Does Correcting Myths about the Flu Vaccine Work?
An experimental evaluation of the effects of corrective information

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Abstract

Seasonal influenza is responsible for thousands of deaths and billions of dollars of medical costs per year in the United States, but influenza vaccination coverage remains substantially below public health targets. One possible obstacle to greater immunization rates is the false belief that it is possible to contract the flu from the flu vaccine. A nationally representative survey experiment was conducted to assess the extent of this flu vaccine misperception. We find that a substantial portion of the public (43%) believes that the flu vaccine can give you the flu. We also evaluate how an intervention designed to address this concern affects belief in the myth, concerns about flu vaccine safety, and future intent to vaccinate. Corrective information adapted from the Centers for Disease Control and Prevention (CDC) website significantly reduced belief in the myth that the flu vaccine can give you the flu as well as concerns about its safety. However, the correction also significantly *reduced* intent to vaccinate among respondents with high levels of concern about vaccine side effects – a response that was not observed among those with low levels of concern. This result, which is consistent with previous research on misperceptions about the MMR vaccine, suggests that correcting myths about vaccines may not be an effective approach to promoting immunization.

Introduction

In the United States, seasonal influenza is responsible for thousands of deaths and billions of dollars in medical costs and lost earnings annually, but immunization rates remain substantially below the targets in *Healthy People 2020*.[12] In 2011-2012, for instance, only 33% of adults aged 18-64 were vaccinated – far short of the *Healthy People 2020* target of 80% for adults.[3]

One possible impediment to higher vaccination rates is the false belief that the influenza vaccine can give people the flu. Health agencies often attempt to correct this false claim, which may contribute to perceptions that the vaccine is unsafe or exacerbate hesitancy about immunization.[4] However, previous research in non-medical contexts suggests that correcting factual misperceptions may be ineffective and can even make false beliefs more prevalent due to people's motivations to defend their prior beliefs.[5] Similarly, corrective information is also often ineffective at changing opinions.[678] Most notably, though debunking the myth that the measles, mumps, and rubella (MMR) vaccine causes autism was found to successfully reduce belief in that false claim, it also *reduced* vaccination intent among parents with the least favorable attitudes towards vaccines.[9] Similarly, exposure to accurate information about the vaccine for diphtheria-pertussis-tetanus (DPT) was associated with non-vaccinators seeing the vaccine as less dangerous but also making them feel less inclined to vaccinate.[10]

In this article, we report the results of a nationally representative survey experiment examining the prevalence of the myth that the flu vaccine can give people the flu and test whether correcting this myth reduces belief in the misperception, increases perceptions that the flu vaccine is safe, and increases vaccination intent. We compare the effect of corrective information with an alternate message about the dangers of the flu as well as a control condition in which respondents were not given any information.

Methods

Data collection

The data for this study were collected as part of the 2012 Cooperative Congressional Election Survey, a multi-investigator online study that primarily focused on questions about politics and government. The survey was fielded in two waves – a pre-election wave in October 2012 and a November 2012 post-election wave for respondents from the first wave (as we discuss below, however, this wave suffered from significant non-random attrition).

Respondents were U.S. adults drawn from the YouGov/Polimetrix PollingPoint Panel and the E-Rewards and Western Wats panels. These respondents were matched and weighted to approximate a national probability sample using the YouGov/Polimetrix sample matching methodology,[11] which has been shown to perform well in predicting the outcome of U.S. elections and was recently adopted by the *New York Times*.[12] The final sample for the module included 1000 respondents who participated in the first wave of the study (822 of these accepted the invitation to complete wave 2). The response rate for wave 1 was 33.4% of the participants in the panels listed above who were invited to take part in the study (American Association for

Public Opinion Research response rate 1).[13] This study was designated as exempt from human subjects review by the Dartmouth Committee for the Protection of Human Subjects (CPHS #23722). Respondents provided informed consent before participating; no adverse events were reported.

Study design

Respondents were randomly assigned to one of three different conditions in our experiment, which allows us to make credible causal inferences about their effects of the messages tested. In each condition, respondents were asked questions about the flu vaccine and whether or not they intended to get vaccinated. One group of respondents received information debunking the myth that people can contract flu from the vaccine (*Correction*). A second group of respondents received information about the risks posed by influenza, a standard type of pro-vaccination information that was included to provide a comparison measure of messaging effectiveness (*Danger)*. Finally, a third group of respondents received no additional information about the flu or flu vaccines prior to answering the outcome questions (the control group). Each respondent was assigned to only one condition and saw no other messages about the flu or vaccines.

Each of these messages was taken nearly verbatim from the CDC website. In the *Correction* condition, which is adapted from the CDC web page "Misconceptions about Seasonal Flu and Flu Vaccines,"[4] respondents were told that people cannot contract flu from the the flu shot or live virus nasal spray. In the *Danger* condition, which uses text from the CDC web page "Key Facts about Influenza (Flu) and Flu Vaccine," respondents were informed that flu is a contagious illness, provided with a list of its signs and symptoms, and told about the serious risks it poses. (The text of each intervention is provided in Online Appendix A.)

Responses to information about vaccines may vary depending on pre-existing attitudes toward vaccines. It was not possible to accurately measure prior vaccine receipt in this study due to concerns about error in self-reports of past behavior. In addition, prior receipt may also not accurately reflect an individual's current beliefs and attitudes. We instead measured participants' general concerns about vaccine safety and possible side effects, which may contribute to beliefs in specific vaccine myths (and rejection of corrective information about them) as well as vaccine hesitancy.[9] Specifically, we asked, "In general, how concerned are you about serious side effects from vaccines?" prior to administering the interventions. Respondents answered on a five-point scale ranging from "not at all concerned" to "extremely concerned." We expected responses to this question to moderate the treatment effect of interest because the corrective information in our study concerns a perceived side effect of vaccines. Specifically, our expectation is that respondents who are most concerned about side effects are most likely to resist corrective information intended to alleviate those concerns.

Approximately a quarter of the sample (24%) answered that they were either "extremely concerned" (11%) or "very concerned" (13%) about side effects from vaccines. In the analyses that follow, this group, which is the most concerned about vaccine side effects, is referred to as the high concern group. The remaining respondents are classified as low concern.

Outcome measures

After the experimental intervention, we assessed the effects of *Correction* and *Danger* on respondents' misperceptions about the flu vaccine, beliefs about flu vaccine safety, and intention to get vaccinated using three outcome measures. Misperceptions about the flu vaccine were measured by asking respondents whether the statement "You can get the flu from the seasonal flu vaccine" is accurate. Respondents' general beliefs about the safety of flu vaccines were measured by asking "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?" Responses to both questions were measured on a four-point scale. We also asked respondents "How likely is it that you will get a flu vaccine for the seasonal flu during the upcoming flu season (fall 2012-spring 2013)?" and measured their reported intention to vaccinate on a six-point scale. (The full text of each measure is provided in Online Appendix A.)

These measures were included due to the complexity of the relationship between attitudes and behavior.[14] They allow us to understand the effect of debunking the myth that the flu vaccine causes the flu on both people's beliefs and their intended behavior. As we show below, the correction turns out to have different effects on people's beliefs about the vaccine than on their intention to vaccinate. If we only measured effects on beliefs, we might have mistakenly concluded that corrective information is an effective way to address vaccine hesitancy. Because we also asked about intention to vaccinate, however, we can show that the correction actually reduces intention to vaccination and that this effect is concentrated among respondents with high levels of concern about vaccine side effects.

Waves

The *Danger* and *Correction* messages were administered only in Wave 1 of the survey. All outcome measures and the side effects concern question were asked in Wave 1 and Wave 2. We asked these outcome measures in both waves in the hopes of assessing whether the treatments had both immediate and lasting effects. As we discuss below, however, wave 2 suffered from significant non-random attrition, especially among respondents with high vaccine side effects concern. As a result, it cannot yield valid inferences about the effect of the treatments given the role of side effects concern as a moderator, though we present these data for completeness in Online Appendix B (we discuss these results further below).

Statistical analysis

The results from the study were analyzed using ordered probit in Stata 13 (Stata Corp, College Station, TX) and incorporate probability weights provided by YouGov to approximate a nationally representative sample. We estimate the effects of assignment to the *Correction* and *Danger* conditions on misperceptions about the flu vaccine (an "intent to treat" effect). In our

analysis below, we consider the possibility that responses to messages about vaccine safety or the dangers of communicable disease may differ depending on respondents' prior attitudes toward vaccines, which has been documented in previous research.[9] Specifically, we test for differences in responses to the *Correction* and *Danger* treatments between respondents with low and high concerns about vaccine side effects. (This attitude was measured using the vaccine side effects concern question described above, which was the only pre-intervention measure of vaccine attitudes administered to respondents; full text in Online Appendix A). We report separate statistical models for respondents with low and high levels of concern about side effects for ease of interpretation. (Online Appendix B reports the results of full statistical models with interactions between high concern over side effects and the experimental interventions; the substantive conclusions are identical.) Predicted probabilities were estimated using SPost.[15]

Results

Table 1 summarizes the characteristics of respondents in our sample, which should reflect the demographics of the national adult population in the U.S.

[Table 1]

The results indicate that our randomization was successful. In each case, we cannot reject the null hypothesis of no association between the characteristic and assignment to condition.

Figure 1 summarizes the weighted distribution of responses to the three outcome variables of interest across all conditions of our study (the control condition, *Correction*, and *Danger*): the misperception that the flu vaccine can give you the flu, perceptions of flu vaccine safety, and self-reported likelihood of vaccinating during the approaching flu season (fall 2012-spring 2013 at the time of the survey was administered).

[Figure 1]

Our results indicate that more than four in ten Americans believe the misperception that the flu vaccine can give you the flu is "somewhat accurate" (31%) or "very accurate" (12%). However, fewer hold the belief that the vaccine is unsafe (12% say "not very safe," 4% "not at all safe"). The distribution of self-reported likelihood of receiving a flu shot are highly bimodal: 34% say they are very unlikely to get a flu shot and 37% say they are very likely while the remaining 29% of respondents were less certain.

Experimental results: Flu vaccine beliefs

Table 2 reports ordered probit models of the effects of our interventions on respondent beliefs that the flu vaccine can you give the flu and that it is unsafe. These models estimate the effect of the *Correction* and *Danger* interventions by comparing responses among individuals assigned to those conditions with those from individuals assigned to the control group. We estimate these effects both for our total sample and separately for respondents with low or high concern about vaccine side effects. Finally, both outcome variables are coded so that higher values represent more negative views of the flu vaccine (i.e., beliefs that the flu vaccine can give you the flu or is unsafe). Negative coefficients thus indicate that an intervention reduced false beliefs.

[Table 2]

The results of our models suggest that *Correction* was generally successful in reducing false beliefs about the flu vaccine. Telling respondents that the vaccine cannot give you the flu significantly reduced beliefs in that false claim in the full sample as well as respondents with both low and high side effects concern. *Correction* also significantly reduced beliefs that the flu vaccine is unsafe for the full sample, though the effect was only statistically significant for the low side effects concern group. (We cannot reject the null hypothesis of no difference in the effects of *Correction* between groups when we estimate a pooled model with interaction terms, however – see Online Appendix B.) By contrast, we find no evidence that *Danger* affected misperceptions about the flu vaccine for the full sample or either side effects concern group. (Note: These findings, and those reported below, are robust to estimating the models with binary dependent variables instead of ordered scales or using OLS instead of ordered probit – all results available upon request.)

To illustrate the substantive effects of our findings, we calculate predicted probabilities from the statistical models in Table 2 that respondents in each vaccine side effects concern group will endorse the myth that the flu vaccine can give you the flu (i.e., that the claim is "somewhat" or "very accurate") or say that the vaccine is not safe ("not very safe" or "not at all safe").

[Figure 2]

As the figure illustrates, the probability of believing that the flu vaccine can give you the flu declines across the two side effects concern groups. Respondents with high side effects concern are much more likely to believe in the claim than those with low concern, but endorsement of the false belief declined significantly in both groups (39% to 27% for low concern; 70% to 51% for high concern). For beliefs that the vaccine is unsafe, the marginal effect is only significant in the low side effects concern group (beliefs that the flu vaccine is unsafe declined from 9% to 5%).

Experimental results: Intention to get flu vaccine

Table 3 reports ordered probit models of the effect of our interventions on respondents' self-reported likelihood of getting a flu vaccine during the 2012-2013 flu season.

[Table 3]

As in the previous analysis, we estimate separate models for the entire sample as well as for the low and high vaccine side effects concern groups. The results indicate that neither intervention had a significant effect on intent to vaccinate on the sample as a whole or the low side effects concern subgroup. However, among the high concern group, we see something strikingly different. While *Danger* again has no significant effect, *Correction* actually *decreases* the reported likelihood of receiving the vaccine. Among those most concerned about vaccine side effects, being told that the flu vaccine does not cause the flu *reduces* one's reported likelihood of getting vaccinated. (The difference in effects between the low and high concern groups is statistically significant in a pooled model with interaction terms; see Online Appendix B.) These results suggest that our findings are not the result of social desirability bias, an account that would not explain why vaccination intent would *decrease* in response to corrective information.

Figure 3 illustrates the negative effect of *Correction* on vaccination intent using predicted probabilities estimated from the statistical models in Table 3 that respondents will answer they are "slightly likely," "somewhat likely," or "very likely" to get a flu vaccine.

[Figure 3]

Corrective information about the flu shot not causing the flu has no significant effect on the reported likelihood of vaccinating among respondents with low side effects concern. However, being told that the flu vaccine cannot give you the flu significantly *decreases* vaccination intent among respondents with high side effects concern, reducing the predicted probability of saying they are likely to get the vaccine from 46% to 27%.

Discussion

Our results indicate that a correction aimed at debunking the myth that the flu vaccine causes the flu can have different effects on beliefs than on intention to vaccinate. Corrective information was found to be generally effective at reducing misperceptions that the flu vaccine causes the flu as well as concerns about its safety. Moreover, neither response varied significantly based on respondents' concern about vaccine side effects. However, the effects of corrective information

on intent to vaccinate varied significantly depending on side effect concerns, which highlights the importance of measuring both beliefs and intended behavior among relevant population subgroups. Specifically, while corrective information about the flu vaccine had no effect on vaccination intention among respondents with low side effects concern, it significantly decreased the reported likelihood of receiving a flu vaccine among those with high side effects concern.

These results are consistent with previous research showing that factual corrections about controversial issues may have unexpected or counterproductive results.[5-8] Most notably, corrective information about the flu vaccine decreased vaccination intent among the high side effects concern group despite reducing misperceptions. This result is highly consistent with the prior finding that corrective information reduced beliefs that the MMR vaccine causes autism but still decreases intent to vaccinate among parents with the least favorable vaccine attitudes.[9] We infer that respondents with high concerns about vaccine side effects brought other concerns to mind in an attempt to maintain their prior attitude when presented with corrective information, causing them to become *less* likely to intend to vaccinate.

Unlike the correction treatment, no difference in responses was observed between the low and high side effects concern groups for the message about the dangers of influenza, which had no significant effect on misperceptions or vaccination intentions among either group. We interpret this finding as the result of the flu danger information being less challenging to respondents' prior beliefs. The risks posed by the flu are widely accepted, whereas the myth that the flu vaccine gives you the flu is prevalent, especially among respondents with high concern about vaccine side effects.

These findings of course have limitations. We were not able to directly measure whether respondents actually received a flu vaccine due to logistical and privacy issues. For simplicity, we did not identify or manipulate the source of the intervention messages. In addition, though we tested actual CDC messages, it is possible that other messages could have different effects. Finally, space constraints in our survey limited us to a single pre-intervention measure of side effects concern rather than a more general vaccine attitudes scale.[9] Because our study focused on a false belief about a supposed side effect of the flu vaccine, we believe this question is the most appropriate. However, future research should also consider whether these responses vary by participants' general attitudes toward vaccines.

Despite these limitations, these results suggest the need to experimentally evaluate the effects of health messages, including those about controversial subjects like vaccines. Randomized controlled trials are as necessary for evaluating the efficacy of public health messaging as for medical treatments. Going forward, researchers should further investigate the process that generated the negative response to corrective information about respondents with high side effects concern. While we cannot directly observe respondents' mental state and any causal mediation analyses require demanding assumptions,[16] we should seek to understand more about why corrective information makes high concern respondents less likely to intend to vaccinate. Further studies of the effects of other pro-vaccine messages would also be valuable.

More generally, future research should continue to explore the causal relationship between vaccine misperceptions and vaccine hesitancy. If misperceptions cause vaccine hesitancy, then

debunking those myths should increase willingness to vaccinate. But if misperceptions are the expression of a more generalized antipathy towards vaccines, then addressing these myths piecemeal is unlikely to be effective. A more comprehensive strategy is likely to be required.

Conclusions

A national survey experiment found that corrective information explaining that the flu vaccine does not give you the flu significantly reduced belief in this myth as well as beliefs that the vaccine is unsafe. However, responses differed significantly depending on respondent concerns about vaccine side effects. In particular, respondents with high levels of concern about side effects were *less likely* to report that they would be immunized after seeing this information. No significant changes in beliefs or likelihood of vaccination were found among respondents exposed to a message about the dangers of influenza. These results suggest that correcting vaccine myths may not be an effective approach to promoting vaccination.

Acknowledgements

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Table 1

	Control	Danger	Correction	Total
Age				
18-29	22%	24%	18%	21%
30-44	27%	18%	29%	24%
45-59	26%	29%	29%	28%
60+	25%	29%	24%	26%
Sex				
Male	45%	50%	49%	48%
Female	55%	50%	51%	52%
Education				
High school or less	38%	42%	39%	40%
Some college	34%	36%	32%	34%
College grad	18%	16%	18%	17%
Post-grad	11%	6%	10%	9%
Race/ethnicity				
White	67%	71%	76%	71%
Black	15%	13%	9%	12%
Hispanic	11%	12%	8%	10%
Other	8%	4%	7%	6%
Concerned about flu vaccine side effects				
Extremely concerned	13%	12%	9%	11%
Very concerned	12%	15%	11%	13%
Somewhat concerned	30%	32%	34%	32%
Not too concerned	31%	28%	33%	31%
Not at all concerned	14%	13%	13%	14%
Number of observations	321	338	341	1000

Sample statistics are computed using weights calculated by YouGov.[10] Due to rounding, some percentages may not add to 100%. Pearson's chi-square is non-significant for differences across intervention groups for each variable listed.

Table 2

	Vaccines can give flu			Flu vaccine unsafe		
	All responses	**Low concern**	**High concern**	**All responses**	**Low concern**	**High concern**
Danger	0.06	0.07	-0.01	-0.14	-0.11	-0.35
treatment	[-0.17, 0.29]	[-0.20, 0.33]	[-0.47, 0.45]	[-0.40, 0.12]	[-0.43, 0.21]	[-0.85, 0.14]
Correction	-0.39**	-0.34**	-0.49*	-0.31**	-0.33**	-0.14
treatment	[-0.65, -0.12]	[-0.64, -0.04]	[-1.02, 0.05]	[-0.57, -0.05]	[-0.65, -0.02]	[-0.62, 0.34]
N	995	769	226	997	772	225

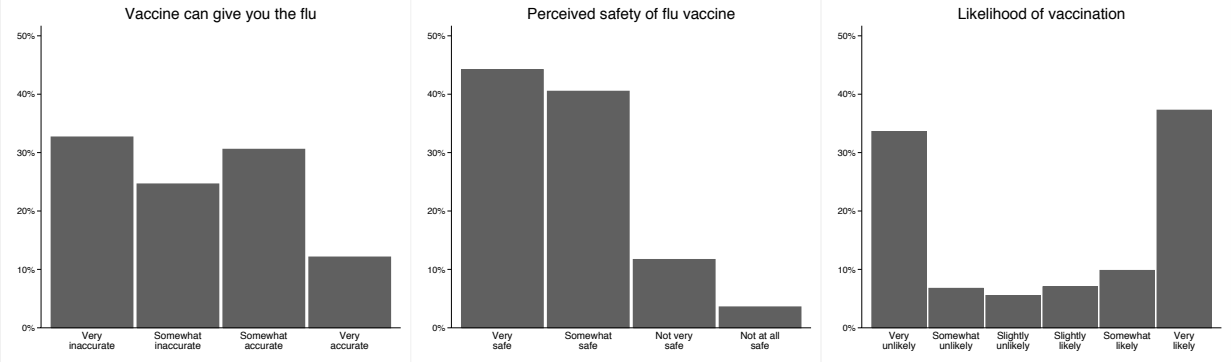
Ordered probit models estimated using weights calculated by YouGov[10] with 95% confidence intervals in brackets (cutpoints omitted; ** $p<.05$, * $p<.10$). Respondents with low side effects concern answered "Not too concerned" or "Not at all concerned" to the question "In general, how concerned are you about serious side effects from vaccines?", while those with high side effects concern answered "Somewhat concerned," "Very concerned," or "Extremely concerned." "Vaccine can give flu" measures belief on a four-point scale from "Very inaccurate" (1) to "Very accurate" (4) in the statement "Just based on what you know, is the following statement accurate or inaccurate? You can get the flu from the seasonal flu vaccine." "Flu vaccine unsafe" measures responses on a four-point scale from "Very safe" (1) to "Not at all safe" (4) to the question "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?" The experimental interventions are provided in Online Appendix A. Table 1 provides the number of respondents who were randomly assigned to each experimental condition.

Table 3

	Likelihood of getting flu vaccine		
	All	Low side effects concern	High side effects concern
Danger treatment	0.10 [-0.14, 0.35]	0.14 [-0.14, 0.42]	0.01 [-0.50, 0.52]
Correction treatment	0.03 [-0.22, 0.28]	0.13 [-0.17, 0.42]	-0.49** [-0.97, -0.01]
N	998	772	226

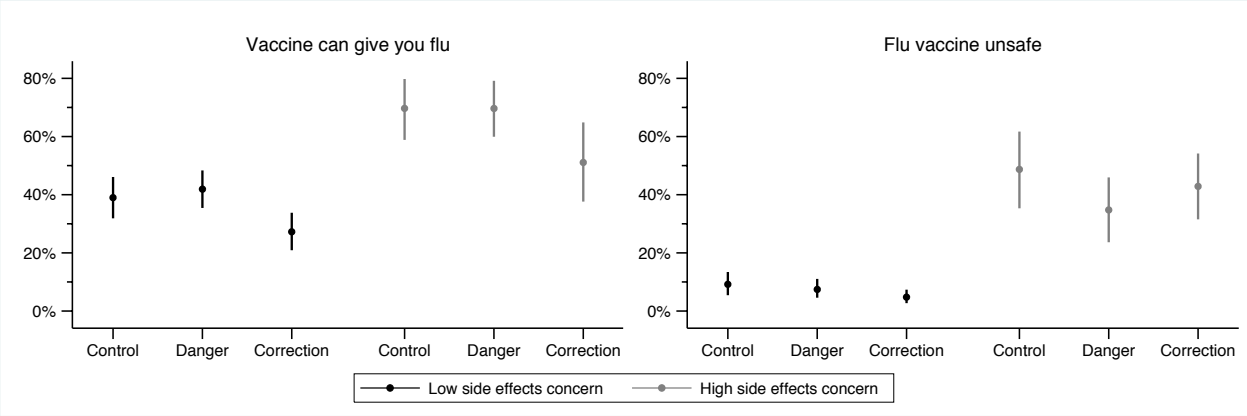
Ordered probit models estimated using weights calculated by YouGov[10] with 95% confidence intervals in brackets (cutpoints omitted; ** $p<.05$, * $p<.10$). "Likelihood of getting flu vaccine" measures belief on a six-point scale from "Very unlikely" (1) to "Very likely" (6) in the statement "How likely is it that you will get a vaccine for the seasonal flu during this flu season (fall 2012-spring 2013)?" The experimental interventions are provided in Online Appendix A. Table 1 provides the number of respondents who were randomly assigned to each experimental condition.

Figure 1



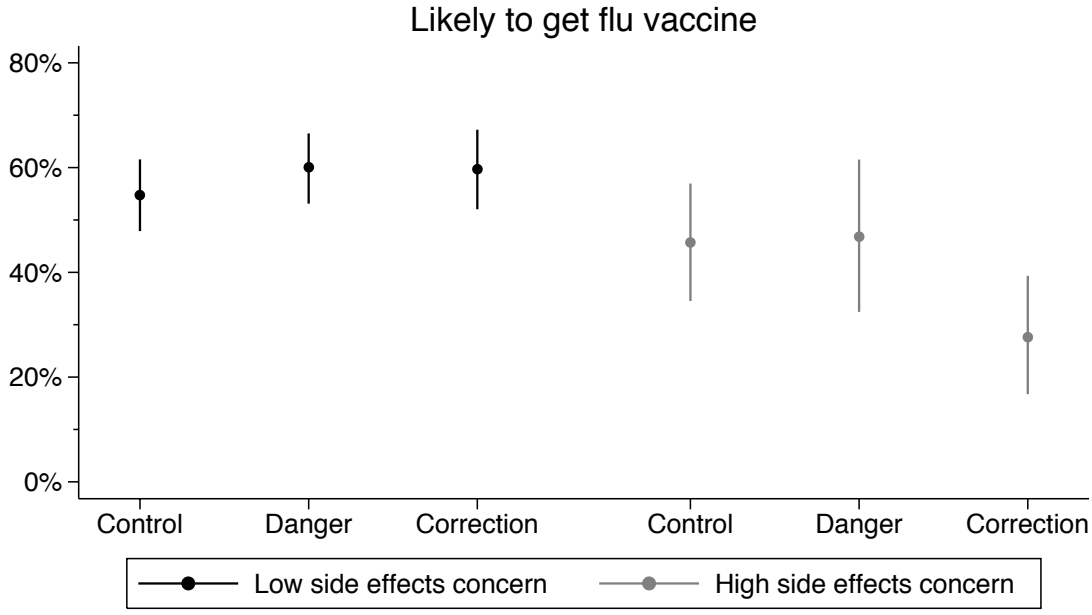
Predicted probabilities computed using weights calculated by YouGov; figure includes responses from respondents in each experimental condition.[10] The left panel presents the distribution of responses to the question "Just based on what you know, is the following statement accurate or inaccurate? You can get the flu from the seasonal flu vaccine." The center panel presents the distribution of responses to the question "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?" The right panel presents the distribution of responses to the question "How likely is it that you will get a vaccine for the seasonal flu during this flu season (fall 2012-spring 2013)?"

Figure 2



Predicted intervention effects for flu vaccine misperceptions for adults with low and high concern about side effects. The left panel presents the predicted probabilities that participants would respond "Very accurate" or "Somewhat accurate" to the question "Just based on what you know, is the following statement accurate or inaccurate? You can get the flu from the seasonal flu vaccine." The correction significantly reduced belief that the flu vaccine can give you the flu among both groups of people. The right panel presents the predicted probabilities that respondents would say "Not very safe" or "Not at all safe" to the question "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?" The correction significantly reduced beliefs that the vaccine is unsafe among people with low concern but not high concern, though the difference in effects between groups is not statistically significant. The predicted probabilities and bootstrapped 95% confidence intervals were estimated from the ordered probit models in Table 2 using SPost in Stata 13.[13] The experimental interventions are provided in Online Appendix A.

Figure 3



Predicted intervention effects for adults with low and high concern about side effects on the probability that respondents would answer "Slightly likely," "Somewhat likely," or "Very likely" to the question "How likely is it that you will get a vaccine for the seasonal flu during this flu season (fall 2012-spring 2013)?" The predicted probabilities and bootstrapped 95% confidence intervals were estimated from the ordered probit models in Table 3 using SPost in Stata 13.[13] The effects of the correction differed by concern about side effects – it reduced intention to vaccinate among people with high concern about side effects but not those with low concern. The experimental interventions are provided in Online Appendix A.

Online Appendix A: Stimulus materials

[Wave 1]

[vaccine concern – pre-intervention]

First, we'd like to ask you a question about medical vaccines.

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]

[randomization after delay – control group receives no message]

[danger intervention]

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

What is influenza (also called flu)?
The flu is a contagious respiratory illness caused by influenza viruses that infect the nose, throat, and lungs. It can cause mild to severe illness, and at times can lead to death.

Signs and symptoms of flu
People who have the flu often feel some or all of these signs and symptoms:

-Fever or feeling feverish/chills
-Cough
-Sore throat
-Runny or stuffy nose
-Muscle or body aches
-Headaches
-Fatigue (very tired)
-Some people may have vomiting and diarrhea, though this is more common in children than adults.

How serious is the flu?
Flu is unpredictable and how severe it is can vary widely from one season to the next depending on many things, including:

-what flu viruses are spreading,
-how much flu vaccine is available
-when vaccine is available
-how many people get vaccinated, and

-how well the flu vaccine is matched to flu viruses that are causing illness.

Certain people are at greater risk for serious complications if they get the flu. This includes older people, young children, pregnant women and people with certain health conditions (such as asthma, diabetes, or heart disease), and persons who live in facilities like nursing homes.

Flu seasons are unpredictable and can be severe. Over a period of 30 years, between 1976 and 2006, estimates of flu-associated deaths in the United States range from a low of about 3,000 to a high of about 49,000 people.

[correction intervention]

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

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:

Carolyn Bridges et al. (2000). Effectiveness and cost-benefit of influenza vaccination of healthy working adults: A randomized controlled trial. JAMA. 284(13):1655-1663.

Kristin Nichol et al. (1995). The effectiveness of vaccination against influenza in healthy working adults. New England Journal of Medicine. 333(14): 889-893.

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.

[dependent variables]

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 the upcoming flu season (fall 2012-spring 2013)?
-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.
-Very accurate [4]
-Somewhat accurate [3]
-Somewhat inaccurate [2]
-Very inaccurate [1]

[Wave 2]

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 vaccine for the seasonal flu during this flu season (fall 2012-spring 2013)?
-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.
-Very accurate [4]
-Somewhat accurate [3]
-Somewhat inaccurate [2]
-Very inaccurate [1]

Online Appendix B: Additional results

	Wave 1				Wave 2				
	Control	Danger	Correction	Total	Control	Danger	Correction	Total	Attrition rate
Age									
18-29	22%	24%	18%	21%	18%	24%	15%	19%	22%
30-44	27%	18%	29%	24%	29%	16%	29%	25%	13%
45-59	26%	29%	29%	28%	27%	29%	29%	28%	14%
60+	25%	29%	24%	26%	26%	30%	27%	28%	9%
Sex									
Male	45%	50%	49%	48%	47%	51%	48%	49%	13%
Female	55%	50%	51%	52%	53%	49%	52%	51%	15%
Education									
High school or less	38%	42%	39%	40%	35%	41%	37%	38%	19%
Some college	34%	36%	32%	34%	34%	35%	32%	34%	16%
College grad	18%	16%	18%	17%	19%	18%	19%	19%	8%
Post-grad	11%	6%	10%	9%	12%	6%	12%	10%	5%
Race/ethnicity									
White	67%	71%	76%	71%	74%	79%	79%	78%	7%
Black	15%	13%	9%	12%	9%	9%	7%	8%	42%
Hispanic	11%	12%	8%	10%	7%	7%	6%	7%	42%
Other	8%	4%	7%	6%	9%	5%	8%	7%	3%
Concerned about vaccine side effects									
Extremely concerned	13%	12%	9%	11%	10%	13%	7%	10%	24%
Very concerned	12%	15%	11%	13%	12%	15%	11%	13%	14%
Somewhat concerned	30%	32%	34%	32%	28%	27%	32%	29%	22%
Not too concerned	31%	28%	33%	31%	34%	32%	35%	34%	7%
Not at all concerned	14%	13%	13%	14%	16%	13%	15%	15%	8%
Number of observations	321	338	341	1000	258	278	286	822	

Sample statistics are computed using weights calculated by YouGov.[10] Due to rounding, some percentages may not add to 100%. Pearson's chi-square is non-significant for differences across intervention groups for each demographic variable listed.

	Vaccine can give flu	Flu vaccine unsafe	Likely to get flu vaccine
Danger treatment	0.06	-0.11	0.14
	[-0.20,0.33]	[-0.43,0.21]	[-0.14,0.43]
Correction treatment	-0.34**	-0.34**	0.13
	[-0.64,-0.04]	[-0.65,-0.02]	[-0.17,0.43]
High concern	0.73**	1.16**	-0.26
	[0.34,1.12]	[0.69,1.63]	[-0.63,0.10]
*Danger * high concern*	-0.07	-0.24	-0.14
	[-0.59,0.44]	[-0.83,0.35]	[-0.70,0.42]
*Correction * high concern*	-0.14	0.2	-0.62**
	[-0.73,0.45]	[-0.37,0.77]	[-1.17,-0.07]
N	995	997	998

Ordered probit models estimated using weights calculated by YouGov[10] with 95% confidence intervals in brackets (cutpoints omitted; ** p<.05, * p<.10). Respondents with low side effects concern answered "Not too concerned" or "Not at all concerned" to the question "In general, how concerned are you about serious side effects from vaccines?", while those with high side effects concern answered "Somewhat concerned," "Very concerned," or "Extremely concerned." "Vaccine can give flu" measures belief on a four-point scale from "Very inaccurate" (1) to "Very accurate" (4) in the statement "Just based on what you know, is the following statement accurate or inaccurate? You can get the flu from the seasonal flu vaccine." "Flu vaccine unsafe" measures responses on a four-point scale from "Very safe" (1) to "Not at all safe" (4) to the question "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?" "Likely to get flu vaccine" measures belief on a six-point scale from "Very unlikely" (1) to "Very likely" (6) in the statement "How likely is it that you will get a vaccine for the seasonal flu during this flu season (fall 2012-spring 2013)?" The experimental interventions are provided in Online Appendix A.

	Wave 2 respondents only					
	Vaccine can give flu		Flu vaccine unsafe		Likely to get flu vaccine	
	Low concern	High concern	Low concern	High concern	Low concern	High concern
Danger	0.08	0.01	-0.05	0.26	0.18	0.28
treatment	[-0.21,0.36]	[-0.56,0.58]	[-0.39,0.28]	[-0.27,0.79]	[-0.15,0.50]	[-0.31,0.87]
Correction	-0.13	-0.45	-0.07	0.44*	0.04	-0.1
treatment	[-0.44,0.19]	[-1.05,0.15]	[-0.41,0.28]	[-0.05,0.93]	[-0.27,0.35]	[-0.70,0.50]
N	650	170	650	171	649	172

Ordered probit models estimated using weights calculated by YouGov[10] with 95% confidence intervals in brackets (cutpoints omitted; ** p<.05, * p<.10). Respondents with low side effects concern answered "Not too concerned" or "Not at all concerned" to the question "In general, how concerned are you about serious side effects from vaccines?", while those with high side effects concern answered "Somewhat concerned," "Very concerned," or "Extremely concerned." "Vaccine can give flu" measures belief on a four-point scale from "Very inaccurate" (1) to "Very accurate" (4) in the statement "Just based on what you know, is the following statement accurate or inaccurate? You can get the flu from the seasonal flu vaccine." "Flu vaccine unsafe" measures responses on a four-point scale from "Very safe" (1) to "Not at all safe" (4) to the question "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?" "Likely to get flu vaccine" measures belief on a six-point scale from "Very unlikely" (1) to "Very likely" (6) in the statement "How likely is it that you will get a vaccine for the seasonal flu during this flu season (fall 2012-spring 2013)?" The experimental interventions are provided in Online Appendix A.