 infections, mortality, and vaccination rates were confidentially collected by the government when we began designing the interventions and experiment. Because our research was a collaboration among NGO

[4] See the Twaweza analysis (Eyakuze, 2020) and an article in the local newspaper, *The Citizen* (Eyakuze, 2021).

researchers at the Impact Evaluation Lab at Tanzania's Economic and Social Research Foundation and our colleagues from Tanzania's National Institute for Medical Research, we were able to get ideas from researchers who were most informed about what was going on concerning COVID-19 while maintaining the confidentiality of the data. We also used survey data from the Africa Centre for Disease Control & Prevention5 along with theories in behavioral economics, political behavior, and psychology to distinguish potential treatments and the mode of delivery of these reminders. Because of Tanzania's socialist tradition and initial evidence that younger individuals and women were potentially the most vaccine-hesitant, we focused on the ideas of (1) empathy for those most vulnerable to COVID-19 infection and mortality, and (2) considerations of ''the future given the uncertain and potentially adverse effects of COVID-19 infection on long-term health.

We also considered a religious treatment given high religiosity among Tanzanians, especially women and how politically salient religion was in a Tanzanian context. For instance, Manda (2022) showed how religious institutions co-evolved with political institutions. Additionally, religious appeals related to mitigating the worst aspects of the COVID-19 pandemic were made by President Magufuli and other political and religious leaders. Nevertheless, we ultimately decided not to implement a religious reminder, largely because of President Magufuli's call for national prayer against COVID-19 and subsequent declaration that the pandemic was over in Tanzania in June 2020.

The placebo message, on the other hand, implored individuals not to support early and forced marriage. Ours was not the first study to use this as a placebo against a health-related treatment in Tanzania. Green, Groves, and Manda (2021) used an early-and-forced-marriage reminder as a placebo to compare against a treatment that reminded Tanzanians not to stigmatize persons living with HIV/AIDS. We used SMS messages as the mode of delivery because of their very low cost and increasing reach. We did not use social media platforms, which we also considered, because they require internet connectivity. As a result, they would not have reached a representative sample of Tanzanians because not all mobile-

5 A fifteen-country survey did not report Tanzanian data at the time, even though Tanzanians were surveyed ("COVID-19 Vaccine," 2021).

phone subscribers have regular access to the internet

Working with the National Institute for Medical Research, we designed and tested an information intervention whose objective was to reduce COVID-19 vaccine hesitancy and expand vaccination rates through altruism for others (empathy) and awareness of COVID-19's long-term health impact (Self-Interest). The intervention was evaluated through a randomized placebo-controlled trial. We hypothesized that:

1. SMS message interventions would increase self-reported intent to vaccinate as well as self-reported vaccination status.
2. SMS message interventions would increase trust in the COVID-19 vaccine.
3. SMS message interventions would increase compliance with COVID-19 prevention measures, which include wearing masks and keeping a social distance.

In our Pre-Analysis Plan (PAP), we specified that the following variables would be analyzed: self-reported vaccination status, household members' vaccination status, objectively verified vaccination status, self-reported intent to vaccinate, household members' intent to vaccinate, subjective trust in COVID-19 vaccines, self-reported compliance with mask-wearing, self-reported compliance with hand washing, and self-reported compliance with social distancing.

IV. Experimental Design, Data, and Empirical Strategy

4.1 Experimental Design

We sent SMS messages of varying content in a randomized, placebo-controlled experiment. Our experiment was based on two treatment arms, in which two groups of participants received different text messages, and one placebo group, whose members received SMS content on a non-public-health issue unrelated to COVID-19.

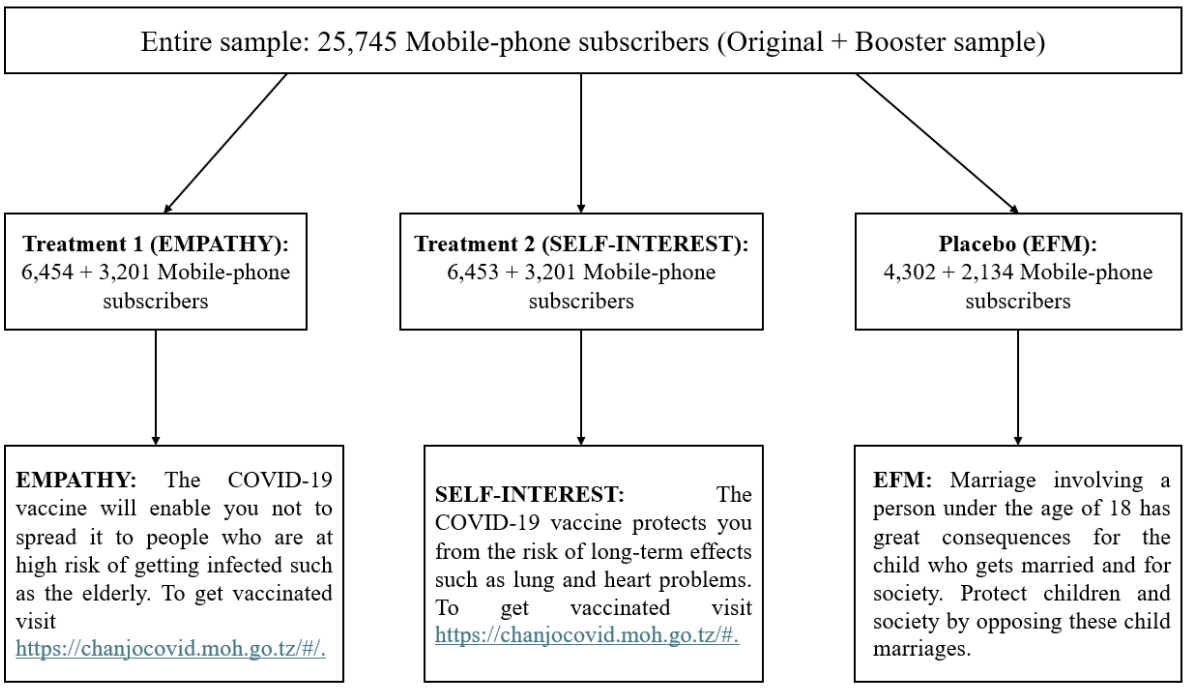
Treatment 1 (T1): We called this treatment the Empathy Treatment. Mobile-phone subscribers in this arm received an SMS message emphasizing 'the potential to cause harm to others by exposing them to COVID-19 in the absence of vaccination.

Treatment 2 (T2): We called this treatment the Self-Interest Treatment. Mobile-phone subscribers in this arm received an SMS message on the adverse long-term effects of COVID-19 infection.

Placebo group (C): Mobile-phone subscribers in this arm received an SMS message on a non-public health issue unrelated to COVID-19.

The figure below provides a summary of the treatment arms and the SMS content for each treatment arm:

Figure 3: Treatment Arms



Note: Each of the SMS messages was sent to the respective treatment arms three times at intervals of one week for the 17,209 respondents; the booster sample of 8,556 was sent the message once. The text messages were delivered in the Swahili language.

We compared outcomes between the treatment arms and the placebo arm using ordinary least squares (OLS) regressions, where outcome variables were regressed on a dummy variable that equaled one if a mobile-phone subscriber was assigned to a

treatment arm and zero if a mobile-phone subscriber was assigned to the placebo arm. We present results of treatment effects both with and without covariates and explore heterogeneity by sex and age.

4.2 Data

We used the Ipsos database, a nationally representative sample of adult Tanzanians who had already granted consent to being contacted by research teams. Because the dataset contained respondents' socio-demographic variables, we were able to perform balance tests. We conducted one mobile phone survey at the endline to collect outcome-variable data as well as to ask questions about treatment spillover effects. From the Ipsos database, a sample of 17,209 respondents was initially selected, and these respondents were randomly assigned to our treatment arms. Additionally, we extracted a booster sample of approximately 8,536 respondents. This booster sample was used because we were unable to reach the 12,000 agreed-upon sample size from our initial sample of 17,209 respondents.

Only respondents who had received at least one SMS were considered for the endline analysis, which was 80% of the original intervention sample. From this sample, we were able to reach 8,895 (65%) out of 13,755 respondents who received at least one SMS message. However, as we did not reach our desired sample size of 12,000, which would have provided sufficient power to detect treatment effects, we decided to intervene with a booster sample consisting of approximately 8,564 respondents.

The intervention for this booster sample began on March 13, 2023. Unlike our original sample, the SMS message in the booster sample was sent only once. Prior analysis of the collected sample indicated that the frequency of the text did not influence any of our outcomes. Out of the 8,536 respondents in our booster sample, only 4,541 (53%) received the intervention and were eligible for the endline survey. From this eligible sample, we were able to reach 3,105 (68%) respondents during the endline survey.

4.3 Summary Statistics and Covariate Balance

Table 2 shows the individual-level characteristics of the resulting sample (successful endline phone survey) and the population of Tanzania from the 2022 Population and Housing Census (see "Basic Demographic," 2024).

Women made up 50% of our sample slightly lower than the general population (51.3%). Sixty-two percent of our sample had completed at least primary education, 7.2 percentage points lower than the overall population (69.2%). The average age in our sample was 38, which was 53.4% of the working-age population (15-64). Married individuals made up 62% of our sample, higher than the 51.4% of people aged 15 and above who are either married or living together in the general population. Geographically, our sample closely matches the general population, with about 34% of urban residents compared to 34.4% nationally. These comparisons suggest that, while our sample was fairly representative in terms of urban-rural distribution, it slightly underrepresents women and those with primary education, overrepresents married individuals, and may have a different age distribution compared to the general population. Also, only 29% trusted the COVID-19 vaccine. To protect themselves from the virus, 47% practiced handwashing, 59% wore masks, 18% relied on prayer, and 18% used local solutions such as steaming (these statistics were only available for a subsample of 2,425 respondents).

We assessed the balance between the treatment groups (Treatment1 or Treatment2) and the control group, as well as the balance between each of the treatment groups and the control group. Our findings revealed no significant differences in the balance of these characteristics as shown in Appendix Tables A2, A3, and A4. However, we observed that the probability of receiving the first SMS was lower for the control group compared to the treatment groups. Additionally, the control group received fewer text messages than the Empathy Treatment group.

4.4 Endline Survey

As previously mentioned, we conducted a single phone survey for the endline data collection, which included questions about outcome variables and spillover effects. The survey questionnaire was structured into five modules: health and wellbeing; questions about COVID-19 vaccines; questions about COVID-19 mitigation measures; intervention checks and spillover; and questions about respondents' perceptions regarding the institutions responsible for providing the text messages (intervention) and making phone calls. The endline survey was conducted three weeks after the intervention had been completed. It was conducted by Ipsos, with close supervision from researchers with the Economic and Social Research Foundation.

4.5 Empirical Strategy

4.5.1. Statistical Methods

Following standard methods in program evaluation, we estimated the treatment effects of these interventions using ordinary least squares (OLS) regression methods that adjust for pre-treatment covariates selected using the "least absolute shrinkage and selection operator" (LASSO; see Abadie et al., 2017). In this context, OLS produces nearly identical point estimates to a simple difference-in-means estimator. The key gain from covariate adjustment was an increase in the statistical power of the study. We also conducted a "change-from-baseline" analysis for 4,766 respondents on the six outcomes for which we had data, with covariates included for each outcome.

4.5.2. Statistical Model

As stated above, the usual ordinary least squares (OLS) regression model was used. The model considered here can be rewritten as:

$$Y_i = \beta_0 + \beta_1 \mathrm{T}_{1i} + \beta_2 \mathrm{T}_{2i} + \beta_4 \mathrm{X}_i + \mathcal{E}_i$$

where:

Yi=Outcome variables

T1= Dummy variable which was equal to 1 if an individual receives Empathy treatment SMS and 0 for the placebo group.

T2= Dummy variable which was equal to 1 if an individual receives Self-Interest treatment SMS and 0 for the placebo group.

X= Control variables which include gender, age, education level, occupation, marital status, and location (urban or rural)

$\mathcal{E}_i$=Error term

Apart from our main specification above, we also conducted a horse race regression to see whether T1 or T2 better explained variations in our outcomes of interest, and we performed a "change-from-baseline" analysis for 4,766 respondents on the six outcomes for which we currently had data, with covariates included for each outcome.

4.5.3. Multiple Outcome and Multiple Hypothesis Testing

We made inferences using standard hypothesis-testing methods and randomization. Outcomes were grouped into families of similar variables to further increase statistical power and as the basis for controlling the false-discovery rate. We also employed the Bonferroni Correction to counteract biases that may have arisen from multiple comparisons (see List, Shaikh & Xu, 2019).

4.5.4. Heterogeneous Effects

According to the Africa CDC vaccine hesitancy survey of March 2021, those who are more skeptical about COVID-19 vaccines tended to be female, young, the unemployed, and urban dwellers. Therefore, regarding our treatments, we expected women, young individuals, the unemployed, and urban dwellers to react less to our treatments. Moreover, concerning our Empathy and Self-Interest Treatments, we expected women to be more empathetic and to have differential discount factors of time

relative to men. Similarly, because younger people have more time relative to older people, we expected their preferences for time and for others to differ. Finally, individuals who were unemployed and/or rural residents have relatively lower incomes than employed/urban dwellers, and we also know that income has an impact on risk preferences. Hence, we anticipated that sex, age, employment status, and urban residency would display heterogeneous effects. To capture this, we analyzed by regressing outcomes on an interaction between the treatment dummy and each characteristic.

V. Results

The research team established and registered a Pre-Analysis Plan outlining the core outcomes of our study.[6] We successfully assessed all the outcomes outlined in our Pre-Analysis Plan, except for objectively verified vaccination status. This omission was attributed to a low response rate during the endline survey when soliciting the registration numbers used for vaccine bookings.

5.1 Self-Reported Vaccination Status

Our analysis began by examining the impact of our treatments on reported vaccination status. The results, as presented in Table 4, indicate that neither of our treatments had a statistically significant influence on vaccination status among individuals who received them. We used three variables to capture this information: (1) whether respondents received any dose of the COVID-19 vaccine, (2) whether they received the full dose, and (3) whether respondents received the vaccine after the intervention period. For both treatments, the coefficients for receiving the first dose and the full dose were negative and non-significant. Moreover, the coefficients for the Empathy and Self-Interest

[6] See the pre-analysis plan registered at the American Economic Association's registry: https://www.socialscienceregistry.org/trials/9832.

Treatments on vaccination status post-intervention were approximately 1.65% and 1.64%, respectively, but these coefficients were also not statistically significant.

After controlling for LASSO-selected covariates, the treatment coefficients for receiving any dose and receiving the full dose became positive, but they remained non-significant, as shown in Appendix Table A5. The effects of empathy and Self-Interest on vaccination status remained positive but still lacked statistical significance.

In conclusion, the results presented in Table 4 and Appendix Table A5 indicate that our two SMS interventions, empathy and Self-Interest, did not significantly influence vaccination status among treated individuals.

5.2 Vaccine Hesitancy and Trust

Table 5 showed the impact of the Empathy and Self-Interest Treatments on vaccine hesitancy, trust, and the likelihood of getting COVID-19 in the future. The first column showed the impact of empathy and Self-Interest on intent to vaccinate, which was assessed through a survey question asking participants to rate their hesitancy in getting vaccinated against COVID-19 on a scale of 1-10, where 1 represents "never get vaccinated" and 10 signifies "definitely get vaccinated or already vaccinated." In our analysis, as indicated in Column 1 of Table B2, the coefficients for both the Empathy and Self-Interest Treatments were not statistically significant ($p>0.1$). This suggests that neither treatment had a significant impact on intent to vaccinate because the coefficients are close to zero.

The second column showed the impact of the Empathy and Self-Interest Treatments on trust levels in vaccines, which was measured by the survey question: "On a scale of 1-10, with 1 being complete DISTRUST and 10 being complete TRUST, how much do you trust these COVID-19 vaccines?" The Empathy treatment coefficient was approximately 0.0630 (SE=0.0862), and the Self-Interest Treatment coefficient was approximately 0.105 (SE=0.0861). Both coefficients suggest positive effects of the treatments on trust in the vaccine, but neither effect was statistically significant ($p>0.1$).

The third column showed the impact of the Empathy and Self-Interest Treatments on the likelihood of being vaccinated in the future. This was captured by the survey question: "In the subsequent three months, do you intend to receive at least 1 dose of any COVID-19 vaccine?" The empathy treatment coefficient was approximately-0.0861 (SE=0.156), and the Self-Interest Treatment coefficient was approximately 0.0293 (SE=0.154). Both coefficients suggest very small effects on the likelihood of future vaccination, but neither effect was statistically significant ($p>0.1$).

Overall, the results indicated in Table 5 show that neither the Empathy Treatment nor the Self-Interest Treatment had a statistically significant impact on vaccine hesitancy, trust in the vaccine, or the likelihood of future vaccination.

When we controlled for LASSO-selected covariates, the effect of both the Empathy and Self-Interest Treatments on intent to vaccinate, trust in the vaccine, and likelihood of vaccinating in the future showed a slight increase in magnitude, as indicated in Appendix Table A6. However, even with this adjustment, the estimates remained statistically insignificant.

5.3 COVID-19 Mitigation Measures

Table 6 presents the treatment effects of COVID-19 mitigation measures, specifically on mask-wearing, social-distancing, and hand-sanitizing behaviors. For mask-wearing, the Empathy Treatment was associated with a statistically insignificant decrease of approximately 0.0524 ($p>0.1$), indicating that it did not significantly affect mask-wearing behavior. Similarly, Self-Interest also had an insignificant effect on mask-wearing, with an estimate of approximately-0.00828 ($p>0.1$). The Empathy treatment showed a non-significant increase of approximately 0.142 ($p>0.1$) in social distancing, suggesting that it had no substantial impact. Similarly, Self-Interest had an insignificant effect on social distancing, with an estimate of approximately 0.0214 ($p>0.1$).

Regarding hand-sanitizing, the Empathy Treatment was associated with a non-significant decrease of approximately-0.0264 ($p>0.1$), indicating that it did not significantly affect hand-sanitizing behavior. On the other hand, Self-Interest showed a

non-significant decrease of approximately-0.126 ($p>0.1$), indicating no substantial effect on hand-sanitizing.

Controlling for LASSO-selected covariates, we still found no indication of a positive impact of either the Empathy or Self-Interest treatments on mask-wearing, social-distancing, and hand-sanitizing behaviors as indicated in Appendix Table A7. The control variable, socioeconomic status, showed a statistically significant negative association with social distancing and a statistically significant positive association with hand-sanitizing, indicating that individuals with higher socioeconomic status tended to engage in less social distancing and less hand-sanitizing, respectively.

The control variable age also showed a statistically significant positive association with social distancing and hand-sanitizing, suggesting that older individuals were more likely to practice social distancing and hand-sanitizing. Gender, in addition, which was included only in mask-wearing, showed positive and statistically significant, suggesting that women were more likely to wear masks than were men.

In summary, the treatment effects for empathy and self-interest on COVID-19 mitigation behaviors remained weak and non-significant even after controlling for LASSO-selected covariates. The control variables socioeconomic status, age, and sex showed associations with certain mitigation behaviors, providing additional insights into the factors influencing these behaviors.

5.4 Spillover Effects

It was unclear ex-ante whether our treatments would have spillover effects on other members of the households. Therefore, we carefully examined the possibility of such spillover effects by analyzing three main outcomes: vaccination by other members of households, number of household members vaccinated, and the perceived intent to vaccinate other household members, measured on a scale of 1-10.

Table 7 showed the point estimates of both the Empathy and Self-Interest Treatments. For the Empathy Treatment, the estimates indicate a small positive effect on

the vaccination of any other member of the household, the number of household members vaccinated, and the intent to vaccinate other members of the household. However, these effects were not statistically significant at conventional levels ($p>0.1$). Similarly, for Self-Interest, the estimates suggest a small negative effect on the vaccination of any other member of the household and the number of other household members vaccinated and a weak positive on intent to vaccinate other members of households, but these effects were not statistically significant.

In summary, treatment spillover effects were small and non-significant. The results indicate that both the Empathy and Self-Interest Treatments had no substantial impact on vaccination behavior among other household members because the coefficients were close to zero and lacked statistical significance.

5.5 Heterogenous Effects

According to the Africa CDC Vaccine Hesitancy Survey of March 2021, those who are more skeptical toward COVID-19 vaccines tended to be women, young people, the unemployed, and urban dwellers. We therefore expected women, young individuals, the unemployed, and urban dwellers to react differently to our treatments. To capture this, we ran the analysis by regressing outcomes on an interaction between the treatment dummy and these characteristics.

First, we interacted our Empathy Treatment with gender, age, employment status, and urban setting. Table 8 shows that the interaction effect of the Empathy Treatment on women was positive but not significant on receiving the first dose of COVID-19, being fully vaccinated, and receiving the COVID-19 vaccine post-intervention period. We found no significant effect of the Empathy Treatment on those living in urban areas.

Furthermore, the interaction effect between the Empathy Treatment and age on both receiving the first dose of COVID-19, being fully vaccinated, and receiving the COVID-19 vaccine post-intervention period was statistically insignificant after correcting for multiple comparisons. This was accomplished by adjusting the significance level (alpha=0.05) to 0.004167 (0.05 divided by twelve, the number of outcomes).

Table 9 shows the interaction effect of the Empathy Treatment on vaccine hesitancy and trust levels. We found no indication whether Empathy had any heterogeneous effects on intent to vaccinate, trust in the vaccine, and future vaccine Take Up. Again, as shown in Table 10, we found no evidence to indicate Empathy's heterogeneous effect on COVID-19 mitigation measures.

Next, we conducted a heterogeneous analysis of the Self-interest Treatment on sex, age, employment status, and urban setting. Table 12 reveals that the interaction effect between the Self-Interest Treatment and gender was negative but insignificant on receiving the first dose of COVID-19, and positive but insignificant on being fully vaccinated and receiving the COVID-19 vaccine post-intervention. Also, the interaction effect between the Self-Interest Treatment and age was negative but insignificant on receiving the first dose of COVID-19 and positive but insignificant on being fully vaccinated and receiving the COVID-19 vaccine post-intervention.

Additionally, with regard to vaccine hesitancy and trust, we found no evidence of an interaction effect between Self-Interest and employment status or between Self-Interest and urban residence. In conclusion, the study revealed no evidence of heterogeneous effects of the Empathy and Self-Interest Treatments on COVID-19 vaccination and vaccine hesitancy and trust. For all demographic characteristics analyzed, including gender, employment status, age, and urban residence, no significant interaction effects were observed. These findings indicate that the treatments had relatively consistent effects across different groups.

VI. Conclusions and Policy Implications

Simple SMS campaigns have been known to be cost-effective in persuading individuals to engage in behaviors that provide both private and social benefits. Can such interventions reduce COVID-19 vaccine hesitancy and expand vaccination rates through altruism for others (empathy) and consideration of COVID-19's long-term health impacts

(self-interest)? Additionally, can these interventions increase compliance with COVID-19 prevention measures, including mask-wearing and social distancing? Our results shed light on each of these questions.

First, we found that the SMS interventions based on empathy and self-interest did not produce the desired outcomes: they neither increased vaccination rates, addressed vaccine hesitancy, built trust in the vaccines, or promoted COVID-19 mitigation measures. Our findings align with those of Burlando et al., (2024), which demonstrated that both peer-based and direct messaging approaches failed to alter the health-related behaviors of individuals who received the messages.

Given the heterogeneous effects observed in the analysis, future interventions may consider adopting targeted approaches that are tailored to older individuals. Understanding the factors that influence vaccine hesitancy and vaccination behaviors among different demographic segments can help health officials design more effective communication strategies.

One limitation of our study is that the baseline data included vaccinated individuals, but we did not have access to individuals' vaccination statuses in our baseline data, which may have hindered our ability to control accurately for individuals who were already vaccinated before the interventions took place, although this did not mask treatment effects because the message assignment was random.

Although we cannot definitively identify the explanations for our null results, possible explanations may include that we were somewhat pessimistic about the willingness of Tanzanians, as well as the Tanzanian government in general, to receive the COVID-19 vaccine. We did not anticipate a significant number of Tanzanians getting the COVID vaccine, considering the prior public health misinformation that was perpetuated by the late President Magufuli. During the initial stage of our project in March 2022, the vaccination rate was below 10%, as shown in Figure 4, but by the time of the endline survey, the vaccination rate had increased to about 40%.

Our null results, therefore, may reflect the significant effort made by the Government of Tanzania and other actors to increase vaccination uptake, including

community engagement and the use of community champions to educate and engage the public about the benefits of COVID-19 vaccination. Social media campaigns, such as "One by One: Target COVID-19," were launched to combat misinformation and boost vaccine confidence (Kim et al., 2024). Mobile outreach efforts included door-to-door vaccination drives (see "Closing the Gap," 2022), vaccination events, and the establishment of vaccination points at markets and community centers (Msunyaro et al., 2023). Additionally, the Ministry of Health, with support from WHO, developed detailed plans and conducted extensive training for health workers and community champions. This training focused on creating standard operating procedures, developing data-collection tools, and establishing systems for daily monitoring and supervision. These measures ensured effective implementation and allowed for timely adjustments to the campaign strategies.

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Tables

Table 1: Descriptive Statistics—Treatments

mean		sd	min	max	count
Empathy=1	0.373	0.483	0	1	11,999
Self-Interest=1	0.377	0.485	0	1	11,999
Empathy/Self-Interest=1	0.749	0.433	0	1	11,999
Placebo=1	0.251	0.433	0	1	11,999
Booster=1	0.259	0.438	0	1	11,999
Observations	11,999				

Source: Intervention data.

Table 2: Descriptive Statistics—Main Covariates

	Mean	SD	Min	Max	Count
Interview length (in min)	20.175	6.732	10	45	**11,999**
Delivered1=1	0.950	0.218	0	1	**8894**
Delivered2=1	0.956	0.206	0	1	**8894**
Delivered3=1	0.944	0.231	0	1	**8894**
Number of texts delivered	2.371	0.894	1	3	**11,999**
Dummy for missing any SMS round for non-booster sample	0.118	0.323	0	1	**8894**
Age	37.870	14.809	18	106	**9873**
1st L of Last Name (A-M)=1	0.671	0.470	0	1	**11,999**
Last Digit Odd=1	0.527	0.499	0	1	**11,999**
Baseline Socioeconomic Status	3.083	1.281	1	5	**9808**
Age (Categorical)	2.621	1.286	1	5	**8894**
Occupation	15.397	13.263	1	45	**11,999**
Baseline employment status	0.821	0.384	0	1	**11,999**
Baseline education level	5.740	1.696	1	9	**11,999**
At least Primary=1	0.618	0.486	0	1	**11,999**
At least Secondary=1	0.480	0.500	0	1	**11,999**
Married=1	0.621	0.485	0	1	**11,999**
Women=1	0.499	0.500	0	1	**11,999**
Urban=1	0.341	0.474	0	1	**11,999**
Region (Categorical)	15.691	9.558	1	31	**11,999**
District (Categorical)	354.041	280.651	1	984	**11,999**
Ward (Categorical)	1068.131	738.331	1	2658	**11998**
EFM Affects Me=1	0.076	0.265	0	**1**	**2009**
Trust Vaccine=1	0.293	0.455	0	1	**2424**
Hand Wash=1	0.466	0.499	0	1	**2,425**
Wear Mask=1	0.588	0.492	0	1	**2,425**
Pray=1	0.188	0.391	0	1	**2,425**
Steaming=1	0.184	0.387	0	1	**2,425**
Observations	**11,999**				

Source: Intervention data.

Table 3: Descriptive Statistics—Outcome Variables

	(1)				
mean		sd	min	max	**count**
Vaccinated: 1 Dose=1	0.336	0.472	0	1	**11991**
Vaccinated: Full Dose=1	0.229	0.420	0	1	**11988**
Vaccinated After Nov 2022=1	0.084	0.277	0	1	**4031**
Intend to Vaccinate Next 3 Months=1	0.530	0.499	0	1	**11,999**
Any Household Member Vaccinated 1 Dose=1	0.400	0.490	0	1	**11,999**
Number of Household Member Vaccinated 1 Dose (0-24)	1.168	1.890	0	44	**10512**
Intend to Vaccinate Next 3 Months: Any Household Member	0.291	0.454	0	1	**11,999**
Trust Vaccine (1-10)	6.739	3.650	1	10	**11,999**
May Vaccinate in Future (1-10)	4.382	3.692	1	10	**3766**
Wore Mask Previous Fourteen Days (1-10)	2.801	3.257	1	10	**11,999**
Social Distanced Previous Fourteen Days (1-10)	4.523	3.931	1	10	**11,999**
Sanitized Previous Fourteen Days (1-10)	6.947	3.772	1	10	**11,999**
Observations	**11,999**				

Source: Endline data.

Table 4: Treatment Effect on Vaccination Status

	(1)	(2)	(3)
	Vaccinated: 1 Dose = 1	Vaccinated: Full Dose = 1	Vaccinated: post treatment
Empathy = 1	-0.110	-0.604	1.645
	(1.117)	(0.994)	(1.088)
Self-Interest = 1	-0.758	-0.476	1.643
	(1.112)	(0.992)	(1.090)
Constant	33.94***	23.27***	7.157***
	(0.864)	(0.771)	(0.807)
Observations	11991	11988	4031
ymean	33.62	22.86	8.385
ysd	47.24	42.00	27.72

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows impact estimates of empathy and self-interest on vaccination status. Column 1 displays the impact on receiving the first vaccine dose, Column 2 on receiving the full vaccine dose, and Column 3 on receiving the vaccine post-treatment. All values are expressed as percentages.

Table 5: Treatment Effects on Vaccine Hesitancy and Trust

	(1)	(2)	(3)
	Intent to Vaccinate = 1	Trust Vaccine (1-10)	May vaccinate in the future = 1
Empathy = 1	0.0114	0.0630	-0.0861
	(1.176)	(0.086)	(0.156)
Self-Interest = 1	-1.456	0.105	0.0293
	(1.174)	(0.086)	(0.154)
Constant	53.59***	6.676***	4.403***
	(0.909)	(0.067)	(0.119)
Observations	11999	11999	3766
ymean	53.05	6.739	4.382
ysd	49.91	3.650	3.692

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows impact

estimates of empathy and self-interest on vaccine hesitancy and trust. Column 1 displays the impact on intention to vaccinate (in%), Column 2 on trust level of vaccine (1-10), and Column 3 on the possibility of future vaccination (1-10).

Table 6: Treatment Effects on COVID-19 Mitigation Measures

	(1) Wears Mask (1-10)	(2) Social Distances (1-10)	(3) Hand Sanitizes (1-10)
Empathy = 1	-0.0524	0.142	-0.0264
	(0.077)	(0.092)	(0.088)
Self-Interest = 1	-0.00828	0.0214	-0.126
	(0.077)	(0.092)	(0.088)
Constant	2.824***	4.462***	7.004***
	(0.060)	(0.071)	(0.068)
Observations	11999	11999	11999
ymean	2.801	4.523	6.947
ysd	3.257	3.931	3.772

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows impact estimates of empathy and self-interest on other COVID-19 mitigation measures. Column 1 displays the impact on mask-wearing (1-10), Column 2 on social distancing (1-10), and Column 3 on hand-sanitizing (1-10). Respondents were asked how often they had worn face masks, maintained social distancing, and sanitized hands in public over the previous fourteen days, rated on a scale of 1-10.

Table 7: Treatment Effects (Spillover Effects)

	(1) Vaccinated: HH = 1	(2) Vacinated: No. HH	(3) Intent to Vaccinate: HH = 1
Empathy = 1	1.033	0.00536	1.406
	(1.156)	(0.051)	(1.068)
Self-Interest = 1	-0.245	-0.0268	0.939
	(1.151)	(0.050)	(1.064)
Constant	39.73***	1.176***	28.26***
	(0.892)	(0.041)	(0.821)
Observations	11999	10512	11999
ymean	40.02	1.168	29.14
ysd	49.00	1.890	45.44

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows impact estimates of empathy and self-interest on other members of households. Column 1 displays the impact on any household member being vaccinated, Column 2 on the number of household members vaccinated, and Column 3 on the intention of any households to be vaccinated in the subsequent three months.

Table 8: Empathy Interaction Effects on Vaccination Status

	(1) Vaccinated: 1 Dose = 1	(2) Vaccinated: Full Dose = 1	(3) Vaccinated: post treatment
Empathy X women	2.064	0.582	2.977
	(1.996)	(1.766)	(2.068)
Empathy X urban	3.400*	0.870	-0.317
	(2.034)	(1.799)	(2.109)
Empathy X employed	-1.505	-2.474	-1.695
	(2.543)	(2.243)	(2.869)
Empathy X age	-0.0648	-0.146**	-0.0876
	(0.069)	(0.062)	(0.062)
Empathy = 1	1.781	6.600**	3.391
	(3.600)	(3.184)	(3.788)
Age	0.322***	0.272***	0.0267
	(0.042)	(0.038)	(0.041)
Women = 1	3.328***	1.248	-0.872
	(1.214)	(1.082)	(1.261)
Urban = 1	-6.722***	-3.247***	-2.473*
	(1.226)	(1.091)	(1.321)
baseline employment status	0.166	0.665	-1.476
	(1.534)	(1.341)	(1.692)
Constant	21.53***	12.28***	10.10***
	(2.166)	(1.926)	(2.294)
Observations	9867	9864	3291
ymean			
ysd			

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 The table shows the interaction effect of empathy on-vaccination status with gender, living in an urban area, being employed, and age. Column 1 displays the impact on receiving the first vaccine dose, Column 2 on receiving the full vaccine dose, and Column 3 on receiving the vaccine post-treatment. All values are expressed as percentages.

Table 9: Empathy Interaction Effects on Vaccine Hesitancy and Trust

	(1) Intent to Vaccinate = 1	(2) Trust Vaccine (1-10)	(3) May vaccinate in the future = 1
Empathy X women	0.0806	0.233	-0.271
	(2.118)	(0.155)	(0.282)
Empathy X urban	2.453	0.163	0.415
	(2.191)	(0.161)	(0.282)
Empathy X employed	-1.593	-0.0660	0.166
	(2.697)	(0.198)	(0.344)
Empathy X age	0.0378	0.00326	-0.0186*
	(0.072)	(0.005)	(0.010)
Empathy = 1	0.00446	-0.210	0.487
	(3.829)	(0.279)	(0.502)
Age	-0.0383	0.00719**	0.00760
	(0.043)	(0.003)	(0.006)
Women = 1	1.212	0.0956	-0.0260
	(1.289)	(0.095)	(0.170)
Urban = 1	-6.278***	-0.332***	-0.215
	(1.337)	(0.098)	(0.169)
baseline employment status	3.530**	0.184	-0.0382
	(1.635)	(0.120)	(0.203)
Constant	52.87***	6.354***	4.233***
	(2.310)	(0.168)	(0.304)
Observations	9873	9873	3117
ymean			
ysd			

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows the interaction effect of empathy on vaccine hesitancy and trust with gender, living in an urban area, being employed, and age. Column 1 displays the impact on intention to vaccinate in the next month, Column 2 on trust level of vaccine (1-10), and Column 3 on the possibility of future vaccination (1-10).

Table 10: Empathy Interaction Effects COVID-19 Mitigation Measures

	(1) Wears Mask (1-10)	(2) Social Distances (1-10)	(3) Hand Sanitizes (1-10)
Empathy X women	-0.0307	0.00368	0.103
	(0.138)	(0.167)	(0.160)
Empathy X urban	-0.0338	-0.0146	-0.139
	(0.142)	(0.173)	(0.166)
Empathy X employed	0.0367	-0.0128	0.136
	(0.174)	(0.211)	(0.205)
Empathy X age	0.000188	0.00680	0.00590
	(0.005)	(0.006)	(0.005)
Empathy = 1	-0.0852	-0.125	-0.284
	(0.247)	(0.302)	(0.295)
Age	-0.00241	0.00533	-0.000425
	(0.003)	(0.003)	(0.003)
Women = 1	0.200**	0.144	0.223**
	(0.085)	(0.102)	(0.098)
Urban = 1	0.0648	-0.0159	0.132
	(0.087)	(0.105)	(0.101)
baseline employment status	0.0714	0.164	0.135
	(0.108)	(0.129)	(0.124)
Constant	2.717***	4.040***	6.673***
	(0.151)	(0.181)	(0.177)
Observations	9873	9873	9873
ymean			
ysd			

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows the interaction effect of empathy with gender, living in an urban area, being employed, and age on other COVID-19 mitigation measures. Column 1 displays the impact on mask-wearing (1-10), Column 2 on social distancing (1-10), and Column 3 on hand-sanitizing (1-10). All outcomes were measured in the previous fourteen days.

Table 11: Empathy Interaction Effects (Spillover Effects)

	(1) Vaccinated: HH = 1	(2) Vaccinated: No. HH	(3) Intent to Vaccinate: HH = 1
Empathy X women	4.095**	-0.158*	1.266
	(2.089)	(0.087)	(1.929)
Empathy X urban	0.0703	-0.0160	-1.305
	(2.145)	(0.085)	(1.960)
Empathy X employed	-1.543	-0.142	-2.656
	(2.653)	(0.110)	(2.428)
Empathy X age	-0.107	-0.00123	-0.0339
	(0.071)	(0.003)	(0.065)
Empathy = 1	4.161	0.256	3.606
	(3.776)	(0.162)	(3.448)
Age	0.116***	0.00211	0.0403
	(0.043)	(0.002)	(0.039)
Women = 1	-2.576**	0.0595	-1.321
	(1.268)	(0.055)	(1.172)
Urban = 1	-3.092**	-0.106**	-2.822**
	(1.304)	(0.053)	(1.199)
baseline employment status	0.242	0.0286	1.928
	(1.596)	(0.066)	(1.455)
Constant	37.54***	1.081***	27.39***
	(2.273)	(0.104)	(2.068)
Observations	9873	8638	9873
ymean			
ysd			

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows the interaction effect of empathy with gender, living in an urban area, being employed, and age on other members of households. Column 1 displays the impact on any household member being vaccinated, Column 2 on the number of household members vaccinated, and Column 3 on the intention of any households to be vaccinated in the subsequent three months.

Table 12: Self-Interest Interaction Effects on Vaccination Status

	(1) Vaccinated: 1 Dose = 1	(2) Vaccinated: Full Dose = 1	(3) Vaccinated: post treatment
Self-Interest X women	-3.547*	-2.015	-1.782
	(1.981)	(1.760)	(2.090)
Self-Interest X employed	-0.399	-0.357	2.817
	(2.519)	(2.214)	(2.821)
Self-Interesty X urban	-3.565*	-2.915	-0.700
	(2.009)	(1.782)	(2.180)
Self-Interest X age	-0.00231	0.0400	0.0398
	(0.069)	(0.062)	(0.067)
Self-Interest = 1	2.683	0.823	-1.725
	(3.552)	(3.160)	(3.762)
Age	0.299***	0.203***	-0.0198
	(0.043)	(0.039)	(0.038)
Women = 1	5.444***	2.239**	0.943
	(1.227)	(1.087)	(1.244)
Urban = 1	-4.105***	-1.809	-2.277*
	(1.247)	(1.106)	(1.259)
baseline employment status	-0.225	-0.109	-3.156*
	(1.552)	(1.365)	(1.739)
Constant	21.14***	14.38***	11.93***
	(2.210)	(1.952)	(2.320)
Observations	9867	9864	3291
ymean			
ysd			

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The **table shows** the interaction effect of self-interest with gender, living in an urban area, being employed, and age-on-vaccination status. Column 1 displays the impact on receiving the first vaccine dose, Column 2 on receiving the full vaccine dose, and Column 3 on receiving the vaccine post-treatment. All values are expressed as percentages.

Table 13: Self-Interest Interaction Effects on Vaccine Hesitancy and Trust

	(1) Intent to Vaccinate = 1	(2) Trust Vaccine (1-10)	(3) May vaccinate in the future = 1
Self-Interest X women	-0.491	-0.107	0.228
	(2.106)	(0.154)	(0.278)
Self-Interest X employed	3.723	0.0662	-0.414
	(2.681)	(0.197)	(0.338)
Self-Interesty X urban	-0.793	-0.0324	0.0943
	(2.187)	(0.161)	(0.278)
Self-Interest X age	-0.156**	-0.00758	0.00944
	(0.071)	(0.005)	(0.010)
Self-Interest = 1	1.775	0.322	-0.256
	(3.784)	(0.275)	(0.500)
Age	0.0353	0.0113***	-0.00313
	(0.044)	(0.003)	(0.006)
Women = 1	1.433	0.223**	-0.203
	(1.300)	(0.095)	(0.174)
Urban = 1	-5.062***	-0.258***	-0.101
	(1.340)	(0.098)	(0.172)
baseline employment status	1.555	0.135	0.173
	(1.645)	(0.120)	(0.209)
Constant	52.15***	6.154***	4.521***
	(2.349)	(0.171)	(0.305)
Observations	9873	9873	3117
ymean			
ysd			

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows the interaction effect of self-interest with gender, living in an urban area, being employed, and age on vaccine hesitancy and trust. Column 1 displays the impact on intention to vaccinate in the next month, Column 2 on the trust level of vaccine (1-10), and Column 3 on the possibility of future vaccination (1-10).

Table 14: Self-Interest Interaction Effects on COVID-19 Mitigation Measures

	(1) Wears Mask (1-10)	(2) Social Distances (1-10)	(3) Hand Sanitizes (1-10)
Self-Interest X women	0.0345	-0.262	-0.126
	(0.138)	(0.166)	(0.160)
Self-Interest X employed	0.0659	-0.157	0.215
	(0.176)	(0.212)	(0.205)
Self-Interest X urban	0.144	0.0808	0.0152
	(0.143)	(0.172)	(0.166)
Self-Interest X age	0.000312	-0.00639	-0.00220
	(0.005)	(0.006)	(0.006)
Self-Interest = 1	-0.0745	0.409	-0.159
	(0.246)	(0.298)	(0.293)
Age	-0.00247	0.0104***	0.00262
	(0.003)	(0.004)	(0.003)
Women = 1	0.175**	0.247**	0.308***
	(0.085)	(0.102)	(0.098)
Urban = 1	-0.00274	-0.0500	0.0720
	(0.087)	(0.105)	(0.101)
baseline employment status	0.0589	0.221*	0.108
	(0.106)	(0.129)	(0.123)
Constant	2.715***	3.833***	6.623***
	(0.152)	(0.184)	(0.179)
Observations	9873	9873	9873
ymean			
ysd			

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows the interaction effect of self-interest with gender, living in an urban area, being employed, and age on other COVID-19 mitigation measures. Column 1 displays the impact on mask-wearing (1-10), Column 2 on social distancing (1-10), and Column 3 on hand-sanitizing (1-10). All outcomes were measured in the previous fourteen days.

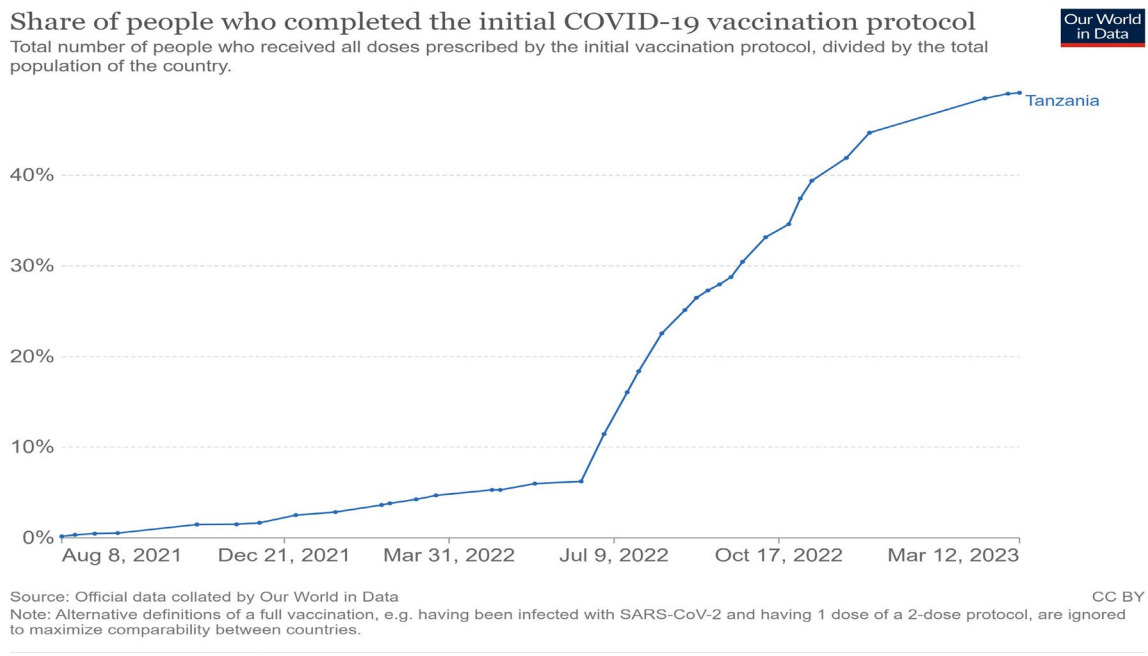
***Table* 15: Self-Interest Interaction Effects (Spillover Effects)**

	(1) Vaccinated: HH = 1	(2) Vacinated: No. HH	(3) Intent to Vaccinate: HH = 1
Self-Interest X women	-1.360	0.0469	0.479
	(2.073)	(0.086)	(1.918)
Self-Interest X employed	0.763	0.0561	2.944
	(2.631)	(0.108)	(2.398)
Self-Interesty X urban	-1.003	0.000280	-0.284
	(2.135)	(0.084)	(1.961)
Self-Interest X age	-0.0823	-0.00650**	0.00892
	(0.070)	(0.003)	(0.065)
Self-Interest = 1	2.547	0.167	-2.752
	(3.730)	(0.160)	(3.411)
Age	0.108**	0.00417**	0.0237
	(0.044)	(0.002)	(0.040)
Women = 1	-0.509	-0.0152	-1.037
	(1.283)	(0.056)	(1.181)
Urban = 1	-2.679**	-0.110**	-3.188***
	(1.313)	(0.053)	(1.198)
baseline employment status	-0.575	-0.0457	-0.136
	(1.617)	(0.068)	(1.480)
Constant	38.07***	1.110***	29.75***
	(2.318)	(0.106)	(2.099)
Observations	9873	8638	9873
ymean			
ysd			

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows the interaction effect of self-interest with gender, living in an urban area, being employed, and age on other members of households. Column 1 displays the impact on any household member being vaccinated, Column 2 on the number of household members vaccinated, and Column 3 on the intention of any households to be vaccinated in the subsequent three months.

Figures

Figure 4: Share of Tanzanians Who Received the First Dose of COVID-19 Vaccine after August 2021



Appendices

Appendix A: Power Calculation

Introduction

Throughout the following power calculations of the pairwise comparisons between T1 and Placebo; T2 and Placebo; and T1 vs. T2 we began by setting the sample sizes as to 4,500; 4,500; and 3,000 for T1, T2, and Placebo, respectively. We also began by setting alpha=0.05 and power=0.8. In accounting for multiple comparison bias, we divided alpha=0.05/7=0.00714286 for our seven outcomes.

Outcome 1: Actual Vaccination Rates

We began by first outlining the assumptions on baseline values of two outcome variables.

The first was on actual vaccination rates in Tanzania, which we set at 7% because Our World In Data's latest data show that, as a percentage of the adult population, only about 6.6% of adult Tanzanians were vaccinated as of the beginning of our research.

Power calculations for a two-sample proportions Chi2 test showed that the Minimum Detectable Effect for the actual vaccination rate outcome, given an assumed 7% rate of vaccinations among adult Tanzanians, was 1.79% points (T1/T2 vs. Placebo). This Minimum Detectable Effect increased to 2.29% points when accounting for multiple comparisons across our 7 outcomes (alpha=0.05/7=0.00714286).

Comparing T1 to T2 and assuming a baseline of 8.06% with alpha=0.05, the Minimum Detectable Effect was 1.68% points, which increased to 2.14% points when accounting for multiple comparisons (alpha=0.05/7=0.00714286).

Outcome 2: Vaccine Hesitancy/Confidence

Regarding the vaccine hesitancy/confidence outcome, we set a baseline percentage of vaccine hesitancy/confidence for Tanzania at 41%. This was informed by a February 2021 report from the Africa Centres for Disease Control and Prevention ("COVID-19 Vaccine Perceptions," 2021, Figure 2.3.2) which provided the results of their COVID-19 survey across fifteen African countries, excluding Tanzania. The survey found that the Democratic Republic of Congo hosted the most vaccine-hesitant population in Africa. Only about 59% of DRC respondents expressed willingness to accept a new COVID-19 vaccine. Please note that surveying likely occurred before any public news of successfully tested COVID-19 vaccines was made available to the public. Nevertheless, we assume a baseline vaccine hesitancy/confidence level of 41%, which was likely a lower limit to COVID-19 vaccine hesitancy/confidence in Tanzania were it to be measured today.

Power calculations for a two-sample proportions Chi2 test showed that the Minimum Detectable Effect for COVID-19 vaccine hesitancy outcome, given an assumed 41% vaccine hesitancy/confidence among adult Tanzanians, was 3.27% points (T1/T2 vs. Placebo). This Minimum Detectable Effect increased to 4.12% points when accounting for multiple comparisons across our seven outcomes (alpha=0.05/7=0.00714286). For T1

vs. T2, with alpha=0.05 with a baseline of 44% the Minimum Detectable Effect was 2.94% points, which after accounting for multiple comparisons (alpha=0.5/7=0.00714286) increased to 3.71% points.

Table A1: Variable Description

Variable	Definition	Type
InstanceID	Respondents unique ID	Baseline Data
employed_baseline	Baseline employment status	Baseline data
education_baseline	Baseline education level	Baseline data
primary_baseline	At least Primary eduaction = 1	Baseline data
secondary_baseline	At least Secondary = 1	Baseline data
married_baseline	Married = 1	Baseline data
women	Women = 1	Baseline data
urban	Urban = 1	Baseline data
region	Region (Categorical)	Baseline data
district	District (Categorical)	Baseline data
ward	Ward (Categorical)	Baseline data
efm_baseline	Early and forced Marriage Affects Me = 1	Baseline data
trustvacc_baseline	Trust Vaccine = 1	Baseline data
handwash_baseline	Hand Wash = 1	Baseline data
wearmask_baseline	Wear Mask = 1	Baseline data
pray_baseline	Pray = 1	Baseline data
steam_baseline	Steaming = 1	Baseline data
Deliverered_1	Delivered=1 for first round sms	Baseline data
Deliverered_2	Delivered=1 for second round sms	Baseline data
Deliverered_3	Delivered=1 for third round sms	Baseline data
delivered_booster	delivered=1 for booster sample	Baseline data
missed_booster	missing sms round in booster sample	Baseline data
treat1_booster	Empathy=1 for booster sample	Baseline data
treat2_booster	Self-Interest=1 for booster sample	Baseline data
treat_booster	Empathy/Self-Interest=1 for booster	Baseline data
placebo_booster	placebo=1 for booster sample	Baseline data
treat1_nonbooster	Empathy=1 for non-booster sample	Baseline data
treat2_nonbooster	Self-Interest=1 for non-booster sample	Baseline data
treat_nonbooster	Empathy/Self-Interest=1 for non-booster	Baseline data
placebo_booster	placebo=1 for non-booster sample	Baseline data
treat1	treatment1=1	Baseline data
treat2	treatment2=1	Baseline data
placebo	placebo=1	Baseline data
treat1_urban	treat1_urban=1	Baseline data
treat1_women	treat1_women=1	Baseline data
treat1_age	treat1_age=1	Baseline data
treat1_employed	treat1_employed=1	Baseline data
treat2_urban	treat2_urban=1	Baseline data
treat2_women	treat2_women=1	Baseline data
treat2_age	treat2_age=1	Baseline data
treat2_employed	treat2_employed=1	Baseline data
treat_urban	treat_urban=1	Baseline data
treat_women	treat_women=1	Baseline data
treat_age	treat_age=1	Baseline data
treat_employed	treat_employed=1	Baseline data

outcome4_vacc1	Vaccinated: 1 Dose = 1	Endline data
outcome5_vaccinetyoe	Vaccine type vaccinated	Endline data
outcome6_vaccfull	Vaccinated: Full Dose = 1	Endline data
outcome7_vaccptrt	Vaccinated After Nov 2022 = 1	Endline data
outcome8_int2vacc	Intend to Vaccinate Next 3 Months = 1	Endline data
outcome9_vaccanyhh	Any HH Member Vaccinated 1 Dose = 1	Endline data
outcome10_vaccnohh	Number of HH Member Vaccinated 1 Dose (0-24)	Endline data
outcome11_int2vaccahh	Intend to Vaccinate Next 3 Months: Any HH Member	Endline data
outcome12_trstvacc	Trust Vaccine (1-10)	Endline data
outcome13_myvaccfut	May Vaccinate in Future (1-10)	Endline data
outcome14_mask	Wore Mask Past 14 Days (1-10)	Endline data
outcome15_socdist	Social Distanced Past 14 Days (1-10)	Endline data
outcome16_sani	Sanitized Past 14 Days (1-10)	Endline data

Table A2: Endline Balance Test between Control and Treatment

	(1)		(2)		(1)- (2)	
	EFM		Treatment		Pairwise t-test	
Variable	N	Mean/(SE)	N	Mean/(SE)	N	Mean difference
Interview length (in min)	3,008	20 (.12)	8,991	20 (.071)	11,999	-0.15
Delivered1=1	2,231	0.94 (.0051)	6,663	0.95 (.0026)	8,894	-.015***
Number of texts delivered	3,008	2.4 (.016)	8,991	2.4 (.0094)	11,999	-0.0022
Dummy for missing any SMS round for non-booster sample	2,231	0.13 (.0071)	6,663	.11 (.0039)	8,894	0.013
Age	2,475	38 (.3)	7,398	38 (.17)	9,873	-0.18
1st L of Last Name (A-M)=1	3,008	.66 (.0086)	8,991	.67 (.0049)	11,999	-0.0089
Last Digit Odd=1	3,008	.53 (.0091)	8,991	.53 (.0053)	11,999	-0.0013
Baseline Socioeconomic Status	2,462	3.1 (.026)	7,346	3.1 (.015)	9,808	0.035
Occupation	3,008	15 (.24)	8,991	15 (.14)	11,999	0.095
Baseline employment status	3,008	.81 (.0071)	8,991	.82 (.004)	11,999	-0.0087
Baseline education level	3,008	5.8 (.031)	8,991	5.7 (.018)	11,999	0.035
At least Primary=1	3,008	.61 (.0089)	8,991	.62 (.0051)	11,999	-0.0047
At least Secondary=1	3,008	.48 (.0091)	8,991	.48 (.0053)	11,999	-0.00098
Married=1	3,008	.63 (.0088)	8,991	.62 (.0051)	11,999	0.0052
Women=1	3,008	.49 (.0091)	8,991	.5 (.0053)	11,999	-0.016
Urban=1	3,008	.34 (.0087)	8,991	.34 (.005)	11,999	0.0023
Region (Categorical)	3,008	16 (.17)	8,991	16 (.1)	11,999	0.099
District (Categorical)	3,008	356 (5.2)	8,991	354 (3)	11,999	2
Ward (Categorical)	3,008	1067 (13)	8990	1,069 (7.8)	11,998	-1.7
Trust Vaccine=1	607	.29 (.018)	1,817	.29 (.011)	2,424	-0.0061
Hand Wash=1	607	.47 (.02)	1,818	.46 (.012)	2,425	0.0097
Wear Mask=1	607	.59 (.02)	1,818	.59 (.012)	2,425	-0.0015
Pray=1	607	.19 (.016)	1,818	.19 (.0092)	2,425	-0.0025
Steaming=1	607	.18 (.016)	1,818	.18 (.0091)	2,425	-0.0014
Booster==1	3,008	.26 (.008)	8,991	.26 (.0046)	11,999	-0.00061
F-test of joint significance (F-stat)						0
F-test, number of observations						0

Significance: ***=.01, **=.05, *=.1. Errors are robust.

Table A3: Endline Balance Test between Control and Empathy Treatment

	(1)		(2)		(1)-(2)	
	EFM		Empathy		Pairwise t-test	
Variable	**N**	**Mean/(SE)**	**N**	**Mean/(SE)**	**N**	**Mean differences**
Interview length (in min)	7,529	20 (.078)	4,470	20 (.1)	11,999	0.014
Delivered1=1	5,543	.94 (.0032)	3,351	.96 (.0032)	8,894	-0.022***
Number of texts delivered	7,529	2.4 (.01)	4,470	2.4 (.013)	11,999	-.041**
Dummy for missing any SMS round for non-booster sample	5,543	.12 (.0044)	3,351	.11 (.0054)	8,894	.017**
Age	6,218	38 (.19)	3,655	38 (.25)	9,873	-0.043
1st L of Last Name (A-M) = 1	7,529	.67 (.0054)	4,470	.68 (.007)	11,999	-0.011
Last Digit Odd = 1	7,529	.53 (.0058)	4,470	.52 (.0075)	11,999	0.0049
Baseline Socio-Economic Status	6,185	3.1 (.016)	3,623	3.1 (.021)	9,808	0.036
Occupation	7,529	15 (.15)	4,470	15 (.2)	11,999	0.039
Baseline employment status	7,529	.82 (.0044)	4,470	.82 (.0057)	11,999	-0.0035
Baseline education level	7,529	5.7 (.02)	4,470	5.8 (.025)	11,999	-0.018
At least Primary = 1	7,529	.62 (.0056)	4,470	.62 (.0073)	11,999	-0.0043
At least Secondary = 1	7,529	.47 (.0058)	4,470	.49 (.0075)	11,999	-.016*
Married = 1	7,529	.62 (.0056)	4,470	.62 (.0073)	11,999	-0.00037
Women = 1	7,529	.49 (.0058)	4,470	.51 (.0075)	11,999	-0.013
Urban = 1	7,529	.34 (.0054)	4,470	.35 (.0071)	11,999	-0.014
Region (Categorical)	7,529	16 (.11)	4,470	16 (.14)	11,999	-0.0073
District (Categorical)	7,529	351 (3.2)	4,470	358 (4.2)	11,999	-7.1
Ward (Categorical)	7,529	1061 (8.5)	4,469	1080 (11)	11998	-19
Trust Vaccine = 1	1,525	.29 (.012)	899	.29 (.015)	2,424	-0.003
Hand Wash = 1	1,525	.45 (.013)	900	.49(.01)	2,425	-0.032
Wear Mask = 1	1,525	.57 (.013)	900	.61 (.016)	2,425	-.041**
Pray = 1	1,525	.19 (.01)	900	.19 (.013)	2,425	-0.0031
Steaming = 1	1,525	.19 (.01)	900	.18 (.013)	2,425	0.008
Booster=1	7,529	.26 (.0051)	4,470	.25 (.0065)	11,999	0.013
F-test of joint significance (F-stat)						**0**
F-test, number of observations						**0**

Significance: *=.01, **=.05, *=.1. Errors are robust.**

Table A4: Endline Balance Test between Control and Self-Interest Treatment

(1) EFM	EFM		(2) Self-Interest		(1)- (2) Pairwise t-test	
Variable	N	Mean/(SE)	N	Mean/(SE)	N	Mean difference
Interview length (in min)	7,478	20 (.077)	4,521	20 (.1)	11,999	-0.14
Delivered1=1	5,582	.95 (.0028)	3,312	.94 (.004)	8,894	.0099**
Number of texts delivered	7,478	2.4 (.01)	4,521	2.4 (.013)	11,999	0.024
Dummy for missing any SMS round for non-booster sample	5,582	.12 (.0043)	3,312	.12 (.0057)	8,894	-0.0066
Age	6,130	38 (.19)	3,743	38 (.24)	9,873	-0.098
1st L of Last Name (A-M)=1	7,478	.67 (.0054)	4,521	.67 (.007)	11,999	0.0038
Last Digit Odd=1	7,478	.52 (.0058)	4,521	.53 (.0074)	11,999	-0.0059
Baseline Socioeconomic Status	6,085	3.1 (.016)	3,723	3.1 (.021)	9,808	-0.0072
Occupation	7,478	15 (.15)	4,521	15 (.2)	11,999	0.037
Baseline employment status	7,478	.82 (.0044)	4,521	.82 (.0057)	11,999	-0.0035
Baseline education level	7,478	5.8 (.02)	4,521	5.7 (.025)	11,999	0.046
At least Primary=1	7,478	.62 (.0056)	4,521	.62 (.0072)	11,999	0.00052
At least Secondary=1	7,478	.49 (.0058)	4,521	.47 (.0074)	11,999	.015*
Married=1	7,478	.62 (.0056)	4,521	.62 (.0072)	11,999	0.0045
Women=1	7,478	.5 (.0058)	4,521	.5 (.0074)	11,999	-0.00012
Urban=1	7,478	.35 (.0055)	4,521	.33 (.007)	11,999	.016*
Region (Categorical)	7,478	16 (.11)	4,521	16 (.14)	11,999	0.086
District (Categorical)	7,478	357 (3.3)	4,521	349 (4.1)	11,999	8.6
Ward (Categorical)	7,477	1,075 (8.6)	4,521	1,057 (11)	11,998	18
Trust Vaccine=1	1,506	.29 (.012)	918	.29 (.015)	2,424	-0.002
Hand Wash=1	1,507	.48 (.013)	918	.44 (.016)	2,425	. 039*
Wear Mask=1	1,507	.6 (.013)	918	.56 (.016)	2,425	. 039*
Pray=1	1,507	0.19	918	.19(.013)	2,425	0.0011
Steaming=1	1,507	.18(.0099)	918	.19 (.013)	2,425	-0.0091
Booster==1	7,478	.25(.005)	4,521	.27(.0066)	11,999	-.014*
F-test of joint significance (F-stat)						0
F-test, number of observations						0

Significance: *=.01, **=.05, *=.1. Errors are robust.**

Table A5: Treatment Effects on Vaccination Status with Controls

	(1) Vaccinated: 1 Dose = 1	(2) Vaccinated: Full Dose = 1	(3) Vaccinated After Nov 2022 = 1
Empathy =1	1.048	-0.540	1.645
	(1.458)	(1.084)	(1.088)
Self-interest =1	0.652	-0.372	1.643
	(1.449)	(1.076)	(1.090)
Age	0.246	0.195***	
	(0.154)	(0.0313)	
Baseline Socio-Economic Status	0.0937		
	(0.535)		
Married = 1	2.099*		
	(1.261)		
Women = 1	5.261***	1.730**	
	(1.141)	(0.850)	
Urban = 1	-5.145***	-1.265	
	(1.318)	(0.979)	
Interview length (in min)	0.146*		
	(0.0812)		
Occupation		-0.0312	
		(0.0317)	
Constant	7.967	11.41***	7.157***
	(5.111)	(2.541)	(0.807)
Observations	6,701	9,864	4,031
R-squared	0.041	0.017	0.001

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows impact estimates of empathy and self-interest with controls on vaccine hesitancy and trust. Column 1 displays the impact on intention to vaccinate (%), Column 2 on the trust level of vaccine (1-10), and Column 3 on the possibility of future vaccination (%).

Table A6: Treatment Effects on Vaccine Hesitancy and Trust with Controls

	(1) Intend to Vaccinate Next 3 Months = 1	(2) Trust Vaccine (1-10)	(3) May Vaccinate in Future (1-10)
Empathy =1	-0.854	0.0528	-0.0861
	(1.652)	(0.0992)	(0.156)
Self-interest =1	-1.523	0.150	0.0293
	(1.642)	(0.0998)	(0.154)
Number of texts delivered	-4.138***		
	(1.456)		
Age	-0.262		
	(0.171)		
Baseline Socio-Economic Status	-1.480**		

	(0.687)		
Occupation	-0.0445	-0.00344	
	(0.0525)	(0.00307)	
Baseline employment status	4.131**		
	(1.777)		
Baseline education level	0.608		
	(0.438)		
At least Primary = 1	0.912		
	(1.368)		
Married = 1	0.299		
	(1.487)		
Women = 1	2.094		
	(1.457)		
Urban = 1	0.0968	-0.226**	
	(4.220)	(0.0916)	
Interview length (in min)	-0.152		
	(0.0928)		
Constant	13.53	5.917***	4.403***
	(8.685)	(0.242)	(0.119)
Observations	6,702	8,894	3,766
R-squared	0.119	0.015	0.000

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows impact estimates of empathy and self-interest with controls on vaccine hesitancy and trust. Column 1 displays the impact on intention to vaccinate (%), Column 2 on trust level of vaccine (1-10), and Column 3 on the possibility of future vaccination (%).

Table A7: Treatment Effects on COVID-19 Mitigation Measures with Controls

	(1) Wore Mask Past 14 Days (1-10)	(2) Social Distanced Past 14 Days (1-10)	(3) Sanitized Past 14 Days (1-10)
Empathy =1	-0.0566	0.131	0.0187
	(0.0769)	(0.122)	(0.122)
Self-interest =1	-0.0110	0.0371	-0.138
	(0.0768)	(0.122)	(0.121)
Occupation	0.00196		
	(0.00233)		
At least Secondary = 1	0.0212		-0.158
	(0.0605)		(0.0993)
Married = 1	-0.000902		
	(0.0624)		
Women = 1	0.177***	0.163*	0.341***
	(0.0603)	(0.0973)	(0.107)
Interview length (in min)	0.00494		0.00578
	(0.00441)		(0.00686)
baseline Socio-Economic Status		-0.0807*	0.0888*
		(0.0425)	(0.0488)

baseline employment status		0.214*	0.350***
		(0.121)	(0.129)
Constant	2.599***	4.350***	0.550*
	(0.125)	(0.199)	(0.325)
Observations	11,999	6,703	6,703
R-squared	0.001	0.003	0.059

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows impact estimates of empathy and self-interest with controls on other COVID-19 mitigation measures. Column 1 displays the impact on mask-wearing (1-10), Column 2 on social distancing (1-10), and Column 3 on hand-sanitizing (1-10). Respondents were asked how often they wore face masks, maintained social distancing, and sanitized hands in public over the previous fourteen days, rated on a scale of 1-10.

Table A8: Treatment Effects (Spillover Effects) with Controls

	(1) Any HH Member Vaccinated 1 Dose = 1	(2) Number of HH Member Vaccinated 1 Dose (0-24)	(3) Intend to Vaccinate Next 3 Months: Any HH Member
Empathy =1	1.967	0.000925	0.648
	(1.567)	(0.0503)	(1.220)
Self-interest =1	1.345	-0.0304	0.311
	(1.560)	(0.0502)	(1.203)
number of texts delivered			-1.892*
			(1.077)
baseline Socio-Economic Status			-0.253
			(0.445)
Occupation	0.0301		-0.0759*
	(0.0491)		(0.0431)
baseline employment status			1.254
			(1.231)
baseline education level	0.611		0.117
	(0.410)		(0.305)
Married = 1	1.790		1.893*
	(1.392)		(0.992)
Women = 1	-0.292		-0.302
	(1.332)		(1.020)
Urban = 1	-0.663		-3.720**
	(1.949)		(1.472)
Age	-0.0195		
	(0.164)		
At least Secondary = 1	-2.670**		
	(1.285)		
Constant	-3.180	1.059***	33.27***
	(7.298)	(0.0920)	(8.901)

Observations	6,768	10,512	9,808
R-squared	0.086	0.019	0.062

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows impact estimates of empathy and self-interest on other members of households. Column 1 displays the impact on any household member being vaccinated, Column 2 on the number of household members vaccinated, and Column 3 on the intention of any households to be vaccinated in the subsequent three months.

Appendix B: Baseline Summary Statistics and Covariate Balance

Table B1: Descriptive Statistics: Non-Booster Sample

Mean		SD	Min	Max	Count
Region (Categorical)	15.197	9.643	1	31	17,209
District (Categorical)	442.190	270.106	1	984	17,209
Ward (Categorical)	1,270.564	732.512	1	2659	17,208
Urban=1	0.362	0.481	0	1	17,209
baseline Socioeconomic Status	2.686	1.114	1	5	13,482
Women=1	0.506	0.500	0	1	17,209
Age (Categorical)	2.454	1.255	1	5	17,209
Age (Categorical)	2.454	1.255	1	5	17,209
Baseline education level	6.247	1.519	1	9	17,209
At least Primary=1	0.581	0.493	0	1	17,209
At least Secondary=1	0.578	0.494	0	1	17,209
Occupation	19.160	13.533	1	45	17,209
Baseline employment status	0.801	0.399	0	1	17,209
Married=1	0.582	0.493	0	1	17,209
1st L of Last Name (A-M)=1	0.680	0.467	0	1	17,209
Last Digit Odd=1	0.498	0.500	0	1	17,209
EFM Affects Me=1	0.079	0.270	0	1	4,005
Trust Vaccine=1	0.298	0.457	0	1	4,765
Hand Wash=1	0.467	0.499	0	1	4,766
Wear Mask=1	0.592	0.491	0	1	4,766
Pray=1	0.183	0.387	0	1	4,766
Steaming=1	0.184	0.388	0	1	4,766
Empathy	0.600	0.490	0	1	10,756
Self-Interest	0.600	0.490	0	1	10,755
Empathy/Self-Interest	0.750	0.433	0	1	17,209
Observations	17,209				

Source: Baseline data.

Table B2: Baseline Balance Test between Control and Treatment

Variable	N	(1) EFM Mean/(SE)	(2) Treatment N mean/(SE)		(1)- (2) Pairwise t-test N mean difference	
Region (Categorical)	4,302	15 (.15)	12,907	15 (.085)	17,209	**.042**
District (Categorical)	4,302	442 (4.2)	12,907	442 (2.4)	17,209	**.15**
Ward (Categorical)	4,302	1,269 (11)	12,906	1271 (6.5)	17208	**-2**
Urban=1	4,302	.36 (.0073)	12,907	.36 (.0042)	17,209	**.0037**
Baseline Socioeconomic Status	3,369	2.7 (.019)	10,113	2.7 (.011)	13,482	**-.0058**
Women=1	4,302	.51 (.0076)	12,907	.51 (.0044)	17,209	**.00027**
Age (Categorical)	4,302	2.5 (.019)	12,907	2.5 (.011)	17,209	**.0064**
Age (Categorical)	4,302	2.5 (.019)	12,907	2.5 (.011)	17,209	**.0064**
Baseline education level	4,302	6.3 (.023)	12,907	6.2 (.013)	17,209	**.044**
At least Primary=1	4,302	.58 (.0075)	12,907	.58 (.0043)	17,209	**-.0024**
At least Secondary=1	4,302	.58 (.0075)	12,907	.58 (.0043)	17,209	**-.0014**
Occupation	4,302	19 (.2)	12,907	19 (.12)	17,209	**-.16**
Baseline employment status	4,302	.8 (.006)	12,907	.8 (.0035)	17,209	**.004**
Married=1	4,302	.58 (.0075)	12,907	.58 (.0043)	17,209	**-.00096**
1st L of Last Name (A-M)=1	4,302	.67 (.0071)	12,907	.68 (.0041)	17,209	**-.0081**
Last Digit Odd=1	4,302	.5 (.0076)	12,907	.5 (.0044)	17,209	**.0024**
Trust Vaccine=1	1,179	.3 (.013)	3,586	.3 (.0076)	4,765	**-.0026**
Hand Wash=1	1,179	.47 (.015)	3,587	.47 (.0083)	4,766	**.00094**
Wear Mask=1	1,179	.59 (.014)	3,587	.59 (.0082)	4,766	**-.0046**
Pray=1	1,179	.18 (.011)	3,587	.19 (.0065)	4,766	**-.007**
Steaming=1	1,179	.18 (.011)	3,587	.18 (.0065)	4,766	**-.0013**
F-test of joint significance (F-stat)						**.o**
F-test, number of observations						**.o**

Significance: ***=0.01, **=0.05, *=0.1. Errors are robust.

Table B3: Baseline Balance Test between Early and Forced Marriage Reminder and Empathy

Variable	N	(1) EFM Mean/(SE)	(2) Empathy N Mean/(SE)		(1)- (2) Pairwise t-test N Mean difference	
Region (Categorical)	4,302	15 (.15)	6,454	15 (.12)	10,756	**.072**
District (Categorical)	4,302	442 (4.2)	6,454	443 (3.4)	10,756	**-.22**
Ward (Categorical)	4,302	1269 (11)	6,453	1279 (9.1)	10,755	**-9.5**
Urban=1	4,302	.36 (.0073)	6,454	.37 (.006)	10,756	**-.00087**
Baseline Socioeconomic Status	3,369	2.7 (.019)	5,020	2.7 (.016)	8,389	**-.015**
Women=1	4,302	.51 (.0076)	6,454	.51 (.0062)	10,756	**-.0035**
Age (Categorical)	4,302	2.5 (.019)	6,454	2.4 (.016)	10,756	**.019**
Age (Categorical)	4,302	2.5 (.019)	6,454	2.4 (.016)	10,756	**.019**

Baseline education level	4,302	6.3 (.023)	6,454	6.2 (.019)	10,756	**.036**
At least Primary=1	4,302	.58 (.0075)	6,454	.58 (.0061)	10,756	**-.0027**
At least Secondary=1	4,302	.58 (.0075)	6,454	.58 (.0061)	10,756	**-.0016**
Occupation	4,302	19 (.2)	6,454	19 (.17)	10,756	**-.18**
Baseline employment status	4,302	.8 (.006)	6,454	.8 (.005)	10,756	**.0049**
Married=1	4,302	.58 (.0075)	6,454	.58 (.0061)	10,756	**-.0027**
1st L of Last Name (A-M)=1	4,302	.67 (.0071)	6,454	.68 (.0058)	10,756	**-.011**
Last Digit Odd=1	4,302	.5 (.0076)	6,454	.5 (.0062)	10,756	**.0029**
Trust Vaccine=1	1,179	.3 (.013)	1,807	.3 (.011)	2,986	**-.0028**
Hand Wash=1	1,179	.47 (.015)	1,808	.48 (.012)	2,987	**-.017**
Wear Mask=1	1,179	.59 (.014)	1,808	.6 (.012)	2,987	**-.0076**
Pray=1	1,179	.18 (.011)	1,808	.19 (.0092)	2,987	**-.012**
Steaming=1	1,179	.18 (.011)	1,808	.17 (.0089)	2,987	**.0084**
F-test of joint significance (F-stat) F-test, number of observations						**.o** **.o**

Significance: ***=.01, **=.05, *=.1. Errors are robust.

Table B4: Baseline Balance Test between Early and Forced Marriage Reminder and Self-Interest

Variable	N	(1) EFM Mean/(SE)	(2) Self-Interest N	Mean/(SE)	(1)- (2) Pairwise t-test N	Mean difference
Region (Categorical)	4,302	15 (.15)	6,453	15 (.12)	10,755	**.013**
District (Categorical)	4,302	442 (4.2)	6,453	442 (3.3)	10,755	**.52**
Ward (Categorical)	4,302	1,269 (11)	6,453	1,264 (9.1)	10,755	**5.5**
Urban=1	4,302	.36 (.0073)	6,453	.36 (.006)	10,755	**.0082**
Baseline Socioeconomic Status	3,369	2.7 (.019)	5,093	2.7 (.016)	8,462	**.0034**
Women=1	4,302	.51 (.0076)	6,453	.5 (.0062)	10,755	**.004**
Age (Categorical)	4,302	2.5 (.019)	6,453	2.5 (.016)	10,755	**-.0059**
Age (Categorical)	4,302	2.5 (.019)	6,453	2.5 (.016)	10,755	**-.0059**
Baseline education level	4,302	6.3 (.023)	6,453	6.2 (.019)	10,755	**.052***
At least Primary=1	4,302	.58 (.0075)	6,453	.58 (.0061)	10,755	**-.0022**
At least Secondary=1	4,302	.58 (.0075)	6,453	.58 (.0061)	10,755	**-.0012**
Occupation	4,302	19 (.2)	6,453	19 (.17)	10,755	**-.14**
Baseline employment status	4,302	.8 (.006)	6,453	.8 (.005)	10,755	**.0032**
Married=1	4,302	.58 (.0075)	6,453	.58 (.0061)	10,755	**.00077**
1st L of Last Name (A-M)=1	4,302	.67 (.0071)	6,453	.68 (.0058)	10,755	**-.0056**
Last Digit Odd=1	4,302	.5 (.0076)	6,453	.5 (.0062)	10,755	**.0019**
Trust Vaccine=1	1,179	.3 (.013)	1,779	.3 (.011)	2,958	**-.0025**
Hand Wash=1	1,179	.47 (.015)	1,779	.45 (.012)	2,958	**.019**

Wear Mask=1	1,179	.59 (.014)	1,779	.59 (.012)	2,958	**-.0016**
Pray=1	1,179	.18 (.011)	1,779	.18 (.0091)	2,958	**-.0023**
Steaming=1	1,179	.18 (.011)	1,779	.19 (.0094)	2,958	**-.011**
F-test of joint significance (F stat) F-test, number of observations						**.o .o**

Significance: ***=.01, **=.05, *=.1. Errors are robust.

Table B5: Descriptive Statistics—Booster Sample

Mean		SD	(1) Min	Max	Count
Region (Categorical)	16.450	9.243	1	31	**8,564**
District (Categorical)	87.512	49.043	1	171	**8,564**
Ward (Categorical)	480.766	278.201	1	956	**8,564**
Urban=1	0.294	0.456	0	1	**8,564**
Social economic status	3.964	1.179	1	5	**8,564**
Women=1	0.579	0.494	0	1	**8,564**
Age	43.842	16.080	22	106	**8,564**
Education	4.389	1.490	1	8	**8,564**
At least Primary=1	0.676	0.468	0	1	**8,564**
At least Secondary=1	0.138	0.344	0	1	**8,564**
Main income generating activity (Occupation)	4.536	3.786	1	13	**8,564**
Employed =1	0.837	0.370	0	1	**8,564**
Married=1	0.640	0.480	0	1	**8,564**
1st L oLast Name (A-M=1)	0.654	0.476	0	1	**8,564**
last digit odd=1	0.613	0.487	0	1	**8,564**
Empathy	0.600	0.490	0	1	**5,352**
Self-Interest	0.600	0.490	0	1	**5,353**
Empathy/Self-Interest	**0.750**	**0.433**	**0**	**1**	**8,564**

Table B6: Baseline Balance Test between Early and Forced Marriage Reminder and Treatment (Booster Sample)

Variable	N	(1) EFM Mean/(SE)	(2) Treatment N: Mean/(SE)		(1)- (2) Pairwise t-test N: Mean difference	
Region (Categorical)	2,141	16 (.2)	6,423	17 (.12)	8,564	**-.3**
District (Categorical)	2,141	88 (1.1)	6,423	87 (.61)	8,564	**.21**
Ward (Categorical)	2,141	485	6,423	479	8,564	**6.1**

		(6.1)		(3.5)		
Urban=1	2,141	.28 (.0098)	6,423	.3 (.0057)	8,564	**-.013**
Social economic status	2,141	4 (.025)	6,423	4 (.015)	8,564	**.015**
Women=1	2,141	.58 (.011)	6,423	.58 (.0062)	8,564	**.00062**
Age	2,141	44 (.35)	6,423	44 (.2)	8,564	**-.23**
Education	2,141	4.4 (.033)	6,423	4.4 (.019)	8,564	**.018**
At least Primary=1	2,141	.67 (.01)	6,423	.68 (.0058)	8,564	**-.014**
At least Secondary=1	2,141	.14 (.0076)	6,423	.14 (.0043)	8,564	**.0084**
Main income generating activity (Occupation)	2,141	4.5 (.08)	6,423	4.6 (.048)	8,564	**-.063**
Employed =1	2,141	.84 (.0079)	6,423	.84 (.0046)	8,564	**.0028**
Married=1	2,141	.65 (.01)	6,423	.64 (.006)	8,564	**.01**
1st Letter of Last Name (A-M=1)	2,141	.65 (.01)	6,423	.66 (.0059)	8,564	**-.0095**
last digit odd=1	2,141	.61 (.011)	6,423	.61 (.0061)	8,564	**.0017**
F-test of joint significance (F-stat)						**.71**
F-test, number of observations						**8,564**

Significance: ***=.01, **=.05, *=.1. Errors are robust.

Source: Booster data.

Table B7: Baseline balance test between Early and Forced Marriage Reminder and Empathy (Booster Sample)

Variable	N	(1) EFM Mean/(SE)	(2) Empathy N	Mean/(SE)	(1)- (2) Pairwise t-test N	Mean difference
Region (Categorical)	2,141	16 (.2)	3,211	17 (.16)	5,352	**-.49***
District (Categorical)	2,141	88 (1.1)	3,211	88 (.86)	5,352	**.092**
Ward (Categorical)	2,141	485 (6.1)	3,211	476 (4.9)	5,352	**9.6**
Urban=1	2,141	.28 (.0098)	3,211	.3 (.0081)	5,352	**-.02**
Social economic status	2,141	4 (.025)	3,211	4 (.021)	5,352	**.023**
Women=1	2,141	.58 (.011)	3,211	.58 (.0087)	5,352	**.0041**
Age	2,141	44 (.35)	3,211	44 (.29)	5,352	**-.27**
Education	2,141	4.4 (.033)	3,211	4.4 (.027)	5,352	**.0062**
At least Primary=1	2,1	.67 (.01)	3,2	.67	5,352	**-.0094**

	41		11	(.0083)		
At least Secondary=1	2,141	.14 (.0076)	3,211	.14 (.0061)	5,352	**.0065**
Main income generating activity (Occupation)	2,141	4.5 (.08)	3,211	4.5 (.067)	5,352	**-.043**
Employed =1	2,141	.84 (.0079)	3,211	.84 (.0065)	5,352	**.0014**
Married=1	2,141	.65 (.01)	3,211	.63 (.0085)	5,352	**.017**
1st L oLast Name (A-M=1)	2,141	.65 (.01)	3,211	.65 (.0084)	5,352	**-.0074**
Last digit odd=1	2,141	.61 (.011)	3,211	.6 (.0086)	5,352	**.013**
F-test of joint significance (F-stat)						**1**
F-test, number of observations						**5,352**
Significance: *=.01, **=.05, *=.1. Errors are robust**	**t**					

Source: Booster data.

Table B8: Baseline Balance Test between Early and Forced Marriage Reminder and Self-Interest (Booster Sample)

Variable	N	(1) EFM Mean/(SE)	(2) Self-Interest N: Mean/(SE)		(1)- (2) Pairwise t-test N: Mean difference	
Region (Categorical)	2,141	16 (.2)	3,212	16 (.16)	5,353	**-.11**
District (Categorical)	2,141	88 (1.1)	3,212	87 (.87)	5,353	**.34**
Ward (Categorical)	2,141	485 (6.1)	3,212	483 (4.9)	5,353	**2.5**
Urban=1	2,141	.28 (.0098)	3,212	.29 (.008)	5,353	**-.0063**
Social economic status	2,141	4 (.025)	3,212	4 (.021)	5,353	**.0068**
Women=1	2,141	.58 (.011)	3,212	.58 (.0087)	5,353	**-.0029**
Age	2,141	44 (.35)	3,212	44 (.28)	5,353	**-.19**
Education	2,141	4.4 (.033)	3,212	4.4 (.026)	5,353	**.029**
At least Primary=1	2,141	.67 (.01)	3,212	.68 (.0082)	5,353	**-.02**
At least Secondary=1	2,141	.14 (.0076)	3,212	.13 (.006)	5,353	**.01**
Main income generating activity (Occupation)	2,141	4.5 (.08)	3,212	4.6 (.067)	5,353	**-.083**
Employed =1	2,141	.84 (.0079)	3,212	.83 (.0066)	5,353	**.0042**
Married=1	2,141	.65 (.01)	3,212	.64 (.0084)	5,353	**.0032**
1st L oLast Name (A-M=1)	2,141	.65 (.01)	3,212	.66 (.0084)	5,353	**-.012**

Last digit odd=1	2,141	.61 (.011)	3,212	.62 (.0085)	5,353	**-.0099**
F-test of joint significance (F-stat)						**.51**
F-test, number of observations						**5,353**
Significance: *=.01, **=.05, *=.1. Errors are robust.**	**t.**					

Source: Booster data.

Appendix C: Intervention Summary

Researchers from the Economic and Social Research Foundation, in collaboration with the National Institute for Medical Research, conducted the intervention phase from November 30, 2022, to January 3, 2023. The intervention targeted a nationally representative sample of respondents from the Ipsos database, consisting of 17,209 mobile-phone subscribers with an average age of 33. The intervention involved sending three text messages, one per week, to each experimental group.

The distribution of SMS delivery during the intervention was as follows: out of the total number of respondents, 3,454 (20%) received no text messages; 755 (4%) received text messages only once; 1,340 (8%) received text messages twice; and 11,624 (68%) received text messages in all three rounds. The distribution per each treatment arm was shown in the following figures:

Number of Texts Delivered, by Treatment Status

Number of texts delivered	**EFM**	**Empathy**	**Self-Interest**	**Total**
0	792	1,333	1,329	3,454
1	283	231	241	755
2	326	484	566	1,376
3	2,901	4,406	4,317	11,624
Total	4,302	6,454	6,453	17,209

Source: Intervention data.

Only respondents who had received at least one SMS were considered for the endline analysis (i.e., 80% of the original intervention sample). From this sample, we were able to reach 8,895 (65%) out of 13,755 respondents who received at least one SMS round. However, as we did not reach our desired sample size of 12,000, which would

have provided sufficient power to detect treatment effects, we decided to intervene with another booster sample consisting of approximately 8,564 respondents.

The intervention for this booster sample began on March 13, 2023. Unlike our original sample, the SMS in the booster sample was sent only once. Prior analysis of the collected sample indicated that the frequency of the text does not influence any of our outcomes. Out of the 8,536 respondents in our booster sample, only 4,541 (53%) received the intervention and were eligible for the endline survey. From this eligible sample, we were able to reach 3,105 (68%) respondents during the endline survey.