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Stigma and misconceptions in the time of the COVID-19 pandemic: A field experiment in India[☆]

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ABSTRACT

A hidden cost of the COVID-19 pandemic is the stigma associated with the disease for those infected and groups that are considered as more likely to be infected. This paper examines whether the provision of accurate and focused information about COVID-19 from a reliable source can reduce stigmatization. We carry out a randomized field experiment in the state of Uttar Pradesh, India, in which we provide an information brief about COVID-19 by phone to a random subsample of participants to address stigma and misconceptions. We find that the information brief decreases stigmatization of COVID-19 patients and certain groups such as religious minorities, lower-caste groups, and frontline workers (healthcare, police), and reduces the belief that infection cases are more prevalent among certain marginalized social and economic groups (Muslims, low caste, rural-poor population). We provide suggestive evidence that improved knowledge about the prevention and transmission of COVID-19 and reduced stress about the disease are important channels for the reduction in stigmatization.

1. Introduction

The COVID-19 pandemic is taking a tremendous toll on humanity. This is evident not only in terms of the significant loss of life but also the negative impact on the world economy caused by the uncertainty and disruptions to economic activities related to the lockdown and other containment measures (Altig et al., 2020; Barro et al., 2020). One consequence of the COVID-19 crisis that has received less attention is the hidden social costs associated with the stigma of the disease (Bagcchi, 2020; Chandrashekar, 2020). The concept of stigma has been applied to a wide array of circumstances and has been the subject of multidisciplinary investigation across the social sciences (Goffman, 1963; Link and Phelan, 2011). According to Major and O'Brien (2005, p.505), "people who are stigmatized have (or are believed to have) an attribute that marks them as different and leads them to be devalued in the eyes of others." (p. 505). Pandemics have a long history of causing fear (Pappas

et al., 2009), and leading to stigmatization of patients and of certain groups and communities that are believed to have high infection rates - leprosy, cholera and more recently HIV-AIDS being leading examples (Parker and Aggleton, 2003; Weiss et al., 2006; Perry and Donini-Lenhoff, 2010; Cohn, 2018; Fischer et al., 2019; Jedwab et al., 2020). Moreover, by engendering scapegoating against outgroups - in particular religious, ethnic and other minorities - pandemic conditions may lead to discriminatory practices and violence against these marginalized groups (Faulkner et al., 2004; Bartos et al., 2020; Van Bavel et al., 2020).

Stigmatization of COVID-19 can have negative public health implications, as it may lead people to avoid testing and respecting prevention measures, not to mention that it can have a direct heavy impact on the mental health of those stigmatized (Keusch et al., 2006; Quinn et al., 2014; Bharadwaj et al., 2017). As COVID-19 is a new disease and the facts surrounding how it is transmitted and can be treated require

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specialized knowledge, people are finding it challenging to discern truth from false information. Therefore, a leading cause of stigma could be the widespread misinformation and false beliefs about COVID-19 that are fueled by rumors circulating in the news (Bursztyn et al., 2020; Simonov et al., 2020; Romer and Jamieson, 2020) and spreading through the social media (Pennycook et al., 2020). The spread of misinformation related to diseases or major outbreaks is not new, but the problem has been exacerbated in the era of internet and social media (Wang, 2019). Indeed, large international organizations are recognizing the harmful role of misinformation in the fight against the pandemic: the WHO has issued a resolution in April 2020 to encourage its member states to redress the problem, while the UN has launched an initiative to encourage social media users to “pause, take care before you share” when it comes to sharing information online. Addressing stigma early on can be key in combatting a pandemic, as historic lessons from previous pandemics such as HIV-AIDS suggest (Chandrashekar, 2020).

This paper examines whether the provision of accurate and focused information about COVID-19 from a reliable source can reduce stigmatization and discrimination. To address this question, we carried out a field experiment in the state of Uttar Pradesh, India, in the summer of 2020 (June/July) with 2138 participants in collaboration with the Indian Institute of Technology (IIT), Kanpur. India is a very suitable country to examine our question as there is an abundance of COVID-19 stigma and discrimination reports in the media (Bhattacharya et al., 2020; Lancet, 2020), and a history of intense intergroup tension and exclusionary practices between religious groups and castes (Munshi, 2019). Examples include reports that Muslim individuals were blamed, threatened, and attacked for spreading the virus, non-Hindu doctors and patients being denied dignified burials, incidents of health care workers being attacked and asked to vacate their rented apartments due to the fear of contraction, members of the lower caste being blamed and discriminated for spreading the virus, and individuals fleeing quarantine facilities or hiding their symptoms or travel history out of fear of stigmatization (Bhattacharya et al., 2020; Ganguly, 2020). Although we focus on India, incidents of stigma and discrimination are not unique to India but have been widely reported in countries such as France, Italy, and the U.S. during the early days of the COVID-19 outbreak (Villa et al., 2020).

In our intervention, we randomly assigned participants to a treatment group that received by phone an information brief about COVID-19 and a control group that did not. We relied on direct communication via phone because mobile phone penetration in India is very high but smart phone ownership is low (Siddique et al., 2020). The brief contained information about (i) the infection transmission and prevention mechanisms; (ii) Ministry of Health & Family Welfare’s (MoHFW) guidelines to address social stigma associated with COVID-19; and (iii) the geographic distribution of infection rates relative to the geographic distribution of stigmatized groups. We collected detailed survey information about a range of outcomes before and after the intervention, namely: (i) knowledge about COVID-19 prevention and transmission; (ii) an incentivized measure of post-intervention knowledge about the geographic distribution of cases across Indian states; (iii) the extent to which people believe that particular groups (religious, castes, or front-line occupations) are to blame for the spread of COVID-19; (iv) whether people respect social distancing measures; and (v) measures of physical and mental health.

We find that the information intervention has a significant impact on all of the main five aforementioned outcomes. Relative to the control group, we find that participants who receive the information brief to: (i) have improved knowledge about the prevention and transmission of COVID-19; (ii) be less likely to believe that infection cases are more prevalent among certain outgroups that are in opposition to themselves (Hindus vs Muslims, low vs high caste, rich vs poor population); (iii) reduce stigmatization of COVID-19 patients, certain occupation groups (healthcare workers, sanitary workers, and the police) and marginalized groups such as religious minorities and lower-caste groups; (iv) increase

compliance with social distancing measures; and (v) report improved physical and mental health.

We then provide suggestive evidence that improved knowledge about the prevention and transmission of COVID-19 and reduced stress are possible channels for the reduction in attaching stigma to COVID-19 patients and their families. Thus, our results are consistent with the notion that misinformation or lack of information and fear and stress associated with COVID-19 are fuelling stigma and discrimination against COVID-19 patients and marginalized socio-economic groups. These findings suggest that designing interventions to combat misinformation and to relieve stress are key for preventing the deeply undesirable consequences of stigma and discrimination.

This paper relates to the growing literature on the COVID-19 pandemic that aims to understand the role of information on people’s beliefs and behavior related to the pandemic (Abel et al., 2021; Akesson et al., 2020; Banerjee et al., 2020; Bursztyn et al., 2020; Dhanani and Franz, 2020; Siddique et al., 2020). A broader literature studies the role of information on health behavior (Cawley and Ruhm, 2011). Dupas (2011) provides an overview of the evidence of the role of information on health behavior in the context of developing countries. Much of this literature, like our study, uses information experiments (Haaland et al., 2020) that allow clean identification of causal effects. To the best of our knowledge, none of this previous work has studied the issue of stigma and discrimination related to COVID-19, which is our focus. One notable exception is the study by Duan et al. (2020) which investigates self-perceived COVID-19 related stigma experienced by residents in Hubei province, China. Our focus is different as we examine the expression of stigmatizing beliefs toward other groups. In particular, this paper contributes to this literature by documenting causally how information can not only lead to better knowledge and higher adherence to protective measures, but also can correct misconceptions about the spread of the virus among different subgroups of the population, alleviate stress and anxiety about the disease, and reduce stigma. More broadly, the study relates to a wider literature on the role of information in overcoming stereotypes and discrimination in various contexts (e.g., Bohren et al., 2019; Bordalo et al., 2016; Ewens et al., 2014; Islam et al., 2021).

The rest of the paper is organized as follows. The next section provides background about the context in which the study takes place. Section 3 presents the information intervention and research design of our study. Section 4 presents the results, while Section 5 explores the plausible mechanisms. Finally, Section 6 offers some concluding remarks.

2. Background: COVID-19, stigma, and discrimination in India

With over 10 million confirmed cases of COVID-19 and more than 146,000 deaths as of December 2020 (Ministry of Health and Family Welfare, 2020), India has one of the largest number of confirmed cases in the world after the United States and Brazil. There have also been numerous reported cases of misinformation, stigmatization, and discrimination since the start of the COVID-19 outbreak in India (Bhattacharya et al., 2020; Lancet, 2020).

India also has a history of tension and conflict between religious groups, especially between Hindus and Muslims (Mitra and Ray, 2014) and of enduring discriminatory practices against members of the lower castes (Munshi, 2019). Uttar Pradesh (UP), the most populous state (with about 225 million) and the state with the largest Scheduled Caste (SC) in India, is of particular interest as it has the highest share of atrocities against SC population in India and has witnessed a near 50% increase in crimes against SC population between 2014 and 2018. The caste system divides Hindus into several hierarchies and has played an important role in India for centuries. At the bottom of this hierarchical system is SC, who continue to face discrimination and stigmatization despite the decline in the influence of caste in recent decades (Madheswaran and Attewell, 2007). The situation in UP became particularly

precarious with the advent of the COVID-19 crisis as more than half of the total confirmed cases in UP by late April in 2020 were linked to the Tablighi Jamaat Muslim event in the previous month in New Delhi. Several COVID-19 hotspots emerged in the district of Kanpur in UP. These patterns have heightened fear and stigma against religious minority and lower-caste groups across UP. Given that these traditionally disadvantaged and vulnerable groups have already suffered disproportionately due to the adverse health and economic effects of the pandemic, the increased stigmatization and discrimination against them would likely further worsen their wellbeing.

3. Information intervention and research design

The study was carried out in three stages. In the first stage, which started in the first week of June 2020, we surveyed individuals (by phone) to collect information about their social and economic backgrounds, their attitudes towards individuals from different religious, caste, and other social backgrounds, their knowledge about COVID-19, their concerns regarding the pandemic, information about their physical and mental health, their sources of information, and their modes of communication with friends and relatives.

In the second stage, which started in the third week of June 2020, we implemented a pre-registered randomized controlled trial (RCT) wherein we randomly assigned half of the sample to the control group and the other half to the treatment group. The treatment group received information about COVID-19, such as transmission and preventive mechanisms, Ministry of Health & Family Welfare's (MoHFW) guidelines that aim to reduce social stigma, and the geographic distribution of case infection rates relative to the geographic distribution of demographic and social groups for selective states (see online Appendix C). In our understanding, these MoHFW guidelines were unlikely to have systematically reached our participants at the time of the experiment.

There are ten items related to the transmission and preventive mechanisms and the MoHFW guidelines. In particular, items 1–3 of the information brief provided information about how COVID-19 is transmitted. Item 4 is an adaptation of MoHFW guidelines that aims to dispel misinformation about the spread of the disease across different religious, caste and income groups. In the adaptation, we specifically include the actual distribution of case infection rates across a selected number of states to highlight that states with a high concentration of lower-caste groups, Muslim individuals, and rural poor population are not states with larger shares of case infection rates. Item 5 provides information about what to do if one develops symptoms, while item 7 about what to do if someone they know gets infected; item 6 provides information about the prevalence of COVID-19 in India relative to other countries; items 8 and 9, provide information about the role and appropriate treatment of health professionals, the police, sanitary workers, and foreign nationals; finally, item 10 urges to trust only information coming from experts.

In the third stage, which took place at the end of July and early August (more than a month after the information intervention), we followed up with the sampled individuals to collect information similar to that collected in the baseline as well as an incentivized measure of beliefs about the geographic distribution of case infection rates relative to the geographic distribution of demographic and social groups for selective states (online Appendix B and Appendix C). The data collected in the follow up survey allow us to assess if the intervention is effective in improving knowledge about transmission and prevention of COVID-19, reducing stigmatization and discrimination against minorities and vulnerable groups, and improving adherence to the physical distancing directives and measures of wellbeing.

By asking incentivized questions about beliefs in the follow-up survey, we ensure that we have at least some outcome measures that are less susceptible to any potential social desirability bias and experimenter demand effect. We collected the incentivized measure of beliefs in the follow-up survey but not in the baseline survey for several reasons. First,

we deliberately kept the baseline phone survey short to ensure that the baseline survey was completed and the experiment implemented in a timely manner given the urgency of the problem. Second, by not including the incentivized questions in the baseline, we minimized the likelihood of participants finding the process demanding and ensured that they were more likely to respond in the follow-up survey. Third, we kept the cost of the experiment low by not asking the incentivized questions in the baseline. Fourth, given that we balanced a range of baseline characteristics between treatment and control, it is unlikely for there to be differences between treatment and control in the incentivized questions at baseline.

Note that the study was carried out in collaboration with the Indian Institute of Technology (IIT) Kanpur, which is a well known and trusted institution. The university has a good reputation in India, and in this region particularly, and this helped us to reach out to the study participants. This also ensures that the content of the information brief was delivered to participants from a reliable source they are familiar with and trust. In order to reduce social desirability bias and experimental demand effects, we had a different enumerator survey (phone) a person in the endline than the one in the baseline, and a third researcher delivering the information brief for the treatment group. In the endline, the enumerators did not mention or remind anything about the information provided during the intervention to the treatment group to minimize any bias.

3.1. Hypotheses

As a large part of the information treatment educates participants about how the virus may spread, how to protect themselves against infection, what symptoms COVID-19 patients may exhibit, what risks are associated with COVID-19, and where to seek medical help, we expect treated participants' knowledge about the prevention and transmission of COVID-19 to improve. The improvement in knowledge should then translate into behaviors, such as adherence to social/physical distancing. Our information treatment also informs participants about the geographic distribution of case infection rates relative to the geographic distribution of demographic and social groups for selective states. If effective, the information will dispel misperceptions about the infection rates among certain marginalized groups. Thus, we expect that the treatment would lead to improved knowledge, greater adherence to social/physical distancing, and lower likelihood for participants to believe that infection cases are more prevalent among certain demographic and social economic groups.

With improved knowledge about transmission and prevention of COVID-19 and the associated behavioral changes, we expect physical health to improve and COVID-19 symptoms to decrease. The reasons are as follows. Other viruses that cause a wide range of common diseases, such as the Influenza and the common cold, also transmit and can be prevented similarly (Jones, 2020). Given improved knowledge and behavioral changes such as wearing masks, maintaining social distancing, the likelihood of them being infected by respiratory viruses is also expected to decrease. Moreover, as treated participants are encouraged to seek medical help when in doubt and also rest adequately to keep their immune system strong, we expect treated participants to have better physical health and fewer COVID-19 symptoms than participants in the control group.

The effects of the information treatment on mental health, life satisfaction, and information need are, however, a priori ambiguous. For example, it is possible that after learning more about the transmission mechanisms and prevention methods of the disease, participants become more stressed and anxious about their health and wellbeing due to the heightened saliency of the disease (Selinger et al., 2013). On the other hand, past experimental evidence of a telephone-based informational and counselling intervention among newly diagnosed glaucoma patients suggests that our information treatment may reduce stress and anxiety and improve life satisfaction (Skalicky et al., 2018). It is possible

that treated participants become less anxious after learning more about the nature of COVID-19 and how to minimize the risks of infection and disease. The net effect of the information treatment on mental health will thus depend on the relative strengths of the positive effect and negative effect. If mental health and physical health both improve as a result of the information treatment, then life satisfaction is also likely to improve too. Similarly, the effect of heightened awareness about COVID-19 may have an ambiguous effect on the demand for news. On the one hand, providing information could make people more inquisitive and hence search for additional information. On the other hand, high-quality information might make people assured of knowing enough and reduce the curiosity about COVID-19. In sum, the intervention is expected to have ambiguous effects on mental health, stress, anxiety, life satisfaction, and information need.

The lack of proper knowledge and the fear and stress about the disease may fuel stigmatization and discrimination toward outgroups (Schaller and Neuberg, 2012; Demirtaş-Madran, 2020; Ransing et al., 2020). As the information treatment is expected to improve knowledge about the transmission and prevention of COVID-19 and to potentially reduce stress and anxiety, the tendency for treated participants to stigmatize and discriminate against various stigmatized and marginalized social, religious, economic and occupational groups as well as COVID-19 patients and their family members may decrease. In sum, the above discussions lead us to the following hypotheses:

H1. (Stigma). Treated participants: (a) reduce stigmatization against COVID-19 patients and their family members; and (b) reduce stigmatization against specific social, religious, economic, and occupational groups, especially against social, religious and economic outgroup members.

H2. (Knowledge). Treated participants: (a) improve knowledge about the prevention and transmission of COVID-19, and increase adherence to social/physical distancing; and (b) reduce the likelihood of believing that infection cases are more prevalent among the Muslim population, lower-caste population, and/or rural poor population.

H3. (Health). Treated participants experience improved physical health and reduced COVID-19 symptoms.

3.2. Data

Our study took place in 40 localities across the Kanpur Nagar district of Uttar Pradesh in India (see the map of the region in the online Appendix A). The 40 localities were selected as the average demographic, economic, and social characteristics of households in these localities are similar to the average characteristics of households in Uttar Pradesh. The randomization was carried out at the individual level such that individuals within a locality could be either in the treatment or the control group. Given that India was in lockdown during the time of the intervention and Kanpur in particular was a hotspot under extended lockdown in most places until the end of July 2020, we expect that the information spillover within locality from treatment to control participants was minimal. Our sample consists of 2138 individuals and their average demographic and socioeconomic characteristics are similar to the averages of individuals in Uttar Pradesh (see the last column of Table A1 in the online Appendix). The individuals in our sample had previously participated in a correspondence study on caste discrimination in 2017, in which they were invited to receive a free health check delivered by a mobile clinic (Islam et al., 2020). We could reach to 2138 of these participants in the baseline. 2117 of these individuals also responded to the follow-up survey. The attrition rate of 1% is statistically similar between the treatment and control group.

Both the baseline and follow-up surveys collect questions related to household composition, demographic and socio-economic characteristics of the household, income and employment status, general attitudes and trust towards different castes and religions, stress and anxiety, self-

reported health, life satisfaction, concerns and anxiety related to the COVID-19 outbreak, opinions and perceptions about COVID-19, knowledge about COVID-19, sources of information, and modes of communication with friends and relatives. In the follow-up survey, we also asked additional incentivized questions about the distribution of infection rates in selective Indian states, which we did not ask in the baseline.

3.2.1. Outcomes

We collected a number of outcomes concerning stigma and knowledge directly related to COVID-19 as well as physical and mental health. Our primary outcomes of interest, which we believe are directly impacted by our intervention are: (1) Stigma index, which is based on five, 5-point Likert scale questions about stigmatization of COVID-19 patients and their family members; (2) Perception that COVID-19 is spread in India, which is based on ten, 5-point Likert scale questions about whether certain groups (nationality/caste/religion/poverty/occupation) are responsible for the spread of COVID-19; (3) Knowledge about COVID-19 prevention and transmission; (4) Knowledge about the distribution of infection cases in six states to measure (incentivized) biased belief or prejudice against religious/vulnerable groups; (5) Compliance with social/physical distancing; (6) Self-reported physical health; and (7) Symptoms of COVID-19.

The secondary outcomes include variables that could potentially be impacted by our intervention: Self-reported mental health; Stress measured using the Perceived Stress Scale (PSS) (Cohen et al., 1997) – ten, 5-point Likert scale questions; Concerns about the COVID-19 outbreak using Nine, 5-point Likert scale questions about various concerns/anxiety related to the COVID-19 outbreak; Life satisfaction; and Demand for information (frequency of news).

Table A2 in online Appendix A provides a summary of how the various outcome variables are defined and measured, while online Appendix B enlists the underlying questions that comprise the various indices that we construct.

3.3. Balancing and summary statistics

Balance tests using data collected in the baseline are reported in Tables A3-A5 in online Appendix A. As can be seen, our treatment and control groups are balanced in terms of individual and household characteristics (Table A3), and the various baseline measures of outcomes (Tables A4-A5).

Table A1 in online Appendix A presents summary statistics of the main individual characteristics. Our sample is balanced in terms of gender. Participants are on average 39 years old, mostly married, and in majority are Hindus (78%), from a low-caste background (63%), and reside in a rural area (64%). About 10% of the sample have college education and are employed. Slightly more than half are below the poverty line. Summary statistics of the follow-up outcomes by treatment group are provided in Table A6.

Next, we summarize participants' beliefs regarding whether particular groups are responsible for spreading COVID-19, drawing on their survey responses in the baseline. In particular, Figure A1 displays these average beliefs for the various groups (measured on a 1–5 scale, where 1 is for strongly disagree and 5 strongly agree). In panel (A), we see that among foreign nationals, healthcare workers, sanitary workers, and the police, foreign nationals are perceived to be the most responsible for the spread of COVID-19. For the three other groups the average responses are very close to three indicating that respondents do not perceive these groups as particularly responsible. Panel (B) shows average beliefs vis-à-vis outgroups; we see that Muslim individuals are perceived by Hindu participants as responsible for the spread of COVID-19. In contrast, general-caste individuals, backward-caste individuals, and Hindu individuals are not perceived by their out-group members as responsible for the spread of COVID-19, as the average response is near two, indicating that on average outgroup members tend to disagree with the

statement.

4. Results

4.1. Empirical framework

To assess the impact of the intervention on the various outcomes, we estimate regressions of the following form:

$$y_{iv1} = \alpha + \beta T_i + \gamma X_{iv} + \delta y_{iv0} + \theta_v + \varepsilon_{iv1}$$

where y_{iv1} is an outcome of individual i living in locality v measured in the endline. This outcome variable can be a primary or secondary outcome of interest, as detailed in section 3. The dummy variable T takes the value of one if the individual is assigned randomly to the treatment group, and zero if otherwise. The coefficient of interest is β , which captures the causal effect of the treatment on an outcome. We also include in the specification a vector of individual and household characteristics X_i : age, religion (Hindu or Muslim) and caste (General or backward caste such as SC/ST/OBC) of the respondent, gender, disability status, marital status, college educated dummy, employed dummy, household size, below poverty level dummy. When available, we also control for the baseline measure of a particular outcome, y_{iv0} . Excluding y_{iv0} and other individual and household controls does not affect our results. θ_v denote locality fixed effects. Finally, the term ε indicates the error term. We cluster standard errors at the locality level. To account for the large set of outcomes that we consider, we also report the Family Wise Error Rate (FWER) adjusted p-values corrected for multiple hypotheses testing using the free step-down resampling approach of Westfall and Young (1993).

4.2. Stigma related to COVID-19

We begin by presenting results on whether the information provision affected stigma associated with COVID-19. In particular, in column 1 of Table 1, Panel A, we estimate the impact of the information treatment on the stigma index (the index ranges from 5 to 25), which measures the strength of the stigma that respondents' attach to people who have had COVID-19 and their families. We find that the treatment leads to a

substantial and statistically significant reduction in the value of the stigma index. Given that the standard deviation of endline stigma index is 2.5 among the control group, the treatment coefficient of -7.01 suggests a sizeable effect, amounting to a reduction of stigmatization by 2.8 standard deviations.

This provides evidence in support of **Hypothesis 1a**.

In the remaining columns of Table 1, Panel A, we present results on the extent to which respondents believe that foreign nationals and frontline workers (i.e., healthcare workers, sanitary workers, and the police) are primarily responsible for spreading COVID-19. In all cases, beliefs are measured on a scale from 1 to 5, where five indicates a stronger agreement. We find that across the board, the treatment leads to a strong and statistically significant reduction in these beliefs. The estimated coefficients between -1.7 and -2.5 indicate that the difference is as much as moving from agreeing with the statement to disagreeing or strongly disagreeing with the statement. These effect sizes are substantial, as the reductions are in the order of at least 2 standard deviations of the control group.

In Table 1, Panel B, we perform further analysis to examine how the treatment has impacted perceptions toward particular outgroups that are in opposition, with regards to their responsibility for the spread of COVID-19. Specifically, we look at the beliefs of the general caste vis-à-vis the backward caste, Muslims versus Hindus, and poor versus rich, and vice-versa for each case. The results indicate that even for these groups with oppositional identities that might be more prejudiced toward each other, the intervention leads to a substantial reduction in the attribution to the outgroup of spreading COVID-19. For example, we estimate a reduction of 2.5 of Hindu respondents' beliefs in the treatment group that Muslims are spreading the disease relative to the control group, which translates to a reduction of 3.5 standard deviations. Here again all the treatment effects are sizeable. The estimated coefficients that range between -2 and -3 indicate that the reductions are as much as going from agreeing with the statement to strongly disagreeing with the statement or in the order of 2.6–4.6 standard deviations of the control group.

These results provide evidence in support of **Hypothesis 1b**.

Table 1
Impact on COVID-19 stigma.

Panel A	Stigma Index	Perception that COVID-19 is spread in India by				
		Foreign nationals	Health care workers	Sanitary workers	Police	
Treatment	-7.008*** (0.372)	-2.449*** (0.054)	-2.305*** (0.058)	-2.172*** (0.055)	-1.705*** (0.053)	
Effect size	-2.834	-3.733	-3.188	-2.971	-2.255	
FWER p-values	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	
R-squared	0.733	0.730	0.652	0.673	0.501	
Control Mean	19.598	4.510	4.089	3.938	3.815	
No. of observations	2117	2117	2117	2117	2117	
Panel B	Perception that COVID-19 is spread in India by					
Outgroup:	Backward	General	Muslim	Hindu	BPL	APL
Sub-sample	General	Backward	Hindu	Muslim	APL	BPL
(respondent)						
Treatment	-2.092*** (0.110)	-2.055*** (0.060)	-2.534*** (0.049)	-2.918*** (0.061)	-2.180*** (0.086)	-2.150*** (0.081)
Effect size	-2.728	-2.823	-3.510	-4.574	-2.633	-3.228
R-squared	0.654	0.574	0.847	0.884	0.688	0.639
Control Mean	3.921	3.979	4.470	4.211	3.797	4.094
No. of observations	776	1341	1667	450	967	1150

Note: All regressions also include controls for age, religion (Hindu or Muslim) and caste (General or backward such as SC/ST/OBC) of the respondent, gender, disability status, marital status, college educated dummy, employed dummy, household size, below poverty level dummy and locality fixed effects. See online Appendix B for variable definitions. Effect size is measured as treatment coefficient divided by the standard deviation of control group in endline for a continuous variable. Standard errors are clustered at the locality level. ***p < 0.01, **p < 0.05, *p < 0.1. The Family Wise Error Rate (FWER) adjusted p-value was estimated using the free step-down resampling approach of Westfall and Young (1993).

4.3. Knowledge and prevention of COVID-19

We next present results related to knowledge about COVID-19 prevention and transmission and on whether participants adhere to social distancing measures, which are shown in Table 2, columns 1 and 2, respectively. The intervention has a statistically significant impact on both these outcomes. In the case of knowledge, which is measured on a scale from 0 to 12, there is a 1.3 points improvement. Given that the standard deviation of endline knowledge among the control group is 1.5, this effect size is as much as 0.85 standard deviations. We also find that individuals in the treatment group are 27.3 pp less likely to report having had any direct contact with friends and relatives in the last week. Given that the mean of the control group is 28.6%, the estimate implies almost perfect compliance with social distancing rules.

This evidence provides support for **Hypothesis 2a**.

We next examine whether the intervention affects participants' knowledge about the geographic distribution of infection cases in Indian states. In particular, we focus on the prevalence of COVID-19 cases in Indian states that have either high or low presence of Muslims, people belonging to the backward caste, and poor people. Recall that information about the share of COVID-19 cases in each of these states and the share of one of these groups was provided to participants in the treatment group during the intervention. Participants are asked to indicate what share of the total COVID-19 cases a certain state with a particular share of caste, religious or economic group has, choosing among the following four options: [1] less than 5%; [2] between 5% and 10%; [3] between 10% and 15%; [4]; more than 15%. Note that we incentivized this part of the experiment; participants earned 25 Indian Rupees for correctly answering a question.

We estimate the effect of the intervention on participants' answers to these questions using as dependent variable the number of correct answers provided out of 6. Because we are interested in knowing whether the intervention corrects prejudiced or biased beliefs, we focus on the direction of the answer and define a "correct" answer when the participant has chosen one of the two options on the left when the correct answer is in one of them, or the one of the two options on the right when the correct answer is in one of them. We are able thus to assess whether the information provision leads participants to choose the right or close to the right answer. Results are presented in Table 3. Note that in online Appendix Table A7, we present results using as dependent variable a dummy variable that takes the value 1 if the participant has chosen exactly the correct answer and zero otherwise. In column 1, we find that overall, the intervention led to a substantial improvement in the number of answers in the correct direction. As compared to the control group, respondents in the treatment group gave 1.1 additional answers in the

Table 2
Impact on COVID-19 knowledge & prevention, and health.

	Knowledge	Physical contact	Physical health	COVID-19 symptoms
	(1)	(2)	(3)	(4)
Treatment	1.288*** (0.145)	-0.273*** (0.019)	0.381*** (0.042)	-0.015* (0.008)
Effect size	0.851	-0.955	0.473	-0.523
FWER p-values	[0.000]	[0.000]	[0.000]	[0.046]
R-squared	0.456	0.215	0.158	0.040
Control Mean	9.865	0.286	3.911	0.029
No. of observations	2117	2117	2117	2117

Note: All regressions also include controls as in Table 1. See online Appendix B for variable definitions. Effect size is measured as treatment coefficient divided by the standard deviation of control group in endline for a continuous variable and the mean of control group in endline for a dummy variable. Standard errors are clustered at the locality level. ***p < 0.01, **p < 0.05, *p < 0.1. The Family Wise Error Rate (FWER) adjusted p-value was estimated using the free step-down resampling approach of Westfall and Young (1993).

correct direction. The effect size is equivalent to an increase of 0.86 standard deviations.

This evidence provides support for **Hypothesis 2b**.

4.3.1. Physical health

In columns 3 and 4 of Table 2, we show results on self-reported physical health and on the development of COVID-19 related symptoms. We find that the treatment has led to a significant improvement in physical health, measured on a 1–5 scale. The estimated coefficient of 0.38 is equivalent to an improvement in physical health of 0.47 standard deviations. We also find a significant reduction in reporting of COVID-19 symptoms of 1.5 pp, which is equivalent to 50% reduction from the endline mean of the control group.

This evidence provides support for **Hypothesis 3**.

4.3.2. Secondary outcomes

We next examine the impact of the information treatment on selected secondary outcomes we collected: mental health, perceived stress, anxiety, life satisfaction, and demand for news. Table 4 presents these results. Several interesting findings emerge.

First, we find that the intervention improves mental health and reduces stress and anxiety substantially. To get a sense of the magnitude of the effect, we find that treated group's mental health, measured on a 1–5 scale, improves by as much as 0.82 (column 1), or an increase of 1.04 standard deviations of the control group. The likelihood of being stressed for the treated group decreases by 75 percentage points (column 3), which translates to almost 76% of the mean of the control. Similarly, we find a substantial reduction in anxiety stemming from COVID-19. The treatment coefficient of -12.4 is equivalent to a reduction in anxiety index of 2.9 standard deviations of the control group (column 4). In the next section, we examine whether this substantial reduction in stress acts as a mediator for the effect that the intervention has on our measures of stigmatization.

Second, we find a substantial improvement in life satisfaction (column 5) for the treated group. The treatment coefficient of 1.25 amounts to an improvement of roughly 1.3 standard deviations of the control group. We also find a slight increase in the frequency of checking the news (column 6), but the effect is small and statistically significant only at 10% level. This result suggests that the information treatment heightened information awareness and information consumption.

All in all, the information brief seems to have significantly alleviated people's stress and anxiety stemming from the COVID-19 crisis.

5. Understanding the role of knowledge and stress for COVID-19 stigma

Next, we aim to understand the channels through which the information treatment leads to reduction in stigma. Two possible leading factors that fuel stigmatization and discrimination toward outgroups are the lack of proper knowledge of COVID-19 facts and the fear and stress about the disease (Schaller and Neuberg, 2012; Demirtaş-Madran, 2020; Ransing et al., 2020). To provide a preliminary assessment of whether these factors are at play in our sample, we first investigate whether there is any correlation between stigma and knowledge of COVID-19 facts and stress in the baseline. Table 5 shows that a one-point increase in baseline knowledge is associated with a 0.51-point decrease in baseline stigma index (column 1), whereas a one-point increase in baseline PSS is associated with a 0.11-point increase in baseline stigma index (column 2). When we include both baseline knowledge and baseline PSS in the same specification, we still find the association to be -0.47 and 0.09 respectively (column 3). Although these are just correlations and can be driven by various factors, they suggest that knowledge and stress are potential channels for the formation of stigma given that less knowledgeable and more stressed individuals are more likely to have stigma against COVID-19 patients and their family members.

To further probe the role of knowledge and stress as channels for the

Table 3
Impact on knowledge about geographic distribution of COVID-19 cases (correct direction).

	Total correct directions (out of 6)						
	Overall	General	Backward	Hindu	Muslim	APL	BPL
Treatment	1.102*** (0.251)	1.379*** (0.353)	0.946*** (0.268)	1.287*** (0.313)	0.483*** (0.138)	1.147*** (0.286)	1.077*** (0.274)
Effect size	0.860	1.062	0.745	0.988	0.439	0.914	0.827
R-squared	0.170	0.250	0.160	0.217	0.105	0.212	0.163
Control Mean	2.594	2.528	2.632	2.475	3.022	2.559	2.622
No. of observations	2117	776	1341	1667	450	967	1150

Note: All regressions also include controls as in Table 1. See online Appendix B for variable definitions. Effect size is measured as treatment coefficient divided by the standard deviation of control group in endline for a continuous variable. Correct direction captures whether a response is towards the right direction (top two or bottom two choices) regarding the share of case infection rates in a particular state with a particular share of demographic or economic group in India. Standard errors are clustered at the locality level. ***p < 0.01, **p < 0.05, *p < 0.1.

Table 4
Impact on secondary outcomes.

	Mental health	PSS	PSS dummy	Anxiety index	Life satisfaction	Frequency of news
Treatment	0.821*** (0.045)	-19.723*** (0.880)	-0.751*** (0.034)	-12.403*** (0.779)	1.248*** (0.103)	0.164* (0.094)
Effect size	1.037	-2.936	-0.761	-2.890	1.271	0.145
FWER p-values	[0.000]	[0.000]	[0.000]	[0.009]	[0.009]	[0.085]
R-squared	0.274	0.798	0.645	0.754	0.411	0.427
Control Mean	3.510	30.608	0.987	34.977	6.027	4.161
No. of observations	2117	2117	2117	2117	2117	2117

Note: All regressions also include controls as in Table 1. See online Appendix B for variable definitions. Effect size is measured as treatment coefficient divided by the standard deviation of control group in endline for a continuous variable and the mean of control group in endline for a dummy variable. Standard errors are clustered at the locality level. ***p < 0.01, **p < 0.05, *p < 0.1. The Family Wise Error Rate (FWER) adjusted p-value was estimated using the free step-down resampling approach of Westfall and Young (1993).

Table 5
Knowledge, stress & COVID-19 stigma (at baseline & endline).

Variables of Interest	Stigma Index at baseline			Stigma Index at endline
	(1)	(2)	(3)	(4)
Treatment				-4.283*** (0.965)
Knowledge score	-0.508*** (0.104)		-0.466*** (0.104)	-0.438*** (0.077)
PSS		0.107*** (0.019)	0.090*** (0.020)	0.111*** (0.037)
Baseline Stigma Index				0.036 (0.037)
R-squared	0.215	0.196	0.232	0.766
Control Mean	12.618	12.618	12.618	19.598
No. of observations	2138	2138	2138	2117

Note: All regressions also include controls as in Table 1. See online Appendix B for variable definitions. Columns (1)–(3) uses knowledge score and PSS at baseline while column (4) uses knowledge score and PSS at the endline. Standard errors are clustered at the locality level. ***p < 0.01, **p < 0.05, *p < 0.1.

impact of the information treatment on stigma that we document above, we next re-estimate the regression models presented in Table 1, adding post-intervention knowledge index and post-intervention PSS index as additional controls. While post-intervention knowledge and post-intervention stress are outcomes of our intervention on their own right and therefore introducing them as right-hand-side variables suffers from a “bad” control problem (Angrist and Pischke, 2009), the aim of this accounting exercise is to assess to what extent addition of knowledge and stress absorbs any of the treatment effects that we estimated in Table 1. Our results remain robust if we use an alternative approach similar to Angrist et al. (2013) and Hahn et al. (2018) where we regress an outcome on these two potential factors and other controls for the sample of treated participants only.

Column 4 of Table 5 presents the estimates for endline stigma index.

The addition of knowledge and stress reduces (in absolute value) substantially the treatment effect on the stigma index from -7.01 (column 1 in panel A of Table 1) to -4.3, while knowledge itself has a negative and statistically significant coefficient and stress has a positive and statistically significant effect on the stigma index. These findings provide suggestive support for the proposition that improved knowledge (see Table 2, column 1) and reduced stress (see Table 4, column 2) are indeed contributing channels for the impact that the information treatment has on stigma.

For completeness, we also investigate whether improved knowledge and reduced stress are channels for the impact of the information treatment on the attitudes toward various outgroups. The results are reported in the online appendix (Table A.8). Briefly, we consistently find that the treatment effect on attitude toward an outgroup is reduced when both endline knowledge scores and endline stress index are included as explanatory variables. The effect of endline stress is consistently significant across all regressions, while the effect of endline knowledge score is less consistently significant across all regressions. This suggests that reduction in stress is a channel for the treatment effects we find on the perceptions that participants have about the role of these groups in spreading COVID-19 and on the beliefs about outgroups, whereas the role of improved knowledge, at least as measured by our index, is somewhat weaker.

Overall, this analysis provides suggestive evidence that both knowledge and stress are mediators of the treatment effect of the information intervention on stigma toward COVID-19 patients. We also find evidence consistent with stress being a more prominent driver of negative attitudes toward various occupational groups and main oppositional outgroups.

6. Conclusion

This study reports the findings of an information provision randomized intervention aimed at curbing COVID19-related stigma in India. We find that the provision of information from a reliable source

has the potential to improve knowledge, reduce stigma, and to improve health and wellbeing. One potential limitation of our study is that participants might report less stigma and better health and wellbeing due to social desirability and experimental demand effects. We partly address this issue by having the different stages of the study delivered by different individuals. Although we still cannot rule out the possibility of bias, we believe that the treatment effects on stigma, health and wellbeing are truly present because we also find treatment effects on outcomes that are not subject to such biases: improved knowledge about COVID-19 and incentivized beliefs about the geographic distribution of infection cases relative to the geographic distribution of demographic and social groups for selective states.

The findings of this study shed light on the possible policy responses that are useful for countering stigma and misinformation as well as reducing discrimination and the associated adverse effects that vulnerable individuals suffer. The Health Ministry in India has stressed that there is an urgent need to counter stigma and prejudice through health literacy and intensive campaigns. The WHO has also issued advice and guidelines to prevent and address social stigma associated with COVID-19. The current study provides experimental evidence that information campaigns would constitute a first step in this direction. Moreover, we provide suggestive evidence that lack of knowledge and presence of stress are important underlying root causes of stigma toward COVID-19 patients and marginalized groups. This suggests that policies that aim to curb COVID-19 stigma should target these two factors to improve the wellbeing of stigmatized individuals. This is a matter that we believe deserves further academic and policy attention.

Authors' contributions

Asad Islam devised the project, manage funding, conceptual ideas, and guiding the overall project and leading the collaboration. Debayan Pakrashi contributed to the field management, supervision, data work and estimation. Michael Vlassopoulos contributed to data analysis, estimation, interpretation and took the lead in writing the manuscript. Liang Choon Wang contributed to the estimation, data analysis, and data interpretation, revising the manuscript. All authors provided critical feedback and helped shape the research, analysis, and manuscript.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2021.113966>.

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