ORIGINAL RESEARCH

Annals of Internal Medicine

Comparison of Knowledge and Information-Seeking Behavior After General COVID-19 Public Health Messages and Messages Tailored for Black and Latinx Communities

A Randomized Controlled Trial

Marcella Alsan, MD, MPH, PhD*; Fatima Cody Stanford, MD, MPH, MPA*; Abhijit Banerjee, PhD; Emily Breza, PhD; Arun G. Chandrasekhar, PhD; Sarah Eichmeyer, MA; Paul Goldsmith-Pinkham, PhD; Lucy Ogbu-Nwobodo, MD, MS, MAS; Benjamin A. Olken, PhD; Carlos Torres, MD; Anirudh Sankar, MMath; Pierre-Luc Vautrey, MSc; and Esther Duflo, PhD

Background: The paucity of public health messages that directly address communities of color might contribute to racial and ethnic disparities in knowledge and behavior related to coronavirus disease 2019 (COVID-19).

Objective: To determine whether physician-delivered prevention messages affect knowledge and information-seeking behavior of Black and Latinx individuals and whether this differs according to the race/ethnicity of the physician and tailored content.

Design: Randomized controlled trial. (Registration: Clinical Trials.gov, NCT04371419; American Economic Association RCT Registry, AEARCTR-0005789)

Setting: United States, 13 May 2020 to 26 May 2020.

Participants: 14 267 self-identified Black or Latinx adults recruited via Lucid survey platform.

Intervention: Participants viewed 3 video messages regarding COVID-19 that varied by physician race/ethnicity, acknowledgment of racism/inequality, and community perceptions of mask wearing.

Measurements: Knowledge gaps (number of errors on 7 facts on COVID-19 symptoms and prevention) and information-seeking behavior (number of web links demanded out of 10 proposed).

Results: 7174 Black (61.3%) and 4520 Latinx (38.7%) participants were included in the analysis. The intervention reduced the knowledge gap incidence from 0.085 to 0.065 (incidence rate ratio [IRR], 0.737 [95% CI, 0.600 to 0.874]) but did not significantly change information-seeking incidence. For Black participants, messages from race/ethnicity-concordant physicians increased information-seeking incidence from 0.329 (for discordant physicians) to 0.357 (IRR, 1.085 [CI, 1.026 to 1.145]).

Limitations: Participants' behavior was not directly observed, outcomes were measured immediately postintervention in May 2020, and online recruitment may not be representative.

Conclusion: Physician-delivered messages increased knowledge of COVID-19 symptoms and prevention methods for Black and Latinx respondents. The desire for additional information increased with race-concordant messages for Black but not Latinx respondents. Other tailoring of the content did not make a significant difference.

Primary Funding Source: National Science Foundation; Massachusetts General Hospital; and National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases.

Ann Intern Med. 2021;174:484–492. doi:10.7326/M20-6141 **Annals.org**
For author, article, and disclosure information, see end of text.
This article was published at Annals.org on 21 December 2020.
* Drs. Alsan and Stanford contributed equally.

Black and Latinx communities have been disproportionately affected by coronavirus disease 2019 (COVID-19) (1, 2). The disparities in prevalence and health outcomes reflect a complex set of factors, including systemic racism, inequality in access to health services, educational opportunities, and occupational differences (3), but they may also partly reflect knowledge gaps. A nationally representative survey found large gaps in knowledge of COVID-19 symptoms and transmission among Black and Latinx respondents (4). While messaging campaigns and public service announcements have been deployed, little attention has been given to how to frame messages for communities of color. In particular, the majority of messaging is delivered by White experts, and messages may not be framed to specifically address these communities' concerns (5). Since the beginning of the pandemic, health care professionals have reached out to spread prevention messages using social media (6), yet there is no evidence on the effectiveness of this effort.

Given this lack of evidence, we partnered with the Center for Diversity and Inclusion at Massachusetts General Hospital (MGH) and over 40 physicians from MGH and Lynn Community Health Center to develop COVID-19 health messages that would address the specific concerns of these communities. We dubbed this group of staff, researchers, and clinicians the "COVID-19 Messaging Working Group." Black and Latinx respondents were randomly assigned to receive video messages on COVID-19 delivered by a study physician.

We sought to identify whether messages delivered by physicians would increase COVID-19 knowledge and improve preventive behaviors for Latinx and Black

See also:

Editorial comment 554

Web-Only
Supplement

individuals and to assess whether racial or ethnic concordance, acknowledgments of injustice, or information on social perceptions would make the message more effective, as measured by a reduced knowledge gap and change in information-seeking behaviors.

METHODS

Trial Design and Oversight

The study flow diagram (Appendix Figures 1 to 3, available at Annals.org) shows the factorial design and the allocation of participants to each intervention arm. The design was approved by the ethical review boards of Massachusetts Institute of Technology and Stanford University, with MGH, Yale University, and Harvard University ceding authority to the Massachusetts Institute of Technology. Messages were produced after several focus groups with physicians and leaders from the Center for Diversity and Inclusion. The trial was registered on ClinicalTrials.gov, which specified the main primary and secondary outcomes. Planned analyses were prespecified and published on the American Economic Association RCT Registry. The main change from preplanned analyses is that we report negative binomial regressions for count outcomes and logistic regression for binary outcomes (rather than ordinary least squares), and we weighted observations to correct for attrition.

Participants

Individuals were recruited throughout the United States by the survey company Lucid from 13 May to 26 May 2020. Only persons aged 18 years or older and self-identifying as Black or Latinx were eligible. Individuals with a secondary education or less were oversampled because these individuals were considered more likely to have knowledge gaps, by imposing a quota of 5% of our target sample size on individuals with a college degree. We also used quotas to match the 2018 population estimates by age, sex, race, and Hispanic origin issued by the U.S. Census Bureau (7). Quotas were implemented to assess eligibility by the survey company Lucid.

Interventions

Messages on COVID-19 developed for the study were read by 42 physicians. Each message was recorded by several physicians, who varied in age, gender, race, and ethnicity. Each respondent saw 3 videos, read by 3 different physicians. Section B of the Supplement (available at Annals.org) includes scripts, and the videos are available on the project website (8). Participants could elect to receive the messages in English or Spanish.

Video 1 defined COVID-19 as a virus that mainly infects the lungs and stated that although many infected people improve spontaneously, some get very sick and die. It discussed common symptoms associated with COVID-19 and asymptomatic transmission. Video 2 defined and discussed the importance of social distancing and hygiene using the script of a public service announcement featuring Dr. Deborah Birx, lead of the White House Coronavirus Task Force. Video 3 discussed wearing a mask or facial covering and emphasized its importance despite potential uncomfortable reactions by others.

In the intervention group, individuals answered sociodemographic questions, saw 3 videos, and then completed the outcome survey questions. In the control group, respondents answered all survey questions first and then saw the 3 videos.

The video messages were all delivered either by a concordant or discordant study physician. The content of the video varied along the following dimensions.

Video 1

In the baseline condition, physicians delivered information about COVID-19 and its symptoms. In the acknowledgment condition, in addition to the baseline message, the physicians explicitly acknowledged social constraints on access to health care. For Black participants, the message either acknowledged unequal treatment in health care or economic hardships that were associated with tight living quarters and working in essential services. For Latinx participants, the message either acknowledged fears about immigration status that made it difficult to seek care or the same economic hardship statement noted for the Black participants.

Video 2

Participants included in the baseline (that is, no acknowledgment) condition in video 1 received a message on social distancing and prevention delivered either by a study physician or by Dr. Deborah Birx. For Dr. Birx, we used an official Public Service Announcement (9), and the study physician read an identical script in their own voice. The rationale was to test whether the same message would be less effective delivered by the White House official spokesperson (who may be viewed as a polarizing figure).

Video 3

All participants received information about the importance of wearing masks. Those assigned to the "social perception" group further received information from study physicians that 8 out of 10 Americans report that a Black/Latinx person wearing a mask is protecting their community (this figure came from a nationally representative survey of 2611 respondents we conducted on 23 April 2020 [Section C of the Supplement]).

Outcomes

All outcomes were measured online immediately after the intervention for the intervention group and immediately after the sociodemographic survey questions for the control group.

The primary outcome prespecified in the registration on ClinicalTrials.gov was knowledge, beliefs, and practices related to COVID-19. The secondary outcome was video ratings. We also collected data on additional outcomes, prespecified in our preanalysis plan. For brevity, in the main text, we only present the results on our primary outcomes: a summary measure of knowledge and beliefs related to COVID-19 and practice. Given the

difficulty of observing actual behavior, practice was measured by information-seeking behavior within the survey.

The full set of outcomes (prespecified in the preanalysis plan, page 7) are as follows.

Time spent watching the videos, and video ratings. Results on time spent watching video and video rating are presented in **Supplement Table 1** (available at Annals.org).

Knowledge and beliefs. To measure knowledge and beliefs, participants were asked to identify ways to prevent COVID-19 spread, including staying 6 feet away from other people when outside, washing their hands when returning home, and wearing a mask/facial covering when outside. Failure to identify each of these 3 practices added 1 to the knowledge gap count. Participants were then asked whether COVID-19 could be asymptomatically transmitted; those who answered "no" received an additional unit to the knowledge gap count. Finally, participants were asked to select exactly 3 common COVID-19 symptoms from a list of 9 symptoms. Each symptom selected that was not among cough, fever, difficulty breathing, or new loss of taste or smell increased the knowledge gap count by 1. The knowledge gaps outcome is an integer that can take values from 0 (complete knowledge) to 7 (incomplete knowledge). We also define an indicator for "any gap in knowledge," which is 1 if the knowledge gap is 1 or greater and 0 otherwise.

Trust in the health care system; health information–seeking behavior and interest in information on social distancing and hygiene. Trust in the health care system, health information–seeking behavior, and interest in more information on social distancing and hygiene were measured by asking whether the participant was interested in web links to webpages or videos. They could elect to obtain any of 10 web links, and if they did, they received the information at the end of the survey. Specifically, the links were presented as more information about web resources about COVID-19 from MGH; a COVID-19 app from MGH; the respondent's state COVID-19 hotline; telehealth; mental health resources; COVID-19 testing locations; how to make a mask at home without sewing; how to safely disinfect one's home; how to exercise in small spaces; and tips to keep children moving in a small space. Links are provided in Section D of the **Supplement**.

The information-seeking behavior outcome is the number of links for which participants expressed interest (that is, the click-through rate), a count variable between 0 (lowest information-seeking behavior) and 10 (greatest information-seeking behavior). We also defined an outcome "any link demanded," which was assigned a value of 1 if the participant demanded any link and 0 otherwise. Click-through rates are a standard metric for gauging the success of advertising campaigns in marketing (10), but a limitation is that they may not be an accurate proxy of behavior.

Views on mask wearing. To assess whether those assigned to the "social perception" intervention in fact changed participants' views, we presented them with a photo asking them their view on how others would perceive people wearing a mask (**Supplement Tables 2** to **4**, available at Annals.org).

Allocations to organizations supporting mask wearing. We asked respondents how they would prefer the study allocate a donation between 2 organizations targeted to their community, one that supports masks and another that supports economic relief (**Supplement Tables 3** and **4**).

Randomization

Random assignment into the control group versus to an intervention group and between intervention groups was stratified according to sex, age (>45 years), and location (by first digit of ZIP code, to proxy for coastal versus noncoastal states: 0, 1, 2, and 9 is one category, and 3, 4, 5, 6, 7, and 8 is another). The study flow diagram (**Appendix Figures 1** to **3**) summarizes the randomization. One in 9 respondents was assigned to the control group, and 8 in 9 respondents were assigned to an intervention group.

In the intervention group, participants were randomly assigned to race/ethnicity-concordant encounters and race/ethnicity-discordant encounters with equal probability. Within each discordant and concordant arm, participants were further randomly assigned, with equal probability, into 1 of 4 arms: the original Dr. Birx video about social distancing; the same message read by one of the study physicians; or 2 versions of the same message read by 1 of the study physicians, with additional acknowledgments of specific difficulties faced by Black and Latinx communities, depending on the respondent. Finally, within each of these arms, participants were randomly assigned with equal probability to receive information about perception of people wearing masks. Random assignment to video content was performed using the online survey platform Qualtrics in its May 2020 version. It was implemented in the Survey Flow using a Randomizer block within each stratum with the option to evenly present elements.

Statistical Analysis

We determined that a sample of 15 000 individuals (10 000 Black and 5000 Latinx) would provide 85% power to detect effect sizes of 0.08 SD for any intervention relative to control, and for effects of specific variations in message content.

The analysis was performed by original assigned group and included all the participants who answered all baseline questions and completed the survey up to the knowledge questions (for the knowledge gaps analysis) or up to the web links question (for all other analyses). For count data, we use negative binomial regression to assess the effectiveness of our randomized messaging interventions. Models include the stratifying variables (age by sex by location dummies), race, and an indicator for preferred video language (English or Spanish).

To address bias stemming from nonrandom attrition, we weight the data using Hainmueller entropy weights

(11), which ensures that the observed baseline characteristics of the sample match the original sample as closely as possible (Section E of the Supplement).

To analyze effects of seeing any video message on the knowledge gap and information-seeking outcomes, we fit the following negative binomial regression model:

$$\log(\mu_i) = \beta_0 + \beta_1\, anymessage_i + \boldsymbol{\beta_2^T stratum_i} + \beta_3\, resp\, lang_i + \beta_4\, resp\, race_i$$

where μ_i is the estimated mean outcome value (knowledge gap count or count of demanded links); *anymessage*$_i$ is an indicator for receipt of videos before outcome measures (that is, not being in the control group); *stratum*$_i$ is a vector of indicator variables, denoting which stratum was assigned; *resp lang*$_i$ is an indicator for participants who chose to receive videos in Spanish; and *resp race*$_i$ is an indicator for the participant's self-identified race or ethnicity.

We also fit a logistic regression on the same model using the outcomes *any gap in knowledge* and *any info demanded* (section H of the Supplement) . Noting $p_i = P$ (*Any gap = 1*), we fit the following logistic regression equation:

$$\ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1\, anytreat_i + \beta_2^T stratum_i + \beta_3\, resp\, lang_i + \beta_4\, resp\, race_i$$

To analyze whether the videos have larger effects when they are tailored to the Black or Latinx communities, we consider only participants assigned to the "any intervention group" and fit a negative binomial regression model:

$$\log(\mu_i) = \beta_0 + \beta_1\, race\, concord_i + \beta_2\, Birx_i + \beta_3 acknowledgment\ 1_i + \beta_4 acknowledgment\ 2_i + \beta_5 socialperception_i + \boldsymbol{\beta_6^T stratum_i} + \beta_7\, resp\, lang_i + \beta_8\, resp\, race_i$$

where *race concord*$_i$ is an indicator that equals 1 if the physician and the recipient share the same race or ethnicity and 0 otherwise, *Birx*$_i$ is an indicator for video 2 featuring Dr. Birx, *acknowledgment 1*$_i$ is an indicator that equals 1 if video 1 included an acknowledgment of inequality in health care (Black participants) or the immigration-related fears associated with seeking health care (Latinx participants), *acknowledgment 2*$_i$ is an indicator for video 1 acknowledging economic hardships affecting minorities, and *socialperception*$_i$ is an indicator that the social perception message is included in video 3.

Finally, we fit the same model for a logistic regression on *any gap in knowledge* and *any info demanded* (Supplement; results are shown in Supplement Tables 6 to 8, available at Annals.org).

We performed additional analyses in which we 1) controlled for additional baseline covariates using a double-robust machine learning algorithm (12), 2) used unweighted regression specifications, 3) analyzed effects on secondary outcomes, and 4) tested for heterogeneous effects by prior perceptions about masks (Section F of the Supplement).

Analyses were performed by using R, version 3.6.1, including the following packages (versions): *stats* (3.6.1), *tidyverse* (1.3.0), *estimatr* (0.22), *anytime* (0.3.9), *readr* (1.3.1), *dplyr* (1.0.0), *lubridate* (1.7.9), *stargazer* (5.2.2), *hdm* (0.3.1), *fastDummies* (1.6.2), *mfx* (1.2-2), *car* (3.0.3), *MASS* (7.3.51.4), *cobalt* (4.2.3), *WeightIt* (0.10.2), *ebal* (0.1.6), and *pscl* (1.5.5). The data and all statistical codes are publicly available on Harvard Dataverse (13).

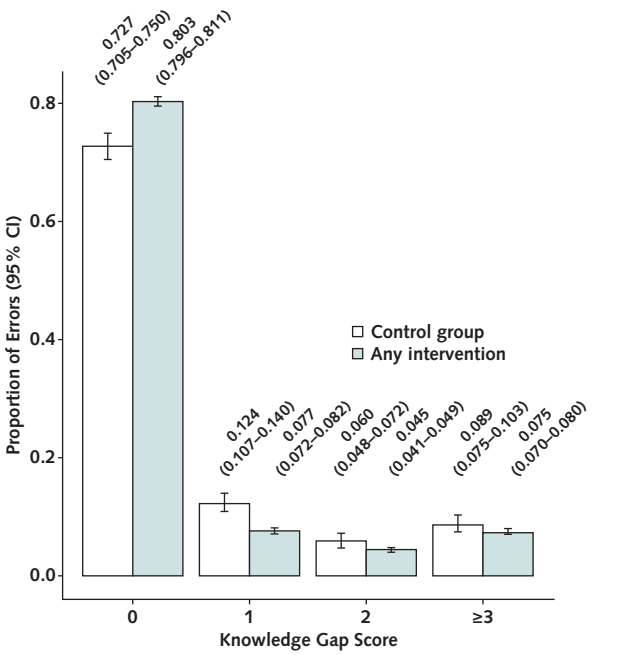
Role of the Funding Source

The study was funded by the National Science Foundation; Massachusetts General Hospital; and National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases. The funding sources had no role in the design or conduct of the trial, interpretation of the data, or preparation of the manuscript.

RESULTS

The trial sample was enrolled from 13 May 2020 through 26 May 2020. Of 35 987 persons screened, 20 925 were eligible for participation (15 062 who would have been eligible were excluded because the demographic quotas were met); 5450 individuals did not consent or failed both basic attention checks, and 1208 left the survey before randomization.

Figure. Distribution of knowledge gap scores in the control group and among participants who received any intervention.



Bars indicate 95% CIs. A Kolmogorov–Smirnov test of the equality of the distribution resulted in a value of 0.07598 ($P < 0.001$).

Table 1. Effect of Any Video Message Intervention Versus Control on Knowledge and Information-Seeking Behavior

Measure	Control			Any Message Intervention			IRR (95% CI)*	*P* Value
	Average Value	Average Incidence Rate	Observations, *n*	Average Value	Average Incidence Rate	Observations, *n*		
All participants								
Knowledge gaps	0.593 (0.532–0.653)	0.085 (0.076–0.093)	1525	0.458 (0.437–0.479)	0.065 (0.062–0.068)	10 711	0.737 (0.643–0.846)	0.001
Information-seeking behavior	3.350 (3.179–3.522)	0.335 (0.318–0.352)	1450	3.445 (3.379–3.511)	0.344 (0.338–0.351)	10 244	1.020 (0.954–1.090)	0.56
African American participants								
Knowledge gaps	0.582 (0.507–0.657)	0.083 (0.072–0.094)	972	0.445 (0.419–0.472)	0.064 (0.060–0.067)	6550	0.737 (0.619–0.877)	0.001
Information-seeking behavior	3.293 (3.078–3.507)	0.329 (0.308–0.351)	923	3.429 (3.344–3.513)	0.343 (0.334–0.351)	6251	1.031 (0.947–1.123)	0.48
Latinx participants								
Knowledge gaps	0.611 (0.509–0.713)	0.087 (0.073–0.102)	553	0.477 (0.442–0.511)	0.068 (0.063–0.073)	4161	0.737 (0.591–0.919)	0.007
Information-seeking behavior	3.452 (3.167–3.736)	0.345 (0.317–0.374)	527	3.470 (3.363–3.576)	0.347 (0.336–0.358)	3993	1.006 (0.904–1.118)	0.92

IRR = incidence rate ratio.
* Incidence rate for knowledge gaps is the count of knowledge gaps divided by the maximum possible count: 7. Incidence rate for interest in links is the count of links demanded divided by the maximum possible count: 10. The IRRs are estimated by fitting a negative binomial regression model with units weighted after Hainmueller entropy-based weighting to account for imbalances due to attrition (9).

Then, 14 267 persons were randomly assigned, of whom 123 failed to answer at least 1 baseline question. The 123 participants with missing baseline data are excluded from the main analysis because we use baseline data to weight observations and account for attrition. Therefore, the final sample comprises 14 144 individuals with complete baseline data.

Of those, all participants who completed the survey at least up to the knowledge gaps survey questions and did not miss any baseline covariates were included in the analyses for knowledge gaps (12 236 participants, including 7522 Black and 4714 Latinx individuals), and all participants who completed the entire survey and did not have missing baseline covariates were included in the rest of the analysis (11 694 participants, including 7174 Black [61.3%] and 4520 Latinx individuals [38.7%]) (Appendix Figures 1 to 3). The target sample size of 15 000 was not reached because of difficulty recruiting participants in selected demographic quotas, particularly men older than 65 years.

Summary statistics on the sample that was randomized are shown in the Appendix Table (available at Annals.org). Our final sample was 57.4% female (60.1% among Black participants). The mean age was almost 40 years. In total, 52.4% of participants reported being likely to run out of money because of COVID-19 and 36.4% reported difficulty paying for food. In addition, 25.5% were essential workers, 14% were unemployed and looking for work, and 9.9% were students. Finally, 54.3% reported a medical condition which placed them or a person close to them at higher risk from COVID-19, and 78.5% reported having health insurance. Most of the Latinx respondents were of Mexican origin (68%).

Baseline covariates were balanced across all intervention arms (Section E of the Supplement and Supplement Table 5, available at Annals.org). Similarly, baseline covariates restricting to participants who did complete the study were also balanced across intervention arms (Supplement Table 5).

Attrition

Because of the online nature of the survey, participants could exit at any point after watching the video messages, but without finishing the survey. The knowledge gaps outcome was measured early in the survey. Thus, when analyzing effects of the intervention on knowledge gaps, we include all participants who completed the survey at least up to that outcome. At that stage, 1908 participants included in the initial randomization who had not missed any baseline question were excluded (5.7% attrition in the control group and 14.5% attrition in any video group). The information-seeking behavior outcome was measured at the end of the survey, when attrition was higher, especially in the intervention group which had gone through a longer study (because they watched the videos), so 2450 participants were excluded (10.3% attrition in the control group and 18.2% attrition in the intervention group). However, attrition probability did not differ across arms (Appendix Figures 1 to 3).

Effects of Any Video Message Intervention Versus Control

Table 1 shows the effect of receiving any video on knowledge gaps and information-seeking behavior. Individuals in the control group had on average 0.6 out of 7 possible knowledge gaps, for a knowledge gap incidence rate of 0.085. Individuals who saw any video had an average of 0.5 knowledge gaps (incidence rate, 0.065). Thus, seeing any video had a significant effect on reducing knowledge gaps relative to the control

(estimated incidence rate ratio [IRR], 0.737] [95% CI, 0.643 to 0.846]; $P < 0.001$).

The **Figure** shows the effect of any intervention on the distribution of knowledge gaps. In the control group, 72.7% participants had no gap in knowledge at all (they answered all questions correctly). The proportion increased to 80.3% among participants who received any intervention. **Supplement Table 6** reports the result of a logistic regression of "any gap in knowledge" and confirms the significant decline in the fraction of participants with any gap in knowledge.

The decline in knowledge gap was distributed across all levels. Participants in the intervention group were less likely than those in the control group to have 1 gap (7.7% versus 12.4%, respectively), 2 gaps (4.5% versus 6.4%), or 3 gaps or more (7.5% versus 8.9%). A Kolmogorov-Smirnov test confirmed that the distribution of knowledge gaps in the control group first-order stochastically dominates the distribution in the intervention group ($P < 0.001$).

In contrast, information-seeking behavior did not change significantly. The incidence rate of interest in links was 0.335 (that is, 3.35 links demanded out of 10 possible) in the control group and 0.344 in the intervention group. The estimated IRR of link demand is 1.02 (CI, 0.954 to 1.090) ($P > 0.56$) (**Supplement Table 6**, confirmed with the outcome "any link demanded").

These results were very similar for Black and Latinx participants.

Effects of Race-Concordant Physicians

Concordance did not affect knowledge retention (**Tables 2** and **3**; **Supplement Tables 7** and **8**). However, assignment to a race-concordant physician increased

Table 2. Effects of Tailoring Messages on Knowledge and Information-Seeking Behavior: Average Incidence Rates by Intervention*

Measure	Racial Concordance/ Discordance Between Physician and Participant		Video 2 Recorded by Study Physician or Dr. Birx		Acknowledgment 1: Racism in Health Care (African Americans), Deportation Fears (Latinx)		Acknowledgment 2: Economic Inequalities		Social Perception: Information About How Others Perceive People Wearing Masks	
	Discordant	Concordant	Study Physician	Dr. Birx	No	Yes	No	Yes	No	Yes
All participants										
Knowledge gaps										
Average incidence rate (95% CI)	0.066 (0.061–0.070)	0.065 (0.061–0.069)	0.065 (0.061–0.068)	0.068 (0.061–0.074)	0.066 (0.063–0.070)	0.063 (0.057–0.069)	0.066 (0.063–0.070)	0.0063 (0.057–0.069)	0.066 (0.062–0.071)	0.065 (0.060–0.069)
Observations, *n*	5395	5316	8041	2670	8010	2701	8058	2653	5366	5345
Information-seeking behavior										
Average incidence rate (95% CI)	0.336 (0.327–0.346)	0.353 (0.343–0.362)	0.343 (0.336–0.351)	0.348 (0.335–0.362)	0.346 (0.338–0.353)	0.341 (0.328–0.354)	0.344 (0.337–0.352)	0.345 (0.332–0.358)	0.345 (0.336–0.355)	0.344 (0.334–0.353)
Observations, *n*	5147	5097	7697	2547	7653	2591	7696	2548	5142	5102
African American participants										
Knowledge gaps										
Average incidence rate (95% CI)	0.063 (0.058–0.069)	0.064 (0.058–0.069)	0.062 (0.058–0.067)	0.068 (0.060–0.076)	0.065 (0.061–0.069)	0.060 (0.052–0.067)	0.065 (0.060–0.069)	0.060 (0.053–0.067)	0.065 (0.059–0.07)	0.063 (0.057–0.068)
Observations	3277	3273	4908	1642	4899	1651	4942	1608	3271	3279
Information-seeking behavior										
Average incidence rate (95% CI)	0.329 (0.317–0.341)	0.357 (0.345–0.369)	0.345 (0.335–0.355)	0.337 (0.320–0.353)	0.344 (0.334–0.353)	0.341 (0.324–0.358)	0.340 (0.330–0.350)	0.351 (0.334–0.368)	0.343 (0.331–0.355)	0.343 (0.331–0.355)
Observations	3121	3130	4683	1568	4676	1575	4712	1539	3135	3116
Latinx participants										
Knowledge gaps										
Average incidence rate (95% CI)	0.069 (0.062–0.076)	0.067 (0.060–0.074)	0.068 (0.063–0.074)	0.067 (0.058–0.077)	0.068 (0.063–0.074)	0.068 (0.058–0.078)	0.068 (0.063–0.074)	0.068 (0.058–0.078)	0.069 (0.062–0.076)	0.068 (0.061–0.075)
Observations	2118	2043	3133	1028	3111	1050	3116	1045	2095	2066
Information-seeking behavior										
Average incidence rate (95% CI)	0.348 (0.333–0.362)	0.346 (0.331–0.362)	0.34 (0.328–0.353)	0.367 (0.345–0.389)	0.349 (0.337–0.362)	0.340 (0.320–0.361)	0.351 (0.339–0.363)	0.335 (0.314–0.356)	0.350 (0.335–0.365)	0.344 (0.329–0.359)
Observations	2026	1967	3014	979	2977	1016	2984	1009	2007	1986

Table 3. Effects of Tailoring Messages on Knowledge and Information-Seeking Behavior: Incidence Rate Ratios Associated With Video Tailoring*

Measure	Racial Concordance/ Discordance Between Physician and Participant		Video 2 Recorded by Study Physician or Dr. Birx		Acknowledgment 1: Racism in Health Care (African Americans), Deportation Fears (Latinx)		Acknowledgment 2: Economic Inequalities		Social Perception: Information About How Others Perceive People Wearing Masks		Observations, *n*
	IRR (95% CI)	*P* Value	IRR (95% CI)	*P* Value	IRR (95% CI)	*P* Value	IRR (95% CI)	*P* Value	IRR (95% CI)	*P* Value	
All participants											
Knowledge gaps	0.975 (0.879–1.081)	0.63	1.042 (0.900–1.205)	0.58	0.954 (0.824–1.104)	0.53	0.982 (0.848–1.137)	0.81	0.962 (0.867–1.067)	0.46	10 711
Information-seeking behavior	1.051 (1.003–1.102)	0.037	1.005 (0.941–1.074)	0.88	0.994 (0.931–1.062)	0.87	1.008 (0.943–1.077)	0.81	0.994 (0.948–1.041)	0.79	10 244
African American participants											
Knowledge gaps	0.998 (0.874–1.139)	0.98	1.071 (0.890–1.288)	0.47	0.923 (0.765–1.113)	0.40	0.967 (0.801–1.167)	0.73	0.979 (0.858–1.117)	0.75	6550
Information-seeking behavior	1.085 (1.022–1.153)	0.007	0.977 (0.898–1.063)	0.59	0.995 (0.915–1.083)	0.91	1.027 (0.943–1.118)	0.54	1.001 (0.943–1.063)	0.97	6251
Latinx participants											
Knowledge gaps	0.953 (0.807–1.125)	0.57	0.997 (0.788–1.261)	0.98	0.976 (0.772–1.234)	0.84	0.977 (0.773–1.236)	0.85	0.936 (0.793–1.105)	0.44	4161
Information-seeking behavior	0.999 (0.927–1.077)	0.98	1.052 (0.945–1.170)	0.36	0.991 (0.892–1.102)	0.87	0.981 (0.882–1.091)	0.72	0.984 (0.912–1.060)	0.67	3993

IRR = incidence rate ratio.

* This table presents the estimate of equation 2 in the text. The estimates in each row come from a single binomial regression on the sample of participants who received the intervention (excluding the control group). The IRRs are calculated from estimates obtained by fitting a negative binomial regression model with units reweighted following Hainmueller entropy-based reweighting to account for imbalances due to attrition (9). The estimated model is: $\log(\mu_i) = \beta_0 + \beta_1\, race\, concord_i + \beta_2\, Birx_i + \beta_3\, acknowledgment\, 1_i + \beta_4\, acknowledgment\, 2_i + \beta_5\, socialperception_i + \beta_6^T stratum_i + \beta_7\, resp\ lang_i + \beta_8\, resp\ race_i$.

our measure of information-seeking behavior. In the intervention sample, the incidence rate of link demand was 0.336 with a discordant physician and 0.353 with a concordant physician (IRR, 1.051 [CI, 1.003 to 1.102]; $P = 0.037$). The effect was significant for Black participants (IRR, 1.085 [CI, 1.022 to 1.153]; $P = 0.007$), although the absolute difference remained relatively small. There was no statistically significant effect on Latinx participants (IRR, 0.999 [CI, 0.927 to 1.077]; $P = 0.98$). The same conclusions were reached when the discrete variables for "any gap in knowledge" and "any link" were used.

Effects of Acknowledgment of Injustice and Economic Hardship and the Dr. Birx Video

There was no further effect of tailoring the message according to each community for either Black or Latinx participants (Tables 2 and 3; Supplement Tables 7 and 8). Random assignment to the message recorded by Dr. Birx, to a message including acknowledgments of racism or deportation fears, or to a message acknowledging economic inequality did not affect knowledge gaps or information-seeking behavior, either overall or for Black or Latinx participants separately. However, Black participants spent less time viewing the video recorded by Dr. Birx than the equivalent video recorded by our study physicians, and they rated it lower.

Effects of Addressing the Fear of Stigma and Racism When Wearing a Mask

In video 3, randomly selected participants were informed that, in a survey, 8 out of 10 respondents believed that a Black (or Latinx) individual wearing a mask was protecting their community. This intervention had no effect on knowledge gaps or information-seeking behavior (Tables 2 and 3; Supplement Tables 7 and 8). Yet, there is evidence that information was retained and belief about social perception of mask wearing shifted: Supplement Table 4 shows that this intervention had the predicted effect on beliefs. Those who initially underestimated the proportion of people with a positive image of mask wearing changed their perception toward believing that more people had a positive image of mask wearing, and vice versa for those who initially overestimated this proportion. However, this updating of the social norm did not translate into changes in information-seeking behavior, even among those whose perception of mask wearing became more favorable.

Heterogeneity by Sex and by Education

Across all conditions, there were no statistically significant differences by sex within race/ethnicity (Supplement Table 9, available at Annals.org). The effect of any intervention relative to control on knowledge gaps was more

pronounced for participants with more than a high school education (**Supplement Table 10**, available at Annals.org). The incidence rate of knowledge gaps was reduced from 0.091 to 0.077 among participants with at most a high school education (IRR, 0.811 [CI, 0.685 to 0.96]) and from 0.073 to 0.048 among more educated participants (IRR, 0.608 [CI, 0.482 to 0.767]). The difference in IRR between the 2 groups is statistically significant ($P = 0.049$). There is no significant difference by education in effects on information-seeking behavior.

We replicated the main analysis in 2 sensitivity analyses that controlled for additional baseline covariates (**Supplement Tables 11** and **12**, available at Annals .org) and that did not apply weights to address possible bias from nonrandom attrition (**Supplement Tables 5** and **6**). Results were consistent with those of the primary analyses.

Additional outcomes listed in the preanalysis plan are reported in **Supplement Tables 1** to **3**.

Discussion

Random assignment of Black and Latinx participants to watch public health video messages recorded by a diverse set of physicians decreased knowledge gaps on COVID-19 symptoms, preventive behaviors, and transmission. Although the level of knowledge was already relatively high at baseline (72.7% had no knowledge gap at all and 12.4% had a knowledge gap of 1), the effect on knowledge was modest but very clear (80.3% of participants receiving the intervention have no knowledge gap at all).

Tailoring the message to specific communities; racial/ethnic concordance of the physician; and acknowledgment of racism, fear of deportation, or economic inequality did not further increase the effectiveness of the messages. Replacing one message by doctors with a message from Dr. Birx of the White House COVID-19 Task Force did not change its effectiveness (although Black participants rated it lower).

Increased knowledge is only 1 step in affecting behavior and exposure to the disease, so the final clinical significance of these findings is uncertain. In general, physician-recorded video messages did not affect information-seeking behavior, as measured by interest in learning more about social distancing strategies, hygiene practices, or how to make a mask. Information on the social acceptability of masks also did not affect information-seeking behavior even among those who modified their beliefs. However, for Black participants, assignment to race-concordant physicians increased information-seeking behavior, although the magnitude of that effect was small. Similar results were not found among Latinx participants. Tailoring the content of messages had no statistically significant effect on information-seeking behavior and did not offset the discordance gap for White physicians. These findings accord with those of studies reporting a positive association between patient–physician racial/ethnic concordance and improved satisfaction or health outcomes (14, 15) and with those of a recent randomized trial performed in Oakland, California (16).

Our study has limitations. First, it was conducted online because field activities were paused for many institutions at the time. Participants thus may have been more likely to have internet access and be interested in an online study than the average low-income Black or Latinx individual, although recruitment was focused on persons with less than a college education and the final sample appears to be economically disadvantaged.

Second, although information-seeking behavior was objectively measured, participants' preventive health behaviors were not directly observed. Outcomes were collected immediately after the intervention and thus may not be durable. Regarding alternative behavior measures, direct observation of physical distancing and hygiene might have been seen as surveillance and thus was eschewed. Moreover, even if information on self-reported behaviors had been collected, it would have been challenging to interpret because immediately after the intervention, nationwide protests occurred following the murder of George Floyd and other unarmed Black persons by police.

Third, outcomes might be subject to social desirability bias. Respondents may have felt compelled to click on links the study provided, for example. However, this was less likely to affect knowledge gaps, and changes in information-seeking behavior were observed only among Black participants who were randomly assigned to a race-concordant doctor. Furthermore, although the increases in knowledge and information-seeking behavior were statistically significant, the clinical significance of changes remains uncertain.

Finally, findings regarding the acknowledgment intervention may be specific to the period of the analysis (May 2020). Preventive behaviors may be easier to measure when COVID-19 restrictions have eased. The effect of tailoring messages may also vary depending on the political climate.

Despite these limitations, the findings provide evidence that, especially in a moment when a novel human-to-human virus is disproportionately affecting communities of color, a diverse physician workforce can be an effective channel to communicate life-saving information.

Our findings lay out several directions for future work. First, would similar video messages have larger or smaller effects as COVID-19 incidence fluctuates? Second, would tailored messaging be important as awareness of systemic racism is heightened? Third, might official statements from health organizations identifying systemic racism as a public health concern increase the effectiveness of messages tailored to each community? Fourth, might intersectionality (concordance across multiple self-reported identities) matter, and could other professional health care staff, not solely physicians, assist in providing trusted messages regarding COVID-19 to underserved communities? Finally,

would the effect of physician messages be the same among White persons? Addressing such research questions will be crucial in guiding the policy response to the pandemic and other health conditions.

From Harvard Kennedy School of Government, Cambridge, Massachusetts (M.A.); Massachusetts General Hospital and Harvard Medical School, Boston, Massachusetts (F.C.S.); Massachusetts Institute of Technology, Cambridge, Massachusetts (A.B., B.A.O., A.S., P.V.); Harvard University, Cambridge, Massachusetts (E.B.); Stanford University, Stanford, California (A.G.C., S.E.); Yale University, New Haven, Connecticut (P.G.); Harvard Medical School and Massachusetts General Hospital, Boston, Massachusetts, and McLean Hospital, Department of Psychiatry, Belmont, Massachusetts (L.O.); Harvard Medical School and Massachusetts General Hospital for Children, Boston, Massachusetts (C.T.); and Massachusetts Institute of Technology, Cambridge, Massachusetts, and Massachusetts General Hospital, Boston, Massachusetts (E.D.).

Disclaimer: The findings and conclusions expressed are solely those of the authors and do not represent the views of their funders.

Acknowledgment: The authors thank the Center for Diversity and Inclusion, especially Sandra Pena Ordonez and Elena Olson, JD, for their assistance in this project; Mohit Karnani, Joyce Kim, Tristan Loisel, and Sirena Yu for research assistance; and all physicians of the COVID-19 Messaging Working Group, who recorded videos and shared their experience with us in early discussions.

Grant Support: By the National Science Foundation under award number 2029880 (Drs. Alsan and Duflo), the Physician/Scientist Development Award granted by the Executive Committee on Research at Massachusetts General Hospital (Dr. Stanford), and National Institutes of Health grants P30 DK040561 and L30 DK118710 (Dr. Stanford).

Disclosures: Disclosures can be viewed at www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M20-6141.

Data Sharing Statement: The prespecified statistical analysis plan is available on our project webpage (www.povertyactionlab.org/project/covid-19-health-messaging-underserved-communities). The following data will be made available with publication: deidentified participant data (https://doi.org/10.7910/DVN/CJPVOD). The following supporting documents will be made available with publication: statistical/analytic code and informed consent form (https://doi.org/10.7910/DVN/CJPVOD). Data will be made available to anyone, for any purpose, without investigator support. No data access document is required.

Corresponding Author: Esther Duflo, PhD, MIT Department of Economics, 77 Massachusetts Avenue, Building E52-544, Cambridge, MA 02139; e-mail, eduflo@mit.edu.

Current author addresses and author contributions are available at Annals.org.

References

1. **Garg S, Kim L, Whitaker M, et al.** Hospitalization rates and characteristics of patients hospitalized with laboratory-confirmed coronavirus disease 2019 - COVID-NET, 14 states, March 1-30, 2020. MMWR Morb Mortal Wkly Rep. 2020;69:458-464. [PMID: 32298251] doi:10.15585/mmwr.mm6915e3

2. **Price-Haywood EG, Burton J, Fort D, et al.** Hospitalization and mortality among black patients and white patients with Covid-19. N Engl J Med. 2020;382:2534-43. [PMID: 32459916] doi:10.1056/NEJMsa2011686

3. **Webb Hooper M, Nápoles AM, Pérez-Stable EJ.** COVID-19 and Racial/Ethnic disparities. JAMA. 2020;323:2466-7. [PMID: 32391864] doi:10.1001/jama.2020.8598

4. **Alsan M, Stantcheva S, Yang D, et al.** Disparities in coronavirus 2019 reported incidence, knowledge, and behavior among US adults. JAMA Netw Open. 2020;3:e2012403. [PMID: 32556260] doi:10.1001/jamanetworkopen.2020.12403

5. **Facher L.** As Covid-19 devastates communities of color, the government's minority health experts are conspicuously quiet. Stat. 22 June 2020. Accessed at www.statnews.com/2020/06/22/covid-19-minority-health-experts-conspicuously-quiet/ on 29 July 2020.

6. **McDonnell Nieto del Rio G.** Doctors plead with Americans to take the virus surge seriously. New York Times. Accessed at www.nytimes.com/live/2020/11/15/world/covid-19-coronavirus/doctors-plead-with-americans-to-take-the-virus-surge-seriously on 25 November 2020.

7. **U.S. Census Bureau.** 2018 population estimates by age, sex, race and Hispanic origin. 20 June 2019. Accessed at www.census.gov/newsroom/press-kits/2019/detailed-estimates.html on 19 June 2020.

8. **Abdul Latif Jameel Poverty Action Lab (J-PAL).** COVID-19 health messaging in underserved communities. Accessed at www.povertyactionlab.org/project/covid-19-health-messaging-underserved-communities on 22 December 2020.

9. **Birx D.** Dr. Birx: stay 6 feet away. YouTube. 6 April 2020. Accessed at www.youtube.com/watch?v=8p0u-d4f604&feature=youtu.be&ab_channel=TheWhiteHouse on 25 November 2020.

10. **Directive Consulting.** Why is click through rate important? Accessed at https://directiveconsulting.com/resources/glossary/click-through-rate/ on 19 June 2020.

11. **Hainmueller J.** Entropy balancing for causal effects: a multivariate reweighting method to produce balanced samples in observational studies. Political Analysis. 2012;20:25-46.

12. **Chernozhukov V, Chetverikov D, Demirer M, et al.** Double/debiased machine learning for treatment and structural parameters. Econometrics Journal. 2018;21:C1-68.

13. **Alsan M, Stanford FC, Banerjee A, et al.** Replication data for: comparison of knowledge and intended behaviors following general COVID-19 public health messages and messages tailored for Black and Latinx communities: a randomized controlled trial. Harvard Dataverse. 2020. doi:10.7910/DVN/CJPVOD

14. **Meghani SH, Brooks JM, Gipson-Jones T, et al.** Patient-provider race-concordance: does it matter in improving minority patients' health outcomes. Ethn Health. 2009;14:107-30. [PMID: 19012091] doi:10.1080/13557850802227031

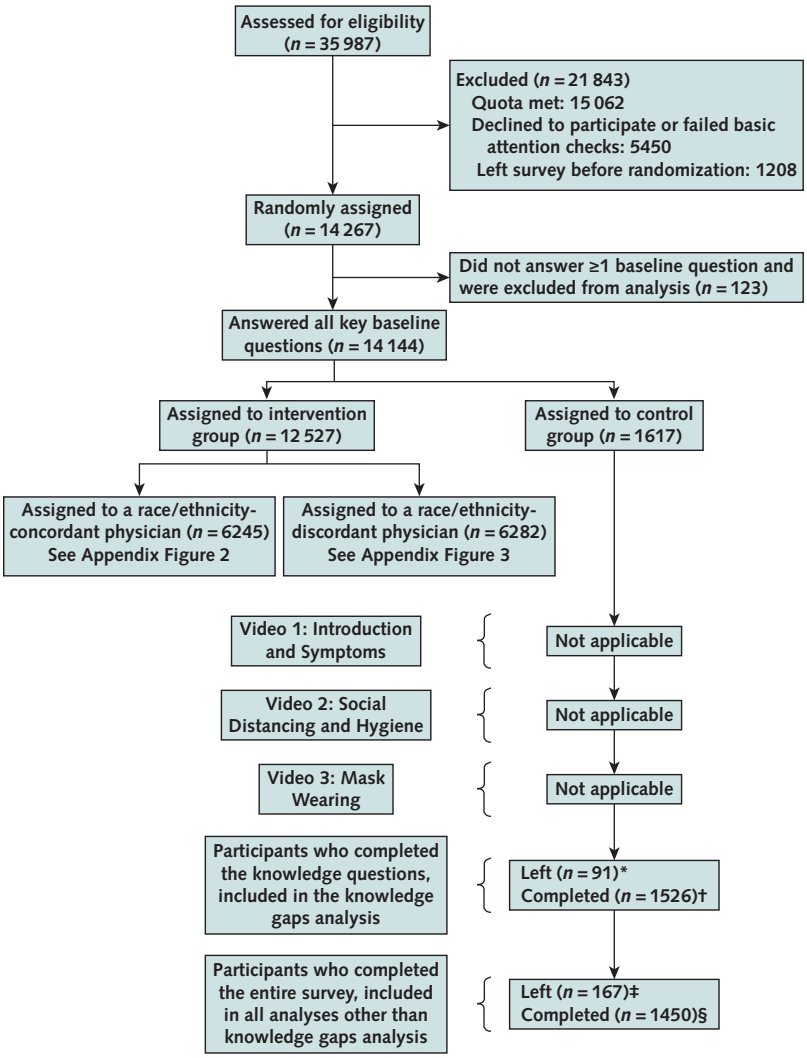
15. **Hill AJ, Jones DB, Woodworth L.** Physician-patient race-match reduces patient mortality. Posted 31 July 2018; last updated 21 August 2020. Accessed at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3211276 on 9 December 2020.

16. **Alsan M, Garrick O, Graziano G.** Does diversity matter for health? Experimental evidence from Oakland. American Economic Review. 2019;109:4071-111. doi:10.1257/aer.20181446

Current Author Addresses: Dr. Alsan: Harvard Kennedy School of Government, 79 John F. Kennedy Street, Cambridge, MA 02138.
Dr. Stanford: MGH Weight Center, 50 Staniford Street, Suite 430, Boston, MA 02114.
Drs. Banerjee, Olken, and Duflo and Mr. Vautrey: MIT Department of Economics, 77 Massachusetts Avenue, Cambridge, MA 02139.
Dr. Breza: Littauer Center, 1805 Cambridge Street, Cambridge, MA 02138.
Dr. Chandrasekhar, Ms. Eichmeyer, and Mr. Sankar: Landau Economics Building, 579 Jane Stanford Way, Stanford, CA 94305.
Dr. Goldsmith-Pinkham: Yale School of Management, 165 Whitney Avenue, New Haven, CT 06511.
Dr. Ogbu-Nwobodo: Massachusetts General Hospital, 55 Fruit Street, Boston, MA 02114.
Dr. Torres: Chelsea HealthCare Center, 151 Everett Avenue, Chelsea, MA 02150.

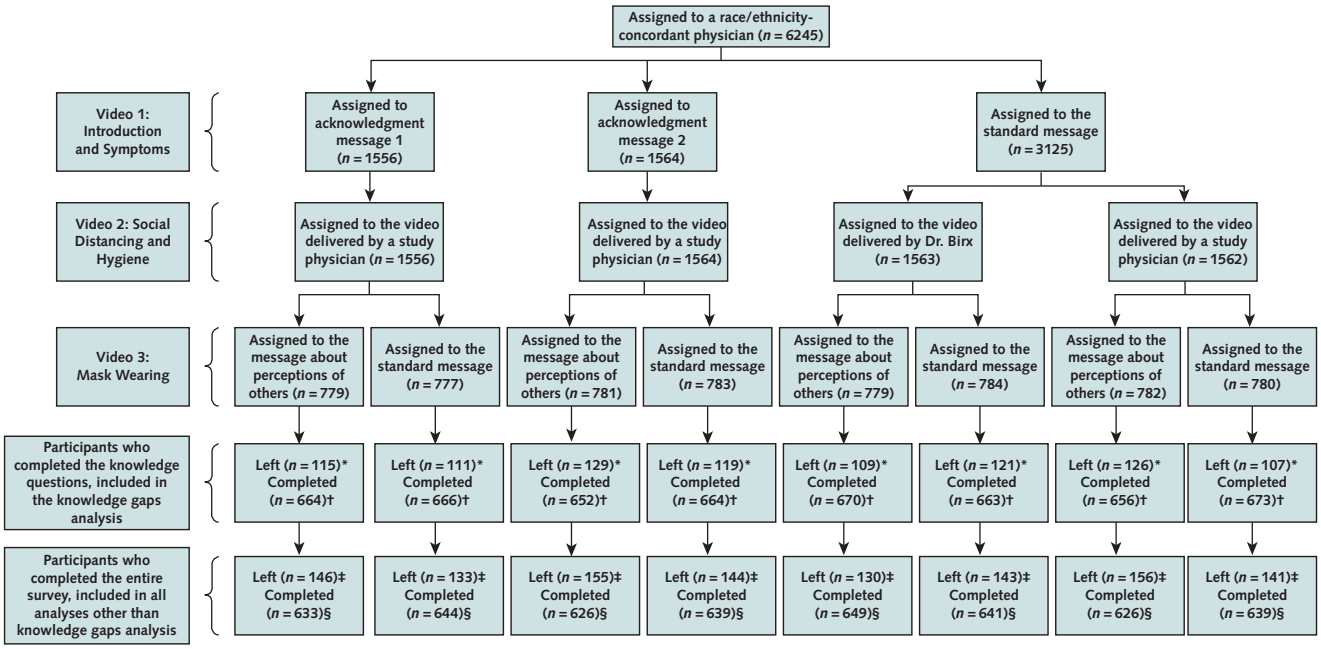
Author Contributions: Conception and design: F.C. Stanford, A. Banerjee, E.L. Breza, A.G. Chandrasekhar, P. Goldsmith-Pinkham, L. Ogbu-Nwobodo, B.A. Olken, C. Torres, A. Sankar, P. Vautrey, E. Duflo.
Analysis and interpretation of the data: M. Alsan, F.C. Stanford, A. Banerjee, E.L. Breza, A.G. Chandrasekhar, P. Goldsmith-Pinkham, L. Ogbu-Nwobodo, B.A. Olken, A. Sankar, P. Vautrey, E. Duflo.
Drafting of the article: M. Alsan, F.C. Stanford, A. Banerjee, E.L. Breza, A.G. Chandrasekhar, S. Eichmeyer, P. Goldsmith-Pinkham, L. Ogbu-Nwobodo, B.A. Olken, C. Torres, A. Sankar, P. Vautrey, E. Duflo.
Critical revision for important intellectual content: F.C. Stanford, A. Banerjee, E.L. Breza, P. Goldsmith-Pinkham, L. Ogbu-Nwobodo, B.A. Olken, C. Torres, P. Vautrey, E. Duflo.
Final approval of the article: M. Alsan, F.C. Stanford, A. Banerjee, E.L. Breza, A.G. Chandrasekhar, S. Eichmeyer, P. Goldsmith-Pinkham, L. Ogbu-Nwobodo, B.A. Olken, C. Torres, A. Sankar, P. Vautrey, E. Duflo.
Provision of study materials or patients: P. Vautrey.
Statistical expertise: A. Banerjee, E.L. Breza, A.G. Chandrasekhar, P. Goldsmith-Pinkham, B.A. Olken, A. Sankar, P. Vautrey, E. Duflo.
Obtaining of funding: A. Banerjee, E.L. Breza, A.G. Chandrasekhar, E. Duflo.
Administrative, technical, or logistic support: E.L. Breza, E. Duflo, C. Torres, A. Sankar.
Collection and assembly of data: M. Alsan, C. Torres, A. Sankar, P. Vautrey, E. Duflo.

Appendix Figure 1. Enrollment and randomization of participants.



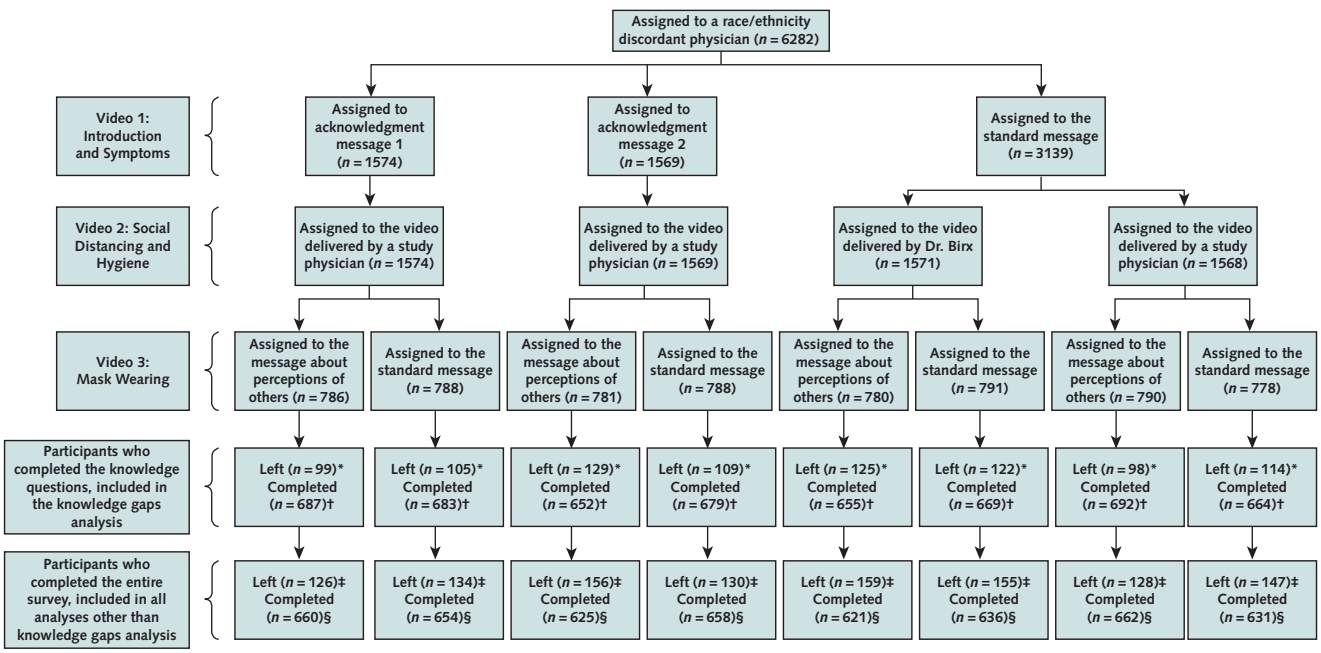
* Participants who left the survey before the knowledge outcome.
† Participants who completed the knowledge questions and were included in the knowledge outcome analysis questions.
‡ Participants left the survey before the links outcome.
§ Participants completed the survey and were included in all analyses.

Appendix Figure 2. Study flow diagram: group assigned to a race/ethnicity-concordant physician.



See Appendix Figure 1 for caption.

Appendix Figure 3. Study flow diagram: group assigned to a race/ethnicity-discordant physician.



See Appendix Figure 1 for caption.

Appendix Table. Summary of Participant Characteristics*

Variable	Study Participants			Control			Any Intervention		
	All	African American	Latinx	All	African American	Latinx	All	African American	Latinx
Measured at baseline									
Observations, *n*	14 144	8767	5377	1617	1042	575	12 527	7725	4802
Gender, *n (%)*									
Female	8112 (57.4)	5277 (60.2)	2835 (52.7)	943 (58.3)	636 (61.0)	307 (53.4)	7169 (57.2)	4641 (60.1)	2528 (52.6)
Male	6032 (42.6)	3490 (39.8)	2542 (47.3)	674 (41.7)	406 (39.0)	268 (46.6)	5358 (42.8)	3084 (39.9)	2274 (47.4)
Mean age (SD), *y*	38.93 (15.3)	39.63 (15.7)	37.78 (14.4)	39.16 (15.6)	39.78 (16.1)	38.03 (14.7)	38.9 (15.2)	39.61 (15.7)	37.76 (14.4)
Stratum									
Female, age ≥45 y, coastal	1318 (9.3)	879 (10.0)	439 (8.2)	164 (10.1)	111 (10.7)	53 (9.2)	1154 (9.2)	768 (9.9)	386 (8.0)
Female, age ≥45 y, central	2013 (14.2)	1380 (15.7)	633 (11.8)	229 (14.2)	162 (15.5)	67 (11.7)	1784 (14.2)	1218 (15.8)	566 (11.8)
Female, age ≤44 y, coastal	2010 (14.2)	1245 (14.2)	765 (14.2)	223 (13.8)	140 (13.4)	83 (14.4)	1787 (14.3)	1105 (14.3)	682 (14.2)
Female, age ≤44 y, central	2771 (19.6)	1773 (20.2)	998 (18.6)	327 (20.2)	223 (21.4)	104 (18.1)	2444 (19.5)	1550 (20.1)	894 (18.6)
Male, age ≥45 y, coastal	820 (5.8)	521 (5.9)	299 (5.6)	96 (5.9)	64 (6.1)	32 (5.6)	724 (5.8)	457 (5.9)	267 (5.6)
Male, age ≥45 y, central	996 (7.0)	641 (7.3)	355 (6.6)	111 (6.9)	75 (7.2)	36 (6.3)	885 (7.1)	566 (7.3)	319 (6.6)
Male, age ≤44 y, coastal	1939 (13.7)	1013 (11.6)	926 (17.2)	199 (12.3)	113 (10.8)	86 (15.0)	1740 (13.9)	900 (11.7)	840 (17.5)
Male, age ≤44 y, central	2277 (16.1)	1315 (15.0)	962 (17.9)	268 (16.6)	154 (14.8)	114 (19.8)	2009 (16.0)	1161 (15.0)	848 (17.7)
Mean household size (SD), *n*	3.22 (1.7)	3.04 (1.7)	3.5 (1.7)	3.23 (1.7)	3 (1.7)	3.64 (1.7)	3.21 (1.7)	3.05 (1.7)	3.48 (1.7)
Mean education index (SD)†	4.56 (1.5)	4.69 (1.5)	4.35 (1.4)	4.53 (1.5)	4.67 (1.5)	4.27 (1.4)	4.57 (1.5)	4.69 (1.5)	4.36 (1.4)
Other, *n (%)*									
Likely to run out of money because of COVID-19	7406 (52.4)	4657 (53.1)	2749 (51.1)	875 (54.1)	566 (54.3)	309 (53.7)	6531 (52.1)	4091 (53.0)	2440 (50.8)
Trouble paying for food	5150 (36.4)	3155 (36.0)	1995 (37.1)	558 (34.5)	358 (34.4)	200 (34.8)	4592 (36.7)	2797 (36.2)	1795 (37.4)
Hispanic origin									
Mexican, Mexican American, Chicano			3658 (68.0)			387 (67.3)			3271 (68.1)
Cuba			230 (4.3)			22 (3.8)			208 (4.3)
Argentina			82 (1.5)			8 (1.4)			74 (1.5)
Colombia			105 (2.0)			8 (1.4)			97 (2.0)
Ecuador			47 (0.9)			9 (1.6)			38 (0.8)
El Salvador			84 (1.6)			8 (1.4)			76 (1.6)
Guatemala			43 (0.8)			3 (0.5)			40 (0.8)
Nicaragua			24 (0.4)			5 (0.9)			19 (0.4)
Panama			22 (0.4)			2 (0.3)			20 (0.4)
Peru			63 (1.2)			8 (1.4)			55 (1.1)
Spain			216 (4)			27 (4.7)			189 (3.9)
Venezuela			59 (1.1)			9 (1.6)			50 (1.0)
Other country			681 (12.7)			73 (12.7)			608 (12.7)
Puerto Rico			63 (1.2)			6 (1.0)			57 (1.2)
Collected later in the survey‡									
Participants who completed additional questions on economic variables, *n (%)*									
Total	13 213	8094	5119	1482	940	542	11 731	7154	4577
Essential worker	3373 (25.5)	2017 (24.9)	1356 (26.5)	385 (26.0)	244 (26.0)	141 (26.0)	2988 (25.5)	1773 (24.8)	1215 (26.5)
Unemployed	1845 (14.0)	1138 (14.1)	707 (13.8)	206 (13.9)	132 (14.0)	74 (13.7)	1639 (14.0)	1006 (14.1)	633 (13.8)
Student	1309 (9.9)	778 (9.6)	531 (10.4)	158 (10.7)	92 (9.8)	66 (12.2)	1151 (9.8)	686 (9.6)	465 (10.2)
No medical condition reported	6034 (45.7)	3721 (46.0)	2313 (45.2)	702 (47.4)	448 (47.7)	254 (46.9)	5332 (45.5)	3273 (45.8)	2059 (45.0)
Health insurance	10 372 (78.5)	6499 (80.3)	3873 (75.7)	1165 (78.6)	766 (81.5)	399 (73.6)	9207 (78.5)	5733 (80.1)	3474 (75.9)

COVID-19 = coronavirus disease 2019.

* Summary statistics on baseline variables that have no missing values for any individual from our main sample. Additional economic variables were added later in the survey and therefore are missing for 931 participants.

† Education index is an integer capturing the highest level of education attained. Most of our respondents score in the following range: 1 (third grade or less), 2 (middle school [grades 4 to 8]), 3 (completed some high school), 4 (high school graduate), 5 (other post–high school vocational training), and 6 (completed some college, but no degree). Other possible values were 7 to 10 (associate's degree or higher) and 11 (doctorate).

‡ No values were missing for these economic variables.