Ameliorating Vaccine Hesitancy: Should You Use Logic or Emotion? Evidence From A Randomized Controlled Trial of 5,000 Participants

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1 Introduction

According to the World Health Organization (2025), there have been over 777 million covid-19 cases reported worldwide, with 7 million deaths worldwide. It is known that covid-19 vaccination is an efficacious means of spread prevention, and survival of patients. However, patients are often unwilling to take the vaccine even in the face of the pandemic. According to Pew Research (2023), 36% of Americans believed that the negatives of the covid vaccine outweighed the positives.

Not only this, but the covid-19 pandemic had a differential impact based on race. African Americans and Hispanics were disproportionately impacted by the coronavirus pandemic. According to Reyes (2020): "Approximately 97.9 out of every 100,000 African Americans have died from COVID-19, a mortality rate that is a third higher than that for Latinos (64.7 per 100,000), and more than double than that for whites (46.6 per 100,000) and Asians (40.4 per 100,000)." Thus, if it is the case that different and more efficient methods can be found to encourage people to take vaccines, it is possible that this racial gap could be closed.

This study employs a randomized controlled trial to examine the impact of stimuli in the form of facebook posts shown to patients to encourage them to take the covid-19 vaccine. There will be two treatment groups and one control. The first treatment group will view a Facebook video that makes an appeal to logic, and the second treatment group will view one that makes an appeal to emotion, while the control group receives no stimulus.

The results will have large implications on future research in how to market and encourage vaccination, working towards eradicating vaccine hestitancy.

2 Data

Our data is garnered from a randomized control trial, where 5,000 participants took part in a baseline survey which tabulated their age, income, most common news consumption modality, political leaning, race, and education attained. This data offers a baseline of information about the patients that will educate the study about those taking part.

We then assigned our treatments randomly, with the first treatment being exposure to a Facebook post that uses a logos appeal, and the second treatment being exposure to a Facebook post that instead uses a pathos appeal. Our final group of the dataset will be our control group, receiving no treatment. An equal $\frac{1}{3}$ of the participants will be assigned to each, with completely random assignment to avoid any issues of selection bias that could harm our study.

Then, we conduct an endline survey after issuing the treatment to a randomly assigned $\frac{1}{3}$ of the participants, another treatment to a randomly assigned $\frac{1}{3}$ of the participants, with a $\frac{1}{3}$ of participants remaining as the control group. Unfortunately, we faced attrition in the study, and 500 participants dropped out of the dataset. Thus, we will only have 9,000 remaining observations for 4,500 unique individuals. Nonetheless, this still offers us the ability to make strong conclusions despite the adversity faced.

Because our trial is as easy as exhibiting a video to the patients, not only does none of the unchanging variables over time such as race alter, but in addition the other variables like education, political leaning, and income do not either, because the continuous time between the discrete time periods is too short for these to see a change. This is very helpful for our study, as it isolates the impact of the treatment effect away from other potential confounders.

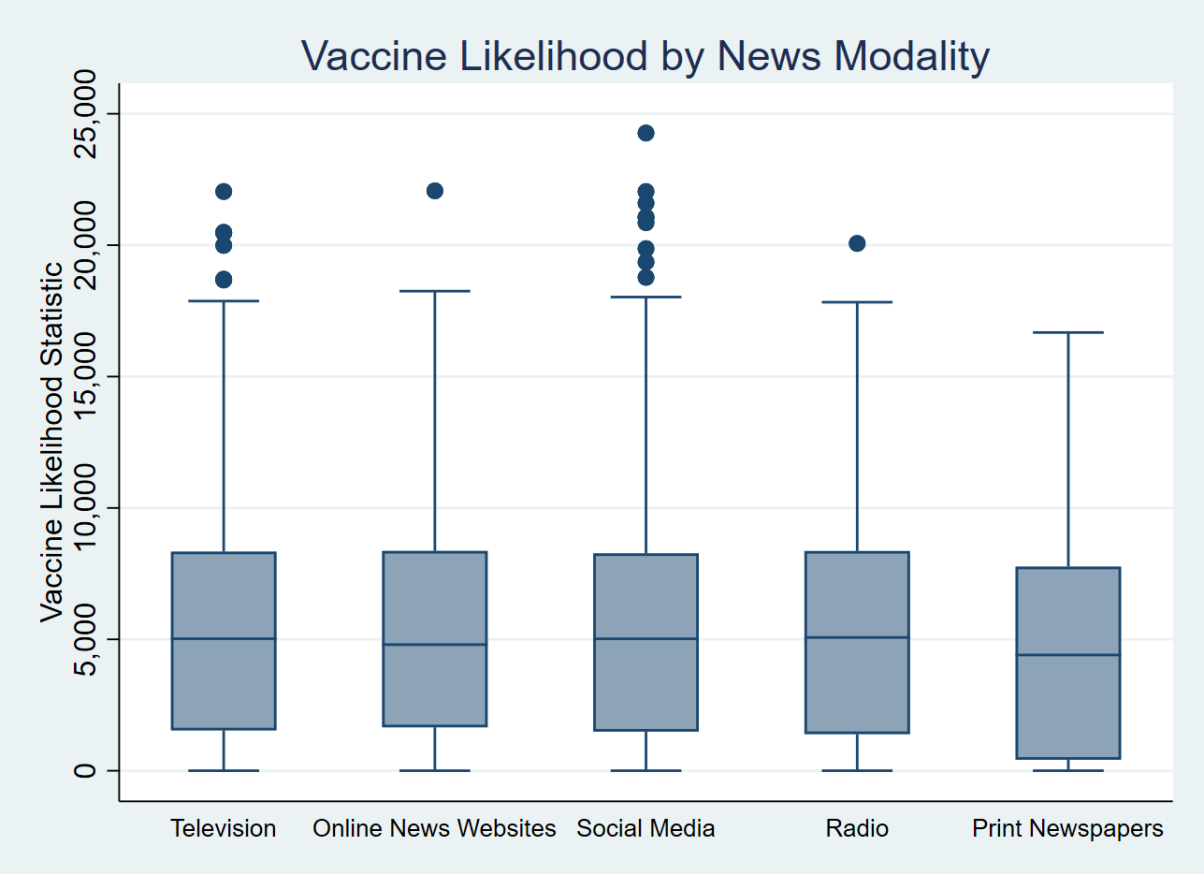

Figure 1: Vaccine Likelihood By News Consumption Modality (Pre-Treatment)

Interestingly, it appears that in our box and whiskers plot of the vaccine likelihood, we have that print newspapres seem to have a very low 25th percentile vaccine likelihood statistic compared to the other news consumption modalities. Perhaps this is due to a lack of information garnered from online sources which may leave the person less inclined.

Additionally, there's seems to be more variability in data points for the patients whose most frequent form of news modality is social media. Potentially the people who are at the top of the vaccine likelihood statistic are very in tune with the current information, hearing about others receiving the vaccine. Often, we think of the downside of potential misinformation, but there may be some who truly receive positive effects from their experience on social media with respect to vaccines.

3 Methodology

In this trial, we've equally broken the participants into three groups, $\frac{1}{3}$ each. The first group viewed a Facebook post that used an appeal to the participants' logic, the second

group viewed one that made an appeal to emotion, and the final third did not view anything. These were completely randomly assigned, assuring the robustness and efficacy of the study.

Due to issues of social desirability bias, such as the Bradley effect in Political Science, we instead construct the vaccine likelihood score by using a weight of the characteristics exhibited by the participant, which we believe accurately weights the determinants of the likelihood of a participant to take the vaccine. This is based on various characteristics of race, age, income, and more.

To measure the impact of the treatments, we utilize a random effects model. Notably, because we ran a trial, we have the same units over more than one time period t = 1,2. Thus, due to the panel nature of our data, we will utilize a random effects model. The benefits of a random effects model over a fixed effects model are as follows:

(1) retain efficiency of the estimator (lowest variance)

(2) able to measure impact of unchanging covariates (such as race, gender, etc)

(3) allows for slope variation instead of just intercept variation due to covariates

However, the random effects model imposes the assumption that the error term $\epsilon_i \sim N(0, \sigma^2)$. To confirm this hypothesis, we will utilize a Hausman test, which first posits that the random effects and fixed effects model are not different from each other, and thus a random effects model should be utilized. If the χ^2 is not large enough, we fail to reject and go with the random effects model.

Our regression formula is as follows:

$$VaccineLikelihood_{it} = \beta_i X_{it} + b_i W_{it} + \epsilon_{it}$$

where X_{it} is a vector of treatment variables: TreatLogic and TreatEmotion, for individual i in time t. β_i is a vector of slope coefficients for TreatLogic and TreatEmotion

where W_{it} is a vector of covariates, including age, income, race, news modality, education, and political leaning. Each b_i will be a vector of the the individual i's change response for the covariates.

4 Results

VARIABLES	Vaccine Likelihood
TreatEmotion	9.990***
	(0.0547)
TreatLogic	4.940***
	(0.0547)
Age	0.0905***
	(0.0106)
Income	0.100***
	(3.41e-06)
NewsModality	-0.0592
	(0.0504)
PoliticalLeaning	0.108**
	(0.0488)
Education	0.0129
	(0.0340)
Constant	0.304
	(0.231)
Observations	9,000
Number of id	4,500

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results from the regression show that both the emotion treatment and logic treatment are statistically significant at the .01 level. Thus, this indicates that the vaccine likelihood score goes up by 10 units for those who received the emotional facebook video compared to the control group (baseline). The standard error is quite low, at .0547, indicating a high level of precision, indicating robustness across samples.

The logic treatment has a much lower but still highly statistically significant at the .01 level coefficient. It states that the increase against baseline of the vaccine likelihood is about 5 units higher than it is for the baseline group that did not receive any treatment.

Interestingly, the modality of news and education are either not significant at all, or only at the 10% level. This indicates these covariates are not having much of an impact in our regression.

However, age and income are both highly related, as we can see that an increase in age by

1 year is associated with a near .1 unit higher in the vaccine likelihood. The income goes up by .1 unit for an increase in 1 unit of income. Additionally, political leaning is also related. If you go up one unit, which is from a democrat to a republican or a republican to an independent, your likelihood score will go up by .11 units. This is quite interesting.

5 Discussion

As expected, the emotional treatment video had a higher impact on the participants than the logical treatment video did. It is often the case that humans are more likely to be convinced on emotional grounds compared to logical grounds, as they feel so deeply with the emotional content as opposed to the logical content.

Thus, this has important implications for public policy makers, where the efficacy of ameliorating vaccine hesitancy is higher for content that may be emotional in nature. Thus, focusing on vaccine deaths, spotlighting personal stories, and making connections to the experiences of others with the viewer may be desired. This may lead to a lower amount of deaths, and overall higher level of health for society, which will also result in less monetary loss.

6 Future Studies

Another possible future study would be centered around the impact of specifically looking at how attempting to focus on personal stories or connecting the viewers' experience with the person shown, as compared to other emotional content. This may further indicate what is the most salient form of ridding vaccine hesitancy and thus improving societal health.

Another form of modeling that could potentially be utilized is to use a linear probability model, probit, or logit model to use a 1 or 0 variable for whether or not the patient will take the covid vaccine. However, due to issues of honesty of asking the patient whether they will or not, as well as the issue with the linear probability model giving predicted probabilities outside of [0,1] and being necessarily heteroskedastic, we instead decided to stick with the vaccine likelihood statistic which avoids these issues. A logit or probit model can also be utilized, but interpreted magnitude from those models is incredibly difficult, because of the fact that it's measuring the change in the latent variable y^* instead of the true y. Thus, it can't be interpreted in magnitude, but only directionality. Thus, this is why we opted for this model instead.

7 References

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