MASTER
Economics & Psychology

Behavioral Interventions to Increase Vaccination Rates Against COVID-19

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Outline

- Review of the literature
  - Importance of Message Framing
  - What we can learn from existing evidence
- Methods
  - Experimental treatments
  - Sample
- Results
  - Pre-tests
  - Regression results
- Further Research

Issue of Vaccine Hesitancy

Vaccine are effective when a substantial portion receives a vaccination

Three main reasons against vaccination

- Personal Reasons
- Lack of trust in medical experts and/or the government
- General anti-vaccination beliefs

This problem is especially salient today with COVID-19 vaccination

Existing Evidence

Social Norms

- Using prestigious figures as a representative to the community
- Letting a person know what others are doing in their community

Using Defaults to Reduce Barriers

- Opt-out strategy of having an appointment as a default, rather than the classic Opt-in strategy

Using Reminders and Commitments

- Aims to remind patients and makes them more likely to commit to an appointment

Message Framing

- Framing messages with various nudges or information to provide behavioral and actual change

Social Norms

Vaccine hesitancy could be product of social influences

- What others approve or disapprove

Brewer et al. (2017)

- Review article found that a prestigious induvial, such as politicians, health workers, media representatives, immunization program managers, or community and religious leaders can influence behavior of the general population.

Pink et al. (2021)

- Found vaccination messages from political leaders matter in influencing COVID-19 vaccine intent, attitudes, and encouragement to others; especially for conservative groups

Milkman et al. (2021)

- Tested 21 different text messages in a field study and the message “more Americans are getting the flu shot than in the past” increased actual vaccination uptake by 1.5% compared to control.

Message Framing

Efficient method to providing nudges in policy

Altay et al. (2021)

- Provided a Q&A website to change attitudes and beliefs related to COVID-19 vaccination and found a 37% increase in positive attitudes toward the vaccine with time spent on the website increased positive attitudes

Lorini et al. (2020)

- The effects of message framing of increasing intention and actual uptake persist over time

Mowbray et al. (2016)

- Promotion of benefits from receiving vaccination is better with factual evidence-based messages

Cuccinello et al. (2020)

- Eliciting altruism or the presence of a third person for vaccination increased cooperation

Backfire effect

Several studies testing message framing have found a backfire effect

Nyhan et al. (2014)

- Tested four messages combating the misperceptions and myths of the measles vaccine
- Information of lack of evidence of autism link, dangers of measles, sick children's images, and dramatic narrative of a child almost dying of measles
- No treatment increased parental intent to vaccinate future child
- Refuting claims of a link reduced misperceptions it also decreased the intent to vaccinate
- Images of sick children and dramatic narrative decreased attitudes

Pluviano et al. (2017)

- Tested similar message frames to increase measle vaccine attitudes and intent
- 2 treatments of myth vs fact and loss frame message of sick children increased misperceptions and attitudes

Methods

Choosing the Sample

Amazon Mechanical Turk (MTurk)

- Proven to be an effective method to gather a sample in the USA and India
- India is more particular than the USA
- Payment must equal the average minimum salary

India was picked for several reasons

- Ability to use MTurk
- Low vaccination rate at the time of data collection, May 4 -7, 2021
- Increasing spread of B.1.617 variant causing a 2nd wave in India
- Recent reacceptance in using the AstraZeneca vaccine after blood clot concerns

Implementation

1. Directed to LimeSurvey to participate in the experiment

2. Demographic information on age, gender, and education

3. Placed randomly in 6 groups
   - 5 treatment groups and control
   - Instructional manipulation check after reading message

4. Answered survey questions measuring intent, attitudes, and encouragement to others for the general COVID-19 vaccine and the AstraZeneca vaccine

Sample demographics

Total sample of 499 subjects

45 participants failed the IMC across the 5 treatments

- Removed for measuring the AstraZeneca related items

Table 1
Sample Demographics: COVID-19 (AstraZeneca)

		Treatment group					
		Control	Gain Frame	Loss Frame	Empirical Evidence	Countering Myth	Moral
Sex, %							
	Female	23	28(24)	27(25)	31(30)	17(33)	24(17)
	Male	77	72(76)	73(75)	69(70)	83(67)	76(83)
Age, %							
	Younger than30	28	45(41)	34(40)	39(35)	25(38)	39(27)
	Older than 30	72	55(59)	66(60)	61(65)	75(62)	61(73)
Education, %							
	Undergraduate and below	11	12(4)	10(10)	12(4)	14(9)	6(13)
	Graduate	70	62(77)	61(63)	75(66)	61(78)	76(60)
	Post-graduate	19	26(19)	29(27)	13(30)	25(13)	18(27)
Total N		88	82(70)	93(73)	87(82)	75(78)	74(63)

Experimental Treatments

5 Experimental treatments

- Gain Frame with scientific information
- Loss Frame with scientific information
- Empirical frame with numerical information
- Myth/Misperception frame to combat the blood clot side effect information
- Moral frame that emphasize the benefit to society

Control group

- A short message about the Eiffel Tower

Intention to get vaccinated

2 questions on the survey aimed to measure a participant's intention to get vaccinated

First question

- Asked if the vaccine is made available to you in the next three months, how likely are you to get the vaccine
- 10-pt Likert scale of 1 being extremely unlikely and 10 extremely likely.

Second question

- If the vaccine is made available, would you get the vaccine right away, after some people you know, most people you know, or not at all.

Attitudes toward vaccination

Four questions aimed to measure attitudes toward vaccination

- 10-point Likert scale of 1 being extremely unlikely and 10 a being extremely likely.

First question

- Asked if the benefits of receiving the vaccine outweigh the risks of not receiving the vaccine

Second question

- Asked if the vaccine would keep them from getting ill

Third question

- Asked if people have a responsibility to get the vaccine

Fourth question

- Asked if a large majority of people receive the vaccine it would help the economy

Encourage a family member or friend to get vaccinated

The encouragement of others was measured with two questions

On a 10-point Likert scale

“If a family member (friend) was unsure to accept the vaccine, how likely would you be to encourage them to get the vaccine?”

Results

Exploratory Factor Analysis (EFA)

Table 2

Exploratory Factor Analysis of COVID-19 scale

Items	F1	F2	h2
Q1		0.62	0.71
Q2		0.3	0.12
Q3	0.73		0.57
Q4	0.73		0.51
Q5	0.73		0.71
Q6	0.73		0.53
Q7		0.96	0.9
Q8		0.88	0.73
	PA2	PA1	
SS Loadings	2.44	2.34	
proportion var	0.31	0.29	
cumulative var	0.31	0.6	

Note: Extraction method; parallel analysis; rotation method; oblimin.
F1, F2 corresponds to Attitudes and Intent, respectively.
Green items represent factor loading scores greater than .30.

Table 3

Exploratory Factor Analysis of AstraZeneca scale

Items	F1	F2	F3	h2
Q1			0.82	0.86
Q2			0.38	0.35
Q3	0.42			0.5
Q4	0.76			0.6
Q5	0.85			0.82
Q6	0.74			0.69
Q7		0.91		0.35
Q8		0.7		0.89
	PA1	PA2	PA3	
SS Loadings	2.36	2.11	1.23	
proportion var	0.3	0.24	0.15	
cumulative var	0.3	0.53	0.69	

Note: Extraction method; parallel analysis; rotation method; oblimin.
F1, F2 corresponds to Attitudes and Intent, respectively.
Green items represent factor loading scores greater than .30.

Confirmatory Factor Analysis (CFA)

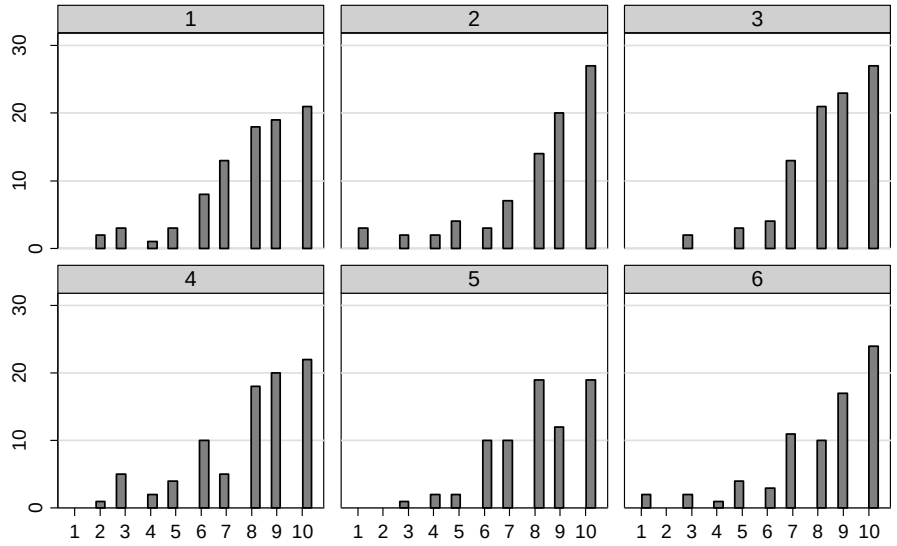
Table 4
Confirmatory Factor Analysis Goodness-of-Fit Measures

Models	χ^2	df	p-value	χ^2/df	CFI	TLI	RMSEA	SRMR
covidf2	36.147	13.000	0.000	2.781	0.971	0.953	0.084	0.033
azf2	11.872	13.000	0.538	0.913	1.000	1.002	0.000	0.019
covidf2 corr benefit +keep	25.854	12.000	0.011	2.155	0.978	0.961	0.081	0.026

Note: The two-factor solution exhibits adequate values for all goodness of fit parameters. Model 1 is for COVID sample model 2 is for AstraZeneca sample

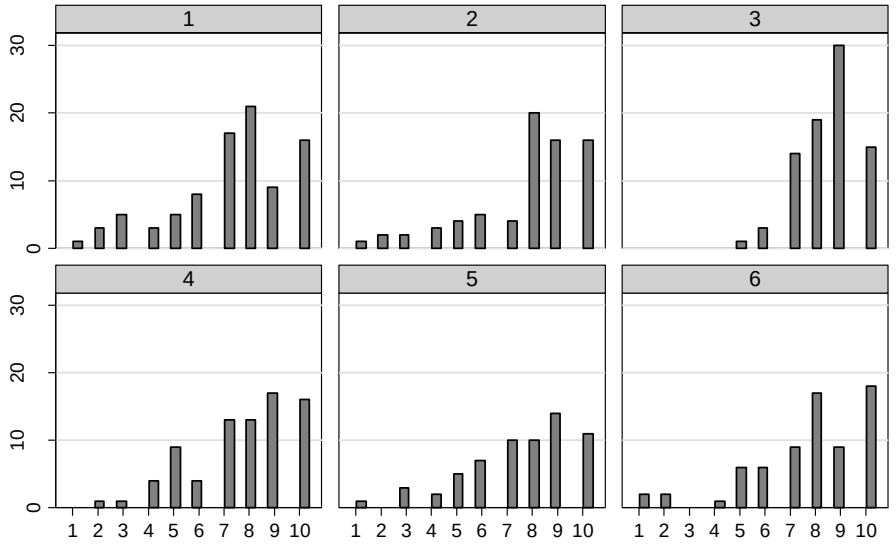
Frequency distribution

Fig 1: Intention to vaccinate COVID-19



Graphs by treatment; 1 is the control group

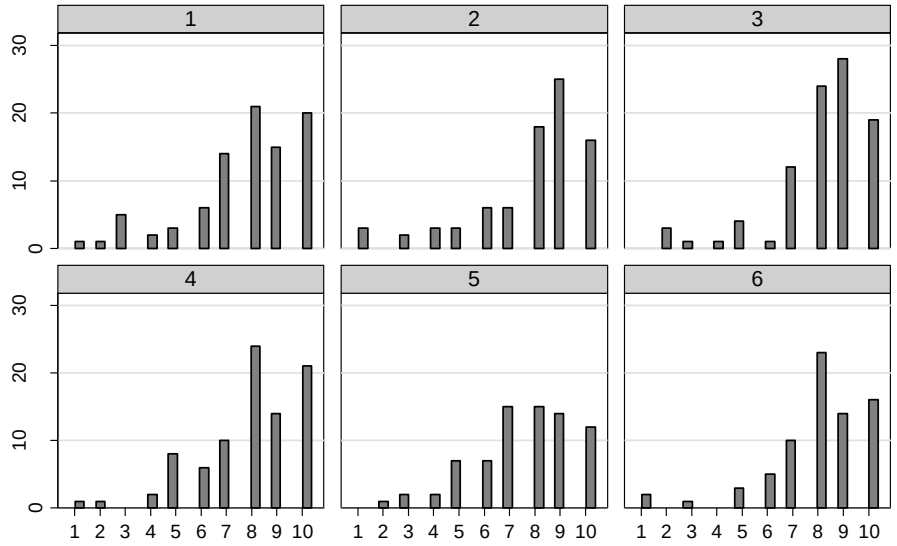
Fig 8: Intent to get AstraZeneca vaccine



Graphs by treatment

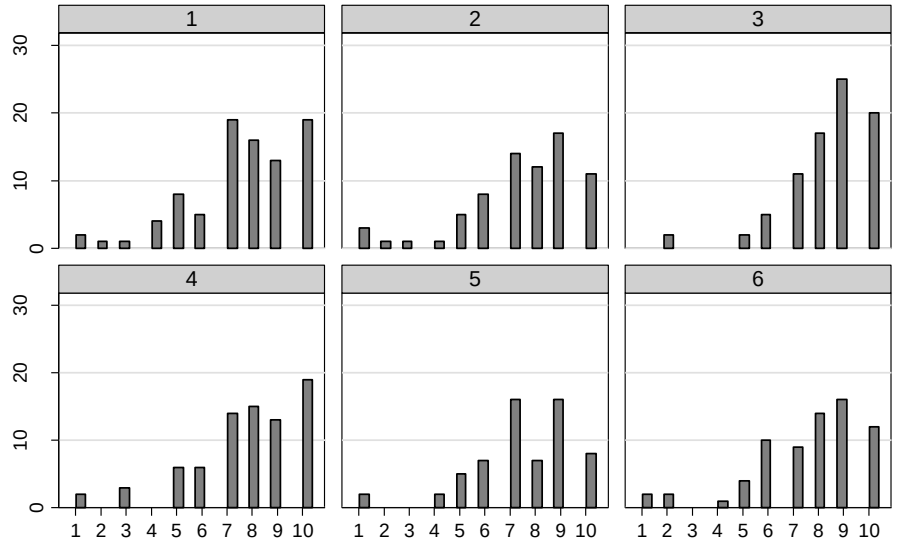
Encourage Family Member

Fig 2: Encourage Family to Vaccinate COVID-19



Graphs by treatment; 1 is the control group

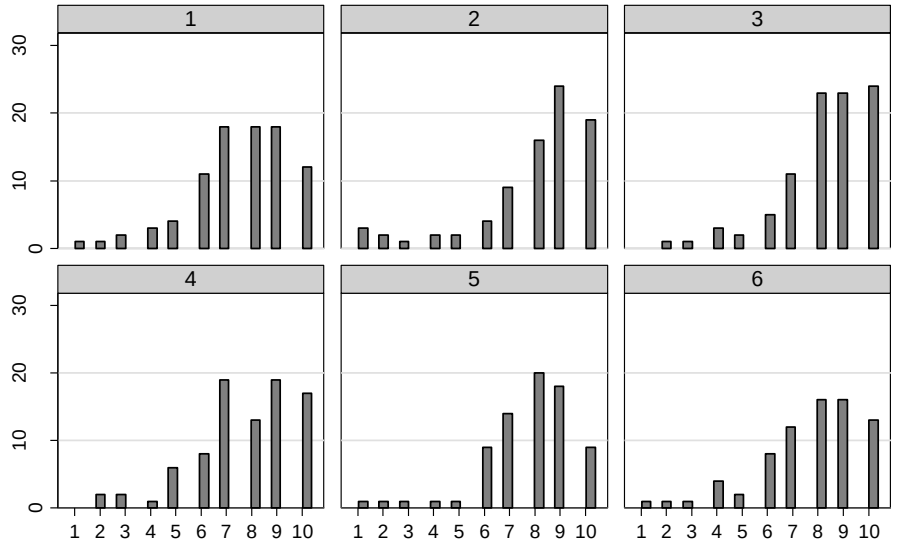
Fig 9: Encourage family to get AstraZeneca



Graphs by treatment, 1 is control

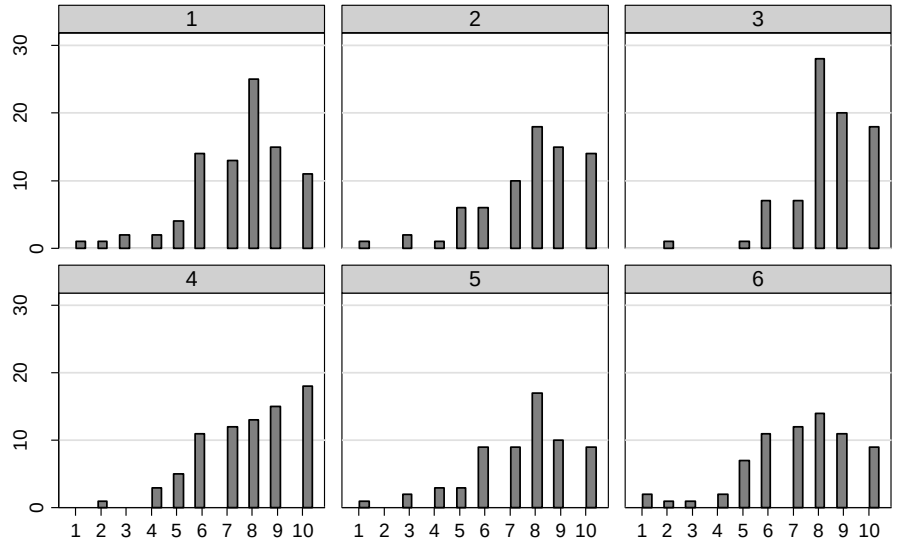
Keep me from getting ill

Fig 5: Vaccine no ill COVID-19



Graphs by treatment; 1 is control

Fig 12: AstraZeneca no ill



Graphs by treatment; 1 is control group

T-test

Table 5
Independent t-test COVID-19 vaccine intent and attitudes by treatment

	Treatment	mean	std. error	df	p-value	t-test
Intent						
	Control	7.909	0.210		0.393	0.857
	Gain Frame	8.108	0.249	160	0.539	-0.616
	Loss Frame	8.122	0.249	168	0.512	-0.657
	Empirical	8.398	0.161	179	0.065	-1.859
	Myth	7.862	0.225	173	0.879	0.153
	Moral	8.013	0.196	161	0.720	-0.359
Attitudes						
	Control	7.810	0.164		0.316	1.020
	Gain Frame	7.871	0.170	160	0.794	-0.261
	Loss Frame	7.960	0.069	168	0.396	-0.851
	Empirical	8.266	0.154	179	0.041	-2.079
	Myth	8.031	0.160	173	0.335	-0.967
	Moral	7.690	0.183	161	0.636	0.475

Note: Intent is Q1, and attitudes is the combined score of the four questions measuring attitude

Table 6
Independent t-test AstraZeneca vaccine intent and attitudes by treatment

	Treatment	mean	std. error	df	p-value	t-test
Intent						
	Control	7.216	0.241		0.022	2.315
	Gain Frame	7.657	2.675	156	0.222	-1.225
	Loss Frame	7.740	0.260	159	0.141	-1.478
	Empirical	8.451	0.128	168	0.000	-4.443
	Myth	7.667	0.226	164	0.177	-1.355
	Moral	7.476	0.268	149	0.475	-0.716
Attitudes						
	Control	7.673	0.156		0.395	0.853
	Gain Frame	7.579	0.191	156	0.699	0.387
	Loss Frame	7.712	0.214	159	0.881	-0.150
	Empirical	8.259	0.155	168	0.009	-2.658
	Myth	7.990	0.167	164	0.167	-1.388
	Moral	7.460	0.226	149	0.424	0.802

Note: Intent is Q1, and attitudes is the combined score of the four questions measuring attitude

Regression Analysis

- The Tobit regression was used due to having censored data; thus, the latent variable cannot always be observed. A following OLS regression is then made to see if the coeffects are not too different for easier comprehension of the observed results.
  - The standard errors were clustered at the session level based on the day the participant took part in the experiment

- As predicted in the t-test result for both the Tobit and OLS regressions, treatment three of the empirical treatment provided the most significant effects.

Tobit Regression

Table 7
Tobit Regression

		Treatment				
		Gain Frame	Loss Frame	Empirical	Myth	Moral
COVID-19 Vaccine						
	Covid Intent	0.410	0.434	0.693***	0.042	0.179
	Covid Family	0.352	0.151	0.514*	0.265	-0.229*
	Covid Friend	0.444	0.463***	0.534*	0.286	-0.129
	Covid Benefit	0.121	0.143	0.330	0.366	-0.351
	Covid Keep getting ill	0.303	0.609	1.005***	0.374	0.236
	Covid Responsibility	-0.006	0.273	0.447	0.412	-0.426
	Covid Economy	0.002	0.282	0.711***	0.348	-0.034
AstraZeneca						
	AZ Intent	0.603***	0.646	1.357***	0.545	0.300
	AZ Family	0.008	-0.145	0.978***	0.287	-0.150
	AZ Friend	-0.002	-0.138	0.718***	0.236	-0.153
	AZ Benefit	-0.051	0.092	0.730***	0.682*	-0.149
	AZ Keep getting ill	-0.240*	0.436	1.110***	0.568***	-0.019
	AZ Responsibility	0.046	-0.040	0.646***	0.299	-0.440
	AZ Economy	-0.021	0.041	0.712***	0.404	-0.226

*=10%, **= 5%, ***=1% significance level
Note: treatment group is based on the control group and data is clustered at session level (day)

OLS Regression

Table 8
OLS Regression

		Treatment				
		Gain Frame	Loss Frame	Empirical	Myth	Moral
COVID-19 Vaccine						
	Covid Intent	0.231	0.247	0.527*	-0.018	0.132
	Covid Family	0.318	0.169	0.474	0.198	-0.148
	Covid Friend	0.379	0.426*	0.503	0.236	-0.059
	Covid Benefit	0.130	0.114	0.234	0.232	-0.287
	Covid Keep getting ill	0.226	0.459	0.773***	0.265	0.240
	Covid Responsibility	0.029	0.155	0.390	0.271	-0.367
AstraZeneca	Covid Economy	0.007	0.191	0.508	0.226	-0.020
	AZ Intent	0.469	0.541	1.255**	0.465	0.278
	AZ Family	0.060	-0.064	0.834**	0.221	-0.044
	AZ Friend	0.079	-0.070	0.639**	0.200	-0.070
	AZ Benefit	-0.026	0.046	0.524	0.550	-0.174
	AZ Keep getting ill	-0.246*	0.326	0.920***	0.402	-0.046
	AZ Responsibility	0.010	-0.069	0.537*	0.158	-0.382
	AZ Economy	-0.074	-0.054	0.502***	0.259	-0.192

*=10%, **= 5%, ***=1% significance level

Note: treatment group is based on the control group and data is clustered at session level (day)

Summary of the Main Results

1. Empirical framed message was statistically significant and effective
   - Increase in intent and attitudes

2. Overall, the moral frame treatment had non-significant backfire effect

3. The gain frame treatment had one backfire effect
   - Attitude of the AstraZeneca vaccine keeps them from getting ill

Discussion

Future studies should expand on the questions to measure vaccine intent and attitudes

Significant results with the empirical message frame

- Support for using a similar message in field studies
- Framing Europe as a social norm

Experiment supports the use of short factual scientific messages

Future research on testing message framing in the field for actual vaccine uptake

Differences between COVID-19 vaccine and AstraZeneca vaccine with other vaccines

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