Community Immunity: Social Pressure and Vaccine Choices

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Abstract

Research in public opinion suggests that individuals often hold beliefs and preferences that are not consistent with the current state of scientific research. Studies addressing this question often operate within a rational choice framework; however, there is evidence that attitudes about scientific findings are not primarily motivated by these factually driven appeals. In this study, I examine whether pro-social appeals to identity can produce shifts in beliefs about the seasonal flu vaccine and change individual’s self-reported intent to vaccinate. The findings suggest that vaccine appeals can change intentions or perceptions, but perhaps not at the same time through the same appeal. Corrective interventions were effective in changing perceptions, while identity appeals were effective in changing individuals vaccination intentions. These results suggest that purely factual appeals are effective in debunking myths, but psychological appeals are more effective in altering behavioral intentions.
Research in public opinion suggests that individuals often hold beliefs and preferences that are not consistent with the current state of scientific research. For example, many people are not concerned about climate change or feel responsible for it despite being well-read on the subject (Kellstedt et al. 2008). More and more parents do not give their children common vaccinations because they consider them unsafe (Nyhan et al. 2014) and millions of Americans do not get an annual flu vaccine for fear of actually getting the flu, despite evidence demonstrating the importance of these inoculations for individual and public health. These misperceptions continue to persist, despite the prevailing scientific consensus and frequent attempts to communicate that consensus to the public at large.

The importance of changing these misperceptions has significant normative implications. As noted by Nyhan and Reifler (2015), seasonal influenza leads to thousands of deaths and high costs in medical care and lost earnings, yet immunizations rates continue to fall well below targeted numbers. Similarly, childhood diseases like measles that rarely occur in the contemporary United States have experienced several major outbreaks as parents forgo the advice of doctors in vaccinating their children. These diseases can cause serious complications and death in young children and other vulnerable populations. These individual consequences underscore the importance of correcting vaccination misperceptions.

Additionally, individuals skewed risk perceptions have consequences for public policy, as policymakers incorporate the public’s misperceptions into the lawmaking process. Mandatory vaccination policies for children remain controversial despite the scientific consensus on vaccine safety and parents disagree on the extent to which state governments can regulate the choices they make about their children’s health. Findings demonstrating resistance,

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rejection, and backfire effects from corrective information (Kuklinski et al. 2000; Nyhan ans Reifler 2010; Nyhan and Reifler 2015), have substantial implications for discourse between the scientific community and the public. It appears that a knowledge deficit is not the primary explanation for misperceptions about scientific issues and that providing that information is either ineffective or counter-productive to science communication efforts.

This paper reports the results of a Texas-based study that investigates the extent to which social pressure appeals embedded in public health vaccination campaigns are effective in changing vaccination attitudes and intentions. The findings suggest that messages that emphasized pro-social appeals to identity were more effective than corrective information alone. Additionally, we find that images are a powerful tool to activate pro-social behavior and that the most effective messages featured both these images and data on vaccination rates at the state level.

1 Rational Choice and Perception Correction

To date, research on misperceptions in political science often operates within a rational choice framework. Rational choice theory, as derived by Arrow (1951) and Riker (1962), rests on the assumption that actors know what they want and can order their wants transitively (Riker 1995) and that individuals weigh the costs and benefits of an action according to these preferences. As long as actors order their preferences, rational choice theory assumes actions can be assessed in relation to that ordering. By extension, rational choice theory

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tells us that if we are able to provide individuals with information that should re-weight and thus reorder their beliefs and preferences, individuals will indeed change those beliefs and intentions.

In recent years, information available to the public about the importance and safety of vaccines has become increasingly salient and more widely available. Yet misperceptions continue to persist; many parents are concerned about the connection between autism and childhood vaccinations and still others believe the flu shot will give you the flu. Given the scientific consensus that neither of these concerns pose a serious risk, scholars have explored how we might correct these misperceptions and, in a rational choice tradition, re-weight individuals cost/benefit calculations such that they arrive conclusions that are in line with the current scientific consensus. If individual’s policy preferences are based on false or unsubstantiated information, correcting these misconceptions is of great normative importance.

However, many studies of misperception correction often find that it is difficult to realign individuals beliefs. In some cases, studies have shown that factual information can be used to change a person’s preferences (Kuklinski 2000; Gilens 2001\(^9\); Howell and West 2009\(^10\)), while in other cases is does not (Kuklinski 2000; Sides and Citrin 2007\(^11\); Kellstedt et al 2008; Nyhan and Reifler 2015). Indeed, many studies of misperception correction often find that it is difficult to realign individuals beliefs. In many cases, citizens resist or reject information and arguments that contradict their opinions. (e.g. Redlawsk 2002\(^12\); Taber and Lodge 2006\(^13\)) And often attempts to correct misperceptions can also result in “backfire

\(^12\)Redlawsk, David P. “Hot cognition or cool consideration? Testing the effects of motivated reasoning on political decision making.” The Journal of Politics 64.04 (2002): 1021-1044.
\(^13\)Taber, Charles S., and Milton Lodge. “Motivated skepticism in the evaluation of political beliefs.”
effects as people attempt to defend their prior beliefs (Nyhan ans Reifler 2010; Nyhan and Reifler 2015), an unexpected outcome in misperception studies. In some cases, those that are the most informed about a topic are the ones least likely to be persuaded by the evidence, indicating that more information may not be the solution to the misconception problem. (Kellstedt et al. 2008) Overall, misperceptions are hardly ever altered and even if they are, individuals intentions typically remain the same (e.g. Nyhan and Reifler 2014). These contradictory findings suggest that simply trying to reorder individuals considerations may not be the most effective approach to correcting misperceptions.

To summarize, scholarship to this point gives us reason to suspect that individuals intentions about vaccines do not always operate in a rational choice framework. Yet misperception studies often do not go beyond attempts to provide factual information that we anticipate will cause individuals to change their minds. This suggests that there is room to explore other possible avenues for effecting attitude change. This paper posits that psychological appeals to identity, specifically one’s social identity and community, have the potential to move attitudes and behavioral intentions.

2 Social Pressure

Political psychology scholarship has long demonstrated that psychological factors are critical components of how individuals understand and navigate the political landscape. In particular, research has shown the effect social pressure and social norms can have on behavior. People are aware of the behavior of others around them and internalize the norms of the community. Knowing ones behavior will be made public is also a compelling factor in complying

with social norms (Cialdini and Goldstein 2004\textsuperscript{14}; Kallgren, Reno, and Cialdini 2000\textsuperscript{15}). Gerber and Green (2008)\textsuperscript{16} demonstrate this effect in a voter turnout context, finding that social pressure matters in get-out-the-vote campaigns, especially when shaming tactics are used to enforce compliance. They further conclude that social pressure is additive: more pressure leads to more voting regardless of predispositions to vote. While there are typical caveats like ceiling effects, on balance, people typically comply with social norms when they know they are being watched in order to avoid being socially excluded when their behavior is made public.

The importance of social setting and norms has been further corroborated in the vaccine context. Nyhan, Reifler, and Richey (2012)\textsuperscript{17} find that health discussion networks play a key role in shaping vaccination attitudes. Those who believe their network supports vaccination feel more positively towards vaccines and have a greater intent to vaccinate themselves. While this is not entirely surprising, it does underscore the importance of the climate in which individuals form attitudes. Being in a particular context can evoke feelings of pride or shame or change an individual’s disposition system. Working to understand the individual, the context they find themselves in, and the relationship between the two could provide significant leverage into understanding attitudes that are not consistent with the current scientific consensus.

3 Expectations and Hypotheses

Given the discussion above, two primary hypotheses are tested in this paper. The first describes expectations for incorporating social pressure and pro-social content into an appeal to vaccinate. Previous work, like that done by Gerber and Green (2008), publicizes whether one has engaged in pro-social behavior, like voting, by sending information to the neighborhood at large. While I cannot do this same procedure with seasonal flu vaccines, demonstrating that there is a community norm or standard belief at the level closest to the individual may still have the power to change intentions about getting the flu vaccine. For flu vaccines, monthly data is collected at the state level by the CDC for each flu season. Hence, we use this data to demonstrate the community behavior at the state level in our appeal.

Relatedly, I expect this appeal to a community norm to be especially effective when there is a strong community identity and pride in that community. By priming this identity and connecting it to a pro-social vaccine appeal, I attempt to exploit the relationship between the individual and the context in order to change intentions. In this study, the identity I prime and connect to CDC data on vaccinations rates is one’s identity as a Texan. It is well known that Texans have high levels of state pride and care deeply about their identity as Texans. Hence, in order to test the effect of pro-social identity appeals, I use data from the CDC reporting the final vaccination rate in the state of Texas at the end of the 2014-2015 flu season. From this discussion, I generate the first hypothesis:

Hypothesis 1: Exposure to a pro-social identity appeal will increase intentions to vaccinate over corrective treatments.

Furthermore, previous findings suggest that simple textual appeals are not compelling enough to change intentions and misperceptions (Nyhan et al. 2014; Nyhan and Reifler 2015). In this study, I go beyond text-only appeals and prime the identity of interest (being a Texan) using symbolic images. Texas is well known for its many icons, including flags,
bluebonnets, and the Texas star, among others. In this study, we chose the Texas state flag as the background imagery for our pro-social appeal. The state flag is well-known, very prevalent in public places, and a symbol of Texas pride. The design elements of the flag also made it an ideal image to use with text in a public health-style appeal. Hence, I produce the second hypothesis:

\textit{Hypothesis 2: Adding images to the pro-social appeal will lead to more positive attitudes toward vaccines than the appeals without images.}

4 Methods

4.1 Data Collection

This study replicates and extends the work done by Nyhan and Reifler (2015) and thus closely follows their methods and procedures. The data for this study were collected using Amazon’s Mechanical Turk platform and the worker pool was limited to those with IP addresses located in Texas. The study was fielded beginning in March 2016 and data collection is ongoing. Respondents were adults located in Texas who were told they would be answering questions meant to elicit their opinions on important political issues of today. The results presented here include 228 respondents, with the intent to collect data from 525 respondents.

4.2 Study Design

Respondents were randomly assigned to one of seven different conditions in the experiment. In each condition respondents were asked about the flu vaccine and whether or not they intended to get vaccinated in a future flu season. The seven conditions were as follows:

1. Control- The respondents received no additional information about the flu or flu vaccines prior to answering the outcome questions.
2. Correction- Respondents received information debunking the myth that people can get the flu from the flu vaccine. The text used in this treatment was the same as in Nyhan and Reifler’s (2015) study and was taken directly from the Centers for Disease Control website.\textsuperscript{18}

3. State Percentage Text- Respondents read a two line statement about flu vaccination in Texas that included an appeal to the respondent’s identity as Texans. This condition used the percent of Texans who got vaccinated last year. The text stated:
Join the 50\% of Texans who got a flu vaccine last year.
Keep Texas Healthy. Keep Texas Strong.

4. Raw Number Text- This condition is identical to condition three, but instead used the raw number of Texans who got vaccinated last year. The text stated:
Join the 13 million Texans who got a flu vaccine last year.
Keep Texas Healthy. Keep Texas Strong.

5. Flag Image with No Data- As seen in Figure 1, respondents were shown an image of the Texas flag with the slogan “Keep Texas Healthy. Keep Texas Strong” printed over the image. The image also included a small logo in the bottom corner featuring an outline of Texas and the phrase “Vaccinate Texas”.\textsuperscript{19}

\textsuperscript{18}Full text of the correction intervention can be found in Appendix A.
\textsuperscript{19}Images of the Texans flag are courtesy of Patriot Wood, LLC and are being used with permission from the company owners.
6. Flag Image with Percentage- As seen in Figure 2, respondents were shown an image of the Texas flag with the slogan “Keep Texas Healthy. Keep Texas Strong” printed over the image. Additionally, the image included the appeal to “join the 50% of Texans who got a flu vaccine last year” and the small logo in the bottom corner featuring an outline of Texas and the phrase Vaccinate Texas.
7. Flag Image with Raw Number- The final condition showed respondents the same image as in the fifth condition, expect that the percentage (50%) was changed to the raw number of Texans who got a flu vaccine last year (13 million).

As noted by Nyhan and Reifler (2015), responses to vaccine information might vary based on ones pre-existing attitudes towards vaccines. Since it was not possible to accurately measure prior vaccine receipt as part of the study, I measured general respondent’s general concerns about vaccine safety and side effects. Specifically, in replicating Nyhan and Reifler (2015), I asked, In general, how concerned are you about serious side effects from vaccines? prior to the interventions. This was measured on a five point scale ranging from not at all concerned to “extremely concerned.”

4.3 Outcome Measures

After the experimental intervention, I measured the effects of each treatment on respondents misperceptions about the flu vaccine (You can get the flu from the seasonal flu vaccine), feelings about vaccine safety (Just based on what you know, how safe do you believe the seasonal flu vaccine, meaning the flu vaccine available every year, is generally for most people to take?), intent to get vaccinated in the future (How likely is it that you will get a flu vaccine for the seasonal flu during future flu seasons?), and attitudes about school vaccination policies (Just based on what you know, how much do you agree with the following statement: If a child has not been vaccinated (even though they are healthy enough to receive vaccines), that child should be allowed to attend public school.). With the exception of the policy question, these measures were taken from Nyhan and Reifler (2015) and the full text and scale of each measure can be found in the appendix.

These measures were used not only for replication purposes, but because they measure the complex relationship between attitudes and behavior regarding vaccinations. By asking
about both beliefs and intentions, I can assess the effect of debunking misperceptions on two different dimensions. As shown below and in line with previous findings, I demonstrate that the interventions have different effects on peoples beliefs as compared to their intentions. If the study had not included these questions, I would not be able to see this differential effect.

4.4 Statistical Analysis

The results of the study were analyzed using paired difference of means tests and ordered probit models in Stata 13 (Stata Corp, College Station, TX). I estimate the effects of assignment to the correction, flag, percent, and raw number conditions on misperceptions about the flu vaccine and intentions to vaccinate in the future. We also test to see if the non-replication treatments result in significantly different outcomes from the correction and control conditions.

5 Results

Table 1 summarizes the characteristics of the respondents in the Mechanical Turk sample. As is to be expected when working with convenience samples like those from MTurk, the sample is not fully representative of the demographics of the national adult population. This sample is younger, more educated, and disproportionately white. However, the sample appears to be roughly balanced across conditions, indicating that the randomization process was successful.

It is also notable that a large portion of the sample (60%) reports themselves as being either not at all concerned or not too concerned about the side effects of vaccines. Approximately 21% of the sample falls into the high concern category, which I define as saying you are either “very” or “extremely” concerned about vaccine side effects. This distribution approximates that found in Nyhan and Reifler’s (2015) sample and thus gives us confidence
that we can make inferences about high and low concern individuals as our sample size increases.
Table 1: Characteristics of Respondents in Study Sample by (%)

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Figures 3 and 4 summarize the distribution of responses to the four outcome variables of interest across all seven conditions in the study: this misperception that the flu vaccine can give you the flu, perceptions of the vaccine’s safety, self-reported intent to vaccinate in the next flu season, and attitudes about school vaccination policies.

The results indicate that roughly 40% of the respondents believe that the myth that the flu vaccine can give you the flu is ‘somewhat accurate’ (27%) or “very accurate” (12%). Yet far fewer believe the flu vaccine is unsafe, with only a total of 12% saying they consider the vaccine “not very safe” or ‘not at all safe.” Figure 4 shows that the distribution of self-reported intentions to vaccinate are quite bimodal. 25% of respondents say it’s unlikely they will get a flu vaccine in the next flu season, while 31% say it is very likely they will get a vaccine. The remaining 44% of the respondents were not as certain and approximately even distributed about the remaining response options. Finally, 41% of the respondents thought a child who has not been vaccinated should not be allowed to attend public school by indicating either “disagree” or “strongly disagree”, with roughly 27% saying that an un-vaccinated child should be allowed to attend public school.

![Figure 3: Distribution of Vaccine Misperception and Safety Measures](image-url)
5.1 Experimental Results: Difference of Means Tests

Figures 5-8 report the differences of means tests for each of the four outcome variables. To compare the effect of the Texas-based treatments to the treatments used in Nyhan and Reifler (2015), the added treatment conditions were compared to the control and correction conditions. In Figures 5-8, magenta indicates that the effect is statistically significantly different from the control condition, while yellow means that the effect is statistically significantly different from the correction condition.

Figure 5 shows the difference of means tests for perceptions of safety, where higher bars mean the respondents think the vaccine is more unsafe. While the bars all fall between 1 ("Very safe") and 2 ("Somewhat safe")\(^{20}\), those in the correction condition and flag image with percentage condition report believing the vaccine is more unsafe than the respondents in other conditions. While none of the difference of means tests were significant, this does provide some preliminary evidence for the backfire effect found by Nyhan and Reifler (2015); the correction treatment is not moving attitudes about safety in the way one might expect.

Figure 6 shows the difference of means tests for vaccine mis-perceptions, where higher bars mean the respondents believe the statement “You can get the flu from the seasonal

\(^{20}\)The question scale ranged from 1 to 4, with 4 corresponding to “Not at all safe”.

![Likelihood of vaccination vs School Vaccination Policy](image)
“flu vaccine” is more accurate. The question scale ranged from 1 ("Very inaccurate") to 4 ("Very accurate"). The magenta bar in the left panel indicates that the correction condition is significantly different from the control group, with about .75 point difference, indicating that the correction treatment is effective in correcting the mis-perception that the flu vaccine can give you the flu. The yellow bars in the left panel further evidence this effect, as the control group is significantly different from the control. The correction treatment reduces misperceptions by roughly .75 points on the question scale compared to both of the percentage conditions. Thus, the percentage text and image with percentage conditions are both significantly different, indicating that the percentage treatment was not effective in changing mis-perceptions. While the percentage treatments were not corrective in the sense that they did not contain information meant to debunk the myth that the flu vaccine gives you the flu, the percentage treatment was found to be ineffective across all outcome measures. This is not entirely surprising; 50% is not a majority of Texans and not as compelling as a call to join a group’s behavior.

Figure 7 shows the difference of means tests for vaccine intentions, where higher bars
mean the respondents are self-reporting a greater likelihood to vaccinate in the next flu season. The question scale ran from 1 ("Very unlikely") to 6 ("Very likely").\textsuperscript{21} The left panel indicates that none of the treatments was significantly different from the control group. However, the right panel indicates that both raw number treatments and the image with no data treatment are significantly different from the correction treatment, leading to about a 1.5 point increase on the intent to vaccinate scale for both treatments. Given the range of the scale, this shift is quite substantial. Additionally, the correction treatment group reports the lowest intent to vaccinate, evidence of the backfire effect described by Nyhan and Reifler.\textsuperscript{21}

\textsuperscript{21}Here, "very likely" means that the respondent self-reported that they were very likely to get a flu vaccine during future flu seasons.
When examined in concert with Figure 6, key conclusions can be drawn from Figure 7. First, it appears that corrective interventions can be used to correct mis-perceptions, but different interventions are effective in changing intentions. In this case, identity appeals that use identity-priming images and provide information about the raw number of individuals engaging in a behavior are effective in changing intentions. Interestingly, the identity-priming images without any data are just as effective as those with the raw number data, indicating that the data does not significantly increase vaccination intentions alone. Furthermore, the image itself does not have an additive effect, as the raw number with text condition is roughly as effective as those with images. In sum, the raw number and the image have independent effects, but are not stronger together.

Furthermore, Figures 6 and 7 show that we can change either intentions or perceptions, but perhaps not at the same time within the same appeal. Insofar as I find evidence for the backfire effect, there is reason to believe that vaccine attitudes are not formed through a purely rational choice process. These findings go further to suggest that perceptions and intentions might be changed through separate processes and that perhaps providing less information might be the most effective methods to change intentions.

Finally, Figure 8 shows the difference of means tests for the school policy attitudes question, where higher bars mean the respondents disagree more with the statement “If a child has not be vaccinated (even though they are healthy enough to receive vaccines), that child should be allowed to attend public school.” While the bars all fall between 4 (“Neither agree nor disagree”) and 5 (“Slightly disagree”), none of the difference of means tests were significant. This suggests that none of the treatments had much of an effect on school vaccine policy attitudes and that perhaps individuals hold separate opinions about childhood

22Table 2 further demonstrates this backfire effect in an ordered probit model, discussed in detail below.  
23The question scale ranged from 1 (“Strongly Agree”) to 7 (“Strongly Disagree”).
vaccines and general vaccines like the seasonal flu vaccine.

6 Experimental Results: Ordered Probit Models

Thus far, the findings replicate the backfire effect identified by Nyhan and Reifler (2010; 2015), as well as their finding that it is possible to change mis-perceptions without changing intentions (Nyhan and Reifler 2014). I have also found that is it possible to change intentions through identity-based prosocial appeals that use images and raw numbers of individuals engaging in a behavior. To further examine the impact of these intervention on our outcome variables, I ran several ordered probit models. These models estimate the independent effect of being in the image, percent, raw number, and correction treatments, as well as the effect of the self-reported level of concern about side effects measured prior to receiving treatment.

Table 2-4 report these results. Across all three outcome variables analyzed here (intent to vaccinate, safety, and vaccine misperception), neither the flag, percent, or raw number conditions exerted a significant independent effect. However, as noted above, the percent
condition was not only ineffective, it often produced a backfire effect like that found in the correction conditions; respondents were less likely to vaccinate themselves and believed vaccines were less safe and more likely to give you the flu after exposure to those treatments. This suggests that even if the effect was not significant, saying 50% of Texans got the vaccine is not an effective appeal. However, the raw number condition does appear to be effective, with the coefficients always being oppositely signed from the percent condition coefficients.

In each of the four tables, the level of side effect concern was a significant predictor of vaccine attitudes. Higher levels of concern lead to decreased intentions to vaccinate, greater belief vaccines are unsafe, and greater belief that the flu vaccine can give you the flu. These results are not particularly surprising and replicate a wide range of previous work; those with the highest levels of concern about vaccines tend to express the greatest skepticism about their safety and getting vaccinations.

Finally, the ordered probit models show the effects of the correction intervention on each of the outcome variables and provide more nuanced support for the findings described in the difference of means tests. The correction treatment has a backfire effect for both intentions to vaccinate and beliefs about vaccine safety as indicated by the negative and positive coefficients, respectively. However, we also see that the correction treatment is effective in debunking the myth that the flu vaccine can give you the flu, as Table 4 indicates with the negative coefficient. Overall, the results of the ordered probit models provide more specific support for our findings and demonstrate the effects of each type of treatment individually.

Finally, the ordered probit models show the effects of the correction intervention on each of the outcome variables and provide more nuanced support for the findings described in the difference of means tests. The correction treatment has a backfire effect for both intentions to vaccinate and beliefs about vaccine safety as indicated by the negative and positive coefficients, respectively. However, we also see that the correction treatment is
### Table 2: Ordered Probit for Intent to Vaccinate

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>(Std. Err.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flag Condition</td>
<td>0.064</td>
<td>(0.156)</td>
</tr>
<tr>
<td>Correction Treatment</td>
<td>-0.543**</td>
<td>(0.248)</td>
</tr>
<tr>
<td>Level of Side Effect Concern</td>
<td>-0.106*</td>
<td>(0.058)</td>
</tr>
<tr>
<td>Percent Condition</td>
<td>-0.239</td>
<td>(0.190)</td>
</tr>
<tr>
<td>Number Condition</td>
<td>0.132</td>
<td>(0.193)</td>
</tr>
</tbody>
</table>

N = 228

** indicates significance at $p < 0.05$

* indicates significance at $p < 0.10$

### Table 3: Ordered Probit for Vaccine Safety

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>(Std. Err.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flag Condition</td>
<td>-0.031</td>
<td>(0.176)</td>
</tr>
<tr>
<td>Correction Treatment</td>
<td>0.254</td>
<td>(0.275)</td>
</tr>
<tr>
<td>Level of Side Effect Concern</td>
<td>0.622**</td>
<td>(0.071)</td>
</tr>
<tr>
<td>Percent Condition</td>
<td>0.266</td>
<td>(0.215)</td>
</tr>
<tr>
<td>Number Condition</td>
<td>-0.083</td>
<td>(0.219)</td>
</tr>
</tbody>
</table>

N = 228

** indicates significance at $p < 0.05$

* indicates significance at $p < 0.10$

### Table 4: Ordered Probit for Vaccine Misperception

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>(Std. Err.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flag Condition</td>
<td>-0.180</td>
<td>(0.155)</td>
</tr>
<tr>
<td>Correction Treatment</td>
<td>-0.689**</td>
<td>(0.258)</td>
</tr>
<tr>
<td>Level of Side Effect Concern</td>
<td>0.285**</td>
<td>(0.059)</td>
</tr>
<tr>
<td>Percent Condition</td>
<td>0.164</td>
<td>(0.189)</td>
</tr>
<tr>
<td>Number Condition</td>
<td>-0.048</td>
<td>(0.190)</td>
</tr>
</tbody>
</table>

N = 228

** indicates significance at $p < 0.05$

* indicates significance at $p < 0.10$
effective in debunking the myth that the flu vaccine can give you the flu, as Table 4 indicates with the negative coefficient. Overall, the results of the ordered probit models provide more specific support for the findings and demonstrate the effects of each type of treatment individually.

7 Discussion and Conclusions

The results of this study indicate that corrective information seeking to debunk myths about the flu vaccine has different effects on beliefs than on intentions to vaccinate. I replicate the findings from Nyhan and Reifler (2014) and Nyhan and Reifler (2015) showing that a corrective intervention reduces misperceptions, but does not change beliefs about safety and creates a backfire effect in intentions to vaccinate. These findings are consistent with previous research on factual corrections.

Most notably, my findings suggest that it is possible to change both intentions or perceptions, but perhaps not at the same time through the same type of appeal. Factual corrective interventions were effective in correcting misperceptions, but not at changing behavioral intentions. The pro-social identity appeals using the raw number of vaccinated Texans proved effective in increasing self-reported intentions to vaccinate, consistent with the theory in research on social pressure. Additionally, the identity appeal devoid of any vaccination rate data also proved effective in increasing intentions to vaccinate, which suggests that appealing directly to ones valued identities without additional information can also change behavior.

This study is of course not without limitations. I was not able to measure directly whether the respondents had actually received a flu vaccine for both logistical and privacy reasons. As such, I was not able to fully explore the impact of social pressure by exposing individual’s behavior to their contemporaries, as Gerber and Green (2008) do in their seminal social pressure study. Additionally, I face some challenges when working with a convenience
sample from Mechanical Turk, particularly when limiting the workers to a specific state. I hope that as our sample size grows that the data will become more representative and increase the power within each treatment such that I can replicate some of Nyhan and Reifler’s (2015) analysis using high and low concern individuals.

Despite these limitations, these results suggest that there is much more work to be done to experimentally evaluate the effects of different types of appeals in science communication. Moving forward, I hope to continue to explore the role of psychological appeals in this sort of messaging, specifically by testing corrective and identity appeals together, as well as separately in contexts other than vaccines. Additionally, I plan to explore how political context effects these types of appeals by attaching partisan content to the appeal. Both these avenues for future work will help further explore the relationship between misperceptions and social pressure.
Appendix: Survey for “Community Immunity: Social Pressure and Vaccine Choices”

[Vaccine concern - pre-intervention]
In general, how concerned are you about serious side effects from vaccines?

- Extremely concerned [5]
- Very concerned [4]
- Somewhat concerned [3]
- Not too concerned [2]
- Not at all concerned [1]

[Delay questions]

[Randomization after delay; control group receives no message]

Please examine the following information about seasonal influenza (the flu) carefully.

[Correction intervention]

Can the flu shot give me the flu?

No, a flu shot cannot cause flu illness. The viruses contained in flu shots are inactivated (killed), which means they cannot cause infection. Flu vaccine manufacturers kill the viruses used in the flu shot during the process of making vaccine, and batches of flu vaccine are tested to make sure they are safe. In randomized, blinded studies, where some people got flu shots and others got saltwater shots, the only differences in symptoms was increased soreness in the arm and redness at the injection site among people who got the flu shot. There were no differences in terms of body aches, fever, cough, runny nose or sore throat.

More information about these studies is available at:


Can the nasal spray flu vaccine give you the flu?
Unlike the flu shot, the nasal spray flu vaccine does contain live viruses. However, the viruses are attenuated (weakened) and cannot cause flu illness. Some children and young adults 2-17 years of age have reported experiencing mild reactions after receiving nasal spray flu vaccine, including runny nose, nasal congestion or cough, chills, tiredness/weakness, sore throat and headache. Some adults 18-49 years of age have reported runny nose or nasal congestion, cough, chills, tiredness/weakness, sore throat and headache. These side effects are mild and short lasting, especially when compared to symptoms of influenza infection.

Join the 50% of Texans who got a flu vaccine last year.

Keep Texas Healthy. Keep Texas Strong.

Join the 13 million Texans who got a flu vaccine last year.

Keep Texas Healthy. Keep Texas Strong.

Figure 9: Flag Image with No CDC Data
We would like to ask you some questions about the seasonal flu vaccine (a flu shot or nasal flu spray).

How likely is it that you will get a flu vaccine for the seasonal flu during future flu seasons?

- Very likely [6]
- Somewhat likely [5]
- Slightly likely [4]
- Slightly unlikely [3]
- Somewhat unlikely [2]
- Very unlikely [1]

Just based on what you know, how safe do you believe the seasonal flu vaccine, meaning the flu vaccine available every year, is generally for most people to take?

- Very safe [1]
- Somewhat safe [2]
- Not very safe [3]
- Not at all safe [4]

Just based on what you know, is the following statement accurate or inaccurate?

You can get the flu from the seasonal flu vaccine.
Figure 11: Flag Image with Percent Vaccinated in Previous Flu Season

- Very accurate [4]
- Somewhat accurate [3]
- Somewhat inaccurate [2]
- Very inaccurate [1]

Just based on what you know, how much do you agree with the following statement?
If a child has not been vaccinated (even though they are healthy enough to receive vaccines), that child should be allowed to attend public school.

- Strongly Agree
- Agree
- Slightly Agree
- Neither Agree Nor Disagree
- Slightly Disagree
- Disagree
- Strongly Disagree

[Manipulation Checks not given to control group]
[If in correction group]

The nasal spray flu vaccine contains live viruses.
• True
• False

[If in Texas raw number group OR Texas text only raw number group]
How many million Texans got a seasonal flu vaccine last year?
• 5 million
• 13.5 million
• 20 million
• 10 million

[If in Texas percentage group OR Texas text only percentage group]
What percent of Texans got a seasonal flu vaccine last year?
• 10%
• 50%
• 20%
• 40%

[If in the Texas image (no data) condition]
Which of the following was used as the background image in the graphic you viewed earlier?
• The Texas state flag
• The Texas State Capitol Building
• The Alamo
• The American flag

[Demographics]
Now we would like to ask you some questions about yourself.

Please indicate your age range:
• 18-29
• 30-44
• 45-59
• 60+

Please indicate your gender:
• Male
• Female
• Prefer Not To Answer

What is the highest degree or level of schooling you have completed?
• High school diploma or less
• Some college credit, no degree
• Trade, technical, or vocational training
• Associates degree
• Bachelors degree
• Masters/Doctoral degree
• Other professional degree

Please indicate your race:
• White
• Black
• Hispanic/Latino
• Native American
• Asian
• Pacific Islander
• Other (please write in)

Generally speaking, do you usually think of yourself as a Republican, a Democrat, an Independent, or what?
• Strong Democrat
• Weak Democrat
We hear a lot of talk these days about liberals and conservatives. Here is a seven-point scale on which the political views people might hold are arranged from extremely liberal to extremely conservative. Where would you place yourself on this scale, or haven’t you thought much about this?

- Very Liberal
- Liberal
- Slightly Liberal
- Moderate, Middle of the Road
- Slightly Conservative
- Conservative
- Very Conservative
- Do Not Know/Have Not Thought About It