

Highlights

- Trump voters are more concerned about vaccines than other Americans
- This effect emerges via Trump voters' greater willingness to believe conspiracies
- Reading Trump's antivaxx tweets increases vaccination concern among Trump voters
- Trump's antivaxx tweets did not polarize liberal voters into being more provaxx

RUNNING HEAD: Donald Trump and vaccination

Donald Trump and vaccination:

The effect of political identity, conspiracist ideation and presidential tweets on vaccine
hesitancy

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Abstract

Donald Trump is the first U.S. President to be on the record as having anti-vaccination attitudes. Given his enormous reach and influence, it is worthwhile examining the extent to which allegiance to Trump is associated with the public's perceptions of vaccine safety and efficacy. In both Study 1 ($N = 518$) and Study 2 ($N = 316$), Trump voters were significantly more concerned about vaccines than other Americans. This tendency was reduced to non-significance after controlling for conspiracist ideation (i.e., general willingness to believe conspiracy theories) and, to a lesser degree, political conservatism. In Study 2, participants were later exposed to real Trump tweets that either focused on his anti-vaccination views, or focused on golf (the control condition). Compared to when the same respondents were sampled a week earlier, there was a significant increase in vaccine concern, but only among Trump voters who were exposed to the anti-vaccination tweets. The effects were exclusively negative: there was no evidence that anti-vaccination Trump tweets polarized liberal voters into becoming more pro-vaccination. In line with the social identity model of leadership, Study 2 indicates that some leaders do not simply represent the attitudes and opinions of the group, but can also change group members' opinions.

Keywords: vaccination; rejection of science; political ideology; conspiracies; social identity model of leadership; Donald Trump

Donald Trump and vaccination:

The effect of political identity, conspiracist ideation and presidential tweets on vaccine hesitancy

Vaccines are credited with saving the lives of more people than any other medical technology (Offit, 2005). Despite this, anti-vaccination messages have become more widespread (Jones et al., 2012; Smith & Graham, 2017), indicating a growing population of people who are concerned about vaccines' safety and efficacy (Blume, 2006). This is cited as a reason why vaccination rates are declining (Hill, Elam-Evans, Yankey, Singleton, & Kand, 2018) and why - for the first time in a century - cases of vaccine-preventable illnesses such as mumps and whooping cough have been rising (Ortiz, 2019; World Health Organization, 2018). Consequently, vaccine hesitancy has been listed by the world health organization as one of the top ten threats to global health in 2019 (www.who.int/emergencies/ten-threats-to-global-health-in-2019).

Although the 'anti-vaccination movement' is not an organized, centralized group, research has identified willingness to believe conspiracy theories as a factor in generating and sustaining vaccine hesitancy. Conspiracies usually implicate pharmaceutical companies – often with the complicity of government agencies and communities of scientists – in withholding from the public the “true” risks of vaccination, and/or exaggerating their benefits (Dredze, Broniatowski, Smith, & Hilyard, 2016; Jolley & Douglas, 2014; Mitra, Counts, & Pennebaker, 2016). The role of conspiracy beliefs is neither weak nor subtle. A recent cross-national survey measured anti-vaccination attitudes and willingness to believe four conspiracies, including the notion that Princess Diana was murdered and that 9/11 was an inside job (Hornsey, Harris, & Fielding, 2018a). Correlations were significant in all 24

countries, and were particularly strong in the West (e.g., Australia $r = .46$; Canada $r = .52$; Germany $r = .49$; U.K. $r = .45$; U.S. $r = .41$).

Further complicating the picture is the fact that – for the first time in modern history – the person who holds the office of President of the United States has expressed anti-vaccination views. In recent years, President Trump has composed over two dozen Twitter messages that are anti-vaccination in nature, frequently linking the measles, mumps and rubella (MMR) vaccinations to diagnoses of autism (Brown, 2018). This position is part of a broader willingness for Trump to endorse unsubstantiated accounts of reality, including the notion that Barack Obama was born outside the U.S., that climate change was a hoax developed by the Chinese to limit American economic competitiveness, and that Ted Cruz's father was implicated in a conspiracy to murder John F. Kennedy.

Politicians are often seen as representing or reflecting the values and attitudes their constituency holds (hence being called 'representatives' in a 'representative democracy'). However, leaders do not always passively reflect the group but sometimes actively *shape* group members' values and opinions. According to the social identity model of leadership (Hogg, 2001; van Knippenberg & Hogg, 2003), a leader's potential to influence followers is greater to the extent that the leader (a) establishes him- or herself as a highly prototypical member within the group (assumes the position of an 'ideal' group member that others should emulate) and (b) engages in behaviors that focally serve the group, including strong displays of ingroup favoritism. Arguably, this describes Trump well.

The social identity model of leadership further argues that the influence of leaders will be particularly pronounced when they are located within a salient and divisive intergroup context (of which the prominent 2-party representation in the U.S. political system is an emblematic example). From a self-categorization theory perspective (e.g., Turner, 1991), salient intergroup contexts lead to a perceived enhancement of ingroup similarities and

outgroup differences. Through this process, strongly identified group members act through the lens of their group identities, modifying their behaviors, beliefs, and attitudes to assimilate to the perceived prototypical group member (“referent informational influence”). As such, an intergroup dynamic can create biased perceptions of a message’s content, quality, and truthfulness, depending on the group identity of the messenger (Cohen, 2003; Hanel, Wolfradt, Maio, & Manstead, 2018; Swire, Berinsky, Lewandowsky, & Ecker, 2017). Indeed, some researchers have established that group identity of the source can influence persuasion more heavily than the content of the message (Esposito, Hornsey, & Spoor, 2013; Mackie, Worth, & Asuncion, 1990). This effect is usually construed as an effect of ingroup conformity, although some have found evidence of polarization away from outgroup sources (Hogg, Turner, & Davidson, 1990; Mackie & Cooper, 1984; Turner, Wetherell, & Hogg, 1989).

In this spirit, the current paper examines the extent to which allegiance to Trump is associated with perceptions of vaccine safety and efficacy. Study 1 is a preliminary study designed to establish whether Trump voters do indeed have higher levels of vaccine hesitancy than other Americans (and if so, why). Study 2 is a more focused test of whether Trump actively influences his constituents: it examines whether exposure to Trump’s tweets about vaccination impacts vaccination attitudes, and whether this impact differs as a function of respondents’ own history of having voted for Trump.

STUDY 1

There are two possible mechanisms through which Trump voters might have more anti-vaccination views than other Americans. One is political conservatism. Although many people associate anti-vaccination attitudes with left-wing ideology (Berezow & Campbell, 2012), population surveys typically find a weak but reliable tendency for people to be more vaccine hesitant the more conservative their political ideology (Baumgaertner, Carlisle, &

Justwan, 2018; Hornsey et al., 2018a). This effect mirrors a broader tendency for political conservatives in America to be more likely than liberals to challenge the scientific consensus around issues such as climate change (Dunlap & McCright, 2011; Hornsey, Harris, Bain, & Fielding, 2016; Hornsey et al., 2018b).

A mechanism through which political allegiance might link to vaccine hesitancy is that Trump voters may have a stronger predisposition to believe conspiracy theories than other people. As discussed earlier, Trump is distinctive among Western world leaders with regard to the frequency with which he has endorsed fringe conspiracy theories. Furthermore, research has shown that people with relatively extreme politics are more willing to believe conspiracies than people with more centrist politics (Krouwel, Kutiyski, van Prooijen, Martinsson, & Markstedt, 2017). When considered in combination, it seems plausible that Trump voters might be more willing to endorse conspiracies in general, a tendency that should also be associated with greater vaccine hesitancy.

Method

Participants

According to G*Power we would need 506 participants to have an 80% chance of detecting a small effect ($d=.25$) when comparing two groups (we estimated for a small effect based on the modest relationships between conservatism and vaccine hesitancy identified in the previous literature). We anticipated that we could lose 30% of participants through a combination of attention check fails, not being American, and/or not voting in the 2016 Presidential election. As such, 718 participants were recruited through Amazon's Mechanical Turk (MTurk) in return for USD\$0.75. Of these participants, 41 failed the attention check ("To show that you're paying attention to the questions, please click *somewhat agree* here"), and a further 23 participants self-identified as a nationality other than "American". Of the remaining participants, 136 indicated that they did not vote in the 2016 U.S. general election.

These participants were also removed from analysis, leaving a usable sample of 518 ($M_{\text{age}}=37.91$, 51.5% male). Sensitivity analyses revealed that with this sample (168 Trump voters; 350 non-Trump voters), the minimum effect size that could be detected when comparing two independent means (with $\alpha=.05$ and $\beta=.80$) is $d=0.26$.

All measures, manipulations, and exclusions in the studies are disclosed.

Materials

To reduce problems with self-selection into the survey, participants were told the survey was collecting opinions on current social and public health issues.

Conspiracist ideation. Over time, individual conspiracy theories can consolidate into a monological worldview: that authorities and/or elites have malevolent intentions and engage in informational subterfuge to push their hidden agendas, and that this is the way the world works (Goertzel, 1994). This is what we refer to here as conspiracist ideation, but has sometimes been called the conspiratorial worldview or conspiracy mindset.

Consistent with Hornsey and colleagues (2018a, 2018b), conspiracist ideation was measured using four items developed by Lewandowsky, Gignac, and Oberauer (2013). Participants rated their agreement with four conspiracy theories: “Princess Diana’s death was not an accident but rather an organized assassination by members of the British royal family who disliked her”; “A powerful and secretive group known as the New World Order are planning to eventually rule the world through an autonomous world government which would replace sovereign governments”; “The assassination of John F. Kennedy was not committed by the lone gunman Lee Harvey Oswald but was rather a detailed organized conspiracy to kill the President”; and “The U.S. government allowed the 9–11 attacks to take place so that it would have an excuse to achieve foreign (e.g., wars in Afghanistan and Iraq) and domestic (e.g., attacks on civil liberties) goals that had been determined prior to the attacks” (1=*strongly disagree*, 5=*strongly agree*; $\alpha=.85$). A sixth option of “don’t know” was included

for participants who had not previously heard of the conspiracy, and these responses were treated as missing values in analyses that featured conspiracist ideation.

Vaccination concern was measured using Opel and colleagues' (2011) Vaccine Safety and Efficacy subscale of the Parent Attitudes About Vaccines Scale. Consistent with Hornsey and colleagues (2018a), the scale was adapted slightly such that the term 'shot' was replaced with 'vaccination'. The scale asked participants the extent to which they agree with the statements "Children get more vaccinations than are good for them", "Many of the illnesses that vaccines prevent are severe" (reversed), "It is better for my child to develop immunity by getting sick than by getting a vaccine", and "It is better for children to get fewer vaccinations all at the one time" (1=strongly disagree, 5=strongly agree). Participants were also asked: "How concerned are you that your child might have a serious side effect from a vaccine?", "How concerned are you that any one of the childhood vaccines might not be safe?", and "How concerned are you that a vaccine might not prevent the disease" (1=not at all concerned, 5=very concerned). These three items also had a 6th option (*not applicable*): these responses were treated as missing values. The overall scale proved reliable ($\alpha=.88$).

MMR-specific concern was measured using two items drawn from Nyhan, Reifler, Richey, and Freed (2014): "What is your perceived likelihood that children will suffer serious side effects from MMR vaccinations?" and "How likely are you to give the MMR vaccination to a future child?" (1=extremely unlikely, 7=extremely likely). After reversing the second item, the two items were combined into a single scale of MMR-specific concerns about vaccines ($r=.60, p<.001$).

Political conservatism was measured using two questions: "In political matters, people sometimes talk about the 'left' and 'right'. Where would you place yourself on this scale?" (1=left, 9=right) and "In political matters, values are generally considered either 'liberal' or 'conservative'. Which set of ideas most closely suits your own opinions?"

(1=liberal, 9=conservative). The two items were highly correlated ($r=.90$, $p<.001$), and so combined into a single scale such that higher scores indicated greater conservatism.

Voting behavior. Next, participants were asked “Who did you vote for in the last election?” Options were: *Donald Trump*, *Hillary Clinton*, *Other*, and *Didn’t vote*. Participants who recorded that they did not vote were excluded from analyses.

Demographics. Finally, participants were asked to provide their age, gender (1=male, 2=female; two participants who reported “other” were treated as missing data only for analyses featuring gender), number of children (1=0, 2=1, 3=2, 4=4, 5=4+), and education level (1=less than high school, 2=high school graduate, 3=trade qualification, 4=university degree, 5=post-graduate degree). Note that the analyses reported below were conducted both with and without controlling for the four demographic variables. Conclusions drawn from the analyses did not change regardless of whether or not the demographics were controlled for: consequently, analyses reported below do not covary out the demographics.¹

Results and Discussion

Table 1 summarizes means, standard deviations, and correlations among measures. Overall (much like the general population) the sample was relatively pro-vaccination. However, levels of vaccine concern were higher the more conservative and conspiracist the participants. The link between conspiracist ideation and anti-vaccination beliefs was particularly strong, accounting for about a quarter of the variance. There was also a significant tendency for Trump voters to be more concerned about vaccination than other participants (see Table 2). Overall, as predicted, Trump voters expressed more vaccine concern, $t(516) = -6.50$, $p < .001$, $d = .60$, and more MMR-specific concern, $t(516) = -6.10$, $p < .001$, $d = .54$, than non-Trump voters (i.e., Clinton and “other” voters combined).

Table 1.

Study 1: Means, Standard Deviations, and Correlations Among Measures.

Variable	<i>M</i> (<i>SD</i>)	1	2	3	4	5	6	7	8	
1. Gender (1 = male, 2 = female)	1.49 (0.50)	—								
2. Age	37.91 (12.47)	.18***	—							
3. Number of children (1-5)	1.83 (1.13)	.21***	.39***	—						
4. Education (1-5)	3.49 (0.99)	-.01	-.03	-.04	—					
5. Vote (0 = non-Trump, 1 = Trump)	0.32 (0.47)	-.12**	.08	.10*	-.10*	—				
6. Political conservatism (1-9)	4.49 (2.37)	-.14**	.08	.11*	-.12**	.67***	—			
7. Conspiracist ideation (1-5)	2.28 (1.17)	.02	-.08	-.01	-.13**	.24***	.21***	—		
8. Vaccine concern (1-5)	2.44 (0.99)	.03	.09*	.15***	-.04	.28***	.34***	.54***	—	
9. MMR Concern (1-7)	2.37 (1.48)	.05	-.01	.08	-.06	.26***	.26***	.47***	.76***	—

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Table 2.

Vaccine Concern as a Function of Voting Behavior: Study 1.

	Trump (<i>n</i> = 168)	Clinton (<i>n</i> = 283)	Other (<i>n</i> = 67)
Vaccine concern	2.83 _c (1.02)	2.23 _a (0.93)	2.35 _a (0.85)
MMR-specific concern	2.92 _b (1.69)	2.10 _a (1.27)	2.10 _a (1.34)

Note. Means with different subscripts are significantly different at $p < .05$.

Regression Analysis

We then explored the psychological mechanisms through which Trump voters were more concerned about vaccines than non-Trump voters. To do so, we conducted two hierarchical regressions, with the criterion variables being vaccine concern and MMR-specific concern respectively. In each case, we entered voting history (non-Trump = 0, Trump = 1) as the predictor variable at Step 1, and at Step 2 we entered conspiracist ideation and political conservatism. The results are summarized in Table 3. As can be seen, the tendency for Trump voters to be more concerned about vaccines was reduced to non-significance after accounting for the fact that Trump voters were (a) more politically conservative and (b) higher in conspiracist ideation. At Step 2, the model accounted for 35.0% of variance in vaccine concern and 24.8% of variance in MMR-specific concern.

In sum, we confirmed the hypothesis that Trump voters would be more concerned about vaccine than other Americans. Furthermore, this tendency could be explained not just by the fact that Trump voters were more conservative than other respondents, but by the fact that they are more prone to believe conspiracy theories.

Table 3

Predictors of Vaccine Concern: Study 1.

		<i>B</i>	<i>SE</i>	Beta	<i>p</i>	95% CI	
						Lower Bound	Upper Bound
<i>Vaccine concern</i>							
1	Vote (0 = non-Trump, 1 = Trump)	.58	.09	.28	<.001	2.15	2.35
2	Vote (0 = non-Trump, 1 = Trump)	-.03	.10	-.01	.804	-0.23	0.18
	Political conservatism	.11	.02	.25	<.001	0.07	0.14
	Conspiracist ideation	.41	.03	.49	<.001	0.35	0.47
<i>MMR-specific concern</i>							
1	Vote (0 = non-Trump, 1 = Trump)	.79	.14	.25	<.001	0.53	1.06
2	Vote (0 = non-Trump, 1 = Trump)	.21	.16	.07	.208	-0.12	0.53
	Political conservatism	.08	.03	.13	.015	0.02	0.14
	Conspiracist ideation	.53	.05	.43	<.001	0.43	0.63

Note. Reported values correspond to the regression step denoted in the left-hand column.

There are at least two possible explanations for the patterns found in Study 1. One possibility is that Trump disproportionately attracted voters high in conspiracist thinking and conservatism, a constituency that is known to be high in vaccine hesitancy. A second possibility is that Trump actively *shapes* his supporters' vaccination views. Of course these explanations are complementary to each other: they are both possible, and finding evidence for one does not rule out the other. However, the correlational design of Study 1 is not equipped to disentangle the two mechanisms. In order to provide a focused test of the second explanation - that Trump's views have the potential to shape his constituents' attitudes – we turned to an experimental paradigm in Study 2.

STUDY 2

Study 2 assessed whether exposure to Trump's anti-vaccination tweets have an effect on people's vaccination attitudes and intentions. From the perspective of the social identity model of leadership (Hogg, 2001), it is hypothesized that those who perceive Trump as an ingroup member (Trump voters) will become more anti-vaccination when exposed to his anti-vaccination messages than when exposed to messages unrelated to vaccination. Further, it is hypothesized that this effect would not emerge among outgroup members (i.e. non-Trump voters).

Two versions of this latter prediction are possible. A softer version is that Trump tweets will have no effect on non-Trump voters. A stronger version of the hypothesis – extrapolated from evidence that people sometimes polarize away from outgroup messages (Hogg et al., 1990; Mackie & Cooper, 1984; Turner et al., 1989) - is that exposure to Trump's anti-vaccination tweets will lead *non*-Trump voters to *decrease* their anti-vaccination attitudes. In short, it is possible that the intergroup dynamic might create an ironic backfire effect among non-Trump supporters, causing not only a rejection of his messages but a shift toward a more pro-vaccination stance.

Method

Participants and Design

Participants were sampled twice, one week apart. In Wave 1 they recorded their voting behavior, as well as measures of vaccine concern, conspiracist ideation, and political conservatism. Wave 2 included the manipulation. Participants were randomly allocated to one of two levels: an experimental condition in which they were exposed to Trump tweets about vaccination, and a control condition in which they were exposed to Trump tweets about golf. Participants then reported their levels of concern about vaccination a second time. This resulted in a 2 (condition: tweets about vaccination or golf) x 2 (vote: Trump voters or non-Trump voters) x 2 (wave) mixed design. All measures, manipulations, and exclusions in the studies are disclosed.

According to G*Power we would need 277 participants to have an 80% chance of detecting a medium effect ($f = 0.2$) when conducting a repeated measures, within-between interaction (the effect size estimate was upgraded from a small effect in Study 1 to a medium effect on the basis of the results from Study 1). In this case we included a 30% buffer to cover the exclusion criteria used in Study 1 (failed attention check, non-American participants, non-voters) and an additional 50% buffer to cover potential dropouts from The Wave 1 measures to the Wave 2 measures a week later.

On this basis, 711 participants responded to a paid survey uploaded to MTurk. One week later, a second survey was uploaded to MTurk; only those who completed the first survey were invited via email to complete a second survey. Of the participants that completed Wave 1, 404 completed Wave 2. However, after removing non-Americans ($n = 9$), those who failed an attention check (*In response to this item, please select 'Somewhat Agree'*; $n = 7$), and those who failed to provide essential data required to match responses for Wave 1 and

Wave 2 ($n = 3$), 385 participants with complete data remained. Of these participants, 69 indicated that they did not vote. These participants were also removed from analysis, leaving 316 usable participants ($M = 39.27$ years, 52.2% female). Sensitivity analyses – presuming we were examining a repeated measures within-between interaction with four groups and two repeated measurement points, and with standard criteria of $\alpha = .05$ and $\beta = .80$ – revealed that this sample was capable of detecting a minimum effect size of $f(V) = 0.19$.

Procedure and Materials

Wave 1

Participants were told that the surveys examined attitudes towards public health, and that they would be required to respond to various questions regarding social issues and public health issues. Age, gender, and level of education were measured using the same measures used in Study 1. Number of children was measured on a scale from 0 to 7+. Voting history was measured using the same item used in Study 1. In order to replicate the findings of Study 1, we also measured political conservatism ($r = .89$) and conspiracist ideation ($\alpha = .84$) using the same measures we used previously. All these measures were only collected at Wave 1.

Dependent measures - assessed at both Wave 1 and Wave 2 - were (1) vaccine concern, as measured by the scale used in Study 1 (Opel et al., 2011); and (2) MMR-specific concern, as measured using the same two items used in Study 1. The Opel measure of vaccine concern again proved reliable (Wave 1 $\alpha = .86$; Wave 2 $\alpha = .87$). However, the two items measuring MMR-specific concern correlated much less strongly than they did in Study 1 ($r = .31$). This may have been due to an error in the development of the survey: unlike every other item in the questionnaire, the second MMR-specific item (*How likely are you to give the MMR vaccination to a future child?*) was measured on a scale such that low scores indicated stronger endorsement of the item (1 = extremely likely, to 7 = extremely unlikely). There also appeared to be a randomization failure on this item at Wave 1: among Trump voters there

was a much higher score on this item in the anti-vaccination condition ($M = 3.33$) than in the golf condition ($M = 2.61$) despite the fact that the manipulation of condition had not occurred. For these reasons we only analyzed the first item in this scale: “*What is your perceived likelihood that children will suffer serious side effects from MMR vaccinations?*” (1 = extremely unlikely, to 7 = extremely likely).

Wave 2

The experimental manipulation occurred at the beginning of Wave 2. Half of the participants were presented with four real tweets from President Trump containing messages which were anti-vaccination in nature (see top half of Figure 1).

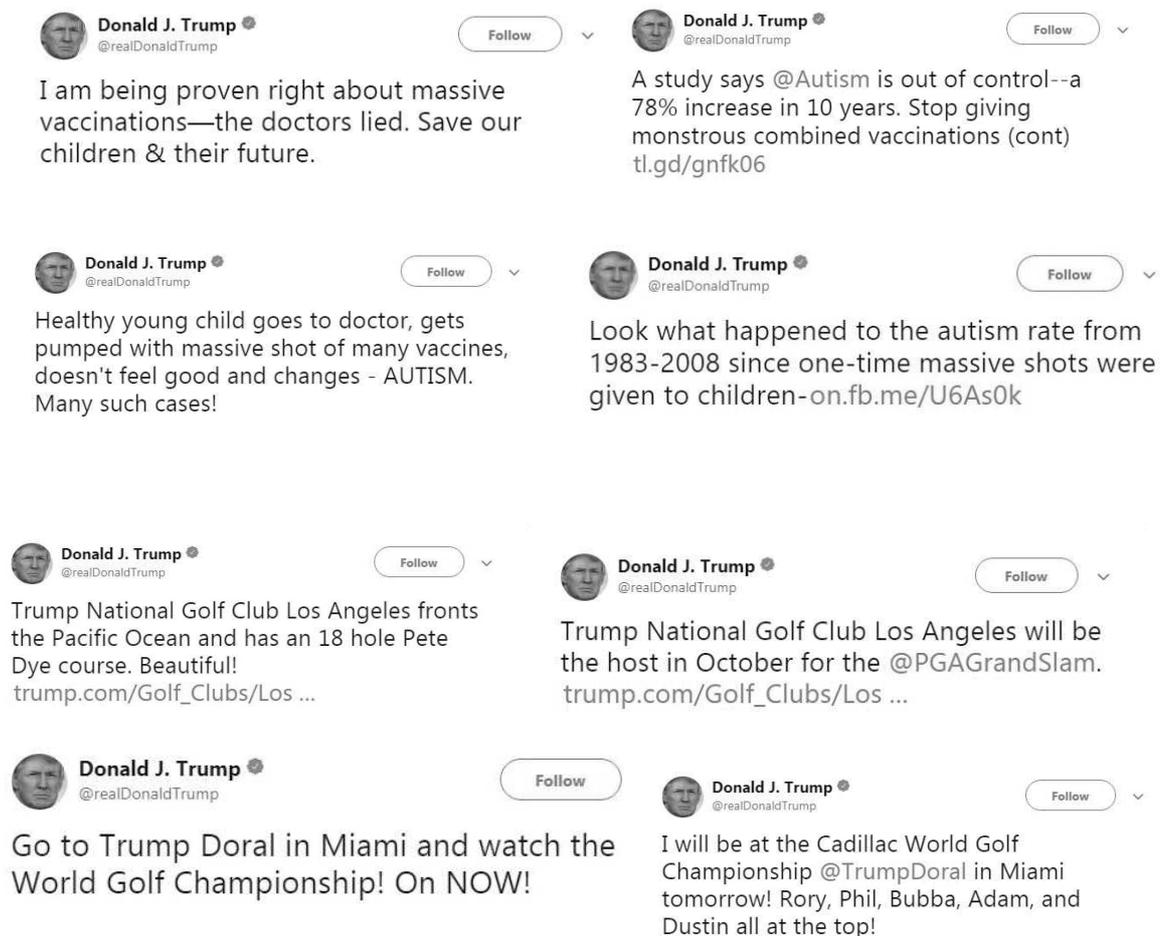


Figure 1. Real tweets from President Trump used in the vaccination condition (top four) and the control condition (bottom four)

The tweets covered multiple aspects of anti-vaccination concern, including a vaccine-autism link, ‘risks’ around vaccinating children, and the potential for negative side effects. The other half of participants were presented with four tweets from President Trump, this time regarding his golf courses and competitions (see bottom half of Figure 1). To ensure maximum comprehension, the images were presented sequentially on separate pages, with the survey software ensuring participants could not click to the next image until they had viewed each one for a minimum of seven seconds. After the manipulation, a comprehension check was included, asking participants: *“In a few words, describe what Donald Trump's tweets were about”*. Keywords such as “Golf”, and “Vaccine” within responses were coded as passes for the respective conditions. No participants failed this comprehension check. After the comprehension check, participants again completed the dependent measures described above and were then debriefed.

Results and Discussion

Using Wave 1 Data to Replicate Study 1

To test whether we could replicate the effects found in Study 1, we again conducted a series of hierarchical regression analyses (see Table 4). Consistent with Study 1, Trump voters were more concerned about vaccines than were non-Trump voters. Furthermore, this tendency was reduced to non-significance after accounting for the fact that Trump voters were more conservative and reported higher levels of conspiracist ideation. At Step 2, the model accounted for 26.6% of variance in vaccine concern and 24.8% if variance in MMR-specific concern. As in Study 1, conspiracist ideation was a stronger predictor than political conservatism; indeed, when it came to MMR-specific concern, political conservatism did not account for a significant amount of variance after controlling for conspiracist ideation.

Table 4

Predictors of Vaccine Concern: Study 2.

		<i>B</i>	<i>SE</i>	Beta	<i>p</i>	95% CI	
						Lower Bound	Upper Bound
<i>Vaccine concern</i>							
1	Vote (0 = non-Trump, 1 = Trump)	.33	.08	.17	<.001	0.16	0.49
2	Vote (0 = non-Trump, 1 = Trump)	-.01	.10	.00	.938	-0.20	0.19
	Political conservatism	.05	.02	.14	.006	0.02	0.09
	Conspiracist ideation	.42	.03	.48	<.001	0.36	0.48
<i>MMR-specific concern</i>							
1	Vote (0 = non-Trump, 1 = Trump)	.45	.15	.13	.002	0.17	0.74
2	Vote (0 = non-Trump, 1 = Trump)	.06	.18	.02	.742	-0.29	0.40
	Political conservatism	.04	.04	.06	.274	-0.03	0.11
	Conspiracist ideation	.74	.06	.48	<.001	0.63	0.85

Note. Reported values correspond to the regression step denoted in the left-hand column.

Analyzing Dropouts

In the next set of analyses, we examined the effects of Trump tweets on vaccine concern; as such, the focus was on respondents who completed both Wave 1 and Wave 2. Before conducting these analyses, however, we examined whether scores differed significantly between those who completed only Wave 1 (dropouts) and those who completed both surveys (completers). Results are summarized in Table 5. For the continuous variables, analyses were conducted through a series of independent-groups t-tests; among categorical variables, chi-square analyses were conducted. As can be seen, a disproportionate number of younger people dropped out of the study from Wave 1 to Wave 2 ($p < .001$). However, there was no systematic difference between dropouts and completers on gender, education, voting behavior, number of children, or either measure of vaccine concern.

Table 5.

Means and Standard Deviations of Dropouts and Completers: Study 2.

Measures	Dropouts	Completers
Vote (0 = non-Trump, 1 = Trump)	0.31 (0.46)	0.34 (0.48)
Gender (1 = male, 2 = female)	1.50 (0.50)	1.53 (0.50)
Age	35.50 _a (11.95)	39.27 _b (11.97)
Education	3.66 (1.04)	3.71 (0.99)
Number of children	1.91 (1.31)	2.02 (1.19)
Vaccine concern	2.33 (0.92)	2.31 (0.93)
MMR-specific concern	2.59 (1.64)	2.37 (1.60)

Note. Means with different subscripts are significantly different at $p < .05$.

Tests of Hypotheses

For the continuous measures, hypotheses were assessed using a series of 2 (wave) x 2 (vote: Trump, non-Trump) x 2 (condition: anti-vaccination, control) mixed ANOVAs.

Vaccine concern. A main effect of vote, $F(1,312)=12.28, p<.001, \eta_p^2=.04$, as well as significant 2-way interactions between vote and wave, $F(1,312)=15.21, p<.001, \eta_p^2=.05$, and between condition and wave, $F(1,312)=17.63, p<.001, \eta_p^2=.05$, were ultimately qualified by a significant three-way interaction between vote, condition, and wave, $F(1,312)=5.47, p=.020, \eta_p^2=.02$ (see Figure 2). Analysis of simple effects at Wave 2 revealed that Trump voters, $F(1,312)=4.80, p=.029, \eta_p^2=.02$, but not non-Trump voters, $F(1,312)=0.01, p=.912, \eta_p^2=.00$, reported more vaccine concern in the anti-vaccination condition than the golf (control) condition. Perhaps more importantly, in the anti-vaccination condition, Trump voters increased their levels of vaccine concern from Wave 1 to Wave 2, $F(1,312)=21.98, p<.001, \eta_p^2=.07$, but non-Trump voters did not, $F(1,312)=0.24, p=.622, \eta_p^2=.00$.

MMR-specific concern. A main effect of vote, $F(1,312)=8.12, p=.005, \eta_p^2=.03$, as well as significant 2-way interactions between vote and wave, $F(1,312)=5.63, p=.018, \eta_p^2=.02$, and between condition and wave, $F(1,312)=7.80, p=.006, \eta_p^2=.02$, were again qualified by the predicted three-way interaction between vote, condition, and wave, $F(1,312)=4.44, p=.036, \eta_p^2=.01$ (see Figure 3). Analysis of simple effects at Wave 2 revealed that Trump voters, $F(1,312)=4.92, p=.027, \eta_p^2=.02$, reported more MMR-specific concern in the anti-vaccination condition than the golf condition, an effect that was not found among non-Trump voters, $F(1,312)=0.29, p=.592, \eta_p^2=.00$. Again, in the anti-vaccination condition, Trump voters increased their levels of MMR-specific concern from Wave 1 to Wave 2, $F(1,312)=12.93, p<.001, \eta_p^2=.04$, but non-Trump voters did not, $F(1,312)=0.00, p=1.00, \eta_p^2=.00$.

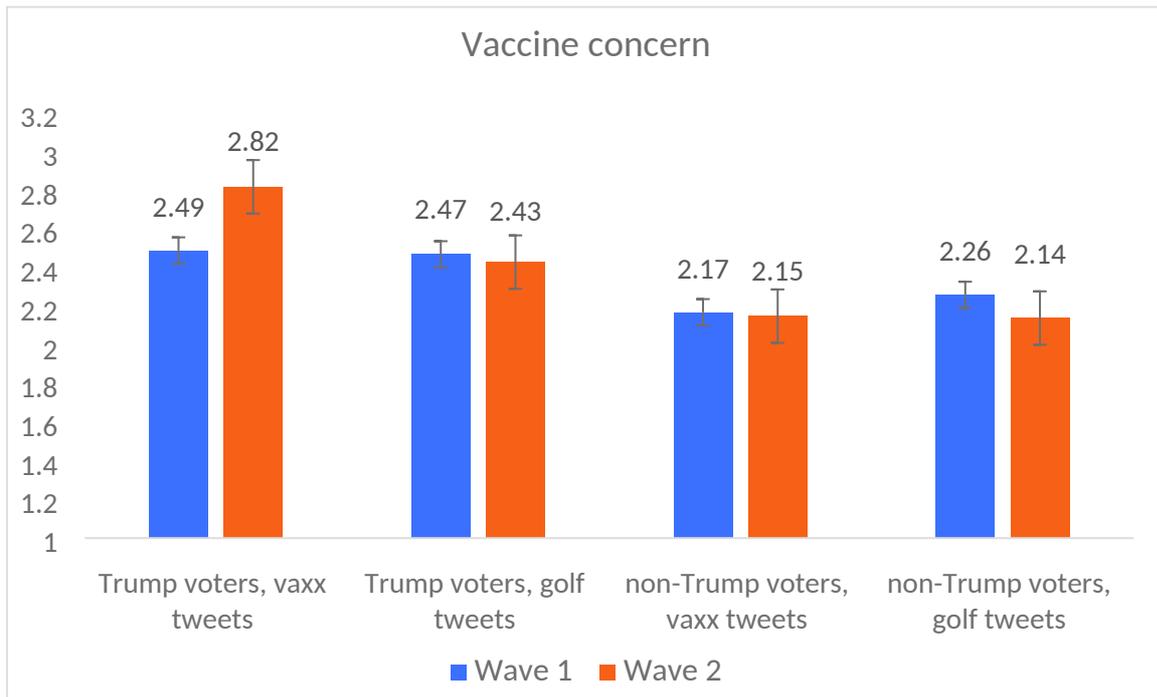


Figure 2. Mean vaccine concern scores as a function of condition, vote, and wave. Error bars represent standard errors.

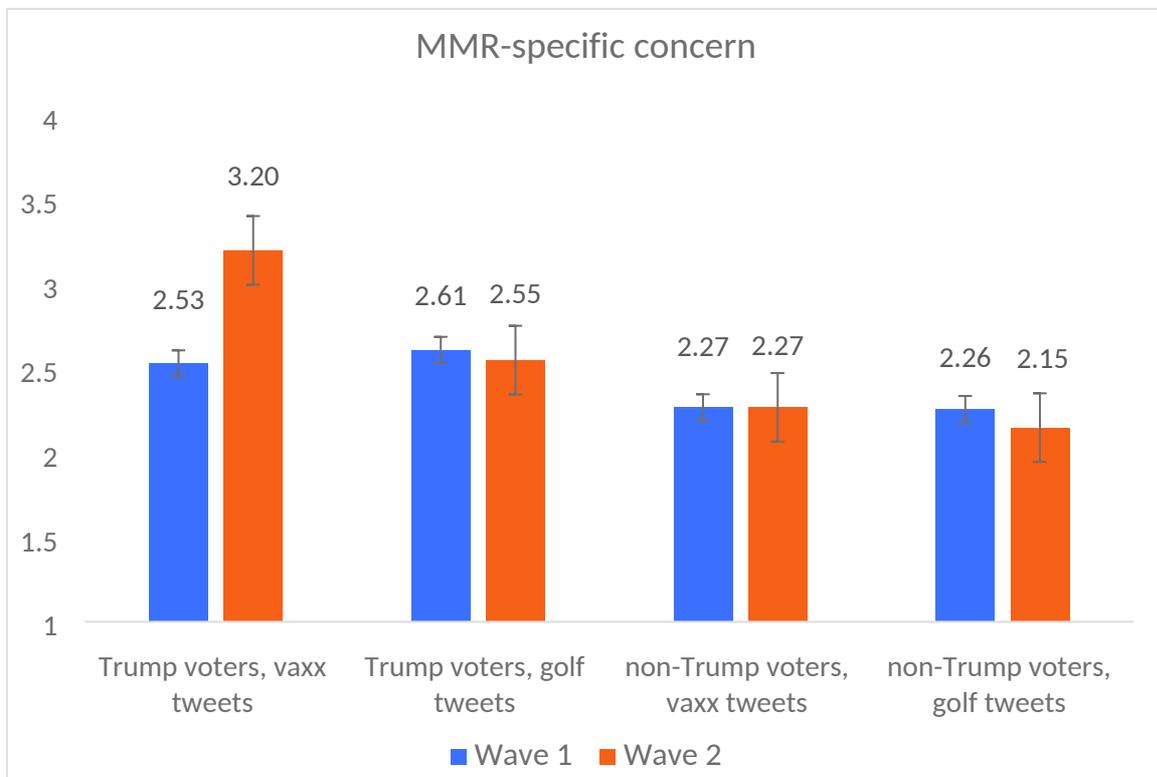


Figure 3. Mean MMR-specific concern scores as a function of condition, vote, and wave.

Error bars represent standard errors.

Analyzing Demographics

We calculated bivariate correlations among the demographics and dependent measures at Wave 1. Number of children positively correlated with vaccine concern, $r(546)=.22, p<.001$, and MMR-specific concern, $r(546)=.14, p<.001$. Women were also more likely than men to report vaccine concern, $r(543)=.16, p<.001$, and MMR-specific concern, $r(543)=.12, p=.005$. The more educated participants, the less they expressed vaccine concern, $r(545)=-.10, p=.022$, and MMR-specific concern, $r(545)=-.10, p=.017$. Finally, age shared no reliable amount of variance with the dependent measures, suggesting that the apparent systematic dropout of younger participants was unlikely to have affected the results.

To control for the effects of demographic variables on the dependent measures, ANCOVAs were conducted to covary out the effects of gender, age, number of children, and education level. Covarying out these variables did not alter the significance of any effects of manipulation condition. Specifically, the predicted three-way interaction between vote, condition, and wave remained significant for both vaccine concern, $F(1,304)=5.49, p=.020, \eta_p^2=.02$, and MMR-specific concern, $F(1,304)=4.44, p=.028, \eta_p^2=.02$.

General Discussion

U.S. citizens are receiving mixed messages about the safety of vaccines. On one hand, The United States Centers for Disease Control and Prevention have described vaccines as “our most effective and cost-saving tools for disease prevention” (CDC, 2011, p.7). At the same time, the current President of the United States has a history of making statements that support the widely-debunked myth that vaccines cause autism. Two studies were conducted to help provide insight into whether political allegiance with Trump is associated with the public’s perceptions of vaccine safety and efficacy. In addition, Study 2 addressed whether Trump’s expressed vaccine hesitancy (via Twitter) shapes the public’s levels of vaccine hesitancy.

Both studies showed that people who voted for Trump in the 2016 Presidential election were more concerned about vaccines than other voters. When it came to general concern about vaccines, this “Trump effect” was entirely accounted for by the fact that Trump voters are not only more politically conservative than other Americans but also (and independently) more predisposed to believe conspiracy theories. In fact, the tendency for Trump voters to have greater concerns about the MMR vaccine in particular was not explained so much by their political conservatism as it was by their conspiracist ideation.

In Study 2, we also tested whether exposure to Trump’s anti-vaccination tweets could shift the public’s sentiment regarding vaccination. Compared to when respondents were sampled a week earlier, there was a significant increase in vaccine concern after being exposed to Trump’s anti-vaccination tweets, but not when reading Trump’s tweets about an unrelated topic. This demonstrates that the effect is specific to the anti-vaccination content, and is not an artefact of priming Trump, or of random political events within the 1-week period between the two waves. Furthermore, the effects of Trump’s tweets were exclusively observed among Trump voters: among those who voted for candidates other than Trump, the manipulation had no effect. Predictions that the effects of Trump’s tweets on his supporters would be offset by a tendency for liberal voters to polarize toward a more *pro*-vaccination stance were not supported. In other words, Trump’s tweets had either a negative or a neutral effect on vaccine hesitancy, depending on political allegiances.

In sum, Study 1 illustrates that Trump voters are particularly prone to anti-vaccination attitudes. Study 2 further demonstrates that these attitudes are not static: it shows that a revered, prototypical ingroup member can actively exacerbate this propensity to endorse factually unfounded beliefs.

It should be noted that the effect of Trump’s anti-vaccination tweets on his supporters – although reliable – was modest in size. However, it is likely that the study under-estimates

the impact, given that many Trump voters would have come into Wave 1 of the study already having internalized his anti-vaccination message. Thus, Study 2 is equipped only to capture the fresh impact of exposure to Trump's tweets, over and above the impact that has already been "banked" from historical exposure to Trump's anti-vaccination messages. The impact of misinformation such as this has proven in the past to be resilient to corrective information (Swire et al., 2017) which may help explain why myth correction has proven to be a somewhat ineffective strategy for changing the minds of vaccine skeptics (Betsch & Sachse, 2013; Horne, Powell, Hummel, & Holyoak, 2015; Nyhan et al., 2014).

Although it remains an empirical question, there are pragmatic and theoretical reasons to believe that Trump's tweets would have a greater impact than other celebrities on their supporters. From a pragmatic point of view, Donald Trump is arguably the most powerful person in the world, and almost certainly the most famous, so his potential reach is enormous. From a theoretical perspective, Trump has a particularly strong potential for influence because he is the prototypical representative of a group that is engaged in a highly conflictual intergroup struggle (Hogg, 2001). It is this salient and highly divisive intergroup context - and the social identity processes that this context triggers - that potentially make Trump more able to influence his supporters than (for example) an actor or writer, who holds a less iconic and prototypical position within this salient intergroup context.

One overarching debate about the influence of political leaders is the extent to which they shape supporters' views, or merely reflect them. Study 2 makes clear that the "Trump effect" is not merely a case of Trump holding a mirror to people's pre-existing views: his messages have the power to change attitudes. As such, future research needs to take seriously the impact of Trump as a change-agent, one that is impeding the broader campaign to increase vaccination uptake and to eliminate infectious diseases.

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Footnotes

1. In both studies the surveys included additional questions (mostly distractor questions that were included with a view to disguising the research question). Full details of these measures can be found in the supplementary online materials.

SUPPLEMENTARY ONLINE MATERIALS

STUDY 1: ADDITIONAL MEASURES

The survey also included some distractor questions that were included with a view to disguising the research question. Full details of these measures can be found in data file on OSF, but for the sake of transparency: disgust sensitivity shared significant positive correlations with vaccine concern ($r = .35, p < .001$) and MMR-specific concern ($r = .33, p < .001$), replicating a previously reported finding (Hornsey et al., 2018). Consequentialism shared smaller but still significant negative correlations with vaccine concern (both $r_s = -.16, p_s < .001$). Trust in government was not significantly correlated with either measure of vaccine concern ($r_s < .05, p_s > .37$). A trolley dilemma measure shared a non-significant correlation with vaccine concern ($r = -.04, p = .43$) and a significant negative correlation with MMR-specific concern ($r = -.10, p = .031$).

In Study 1, participants also completed a scale measuring vaccination attitudes and beliefs used by Horne and colleagues (2015). Participants rated their agreement with five statements (1 = *strongly disagree*, 7 = *strongly agree*). Three of these items were positively worded: “I plan to vaccinate my children”, “Vaccinating healthy children helps protect others by stopping the spread of disease”, and “Doctors would not recommend vaccines if they were unsafe”. The other two items negatively worded: “The risk of side effects outweighs any protective benefits” and “Children do not need vaccines for diseases that are not common anymore” ($\alpha = .85$).

As can be seen in Table S1, the results mirrored those reported for the Opel et al. (2011) scale and the MMR-specific scale: there was a tendency for Trump voters to be more vaccine hesitant, variance that was fully accounted for by both political conservatism and conspiracist ideation. Specifically, Trump voters were more conservative and more prone to

believing conspiracy theories, and it is through these independent mechanisms that the effects on vaccine hesitancy emerged.

Because the effects on the Horne et al. (2015) scale duplicated those of the other two scales – and because the correlations among the three outcome measures were high (all r s > .75) – we did not measure the Horne et al. scale in Study 2.

Table S1

Predictors of Horne et al. measure of vaccine concern: Study 1.

		<i>B</i>	<i>SE</i>	Beta	<i>p</i>	95% CI	
						Lower Bound	Upper Bound
<i>Vaccine concern (Horne et al.)</i>							
1	Vote (0 = non-Trump, 1 = Trump)	.79	.13	.27	<.001	0.55	1.04
2	Vote (0 = non-Trump, 1 = Trump)	.08	.15	.03	.578	-0.21	0.37
	Political conservatism	.12	.03	.20	<.001	0.06	0.17
	Conspiracist ideation	.53	.05	.45	<.001	0.44	0.62

Note. Reported values correspond to the regression step denoted in the left-hand column.

STUDY 2: ADDITIONAL MEASURES

As for Study 1, we also measured trust in government and the trolley dilemma at Wave 1.

The trolley dilemma responses shared no significant correlations with either of our measures of vaccine concern (r s < .03). Trust in government shared small negative relationships with vaccine concern and MMR-specific concern (both r s = -.09, both p s = .042). Over and above these measures, we also included a measure of certainty in the belief that vaccinations cause autism at both wave 1 and wave 2. This item proved to be difficult to interpret, given that the meaning of certainty changed as a function of whether they agreed with the notion that

vaccines caused autism in the first place; which in turn was influenced by the manipulation. Consequently, this measure is not reported in this paper, but for the sake of transparency we note that no significant effects emerged on certainty as a function of any of the independent variables.