Role Models Matter for Covid Vaccinations and Conditional Cash Transfers Do Not: Impact on Vaccinations and Student Achievement

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September 2022

Abstract:

The COVID-19 pandemic has taken an unprecedented hit on student learning across the globe. This paper provides experimental evidence that targeted messaging from role models can cause large reductions in vaccine hesitancy and improve student achievement. We randomly assign teachers to a menu of cash incentives, role models and celebrity messaging. One year later, teachers assigned to the role model treatment were 0.35 standard deviation units more likely to get vaccinated, had lower COVID-19 related absences, and had students with 0.15 standard deviation higher test scores. Our use of QR-code verified vaccine certificates provides a reliable and robust tracker of vaccination status. Behavioral data on theory-of-mind suggests the mechanism underlying the role model effect. Overall, our results suggest that an effective teacher vaccination campaign may attenuate learning losses among students due to COVID-19. To best of our knowledge, our study is the first to provide evidence from the Global South on how to increase COVID-19 vaccine take-up and mitigate learning losses using administrative data on vaccination certificates.

Keywords: COVID-19 Vaccination Certificates, Cash Transfers, Role Models, Reading the Mind in the Eyes Test.

JEL Codes: C90, D90, I10.

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I. Introduction

COVID-19 has taken an unprecedented toll on student learning across the globe. The World Bank estimates that the COVID-19 related school disruptions resulted in losses amounting to USD 17 trillion in lifetime earnings or about 15% of total global income lost (Azevedo et al., 2021). Almost two years after the outbreak, millions of children are still unable to return to school, making the issue of reviving schooling to pre-pandemic levels a global concern (Martinez, 2022). Vaccine hesitancy remains a key stumbling block to effectively tackling the pandemic, with many people refusing to get the vaccine even as effective and safe vaccines have become available (Machingaidze and Wiysonge, 2021). The problem is compounded by prominent celebrities and role models abstaining from or even actively discouraging vaccination (Rajan, 2022; Higgins, 2022).

In this paper, we provide experimental evidence that role models may be leveraged to reduce vaccine hesitancy and mitigate COVID-19 related learning losses. Motivated by a literature on role models (Bénabou et al., 2020) and conditional cash transfers (Sridhar and Duffield, 2006; Fiszbein et al., 2009; Manley et al., 2013), we implement a pre-registered randomized control trial among teachers in Pakistan to test the efficacy of conditional cash transfers, role models and celebrity appeals to spur COVID-19 vaccinations. We use a novel combination of behavioral and administrative data on QR-validated COVID-19 vaccination certificates and Reading the Mind in the Eyes test (REMT) to understand the mechanism for our treatment effects. Three treatment arms involve varying intensities of monetary incentives amounting up to 30% increases in monthly wages of teachers. Two treatment arms involve a role model and celebrity delivering a targeted message to get the COVID-19 vaccine. A final treatment arm involves the role model delivering a placebo lecture unrelated to vaccination. To ensure comprehensibility and reinforce the message of the treatment, each treatment is accompanied with an individual one-on-one structured discussion with our enumerator, building on recent studies advocating discussions as an effective medium of persuasion (see e.g., Schwardmann et al., 2022).

Our results indicate a substantial impact of role models on teachers' vaccination status as verified by their COVID-19 certificates. A year after the treatment, the teachers assigned to the role model delivering a targeted message about getting vaccinated were 0.35 sigma more likely to get vaccinated. These effects are qualitatively significant and indicate a persuasion rate of about 20% (DellaVigna and Gentzkow, 2010). To put this magnitude into perspective, the effect sizes

are roughly equivalent to exposure to Fox News on Republican vote share in Presidential elections (DellaVigna and Kaplan, 2007) or the impact of get-out-to-vote phone calls on voter turnout in the United States (Gerber and Green, 2001). The role model treated teachers are also 0.5 sigma less likely to be absent in the following academic year, and their students see a rise in test scores across all subjects in national assessments: a 0.11 sigma increase in mathematics, 0.15 sigma increase in English Language, 0.13 sigma increase in General Knowledge, and a 0.14 sigma increase in Urdu Language test scores. In contrast, cash incentives and celebrity treatments have no statistically discernible impact on teachers' vaccinations or students test scores. Our study shows, therefore, that one way to ameliorate learning losses due to the COVID pandemic may be an effective teacher vaccination campaign.

We next leverage the information on the timing of vaccination through the certificates, detailed teachers' absenteeism data and student mathematics test scores available for up to 18 months post-treatment to trace the dynamic impact of the treatment. The dynamics clarifies the mechanism explaining the rise in test scores. In the months after the treatment, we see the impact of role model gradually increasing the vaccination rates and student test scores, while it lowers teacher absenteeism. The dynamic pattern of teacher absenteeism being impacted after vaccination spikes is consistent with a recent study finding a lag of about 2 months between getting vaccinated and developing immunity for COVID-19 (Lin et al., 2022). Notably, the impacts on teacher absenteeism are only observed for lumpy absences (i.e., for consecutive absences over 7 days) rather than shorter absences. As vaccination becomes widespread, the effect of role model messaging diminishes for vaccination and absenteeism, but the impacts on student achievement persist, consistent with lasting impacts of teacher absenteeism on student learning.

To investigate if the ability to empathize with the gender identity of the role model enhances the role model effect, we prespecified *Reading the Mind in the Eyes Test* (REMT) by gender of eyes.[4] We hypothesized that since all PEN teachers are female, the teachers who are better able to empathize with the female role model will be disproportionately impacted by the role model treatment. We find this to be the case. The teachers who better identify the mental states in female eyes are more impacted by the role model treatment. In contrast, teachers' better

[4] Reading the Mind in the Eyes Test (REMT) scores participants on their ability to recognize mental states of others as expressed by human eyes. This outcome is preregistered within the AEA RCT Registry ID AEARCTR-0008084.

identification of emotions in male eyes do not appear to mediate the impact of the role model treatment.

Our experiment randomly assigned the treatments among 607 teachers across 52 schools in Pakistan. The randomization at the teacher level provided advantages such as the ability to match an individual teacher to the class and to collect rich granular data such as COVID-19 Vaccination Certificates and data on Reading the Mind in the Eyes tests (REMT). However, because treatment and control group teachers may interact within a school, we might have spillover effects with some of the control teachers becoming partially treated. Several reasons mitigate concerns of spillovers explaining our results. First, to the extent that there are spillovers across teachers within schools, we would then underestimate the true effect of our treatments since our control teachers would also end up being treated. Second, spillovers between teachers across schools are likely to be small in our context because of the geographic dispersion of schools and the female teachers' heavy responsibilities at work and home. Third, and more importantly, our research design actually allows us to testing for the extent of spillovers, which we find to be limited in magnitude: we use the random variation in treated teachers across schools in our sample and find that the treatment effect on vaccinations and test scores are essentially identical as more teachers get treated within a school. Restricting to the sample of control teachers, the fraction of treated teachers in a school also does not appear to have spillover effects. These patterns indicate that spillover effects between treated and control teachers within a school are likely to be small. Irrespective of the fraction of treated teachers in a school, the role model treatment increases vaccinations, decreases absenteeism and raises students' test scores.

Our research contributes to three key literatures. First, it contributes to the literature on vaccine hesitancy that has emerged as a global phenomenon amid COVID-19 (Machingaidze and Wiysonge, 2021). Recent scholarship is mixed on optimal ways to reduce vaccine hesitancy. Dai et al., (2021) found that timely nudges to get vaccinated increase vaccine-uptake, while Rabb et al., (2022) document these very same messages do not stimulate vaccine demand and argued that the earlier result merely accelerated vaccination among those who were already intending to get vaccinated. In contrast, Campos-Mercade et al., (2021) finds that monetary incentives increase vaccine uptake, though Chang et al., (2021) conclude they do not. These studies are important but their lessons may be more relevant to countries in the Global North. In addition, different from

past studies, our study focuses on primary school *teachers* who may act as role models for the students that they teach and are known to have substantial impact on student learning and future labor market outcomes (Chetty et al., 2014). We further are able to measure and observe student learning outcomes and link teachers-to-students at the classroom level. Our results suggest that targeted messaging by role models may be an effective tool for overcoming vaccine hesitancy in the Global South. We believe our study to be the first pre-registered randomized trial (Registration ID: *AEARCTR-0008084*) conducted in the Global South on vaccination using administrative data on vaccination certificates.

Second, we contribute to the important literature on teacher absenteeism, a widespread phenomenon in developing countries where nationwide surveys have documented up to 25% of teachers being found absent from classes during regular school hours (Chaudhury et al., 2006; Ullah et al., 2021). Randomizing teacher absences for estimating causal effects is challenging. In our experiment, we are able to ascertain the causal effects of teacher absenteeism on student achievement. Instrumental variables estimate would suggest that one standard deviation increase in teacher absenteeism reduces student achievement by 0.6 standard deviations. Put differently, we found that role model messaging reduced teacher absenteeism by 20% and raised student test scores by 0.15 standard deviations. Our reduced form results are close to the effect of the only other randomized trial we are aware of (Duflo et al., 2012) where a 20% reduction in teacher absenteeism achieved with monitoring technology and financial incentives led to student achievement increasing by 0.17 standard deviations.

Finally, we build on a burgeoning literature on trust in healthcare (Alsan and Wanamaker, 2018). Recent research has indicated that disparities in healthcare outcomes may be attributed to identity of the health-care deliverer with Alsan et al., (2019) documenting that racial identity of care-giver is a crucial determinant that explains the gap in mortality between black and white males. We show that gender identity also matters. We use a behavioral measure of social-emotional recognition of the messenger, namely, RMET (Reading the Eyes in the Mind Test of Males and Females). Emotional intelligence is deemed to play an important role in 21st century economy and RMET, as a measure of emotional intelligence, is found to be predictive of actual behavior in the lab (Cohen et al., 2001; Weidmann and Deming, 2021). We show that gender-specific RMET is predictive of behavior in the field, namely, the behavioral response to a role model for getting the COVID-19 vaccine.

The rest of this paper is organized as follows. In Section II, we discuss the background, ethics and design of the experiment. Section III describes the data and empirical strategy. Sections IV report the results of impact on vaccinations of teachers and learning outcomes of students, while Section V reports evidence for the mechanism and dynamics of the treatment effects. Section VI reports a series of robustness checks. A final section provides some concluding remarks.

II. Background, Ethics, and Experiment Design

Background.—We collaborate with the Progressive Education Network (PEN), a network of schools, that aims to improve the quality of education via a public-private partnership similar to charter schools in the United States (Angrist and Pischke, 2014). These schools are privately managed using public funds, in a public-private partnership. We implement a randomized evaluation in all of PEN's charter schools in the State of Punjab, the largest province of Pakistan, where the network "adopts" 52 schools, employs 607 teachers and has roughly 15, 000 students. The experiment was rolled out in early 2021 with the baseline, midline and endline data for teachers collected a month before, 12 months and 18 months post-treatment, respectively. The students' test scores are from standardized exams held 12 months following the treatment. For mathematics, we have test scores for 6, 12 and 18 months after the treatment, and vaccinations and absenteeism data is available at the monthly level up to 18 months post-treatment. The evolution of vaccinations is ascertained by the dates on the vaccination certificates. A typical official COVID-19 certificate is presented as Figure S1 in the Online Appendix S1. This allows us to trace the dynamic effect of the treatments.

Research Ethics Approvals.— Our study protocols were reviewed and approved by two independent Institutional Review Boards. The first ethical approval was received from the New Economic School with IRB number 00059/21 and the second a local IRB from Lahore School of Economics with IRB Number RERC-062021-02. The Lahore School of Economics Ethical Review Board, in particular, made several random spot visits to our experimental site and ensured that all ethical protocols—for instance, consent from teachers and PEN administration—were followed as per international standards. Earlier, we had also received separate administrative

approvals from the PEN administration, and teacher representatives and consent from individual teachers and caregivers of students.[5]

Study Design.— Using a random number generator, we randomly assigned 607 teachers to one of the following treatment arms: (i) Cash 15% treatment (101 teachers); (ii) Cash 30% treatment (101 teachers); (iii) Cash Lottery treatment (101 teachers) (iv) Celebrity treatment (101 teachers), (v) Role Model treatment (101 teachers) and (vi) the control or placebo treatment on macroeconomics of equal length to celebrity and role model treatment and was delivered by the same person delivering the role model treatment (102 teachers).

Treatment Logistics.— The treatments were delivered to the teachers according to their treatment status via a pre-recorded videos live on Zoom. PEN administration organized classrooms for the teachers in their district, where they could access Zoom. Our team of field assistants shared their screen to show the recorded video to each individual teacher according to her treatment status. Specifically, according to each teachers' treatment status, first a video recording was shown live by a field assistant to the individual teacher on Zoom by sharing their screens. These videos are hyperlinked in Figures S1.1 to S2 of the Online Appendix. The video treatment was followed by a *20-minute individual structured discussion* between the teacher and the field assistant. Particularly, each video was followed by the field assistant asking the following questions: Q1. *What do you think was the main message of the video*? Q2. *Did you find the video useful*? Q3. *How can you apply the video lessons in your life*? The recording of the video on Zoom was also disabled and we gave explicit instructions not to communicate the contents with fellow teachers. We also gave explicit instructions for teachers to be alone in the room during the intervention and our team of field assistants were able to interact with teachers one-on-one on Zoom and finish the treatment roll out within two days.

Cash 15%, Cash 30% and Lottery Treatments.— In the first two treatment arms, the teachers are randomly assigned to receive a cash incentive equivalent to 15% and 30% of their monthly salary if they got the COVID-19 vaccine. In the first treatment arm it was announced: "*We offer a one-time cash award of **15%** of teachers' monthly salary* (US$7.5) *for those teachers getting the COVID-19 vaccine. For teachers getting vaccinated after this announcement, please*

[5] The consent statement that we administered can be found in Appendix S2.1.

present proof of your vaccination via the official COVID-19 certificate to the PEN administration". In the second treatment arm, we offer a one-time cash award of **30%** of teachers' monthly salary (US$15) for those teachers getting the COVID-19 vaccine, we announce *"For teachers getting vaccinated after this announcement, please present proof of your vaccination via the official COVID-19 certificate to the PEN administration*". In the lottery treatment arm, the teachers are randomly assigned with an opportunity to win a cash award through a "lucky draw". Those who get vaccinated after our treatment are eligible for the lottery. In this treatment arm, it is announced: *"those getting vaccinated after this date, please share your certificates with us and become part of this lottery and get the opportunity of winning a 50,000 rupees Cash prize".* Figures S1.1 and S1.2 provide the complete video announcements made in this treatment arm with subtitles in English, while in Appendix S2.2, we provide a transcript of structured discussion questions that followed the video announcements of the treatments.

Celebrity Treatment.— In this treatment arm, a prominent Pakistani newscaster and journalist, Mr Iqrar-ul-Hassan makes a personalized appeal to the PEN teachers to get the COVID-19 vaccine. The message urged the teachers that the COVID-19 vaccine is safe and effective, that the celebrity himself, his siblings and parents are all vaccinated against COVID-19. The video message ends by Mr Iqrar making an appeal to all PEN teachers to get vaccinated as soon as possible. The picture, transcript and video recording of the celebrity treatment can be found in Figure S2's Panel A and its corresponding note in the Online Appendix S1.[6]

Role Model Treatment.— In the role model treatment group, the exact message of the celebrity is repeated but it is now delivered by a female role model. Specifically, the role model is someone the teachers look up to, a young professor at an elite private university in Lahore, Pakistan. This role model was chosen following three 30-minute auditions of three role models (2 females and one male) with a random sample of 17 PEN teachers where we assessed who the teachers are most likely to look up to. Specifically, we ask the 17 teachers to choose one of the three auditioners after a 15 minute presentation by each of them. The specific question was: *Who among the three presenters would you most likely to consider as a role model*? We selected the

[6] To get an idea about the celebrity's popularity, he for instance has 6.4 million Twitter followers, see e.g. his Twitter (hyperlinked).

auditioner that received the most votes.[7] The role model urged the teachers that the COVID-19 vaccine is safe and effective, that she, her siblings and parents all got the vaccine. Identical to the celebrity message, this treatment arm also ends by making an appeal to all PEN teachers to get vaccinated as soon as possible. The transcript and links to the video recording of actual role model treatment can be found in Figure S2 of Panel B of the Online Appendix.

Placebo.— The placebo group gets a lecture of equal length as the role model and celebrity treatment, on macroeconomics. The message is delivered by the *same female role model* but this time with no mention of COVID-19 vaccination. Specifically, the lecture provides brief explanations of macroeconomic concepts such as GDP, GNP, unemployment, savings, and investments.

III. Data and Empirical Strategy

A. *The Data*

Sample.— The sample consists of all 607 teachers and their 13,911 students across all 52 schools chartered by the PEN network in the State of Punjab. As is common in most primary schools in Pakistan, all teachers are *female* and teach every class from Kindergarten to Grade 6. The students, however, are of mixed-gender in public schools of Pakistan at the primary level. Our sample consists of 7107 boys and 6804 girls with age in the range of 5 to 12 years. The PEN network organizes several training workshops for teachers, and our experiment took place within one of the PEN teacher training drives in early 2021. As a result of having our experiment embedded within PEN's regular training programs, we essentially have no attrition. All 607 PEN teachers in the State of Punjab participated. Close collaboration and cooperation with the PEN leadership and teacher training department, in particular, also allowed us access to detailed administrative data on teachers, including their monthly absenteeism and COVID-19 vaccination certificates.

Outcome Variables on Teachers and Students.— Our key pre-registered outcome variable is a COVID-19 vaccination dummy variable that switches on if the teacher gets vaccinated. This happens only if we confirm via COVID-19 certification and embedded QR code within the

[7] The chosen role model received 16 out of 17 votes, making her a clear winner.

certificate whether the COVID vaccination took place *after* our treatment rollout. In the case of vaccination taking place after the treatment, this variable takes the value of one. We also measure teacher absenteeism by the attendance rate of the teacher post-treatment. PEN administrative data is used to construct this variable at the teacher level. We standardize both of these variables to mean zero and standard deviation one. The student outcome variables are test scores for English and Urdu Languages, Mathematics and General Knowledge measured on national examinations held about 12 months following the treatments. These standardized examinations are taken by all PEN school students. However, to make comparisons of effect sizes, we standardized these test scores to mean zero and standard deviation one. For evaluation of an alternate mechanism, we use as outcomes, gender indices which we construct using methodology outlined in Appendices S2.3 and S2.4. For more details on the experimental set-up, please refer to the flow chart presented in Appendix S2.5.

Main Explanatory Variables.— In addition to the explanatory variables corresponding to the five treatments, we investigate whether teachers that empathize more with the gender identity of the role model are more likely to be impacted by the role model treatment. To do this, we pre-register the Reading the Mind in the Eyes Test (RMET) and examine if the impact differs by gender of the RMET eyes. RMET assesses the ability to recognize mental states and emotions of others as expressed by human eyes. The participants pick one of four pictures which they think best describes what the person in each photograph is thinking or feeling (see Figure S3 in the Appendix for an example).[8] We also include a number of teacher and student level controls. The teacher level controls include pre-treatment COVID vaccination status, years of teaching experience, educational qualification, professional qualification, average teaching hours and class size. Student level controls include dummies for eligibility of students to the PEN network's free lunch program and if the student is raised by a single parent, number of siblings, pre-treatment verbal assessment scores, mother's and father's education level.

[8] More specifically, the RMET calculates the number of correct answers to read the emotion based on a picture of a pair of 20 eyes, with half of the pictures being male and the other half females.

B. *Empirical Specification*

The impact of our five treatments can be evaluated by comparing outcomes across groups in a simple regression framework. For each outcome, the estimation equation is:

$$Y_i = \alpha + \beta\, Cash\ 15\%_i + \gamma\, Cash\ 30\%_i + \delta\, Lottery_i + \omega\, Celebrity_i + \theta\, Role\ Model_i + \boldsymbol{X}_i\, \mu + \epsilon_i \quad (1)$$

where Y_i is the outcome for a teacher or student i, $Cash\ 15\%_i$ is a dummy variable equal to one if the teacher is assigned to the monetary incentive of 15% of monthly salary as a cash award treatment; $Cash\ 30\%_i$ is a dummy variable equal to one if the teacher is assigned the monetary incentive of 30% of monthly pay cash award treatment; $Lottery_i$ is a dummy variable equal to one if the teacher is in the group given the opportunity to participate in the lottery monetary incentive treatment, $Celebrity_i$ and $Role\ Model_i$ switch on if the teacher is assigned celebrity and role model treatments, respectively. $\boldsymbol{X}_i$ is a vector of individual-level controls. We cluster standard errors at the teacher level since that is our level of randomization. In equation (1), β measures the effect of the 15% cash treatment; γ the effect of the 30% cash treatment; δ the effect of the lottery treatment; ω measures the effect of the celebrity treatment, while θ measures the impact of the role model treatment.

C. *Attrition and Balance*

Collaboration with the PEN network not only gives us access to administrative data allows us to embed the treatment during one of PEN's regular training drives. This meant that attrition was zero for teachers, and student attrition amounted to only about 30 students.[9] Nevertheless, a lack of balance might still bring to question the causal interpretation of our results. We therefore examine whether our randomization was successful in creating balance among teachers and students. Table 1 shows individual characteristics, with Panel A reporting the treatments being balanced over individual teacher characteristics, and Panel B on student characteristics. Differences across treatment groups are small in magnitude, and almost all estimated p-values are larger than 0.10, suggesting that the randomization was effective at creating balance between the

[9] This take-up was only possible due to gracious support and leadership of the Director of Training and Research, Miss Sumera Morris and her staff at PEN.

groups. Importantly, we observe teachers are balanced in their pretreatment vaccination status (Table 1, Panel A, Column 1).

IV. Main Results

Impact on Vaccinations.— Our results indicate that the role model treatment had a qualitatively and statistically significant impact on vaccinations as verified by the teachers' COVID-19 certificates. From Figure 1, we observe that one year after the treatment, about 50% of the teachers are fully vaccinated in the group assigned the role model treatment, relative to about 30% in the placebo group. This is particularly interesting since the same person delivered the role model and placebo treatment. Column (1) of Table 2 reports these results standardized to mean zero and standard deviation one in regression-form with the addition of individual level controls. The coefficient estimate implies that the role model treatment increased vaccinations by 0.37 standard deviations.[10] These results are also summarized in Figure S4 of the Appendix.[11]

Heterogeneity by Gender of Eyes.— The effect of role models on vaccinations is more pronounced on teachers who better identify with the gender of the role model. We hypothesized that since all PEN teachers are female, the teachers that are better able to empathize with the gender identity of the female role model as opposed to the male celebrity treatment, would be disproportionately impacted by the role model treatment. We, therefore, pre-register outcome on the Reading the Mind in the Eyes Test. Estimates from Table 2 suggest that the results are largely driven by only those teachers that scored high in ascertaining mental states in female eyes in the Reading the Mind in the Eyes Test (RMET). Table 2's Column 2 shows that a teacher who scored 1 standard deviation higher in Female RMET is about 0.2 standard deviations more likely to be vaccinated due to the role model treatment. Column 3 of Table 2 documents that the Male RMET

[10] Using the formula for persuasion rate, in (DellaVigna and Gentzkow, 2010), we obtain persuasion rate (f) = 21.7%. We used data from Table S1 in Appendix and the pretreatment vaccinations from Table 1 to make this computation. The formula for persuasion rate is as follows: f = 100 * (Y_T - Y_C) / (e_T - e_C) * 1 / (1-Y_0). Specifically, Y_T (successful vaccinations in the Treatment group) = 52, Y_C (successful vaccinations in the Control group) = 32, e_T (size of role model treatment group) = 101, e_C (size of control group who got the treatment = 0, (1-Y_0) (the fraction of population left to be convinced, i.e., 1 - fraction of people already vaccinated at baseline = (1 - 0.088). This gives Persuasion rate (f) = 100* ((52-32)/ (101))(1/0.912) = 21.7 %

[11] Please note that very few teachers only got a single dose of the COVID-19 vaccine, therefore, we likely do not have enough power to detect effect on getting just one dose (see Figure S5 in the Supplementary Material files for the effect of our treatment on getting only one dose of COVID-19 vaccine, and Table S1 for number of teachers getting one versus two doses of vaccinations across the treatment arms).

score does not mediate the effect of the role model treatment on vaccination. In contrast, Column 4 suggests that Female and Male RMET capture different soft skills. Teachers who better evaluate the emotion associated with men's' eyes are no more likely to get vaccinated, while those who better evaluate female eyes are more likely to get vaccinated. This suggests a mechanism of these female teachers successfully mentalizing and empathizing more with the female role model –who matches with their gender identity– compounds the effect of the role model treatment on getting the COVID-19 vaccine.[12]

Impact on Student Test Scores.— We also observe that our treatment spilled over to students and raised their test scores. Figure 2 and Table S3 in Appendix presents these results with our full set of student test scores measured at month 12 post treatment. The role model treated teachers have students whose test scores are 0.10-0.15 standard deviations higher than the placebo treated group. To put this in perspective, the role model treatment moves a typical B+ student to A-. The teachers in the role model treated group have students who show improvements in test-scores across the board: in Mathematics, English Language, General Knowledge and Urdu Language standardized tests. The increase in test scores across all available subject domains is suggestive of a global improvement in academic achievement. In the next section, we will analyze the dynamics of the treatment effect for mathematics, for which we have more fine-grained data.

V. Mechanism and Dynamics of Treatment Effects

Impact on Teacher Absenteeism.— We find support for a mechanism explaining this rise in student test scores: teacher absenteeism. The evidence suggests that the role model treated teachers are about 0.5 standard deviations less likely to be absent relative to the placebo group, 12 months post-treatment (Column 1 of Table 3). These effects are particularly pronounced in those teachers who scored high in the RMET for female eyes (Column 2 of Table 3). In contrast, teachers who score high for male eyes in the RMET are no more likely to reduce their school absenteeism. This is precisely what we had found for the role model treatment impacting teacher COVID-19 vaccinations. The role model treatment teachers who score high in female RMET scores are more likely to be vaccinated and less likely to miss school. This further supports the idea that teachers

[12] Table S2 in Appendix S2 reports the results corresponding to Table 2 in levels.

who got vaccinated were less likely to miss school and hence had students who performed better academically.[13]

Dynamic Impact on Vaccinations, Absenteeism and Student Test Scores.— We next leverage the exact timings of vaccinations using the dates on vaccine certificates and teacher "attendance registers" that PEN network records to ascertain evolution of absences. This allows us to explore the mechanism underlying increase in student test scores and assess the overtime impact of the role model treatment on teacher vaccinations and absenteeism up to 18 months post-treatment. Figure 3 reports the evolution of coefficient estimates of the role model treatment on vaccinations (Panel A) and absenteeism (Panel B). We find that vaccination among teachers gradually rises following the role model message to get vaccinated and peaks at about 6 months post-treatment. Around the same time, we observe absenteeism falls with the minimum point at month 8, post-treatment. This is consistent with recent evidence that vaccine immunity peaks around 1 to 2 months post-vaccination (Lin et al., 2022). We interpret these results as vaccinated teachers building immunity against COVID-19 and who are then less likely to be absent. Similar pattern is observed for mathematics test scores for which we have data for 4 exams, 1 exam pre-treatment and 3 post-treatment, with each exam held about 6 months apart. Figure 4 reports the impact of role model treatment on math test scores. We find that the treatment effects on math scores gradually increase following the treatment.[14] However, unlike the results for vaccinations and absenteeism, the impact on student test scores appear persistent. This is consistent with recent concerns on the learning losses due to COVID-19 may lead to permanent disparities in learning that may not be easy to reverse with a single policy action (Azevedo et al., 2021).

Additional Evidence for the Mechanism.— The results on the dynamics of the treatment effects strongly suggest that the rise in student test scores may be explained by the rise of vaccinations and a fall in teacher absenteeism. Additional evidence supports this interpretation. First, we leverage administrative data on "attendance registers" of teachers at PEN that record teacher absences by reason of absence. We do this to investigate whether the role model treatment impacts

[13] Table S4 of the Appendix reports corresponding results on absenteeism in levels i.e. in terms of days missed.
[14] To ease comparisons, figures report the results in standard deviations, however, results in levels are reported in Figure S6 and Figure S7 of the Appendix.

teacher absences due to all reasons or only those sought due to catching COVID-19. Table 4 reports these results where we estimate the specification in Column 4 of Table 2 but where we distinguish absences by the reason of absence. We find that only when COVID-19 is explicitly stated as the reason for absence in PEN attendance registers, do we find an effect of the role model treatment. The absences due to other reasons for leaves appear to be unaffected by the role model treatment. These results are further reinforced when we assess the treatment effect by lumpy (more than a week) or short absences (less than a week). These results presented in Table 5 indicate that the role model treatment effect is almost exclusively driven by lumpy absences, what one would expect for the teacher catching COVID-19 and not being able to attend class. Shorter than a week absences are unaffected by the role model treatment.

Alternative Mechanism.— The rise of test scores following the role model treatment may also be explained by the role model, who is a female, influencing gender norms. For instance, just a message by a role model fosters progressive gender attitudes among teachers, which facilitates learning among boys and girls. The fact that the macroeconomics placebo video message was also delivered by the same role model undermines this hypothesis. Moreover, we draw on data collected on gender attitudes from our recent work (Mehmood, Nasseer, and Chen (2022) and test whether the treatment impacts gender norms. Table 6 reports these results. We find that the role model does not impact our overall composite index of gender attitudes (Column 1), nor do we find statistically significant impact of the role model treatment on the indices' subcomponents: women's economic, political and social rights indices are unaffected by the role model treatment.[15]

VI. Robustness and Discussion

Spillovers.—Our experiment allowed us to randomly allocate treatment at the teacher-level for 607 teachers across 52 schools, which together enroll about 15000 students. However, students and teachers in the treated and control groups may interact within a school. This can lead to potential spillover effects if individuals in the control group also end up being partially treated. First, to the extent there are spillovers within a school, the estimate may then be considered as a

[15] For details on the construction of indices, including the survey instrument used see Appendix S2.3 and Appendix S2.4 in the online Appendix.

lower bound on the impact of the treatments. Second, spillovers between teachers across schools are likely to be small in our context because of the geographic dispersion of schools and the teachers' heavy responsibilities at work and home. Third, our experimental design allows us to ascertain the extent of these spillover effects. That is, we exploit the variation in treated teachers within schools across the 52 PEN schools in our sample to explore how it impacts vaccinations and student test scores. Table S5 (Column 1) of the Online Appendix shows that as more teachers get treated with the role model treatment within a school, the effect of role model treatment does not dissipate. Likewise, in Columns 2, 3, 4 and 5 of Table S5, we observe that the treatment effect on students' test scores is also similar as more teachers within a school get treated. That is, regardless of the fraction of treated teachers in a school, role model treatment has similar impacts.[16] Last, we leverage the fact that our cash and celebrity treatments had no impact on vaccinations, absenteeism or test scores over the placebo group. This allows us to investigate whether the fraction of schools treated with the role model causes the placebo group to increase vaccinations. Under the assumption that a higher fraction of treated teachers leads to a greater likelihood for interactions between treated teachers and control teachers, we assess the impact of fraction of treated teachers on the control teacher's outcomes. However, we find little impact of fraction of treated teachers among control teachers on vaccinations or absenteeism (Table S6). The null effect of more intensely treated schools holds for Cash, Celebrity and Placebo assigned teachers. Taken together, the evidence strongly suggests that spillover effects between treated and control teachers, even if they exist, are likely to be small in magnitude and unlikely to explain our main results.

Experimental Demand.— Experimental demand is also unlikely to explain our results for at least three reasons. First, we observe a virtually zero effect on teachers and students of all but the role model treatment. Since all the treatments attempted to increase teacher vaccinations but only one of them succeeded in doing so, therefore, experimental demand alone is unlikely to explain our results. Second, COVID-19 vaccinations as confirmed by official QR verifiable certificates indicate that our treatment had real impacts with teachers getting vaccinated beyond just intention to get vaccinated. Last, the impact on student achievement is challenging to explain with experimental demand effects since we only treated teachers not students. All these factors together suggest experimental demand is unlikely to explain the results.

[16]For the distribution of fraction of treated teachers by the role model within a school, see Figure S8 in the Appendix.

Multiple Hypothesis Testing. — Given that we are testing multiple hypotheses, we also examine whether our results might be explained by false positives. Under the assumption that the treatments have no effect on any of our outcomes (all our null hypotheses are true), then the probability of at least one false rejection when using a critical value of 0.05 is about 60%. Consequently, we adjust for the fact that we are testing for multiple hypotheses by using sharpened False Discovery Rate (FDR) q-values. The sharpened q-values are reported in square brackets in Table S7 of Supplementary Material, which also shows standard p-values from our baseline regressions in parentheses for comparison. The results, reported in Table S7 of Appendix suggest that false positives are also unlikely to explain our results.

Sample Size and Randomization Inference.— Finally, we conduct a randomization inference check. Our collaboration with the PEN network enables us to randomly assign treatments to teachers within schools and hence include school fixed-effects, which makes within-school comparisons possible. Our sample size is about 600 teachers and 15000 students, and likely has more statistical power than several important experimental studies, for instance, the Abecedarian Program (n = 111), the Perry Preschool Program (n = 123), and the Jamaican Study (n = 129) (Muennig et al., 2011; Heckman and Karapakula, 2019; Walker and Himes, 1991). We should nevertheless, be cautious that our results may be driven by an idiosyncratic sample. To engage with this issue, we follow Imbens and Rubin (2015) suggestion to conduct a randomization inference test by scrambling the data, reassigning treatments, and comparing the distribution of control estimates with the estimates from the experiment. The resulting p-values for 1000 iterations of this process are reported in Table S8 of the Online Appendix. The treatment effects are still statistically significant at conventional levels, suggesting that an idiosyncratic draw is unlikely to explain our results.

Additional Sensitivity Checks. — We conduct a series of additional robustness checks and find our main results remain essentially unchanged. For instance, in Table S9 of Appendix S1, we show results are robust to alternative clustering of standard errors. In Table S10, we show that our results are similar when we drop teachers with the least and most number of students. We also show that in Table S11 that our results are essentially identical when we vary our choice of control variables. All these checks further reinforce the results as real and robust.

VIII. Conclusions

The consequences of low COVID-19 vaccination coverage could prove severe. The emergence of dangerous variants threatens the already precarious recovery from the pandemic. A substantial fraction of vaccine doses delivered to the Global South have gone unused. We find that role models, more so than celebrity messaging or monetary incentives, can be an important lever in overcoming COVID-19 vaccine hesitancy and mitigate the large learning losses resulting from the pandemic, especially in the Global South. We implement a randomized control trial to horserace different methods to increase COVID-19 vaccine uptake among teachers in Pakistan, which had one of the highest levels of vaccine hesitancy in the world (Ullah et al., 2022). We show that role model message to get vaccinated increases vaccinations, translating into lower teacher absenteeism and greater student achievement.

We find that vaccination among teachers gradually rises following the role model message. The treatment effect grows until about 6 months post-treatment. Absenteeism is impacted about two month after vaccination. We interpret these results as vaccinated teachers building immunity against COVID-19 and are hence less likely to be absent. Consistent with this, the absenteeism is more pronounced for lumpy absences. We see a similar dynamic pattern for mathematics test scores. Notably, the effect of role model messaging diminishes for vaccination and absenteeism as vaccination rates appear to converge, but the impacts on student achievement remain persistent, consistent with policy concerns surrounding the lasting losses in student learning due to the Covid pandemic.

Our behavioral data suggests social-emotional connections may explain the increase in vaccine uptake. Theory of mind towards the gender of the role model magnifies the impact of role model messaging. Our results underscore that one way to ameliorate learning losses due to COVID-19 may be an effective teacher vaccine campaign.

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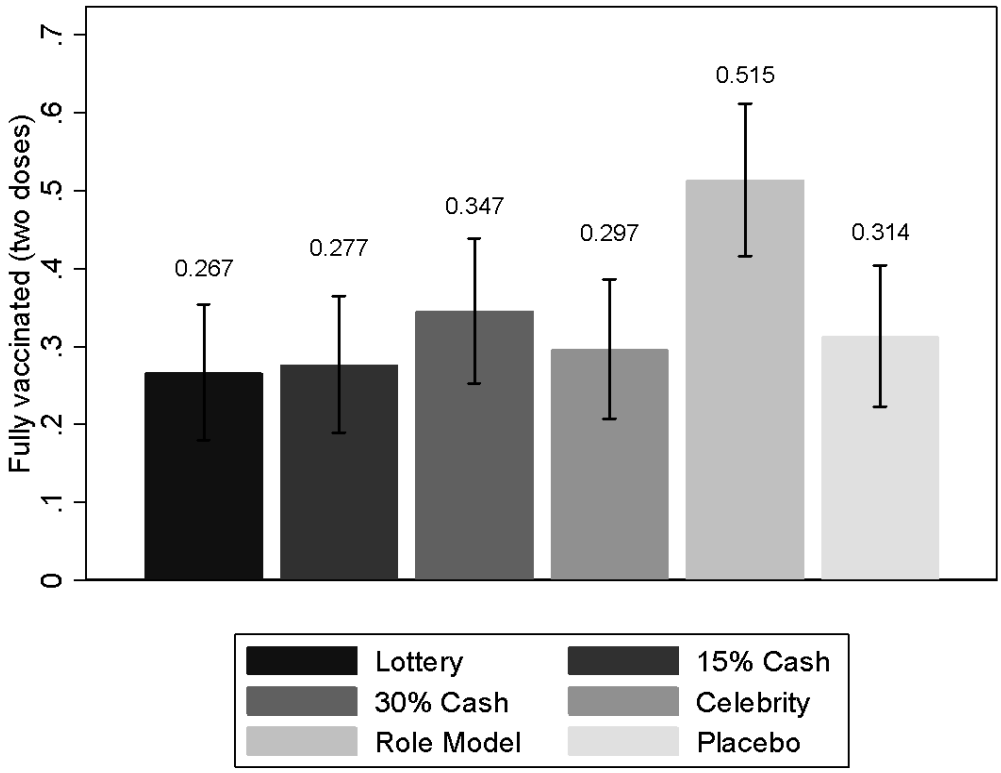
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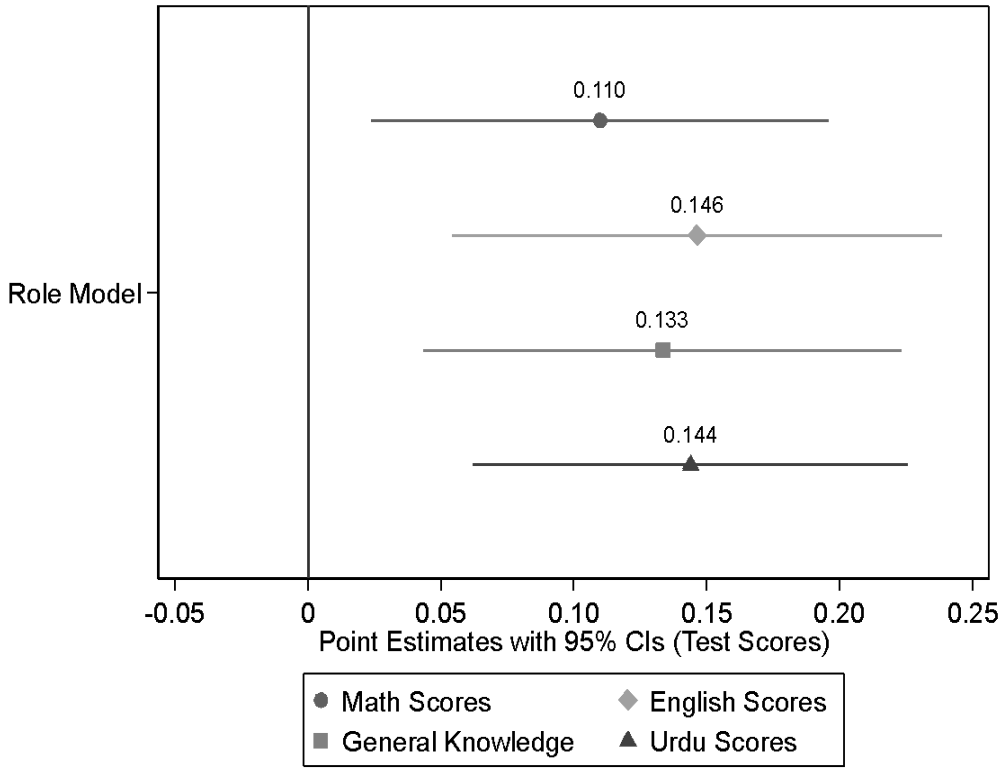
Figures and Tables

Figure 1: Impact on Full Vaccinations



Note: The figure above present fraction of teachers who got two doses of COVID-19 vaccination as ascertained by their COVID-19 certificate, by their treatment status, 12 months post-treatment. Lottery is the average for the group of teachers given Lottery treatment i.e., opportunity to win a "lucky draw" of 10 times her monthly salary, Cash 15% stands a cash award equivalent to 15% of teachers' monthly salary, while the Cash 30% stands for the randomly assigned group of teachers has given cash equivalent to about 30% of their monthly salary. Celebrity treatment requests for vaccination by a prominent celebrity. Role Model emphasizes the same message but via the medium of a female role model. Further details on the treatment, can be found in Figure S2 of the Online Appendix. 95% Confidence intervals are also presented.

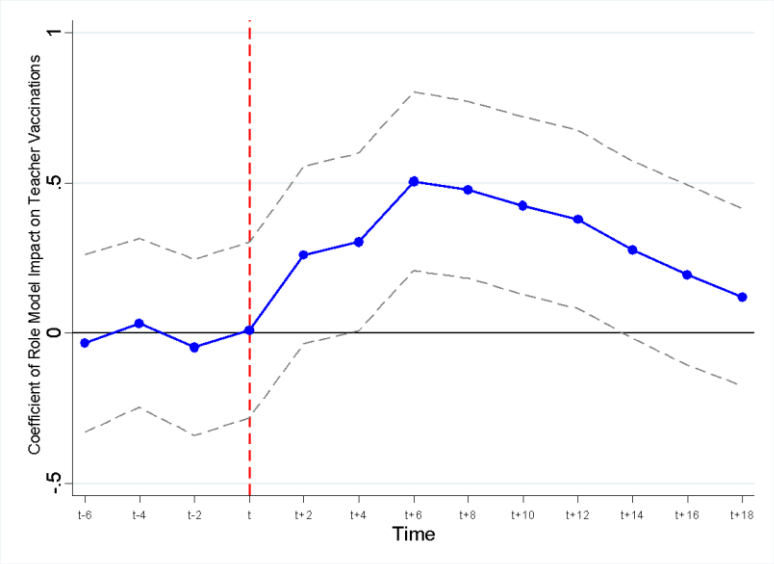
Figure 2: Impact on Student Test Scores - Standardized



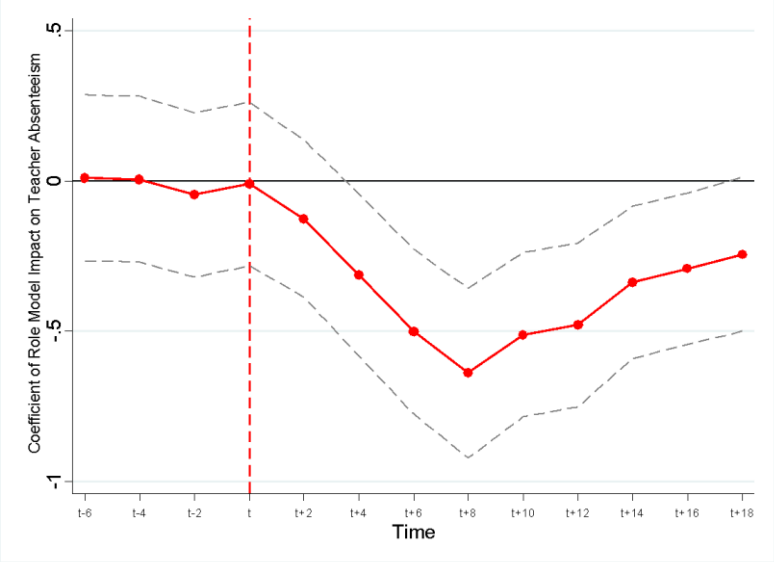
Note: The figure reports coefficient estimates corresponding to the Role Model Treatment based on specification (1) with all controls are reported. The dependent variables are standardized to mean zero and standard deviation for test scores in Math, English, General Knowledge, and Urdu scores from regular examinations held 12 months following the treatment. Controls include all individual characteristics. 95% confidence bands are also reported. Table-form representation of this figure with coefficient estimates on all other treatments are reported in Table S3 of the Online Appendix.

Figure 3: Treatment Effect on Teachers' Absenteeism and Vaccinations - Standardized

Panel A: Impact of Role Model on Teachers' Vaccinations

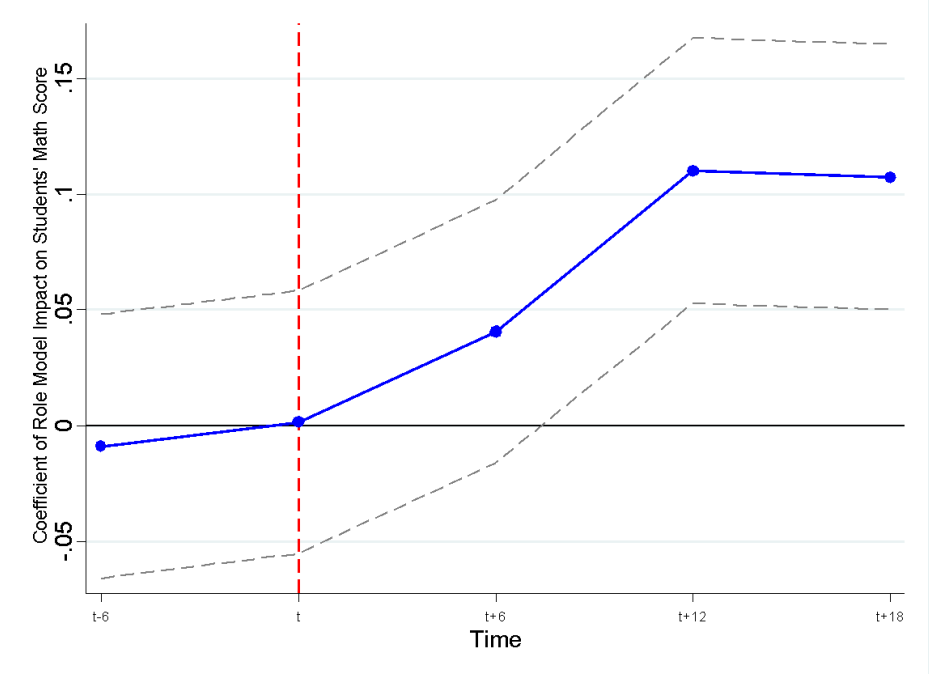


Panel B: Impact of Role Model on Teachers' Absenteeism



Note: The figure reports coefficient estimates corresponding to the Role Model Treatment based on specification (1) but at the month level. The dependent variable in Panel A and B, are teachers' full vaccinations and absences, respectively, recorded monthly. The dependent variables are standardized to mean zero and standard deviation 1. 95% confidence intervals are also reported. Table 2 and 3 i results at month t+12 of this figure for all treatments.

Figure 4: Impact on Students' Mathematics Scores - Standardized



Note: The figure reports coefficient estimates corresponding to the Role Model Treatment based on specification (1). The dependent variable is students' Math score every 6 months, standardized to mean zero and standard deviation one. The record of Mathematics scores is available from six months prior to the treatment i.e., for (t-6) till (t + 18), for every semester, roughly lasting 6 months. Estimates in regression tables are for 12 months following the treatment. Controls include all individual characteristics. 95% confidence intervals are also reported.

Table 1: Balance over Teacher Characteristics

Panel A: Teacher Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
	Pre-Treatment COVID Vaccination	Av. Teaching Hours	Av. Class Size	Teaching Experience	Years of Education	Educational Specialization
Lottery	-0.0368	-0.553	-1.362	-0.226	0.186	-0.0502
	(0.0336)	(0.350)	(2.780)	(0.399)	(0.222)	(0.0659)
Cash 15%	-0.0199	-0.451	-1.896	-0.380	-0.000486	0.0198
	(0.0337)	(0.275)	(2.898)	(0.427)	(0.222)	(0.0677)
Cash 30%	-0.00106	-0.284	-0.350	-0.551	0.213	-0.0133
	(0.0364)	(0.369)	(2.939)	(0.384)	(0.207)	(0.0643)
Celebrity	-0.0528	0.133	1.550	0.110	0.162	-0.0478
	(0.0353)	(0.425)	(2.962)	(0.416)	(0.213)	(0.0632)
Role Model	-0.0278	-0.346	-1.108	-0.271	0.335*	0.00270
	(0.0407)	(0.443)	(2.947)	(0.433)	(0.196)	(0.0666)
Individual Controls and School FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	607	607	607	607	607	607
R-squared	0.094	0.081	0.120	0.157	0.129	0.094
F Statistics (Joint Significance)	0.670 [0.647]	1.140 [0.336]	0.320 [0.903]	0.720 [0.609]	0.870 [0.502]	0.390 [0.854]
Mean of dependent var	0.088	30.49	25.275	4.706	12.549	0.255

Panel B: Students Characteristics

	Free Lunch Eligible	Single Parent	Number of Siblings	Pre-Treatment Verbal Assessment	Father's Education	Mother's Education
Lottery	-0.0115	-0.0110	0.0703	0.00575	-0.205	-0.235
	(0.0153)	(0.0105)	(0.0792)	(0.0153)	(0.169)	(0.171)
Cash 15%	-0.0157	-0.00124	0.0325	-0.00100	0.00957	0.194
	(0.0153)	(0.0106)	(0.0800)	(0.0154)	(0.169)	(0.169)
Cash 30%	-0.000581	-0.0138	0.0584	0.00298	-0.0400	-0.00310
	(0.0153)	(0.0105)	(0.0794)	(0.0153)	(0.168)	(0.167)
Celebrity	-0.0170	-0.0119	0.0642	0.00487	-0.0427	0.103
	(0.0152)	(0.0103)	(0.0782)	(0.0152)	(0.167)	(0.167)
Role Model	-0.00491	-0.00276	0.0782	0.0137	-0.217	-0.138
	(0.0155)	(0.0109)	(0.0808)	(0.0155)	(0.169)	(0.171)
Individual Controls and School FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13,911	13,911	13,911	13,911	13,911	13,911
R-squared	0.004	0.043	0.009	0.003	0.009	0.008
F Statistics (Joint Significance)	0.480 [0.791]	0.290 [0.630]	0.270 [0.931]	0.230 [0.949]	0.720 [0.608]	1.640 [0.145]
Mean of dependent var	0.524	0.143	3.926	0.496	9.051	8.889

Robust standard errors appear in brackets (clustered at the teacher level). In Panel A, teacher characteristics are presented, while in Panel B, student characteristics are reported. The dependent variables in Panel A are Pre-Treatment vaccination status dummy, teaching experience which is the years of experience in teaching. Years of Education which is the years of teachers' education. Educational Specialization is a dummy variable that switches on when a teacher has obtained pedagogical specialization. Av. Teaching Hours is the total number of teaching hours per week. Av. Class Size is the average number of students a teacher teaches in each class. *Lottery* is a dummy variable that switches on when the teacher was assigned the Lottery treatment i.e. opportunity to win a "lucky draw" equivalent to 10 times her monthly salary, *Cash 15%* stands a cash award upon getting vaccinated equivalent to 15% of teachers monthly salary, while the *Cash 30%* stands for dummy switches on when the teacher has been given cash equivalent to about 30% of her monthly salary. *Celebrity* treatment requests for vaccination by a prominent celebrity. *Role Model* delivers the same message but via the medium of a female role model. A placebo group is assigned an equal length message unrelated to COVID-19 vaccination via the same female role model. The student-level controls include dummies for whether the student is eligible for the free lunch program, number of siblings, dummy for single parent, a pre-treatment verbal reasoning score in Urdu, fathers and mother's education. *** p<0.01, ** p<0.05, * p<0.1.

Table 2: Impact on Vaccinations - Standardized

	Fully Vaccinated			
	(1)	(2)	(3)	(4)
Lottery	-0.144	-0.150	-0.137	-0.152
	(0.140)	(0.137)	(0.140)	(0.137)
Cash 15%	-0.0782	-0.0599	-0.0796	-0.0542
	(0.137)	(0.138)	(0.138)	(0.139)
Cash 30%	0.0591	0.0655	0.0636	0.0656
	(0.139)	(0.137)	(0.139)	(0.138)
Celebrity	0.00251	0.00582	0.00415	0.00486
	(0.138)	(0.139)	(0.138)	(0.139)
Role Model	0.374**	0.198	0.390**	0.211
	(0.150)	(0.147)	(0.151)	(0.148)
Role Model X *Female RMET*		0.219**		0.204*
		(0.102)		(0.109)
Role Model X *Male RMET*			0.00508	0.110
			(0.110)	(0.107)
Female RMET		0.127***		0.146**
		(0.0468)		(0.0593)
Male RMET			0.0454	-0.0324
			(0.0455)	(0.0566)
Individual Teacher Controls	Yes	Yes	Yes	Yes
School Fixed Effects	Yes	Yes	Yes	Yes
Observations	607	607	607	607
R-squared	0.163	0.197	0.165	0.199

Robust standard errors appear in brackets (clustered at the teacher level). The dependent variable switches on if the teacher has taken two doses of COVID-19 vaccination as ascertained by their COVID-19 certificate. This variable is standardized to mean zero and standard deviation one and measured 12 months following the treatment. Lottery is a dummy variable that switches on when the teacher has given Lottery treatment i.e. opportunity to win a "lucky draw" equivalent to about 10 times teachers' monthly salary, Cash 15% stands a cash award equivalent to 15% of teachers' monthly salary, while the Cash 30% stands for dummy switches on when the teacher has given cash equivalent to about 30% of her monthly salary. Celebrity treatment requests for vaccination by a prominent celebrity. Role Model delivers the same message but via the medium of a female role model. RMET reports the total number of correct answers to a total of 20 questions, each of which asks "What emotion are the eyes showing?" on different pictures of male and female eyes. This is also standardized to mean zero and standard deviation one. The teacher level controls include years of teaching experience, educational qualification, professional qualification, average teaching hours, class size, and marital status. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Mechanism - Impact on Teacher Absenteeism - Standardized

	Teachers' Absenteeism			
	(1)	(2)	(3)	(4)
Lottery	-0.187	-0.180	-0.195	-0.182
	(0.136)	(0.135)	(0.136)	(0.136)
Cash 15%	-0.125	-0.142	-0.122	-0.142
	(0.134)	(0.135)	(0.134)	(0.136)
Cash 30%	-0.123	-0.130	-0.127	-0.130
	(0.140)	(0.138)	(0.140)	(0.139)
Celebrity	-0.167	-0.172	-0.169	-0.172
	(0.135)	(0.135)	(0.136)	(0.135)
Role Model	-0.480***	-0.275**	-0.484***	-0.281**
	(0.139)	(0.128)	(0.141)	(0.129)
Role Model X *Female RMET*		-0.289***		-0.292***
		(0.102)		(0.109)
Role Model X *Male RMET*			0.0742	-0.0180
			(0.107)	(0.108)
Female RMET		-0.118**		-0.116*
		(0.0597)		(0.0697)
Male RMET			-0.0661	-0.00411
			(0.0527)	(0.0605)
Individual Teacher Controls	Yes	Yes	Yes	Yes
School Fixed Effects	Yes	Yes	Yes	Yes
Observations	607	607	607	607
R-squared	0.121	0.163	0.124	0.163

Robust standard errors appear in brackets (clustered at the teacher level). The dependent variable is the total number of absences recorded after 12 months post treatment which is standardized to mean zero and standard deviation one and measured 12 months following the treatment. *Lottery* is a dummy variable that switches on when the teacher was assigned the Lottery treatment i.e., opportunity to win a "lucky draw" equivalent to 10 times her monthly salary, *Cash 15%* stands a cash award upon getting vaccinated equivalent to 15% of teachers' monthly salary, while the *Cash 30%* stands for dummy switches on when the teacher has been given cash equivalent to about 30% of her monthly salary. *Celebrity* treatment requests for vaccination by a prominent celebrity. *Role Model* delivers the same message but via the medium of a female role model. A placebo group is assigned an equal length message unrelated to COVID-19 vaccination delivered via the same female role model. RMET reports the total number of correct answers to a total of 20 questions, each of which asks "What emotion are the eyes showing?" on different pictures of male and female eyes. This is also standardized to mean zero and standard deviation one. The teacher-level controls include years of teaching experience, educational qualification, professional qualification, average teaching hours, class size, and pre-treatment vaccination status. The student-level controls include dummies for student grade (i.e., KG, Nursery, Prep, one, two, three, four, five and six class) and pre-treatment math scores. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Mechanism - Impact on Teacher's Reason for Absence - Standardized

	COVID is Reason for Absence		All Other Reasons for Absence	
	(1)	(2)	(3)	(4)
Lottery	-0.196	-0.192	0.0223	0.0188
	(0.136)	(0.137)	(0.149)	(0.149)
Cash 15%	-0.165	-0.158	0.0716	0.0444
	(0.137)	(0.137)	(0.155)	(0.155)
Cash 30%	-0.138	-0.132	-0.00740	-0.00958
	(0.136)	(0.137)	(0.151)	(0.150)
Celebrity	-0.179	-0.178	-0.0165	0.00524
	(0.133)	(0.134)	(0.150)	(0.149)
Role Model	-0.321**	-0.318**	0.115	0.117
	(0.130)	(0.132)	(0.162)	(0.159)
Role Model X *Female RMET*	-0.326***	-0.323***	0.0938	0.0875
	(0.108)	(0.110)	(0.108)	(0.108)
Role Model X *Male RMET*	-0.0325	-0.0373	0.0709	0.0747
	(0.107)	(0.107)	(0.106)	(0.104)
Female RMET	-0.111	-0.112	-0.0310	-0.0298
	(0.0696)	(0.0703)	(0.0593)	(0.0596)
Male RMET	-0.000889	-0.00139	-0.0181	-0.0113
	(0.0590)	(0.0599)	(0.0561)	(0.0558)
Individual Teacher Controls	No	Yes	No	Yes
School Fixed Effects	Yes	Yes	Yes	Yes
Observations	607	607	607	607
R-squared	0.174	0.176	0.063	0.085

Robust standard errors appear in brackets (clustered at the teacher level). The dependent variable in columns (1) and (2) is the total number of absences due COVID illness and measured 12 months following the treatment. The dependent variable in columns (3) and (4) is the total number of absences due to other reasons (i.e., marriage, funeral) recorded after 12 months post treatment. The dependent variables are standardized to mean zero and standard deviation one. *Lottery* is a dummy variable that switches on when the teacher was assigned the Lottery treatment i.e., opportunity to win a "lucky draw" equivalent to 10 times her monthly salary, *Cash 15%* stands a cash award upon getting vaccinated equivalent to 15% of teachers monthly salary, while the *Cash 30%* stands for dummy switches on when the teacher has been given cash equivalent to about 30% of her monthly salary. *Celebrity* treatment requests for vaccination by a prominent celebrity. *Role Model* delivers the same message but via the medium of a female role model. A placebo group is assigned an equal length message unrelated to COVID-19 vaccination delivered via the same female role model. RMET reports the total number of correct answers to a total of 20 questions, each of which asks "What emotion are the eyes showing?" on different pictures of male and female eyes. This is also standardized to mean zero and standard deviation one. The teacher-level controls include years of teaching experience, educational qualification, professional qualification, average teaching hours, class size, and pre-treatment vaccination status. The student-level controls include dummies for student grade (i.e., KG, Nursery, Prep, one, two, three, four, five and six class) and pre-treatment math scores. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Impact on Lumpy versus Short Leaves - Standardized

	Lumpy Absences > 7 Days		Short Absences < 7 Days	
	(1)	(2)	(3)	(4)
Lottery	-0.166	-0.151	-0.0792	-0.0933
	(0.131)	(0.132)	(0.143)	(0.143)
Cash 15%	-0.164	-0.145	-0.0939	-0.110
	(0.141)	(0.141)	(0.150)	(0.150)
Cash 30%	-0.208	-0.200	-0.0193	-0.0315
	(0.139)	(0.140)	(0.149)	(0.150)
Celebrity	-0.169	-0.169	-0.0724	-0.0705
	(0.137)	(0.137)	(0.146)	(0.147)
Role Model	-0.347**	-0.335**	0.0740	0.0581
	(0.146)	(0.148)	(0.155)	(0.157)
Individual Teacher Controls	No	Yes	No	Yes
School Fixed Effects	Yes	Yes	Yes	Yes
Observations	607	607	607	607
R-squared	0.100	0.106	0.089	0.093

Robust standard errors appear in brackets (clustered at the teacher level). The dependent variable in Columns 1 and 2 is a dummy that switches on if the teacher has taken a consecutive leave for more than 7 days. The dependent variable in Columns 3 and 4 is a dummy that switches on if the teacher has taken a consecutive leave for 7 days or less. These variables are standardized to mean zero and standard deviation one and measured 12 months following the treatment. Lottery is a dummy variable that switches on when the teacher is assigned the Lottery treatment i.e., opportunity to win a "lucky draw" equivalent to about 10 times teachers' monthly salary, Cash 15% stands a cash award equivalent to 15% of teachers' monthly salary, while the Cash 30% stands for dummy switches on when the teacher has given cash equivalent to about 30% of her monthly salary. Celebrity treatment requests for vaccination by a prominent celebrity. Role Model delivers the same message but via the medium of a female role model. The teacher level controls include years of teaching experience, educational qualification, professional qualification, average teaching hours, class size, and marital status. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Alternate Mechanism - Impact on Gender Attitudes

	Women's Rights Overall	Women's Economic Rights	Women's Political Rights	Women's Social Rights	Women's Legal Rights
	(1)	(2)	(3)	(4)	(5)
Lottery	0.0602	0.0774	0.0513	0.0481	0.0390
	(0.0548)	(0.0585)	(0.102)	(0.105)	(0.0919)
Cash 15%	-0.0234	0.0654	-0.0165	-0.145	-0.0358
	(0.0508)	(0.0553)	(0.0912)	(0.101)	(0.0820)
Cash 30%	-0.0716	-0.0111	-0.0884	-0.184*	0.0158
	(0.0485)	(0.0510)	(0.0827)	(0.101)	(0.0772)
Celebrity	-0.0424	0.0219	-0.0904	-0.108	-0.0564
	(0.0502)	(0.0515)	(0.0921)	(0.107)	(0.0774)
Role Model	-0.0380	0.0559	-0.0499	-0.165*	-0.0377
	(0.0519)	(0.0536)	(0.0920)	(0.1000)	(0.0826)
Individual Teacher Controls	No	Yes	No	Yes	Yes
School Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	607	607	607	607	607
R-squared	0.134	0.101	0.110	0.121	0.117

Robust standard errors appear in brackets (clustered at the teacher level). Women's Rights Overall is an index consisting of all the statements concerning Women's Economic, Social, Legal and Political Rights. Women's Economic Rights is an index combining women's rights to education and work outside home, based on reactions to statements "Women should be allowed to work outside the home". "Women and men should have equal rights to jobs". "I have no problem with my sister or female cousin working outside the home". "Daughters should have the same right to inherit property as sons". "Women and men should have equal rights to get an education". "Wives should not be less educated than their husbands". "Boys should not have more opportunities and resources for education than girls.". Women's Political Rights is based on statements "It would be a good idea to elect a woman as the village Sarpanch (local politician)." "Women and men have equal rights to be President or Prime Minister.". Women's Social Rights is based on statements "Domestic violence by husbands cannot be justified" "Parents should seek their daughter's consent before fixing her marriage". "A woman should not necessarily get married before her 25th Birthday". "Women who give birth to a son need not be honored in the family". "A woman with five daughters should not be under social pressure to bear a son.". Finally, the Women's Legal Rights index is based on statements "Laws should be passed to ban dowry.". "Under Article 35 of the Constitution of Pakistan & Judgment of Federal Shariat Court, the consent of `Wali' is not required and a sui juris Muslim female can enter into a valid Nikah / Marriage under her own free will without the consent of Wali. To what extent do you approve of this legal right of women to enter marriage under their own free will". Lottery is a dummy variable that switches on when the teacher is assigned Lottery treatment i.e. opportunity to win a "lucky draw" equivalent to about 10 times teachers' monthly salary, Cash 15% stands a cash award equivalent to 15% of teachers' monthly salary, while the Cash 30% stands for dummy switches on when the teacher has given cash equivalent to about 30% of her monthly salary. Celebrity treatment requests for vaccination by a prominent celebrity. Role Model delivers the same message but via the medium of a female role model. The teacher level controls include years of teaching experience, educational qualification, professional qualification, average teaching hours, class size, and marital status. *** p<0.01, ** p<0.05, * p<0.1.

ACKNOWLEDGEMENTS

New Economic School (E-mail: smehmood@nes.ru), Lahore School of Economics (Email: ranashaheen133@gmail.com), Toulouse School of Economics (E-mail: daniel.chen@iast.fr). AEA RCT Registry number ID is: AEARCTR-0006655. An IRB is obtained from the Lahore School of Economics with IRB Number RERC-022021-01. We would like to thank Marcella Alsan, John List, Peter Singer, Ray Fisman, Kevin Tobia, Moshe Hoffman, Jamil Zaki, Rosemarie Nagel, Martha Nussbaum, and seminar participants at Institute for Advanced Study in Toulouse, Paris School of Economics, Aix-Marseille University, American Political Science Association, NBER Fall Development Meeting 2021 and World Bank Research Department for their helpful suggestions and comments. Sajwaar Khalid and Sameen Tariq provided excellent research assistance. Daniel Chen acknowledges IAST funding from the French National Research Agency (ANR) under the Investments for the Future (Investissements d'Avenir) program, grant ANR-17-EUR-0010.

SUPPLEMENTARY MATERIALS FOR ONLINE APPENDIX

Additional Figures and Tables in Appendix S1: Figures S1 to S8 and Tables S1 to S11. Materials and Methods Supplementary Text in Appendix S2.

Reference (34)

Supplementary Materials - Online Appendix

Role Models Matter for Covid Vaccinations and Conditional Cash Transfers Do Not: Impact on Vaccinations and Student Achievement

BY SULTAN MEHMOOD[17*], SHAHEEN NASEER[18] AND DANIEL L. CHEN[19]

September 2022

Contents

Appendix S1. Supplementary Figures and Tables

Appendix S2. Consent, Survey Instrument and Flow Chart

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Appendix S1. Supplementary Figures and Tables

Figure S1: A Typical Official COVID-19 Certificate



Note: The figure above shows a typical COVID-19 certificate that we used the verify the vaccination status. The QR code was used to ascertain authenticity with the official COVID-19 database. The QR code in this certificate is disabled to preserve the anonymity of the teacher.

Figure S1.1: Lottery Treatment

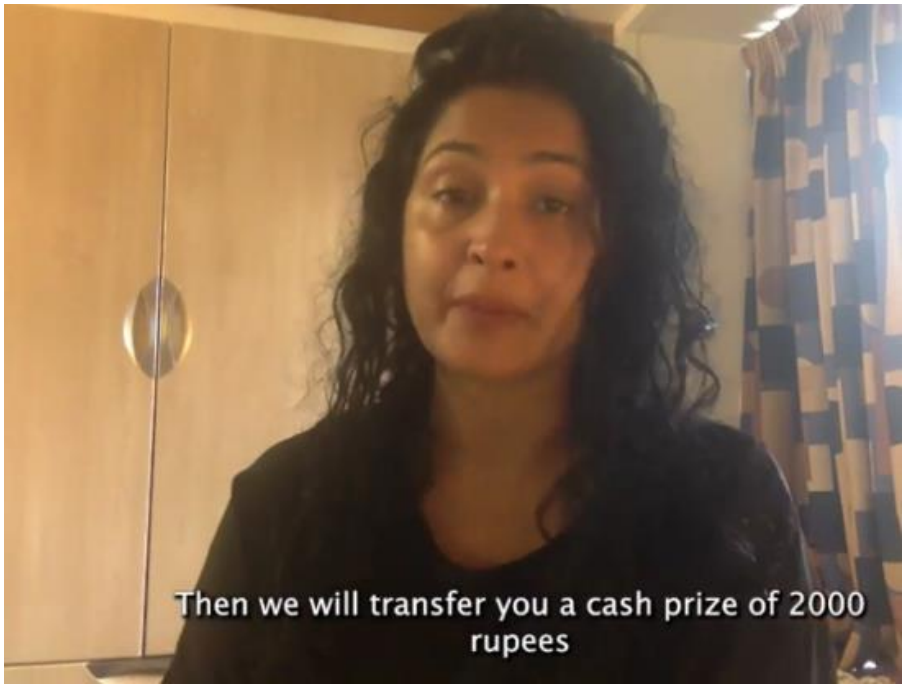


Note: The full treatment video can be found in the following embedded link: Lottery. The video message is shown live on Zoom to the randomly assigned lottery treatment group. The original announcement for the lottery could not be recorded, so we reenacted the announcement to be as close as possible to the original to the best of our knowledge. This was possible due to the availability of the exact transcript of the treatment. The original video is in Urdu, and we provide subtitles in English.

Figure S1.2: Cash 15% (PKR 1000) and Cash 30% (PKR 2000)



Panel A: 15% Cash Prize



Panel B: 30%% Cash Prize

Note: The exact treatment announcement videos with subtitles in English can be found in the following embedded links: Cash 15% and Cash 30%.

Figure S2: Celebrity and Role Model Treatments



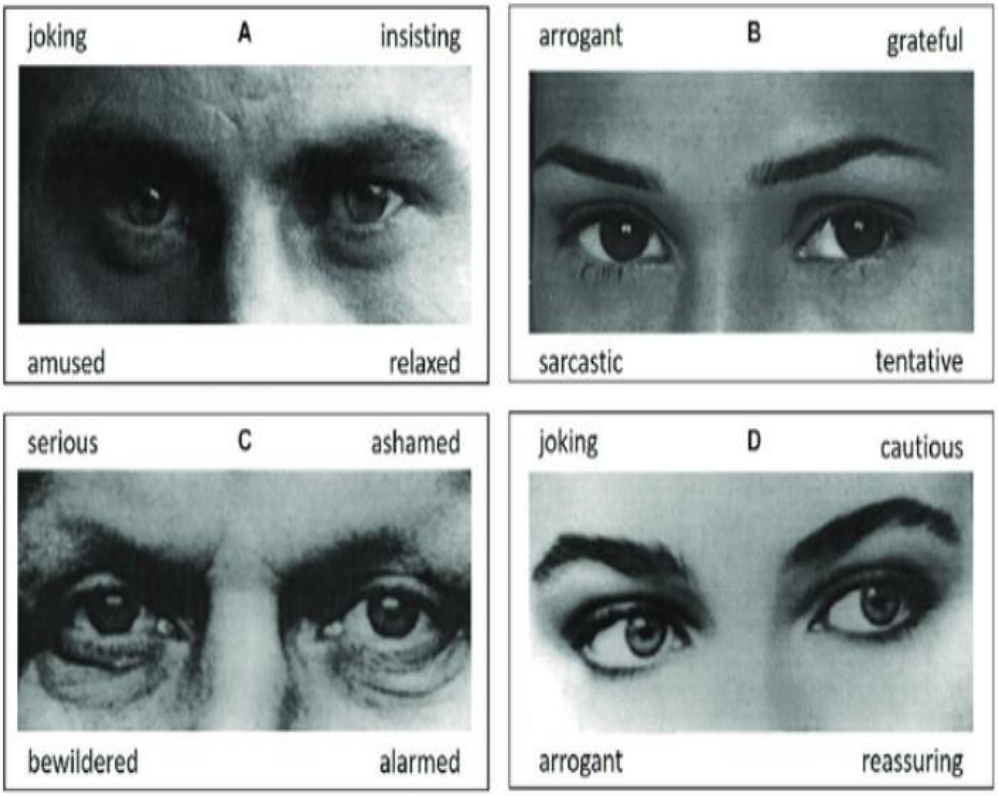
Panel A: Celebrity Snapshot



Panel B: Role Model Snapshot

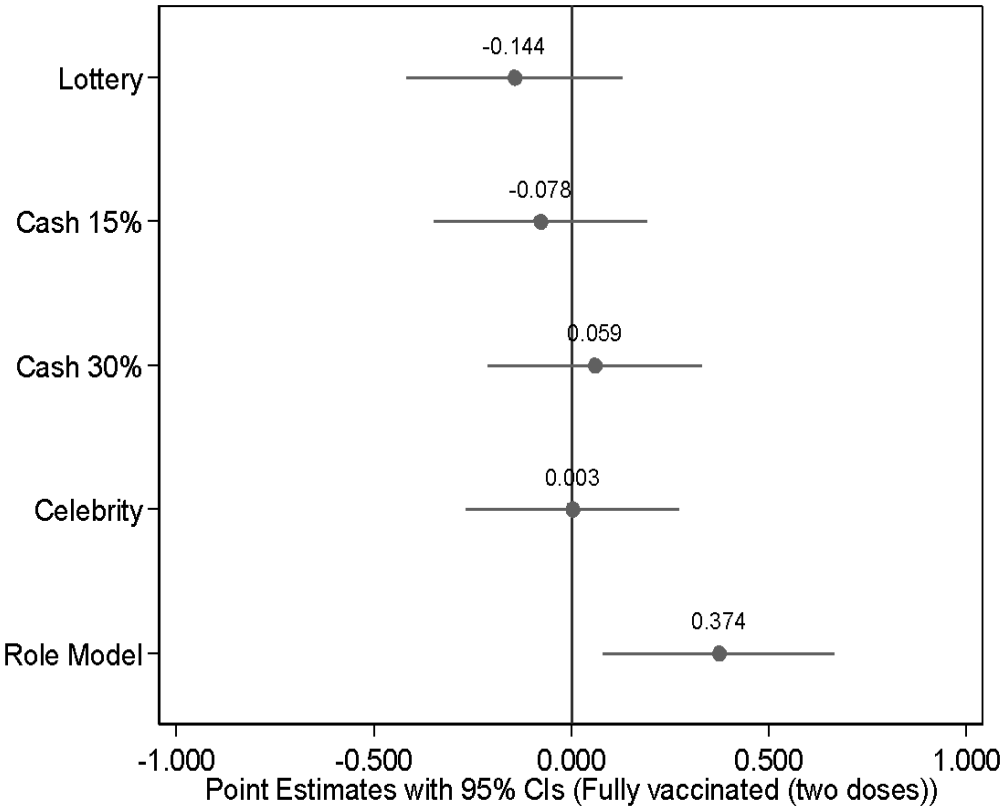
Note: The exact treatment videos can be found in the following embedded links: Celebrity and Role Model. Translation of transcript of both treatments is as follows: In the name of Allah, the Most Gracious, the Most Merciful. Assalam-o-Alaikum (Peace be upon you) Right now, I am addressing all the teachers of Progressive Education Network. I request you all to please, please, please get Covid-19 Vaccination as this is really important for your safety as well as for all your students. I myself am fully vaccinated along with all my family members. I request you all please do not fall for any misinformation or rumor, this vaccination is completely safe and is for our own protection. So I request you all to get fully vaccinated as soon as possible.

Figure S3: Reading the Mind in the Eyes Test Illustration



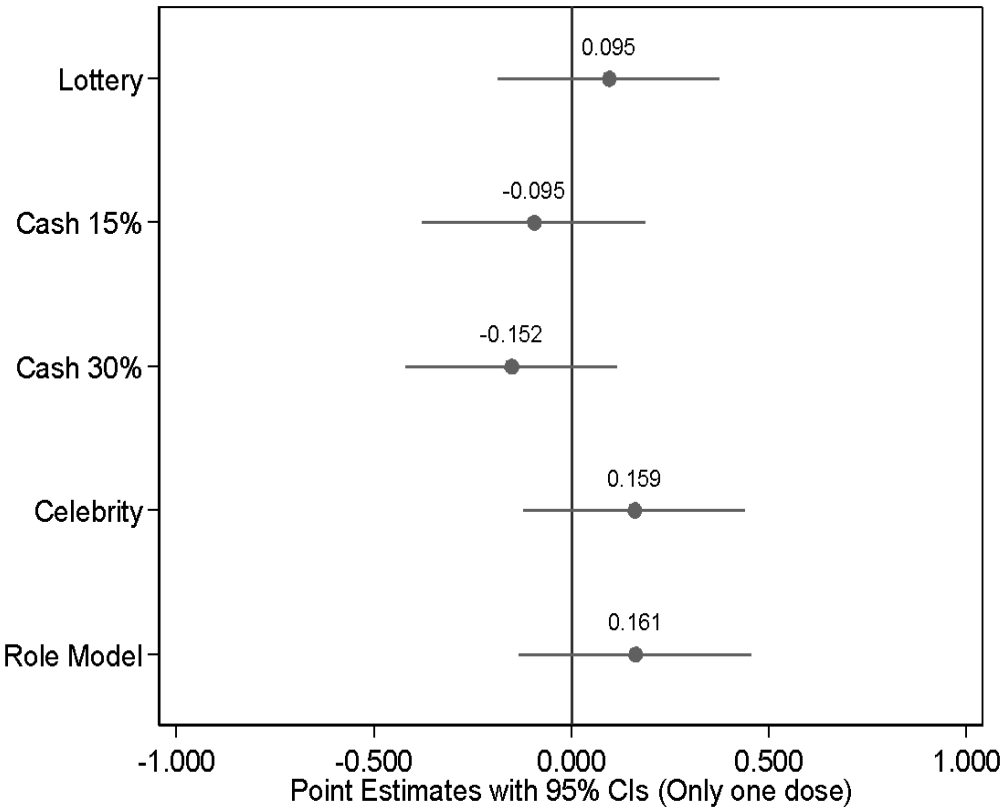
Note: The figure above summarizes the Reading the Mind in the Eyes Test (RMET) with the pictures on the left showing male eyes, while figures on the right showing female eyes. We implemented the revised RMET due to its higher accuracy in predicting mentals states and being a more robust measure of Theory of Mind (see Cohen et al., 2001 for more details).

Figure S4: Impact on Teacher Vaccinations – Standardized



Note: The figure report estimates from equation (1) with all controls. The dependent variable switches on if the teacher has taken two doses of COVID-19 vaccination as ascertained by their COVID-19 certificate. The dummy is standardized to mean zero and standard deviation one. Controls include all individual characteristics. 95% confidence bands are also reported. *Lottery* is a dummy variable that switches on when the teacher was assigned the Lottery treatment i.e. opportunity to win a "lucky draw" equivalent to 10 times her monthly salary, *Cash 15%* stands a cash award upon getting vaccinated equivalent to 15% of teachers monthly salary, while the *Cash 30%* stands for dummy switches on when the teacher has been given cash equivalent to about 30% of her monthly salary. *Celebrity* treatment requests for vaccination by a prominent celebrity. *Role Model* delivers the same message but via the medium of a female role model. A placebo group is assigned an equal length message unrelated to COVID-19 vaccination via the same female role model. 95% Confidence Bands are also reported.

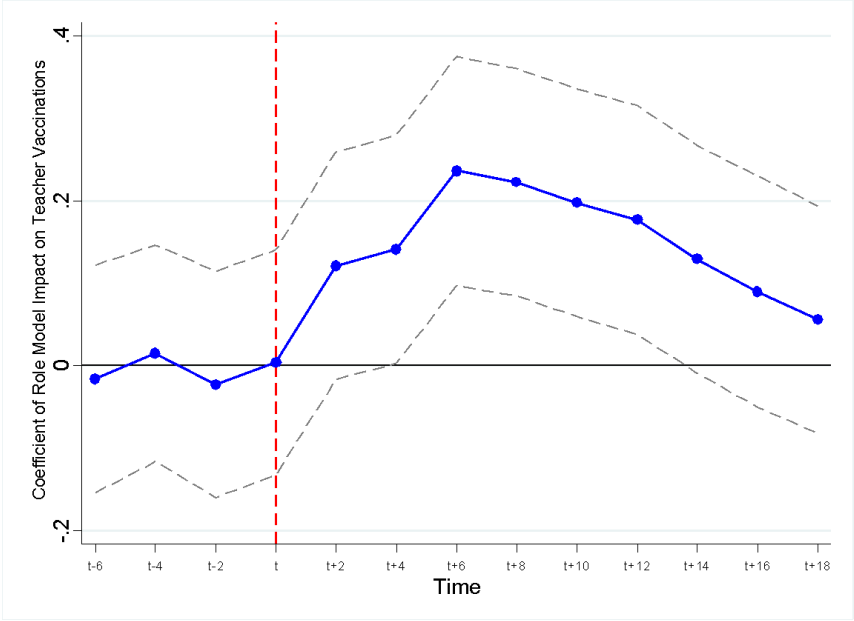
Figure S5: Impact on Vaccinations - Single Dose



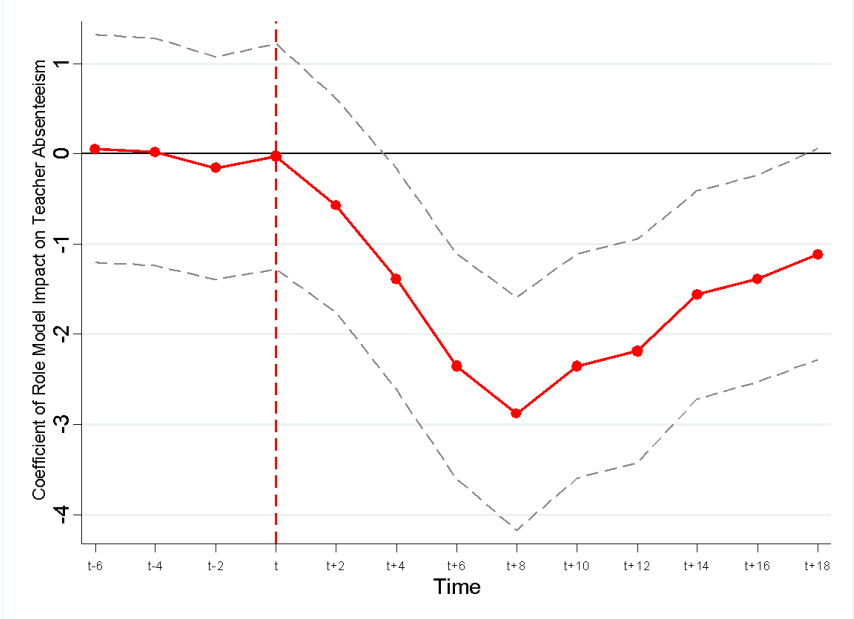
Note: The figure reports estimates from equation (1) with all controls. The dependent variable switches on if the teacher has taken only one dose of COVID-19 vaccination as ascertained by COVID-19 certificate. The dummy is standardized to mean zero and standard deviation one. Controls include all individual characteristics. 95% confidence bands are also reported.

Figure S6: Treatment Effect on Teachers' Absenteeism and Vaccinations - Levels

Panel A: Impact of Role Model on Teachers' Vaccinations

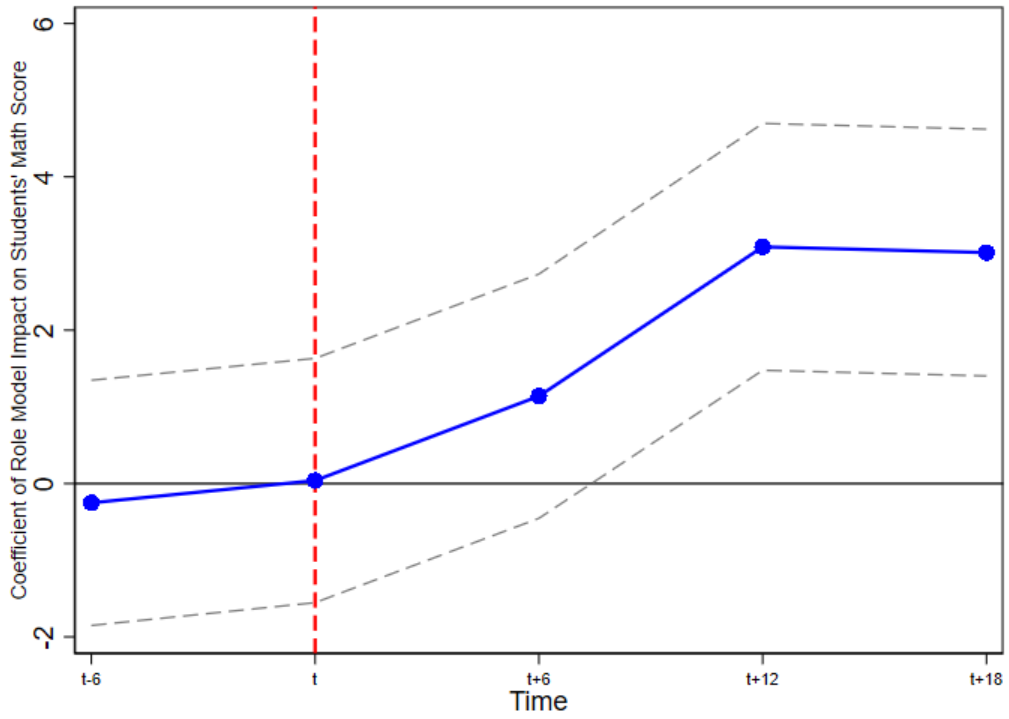


Panel B: Impact of Role Model on Teachers' Absenteeism



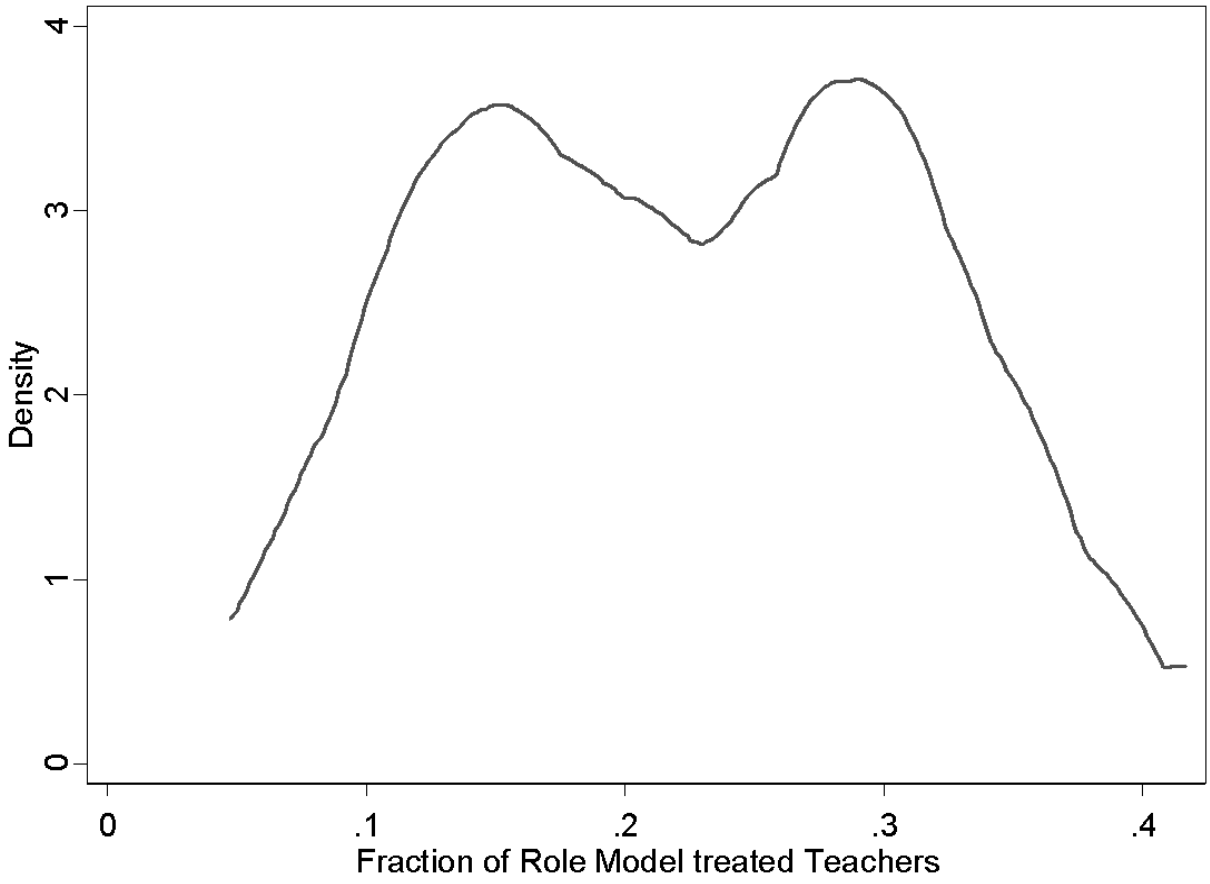
Note: The figure reports coefficient estimates corresponding to the Role Model Treatment based on specification (1) but at the month level. The dependent variable in Panel A and B, are teachers' full vaccinations and absences, respectively, recorded at the month level. Tables report results at month t+12. 95% confidence intervals are also reported. Both panels present results in levels.

Figure S7: Dynamic Impact on Students' Mathematics Scores - Raw Scores



Note: The figure reports coefficient estimates corresponding to the Role Model Treatment based on specification (1) but at the month level. The dependent variable is students' Math score every 6 months. The record of Math scores is available from six months prior to the treatment (t-6) and for midterms (t+6), end term (t+12) and next midterm (t + 18). Controls include all individual characteristics. Table report results at month (t+12). 95% confidence interval is reported.

Figure S8: Distribution of Fraction of Role Model Treated Teachers



Note: The figure above shows the distribution of fraction of teachers within a school that were treated by the role model.

Table S1: Summary Statistics by Treatment Arm

	Number of teachers Vaccinated According to QR Verified Certificates			
	At least One Dose Vaccinated	One Dose Vaccinated	Fully Vaccinated	**Total**
Lottery	53	26	27	106
15% Cash	48	20	28	96
30% Cash	54	19	35	118
Celebrity	58	28	30	116
Role Model	80	28	52	160
Placebo	58	26	32	116
Total	351	147	204	351

Note: The table above provides the total number of teachers who opted for one dose of COVID-19 vaccination, more than one dose of vaccination, and two doses of vaccination for all the treatment groups and placebo. *Lottery* is a dummy variable that switches on when the teacher was assigned the Lottery treatment i.e. opportunity to win a "lucky draw" equivalent to 10 times her monthly salary, *Cash 15%* stands a cash award upon getting vaccinated equivalent to 15% of teachers monthly salary, while the *Cash 30%* stands for dummy switches on when the teacher has been given cash equivalent to about 30% of her monthly salary. *Celebrity* treatment requests for vaccination by a prominent celebrity. *Role Model* delivers the same message but via the medium of a female role model. A placebo group is assigned an equal length message unrelated to COVID-19 vaccination via the same female role model. For balance over characteristics of teachers, see Table 1 in the main text.

Table S2: Impact on Vaccinations in Levels

	Fully Vaccinated (2 Doses)			
	(1)	(2)	(3)	(4)
Lottery	-0.0682	-0.0709	-0.0646	-0.0718
	(0.0662)	(0.0647)	(0.0664)	(0.0645)
Cash 15%	-0.0370	-0.0283	-0.0376	-0.0256
	(0.0649)	(0.0655)	(0.0650)	(0.0657)
Cash 30%	0.0280	0.0309	0.0301	0.0310
	(0.0656)	(0.0649)	(0.0656)	(0.0650)
Celebrity	0.00119	0.00275	0.00196	0.00230
	(0.0651)	(0.0655)	(0.0651)	(0.0657)
Role Model	0.177**	0.0938	0.185**	0.0999
	(0.0708)	(0.0695)	(0.0715)	(0.0700)
Role Model X *Female RMET*		0.0599***		0.0692**
		(0.0221)		(0.0280)
Role Model X *Male RMET*			0.00240	0.0518
			(0.0521)	(0.0506)
Female RMET		0.0599***		0.0692**
		(0.0221)		(0.0280)
Male RMET			0.0215	-0.0153
			(0.0215)	(0.0268)
Individual Teacher Controls	Yes	Yes	Yes	Yes
School Fixed Effects	Yes	Yes	Yes	Yes
Observations	607	607	607	607
R-square	0.163	0.197	0.165	0.199
Mean Dependent var	0.336	0.336	0.336	0.336

Robust standard errors appear in brackets (clustered at the teacher level). The dependent variable switches on if the teacher has taken two doses of COVID-19 vaccination as ascertained by their COVID-19 certificate. Lottery is a dummy variable that switches on when the teacher has given Lottery treatment i.e. opportunity to win a "lucky draw" equivalent to about 10 times teachers' monthly salary, Cash 15% stands a cash award equivalent to 15% of teachers' monthly salary, while the Cash 30% stands for dummy switches on when the teacher has given cash equivalent to about 30% of her monthly salary. Celebrity treatment requests for vaccination by a prominent celebrity. Role Model delivers the same message but via the medium of a female role model. RMET reports the total number of correct answers to a total of 20 questions, each of which asks "What emotion are the eyes showing?" on different pictures of male and female eyes. This is also standardized to mean zero and standard deviation one. The teacher level controls include years of teaching experience, educational qualification, professional qualification, average teaching hours, class size, and marital status. *** p<0.01, ** p<0.05, * p<0.1.

Table S3: Impact on Students' Test Scores - Standardized

	(1)	(2)	(3)	(4)
	Mathematics	*English*	*General Knowledge*	*Urdu*
Lottery	-0.0382	0.0397	-0.0207	-0.00687
	(0.0309)	(0.0307)	(0.0307)	(0.0307)
Cash 15%	-0.0474	-0.00233	-0.0112	0.00538
	(0.0309)	(0.0310)	(0.0309)	(0.0312)
Cash 30%	-0.0194	0.0422	0.00450	0.0226
	(0.0313)	(0.0307)	(0.0310)	(0.0310)
Celebrity	0.0328	0.00117	-0.00728	-0.00379
	(0.0308)	(0.0307)	(0.0306)	(0.0309)
Role Model	0.110***	0.146***	0.133***	0.144***
	(0.0292)	(0.0291)	(0.0291)	(0.0291)
Individual Controls	Yes	Yes	Yes	Yes
School Fixed Effects	Yes	Yes	Yes	Yes
Observations	13,933	13,933	13,933	13,933
R-squared	0.013	0.015	0.012	0.015

Note: Robust standard errors appear in brackets (clustered at the teacher level). The dependent variables are test scores that are standardized to mean zero and standard deviation for Math, English, General Knowledge and Urdu standardized test scores. *Lottery* is a dummy variable that switches on when the teacher was assigned the Lottery treatment i.e. opportunity to win a "lucky draw" equivalent to 10 times her monthly salary, *Cash 15%* stands a cash award upon getting vaccinated equivalent to 15% of teachers monthly salary, while the *Cash 30%* stands for dummy switches on when the teacher has been given cash equivalent to about 30% of her monthly salary. *Celebrity* treatment requests for vaccination by a prominent celebrity. *Role Model* delivers the same message but via the medium of a female role model. A placebo group is assigned an equal length message unrelated to COVID-19 vaccination via the same female role model. The teacher-level controls include years of teaching experience, educational qualification, professional qualification, average teaching hours, class size, and pre-treatment vaccination status. The student-level controls include all student characteristics reported in Panel B of Table 1. *** p<0.01, ** p<0.05, * p<0.1.

Table S4: Mechanism - Impact on Teacher Absenteeism in Levels - Days Missed

	Teachers' Absenteeism			
	(1)	(2)	(3)	(4)
Lottery	-0.850	-0.821	-0.888	-0.827
	(0.617)	(0.614)	(0.619)	(0.617)
Cash 15%	-0.571	-0.648	-0.555	-0.647
	(0.611)	(0.616)	(0.610)	(0.618)
Cash 30%	-0.559	-0.590	-0.579	-0.594
	(0.636)	(0.629)	(0.638)	(0.630)
Celebrity	-0.762	-0.781	-0.771	-0.782
	(0.615)	(0.616)	(0.618)	(0.617)
Role Model	-2.185***	-1.253**	-2.205***	-1.277**
	(0.633)	(0.582)	(0.640)	(0.589)
Role Model X *Female RMET*		-1.314***		-1.331***
		(0.463)		(0.494)
Role Model X *Male RMET*			0.338	-0.0821
			(0.486)	(0.492)
Female RMET		-0.539**		-0.528*
		(0.272)		(0.317)
Male RMET			-0.301	-0.0187
			(0.240)	(0.275)
Individual Teacher Controls	Yes	Yes	Yes	Yes
School Fixed Effects	Yes	Yes	Yes	Yes
Observations	607	607	607	607
R-squared	0.121	0.163	0.124	0.163
Mean Dependent var	10.145	10.145	10.145	10.145

Robust standard errors appear in brackets (clustered at the teacher level). The dependent variable is the total number of absences recorded after 12 months post treatment. *Lottery* is a dummy variable that switches on when the teacher was assigned the Lottery treatment i.e. opportunity to win a "lucky draw" equivalent to 10 times her monthly salary, *Cash 15%* stands a cash award upon getting vaccinated equivalent to 15% of teachers monthly salary, while the *Cash 30%* stands for dummy switches on when the teacher has been given cash equivalent to about 30% of her monthly salary. *Celebrity* treatment requests for vaccination by a prominent celebrity. *Role Model* delivers the same message but via the medium of a female role model. A placebo group is assigned an equal length message unrelated to COVID-19 vaccination delivered via the same female role model. RMET reports the total number of correct answers to a total of 20 questions, each of which asks "What emotion are the eyes showing?" on different pictures of male and female eyes. This is also standardized to mean zero and standard deviation one. The teacher-level controls include years of teaching experience, educational qualification, professional qualification, average teaching hours, class size, and pre-treatment vaccination status. The student-level controls include dummies for student grade (i.e., KG, Nursery, Prep, one, two, three, four, five and six class) and pre-treatment math scores. *** p<0.01, ** p<0.05, * p<0.1.

Table S5: Impact on Vaccinations and Student Achievement – Assessing Spillovers

	(1)	(2)	(3)	(4)	(5)
	Full Vaccination	*Math*	*English*	*General Knowledge*	*Urdu*
Fraction of Role Model Treated Teachers X Role Model	-0.624	0.316	0.417	0.482*	0.436
	(0.995)	(0.229)	(0.290)	(0.248)	(0.292)
Role Model	0.513*	0.0286	0.0415	0.0247	0.0392
	(0.275)	(0.0694)	(0.0907)	(0.0784)	(0.0828)
Individual Teacher Controls	Yes	Yes	Yes	Yes	Yes
School Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	607	13,933	13,933	13,933	13,933
R- squared	0.163	0.024	0.024	0.026	0.018

Note: Robust standard errors appear in brackets (clustered at the teacher level). The dependent variable in Column (1) switches on if the teacher has taken two doses of COVID-19 vaccination as ascertained by COVID-19 certificates. This variable is standardized to mean zero and standard deviation one. The dependent variables in Columns 2, 3, 4 and 5 are standardized to mean zero and standard deviation one scores for Mathematics, English, General Knowledge, and Urdu. The Fraction of Role Model Treated Teachers is the proportion of teachers treated with the Role Model treatment within a school. Role Model treatment delivers the same message as the celebrity but via the medium of a female role model. The teacher-level controls include years of teaching experience, educational qualification, professional qualification, average teaching hours, class size, and pre-treatment vaccination status. The student-level controls include all student characteristics reported in Panel B of Table 1. *** p<0.01, ** p<0.05, * p<0.1.

Table S6: Impact of schools more intensely treated by the Role Model

Panel A: *Lottery, Cash 15%, Cash 30%*				
	(1)	(2)	(3)	(4)
	Full Vaccination		*Teachers' Absenteeism*	
Fraction of Role Model Treated Teachers	0.904	0.728	-0.0277	-0.0149
	(0.552)	(0.536)	(0.558)	(0.543)
Individual controls	No	Yes	No	Yes
School Fixed Effects	Yes	Yes	Yes	Yes
Observations	303	303	303	303
R-squared	0.010	0.039	0.000	0.015
Panel B: *Celebrity*				
Fraction of Role Model Treated Teachers	-0.966	-0.779	-0.519	-0.402
	(0.766)	(0.755)	(0.875)	(0.872)
Individual controls	No	Yes	No	Yes
School Fixed Effects	Yes	Yes	Yes	Yes
Observations	101	101	101	101
R-squared	0.013	0.080	0.004	0.052
Panel C: *Role Model*				
Fraction of Role Model Treated Teachers	0.248	0.181	-0.611	-0.637
	(0.775)	(0.750)	(0.749)	(0.761)
Individual controls	No	Yes	No	Yes
School Fixed Effects	Yes	Yes	Yes	Yes
Observations	101	101	101	101
R-squared	0.001	0.086	0.007	0.022
Panel D: *Placebo*				
Fraction of Role Model Treated Teachers	0.974	1.340	1.428*	1.689*
	(1.048)	(1.117)	(0.742)	(0.851)
Individual controls	No	Yes	No	Yes
School Fixed Effects	Yes	Yes	Yes	Yes
Observations	102	102	102	102
R-squared	0.010	0.042	0.029	0.065

Note: Robust standard errors appear in brackets (clustered at the teacher level). The dependent variable in Columns (1) and (2) switches on if the teacher is fully vaccinated against COVID-19. The dependent variable in Columns (3) and (4) is the total number of absences recorded 12 months post-treatment. The Fraction of Role Model Treated Teachers is the proportion of teachers treated with the Role Model treatment within a school. Role Model treatment delivers the same message as the celebrity but via the medium of a female role model. The teacher-level controls are the same as in the baseline specification. *** p<0.01, ** p<0.05, * p<0.1.

Table S7: Impact on Vaccinations and Student Achievement – Multiple Hypothesis Test

	(1)	(2)	(3)	(4)	(5)
	Full Vaccination	*Math*	*English*	*General Knowledge*	*Urdu*
Role Model	0.374	0.110	0.146	0.133	0.144
p-value	(0.013) **	(0.013) **	(0.002) ***	(0.004) ***	(0.001) **
Sharpened q-value	[0.007] **	[0.007] ***	[0.006] ***	[0.006] ***	[0.006] **
Individual Teacher Controls	Yes	Yes	Yes	Yes	Yes
School Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	607	13,933	13,933	13,933	13,933
R- squared	0.163	0.013	0.015	0.012	0.015

Note: p-values from our baseline regressions appear in parentheses for comparison, while Anderson q-values are reported in square brackets. Note that the sharpened q-values can be less than unadjusted p-values when several hypotheses are rejected, because if there are many true rejections, you can tolerate several false rejections too and still maintain a low false discovery rate.The dependent variable in column (1) switches on if the teacher has taken two doses of COVID-19 vaccination as ascertained by COVID-19 certificate. This variable is standardized to mean zero and standard deviation one. The dependent variables in Columns 2, 3, 4 and 5 are standardized to mean zero and standard deviation for Mathematics, English, General Knowledge, and Urdu test scores. Role Model emphasizes the same message as the celebrity but via the medium of a female role model. The teacher-level controls include years of teaching experience, educational qualification, professional qualification, average teaching hours, class size, and pre-treatment vaccination status. The student-level controls include dummies for student grade (i.e., KG, Nursery, Prep, one, two, three, four, five and six class) and pre-treatment math scores. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table S8: Impact on Vaccinations and Student Achievement – Randomization Inference

	(1)	(2)	(3)	(4)	(5)
	Full Vaccination	*Math*	*English*	*General Knowledge*	*Urdu*
Role Model	0.374	0.110	0.146	0.133	0.144
	(0.013)**	(0.013)**	(0.002)***	(0.004)***	(0.001)***
	{0.011}***	{0.001}***	{0.001}***	{0.001}***	{0.001}***
Individual Teacher Controls	Yes	Yes	Yes	Yes	Yes
School Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	607	13,933	13,933	13,933	13,933
R- squared	0.163	0.013	0.015	0.012	0.015

Note: p-values from our baseline regressions appear in parentheses for comparison, while p-values from randomization inference due to Heß (2017) are reported in curly brackets. The dependent variable in column (1) switches on if the teacher has taken two doses of COVID-19 vaccination as ascertained by COVID-19 certificate. This variable is standardized to mean zero and standard deviation one. The dependent variables in Columns 2, 3, 4 and 5 are standardized to mean zero and standard deviation for Math scores, English scores, General Knowledge scores, and Urdu scores about six months after the treatment. Lottery is a dummy variable that switches on when the teacher has given Lottery treatment i.e. opportunity to win a "lucky draw" of 10 times her monthly salary, Cash 15% stands a cash award equivalent to 15% of teachers monthly salary, while the Cash 30% stands for dummy switches on when the teacher has given cash equivalent to about 30% of her monthly salary. Celebrity treatment requests for vaccination by a prominent celebrity. Role Model emphasizes the same message but via the medium of a female role model. The teacher-level controls include years of teaching experience, educational qualification, professional qualification, average teaching hours, class size, and pre-treatment vaccination status. The student-level controls include dummies for student grade (i.e., KG, Nursery, Prep, one, two, three, four, five and six class) and pre-treatment math scores. *** p<0.01, ** p<0.05, * p<0.1.

Table S9: Robustness to different Clustering

	Fully Vaccinated - Standardized			
	Clustered at Teacher level	Clustered at School level	Clustered at City level	Clustered at State Capital level
	(1)	(2)	(3)	(4)
Lottery	-0.144	-0.144	-0.144	-0.144
	(0.140)	(0.157)	(0.108)	(0.0649)
Cash 15%	-0.0782	-0.0782	-0.0782	-0.0782
	(0.137)	(0.119)	(0.176)	(0.0396)
Cash 30%	0.0591	0.0591	0.0591	0.0591
	(0.139)	(0.143)	(0.184)	(0.0923)
Celebrity	0.00251	0.00251	0.00251	0.00251
	(0.138)	(0.173)	(0.119)	(0.0171)
Role Model	0.374**	0.374**	0.374**	0.374*
	(0.150)	(0.142)	(0.164)	(0.0356)
Individual Teacher Controls	Yes	Yes	Yes	Yes
School Fixed Effects	Yes	Yes	Yes	Yes
Observations	607	607	607	607
R-squared	0.163	0.163	0.163	0.163

Robust standard errors appear in brackets (clustered at the teacher level). The dependent variable switches on if the teacher has taken two doses of COVID-19 vaccination as ascertained by their COVID-19 certificate. This variable is standardized to mean zero and standard deviation one. In Column (1) Lottery is a dummy variable that switches on when the teacher has given Lottery treatment i.e. opportunity to win a "lucky draw" equivalent to about 10 times teachers' monthly salary, Cash 15% stands a cash award equivalent to 15% of teachers' monthly salary, while the Cash 30% stands for dummy switches on when the teacher has given cash equivalent to about 30% of her monthly salary. Celebrity treatment requests for vaccination by a prominent celebrity. Role Model delivers the same message but via the medium of a female role model. The teacher level controls include years of teaching experience, educational qualification, professional qualification, average teaching hours, class size, and marital status. *** p<0.01, ** p<0.05, * p<0.1.

Table S10: Robustness to Dropping Largest and Smallest Percentile Schools

Fully Vaccinated - Standardized				
	Dropped Schools with top 5% Teachers	Dropped Schools with top 10% Teachers	Dropped Schools with Bottom 5% Teachers	Dropped Schools with Bottom 10% Teachers
	(1)	(2)	(3)	(4)
Lottery	-0.197	-0.204	-0.161	-0.153
	(0.145)	(0.163)	(0.145)	(0.148)
Cash 15%	-0.0843	-0.138	-0.130	-0.127
	(0.143)	(0.159)	(0.141)	(0.142)
Cash 30%	0.0169	-0.0112	0.0228	0.0151
	(0.144)	(0.155)	(0.144)	(0.147)
Celebrity	-0.0394	-0.153	-0.00358	0.0217
	(0.143)	(0.154)	(0.139)	(0.143)
Role Model	0.327**	0.318*	0.365**	0.373**
	(0.156)	(0.169)	(0.154)	(0.156)
Individual Teacher Controls	Yes	Yes	No	No
School Fixed Effects	Yes	Yes	Yes	Yes
Observations	576	502	565	544
R-squared	0.166	0.155	0.158	0.161

Robust standard errors appear in brackets (clustered at the teacher level). The dependent variable switches on if the teacher has taken two doses of COVID-19 vaccination as ascertained by their COVID-19 certificate. This variable is standardized to mean zero and standard deviation one. Lottery is a dummy variable that switches on when the teacher has given Lottery treatment i.e. opportunity to win a "lucky draw" equivalent to about 10 times teachers' monthly salary, Cash 15% stands a cash award equivalent to 15% of teachers' monthly salary, while the Cash 30% stands for dummy switches on when the teacher has given cash equivalent to about 30% of her monthly salary. Celebrity treatment requests for vaccination by a prominent celebrity. Role Model delivers the same message but via the medium of a female role model. The teacher level controls include years of teaching experience, educational qualification, professional qualification, average teaching hours, class size, and marital status. *** p<0.01, ** p<0.05, * p<0.1.

Table S11: Robustness to different sets of Controls

	Fully Vaccinated - Standardized			
	(1)	(2)	(3)	(4)
Lottery	-0.144	-0.162	-0.143	-0.161
	(0.140)	(0.139)	(0.140)	(0.139)
Cash 15%	-0.0782	-0.0881	-0.0671	-0.0780
	(0.137)	(0.139)	(0.137)	(0.138)
Cash 30%	0.0591	0.0586	0.0618	0.0615
	(0.139)	(0.139)	(0.140)	(0.139)
Celebrity	0.00251	-0.0238	-0.00736	-0.0311
	(0.138)	(0.137)	(0.137)	(0.137)
	0.374**	0.360**	0.377**	0.363**
Role Model	(0.150)	(0.150)	(0.149)	(0.149)
	(0.150)	(0.142)	(0.164)	(0.0356)
Individual Teacher Controls	Yes	Yes	No	No
Pre-Treatment Outcomes	Yes	No	Yes	No
School Fixed Effects	Yes	Yes	Yes	Yes
Observations	607	607	607	607
R-squared	0.163	0.150	0.156	0.144

Robust standard errors appear in brackets (clustered at the teacher level). The dependent variable switches on if the teacher has taken two doses of COVID-19 vaccination as ascertained by their COVID-19 certificate. This variable is standardized to mean zero and standard deviation one. Lottery is a dummy variable that switches on when the teacher has given Lottery treatment i.e. opportunity to win a "lucky draw" equivalent to about 10 times teachers' monthly salary, Cash 15% stands a cash award equivalent to 15% of teachers' monthly salary, while the Cash 30% stands for dummy switches on when the teacher has given cash equivalent to about 30% of her monthly salary. Celebrity treatment requests for vaccination by a prominent celebrity. Role Model delivers the same message but via the medium of a female role model. The teacher level controls include years of teaching experience, educational qualification, professional qualification, average teaching hours, class size, and marital status. *** p<0.01, ** p<0.05, * p<0.1.

Appendix S2. Consent, Survey Instrument and Flow Chart

Appendix S2.1. Consent

For teachers:

I agreed to participate in the research study. I understand the purpose and nature of this study and I am participating voluntarily. I understand that I can withdraw from the study at any time, without any penalty or consequences.

Yes ◉ No ◉

I grant permission for the data generated from this survey to be used in the researcher's publications on this topic.

Yes ◉ No ◉

I grant permission to researchers to use my anonymized information for research purposes and this includes my personal data with PEN.

Yes ◉ No ◉

For parents/caregivers:

I grant permission to researchers to use my son or daughter’s anonymized information for research purposes and this includes the personal data with PEN.

Yes ◉ No ◉

Appendix S2.2. Transcript of Structured Discussion Questions

Following teach treatment video, teachers are prompted the following three questions:

Q1. What do you think was the main message of the video?

Q2. Did you find the video useful?

Q3. How can you apply the video lessons in your life?

Appendix S2.3. Survey Instrument: Gender Rights Index Statements

Likert Scale:

1. Totally Disagree
2. Disagree
3. Neutral
4. Agree
5. Totally Agree

S1. Women should be allowed to work outside the home.

S2. Women and men should have equal rights to jobs.

S3. I have no problem with my sister or female cousin from working outside the home.

S4. Daughters should have a similar right to inherited property as sons.

S5. Women and men should have equal rights to get an education as men.

S6. Wives should not be less educated than their husbands.

S7. Boys should not get more opportunities and resources for education than girls

S8. It would be a good idea to elect a woman as the village Sarpanch (local politician).

S9. Women and men have equal rights to be President or Prime Minister.

S10. Domestic violence by husbands cannot be justified.

S12. Women should not necessarily get married before her 25th Birthday.

S13. Women who give birth to a son need not be honored in the family.

S14. A woman with five daughters should not be under social pressure to bear a son.

S15. Laws should be passed to ban dowry.

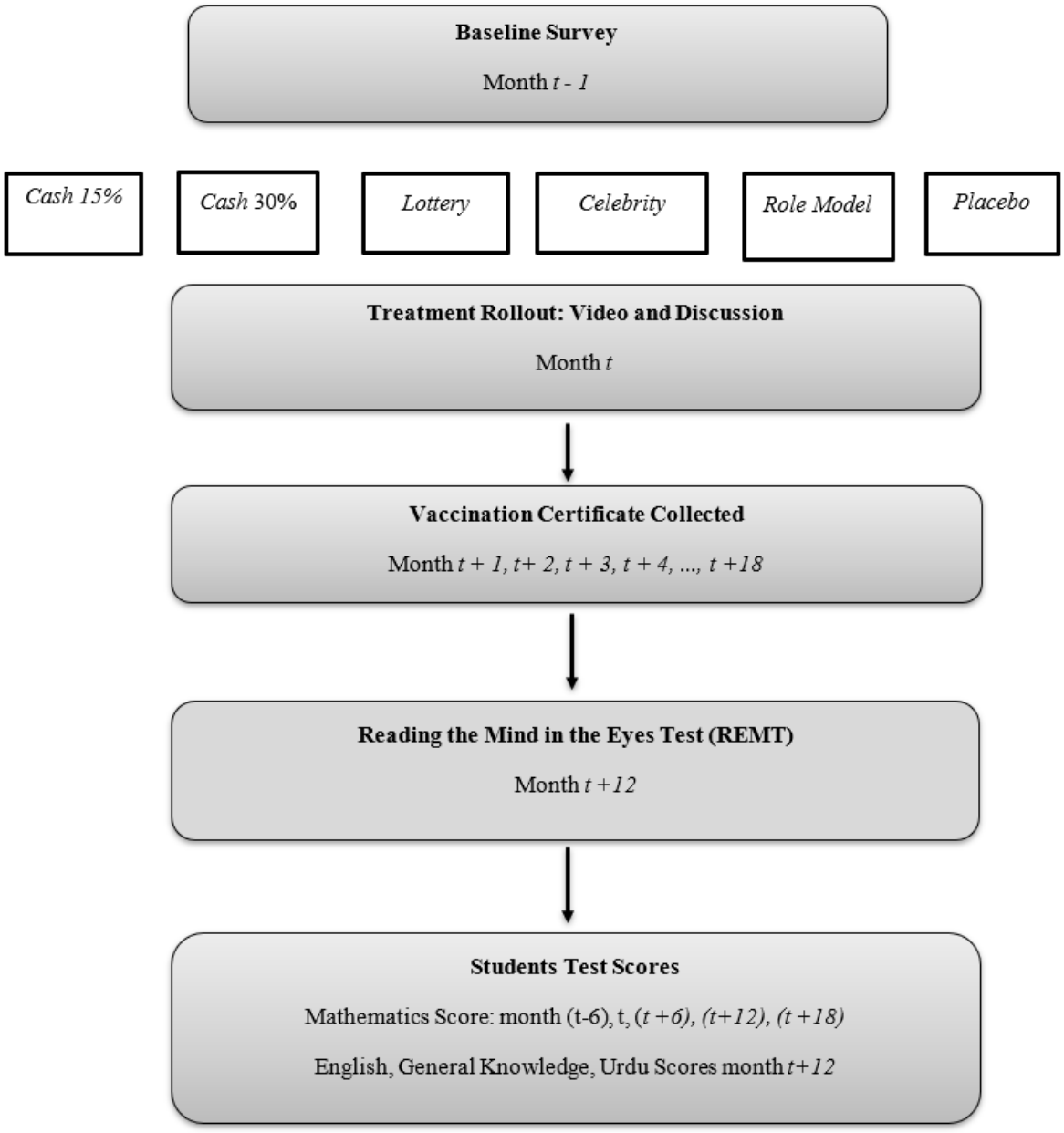
S16. Under Article 35 of the Constitution of Pakistan & Judgment of Federal Shariat Court, the consent of `Wali' is not required and a sui juris Muslim female can enter into a valid Nikah / Marriage under her own freewill without the consent of Wali. How much do you approve of this legal right of women to enter marriage under their own freewill.

Appendix S2.4. Procedure for Index Construction

Average effect size (AES) approach of Kling et al., 2004 and Kremer et al., 2009, is used to construct gender rights indices. The AES averages the normalized effects obtained from a seemingly unrelated regression in which each dependent variable is an index of several variables. Normalization is relative to the control group. Women's Rights Overall is an index consisting of all the statements concerning Women's Economic, Social, Legal and Political Rights i.e. all the 16 statements in section C2. Women's Economic Rights is an index combining women rights relevant to education and work outside home i.e. statements 1 to 7. Women's Political rights is an index of statements 8 and 9, while women's social rights is based on statements 10 to 14. Finally, the legal rights index combines statements 15 and 16. Specifically, Women's Rights Overall is an index consisting of all the statements concerning Women's Economic, Social, Legal and Political Rights. Women's Economic Rights is an index combining women rights relevant to education and work outside home i.e. statements "Women should be allowed to work outside the home". "Women and men should have equal rights to jobs". "I have no problem with my sister or female cousin from working outside the home". "Daughters should have a similar right to inherited property as sons".

“Women and men should have equal rights to get an education as men”. “Wives should not be less educated than their husbands”. “Boys should not get more opportunities and resources for education than girls.”. Women’s Political rights is an index of statements “It would be a good idea to elect a woman as the village Sarpanch (local politician).” “Women and men have equal rights to be President or Prime Minister.”, while women's social rights index is based on statements “Domestic violence by husbands cannot be justified” “Parents should seek their daughter's consent before fixing her marriage”. “Women should not necessarily get married before her 25th Birthday”. “Women who give birth to a son need not be honored in the family”. “A woman with five daughters should not be under social pressure to bear a son.”. Finally, the legal rights index combines statements “Laws should be passed to ban dowry. Under Article 35 of the Constitution of Pakistan & Judgment of Federal Shariat Court, the consent of `Wali’ is not required and a sui juris Muslim female can enter into a valid Nikah / Marriage under her own freewill without the consent of Wali. How much do you approve of this legal right of women to enter marriage under their own freewill.”

Appendix S2.5. Flow Chart



Note: The experiment was rolled out in early 2021 with the baseline, midline and endline data for teachers collected a month before, 12 months and 18 months post-treatment, respectively. The students' test scores are from standardized exams held 12 months following the treatment. For mathematics, we have test scores for 6, 12 and 18 months after the treatment, and vaccinations and absenteeism data is available at the monthly level up to 18 months post-treatment.