Pre-Analysis Plan

Persuasion in Medicine: Experimental Evidence on Sender and Signal Effects

This Draft: January 22, 2020

1. Introduction

The aim of the study described in this pre-analysis plan is to identify what sender/signal combinations are most persuasive in encouraging low socioeconomic males living in the U.S. to take-up seasonal flu vaccination. We plan to recruit subjects and randomly assign them to persuasion treatments in the form of video infomercials that vary dimensions of the sender of the medical recommendation (concordance, expert, and empathy treatments). Specifically, we will cross-randomize race with "expert" as the actor in the video will portray either a doctor or a layperson. In addition, we will vary the script used in the experiment between one that acknowledges past injustices and one that does not.[1] Our outcomes of interest are posterior beliefs about seasonal flu vaccination, WTP for a free flu shot coupon and redemption of the coupon.

We are interested in testing the following hypotheses: (1) whether low-income male subjects (both pooled and separately by race) are more likely to be persuaded by concordant race doctors; and, (2) whether the concordance effect is similar for black and white male respondents. In addition, given the pipeline issues associated with increasing the supply of black male physicians in the short-run, a policy relevant question is whether community health workers (CHW) or other ancillary staff could function in place of medical doctors when recommending or informing about preventive health services. This could be a particularly effective strategy for distributing routine preventive medical care.[2] Theoretically, doctors may have more expertise when it comes to medical issues and may be viewed as more trustworthy, but laypeople might be socially more proximate to the men we are trying to reach. Thus, we will test, within black respondents, whether a black male doctor has the same effect as a black male layperson (Hypothesis (3)). Finally, for similar (pipeline) reasons, we are interested in whether the current stock of medical doctors (which has relatively few African-American and Hispanic doctors) could be trained in such a way to bridge any discordance effect (if one is shown to exist in our context). Thus, among black respondents, we will randomize them to white doctors that give a standard script vs. those that provide a more empathetic signal[3], and we will test, within black respondents, whether

[1] See Section 3.3 for transcripts of the scripts.

[2] The CHW model has been used extensively in developing world settings and for prenatal care in the U.S. See Srinivas et al (2019).

[3] Although we could test both the layman and empathy with white respondents as well, it's not clear how white respondents will interpret the signal. Prior piloting showed that white respondents assumed that black respondents dressed as laymen were less educated, which might make them more socially proximate than white men dressed as laymen. In addition, by focusing our hypotheses on policy-relevant parameters, we increase our power by reducing the number of arms from 16 to 6.

the white doctor empathy treatment has the same effect as the white doctor standard treatment (Hypothesis (4)).

The basic design requires collection of baseline and endline surveys combined with administrative data from pharmacies about coupon redemption. The outcomes of interest are posterior beliefs about the safety of seasonal flu vaccination, WTP for a free flu shot coupon, and redemption of the coupon.

First Pilot Lessons We have run a pilot with approximately 1000 male subjects recruited using the Qualtrics Panel. Unfortunately, our targeting of low-education was not precise - 500 of the subjects had some college education. We only asked half the sample priors, and piloted 16 treatment arms – making it difficult to detect effects. But among less educated, African-American subjects, there was some indication that the aforementioned interventions might prove effective (see power calculation below for further details).

A few additional points about the pilot. First, we had difficulty filling in cells for older African-American men using a Qualtrics panel. We are modifying the recruitment (as we originally planned to do for scale-up purposes) by adding online recruitment via Google/Facebook. Although Facebook still draws a more educated and majority population (see Allcott et al. 2019), the ad manager does provide the opportunity to target less educated individuals (see section on Targeting below). Google targets ads through searches and reaches a wide audience as well. A complementary exercise (pending IRB approval) is to have a video ad that plays automatically on Facebook.

Second, we noted that despite shifting posteriors in the direction of more favorable views of the flu vaccine, flu shot coupon redemption was virtually zero. This finding indicates that among the Qualtrics survey sample population, even our most "persuasive" intervention did not shift beliefs enough so as to pass individuals' net benefit thresholds and trigger coupon redemption. Thus, we are adding a deadline to the coupon (currently within 5 days of receipt) for entry into a lottery among those who redeem in that time frame. In addition, we are targeting people "on the margin" with our Facebook ad – those who will click on the link "Haven't had your Flu Shot yet?".[4] This is also of practical value because we are not only paying for survey completions, as in Qualtrics, but rather for "clicks" – thus the only way to target individuals that have not yet had a flu shot this season is via the actual ad.[5] For Google we will target people searching for flu-related terms. However, we still screen out those who have already taken the flu shot, since it is not recommended to obtain two shots in the same season.

Third, in the pilot, we randomly assigned half the sample to a survey that elicited prior beliefs about the flu and the flu shot and the other half to a survey that did not elicit priors. The rationale was the following: While priors are key heterogeneity dimensions of interest and while they increase the power of our analysis, we were worried that they would trigger a "doubling-down" effect or lead individuals to engage System II more often, thereby muting treatment effects in an undesirable (because not externally valid) way. However, our pilot revealed no such effects. Therefore, in the current wave that

[4]However, we've noted that people are sharing our ads and the targeting is being undone. We are currently exploring using lead ads and shifting our focus to Google.

[5]This however may lead only those who are mildly interested in either a) the survey incentive and/or b) the flu shot to click or ads. The pilot had no such ad associated with it (it was purely recruiting based on Qualtrics pool specifications and willingness to complete the survey for money).

recruits via multiple methods, we will ask priors to everyone.

Our field experiment has the following structure:

1. Recruitment and Baseline survey
    (a) Recruit via Qualtrics and online ads during the flu season.
    (b) Collect demographic information and healthcare experience.
    (c) Elicit prior likelihood/intent for getting vaccinated and probability of getting sick with the flu
    (d) Elicit priors from subjects about flu shot safety.
    (e) Assign video treatment.
    (f) Elicit willingness-to-pay (WTP) for a flu shot coupon with a multiple price list.[6]
    (g) Elicit posterior likelihood/intent for getting vaccinated.
    (h) Elicit posteriors about flu shot safety
    (i) Elicit social distance between the sender and receiver
    (j) Elicit ratings on the sender in the video.
    (k) Elicit attention to signal in the video.
    (l) Distribute flu shot coupons by email.
2. Endline survey, 3 months after Baseline
    (a) Elicit posteriors about flu shot safety.
    (b) Elicit self-report on whether received flu shot.
    (c) Elicit recall of information from Baseline video.
    (d) Debrief subjects.
3. Between Baseline and Endline
    (a) Collect information on flu shot coupon redemption from corporate partner.

For the option of showing a video immediately (as the ad) on a platform such as Facebook, the approach will need to be different. Also, see Section 7 on Complementary Evidence for more details.

1. Recruitment
    (a) Use the lead ad function to randomize groups of individuals to a given video (Note - this is a change from above where individuals are randomized via Qualtrics within the survey at the individual level).
2. Cluster Randomization

[6]The algorithm will oversample 0$ USD price draw, in which case the coupon will be provided for free.

(a) Will occur at the race-cohort-geography level. That is, within geographic cells (top ten MSAs with largest African American populations), we will randomize cohorts born in even or odd years to a given race sender. First, we will stratify on adjacent years of age and within each dyad we will randomly assign one cluster to receive the black and one cluster to receive the white doctor treatment. Then, we will randomly assign those in the black doctor treatment to one of our five black actors and similarly for those in the white treatment.

3. Outcomes

   (a) Since we will not be deploying a survey items will be limited to what we can gather on the social media platform such as: (i) Liking the video (ii) Amount and tone of comments on the video (iii) Clicking on the video (iv) Submitting email address to obtain flu shot voucher (v) Redemption of coupon.

Lead Ads: We plan to use "lead ads" when advertising with Facebook. Lead ads have two key advantages: 1) Lead ads can be configured such that individuals cannot share the advertisement. Preventing the sharing function gives us control over who sees the ad - we can limit it to just the people targeted by us.[7] 2) Lead ads allow Facebook users to submit their email address without having to leave the platform; furthermore, only people who receive the targeted ad can submit their email address. A disadvantage of lead ads is that you pay for impressions, not clicks.

2. Hypotheses Tested

In this study, we seek to answer the following research questions:

1. Does concordance between an expert (i.e. doctor) sender and receiver affect flu shot beliefs and/or behavior?
2. Is the effect of race concordance between expert sender and receiver stronger for black vs. white men?
3. Does a layperson sender work as well as an expert figure (i.e. medical doctor) in shifting the beliefs and/or behavior of black respondents?
4. If negative effects of a discordant expert sender to receiver exist, can these be mitigated by a signal that acknowledges past injustices?

3. Research Strategy

3.1 Recruitment and Sampling

Recruitment for the pilot was done via Qualtrics and ads on social media and Google. Our target population includes adult US males with a high school degree or less in a high flu activity geographic area.

[7] Although sharing itself is an interesting outcome, since we cannot distinguish how the recipient received the ad (targeting vs. share) without Facebook's assistance. Even if they provided such assistance we could not link their distribution method with the treatment arm unless Facebook also granted access to their emails. So, we will only used lead ads.

We aim to recruit 70% African Americans, and 30% Caucasians.

Recruitment - Qualtrics We will continue the Qualtrics sampling as an adjunct to the "scale-up" sample recruited via targeted advertising on Google/Facebook. Using Qualtrics to recruit is straightforward: the researcher specifies the demographics of the respondents and Qualtrics finds those individuals through one of its panels. Note they do not divulge details of how they recruit to their panels. On Qualtrics, we target African American and Caucasian males between the ages of 30 to 50 years old.

Recruitment - Ads We will also recruit via ads. One challenge of online advertising is that the impression/click to-survey-completion conversion rates are uncertain and can drive up costs. We discuss other nuances below.

Facebook Text Ad: Our procedure is to target individuals who Facebook identifies as African-American males in the odd ages between 35 to 45 years old and target all users who are male (regardless of race) for even ages.[8] Users will be shown an ad inviting them to participate in a health survey (see figure 1 below). Users will be shown a text ad leading them to enter their email address to learn more about the ad. (see figure 1 below).[9] After submitting the email address, they will receive a link via email that directs them to our Qualtrics survey with queries about demographic information including race.

Google Ads: Searchers who meet our criteria will be shown a similar ad to those using Facebook. They will be shown this ad when searching for key words related to the flu or flu shot.[10] They will then be asked to enter their email address and sent the Qualtrics survey. Google does not allow for targeting by race/ethnicity, but our survey screens for those who fall into the categories described above.

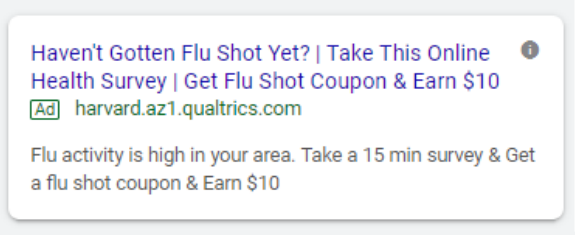
Figure 1: Facebook Ad

[8]Facebook ads do not allow for segmenting ads only to white individuals. The survey screens out those who are not in the race categories.

[9]Our ad will specifically ask if individuals have not yet had a flu shot this season, and whether they are interested in learning more about the flu shot – this is so as to target individuals who satisfy our key screening criterion (that is, have not received flu shot yet), and who are "on the margin" (that is, have at least some interest in learning more or receiving the flu shot).

[10]Flu Vaccine; Influenza; Flu shot; Free flu shot; Cdc flu shot; Free flu shot near me; Flu symptoms; Flu vaccination; Flu shot near me; Best time to get flu shot; Can flu shot make you sick; Can you get flu shot if you have a cold; Can you get sick from the flu shot; Flu shot effectiveness; Flu shot reactions; Mercury in flu shot; Side effects flu shot; When to get flu shot; Who should get a flu shot.

Figure 2: Google Ad



Facebook Video Ads: In this approach, which is distinct from the others, users will see the infomercial video as they scroll through their feed. The randomization will be clustered. The outcomes will also be different, likes, clicks, comments, email entry, coupon redemption. Since it will also be deployed via the lead ad mechanism which precludes sharing.

Target Sample – High Flu Activity Areas To target high flu areas, we monitor a weekly influenza surveillance update reported by state and territorial epidemiologists and compiled by CDC.[11] CDC categorizes each state by geographic spread of flu activity - "No activity", "Sporadic", "Local Activity", "Regional", "Widespread", and "No Report". We target the states categorized as "Widespread".

The target population is defined by the following criteria:

Demographic criteria For inclusion in our study are the following:

- Age: between 35 and 45 for Online Ads, and between 30 and 50 for Qualtrics.[12]
- Education: High school education or less.
- Gender: Male.
- Race: Caucasian or African American.
- Miscellaneous 1: Has not received the flu shot in the current flu season yet.
- Miscellaneous 2: Has sound on his device turned on.

Data quality checks Among the subjects who complete the Baseline survey, we will further exclude subjects from the analysis if they satisfy the following indicator for low-quality survey responses:

- Fast survey-taking: Within race and treatment group, is among the 5% fastest in terms of total time spent on survey.
- Nonsense answers in the open text sections that suggest low effort.[13]
- Inconsistent responses to questions. [14]

[11] See https://www.cdc.gov/flu/weekly/usmap.htm

[12] 35 and 44 for video scroll to keep only 10 groups.

[13] We refer to nonsense answers in the open text sections as answers that do not have decipherable English. We plan to have Mturkers code this

[14] Examples of inconsistent responses are (1) a respondent responds that he earns a high income but is unemployed or on disability; (2) a respondent who replies inconsistently on WTP questions (i.e. he is willing to give up $10 but not $1).

- Repeat survey takers.[15]

Flu shot coupon assignment Non-zero price draw: Among the subjects who complete the Baseline survey, we will further exclude subjects from the analysis if they received a non-zero price draw in the WTP elicitation for the flu shot coupon.[16]

3.2 Statistical Power

In the power calculation below, we state minimum sample sizes needed in order to detect effect sizes of 0.15 in terms of standard deviation units of WTP for the flu shot coupon.

For hypothesis 1, we need 743 subjects for each treatment (i.e. concordance) and control (i.e. discordance) to test an overall racial concordance effect across both black and white respondents assigned to an expert figure, detecting a difference in means (in standard deviation units) of 0.15. To detect this effect size *within* each race group, we need 803 subjects for treatment (i.e. concordance) and control (i.e. discordance) group within black respondents, and 828 subjects for treatment (i.e. concordance) and control (i.e. discordance) group within white respondents. Given that we are randomizing subjects to concordance or discordance as well as (for the African-American respondents) expert or layperson with a chance of 50/50, therefore, we need a total sample size of approximately 4,142 (3,212 for black and 930 white respondents).

For hypothesis 2, we need to double the sample size needed to test an overall racial concordance effect across both races assigned to an expert figure in order to test an interaction effect (i.e testing whether the effect of concordance varies by race of respondent).

For hypothesis 3, we need 639 subjects for each treatment (i.e. black respondents assigned to a concordant *doctor* delivering a standard message) and control group (i.e. black respondents assigned to a concordant *layperson* delivering a standard message) to detect 0.15 effect size in units of standard deviations.

For hypothesis 4, we need 861 for each treatment (i.e. empathetic treatment arm) and control (i.e. standard message arm) within black respondents assigned to a discordant doctor in order to detect a 0.15 effect size in units of standard deviations.

In conclusion, we need a sample size of 5,100 (3,444 black and 1,656 white respondents) to test our main hypotheses described in section 5.4 with 80% power and at a significance level of 0.05.

Using a sample size of 5,100 we can detect a difference in means (in standard deviation units) of (1) 0.08 between concordance and discordance group for both races; (2) 0.12 between concordance and discordance group within black respondents assigned to an expert figure; (3) 0.14 between concordance and discordance group within white respondents assigned to an expert figure; (4) 0.14 between doctor and layperson group within black respondents assigned to a concordant sender; and (5) 0.14 between

[15] We will identify repeat survey takers by checking for duplicate email or IP addresses in survey data.

[16] The probability of receiving a non-zero price draw is $\frac{1}{1000}$.

empathetic (M2) and normal message (M1) group within black respondents assigned to a discordant expert figure.

3.3 Treatment

We will randomize subjects across three different treatments, with respect to variation in the sender and message. Each treatment will involve an infomercial video in which a male actor gives information about the safety and efficacy of the flu shot. We will experimentally vary the: 1) race of the sender (either African American or Caucasian), 2) the sender "expert" (either doctor or layperson), 3) the message (either M1 or M2).

We produced videos with a total of 5 African American and 5 Caucasian actors. All actors wear the exact same clothes, and they record the video four times representing the experimental variation discussed above. All actors were recruited from the same casting agency and have separately been rated on attractiveness etc via Mturk. We also collected data from imdb.com and mandy.com about age, education, height, and weight. In the doctor role, the actors wear a button-down blue shirt, striped tie, a lab coat and stethoscope. In the layperson role, they wear a white T-shirt. The baseline script video is about 40 seconds long and is reproduced below.[17]

Message 1 (M1) script reads:

The Centers for Disease Control and Prevention, or CDC, recommends everyone 6 months and older get the flu shot. The shot protects you from getting sick by cutting your chance of catching the flu in half. It's also very safe: less than 1 in 100 vaccinated people experiences a side effect such as fever or chills. The flu shot does not contain an active flu virus, so you cannot get the flu virus from the shot. I get the flu shot every year to protect myself, my family, and my community. I recommend you look into getting vaccinated as soon as possible.

Message 2 (M2) script is identical to the above, except that we added three more sentences acknowledging historical injustices committed by the medical establishment. They are highlighted in bold-face below:

The Centers for Disease Control and Prevention, or CDC, recommends everyone 6 months and older get the flu shot. ***I know some people are nervous to follow medical advice about vaccines. In the past, there may have been times when the medical community broke your trust. But I hope that sharing some information with you can help you understand how important the flu shot is.*** *The shot protects you from getting sick by cutting your chance of catching the flu in half. It's also very safe: less than 1 in 100 vaccinated people experiences a side effect such as fever or chills. The flu shot does not contain an active flu virus, so you cannot get the flu virus from the shot. I get the flu shot every year to protect myself, my family, and my community. I recommend you look into getting vaccinated as soon as possible.*[18]

[17] See appendix materials to this pre-analysis plan for two examples of the videos we recorded.

[18] For the layperson video - we replaced the word "cannot" with "can't" for the phrase "cannot get the flu virus from the shot."

We include as a screening question the capability to turn the sound on so individuals can hear the video.

3.4 Assignment to Treatment

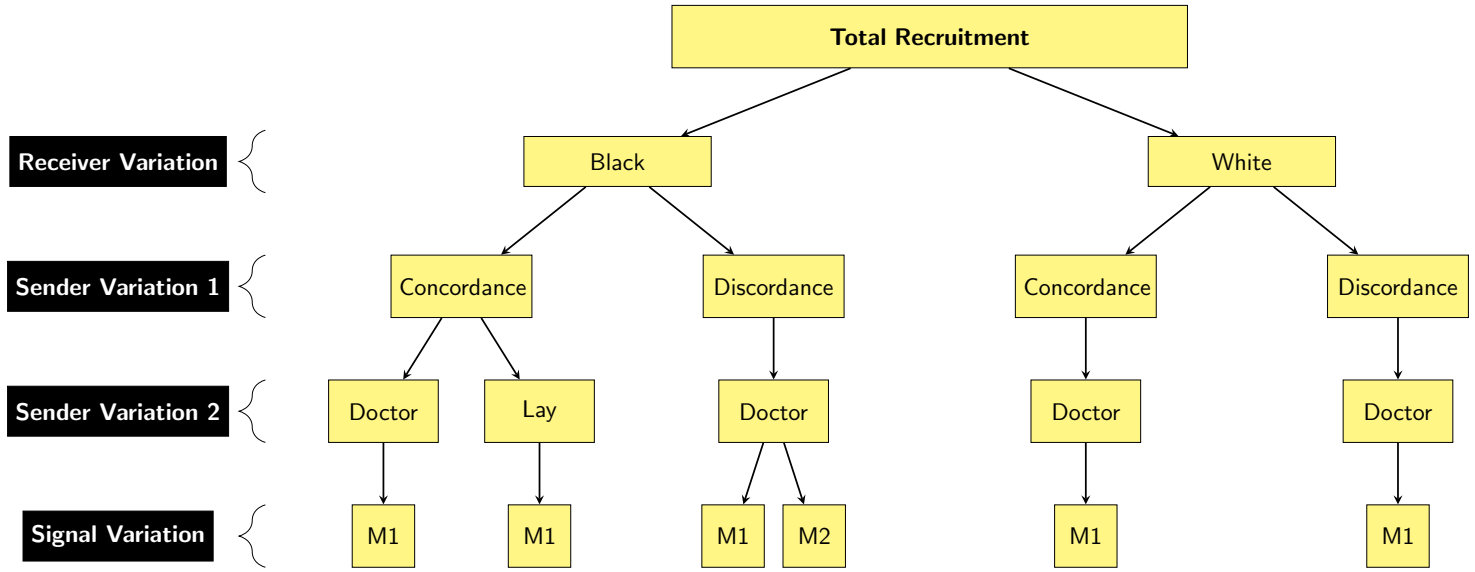
Subjects will be randomly assigned to one of six main treatment groups that differ in the three dimensions described in Section 3.3, with respect to variation in the sender and message. There will be an equal draw for black and white senders, an equal draw of M1 and M2, and an equal draw towards a doctor vs. layperson. Within each treatment group, subjects will be randomly assigned to one of the 5 recorded actors of the assigned race; we will assign subjects to each actor with equal proportion.

All subjects with a price draw of $0 in the WTP elicitation will receive a free flu shot coupon. We will draw the price of $0 with a probability $\frac{999}{1000}$. This is so that we can measure redemption in the majority of the sample.

We checked whether asking priors changes behaviors via a "doubling down effect" or engaging System II vs. System I in decision-making. We did not see a strong effect and scaled up the asking of priors to all respondents (See section on Pilot Lessons above).

Please see Figure 3 for the overview of the study design.

Figure 3: Study Design



3.5 WTP elicitation

Redemption rates of the flu shot coupon (Redemption) as well as willingness to pay (WTP) for the coupon are the main outcomes of interest in this study. We will use the following method to elicit flu shot coupon valuations in an incentivized manner.

Immediately after the video treatment stage, we will use a multiple price list to elicit WTP. The price list includes prices $1, $2, $5, and $10. Prices will be presented as a take-it-or-leave-it offers. Subjects will be asked whether they prefer to receive or not receive the coupon at each price.

Subjects will be made aware that the amount would be deducted from their overall survey earnings. They will also be informed that the computer will randomly draw one of the prices after they made their decision, and that a price of $0 might also be drawn. At price $0, the coupon would be handed out for free. If the price drawn is above $0 and a subject accepted at that price, he will receive the coupon and pay that amount out of his survey earnings. If the subject rejected the price, he will not receive the coupon and will keep his entire survey earnings. We will skew towards drawing a $0 price so that we can observe redemption decisions for most subjects.

Since our target population is expected to have lower literacy and numeracy then other experimental samples – we have striven to keep our questions about WTP straightforward and provide an explanation in words of the consequences of each decision.[19]

3.6 Coupon Redemption

The pilot revealed a very low take-up of the flu shot coupon. We have endeavored to improve this using two strategies; one is to inform respondents that they can enter a lottery for $100 if they redeem the coupon. Two is to make entry into the lottery contingent on redemption in a narrow window of time after coupon receipt so as to militate against procrastination.

This strategy is helpful under the following circumstance: Although our intervention shifts beliefs in the right direction (i.e. towards increased net benefits of the flu shot), beliefs about net benefits are still below the internal “threshold" for taking the action to redeem the coupon – see theories of behavior change in Prochaska and Wayne (1997).[20] That is, even after our intervention subjects are potentially still in the contemplation phase. Our supposition is that the lottery will help clear the threshold for some, while preserving differences between the treatment groups that are due to treatment.[21]

[19] We also wanted to keep the survey length manageable and hence we do not have training/understanding questions in the survey.

[20] According to the transtheoretical model in Prochaska and Wayne (1997), behavioral change is a “process involving progress through a series of stages", which is composed of precontemplation, contemplation, preparation, action, maintenance, and termination.

[21] The one potential drawback is that financial incentive/lottery overpowers the lighter touch treatment that we give via the videos. Because we are not interested in whether incentives change behavior, we are not randomizing the lottery.

3.7 Attrition from the Sample

The vast majority of our outcome variables will be collected in the Baseline survey, and thus will not be subject to attrition. That is, we expect few, if any, people to drop out after watching the video but before completing the survey, since they would lose the $10 survey incentive. We have some secondary outcome variables that can be impacted by attrition, though. Namely, all variables that will be collected in the Endline survey. The variables are: "Flu shot - self report / spouse / child", all secondary outcomes in the "Beliefs about the flu and flu shot" section, and all attention/recall questions elicited at Endline.

4. Fieldwork

4.1 Instruments

We will collect data from two major sources: Online surveys and administrative data on flu coupon redemption from the pharmacies. The surveys will be hosted by the survey platform Qualtrics. Individual-level data on flu shot coupon redemption will come from TotalWellness, the company that will provide the flu shot coupons to us. The coupons are redeemable at all major pharmacies, such as CVS, Walgreens, Kroger, and Wal-Mart, in the US.[22]

4.2 Incentives

With respect to incentives, we will pay each subject a $10 gift card for completing the Baseline survey, and $5 gift card for completing the Endline survey. Among Baseline survey participants who redeem the flu shot coupon within 5 days of coupon receipt, we will draw a lottery winner and pay the winner a $100 gift card.

4.3 Data Collection

The field experiment will take place during the flu season, that is between December and February. Our experiment will commence with the Baseline survey around the second or first week of December and data collection is projected to be completed with an Endline survey in March 2019.

Data collection will entail three components: Baseline survey responses, Endline survey responses, and data on flu shot coupon redemption. We will link the data across the three components using a unique numeric study identifier (ID) for each subject. In practice, we will assign the ID in the Baseline survey, where we also collect subjects' email addresses. After a participant who is eligible for the coupon completes the Baseline survey, he will receive the coupon immediately by email. The coupon has the subject's study ID printed on it. When a coupon is redeemed at a pharmacy, the pharmacist will record the ID and automatically pass it on electronically to TotalWellness for billing. TotalWellness in turn will collect the IDs of redeemed flu shot coupons and pass the list on to the research team for billing.

In addition to the above, we will collect data from a separate sample of low-income men regarding feedback on the actors including their attractiveness, tone and trustworthiness.

[22] See list of participating pharmacies here: https://www.totalwellnesshealth.com/pharmacy-2/.

4.4 Data Processing

Survey responses collected on Qualtrics will be downloaded as a .csv file, and then cleaned and analyzed in STATA. Data on flu shot coupon redemption will be merged with the unique study ID of each subject. Any PII will be dropped from the dataset, since it is not needed for the analysis. It is anticipated that do files that create and analyze the data will be made available to other research teams. The clean data (without identifiers) will also be made available. Only non-PII information on the actors will be released.

5. Empirical Analysis

5.1 Outcome Variable Construction

5.1.1 Flu shot take-up

Primary outcomes:

- **Flu shot coupon redemption**: Indicator for whether a flu shot coupon was redeemed. Coded 1 if yes, and 0 if no.

Secondary outcomes:

- **Flu shot likelihood - self**: Collected before and after display of the video at Baseline. Measured by answer to the survey question *"How likely are you to get a flu shot before February 2020? - scaled from 0 (Not at all likely) to 10 (Extremely likely).*
- **Likelihood of recommending the flu shot to friends or family - self**: Collected after display of the video at Baseline. Measured by answer to the survey question *"How likely are you to recommend the flu shot to a family member or friend? - scaled from 0 (Not at all likely) to 10 (Extremely likely).*
- **Flu shot - self report**: Collected at Endline. Indicator based on answer to the survey question *Did you get the flu shot since you completed our first survey (i.e. since October 2019)? - Yes/No.*
- **Flu shot - spouse**: Collected at Endline. Based on answer to the survey question *Did your spouse get a flu shot this season? - Yes/No/Don't have a spouse/Don't know.* - Coded 1 if "Yes", 0.5 if "Don't know", 0 if "No", and missing if "Don't have a spouse".
- **Flu shot - child**: Collected at Endline. Based on answer to the survey question *Did your children get a flu shot this season? - Yes/No/Don't have children/Don't know.* - Coded 1 if "Yes", 0.5 if "Don't know", 0 if "No", and missing if "Don't have children".
- **Flu shot - household**: Collected at Endline. Based on answer to the survey question *Did anyone in your household get a flu shot this season? - Yes/No/Live alone/Don't know.* - Coded 1 if "Yes", 0.5 if "Don't know", 0 if "No", and missing if "Live alone".

Index of flu shot take-up:

- Includes all primary and secondary outcomes listed above that are measured at Baseline.[23]

[23]The index is based on Baseline responses only to reduce any bias due to selective attrition between Baseline and Endline.

5.1.2 Flu Shot Valuation (WTP)

- **Flu shot coupon WTP**: Collected after display of the video at Baseline. Measured using the WTP elicitation as detailed in Section 3.5. Coded as the maximum price at which a subject opted to receive the coupon. If a subject preferred not to receive the coupon at all prices, WTP will be coded as 0. Because our funding is currently limited, we may not have the power to detect all differences but we are actively pursuing sources.

5.1.3 Beliefs about Flu Shot Safety

Primary outcomes:[24]

- **Flu shot safety**: Collected before and after display of the video at Baseline. Measured by answer to survey question *"Take 100 adult men, selected from your community at random. Let's say all of the 100 adult men receive a flu shot at the start of the flu season. How many of them do you believe get the flu from the flu shot?"*. Coded as 100 minus the subject's answer. [25]

- **Self-Confidence on Flu Shot Safety**: Collected before and after display of the video at Baseline. Measured by answer to survey question that asks subject to distribute 10 balls over 10 different bins. Each bin represents a range of people, out of 100, who get sick from the flu shot. Coded as total number of balls that are put into the "0-9" bin. [26]

Index of beliefs - primary:

- Includes all variables from Section 5.1.3.

Secondary outcomes:[27]

- **Flu shot safety**: Collected at Endline. Answer to the survey question phrased exactly as the question described in "Flu shot safety".

- **Self-Confidence on Flu Shot Safety**: Collected at Endline. Answer to the survey question phrased exactly as the question described in "Flu shot safety confidence 1".

Index of beliefs - secondary:

- Includes all variables from the "Secondary outcomes" section of Section 5.1.3.

[24] Note we also considered incentivizing the belief elicitation, whereby people would make predictions and their guesses would be rewarded if correct. However we found it challenging to find an accepted arbitrator of the "truth".

[25] We have developed a novel interactive graphic for this and the question above that use a frequentist interpretation of probability and involves highlighting gray individual stick men with blue shading. This form of probability has been found to be easier to understand than others – see work by Gerd Gigerenzer.

[26] We have developed a new graphic interface for this question based on work by Delavande and Rohwedder (2008). See a picture of the graphic in the Appendix.

[27] All of the outcomes listed will be collected at Endline

5.1.4 Social Distance Between Sender and Receiver

All of the outcomes listed will be collected at Baseline.

- **Measure of Social Distance 1**: Collected after display of the video at Baseline. Measured by answer to the survey question *"If a person like the one in the video was located near you, would you want to ask him about other health issues?" - coded as 1 if yes, and 0 if no.*
- **Measure of Social Distance 2**: Collected after display of the video at Baseline. Measured by answer to the survey question *"Would a person like the one in the video be a contact in your phone or a friend on social media?" - coded as 1 if yes, and 0 if no.*

5.1.5 Sender and Signal Rating

All of the outcomes listed will be collected at Baseline.

- **Likelihood of recommending the video to friends or family - self**: Collected after display of the video at Baseline. Measured by answer to the survey question *"How likely are you to recommend this video to your friends or family? - scaled from 0 (Not at all likely) to 10 (Extremely likely).*
- **Trustworthiness**: Answer to survey question *"How much do you agree or disagree with the following statement?: I trust the person in the video to give me medical advice. - Disagree strongly/Disagree/Neither agree nor disagree/Agree/Agree strongly"*. Coded as -2, -1, 0, 1, 2.
- **Qualification**: Answer to survey question *"How much do you agree or disagree with the following statement?: The person in the video is qualified to give me medical advice. - Disagree strongly/Disagree/Neither agree nor disagree/Agree/Agree strongly"*. Coded as -2, -1, 0, 1, 2.
- **Applicability**: Answer to survey question *"How much do you agree or disagree with the following statement?: The information provided in the video applies to people like me. - Disagree strongly/Disagree/Neither agree nor disagree/Agree/Agree strongly"*. Coded as -2, -1, 0, 1, 2.

Index of messenger rating:

- Includes all variables from the Section 5.1.5.

5.1.6 Attention / Recall

Primary outcomes:[28]

- **Frequency recall**: Measured by answer to the survey question *What did the person in the video say about who should get the flu shot?* - Everyone 6 months and older/Everyone 5 years and older/Everyone 18 years and older/I don't know. Coded 1 if selected "Everyone 6 months and older", and 0 otherwise.
- **Flu shot ingredient recall**: Measured by answer to the survey question *What did the person in the video say about what the flu shot contains?* - Contains active flu virus/Contains no active flu virus/I don't know. Coded 1 if selected "Contains no active flu virus", and 0 otherwise.

[28] All of the outcomes listed will be collected at Baseline.

- **Background color recall**: This question is incentivized: Subjects will earn an extra $ if they answer correctly. Measured by answer to the survey question *What color was background displayed in the video?* - Gray/White/Blue/I don't know. Coded 1 if selected "Blue", and 0 otherwise.

Index of attention/recall - primary:

- Includes all variables from the Section 5.1.6.

Secondary outcomes:[29]

- **Gender recall**: Measured by answer to the survey question *Was the person in the video a man or a woman?* - Man/Woman/I don't know. Coded 1 if "Man", and 0 otherwise.
- **Race recall**: Measured by answer to the survey question *What was the race of the person in the video?* - Black/White/Other/I don't know. Coded 1 if selected correct answer, and 0 otherwise.
- **Expert recall**: Measured by answer to the survey question *What was the person in the video wearing?* - A doctor's coat/Casual clothes/I don't know. Coded 1 if selected correct answer, and 0 otherwise.

Index of attention/recall - secondary:

- Includes all variables from the "Secondary outcomes" section of Section 5.1.6.

5.2 Index Construction

We plan to construct indices of all outcomes related to beliefs in the flu vaccine, WTP, likely to get a flu shot, and coupon redemption according to the procedure outlined in Anderson et al. (2008) and Kling Liebman and Katz (2007). We will also create additional indices of other outcomes related to beliefs about the actor in the video and attention to the video. XXYY decide on groupings

5.3 Balance Checks

We will conduct a series of balance tests across treatment arms to ensure that there are no chance differences between subjects in the various arms. We will regress characteristics on indicators for the arms and test their individual and joint significance. Balance tests will be conducted using the following subject background covariates:[30]

- Age
- High School Diploma
- Health Insurance

[29] All of the outcomes listed will be collected at Endline.

[30] We will also have a balance test for the actors across race. Caucasian respondents are included reducing the chance that a concordance effect for African-American subjects, for example, is being driven by the African-American actors being more attractive, higher quality etc than the Caucasian actors. This is because the same set of African-American actors/videos would not have the same predicted effect on Caucasian subjects. It's also possible that if there are differential perceptions across doctor race by respondent race, this is mediating any concordance effect we find.

- Unemployed
- Married
- Income
- Ever Vaccinated
- Prior Belief on Likelihood of Getting a Flu shot and the Flu
- Prior Belief on Cost of Flu Shot
- Prior Belief on Flu Effectiveness and Safety

5.4 Treatment Effects

We intend to measure the treatment effects in the following primary outcomes:

- y_1: difference between prior and posterior beliefs about flu shot safety, such that:

$$y_{1i} = \mu_{1i}^0 - \mu_{1i}^1$$

  where μ_{1i}^0 is subject i's prior belief on the perceived safety of the flu vaccine, while μ_{1i}^1 is subject i's update belief on the perceived safety. If the information from the video shifts the subject's priors to the truth, y_{1i} is positive.

- y_2: difference between prior and posterior intention for a flu shot, such that:

$$y_{2i} = \mu_{2i}^1 - \mu_{2i}^0$$

  where μ_{2i}^0 is subject i's prior intention for getting a flu shot, while μ_{2i}^1 is subject i's posterior intention for getting a flu shot. If the subject becomes more willing to get a flu shot after watching the video, y_{2i} is positive.

- y_3: highest WTP price for a flu shot coupon within a set of prices, \$1, \$2, \$5, \$10. If a subject rejects all the prices, it is recorded as \$0.

- y_4: coupon redemption, which is equal to 1 if redeemed, or 0 otherwise.

- y_5: likelihood to recommend the video to friends or family.

- y_6: likelihood to recommend a flu shot to friends or family after watching the video.

Using these variables, we construct a single vector variable, Y', for each individual i, such that:

$$Y_i' = \begin{bmatrix} y_{1i} \\ y_{2i} \\ y_{3i} \\ y_{4i} \\ y_{5i} \\ y_{6i} \end{bmatrix}$$

We intend to test the following hypotheses with this outcome variable:

H1: Y' ***is higher for subjects randomized to a concordant doctor than those randomized to a discordant doctor.***

$$Y_i' = \alpha + \beta_1 \mathbb{1}_i^{c|a=1,e=0} + X_i'\Omega + \epsilon_i$$

where i is an individual subject. The following indicators describe subjects' treatment status:

- c indicates whether a respondent is assigned to a concordant sender; 1 if so, or 0 otherwise.
- a indicates whether a respondent is assigned to an expert sender; 1 if so, or 0 otherwise.
- e indicates whether a respondent is assigned to receive an empathetic message; 1 if so, or 0 otherwise.

$\mathbb{1}_i^{c|a=1,e=0}$ is an indicator for random assignment to a concordant setting for the respondents assigned to an expert sender delivering no empathetic message.

X is a vector of attributes of the subjects and of the actors they are assigned to. We will obtain perceptions of the actors from a separate sample of men that are similar to the target population.[31] Ideally these subject and actor characteristics would be balanced across arms but it's possible there is imbalance by chance. Additional important controls in our context may be the timing in which recruitment occurs relative to the flu season and the local intensity of the flu virus nationally or at a more local geographic level (i.e date and place of recruitment). We will use double-selection LASSO to choose a control set.[32]

The coefficients of interest are the β. If concordant pairs update more than discordant among those assigned to an expert sender delivering no empathetic message, then β_1 should be positive (negative) and significant for the outcomes of effectiveness (harm).[33]

H2: Concordance is more important for blacks than for whites.

$$Y_i' = \alpha + \beta_2 \mathbb{1}_i^{c|a=1,e=0} + \beta_3 \mathbb{1}_i^{r=b} + \beta_4 [\mathbb{1}_i^{c|a=1,e=0} \cdot \mathbb{1}_i^{r=b}] + X_{i,r}'\Omega + \epsilon_i$$

where $\mathbb{1}_i^{c|a=1,e=0} \cdot \mathbb{1}_i^{r=b}$ is an interaction term between a concordance effect and subject's race. This term tests the effect of concordance(or discordance) across black and white respondents.

[31] A subset of these questions are also asked in the baseline survey to the experimental sample. These variables include perceived age, qualifications, education, attractiveness, and trustworthiness. We will also use a voice analytic software to characterize the actors' voices.

[32] http://www.nber.org/programs/dev/slides/18Duflo.pdf.

[33] This follows Hjort et al. (2019) who examine posterior beliefs based on the signal (re: early childhood intervention effect size) and the prior.

H3: The racial concordance effect will be greater for a black respondent assigned to a black doctor than for a black respondent assigned to a black layperson sender.

$$Y'_{i,r} = \alpha + \beta_4 \mathbb{1}_{i,r=b}^{a|c=1,e=0} + X'_{i,r=b}\Omega + \epsilon_{i,r=b}$$

where $\mathbb{1}_{i,r=b}^{a|c=1,e=0}$ is an indicator for random assignment to an expert actor among the black respondents assigned to a concordant sender delivering a standard message, M1. If β_4 is positive and significant, this suggests that an expert is specifically important for black respondents in terms of updating beliefs in a concordant setting.

H4: For black respondents, Y' is higher for subjects randomized to a discordant doctor delivering an empathetic message, M2, than those randomized to a discordant doctor delivering a standard message.

$$Y'_{i,r} = \alpha + \beta_6 \mathbb{1}_{i,r=b}^{e|a=1,c=0} + X'_{i,r=b}\Omega + \epsilon_{i,r=b}$$

where $\mathbb{1}_{i,r=b}^{e|a=1,c=0}$ is an indicator for random assignment to receive a empathetic message among the black respondents assigned to a discordant expert sender. If β_6 is positive and significant, this suggests that, in a discordant setting, validating perceived mistreatment in the past by an expert figure makes black respondents update their beliefs more.

5.5 Heterogeneous Effects

Important secondary analyses will include investigating variation in the treatment response through interaction effects and sample splits. In particular, we are interested in whether the:

- persuasion treatment effects (TE) (concordance expert and/or empathy) are different for black and white respondents
- persuasion treatment effects interact with each other
- TE vary by level of attention[34]
- TE vary by priors (beliefs about safety of shot)
- TE vary by perceived cost of flu shot
- TE vary by sociodemographic characteristics or medical history of the respondent (e.g. insurance status, marital status, has PCP, education)
- TE vary by "social distance" between the sender and receiver.[35]
- TE vary by local conditions, such as flu severity, flu shot availability, perceived and actual number of individuals vaccinated in community
- TE vary by distance to nearest pharmacy
- TE vary by double selection LASSO for finding heterogeneous treatment effects

[34] Attention may also be an outcome, if so we would be estimating complementary effects.

[35] Social distance proxied by age, education, race, income.

5.6 Standard Error Adjustments

Although the level of randomization is the individual (respondent) there could be correlation across individuals randomized to the same actor-script-expert combination. Since we have 40 such treatment clusters we will plan to cluster at this level. We will also use randomization inference to calculate p-values (i.e. RI-test command developed by Simon Heß).[36]

5.7 Attrition

Attrition will be defined as those who have viewed the video but then drop out of the survey afterwards and do not complete it within four days of initiation.[37] We will check that attrition is not differential across study arms. We will send respondents links to complete the survey from the point that they dropped out.[38] The target for the sample is 5,000 *completed* surveys.

6. Research Team

The principal investigators of this study are Marcella Alsan and Sarah Eichmeyer. They will contribute equally to all stages of the project - that is the design and execution of the field experiment, as well as to the analysis of the collected data. Min Jeong (Joyce) Kim will support the project as a research assistant. She will assist in all aspects of the project implementation.

7. Complementary Evidence

We propose the following extensions to our design:

Randomize African American Facebook users in high flu-activity regions into receiving an infomercial displaying either a concordant or a discordant individual (and we may also vary authority) *directly on their Facebook wall*, using targeted video advertising. We will randomize at the cohort-level (such that 31, 33, and 35 year olds receive video A, and 30,32,34, and 36 year olds receive video B, etc.).

Underneath the infomercial will be a button allowing viewers to submit their email address, in order to receive a coupon for a free flu shot. We will track the following outcomes:

1. Whether the individual submitted his email address to receive a coupon.
2. Whether the individual "liked" the video.
3. Amount and tone of comments underneath the video.
4. Number of vouchers redeemed, by infomercial treatment condition.

[36] See https://github.com/simonheb

[37] Qualtrics allows up to four days to finish the survey after starting it.

[38] This is a modification from the originally posted plan on 10/31/19 and takes into account that some subjects had technical difficulty returning to the survey after clicking on the map.

We hope that this extension can complement our survey design in the following ways:

1. Obtain more directly externally valid measures of concordance effects, via an "organic" distribution of the infomercials through videos on Facebook.
2. Obtain additional "hard", non-survey-based measures of effects on vaccination intent.

8. Funding and Ethics

Funding is provided by the J-PAL Health Care Delivery Initiative from MIT as well as Harvard Kennedy School. The IRB at Harvard is serving as the primary institution of record and has entered into a reliance agreement with Stanford and MIT.

9. References

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Appendix

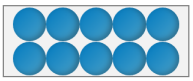
A. Baseline Survey Link

https://harvard.az1.qualtrics.com/jfe/form/SV_ellmX4HMb5h3NVH

B. Infomercial Video Link

- Version Message 1: https://youtu.be/CxxWBTOew-U
- Version Message 2: https://youtu.be/TlruIaBOk3o

C. Distribution of Beliefs



This next question further helps us understand how certain you are of your answer regarding the side effects of the flu shot.

Again, consider the group of 100 adult men selected at random from your community, and suppose all of them **get the flu shot**.

You have 10 balls that you can put in 10 different bins, reflecting **what you think are the chances out of 10 that the number of men who get sick from the flu shot falls in each bin**. The more likely you think it is that the number of men with side effects falls in a given bin, the more balls you should place in that bin.

For example, if you put all the balls in one bin, it means you are certain the number of men that will fall sick from the flu shot is somewhere in that range.

− + **0-9** out of 100 get sick from flu shot

− + **10-19** out of 100 get sick from flu shot

− + **20-29** out of 100 get sick from flu shot

− + **30-39** out of 100 get sick from flu shot

− + **40-49** out of 100 get sick from flu shot

− + **50-59** out of 100 get sick from flu shot