

# Factual Corrections Eliminate False Beliefs About COVID-19 Vaccines \*

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## Abstract

The spread of misinformation about COVID-19 vaccines threatens to prolong the pandemic, with prior evidence indicating that exposure to misinformation has negative effects on intent to take the vaccine. Here, we describe results from randomized experiments in the U.S. (n=5,075) that allow us to measure the effects of factual corrections on false beliefs about the vaccine, as well as vaccine intent. Our evidence makes clear that corrections eliminate the effects of misinformation on beliefs about the vaccine, but that neither misinformation nor corrections affect vaccine intention. Our experiments also allow us to evaluate how formatting changes to the presentation of corrections alter the overall effects of corrections. We find that corrections without any formatting modifications are effective at reducing false beliefs, with formatting variations playing a very minor role. Factual corrections are powerful tools in the fight against misinformation during the COVID-19 pandemic, with effects robust to a wide variety of formatting changes.

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Delays in uptake of COVID-19 vaccines may prolong the pandemic, with perilous consequences for public health (Wood and Schulman, 2021). The spread of misinformation about the vaccines compounds the challenge, as such misinformation may depress vaccine uptake (Rosenbaum, 2021). While meta-analyses show that factual corrections in general reduce false beliefs (Man-pui et al., 2017; Walter et al., 2019), prior research has found that correcting misinformation about vaccines in particular can not only fail to improve accurate beliefs (Pluviano, Watt and Della Sala, 2017), but entrench unwillingness to receive vaccinations among those previously skeptical of vaccines (Nyhan and Reifler, 2015). Indeed, consistent evidence indicates that misperceptions about health crises are difficult to dislodge (Carey et al., 2020). Recent survey evidence indicates that more than 1/3 of Americans inaccurately believe that dangerous side effects of COVID-19 vaccines are not being disclosed to the public (Kaplan and Milstein, 2021). Social media companies have taken a variety of steps to stanch the flow of misinformation about the disease and vaccines, including directing users to accurate information, labeling claims as false (Thorbecke, 2021), and removing false claims about the vaccines from their platforms altogether (Bond, 2021).

Here, we present evidence from pre-registered randomized experiments gathered over large samples in the U.S. ( $n=5,075$ ) on the effects of misinformation, and corresponding fact-checks, about COVID-19 vaccines. Unlike prior research in this area (Loomba et al., 2021), our design permits us to evaluate the extent to which factual corrections rebut the effects of misinformation. Across ten pairs of factual corrections and corresponding misinformation, we find that, while exposure to misinformation increases false beliefs, subsequent exposure to factual corrections eliminates the adverse effects of misinformation on belief accuracy. After factual corrections, beliefs about COVID-19 vaccines are more factually correct than they would be without exposure to misinformation. In addition, and in a departure from some prior findings (Nyhan and Reifler, 2015), we do not find that refutations of false claims about vaccines decrease intent to vaccinate among those who were most skeptical of vaccines prior to treatment.

Our study is also designed to shed light on whether the effects of fact-checks are robust to formatting differences. As fact-checking has grown in popularity (Graves, 2016), fact-checking organizations and social media companies have issued fact-checks that vary widely by type and format. Previous scholars have investigated the effectiveness of labels (Pennycook et al., 2020a; Brashier et al., 2021), the role of visual imagery (Vraga et al., 2020), and specific changes to the content of the fact-check (Lee, 2020; Lewandowsky et al., 2020), such as length (Ecker et al., 2020) and the repetition of the underlying misinformation (Ecker, Hogan and Lewandowsky, 2017). However, no systemic evidence compares the effects of differences in formatting to the effects

of corrections without any formatting modifications.

We find that the accuracy increases prompted by fact-checks are strongly robust to formatting changes. Indeed, the effects of individual changes to the presentation of fact-checks pale in comparison to the effects of fact-checks themselves. Our random effects meta-analysis shows that, regardless of formatting differences, fact-checks increase accuracy by .43 on a 4-point accuracy scale. In contrast, modifications to the presentation of fact-checks increase accuracy by .03 points on a 4-point accuracy scale. These effects correspond, respectively, to effect sizes of .50 and .03 control-group standard deviations.

Our experiment proceeded as follows. We gathered respondents simultaneously over three online platforms (Mechanical Turk, Lucid and Cloud Research) that have been used in similar research (Wood and Porter, 2018; Pennycook and Rand, 2019*b*; Vlasceanu and Coman, 2021) (see the appendix for sample composition on each platform). Participants were enrolled in three trials. Within each trial, subjects were randomly assigned to one of ten fact-check/misinformation pairs.<sup>1</sup> Within each pair, participants were randomly assigned to a *control* condition, for which they were asked only outcome items; or a *misinformation* condition, which exposed them to misinformation before outcome items; or a *misinformation and fact-check* condition, which exposed them to misinformation and then the accompanying fact-check before outcome items. If they were assigned to see a fact-check, different elements of the fact-check format were randomized. Table 1 displays how the fact-checks appeared within our study, while also outlining what was randomized (i.e., whether the source of the original misinformation was identified, whether a graphical verdict appeared, whether a header appeared and whether it was phrased as a statement or question, whether a precis of the fact-check was displayed, and whether the fact-check minimized repeating the original misinformation).

Table 1: Factors and levels in the fact-check condition

| <b>Factor</b>      | <b>Levels</b>           |                       |          |           |
|--------------------|-------------------------|-----------------------|----------|-----------|
| Claim              | [1, . . . ,10]          |                       |          |           |
| Source             | None                    | Twitter               | Facebook | Instagram |
| Graphical Verdict  | None                    | Cross-mark            | Gauge    |           |
| Subheader          | None                    | Statement             | Question |           |
| Precis             | None                    | Precis                |          |           |
| Fact Check Content | Minimize misinformation | Repeat misinformation |          |           |

We measured outcomes as follows. To measure factual beliefs, we first used a 1-4 scale to evaluate beliefs about the false claim, with choices ranging from “Not at all accurate” to “Very accurate.” Then, following earlier research (Graham, 2020), we asked

<sup>1</sup>We prevented participants from being assigned to the same pair in more than one trial.

respondents to express their confidence in their previously expressed response on a 0-100 scale. Next, we transformed their initial response, with subjects who regarded the false claim as accurate having their 0-100 scale response turned into a negative number, and those who regarded the false claim as inaccurate having their scale response kept as a positive number. We then evaluated effects on the resulting 200-point scale.

To evaluate effects on potential vaccine uptake, we relied on a 6-question battery in which respondents are prompted to agree/disagree with statements on a 5-point scale, with choices ranging from “Strongly agree” to “Strongly disagree” ( $\alpha = .94$ ). We also relied on an intent-to-vaccinate item, which asked respondents to rate their likelihood of taking a COVID-19 vaccine, and a behavioral click-based measure, which captured whether respondents clicked on a personalized link describing the vaccination process in their state. In addition, we measured confidence in vaccine safety. Those who regard the vaccine as unsafe (safe) will score at -100 (100) when they are maximally uncertain of their position and 0 when they are maximally certain. Those who select the middle response category were assigned the median response. To measure pre-treatment vaccine attitudes, we relied on an abbreviated version of a vaccine attitudes battery developed previously (Larson et al., 2015) ( $\alpha = .82$ ).

In line with prior research on the general effectiveness of fact-checks (Porter and Wood, 2019), we expected fact-checking content to reduce false beliefs about vaccines (H1). Although some studies have reached more skeptical conclusions on the capacity of fact-checks to reduce false beliefs (Christenson, Kreps and Kriner, 2020), especially when applied to vaccine misinformation (Nyhan and Reifler, 2015; Pluviano, Watt and Della Sala, 2017), the weight of the evidence across topic areas is in the other direction (Lewandowsky, 2020; Man-pui et al., 2017; Walter et al., 2019). In addition, we expected that the magnitude of the effects of fact-checks on beliefs to be greater than the magnitude of effects on beliefs owed to modifications to the presentation of fact-checks (H2). We anticipated this outcome after inspecting the effect size of accuracy increases and formatting changes in prior research, and because of promising pilot data we collected. Finally, we doubted that fact-checks would either decrease *or* increase intent to vaccinate (H3).

Our design facilitated the evaluation of questions for which we did not have strong expectations. We investigated whether corrections will change other vaccine-related attitudes, including confidence in the safety of vaccines (RQ1 and RQ2) and skepticism toward vaccines (RQ3).<sup>2</sup> We also estimated the extent to which pre-treatment measurements, including performance on the cognitive reflection test (RQ5), condition the effects of fact-checks. Vaccine skepticism has been found especially difficult to dis-

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<sup>2</sup>We also pre-registered an analysis involving attitudes toward fact-checking organizations (RQ4). However, this is beyond the scope of the present paper.

lodge in prior studies (Nyhan et al., 2014), and there is emerging evidence that those who perform comparatively well on cognitive reflection tests are more resistant to misinformation (Pennycook et al., 2020b).

## Results

While misinformation reliably diminished factual accuracy, fact-checks just as reliably increased factual accuracy. For nine of ten pairs of fact-checks and misinformation, we observe the fact-check leading to more factually accurate beliefs ( $p < .05$ ). When not followed by a fact-check, seven of ten misinformation items reduce factual accuracy ( $p < .05$ ). On average, along a four-point scale, with larger numbers corresponding to greater accuracy, fact-checks that follow misinformation have a .14 point effect on a 4-point accuracy scale ( $p < .01$ ), while misinformation on its own degrades factual accuracy by -.29 points on a 4-point accuracy scale ( $p < .01$ ). Therefore, on average, fact-checks undo the effects of misinformation, and also significantly increase factual beliefs relative to the baseline.

Figure 1 presents the effects of fact-checks and misinformation for each item. Across items, on our four-point scale, correction effects vary from .2 to 1.03 ( $p < .05$ ). The largest correction pertains to a false claim that a U.K. woman died from a COVID-19 vaccine, while the smallest correction effect targets a claim that the Pope declared a COVID-19 vaccination would be necessary to enter heaven. The sole non-significant correction effect targets a false claim that COVID-19 vaccines modify DNA.

Misinformation effects range from -.18 to -1.01 points on a 4-point accuracy scale ( $p < .05$ ). The largest misinformation effect resulted from exposure to a false claim about vaccines being made with aborted fetuses, while the smallest resulted from exposure to the false claim about the Pope requiring vaccination for entrance to heaven. Of the three non-significant misinformation effects, one false item, which alleged that Senegalese children died after receiving the vaccine, prompted subjects to become *more* accurate, though this effect was not significant ( $p = .15$ ). Figure 2 summarizes misinformation and correction effects.<sup>34</sup>

Neither misinformation nor fact-checking affected intent-to-vaccinate or a host of related vaccine attitudes. The complete results for these outcomes can be glimpsed in the appendix (as can complete results for all our outcomes).

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<sup>3</sup>For ease of exposition, this figure deviates from the pre-registration, in that it represents 1,000 bootstraps.

<sup>4</sup>The results depicted here on the ordinal measure only. The results on the 200-point scale are indistinguishable and can be found in the appendix.

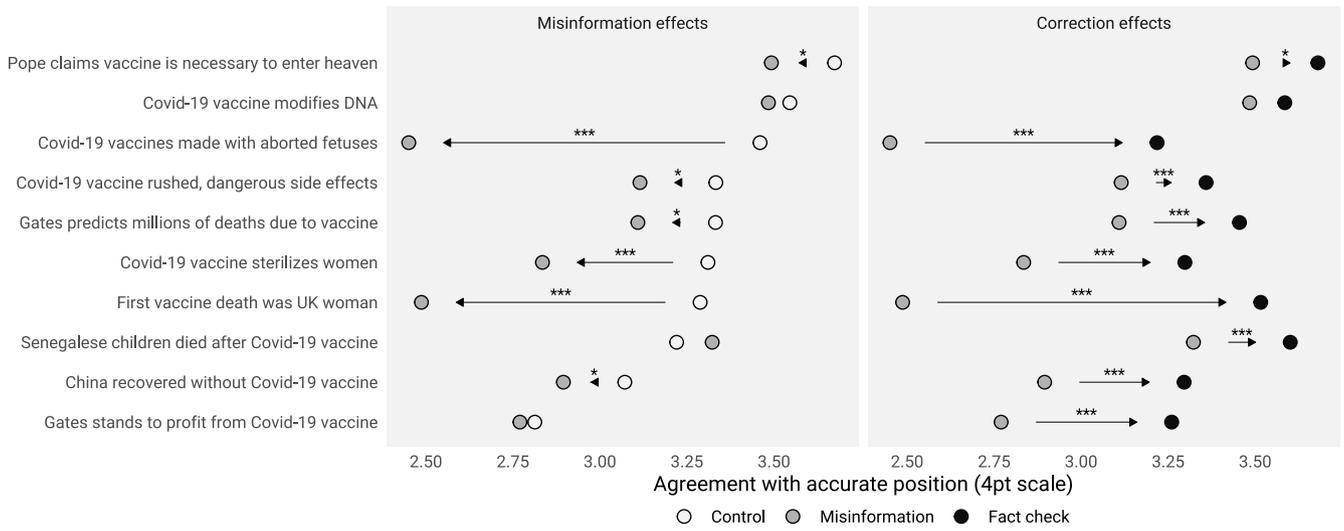


Figure 1: Correction and Misinformation Effects

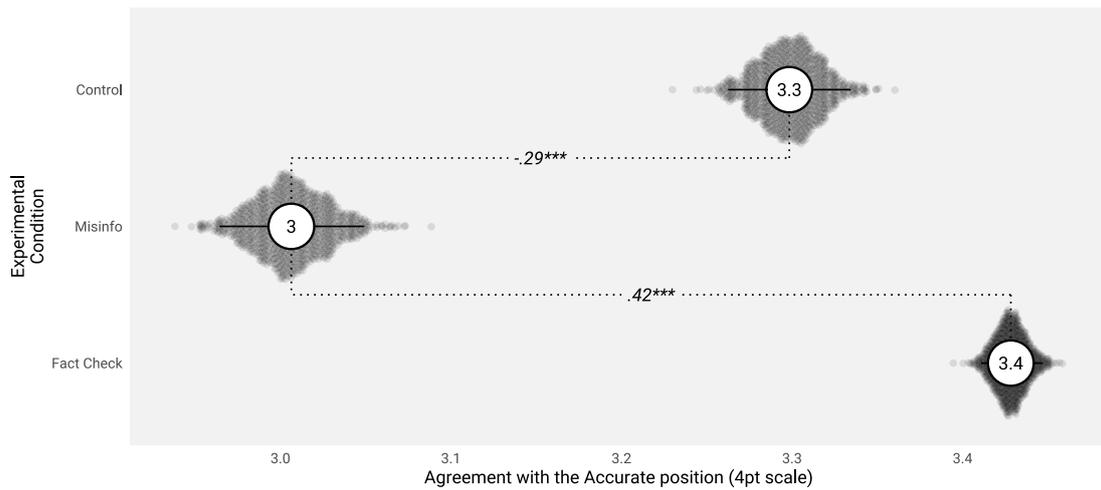


Figure 2: Average Correction and Misinformation Effects (Bootstrapped)

Despite the null effects observed on vaccine intent, the effects on factual accuracy remained robust to the randomized formatting changes. Indeed, compared to the effects of fact-checking, the effects of changes to the formatting of fact-checks are small. In Figure 3, we display the effects of the formatting changes investigated, as well as the effects of the fact-checks on their own, averaging over formatting features (e.g., use of a graphical verdict). As should be clear, while formatting changes yield either non-significant or minor effects, the overall effects of fact-checks lead to powerful changes in factual accuracy, all in the direction of greater accuracy.<sup>5</sup> Random effects meta-analysis concludes that, while fact-checks increase accuracy by .43 scale points on a 4-point scale regardless of formatting differences, modifications to the presentation of fact-checks increase accuracy by .03 points on the same scale. Across presentational styles, fact-checks targeting COVID-19 vaccine misinformation remain effective at reducing false beliefs about the vaccines.

In the supplemental appendix, we evaluate heterogeneous treatment effects. When we decompose subjects by pre-treatment vaccine attitudes, we find limited heterogeneity across correction and misinformation effects. In fact, correction effects were largest among people who were most skeptical of vaccines prior to treatment. We also find little evidence of heterogeneity by partisanship, with both Democrats and Republicans made more accurate by fact-checks, and less accurate by misinformation. However, correction effects are slightly larger among Republicans than Democrats. Finally, we find that people who score high on the cognitive reflection test are less susceptible to misinformation than those who score lower, which is consistent with prior findings (Pennycook and Rand, 2019a). However, these differences are not significant. Altogether, our evidence corroborates prior work which finds surprisingly low levels of heterogeneity in social science experiments (Coppock, Leeper and Mullinix, 2018).

## Discussion and Conclusion

Correcting misinformation amidst a health crisis is fraught with challenges. Efforts to provide corrective information may only partially succeed, fail altogether (Reavis et al., 2017; Carey et al., 2020) or even backfire (Pluviano, Watt and Della Sala, 2017). Even when they succeed, intent-to-vaccinate may be depressed, especially among those who were skeptical toward vaccines previously (Nyhan and Reifler, 2015). Prior research into COVID-19 specifically has reached similar conclusions, finding that misinformation's effects on intent to vaccinate outpace the effects of factual information (Loomba

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<sup>5</sup>A more technical discussion of these effects is located in the Analysis section below.

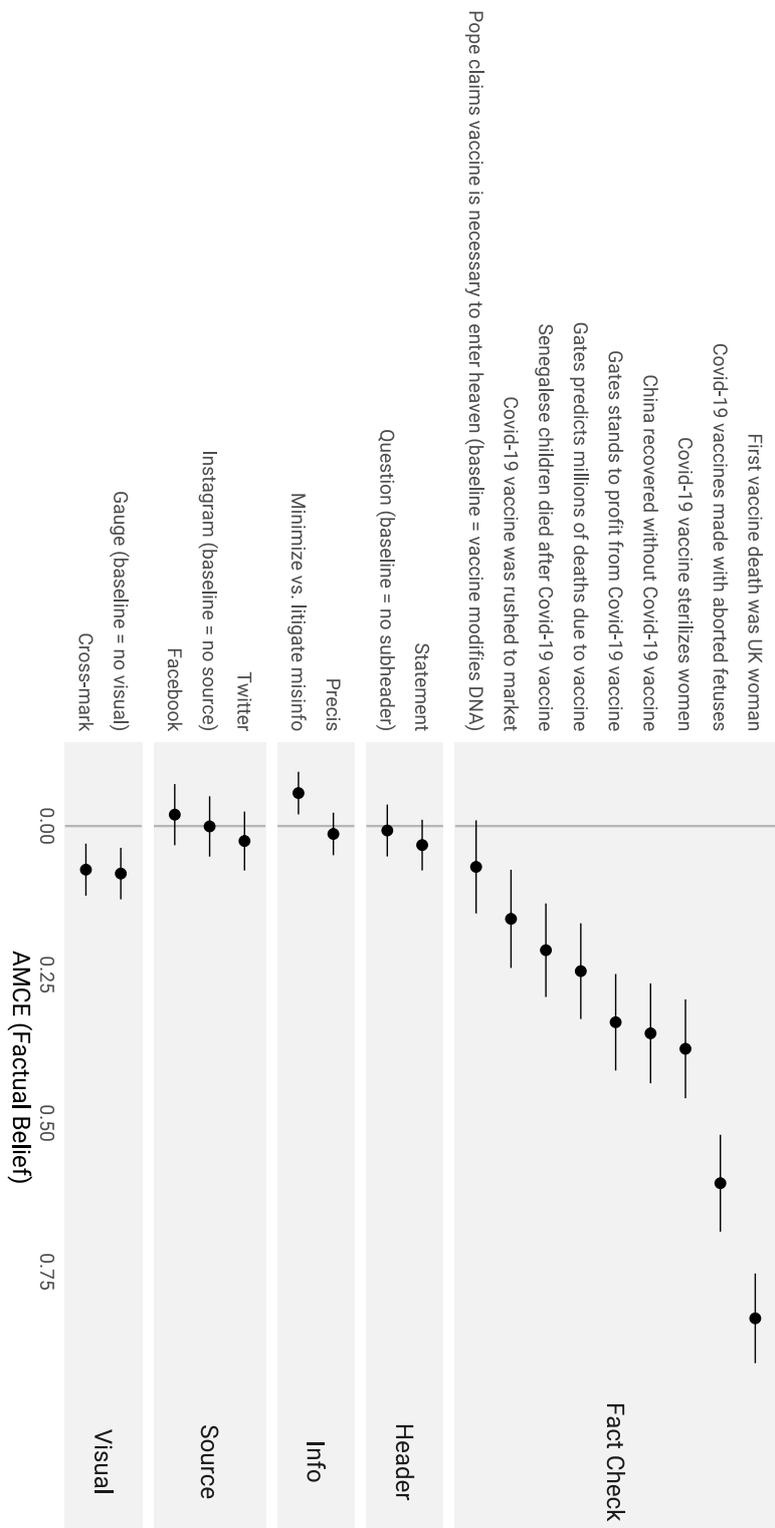


Figure 3: Formatting effects are small, relative to overall fact check effects

et al., 2021).

In comparison, our results offer reason for guarded optimism. By design, our experiments permit us to compare the effects of misinformation to the effects of fact-checks. We find that corrections reverse the effects of misinformation on belief accuracy, leading to greater accuracy and affirming H1. Subjects who encounter a correction after misinformation are approximately as accurate as subjects in control, who did not encounter misinformation. These effects prove robust across a wide variety of formatting changes. As we anticipated (H2), the magnitude of the effects of fact-checks on factual beliefs was greater than the magnitude of effects on beliefs owed to modifications to the presentation of fact-checks.

In addition, and as we expected (H3), we find that vaccine use intention is unaffected by misinformation *or* its correction. In contrast with some prior research (Nyhan and Reifler, 2015), this is true even among participants who were more skeptical of vaccines before exposure to corrections. Our general failure to observe effects on vaccination intent corroborate a related set of earlier findings on the effects of correcting vaccine myths (Horne et al., 2015; Reavis et al., 2017), and correspond with the broader failure of educational interventions to move vaccination intent (Dubé, Gagnon and MacDonald, 2015). Ultimately, our evidence underscores the conclusion of Nyhan et al. (2019): While factual corrections can effectively diminish false beliefs, including among those otherwise predisposed against them, their ability to affect downstream attitudes appears limited.

We cannot say definitively why our results diverge from prior findings. It may be the case that, while vaccine beliefs in general have had years to calcify, beliefs about the COVID-19 vaccine are unformed enough to be especially sensitive to new information. Respondents who are skeptical of vaccines in general do not yet have the resources to counter-argue factual corrections about COVID-19 vaccines. It may also be the case that the factual corrections used here were of a higher-quality than those used in prior studies. Future research should disentangle these open questions. Future research should also investigate whether these effects are more or less pronounced in other environments. We plan to soon administer similar experiments in Brazil, France, Germany, India, Indonesia, Mexico, Nigeria, Peru, and South Africa.

None of our findings should be understood to minimize the threat that COVID-19 vaccine misinformation poses. Indeed, our evidence clearly shows that, when not followed by correction, misinformation has pernicious effects on beliefs toward the vaccines. When left alone, misinformation matters. For this reason, our comparisons of misinformation item differences to formatting differences are especially instructive. While researchers and practitioners have devoted substantial resources to investigat-

ing changes in fact-checking format (Vraga et al., 2020; Pennycook et al., 2020a; Ecker et al., 2020), we show that the effects of formatting differences on belief accuracy are small. Straightforward fact-checks, sans modifications, prove to be very effective at reducing false beliefs. As others have noted, the discrepancy between people who consume fact-checks on their own accord, and those who hold false beliefs, is sizable (Guess, Nyhan and Reifler, 2020). The evidence marshaled here indicates that resources should be focused on narrowing that gap, and persuading more people to read factual corrections, rather than making formatting modifications to the presentation of those corrections to make them more effective or engaging.

## Materials and methods

### IRB approval

The study was approved by the Institutional Review Boards at Columbia University, George Washington University and the Ohio State University. All participants provided informed consent prior to participating.

### Experimental Design

We conducted our experiment between February 19, 2021 and March 4, 2021 over Mechanical Turk ( $n=1,775$ ), Cloud Research ( $n=1,690$ ) and Lucid ( $n=1,610$ ). Subjects participated in three within-subjects trials. In each trial, subjects were randomly assigned to either a misinformation, fact-check or control condition. Given the desire to vary many features of fact checks, we employed unequal assignment probabilities to place more respondents in the fact checking condition. For the first trial (or experimental round), 12.5% were assigned to the control, 12.5% were assigned to the misinformation condition, 12.5% were assigned to a WHO vaccine information condition, and 62.5% were assigned to the misinformation + fact check condition.<sup>6</sup> For the second trial, 16.6% were assigned to the control, 16.6% were assigned to the misinformation condition, and 66% were assigned to the misinformation + fact check condition. The same assignment probabilities were used for the third trial. For those in the control condition, only outcomes were measured. If respondents were in a misinformation

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<sup>6</sup>Those assigned to the WHO vaccine information condition were presented with a vignette that described how vaccines work. Consistent with our pre-registration, and given that our inferences concern the misinformation and fact-check conditions, we do not present the estimates from this condition in our analyses. The effect of this information on factual beliefs is small and insignificant ( $A\hat{T}E = .008$ ;  $SE = .04$ ;  $p$ -value = .84).

condition, they saw misinformation, and then answered outcome questions.<sup>7</sup>

If they were in a fact-check condition, subjects saw misinformation and then a fact-check. We further randomized elements of the fact-check, so that subjects saw a fact-check with a “visual verdict” of the fact-check (e.g., a “false” label); whether the verdict of the fact-check was summarized in abbreviated form; whether the fact-check sub-headline was visible and how it was constructed (i.e., presented as a statement or question); whether the fact-check was edited to avoid repeating the initial misinformation; and whether the source of the misinformation was displayed, and which source was used (e.g., Facebook, Twitter, or Instagram). We varied these factors across ten different fact-checks.

## **Stimuli**

To maximize external validity, all fact-checks are attributed to Politifact, the non-partisan fact-checking organization. The misinformation was presented in its original form, or as close as possible. We selected misinformation and stimuli based on our review of popular fact-checking and misinformation items at the time the study was conducted.

## **Analysis**

We assess (1) misinformation effects and (2) correction effects by estimating the mean difference in outcomes between (1) those assigned to the misinformation and those assigned to the control condition, and (2) those assigned to the fact-check condition and the misinformation condition. A negative estimate for (1) indicates that respondents, on average, are less likely to report that a piece of misinformation is factually inaccurate. For (2), a positive estimate indicates that the fact check improves factual accuracy whereas a negative estimate indicates it worsens factual accuracy. The latter is traditionally described as a “backfire effect” (Nyhan and Reifler, 2010). Models of misinformation effects and correction effects are estimated using ordinary least squares and adjust for sample and trial fixed effects.<sup>8</sup> Standard errors are clustered by respondent.

Beyond allowing us to assess the effectiveness of fact checks across a variety of claims, our design facilitates the estimation of Average Marginal Component Effects

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<sup>7</sup>At the end of the three trials, all subjects were presented with fact checks pertaining to the information they were assigned to and debriefed.

<sup>8</sup>Vaccination-related outcomes were only measured in the first trial. Therefore, we only adjust for sample fixed effects in those models.

(AMCEs) for those in the fact-check condition, similar to that estimated in conventional conjoint experiments (Hainmueller, Hopkins and Yamamoto, 2014). The AMCE estimates the marginal effect of a factor  $k$  (e.g., whether a visual verdict is displayed), averaging over the values of all other factors. For a binary factor, the AMCE is formally defined as  $\sum_{-k} E[Y(Z_k = 1, Z_{-k}) - Y(Z_k = 0, Z_{-k})]$  (Egami et al., 2018). Put another way, the AMCE captures how much better or worse a randomly selected fact check performs when feature  $k$  is present versus absent. For these analyses, we also cluster standard errors by respondent, and adjust for sample and trial fixed effects. We standardize the outcome using misinformation-group standard errors, and mean center using claim-specific misinformation-group means.<sup>9</sup> Positive values indicate that the reported factor level is associated with larger “correction effects” (e.g., improvements in factual accuracy) relative to the baseline, whereas negative values indicate decreases in factual accuracy.

For example, a fact-check that minimizes the repetition of misinformation is associated with a 6% of a standard deviation reduction in factual accuracy relative to one that repeats the misinformation, whereas a graphical verdict using a gauge or cross-mark is associated with a 7% of a standard deviation increase in factual accuracy *relative to no graphical verdict*. As shown in the Figure, AMCEs for formatting features are generally smaller than overall fact check effects. We also replicate these general findings by conducting a random effects meta analysis. Specifically, we estimated the binary treatment effect of (1) including a subheader that contests the claim in the form of a statement or question, (2) the use of a graphical verdict, (3) the presentation of source information (e.g., Twitter, Facebook), (4) the inclusion of a precis, and (5) minimizing vs. litigating misinformation on factual beliefs. Then, we estimated the correction effect for each of our factual claims with all of these variables set to zero (i.e., a fact check with no graphic verdict, subheader, source information, precis, and no repetition of misinformation). We conducted a random effects meta-analysis using these two sets of estimates. Comparing the meta-analytical effect size of formatting changes to the meta-analytical effect size of our “no frills” fact checking interventions, we similarly find that formatting effects are small relative to the overall effects of fact checks.

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<sup>9</sup>This is done to facilitate the interpretation of claim-specific AMCEs and the comparison of effect sizes. Otherwise, AMCE estimates for each claim represent the mean difference in factual belief scores for a given claim relative to the baseline claim (i.e., DNA modification), averaging over all other features. Estimates are substantively similar across different codings.

## Data availability

Data files and scripts necessary to replicate the results in this article will be made available in the Dataverse repository upon publication.

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# Appendix

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**Don't Sweat the Small Stuff: Issue Topic and Formatting Differences (#58716)**

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---

**1) Have any data been collected for this study already?**

No, no data have been collected for this study yet.

**2) What's the main question being asked or hypothesis being tested in this study?**

H1: Exposure to fact-checking content about Covid vaccines will reduce related false beliefs about the vaccines.

H2: The magnitude of the effects of fact-checks on factual beliefs will be greater than the magnitude of effects on beliefs owed to modifications to the presentation of fact-checks, including whether a visual verdict is offered, whether the verdict of the fact-check is summarized; whether the fact-check is edited to avoid reiterating the misinformation; whether the fact-check sub-headline is not present, posed as a statement or question; and whether the source of the fact-checked misinformation is displayed.

H3: Factual corrections will not affect intent-to-vaccinate.

RQ1: Will factual corrections change confidence in the safety of vaccines?

RQ2: Will factual corrections change other attitudes related to vaccines?

RQ3: Will those who evince higher levels of pre-treatment vaccine skepticism prove more resistant to factual corrections?

RQ4: Will factual corrections change attitudes toward fact-checking as a practice and/or fact-checking organizations?

RQ5: Will the effects of factual corrections differ by performance on the Cognitive Reflection Test or according to the Need for Cognition scale?

**3) Describe the key dependent variable(s) specifying how they will be measured.**

To evaluate effects on factual beliefs, we will be fielding factual questions that pertain to each fact-check. The questions will be two-pronged. First, we will measure beliefs on a 1-4 scale, ranging from "Not at all accurate" to "Very accurate." Then, following Graham (2020), we will ask respondents to express their confidence in their previously expressed belief on a 0-100 scale. We will then dichotomize based on the above, with subjects who regarded the false claim as accurate having their 0-100 scale response transformed into a negative number and those who regarded the false claim as inaccurate having their scale response kept as a positive number. We will then evaluate effects based on the resulting 200-point scale.

To evaluate effects on intent-to-vaccinate, we will rely on a 6-question battery in which respondents are prompted to agree/disagree with statements on a 5-point scale, with choices ranging from "Strongly agree" to "Strongly disagree." We will perform the same procedure from Graham (2020) outlined above, to measure the confidence with which people have in the safety of vaccines. This will be coded such that those who regard the vaccine as unsafe (safe) will score at -100 (100) when they are maximally uncertain of their position and 0 when they are maximally certain. Those who select the middle response category will be coded using the median response.

**4) How many and which conditions will participants be assigned to?**

Each participant will complete three trials. Within each trial, subjects will be randomly assigned to one of the following conditions:

-control, for which they only answer outcome questions;

▣-misinformation, for which they see only an item of misinformation;

-a fact-check that randomly varies whether a visual verdict is offered, whether the verdict of the fact-check is summarized; whether the fact-check is edited to avoid reiterating the misinformation; whether the fact-check sub-headline is not present, posed as a statement or question; and whether the source of the fact-checked misinformation is displayed.

**5) Specify exactly which analyses you will conduct to examine the main question/hypothesis.**

We will then analyze the results as Average Marginal Component Effects (AMCEs) of each condition mentioned above, as a conjoint experiment would typically be analyzed.

We will include trial fixed-effects with respondent clustered-standard errors.

Because we are relying on multiple survey vendors to gather respondents, we will also include fixed-effects for sample source.

For all possible heterogeneous effects--primarily cognitive style, as measured by CRT and NFC, and vaccine skepticism--we will decompose respondents into terciles and then estimate separate models for each tercile. As a robustness check, we will also estimate these effects using the inferflex package of Hainmueller et al (2017) and report any meaningful differences between those results.



We expect results for H1 and H2 will be apparent upon inspecting an AMCE plot. To further evaluate H1 and H2, we will conduct meta-analysis with random effects to arrive at aggregate estimates of the effects of the following on factual beliefs: factual corrections by topic, and the modifications to the factual corrections described above.

**6) Describe exactly how outliers will be defined and handled, and your precise rule(s) for excluding observations.**

Prior to treatment, subjects on all three platforms will answer an attention check screener. Should they fail it, they will be prevented from proceeding.

**7) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.**

We will be enrolling 6,000 respondents in experiments administered simultaneously on Mechanical Turk, Lucid and Cloud Research, with 2,000 respondents collected by each vendor.

**8) Anything else you would like to pre-register? (e.g., secondary analyses, variables collected for exploratory purposes, unusual analyses planned?)**

We may use this data in later projects to evaluate how effects differ across platforms.

We will use the Lin estimator in our analyses.

We may conduct an additional analysis subsetting the sample on passage of a "mock vignette" attention check.

We may also compare marginal means of factor levels using OLS, including a condition with all factors, except for the issue topic, at their baseline levels.

For any missing data, we may impute the mean of the remaining responses.

## Survey Text

Pre-treatment vaccine attitudes

Please indicate your agreement or disagreement with the following statements.

Overall, vaccines are safe

Vaccines are ineffective.

It is important for children to be vaccinated.

Strongly agree/Somewhat agree/Neither agree nor disagree/Somewhat disagree/Strongly disagree

Demographics

In what state do you currently reside?

[Drop-down menu with 50 states and Washington D.C.]

What year were you born in?

[numeric text entry box]

What is your zip code?

[numeric text entry box]

Are you of Spanish or Hispanic origin or descent?

-No, not of Hispanic, Latino, or Spanish origin

-Yes, Mexican, Mexican American, Chicano

-Yes, Cuban

-Yes, another Hispanic, Latino, or Spanish origin/Argentina

-Yes, another Hispanic, Latino, or Spanish origin/Colombia

-Yes, another Hispanic, Latino, or Spanish origin/Ecuador

-Yes, another Hispanic, Latino, or Spanish origin/El Salvadore

-Yes, another Hispanic, Latino, or Spanish origin/Guatemala

-Yes, another Hispanic, Latino, or Spanish origin/Nicaragua

-Yes, another Hispanic, Latino, or Spanish origin/Panama

-Yes, another Hispanic, Latino, or Spanish origin/Peru

-Yes, another Hispanic, Latino, or Spanish origin/Spain

-Yes, another Hispanic, Latino, or Spanish origin/Venezuela

-Yes, another Hispanic, Latino, or Spanish origin/Other Country

-Prefer not to answer

-What is your race?

- White
- Black, or African American
- American Indian or Alaska Native
- Asian/Asian Indian
- Asian/Chinese
- Asian/Filipino
- Asian/Japanese
- Asian/Korean
- Asian/Vietnamese
- Asian/Other
- Pacific Islander/Native Hawaiian
- Pacific Islander/Guamanian
- Pacific Islander/Samoan
- Pacific Islander/Other Pacific Islander
- Some other race
- Prefer not to answer

What is the highest level of education you have completed?

- 3rd Grade or less
- Middle School - Grades 4 - 8
- Completed some high school
- High school graduate
- Other post high school vocational training
- Completed some college, but no degree
- Associate Degree
- College Degree (such as B.A., B.S.)
- Completed some graduate, but no degree
- Masters degree
- Doctorate degree
- None of the above

How much total combined income do all members of your household earn before taxes?

- Less than \$5,000
- \$5,000 to \$9,999
- \$10,000 to \$14,999
- \$15,000 to \$19,999
- \$20,000 to \$24,999

- \$25,000 to \$29,999
- \$30,000 to \$34,999
- \$35,000 to \$39,999
- \$40,000 to \$44,999
- \$45,000 to \$49,999
- \$50,000 to \$54,999
- \$55,000 to \$59,999
- \$60,000 to \$64,999
- \$65,000 to \$69,999
- \$70,000 to \$74,999
- \$75,000 to \$79,999
- \$80,000 to \$84,999
- \$85,000 to \$89,999
- \$90,000 to \$94,999
- \$95,000 to \$99,999
- \$100,000 to \$124,999
- \$125,000 to \$149,999
- \$150,000 to \$174,999
- \$175,000 to \$199,999
- \$200,000 to \$249,999
- \$250,000 and above
- Prefer not to answer

What is your gender?

- Male
- Female
- Other

Generally speaking, do you usually think of yourself as a Republican, a Democrat, an Independent, or something else?

- Republican
- Democrat
- Independent
- Something else

[if "Democrat"]

Would you call yourself a strong Democrat or not very strong Democrat?

- Strong Democrat
- Not very strong Democrat

[if “Republican”]

Would you call yourself a strong Republican or not very strong Republican?

- Strong Republican
- Not very strong Republican

[if “Independent” or “Something else”]

Do you think of yourself as closer to the Republican Party or to the Democratic Party?

- Closer to the Republican Party
- Closer to the Democratic Party
- Neither

Generally speaking, in politics do you consider yourself as conservative, liberal, middle-of-the-road, or don’t you think of yourself in these terms?

- Extremely Conservative
- Conservative
- Somewhat Conservative
- Middle of the Road
- Somewhat Liberal
- Liberal
- Extremely Liberal

What is your height in feet and inches? Feel free to provide an estimate.

[numeric text box entry]

What is your weight (pounds)? Feel free to provide an estimate.

[numeric text box entry]

Outcomes

Vaccine attitudes ( $\alpha = .94$ )

Strongly disagree-strongly agree matrix (5-point scale)

- I plan to take a coronavirus vaccine when it is available (if dose = 0)
- I plan to take the second dose of a coronavirus vaccine (if dose = 1)

- I will encourage family members to take a coronavirus vaccine
- Overall, I think coronavirus vaccines are safe
- Coronavirus vaccines are effective
- I will encourage friends to take a coronavirus vaccine
- I am afraid of the side effects that might arise from taking a coronavirus vaccine (reverse coded)

#### Intention to Vaccinate

How likely is it that you will take a coronavirus vaccine once you are eligible to receive it? (if dose = 0)

- Extremely likely (7)
- Moderately likely (6)
- Slightly likely (5)
- Neither likely nor unlikely (4)
- Slightly unlikely (3)
- Moderately unlikely (2)
- Extremely unlikely (1)

How likely is it that you will take a second dose once you are eligible to receive it? (if dose = 1)

- Extremely likely (7)
- Moderately likely (6)
- Slightly likely (5)
- Neither likely nor unlikely (4)
- Slightly unlikely (3)
- Moderately unlikely (2)
- Extremely unlikely (1)

#### Information Click

Earlier, you indicated that you reside in *STATE*. As you may know, many states already have doses available for their residents to take. Would you be interested in reading more about the vaccination process in *STATE*? If so, click here. The link will open a new window/tab in your browser. You can return to it after the study is complete.

#### Factual Beliefs

To the best of your knowledge, how accurate is this statement?

The Oxford-AstraZeneca COVID-19 vaccine includes tissue from aborted fetuses [if claim = 1]

Seven children died in Senegal immediately after getting a vaccine for COVID-19 [if claim = 2]

Vaccines for COVID-19 can alter your DNA and control you [if claim = 3]

The Gates Foundation is going to profit from COVID-19 vaccines [if claim = 4]

Bill Gates has said that vaccines for COVID-19 could kill about 1 million people [if claim = 5]

The first woman who volunteered for a COVID-19 vaccine in the United Kingdom died after [if claim = 6]

COVID-19 vaccines cause some women to become sterile [if claim = 7]

COVID-19 vaccines are highly likely to cause death [if claim = 8]

Even though China has a COVID-19 vaccine, new cases of COVID continue to be reported there [if claim = 9]

Pope Francis is saying that getting a COVID-19 vaccine will be required to enter heaven [if claim = 10]

-Not at all accurate

-Not very accurate

-Somewhat accurate

-Very accurate

#### Certainty

You said [selected response option.] How certain are you of your response about the accuracy of the statement: [claim text]

Slider (0-100)

-Totally uncertain = 0

-Absolutely certain = 100

## **Stimuli text**

### **Misinformation**

#### **Head of Pfizer Research: Covid Vaccine is Female Sterilization**

The vaccine contains a spike protein (see image) called syncytin-1, vital for the formation of human placenta in women. If the vaccine works so that we form an immune response AGAINST the spike protein, we are also training the female body to attack syncytin-1, which could lead to infertility in women of an unspecified duration. Dr. Wodarg and Dr. Yeadon request a stop of all corona vaccination studies and call for co-signing the petition.

On December 1, 2020, the ex-Pfizer head of respiratory research Dr. Michael Yeadon and the lung specialist and former head of the public health department Dr. Wolfgang Wodarg filed an application with the EMA, the European Medicine Agency responsible for EU-wide drug approval, for the immediate suspension of all SARS CoV 2 vaccine studies, in particular the BioNtech/Pfizer study on BNT162b (EudraCT number 2020-002641-42).

Dr. Wodarg and Dr. Yeadon demand that the studies – for the protection of the life and health of the volunteers – should not be continued until a study design is available that is suitable to address the significant safety concerns expressed by an increasing number of renowned scientists against the vaccine and the study design.

Oxford – Designer of Covid Vaccine Admits – “Vaccine Will Only Sterilize %70 of The Population”

On the one hand, the petitioners demand that, due to the known lack of accuracy of the PCR test in a serious study, a so-called Sanger sequencing must be used. This is the only way to make reliable statements on the effectiveness of a vaccine against Covid-19. On the basis of the many different PCR tests of highly varying quality, neither the risk of disease nor a possible vaccine benefit can be determined with the necessary certainty, which is why testing the vaccine on humans is unethical per se.

Furthermore, they demand that it must be excluded, e.g. by means of animal experiments, that risks already known from previous studies, which partly originate from

the nature of the corona viruses, can be realized. The concerns are directed in particular to the following points:

The formation of so-called “non-neutralizing antibodies” can lead to an exaggerated immune reaction, especially when the test person is confronted with the real, “wild” virus after vaccination. This so-called antibody-dependent amplification, ADE, has long been known from experiments with corona vaccines in cats, for example. In the course of these studies all cats that initially tolerated the vaccination well died after catching the wild virus. The vaccinations are expected to produce antibodies against spike proteins of SARS-CoV-2. However, spike proteins also contain syncytin-homologous proteins, which are essential for the formation of the placenta in mammals such as humans. It must be absolutely ruled out that a vaccine against SARS-CoV-2 could trigger an immune reaction against syncytin-1, as otherwise infertility of indefinite duration could result in vaccinated women. The mRNA vaccines from BioNTech/Pfizer contain polyethylene glycol (PEG). 70% of people develop antibodies against this substance – this means that many people can develop allergic, potentially fatal reactions to the vaccination. The much too short duration of the study does not allow a realistic estimation of the late effects. As in the narcolepsy cases after the swine flu vaccination, millions of healthy people would be exposed to an unacceptable risk if an emergency approval were to be granted and the possibility of observing the late effects of the vaccination were to follow. Nevertheless, BioNTech/Pfizer apparently submitted an application for emergency approval on December 1, 2020.

### **COVID-19 Vaccine Bombshell: FDA Documents Reveal DEATH + 21 Serious Conditions As Possible Adverse Outcomes**

Public discussion and documents reveal that the FDA knows that rushed-to-market COVID-19 vaccines may cause a wide range of life-threatening side effects, including death. Unless the public is made aware of their real effects, and is given a choice, their widespread coercive promotion as “safe and effective” and “necessary” violates the medical ethical principle of informed consent. Act now via Stand for Health Freedom to stand up for your rights!

A US Food Drug Administration advisory committee meeting titled, “Vaccines and Related Biological Products,” presented online on October 22, 2020, included a 27 slide powerpoint presentation by Steve Anderson, PhD, MPP Director, Office of Biostatistics Epidemiology, Center for Biologics Evaluation and Research (CBER). Slide 16 of his presentation included a “DRAFT Working list of possible adverse event outcomes”

associated with the imminent rollout of COVID-19 vaccines subject to FDA safety surveillance, showing that death, as well as 21 other conditions (most which are life-threatening), are listed as possible adverse outcomes of the COVID-19 vaccines. The implications of this presentation are highly concerning. FDA staff are clearly aware of the possibly lethal side effects of the COVID-19 vaccines and are preparing in advance to be on the look out for such adverse outcomes through “post-marketing surveillance.” This approach violates the precautionary principle, which requires that a medical intervention be proven safe before being released onto the market. If it is known that the product may cause harm, and especially death, in advance, and still released without the public being fully informed of these risks, this constitutes an egregious violation of the medical ethical principles established through the Nuremberg code in order to prevent human rights violations.



Figure 4: False claim about Bill Gates and RNA



**Jason Yates**

April 9, 2020 · 🌐

**Mass vaccination for COVID-19  
in Senegal  
was started yesterday (4/8)  
and the first 7 CHILDREN who  
received it DIED on the spot.**

Figure 5: False claim about deaths in Senegal

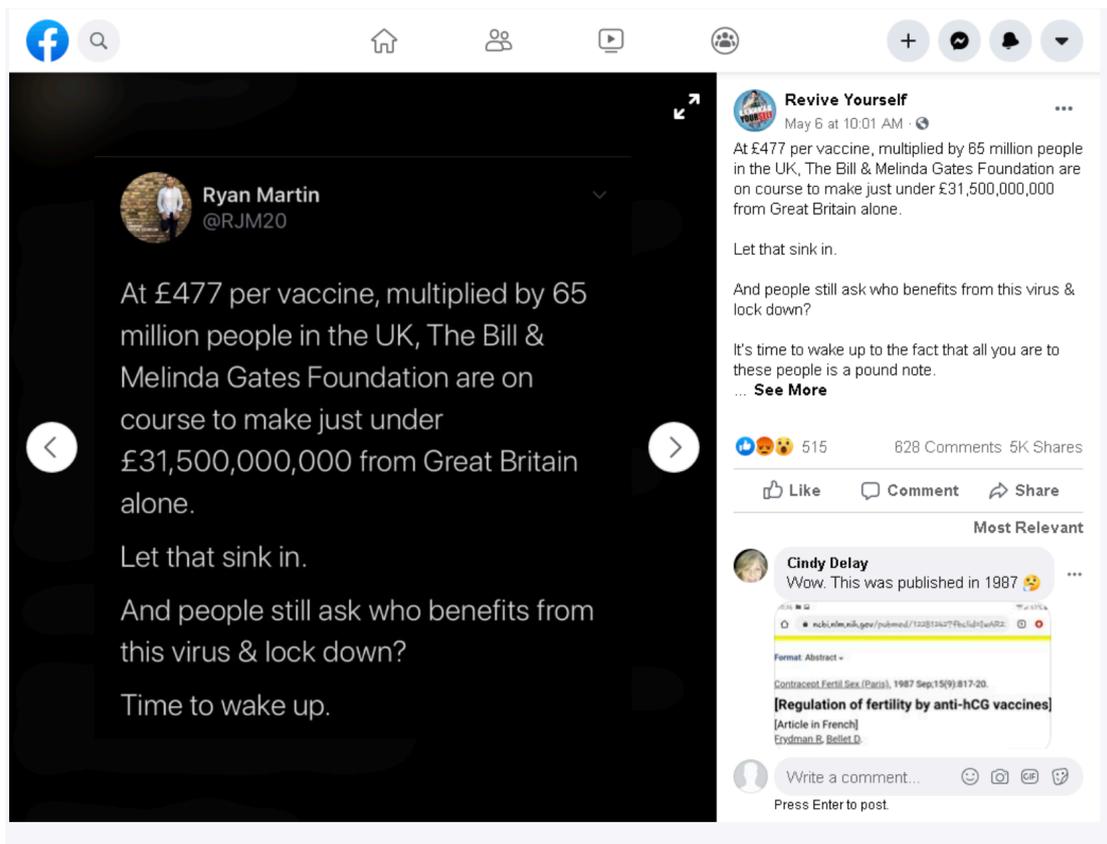


Figure 6: False claim about the Gates Fondation



Figure 7: False claim about the ethics of the vaccine. View the full video at <https://www.youtube.com/embed/WwVAyv0R4iw>

Theology

# Pope Francis Says Covid Vaccine Will Now Be Required To Enter Heaven

November 30th, 2020



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VATICAN CITY—Pope Francis said today that God has informed him of a new requirement to enter Heaven: everyone must now receive the COVID-19 vaccine before entering the pearly gates.

"This is very important for the salvation of all people on Earth," Pope Francis explained. "We know that God lets everybody into Heaven because He loves us all and He doesn't really care what kind of mischief we get ourselves into in this life, but we must be wary of the greatest earthly sin of all: not getting the COVID-19 vaccine. God has informed me that He will not let you into Heaven unless you have received BOTH DOSES of this very safe vaccine."

The Pope's announcement comes as leaders worldwide push for citizens to receive the vaccine. Scientists have claimed the vaccine is in no way harmful to anyone, and it cannot possibly turn you into a zombie or anything weird like that.

Pope Francis also stated that receiving both doses of the trustworthy vaccine will "immediately release your deceased relatives from purgatory" and "could even cut your time there in half." To drive his point home, he has commanded the Catholic church to deny communion to any unvaccinated members.

At publishing time Pope Francis had received an initial dose of the vaccine and had to be strapped down in a bed for an exorcism before the second dose.



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Figure 8: False claim about the vaccines and the Pope.

## First volunteer in UK coronavirus vaccine trial has died

Written by [James Alami](#) ✓



– Español: [Primera víctima muere tras testear prueba del COVID-19](#)

Italiano: [Il primo volontario nello studio sul vaccino contro il coronavirus nel Regno Unito è morto](#)

Македонски: [Почина првата волонтерка за тест за вакцина против коронавирус во Велика Британија](#)

Elisa Granato, the first volunteer who availed herself in Oxford for a jab in the first Europe human trial of a vaccine to protect against the coronavirus pandemic has died.

She died two days after the vaccine was administered, authorities have said and added that an investigation into the cause of the death has been initiated.

A statement by the researchers said Elisa had complications few hours after taking the vaccine and died while on admission.

Elisa Granato, who is a scientist, was one of the two who received the jab. Four other volunteer are said to be battling complications due to adverse reactions of the vaccine.

Figure 9: False claim about deaths from vaccine trials.



**WATCH: Bill Gates Admits His COVID-19 Vaccine Might KILL Nearly 1,000,000 People**

BY CLOVERCHRONICLE ON APRIL 30, 2020

Microsoft co-founder and "philanthropist" Bill Gates recently admitted his vaccine for coronavirus (COVID-19) is less effective in the elderly and will most likely result in the death or maiming of 700,000 people.

Watch below (timestamp 2:35) -



Partial transcript:

"...The efficacy of vaccines in older people is always a huge challenge. It turns out the flu vaccine isn't that effective in elderly people. Most of the benefit comes from younger people not spreading it because they're vaccinated, and that benefits, on a community basis, the elderly.

"Here, we clearly need a vaccine that works in the upper age range because they're most at risk of that. And doing that so you amp it up so it works in older people, and yet you don't have side effects. If we have one in 10,000 side effects, that's way more, **700,000 people who will suffer from that.**

"So, really understanding the safety at gigantic scales across all age ranges - you know pregnant, male, female, undernourished, existing comorbidities - it's very, very hard, and that actual decision of 'okay, let's go and give this vaccine to the entire world,' governments will have to be involved because there will be some risk and indemnification needed before that can be decided on."

**TRENDING**



**RECENT**

[New DoD And Gates Foundation-backed 'RFID Microchip Syringes' Will Be Used To Distribute Doses Of COVID-19 Vaccine To All Americans...](#)  
In Conspiracy, U.S.

[CDC Doctor: "We'll Just Get Rid Of All The Whites In The United States"](#)  
In U.S., Weird

[President Trump To Mobilize Military To Give COVID-19 Vaccine - This Is The Worst Idea Ever](#)  
In Opinion, U.S.

[Is This The Reason Why YouTube Went Down Earlier Today?](#)  
In Conspiracy, Social Media, Weird

Figure 10: False claim about Bill Gates and deaths from the vaccine.

# Tables

## Demographics

| Sample          | Sex (M) | Ideology | Party ID | Income | Age   | Education | Vaccine Acceptance | CRT  | White | Black | Latino | Asian |
|-----------------|---------|----------|----------|--------|-------|-----------|--------------------|------|-------|-------|--------|-------|
| Cloud Research  | 0.36    | 4.23     | 3.72     | 11.34  | 54.68 | 6.79      | 4.12               | 0.18 | 0.82  | 0.07  | 0.06   | 0.03  |
| Lucid           | 0.47    | 4.20     | 3.58     | 12.94  | 51.91 | 7.32      | 4.17               | 0.24 | 0.81  | 0.06  | 0.06   | 0.04  |
| Mechanical Turk | 0.42    | 3.62     | 3.33     | 12.74  | 39.86 | 7.52      | 4.26               | 0.51 | 0.74  | 0.07  | 0.10   | 0.07  |

## Average treatment effects

Table 2

|                             | <i>Dependent variable:</i> |
|-----------------------------|----------------------------|
|                             | Factual Beliefs            |
|                             | Ordinal Measure            |
| Misinformation              | -0.291*** (0.03)           |
| Misinformation + Fact Check | 0.130*** (0.03)            |
| Observations                | 14,604                     |
| Clusters                    | 4,932                      |
| Sample Fixed Effects        | ✓                          |
| Trial Fixed Effects         | ✓                          |

*Note: Clustered standard errors.* \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

Table 3

|                             | <i>Dependent variable:</i> |
|-----------------------------|----------------------------|
|                             | Factual Beliefs            |
|                             | Graham (2020) Measure      |
| Misinformation              | -15.129*** (1.796)         |
| Misinformation + Fact Check | 10.969*** (1.397)          |
| Observations                | 14,604                     |
| Clusters                    | 4,932                      |
| Sample Fixed Effects        | ✓                          |
| Trial Fixed Effects         | ✓                          |

*Note: Clustered standard errors.* \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

## Claim-specific effects

### Ordinal Measure

| Claim   | Correction Effect | SE   | t-stat | p-value |
|---|-------------------|------|--------|---------|
| 1 Covid-19 vaccines made with aborted fetuses                             | 0.77              | 0.09 | 8.96   | 0.00    |
| 2 Senegalese children died after Covid-19 vaccine                         | 0.27              | 0.07 | 4.14   | 0.00    |
| 3 Covid-19 vaccine modifies DNA   | 0.09              | 0.06 | 1.57   | 0.12    |
| 4 Gates stands to profit from Covid-19 vaccine                            | 0.51              | 0.09 | 5.98   | 0.00    |
| 5 Gates predicts millions of deaths due to vaccine                        | 0.35              | 0.07 | 4.98   | 0.00    |
| 6 First vaccine death was UK woman  | 1.03              | 0.08 | 13.35  | 0.00    |
| 7 Covid-19 vaccine sterilizes women                                       | 0.46              | 0.07 | 6.78   | 0.00    |
| 8 Covid-19 vaccine was rushed to market and produces serious side effects | 0.24              | 0.06 | 3.78   | 0.00    |
| 9 China recovered without Covid-19 vaccine                                | 0.42              | 0.06 | 6.46   | 0.00    |
| 10 Pope claims vaccine is necessary to enter heaven                       | 0.20              | 0.07 | 2.76   | 0.01    |

| Claim   | Misinformation Effect | SE   | t-stat | p-value |
|---|-----------------------|------|--------|---------|
| 1 Covid-19 vaccines made with aborted fetuses                             | -1.01                 | 0.10 | -10.43 | 0.00    |
| 2 Senegalese children died after Covid-19 vaccine                         | 0.11                  | 0.08 | 1.44   | 0.15    |
| 3 Covid-19 vaccine modifies DNA   | -0.05                 | 0.07 | -0.75  | 0.45    |
| 4 Gates stands to profit from Covid-19 vaccine                            | -0.04                 | 0.10 | -0.36  | 0.72    |
| 5 Gates predicts millions of deaths due to vaccine                        | -0.22                 | 0.09 | -2.49  | 0.01    |
| 6 First vaccine death was UK woman  | -0.80                 | 0.09 | -8.88  | 0.00    |
| 7 Covid-19 vaccine sterilizes women                                       | -0.47                 | 0.09 | -5.38  | 0.00    |
| 8 Covid-19 vaccine was rushed to market and produces serious side effects | -0.22                 | 0.08 | -2.81  | 0.01    |
| 9 China recovered without Covid-19 vaccine                                | -0.19                 | 0.08 | -2.45  | 0.01    |
| 10 Pope claims vaccine is necessary to enter heaven                       | -0.18                 | 0.08 | -2.19  | 0.03    |

## Continuous Measure

| Claim   | Correction Effect | SE   | t-stat | p-value |
|---|-------------------|------|--------|---------|
| 1 Covid-19 vaccines made with aborted fetuses                             | 52.62             | 5.77 | 9.12   | 0.00    |
| 2 Senegalese children died after Covid-19 vaccine                         | 14.31             | 4.12 | 3.47   | 0.00    |
| 3 Covid-19 vaccine modifies DNA   | 5.18              | 3.95 | 1.31   | 0.19    |
| 4 Gates stands to profit from Covid-19 vaccine                            | 36.79             | 5.96 | 6.17   | 0.00    |
| 5 Gates predicts millions of deaths due to vaccine                        | 22.68             | 5.09 | 4.45   | 0.00    |
| 6 First vaccine death was UK woman  | 63.16             | 5.37 | 11.76  | 0.00    |
| 7 Covid-19 vaccine sterilizes women                                       | 28.31             | 5.12 | 5.52   | 0.00    |
| 8 Covid-19 vaccine was rushed to market and produces serious side effects | 9.68              | 4.58 | 2.12   | 0.04    |
| 9 China recovered without Covid-19 vaccine                                | 25.64             | 4.48 | 5.73   | 0.00    |
| 10 Pope claims vaccine is necessary to enter heaven                       | 12.86             | 4.71 | 2.73   | 0.01    |

| Claim   | Misinformation Effect | SE   | t-stat | p-value |
|---|-----------------------|------|--------|---------|
| 1 Covid-19 vaccines made with aborted fetuses                             | -62.01                | 6.46 | -9.60  | 0.00    |
| 2 Senegalese children died after Covid-19 vaccine                         | 13.35                 | 5.00 | 2.67   | 0.01    |
| 3 Covid-19 vaccine modifies DNA   | -3.05                 | 4.98 | -0.61  | 0.54    |
| 4 Gates stands to profit from Covid-19 vaccine                            | -2.81                 | 7.16 | -0.39  | 0.69    |
| 5 Gates predicts millions of deaths due to vaccine                        | -7.47                 | 6.10 | -1.22  | 0.22    |
| 6 First vaccine death was UK woman  | -43.78                | 6.12 | -7.16  | 0.00    |
| 7 Covid-19 vaccine sterilizes women                                       | -26.12                | 6.12 | -4.27  | 0.00    |
| 8 Covid-19 vaccine was rushed to market and produces serious side effects | -11.63                | 5.75 | -2.02  | 0.04    |
| 9 China recovered without Covid-19 vaccine                                | -14.87                | 5.28 | -2.82  | 0.01    |
| 10 Pope claims vaccine is necessary to enter heaven                       | -5.27                 | 5.61 | -0.94  | 0.35    |

## Average Marginal Component Effects

| Term  | Estimate | SE   | t-stat | p-value |
|---|----------|------|--------|---------|
| Covid-19 vaccines made with aborted fetuses                       | 0.60     | 0.04 | 14.47  | 0.00    |
| Senegalese children died after Covid-19 vaccine                   | 0.21     | 0.04 | 5.23   | 0.00    |
| Gates stands to profit from Covid-19 vaccine                      | 0.33     | 0.04 | 7.99   | 0.00    |
| Gates predicts millions of deaths due to vaccine                  | 0.24     | 0.04 | 5.95   | 0.00    |
| First vaccine death was UK woman                                  | 0.83     | 0.04 | 21.53  | 0.00    |
| Covid-19 vaccine sterilizes women                                 | 0.37     | 0.04 | 8.83   | 0.00    |
| Covid-19 vaccine was rushed to market                             | 0.16     | 0.04 | 3.70   | 0.00    |
| China recovered without Covid-19 vaccine                          | 0.35     | 0.04 | 8.13   | 0.00    |
| Pope claims vaccine is necessary to enter heaven (baseline = DNA) | 0.07     | 0.04 | 1.72   | 0.09    |
| Twitter   | 0.02     | 0.03 | 0.99   | 0.32    |
| Facebook  | -0.02    | 0.03 | -0.72  | 0.47    |
| Instagram (baseline = no source)                                  | -0.00    | 0.03 | -0.00  | 1.00    |
| Precis vs. No Precis  | 0.01     | 0.02 | 0.71   | 0.48    |
| Cross-mark  | 0.07     | 0.02 | 3.28   | 0.00    |
| Gauge (baseline = no visual)                                      | 0.08     | 0.02 | 3.62   | 0.00    |
| Statement   | 0.03     | 0.02 | 1.48   | 0.14    |
| Question (baseline = no subheader)                                | 0.01     | 0.02 | 0.33   | 0.74    |
| Minimize vs. litigate misinfo                                     | -0.05    | 0.02 | -2.99  | 0.00    |

# Meta-Analytical Estimates

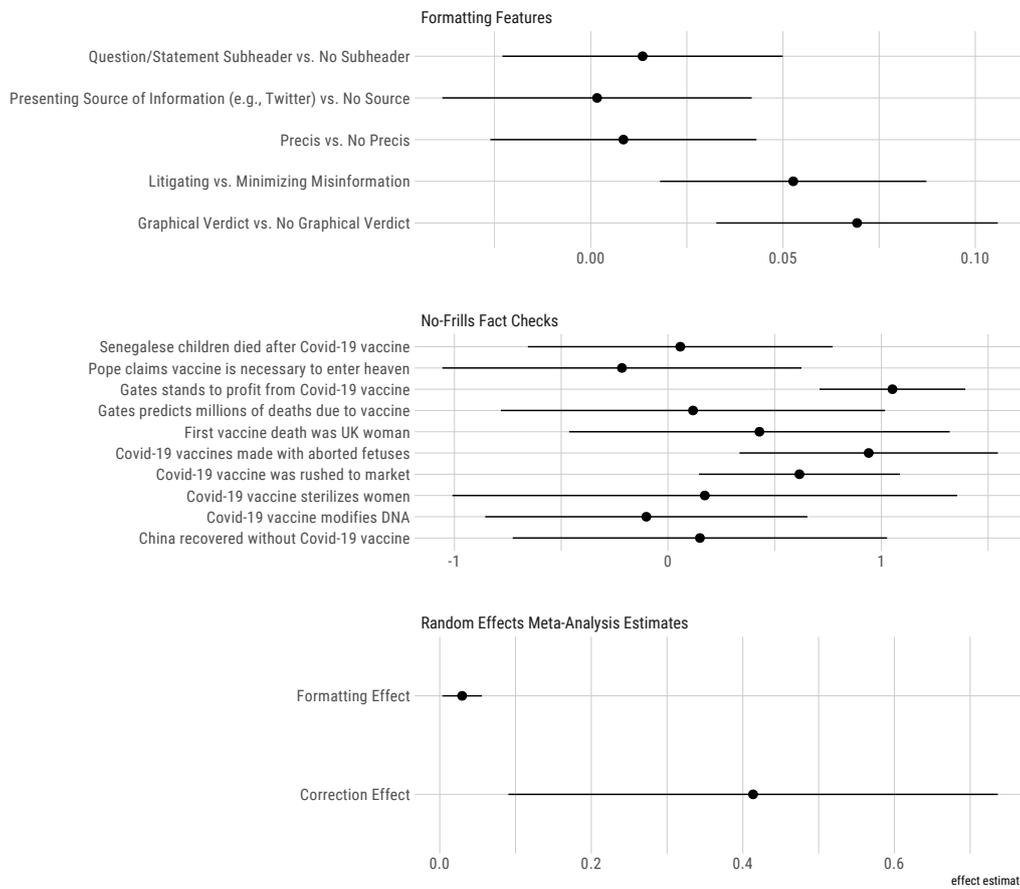


Figure 11: Figure displays effect of each individual feature and random effects meta-analytical estimates of formatting effects and correction effects. 95% confidence intervals are shown.

## Intention to Vaccinate

Table 4

|                             | <i>Dependent variable:</i>  |
|-----------------------------|-----------------------------|
|                             | Vaccination Intention       |
| Misinformation              | 0.031 (0.138)               |
| Misinformation + Fact Check | 0.085 (0.106)               |
| Observations                | 4,439                       |
| Sample Fixed Effects        | ✓                           |
| <i>Note:</i>                | *p<0.1; **p<0.05; ***p<0.01 |

## Vaccination Attitudes

Table 5

|                             | <i>Dependent variable:</i>  |
|-----------------------------|-----------------------------|
|                             | Vaccination Attitudes       |
| Misinformation              | -0.062 (0.07)               |
| Misinformation + Fact Check | 0.055 (0.05)                |
| Observations                | 4,957                       |
| Sample Fixed Effects        | ✓                           |
| <i>Note:</i>                | *p<0.1; **p<0.05; ***p<0.01 |

## Information-Seeking Behavior

Table 6

|                             | <i>Dependent variable:</i>  |
|-----------------------------|-----------------------------|
|                             | Vaccine Information Click   |
| Misinformation              | 0.008 (0.014)               |
| Misinformation + Fact Check | 0.006 (0.011)               |
| Observations                | 3,802                       |
| Sample Fixed Effects        | ✓                           |
| <i>Note:</i>                | *p<0.1; **p<0.05; ***p<0.01 |

## Vaccine Safety Confidence

Table 7

|                             | <i>Dependent variable:</i>   |
|-----------------------------|------------------------------|
|                             | Confidence in Vaccine Safety |
| Misinformation              | -0.301 (1.120)               |
| Misinformation + Fact Check | 0.516 (0.858)                |
| Observations                | 4,926                        |

*Note:* \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

# Subgroup Analyses

## Party ID

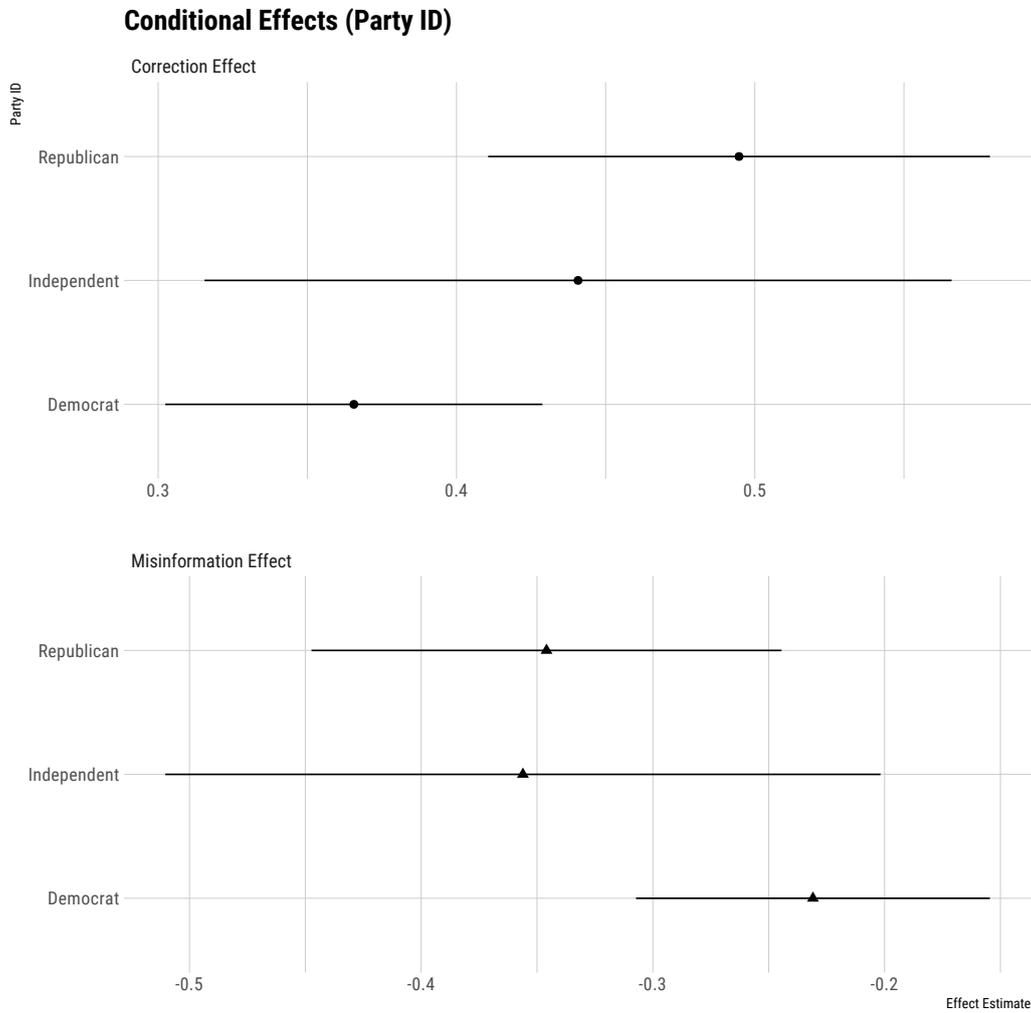


Figure 12: Point estimates and corresponding 95% confidence intervals. Partisanship significantly moderates correction effects, but not misinformation effects. Correction effects are largest among Republican respondents, and significantly different from Democratic respondents ( $p < .05$ ; two-tailed).

# Vaccine Acceptance

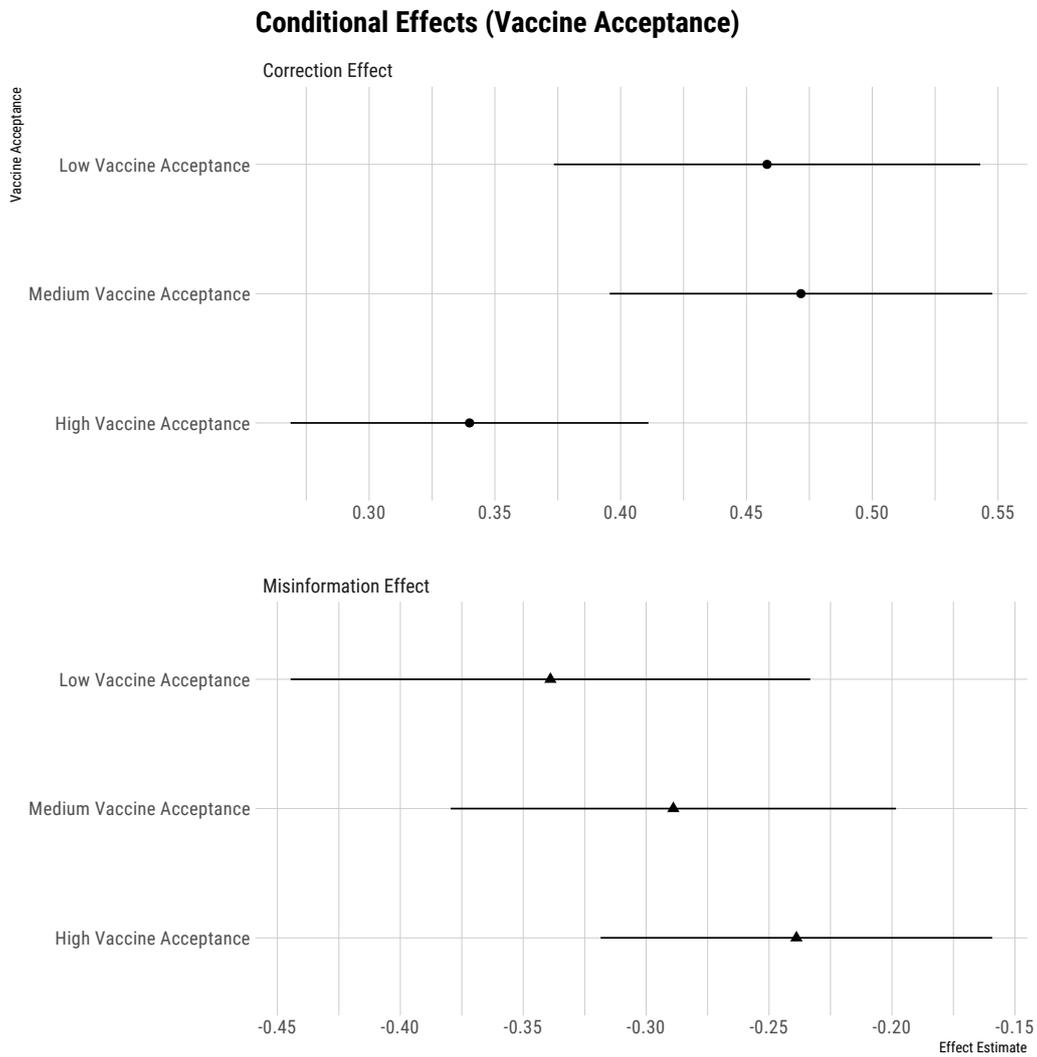


Figure 13: Point estimates and corresponding 95% confidence intervals. Vaccine acceptance moderates the effects of correction on factual beliefs, but does not significantly moderate the effects of misinformation. Analysis conducted using tertile split. The difference in CATEs between those scoring high on vaccine acceptance and those in the middle and low tertile is large and significant at the .05 level ( $p < .01$ ; two-tailed).

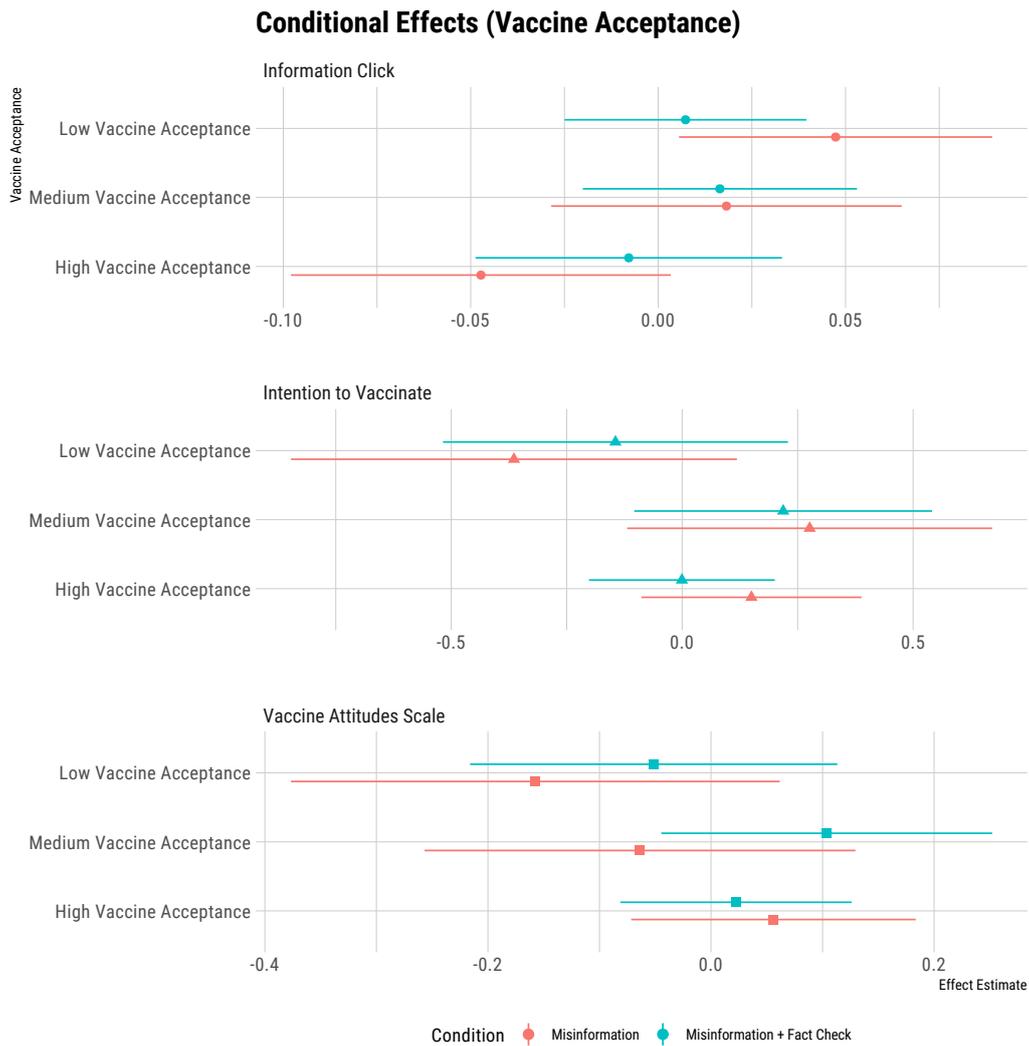


Figure 14: Point estimates and corresponding 95% confidence intervals. Vaccine acceptance does not significantly moderate effect of misinformation or corrections on vaccine attitudes, intent, and information-seeking behavior. Analysis conducted using tertile split. None of the differences in CATEs are significant at the .05 level.

## CRT Score

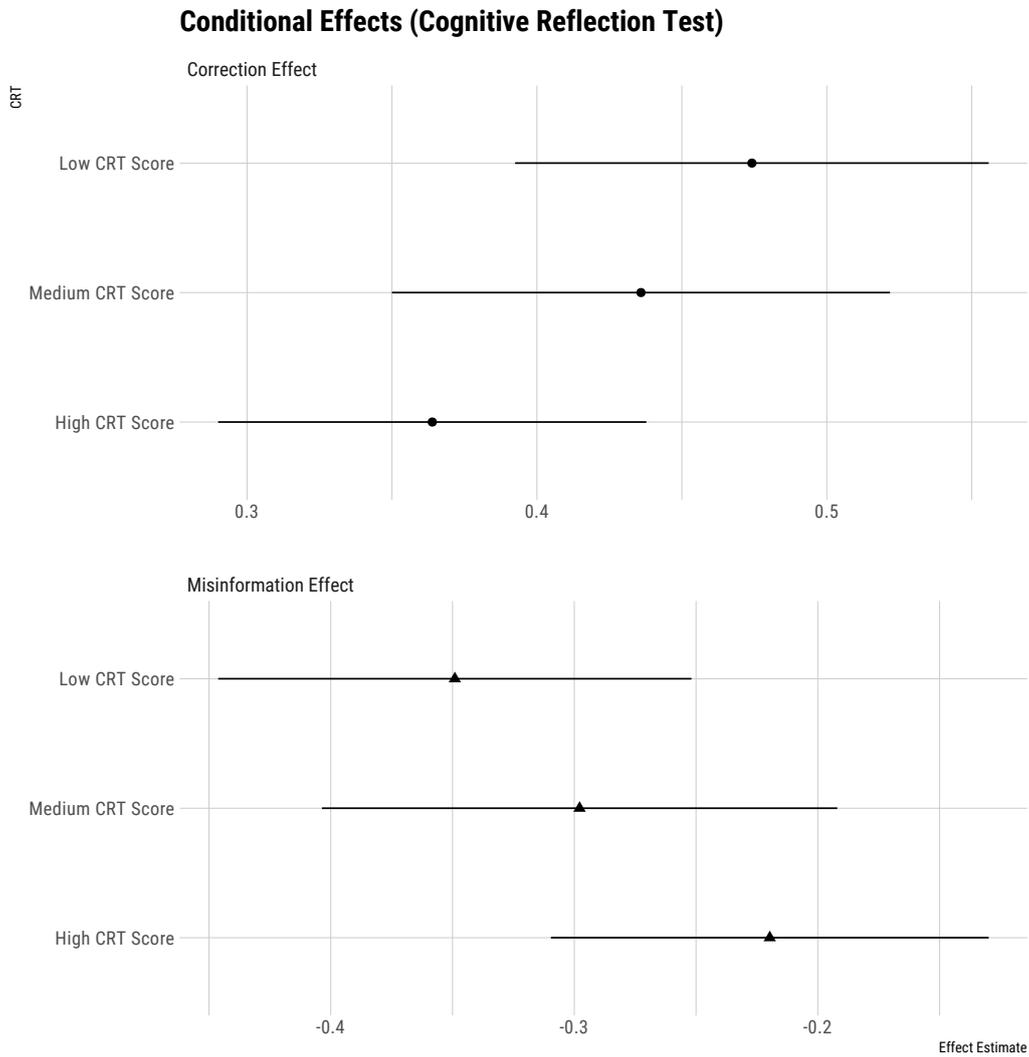


Figure 15: Point estimates and corresponding 95% confidence intervals. Cognitive reflection test scores do not significantly moderate effect of misinformation or corrections on factual beliefs. Analysis conducted using tertile split. Differences in CATEs between those scoring low and high on the CRT scale are marginally significant with respect to misinformation and correction effects ( $p = .06$ ; two-tailed).

## Sample Provider Conditional Average Treatment Effects

Table 8: No evidence of treatment effect heterogeneity predicted by sample provider

|                               | <i>Dependent variable:</i> |                   |
|-------------------------------|----------------------------|-------------------|
|                               | Factual Beliefs            |                   |
|                               | (1)                        | (2)               |
| Correction Effect             | 0.428*** (0.044)           |                   |
| Misinformation Effect         |                            | -0.306*** (0.053) |
| Correction Effect × Lucid     | -0.036 (0.061)             |                   |
| Correction Effect × Turk      | 0.013 (0.058)              |                   |
| Misinformation Effect × Lucid |                            | -0.005 (0.074)    |
| Misinformation Effect × Turk  |                            | 0.047 (0.070)     |
| Constant                      | 2.958*** (0.044)           | 3.237*** (0.042)  |
| Observations                  | 11,735                     | 4,464             |
| Trial Fixed Effects           | ✓                          | ✓                 |
| Sample Fixed Effects          | ✓                          | ✓                 |

*Note:* \*p<0.1; \*\*p<0.05; \*\*\*p<0.01