Public health messages encouraging emotion reappraisal reduces vaccine hesitancy and betrayal aversion

Esha Dwibedi [1]   Abdelaziz Alsharawy [2]   Jason A. Aimone [3]   Sheryl Ball [4]

[1] University of Washington

[2] Princeton University

[3] Baylor University

[4] Virginia Tech

20th December, 2023

Introduction

Aim of the paper

Explore the impact of emotion reappraisal messaging on betrayal aversion (a decision-making preference that occurs when people avoid situations involving trust to avoid disutility associated with the negative emotions experienced when being betrayed) related to vaccination decision and on related vaccine hesitancy

Introduction

Why is it important?

- Proportion of population remains vaccine hesitant
- Betrayal aversion recently discovered as an important factor in vaccination decision
- Health communication strategies necessary to foster vaccine confidence
- Role of emotion one relevant aspect of communication strategies
- Emotion reappraisal is aimed at restructuring the meaning and impact of an emotion eliciting situation

Introduction

Context on vaccine hesitancy

- Vaccines are a cost-effective public health intervention which can prevent disease outbreak and lower the disease burden

- Delay in acceptance or refusal of a vaccine, has typically been explained by the 3C model, which articulates three factors- confidence, convenience, and complacency that determine vaccine acceptance (Larson H. J., 2014), (MacDonald, 2015)

- Other factors associated with vaccine hesitancy acceptance like include demographic factors, individual risk attitudes and perception of responsibility, trust in authorities involved with in vaccination drives, lack of information and/or vaccine misinformation (Truong, 2022)

Introduction

Context on betrayal aversion

- While selecting amongst products related to safety (such as airbags or vaccines) individuals who are betrayal averse might tend to take up less efficient protection to stave off a comparatively small chances of getting hurt by a safety device itself

- Individuals have shown significantly higher probability of buying safety devices like smoke alarms and airbags, and marginally higher probability of getting vaccinated when the risks associated with these safety products involved no chance of betrayal

- Betrayal aversion is sensitive to the characteristics of the betrayal in question, such as whether an aligned or unaligned political party or scientists were connected to vaccines (Alsharawy et al., 2022)

Introduction

Context on health communication strategies

- Health communications which address emotions in addition to providing information would be an effective strategy (Ferrer & Ellis, 2019) (Chou, 2020)

- Messaging targeting emotional engagement has been effective in the context of health behaviors, such as improved rates of cancer screening and detection (Perugini & Bagozzi, 2001), (Dillard & Nabi, 2006), (Lang & Yegiyan, 2008).

- Studies have reported higher willingness to become vaccinated in the presence of effective communication [(Quinn, et al., 2013), (Nyhan, Reifler, Richey, and Freed, 2014), (Odone, et al., 2015), (Milkman, et al., 2021)]

- Emotion regulation has previously been used to reduce, strengthen, or maintain the positive or negative emotions as required (Gross J. J., 2014) and has been found to have positive effect on psychological health and well-being and in achieving goals (Aldao, 2015)

Literature Review

- Literature on health communication strategies targeting emotions
  - Dillard, J. P., and Nabi R. L. 2006. "The persuasive influence of emotion in cancer prevention and detection messages." Journal of Communication, 56(suppl1) : S123–S139.
- Literature on betrayal aversion
  - Koehler, J., and Gershoff A. 2003. "Betrayal Aversion: When Agents of Protection Become Agents of Harm." Organizational Behavior and Human Decision Processes, 90.
  - Alsharawy, A., Dwibedi, E., Aimone, J., and Ball, S. 2022. "Vaccine Hesitancy and Betrayal Aversion." Annals of Biomedical Engineering, 50(7): 794–804.
- Literature on emotion reappraisal
  - Gross, J., and John. O. 2003. "Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being." Journal of Personality and Social Psychology, 85: 348–362.

Methodology

- Online survey using Qualtrics via Amazon Mechanical Turk (MTurk)
- Inclusion criteria for the MTurk responders- United States resident with 97% and higher HIT (Human Intelligence Tasks) approval rating and at least 5000 HITs approved in MTurk
- Participants received $2.5 as compensation
- Final sample includes 1189 participants
- Vignette experiment on hypothetical scenario about a novel future disease described as both highly infectious and deadly, with an available free and easy-to-take vaccine (via a pill)
- Within-subject design to detect betrayal aversion to vaccines
- Between-subjects design to detect effect of reappraisal messaging conditions on betrayal aversion and vaccine hesitancy

Methodology

Statement displayed uniformly across 4 messaging treatments (including *Neutral, Ambiguous, Negative* and *Positive* emotion reappraisal messaging conditions)

> *"Health is very personal, so people often have emotional reactions associated with medical procedures. Sometimes, people do not make their best decisions when they are feeling emotional; that is why it's good to plan ahead. For the medical decision here, (*...). Register today to get the vaccine at an opportune time."*

For example, for the Ambiguous reappraisal messaging condition, the statement displayed is:

> *"Health is very personal, so people often have emotional reactions associated with medical procedures. Sometimes, people do not make their best decisions when they are feeling emotional; that is why it's good to plan ahead. For the medical decision here, really focus on using your emotions to help you make a good decision. Register today to get the vaccine at an opportune time."*

Methodology

Table: Variation in Messaging Conditions Displayed Statements

Sl.No.	Message Treatment	Statement Displayed
1	Neutral	(*...adopt a neutral attitude by thinking objectively and analytically rather than in an emotional way)
2	Ambiguous	(*...really focus on using your emotions to help you make a good decision)
3	Negative	(*...really focus on the emotions associated with how bad you would feel if you experienced the negative effects of getting the disease if you chose to not get vaccinated)
4	Positive	(*...really focus on the emotions associated with how good you would feel if you experienced the positive effects of receiving the additional protection against the disease if you chose to get vaccinated)

Methodology

For the Betrayal aversion messaging condition, the statement displayed is:

"Health is very personal, so people often have emotional reactions associated with medical procedures. Specifically, negative emotions associated with a fear of the procedure itself causing harm is known as 'betrayal aversion'. While this response can be helpful for avoiding certain dangerous situations, we do not want betrayal aversion to prevent us from receiving safe and effective protection against the virus. For the medical decision here, try to avoid letting any feelings of betrayal aversion prevent you from getting your vaccine. Register today to get the vaccine at an opportune time."

Methodology

Hypothetical disease scenario

- Unvaccinated face a 2% risk of death
- Divided Risk: Vaccinated face a 1.01% risk of death, where 1% was due to the virus, while the explanation for the remaining 0.01% varies across treatments
  - Non-Betrayal treatment: the 0.01% described as "problems unrelated to the vaccine"
  - Active Betrayal treatment: the 0.01% described as "vaccine-induced complications (side effects)"
- Undivided Risk: Vaccinated face a 1.01% risk of death due to contracting the virus

Methodology

Additional Survey Components

- Self Assessment Manikin (SAM) tool- Participants asked to self-report their emotions the domains of pleasure, arousal, and dominance at the beginning and at the end of the experiment
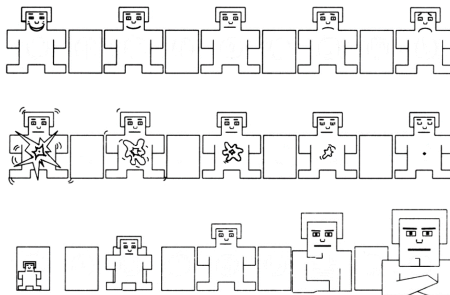
- Questions on vaccine attitude and experience (Vaccine history, Global Vaccine Confidence Index, PACV, Covid vaccine history), emotion regulation (ERQ), demographic characteristics (gender, age, ethnicity, race, education, and political orientation)

Methodology

Variables of interest

- Willingness to become vaccinated measured by single 7-point Likert question with response alternatives ranging from "Definitely reject" at 1 to "Definitely accept" at 7 under both betrayal scenarios

- The difference between an individual's willingness to get vaccinated in the Active Betrayal treatments and their willingness to get vaccinated in the Non-Betrayal treatment gives us the measure of betrayal aversion at the individual level

Data- Divided Risk

Table: List of Divided Risk Treatment Conditions

Treatment (Explanations for the 1.01% chance of Death after Vaccine)		
Message Treatment	Betrayal aversion question 1/ Betrayal aversion question 2	Participants
No message	Non betrayal / Active Betrayal	102
Neutral reappraisal	Non betrayal / Active Betrayal	100
Embrace Emotions Ambiguous Reappraisal	Non betrayal / Active Betrayal	104
Embrace Negative Emotions Reappraisal	Non betrayal / Active Betrayal	97
Embrace Positive Emotions Reappraisal	Non betrayal / Active Betrayal	97
Betrayal Aversion message	Non betrayal / Active Betrayal	97
Total # of Participants		597

Note 1: Divided Risk refers to "a 1% chance that people treated with the vaccine will contract the virus and die as a result." and "an additional one chance in 10,000 (0.01%) that someone who is treated with the vaccine will die due to..."
Note 2: Number of participants for Betrayal Aversions question 1 & 2 are order counterbalanced

Data- Undivided Risk

Table: List of Undivided Risk Treatment Conditions

Treatment (Explanations for the 1.01% chance of Death after Vaccine)	
Message Treatment	Participants
No message	96
Neutral reappraisal	99
Embrace Emotions Ambiguous Reappraisal	99
Embrace Negative Emotions Reappraisal	101
Embrace Positive Emotions Reappraisal	99
Betrayal Aversion message	98
Total # of Participants	597

Note 1: Undivided Risk refers to "a 1.01% chance that people treated with the vaccine will contract the virus and die as a result."

Data

Table: Summary statistics of variables of interest

Variable	Mean
Woman, %	50.97
Man, %	48.53
Non-binary, %	0.42
Age, Mean (SD)	41.92 (12.34)
Hispanic, %	7.49
Caucasian, %	81.58
Education:	
High School and Less, %	11.35
Some college, %	27.84
Bachelor, %	44.49
Masters or above, %	16.32
Work full time, %	69.55
Political Orientation:	
Independent, %	27.33
Republican, %	22.88
Democrat, %	49.79
Total number of responses	1207
Sample used in analysis after exclusions:	1189

Results
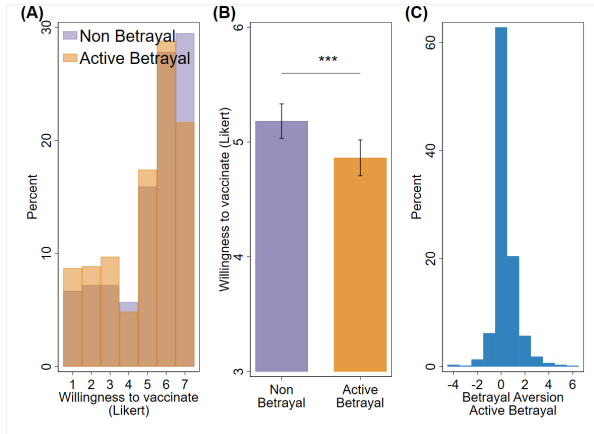
Figure: Willingness to vaccinate and betrayal aversion

(A) Distribution of willingness to vaccinate responses across Non Betrayal and Active Betrayal treatments. (B) Average willingness to vaccinate across betrayal treatments. (C) Distribution of Betrayal Aversion pooled across treatments.

Results
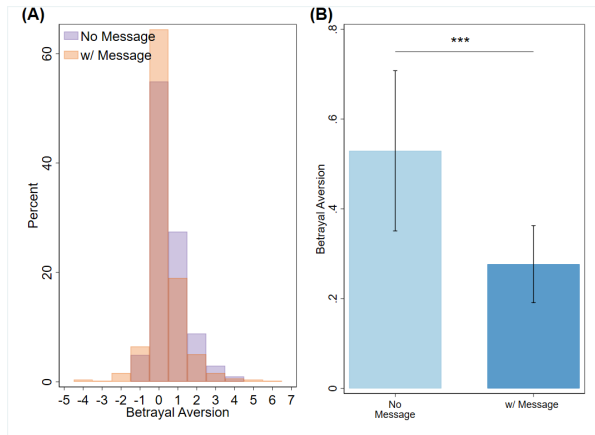
Figure: Betrayal aversion for Pooled messages vs. baseline

(A) Distribution of betrayal aversion for pooled messages vs. baseline. (B) Average betrayal aversion for pooled messages vs. baseline.

Results

Table: Differences across Messaging Treatments (Two sample t-test)

| Message Treatment | Vaccine Hesitancy | | | P-values(Non Betrayal / Active Betrayal / Betrayal Aversion) |
	Non Betrayal (Mean)	Active Betrayal (Mean)	Betrayal Aversion (Mean)	
No message	5.206 (0.175)	4.677 (0.182)	0.529 (0.090)	
Neutral	5.02 (0.204)	4.72 (0.209)	0.3* (0.092)	0.490/0.875/0.075
Ambiguous	5.077 (0.181)	4.933 (0.182)	0.144*** (0.091)	0.609/0.320/0.003
Negative	5.227 (0.194)	4.887 (0.207)	0.340 (0.098)	0.936/0.445/0.156
Positive	5.330 (0.184)	5.072 (0.190)	0.258** (0.086)	0.626/0.133/0.030
Betrayal Aversion	5.247 (0.189)	4.897 (0.201)	0.351 (0.120)	0.872/0.416/0.231

Results

Dependent Variable:	(1) Betrayal Aversion	(2) Betrayal Aversion
Message	-.05***	-.05***
	(.011)	(.012)
Non-Betrayal scenario first	.046***	.045***
	(.007)	(.006)
Woman	.017	.017
	(.015)	(.015)
Age/100	.036	.04
	(.084)	(.084)
Hispanic	.063**	.063**
	(.025)	(.027)
Caucasian	.009	.009
	(.022)	(.021)
Education (Base: high school or less)		
Some college	-.029**	-.03**
	(.009)	(.009)
Bachelor	-.015	-.014
	(.012)	(.011)
Masters or above	-.032	-.032*
	(.018)	(.017)
Work full time	.008	.008
	(.032)	(.033)
Political orientation (Base: Democrat)		
Independent	-.017	-.018
	(.021)	(.021)
Republican	-.007	-.006
	(.019)	(.017)
PACV	-.002	-
	(.004)	
ERQ Reappraisal	-.001	0
	(.002)	(.002)
ERQ Suppression	0	.001
	(.001)	(.001)
VCI (average)	-	-.075
		(.086)
Constant	.088	.062
	(.053)	(.045)
Region (BEA) fixed effects	Yes	Yes
Observations	592	592
R-squared	.05	.053

Standard errors (clustered at the region level) are in parentheses. Likert-scale (7-point) measures are standardized at the individual level (z-score). Dependent variable is constructed by taking the difference between the z-scored willingness to get the vaccine across the non-betrayal and active betrayal conditions. A more positive score on PACV or VCI denotes higher hesitancy. ***$p<.01$, **$p<.05$, *$p<.1$

Figure: Betrayal aversion to active betrayal and pooled message treatments (Fixed effect linear regressions)

Results

Dependent Variable:	(1) Betrayal Aversion	(2) Betrayal Aversion
Messaging condition (Base: No Message)		
Neutral Reappraisal Message	-.046***	-.045**
	(.013)	(.014)
Embrace Emotions Ambiguous Reappraisal Message	-.065***	-.065**
	(.017)	(.019)
Embrace Negative Emotions Reappraisal Message	-.038	-.038
	(.023)	(.024)
Embrace Positive Emotions Reappraisal Message	-.059***	-.059***
	(.01)	(.01)
Betrayal Aversion Message	-.043*	-.042
	(.022)	(.022)
Non-Betrayal scenario first	.046***	.045***
	(.006)	(.006)
Woman	.017	.016
	(.016)	(.016)
Age/100	.041	.046
	(.084)	(.084)
Hispanic	.064**	.063*
	(.025)	(.027)
Caucasian	.008	.007
	(.023)	(.023)
Education (Base: high school or less)		
Some college	-.028***	-.029**
	(.008)	(.009)
Bachelor	-.014	-.013
	(.012)	(.011)
Masters or above	-.031	-.031
	(.018)	(.017)
Work full time	.008	.009
	(.032)	(.033)
Political orientation (Base: Democrat)		
Independent	-.018	-.018
	(.021)	(.021)
Republican	-.008	-.007
	(.018)	(.016)
PACV	-.001	-
	(.004)	
ERQ Reappraisal	-.001	0
	(.002)	(.002)
ERQ Suppression	0	.001
	(.001)	(.001)
VCI (average)	-	-.072
		(.091)
Constant	.083	.06
	(.056)	(.049)
Region (BEA) fixed effects	Yes	Yes
Observations	592	592
R-squared	.052	.056

Standard errors (clustered at the region level) are in parentheses. Likert-scale (7-point) measures are standardized at the individual level (z-score). Dependent variable is constructed by taking the difference between the z-scored willingness to get the vaccine across the non-betrayal and active betrayal conditions. A more positive score on PACV or VCI denotes higher hesitancy. *** $p<.01$, ** $p<.05$, * $p<.1$

Figure: Betrayal aversion across different reappraisal messaging conditions (Fixed effect linear regressions)

Results

Dependent variable: Willingness to vaccinate	(1) Non-Betrayal	(2) Non-Betrayal	(3) Active Betrayal	(4) Active Betrayal
Message	-.01	-.007	.041	.044
	(.021)	(.021)	(.03)	(.029)
Non-Betrayal scenario first	-.013	-.016	-.064**	-.066**
	(.025)	(.024)	(.024)	(.022)
Woman	-.003	.002	-.018	-.012
	(.02)	(.023)	(.025)	(.029)
Age/100	.072	.068	.034	.026
	(.061)	(.074)	(.05)	(.035)
Hispanic	.052*	.054	-.015	-.012
	(.025)	(.031)	(.032)	(.037)
Caucasian	.026	.031	.025	.03
	(.034)	(.037)	(.022)	(.025)
Education (Base: high school or less)				
Some college	-.009	-.018	.021	.013
	(.026)	(.038)	(.029)	(.039)
Bachelor	.032	.04	.047*	.056
	(.021)	(.027)	(.021)	(.031)
Mastees or above	.046*	.047*	.071***	.072**
	(.021)	(.024)	(.017)	(.024)
Work full time	.016	.007	.013	.004
	(.011)	(.01)	(.033)	(.031)
Political orientation (Base: Democrat)				
Independent	-.062	-.081**	-.033	-.052
	(.039)	(.031)	(.059)	(.05)
Republican	-.112**	-.141***	-.091*	-.122**
	(.038)	(.034)	(.044)	(.037)
PACV	-.042***		-.041***	
	(.007)		(.005)	
ERQ Reappraisal	-.006**	-.003	-.006***	-.003*
	(.002)	(.002)	(.001)	(.002)
ERQ Suppression	-.002	-.001	-.003*	-.002
	(.002)	(.002)	(.001)	(.001)
VCI (average)		-.503***		-.438***
		(.073)		(.055)
Constant	.177*	-.05	.088	-.118
	(.075)	(.096)	(.077)	(.098)
Region (BEA) fixed effects	Yes	Yes	Yes	Yes
Observations	592	592	592	592
R-squared	.221	.204	.178	.152

Standard errors are in parentheses
*** $p<.01$, ** $p<.05$, * $p<.1$

Figure: Willingness to get the vaccine for pooled messaging vs. no messaging condition (Fixed effect linear regressions)

Results

Dependent variable: Willingness to vaccinate	(1) Non-Betrayal	(2) Non-Betrayal	(3) Active Betrayal	(4) Active Betrayal
Messaging condition (Base: No Message)				
Neutral Reappraisal Message	-.039	-.04	.007	.006
	(.038)	(.038)	(.036)	(.035)
Embrace Emotions Ambiguous Reappraisal Message	-.018	-.026	.047	.039
	(.026)	(.024)	(.032)	(.028)
Embrace Negative Emotions Reappraisal Message	0	.006	.038	.044
	(.016)	(.025)	(.029)	(.033)
Embrace Positive Emotions Reappraisal Message	.009	.011	.068	.07
	(.032)	(.038)	(.039)	(.044)
Betrayal Aversion Message	-.021	-.012	.022	.03
	(.032)	(.025)	(.046)	(.042)
Non-Betrayal scenario first	-.014	-.014	-.06**	-.059**
	(.021)	(.019)	(.022)	(.02)
Woman	.005	.007	-.012	-.009
	(.023)	(.026)	(.026)	(.028)
Age/100	.059	.064	.018	.018
	(.056)	(.065)	(.035)	(.037)
Hispanic	.064*	.067*	0	.004
	(.028)	(.034)	(.036)	(.041)
Caucasian	.025	.027	.017	.02
	(.034)	(.034)	(.02)	(.021)
Education (Base: high school or less)				
Some college	0	-.005	.028	.024
	(.028)	(.04)	(.028)	(.039)
Bachelor	.032*	.039	.045*	.052
	(.016)	(.025)	(.02)	(.03)
Masters or above	.037**	.04*	.067***	.071**
	(.015)	(.02)	(.015)	(.022)
Work full time	.019	.011	.011	.002
	(.014)	(.014)	(.031)	(.028)
Political orientation (Base: Democrat)				
Independent	-.05	-.075**	-.032	-.057
	(.036)	(.029)	(.054)	(.047)
Republican	-.108**	-.141***	-.1*	-.134***
	(.037)	(.033)	(.043)	(.036)
PACV	-.041***		-.04***	
	(.006)		(.005)	
ERQ Reappraisal	-.006**	-.003	-.005***	-.003*
	(.002)	(.002)	(.001)	(.001)
ERQ Suppression	-.002	-.001	-.003**	-.002**
	(.002)	(.002)	(.001)	(.001)
VCI (average)		-.462***		-.39***
		(.069)		(.053)
Constant	.163*	-.049	.08	-.108
	(.08)	(.091)	(.077)	(.091)
Region (BEA) fixed effects	Yes	Yes	Yes	Yes
Observations	592	592	592	592
R-squared	.219	.197	.179	.147

Figure: Willingness to get the vaccine across different reappraisal messaging conditions (Fixed effect linear regressions)

Results

Dependent variable: Willingness to vaccinate	(1) Benchmark	(2) To protect oneself	(3) To protect others	(4) Wait and see	(5) Only if required
Messaging condition (Base: No Message)					
Neutral Reappraisal Message	-.119	-.152	.015	-.018	-.031
	(.28)	(.309)	(.047)	(.05)	(.04)
Embrace Emotions Ambiguous Reappraisal Message	-.091	-.052	-.018	-.004	-.002
	(.232)	(.261)	(.043)	(.05)	(.047)
Embrace Negative Emotions Reappraisal Message	-.13	-.119	-.019	.035	.029
	(.221)	(.202)	(.029)	(.046)	(.042)
Embrace Positive Emotions Reappraisal Message	.296	.279	.052	-.09	-.021
	(.238)	(.237)	(.033)	(.048)	(.057)
Betrayal Aversion Message	.027	.072	.045	.002	.026
	(.185)	(.204)	(.053)	(.045)	(.038)
Woman	-.141	-.145	-.002	.034	-.042
	(.129)	(.149)	(.029)	(.041)	(.03)
Age/100	.214	.417	.025	-.257**	-.36***
	(.519)	(.655)	(.126)	(.081)	(.075)
Hispanic	.144	-.117	-.023	.078	.021
	(.369)	(.389)	(.048)	(.058)	(.071)
Caucasian	.252	.153	.05*	-.051	-.009
	(.155)	(.091)	(.026)	(.036)	(.026)
Education (Base: high school or less)					
Some college	-.233	-.459**	-.068*	.046	-.027
	(.191)	(.176)	(.031)	(.057)	(.057)
Bachelor	.271	.051	-.004	-.037	-.073
	(.319)	(.331)	(.041)	(.07)	(.068)
Masters or above	.495	.323	.004	-.095**	-.101*
	(.271)	(.286)	(.06)	(.039)	(.048)
Work full time	.139	.18	.026	-.014	-.038
	(.149)	(.181)	(.022)	(.031)	(.034)
Political orientation (Base: Democrat)					
Independent	-.564**	-.572**	-.065	.139**	.04
	(.173)	(.174)	(.039)	(.052)	(.036)
Republican	-.764***	-.715***	-.09***	.206***	.095**
	(.109)	(.137)	(.015)	(.023)	(.039)
PACV	-.495***	-.408***	-.058***	.105***	.101***
	(.027)	(.021)	(.005)	(.006)	(.007)
ERQ Reappraisal	.017*	.021*	-.003	.004	.012***
	(.008)	(.009)	(.002)	(.003)	(.001)
ERQ Suppression	.024	.028	-.001	-.001	.004
	(.019)	(.02)	(.003)	(.003)	(.003)
Constant	6.158***	6.225***	.159	-.866***	-1.264***
	(1.023)	(.943)	(.116)	(.149)	(.099)
Region (BEA) fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	583	583	583	583	583
R-squared	.384	.38	.281	.363	.361

Standard errors (clustered at the region level) are in parentheses. Likert-scale (7-point) measures, including dependent variable, are standardized at the individual level (z-score). A more positive score on PACV or VCI denotes higher hesitancy.

Figure: Willingness to get the vaccine disassociated by motivation, across reappraisal messaging treatments, controlling for PACV (Fixed effect linear regressions)

Dependent variable: Willingness to vaccinate	(1) Benchmark (Unconditional)	(2) To protect oneself	(3) To protect others	(4) Wait and see	(5) Only if required
Messaging condition (Base: No Message)					
Neutral Reappraisal Message	-.173	-.208	.008	-.006	-.019
	(.283)	(.306)	(.041)	(.053)	(.043)
Embrace Emotions Ambiguous Reappraisal Message	-.18	-.138	-.027	.014	.013
	(.291)	(.316)	(.041)	(.047)	(.046)
Embrace Negative Emotions Reappraisal Message	-.219	-.207	-.029	.053	.046
	(.254)	(.26)	(.031)	(.036)	(.048)
Embrace Positive Emotions Reappraisal Message	.057	.038	.023	-.039	.028
	(.348)	(.316)	(.036)	(.066)	(.07)
Betrayal Aversion Message	-.224	-.18	.016	.055	.076*
	(.184)	(.169)	(.05)	(.037)	(.04)
Woman	-.129	-.126	.002	.029	-.049*
	(.106)	(.128)	(.027)	(.035)	(.026)
Age/100	.462	.662	.053	-.309***	-.407***
	(.442)	(.558)	(.114)	(.068)	(.074)
Hispanic	.123	-.128	-.022	.08	.018
	(.384)	(.416)	(.054)	(.069)	(.085)
Caucasian	.343	.246	.061*	-.07	-.029
	(.221)	(.14)	(.026)	(.053)	(.029)
Education (Base: high school or less)					
Some college	-.207	-.422**	-.061*	.037	-.04
	(.165)	(.148)	(.027)	(.047)	(.046)
Bachelor	.175	-.043	-.014	-.017	-.056
	(.306)	(.316)	(.035)	(.074)	(.06)
Masters or above	.352	.177	-.014	-.064	-.071
	(.234)	(.253)	(.051)	(.039)	(.043)
Work full time	.191	.233	.033	-.026	-.049*
	(.165)	(.2)	(.018)	(.02)	(.026)
Political orientation (Base: Democrat)					
Independent	-.814***	-.813***	-.091**	.189***	.083**
	(.177)	(.16)	(.038)	(.037)	(.025)
Republican	-1.085***	-1.025***	-.123***	.27***	.152***
	(.115)	(.141)	(.021)	(.035)	(.043)
VCI (average)	-4.479***	-4.754***	-.609***	1.03***	1.093***
	(.22)	(.191)	(.079)	(.08)	(.134)
ERQ Reappraisal	.034**	.04***	0	0	.008***
	(.011)	(.009)	(.002)	(.004)	(.002)
ERQ Suppression	.036	.042*	.001	-.004	0
	(.023)	(.021)	(.003)	(.004)	(.003)
Constant	3.841***	3.831***	-.133	-.354	-.746***
	(1.211)	(1.092)	(.131)	(.195)	(.115)
Region (BEA) fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	583	583	583	583	583
R-squared	.286	.298	.245	.298	.323

Standard errors (clustered at the region level) are in parentheses. Likert-scale (7-point) measures, including dependent variable, are standardized at the individual level (z-score). A more positive score on PACV or VCI denotes higher hesitancy. *** $p<.01$, ** $p<.05$, * $p<.1$

Figure: Willingness to get the vaccine disassociated by motivation, across reappraisal messaging treatments, controlling for VCI (average of four z-scored measures)

Implications

- Emotion reappraisal messages were successful in targeting individuals' betrayal aversion

- Messages that appealed to embrace the ambiguity in the emotions felt regarding vaccination decisions as well as messages that appealed to embracing the positive emotions from getting vaccinated were both successful in decreasing betrayal aversion

- Heterogeneous effect of education (High school or less compared to more education) on betrayal aversion and vaccine hesitancy

- Heterogeneous effect of political orientation (democrats vs. republicans or independents) on betrayal aversion

Future Work

- Use of reappraisal messaging in targeted healthcare messaging related to emotion reappraisal
- Channels through which betrayal aversion affects vaccine hesitancy
- Further field research on messaging that influences betrayal aversion

Thank You!