ORIGINAL ARTICLE

The anti-scientists bias: The role of feelings about scientists in COVID-19 attitudes and behaviors

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Abstract

Across three studies, we investigated who expresses concern for COVID-19, or coronavirus, and engages in behaviors that are consistent with slowing the spread of COVID-19. In Studies 1 and 2 ($n = 415$, $n = 199$), those with warmer feelings toward scientists were more concerned and engaged in greater COVID-preventative behaviors, regardless of partisanship. That is, an anti-scientists bias was related to lessened concern and toward less preventive behaviors. Furthermore, those who were the most optimistic about hydroxychloroquine, a purported but unproven treatment against the virus, were less likely to engage in behaviors designed to decrease the spread of COVID-19. In Study 3 ($n = 259$), asking participants to watch a scientist discuss hydroxychloroquine on Fox News led people to greater endorsement of COVID behaviors. In short, positive feelings toward scientists, rather than political attitudes or knowledge, related to who was concerned and those willing to engage in pandemic reducing behaviors. These behaviors were not immutable and can be changed by scientific out-reach.

1 | INTRODUCTION

In a pandemic, people can pursue behaviors that minimize the spread of infection (Centers for Disease Control & Prevention, 2020a; Del Valle et al., 2013; World Health Organization, 2020). People learn about these behaviors through a variety of sources, including politicians and scientists. Who is most likely to comply with admonishments to engage in these types of behaviors and what can be done to increase them?

In the present research, we tested who expresses worry and concern about COVID-19 and who is more likely to engage in behaviors consistent with slowing the spread of the COVID-19 pandemic. COVID-19, or coronavirus disease, is a contagious respiratory tract viral infection that has quickly spread globally generally causing mild pneumonia-like symptoms. However, it is estimated 1 in 5 people experience severe symptoms, such as difficulty breathing, respiratory failure, and multiorgan system dysfunction, requiring them to

be hospitalized (Cascella et al., 2020; Centers for Disease Control & Prevention, 2020b). At the time these studies were conducted, there was no vaccine for the disease and no known effective treatments. Therefore, medical professionals recommended that people engage in behaviors to prevent the spread of the disease.

We distinguished between COVID attitudes and behaviors. We defined COVID attitudes as beliefs or worries about COVID-19, for example, are businesses suffering, are hospitals straining. We defined COVID behaviors as how people personally act or plan to act in response to reduce the spread of the pandemic, such as engaging in social distancing and wearing face masks. To be sure, attitudes do not necessarily guide behaviors (Ajzen & Fishbein, 2005; Fazio, 1986). That is, just because people feel a certain way does not mean they will behave in a manner consistent with their feelings. In our case, people may state they are very concerned about COVID-19's impact on the economy but also indicate they do not plan on engaging in social distancing behaviors.

In examining COVID-19 attitudes and behaviors, we also explored how touting potential treatments impacted these attitudes and behaviors. While we conducted these studies, many politicians and the media were promoting hydroxychloroquine as a treatment for COVID-19. Hydroxychloroquine is an anti-malarial drug that many believed, without sufficient scientific evidence supporting or disconfirming its effects, could serve as an effective treatment for COVID-19. It gained prominence, in part, when a study reported it was an effective treatment for COVID-19 in a nonrandomized experiment that used a sample size too small to draw definitive conclusions (Gautret et al., 2020). In doing these studies, we explored how advocating potential treatments impacts COVID-19 attitudes and behaviors. To be sure, our primary question is-Who will endorse COVID-19 attitudes and behaviors?

Centrally, we focused on two variables that may associate with COVID attitudes, behaviors, and beliefs about potential treatments. One variable was political partisanship. The second was the affective stance people take to the group, scientists, who provide information and advice about how to respond to the virus. Would COVID attitudes and behaviors be associated with how warmly or coldly people felt toward scientists?

2 | POLITICAL PARTISANSHIP

Political parties have different values that they emphasize (Goren, 2005; Graham et al., 2009; Hirsh et al., 2010; Kugler et al., 2014; Lewis-Beck et al., 2008; Lye & Waldron, 1997; Sheldon & Nichols, 2009). To the extent that COVID-19 behaviors or attitudes are consistent with these values, that political party may endorse them more enthusiastically or deny their worth.

More generally, people hold partisan beliefs and attitudes that are consistent with their political preferences, while denying those of the opposing party (Bolsen et al., 2014; Slothuus & De Vreese, 2010). Partisans confronted with identical facts come to different interpretations of those facts and different ideas of their implications (Gaines et al., 2007). To the extent that the COVID-19 pandemic has been politicized, as has been suggested by World Health Organization Director-General Tedros Adhanom Ghebreyesus (Chappell, 2020), some may be more willing to engage in COVID-19 behaviors and endorse COVID-19 attitudes. For example, if conservatives place a greater emphasis on the economy compared to liberals, they may be more worried about COVID-19's impact on the economy (Morning Consult Poll/Politico, 2020).

Further, different patterns of media consumption among partisans might influence attitudes about the pandemic. Conservatives are more likely to seek our conservative news and liberals are more likely to seek out liberal news (Merkley & Stecula, 2020; Stroud, 2010). Unfortunately, this may mean that conservatives are more likely to hold more COVID misbeliefs because, at the beginning of the pandemic, conservative news outlets contained more COVID-related misinformation in the early phases of the pandemic (Motta et al., 2020).

Consistent with this argument, pollsters and political scientists have reported a partisan divide in the perceived dangers of the coronavirus. They report that Democrats are more likely to engage in behaviors that are designed to reduce the spread of COVID-19 and that they are far more concerned than Republicans that someone in their family would catch the virus, that the worse is yet to come, and that their daily lives could change in some major way in the future, to name a few (Gadarian et al., 2020; NBC News/Wall Street Journal Survey, 2020; Pew Research Center, 2020). Meanwhile, more Republicans than Democrats favored restrictions on international travel to the United States, and that Americans, in general, were overreacting to the pandemic (Pew Research Center, 2020).

To be sure, though partisan differences in concerns about COVID-19 have been noted, others have found that Americans, in general, are quite concerned about the spread of the coronavirus and 81% believed social distancing orders should continue (Politico/ Morning Consult Poll, 2020), despite current President Trump advocating the economy reopen at this same time, in contrast to the advice given by scientists. It could be that when it comes to scientific beliefs, like the dangers of a virus, people may be more likely to heed advice from scientists and medical experts.

3 | FEELINGS TOWARD SCIENTISTS

Independent of political partisanship, people's behaviors in a pandemic may also be guided by their beliefs about science and those who practice it. A vast literature has noted that attitudes toward groups predict behavior relevant to that group (for a review see Wallace et al., 2005).

Consistent with this line of work, we specifically predicted that people with warmer feelings about scientists, beyond their political partisanship, may be more likely to engage in activities that are consistent with reducing the spread of coronavirus and may be more concerned about the pandemic. Furthermore, messages from scientists may make people more likely to engage in COVID-19 behaviors, to the extent that these scientists elicit warm feelings.

Feelings matter when it comes to perceptions of social groups. In our previous work, we have found that cold and negative feelings toward opposing political parties are more strongly associated with endorsing derogatory conspiracy theories about those parties. Cognitive variables, such as general cognitive ability, are of lesser importance (Sanchez & Dunning, in press). Moreover, in a meta-analysis examining the correlates of intergroup discrimination, researchers found that feelings toward groups are more closely associated with prejudice and discriminatory behavior toward outgroups than cognitive measures, such as negative stereotypes, (Talaska et al., 2008). Thus, these findings led us to test whether liking scientists or feeling emotionally attached to your political party was related to whether you engaged in COVID attitudes and COVID behaviors.

In a sense, our work can be construed as suggesting that there is an affective component to anti-intellectualism when it comes to reactions toward scientists and what they say. Anti-intellectualism is

the rejection of critical thought as a desirable quality (Motta, 2018; Rigney, 1991). Anti-intellectualism is associated with the rejection of policy-relevant matters of scientific consensus, support for political movements and politicians who are skeptical of experts (Motta, 2018), and opposition to a variety of scientific positions (Merkley, 2020). To be sure, some theorists contend that anti-intellectualism as a construct is poorly defined (Rigney, 1991). At times, anti-intellectualism is simply measured as trust toward experts, though others have applied the construct more broadly (for examples, see Merkley, 2020; Motta, 2018). Furthermore, the measure of anti-intellectualism is a distinct construct from our measure of interest, merely liking scientists. Here, we explore whether the rejection of science, a core indicator of anti-intellectualism, could be associated with simple affective reactions to the profession.

It is important to note that we are interested in feelings toward scientists, not trust toward them and how this impacts COVID behaviors and attitudes. There is some nascent work that finds that trust toward scientists is related to COVID-19 information seeking (Merkley et al., 2020). However, whether people trust or distrust scientists is not within the scope of this paper. We were interested in how feelings that scientists elicit is related to COVID attitudes and COVID behaviors. You can trust someone and not like them. For example, you may trust the dentist but not like him or her, you may also trust your ex-wife with your children but that does not mean you like her.

We also note that feelings toward scientists might have a relationship to the rejection of science that lies outside of political partisanship, but may still be related to that political partisanship. Researchers have noted there are political differences in attitudes toward scientists, finding that conservatives are less likely to trust scientists (Mooney, 2005, 2012; see also discussion by Kahan et al., 2012). This is consistent with the assertion that conservatives may be less warm toward the scientific community, which would be associated with fewer behaviors that could lower the spread of the pandemic. If this is the case, then interventions that specifically target attitudes toward conservatives may be especially helpful in reducing the spread of COVID-19.

Additionally, although we focused primarily on feelings toward scientists, we also examined the role of knowledge on COVID-19 attitudes and beliefs. Past work has found that knowledge has modest to nonexistent correlations with health-related behaviors across a variety of domains (Ajzen et al., 2011; Kelly & Barker, 2016). However, others have noted those low in cognitive ability are more likely to believe incorrect information (Pennycook & Rand, 2019) and those who hold the most medical misbeliefs are more likely to place less value on medical experts (Motta & Callaghan, 2020).

Finally, we anticipated that listening to a scientist may enhance COVID attitudes and COVID behaviors. If it is liking a scientist that makes people more inclined toward these behaviors, perhaps watching one talk would increase concern for COVID or the likelihood to engage in COVID behaviors. In essence, watching someone might make you like them more, which may make you more likely to intend on engaging in a behavior.

4 | OVERVIEW OF PRESENT STUDIES

Across three studies, we explored who was more likely to express concerns about COVID-19, which we simply refer to as COVID attitudes, and engage in COVID-19 behaviors. We measured political partisanship and emotional views (warm vs. cold) about scientists. Also, we tested two interventions that might increase compliance with COVID-19 behaviors (studies 2–3). In doing so we tested one intervention that involved leading infectious disease expert Dr. Fauci talking about mitigation efforts (study 2). The other intervention involved Dr. Fauci talking about hydroxychloroquine, an unproven drug that President Trump has touted, on Fox News, a conservative news source (study 3).

5 | STUDY 1: RELATIONSHIPS WITH COVID BEHAVIORS AND ATTITUDES

In Study 1, our aim was to understand if partisanship and feelings about scientists were related to who is concerned about COVID-19, or COVID attitudes, and the propensity to engage in behaviors that slow the spread of the pandemic, or COVID-19 behaviors. In doing so, we also measured cognitive ability, current emotional state, and other emotional variables to ensure other constructs are not actually driving beliefs about COVID-19.

6 | METHOD

6.1 | Participants

Participants (n = 415) from Mechanical Turk using the Turk Prime platform received \$1.50 for their participation. We estimated 347 respondents would give us an 80% chance of detecting correlations of .15 when α = .05, two-tailed, and rounded up to 400 participants. However, due to the vagaries of online crowdsourcing, we ended up with 15 additional participants. In sum, there were 196 liberals, 184 conservatives, and the remaining 35 were classified as moderate or other.

6.2 | Procedure

Participants completed the following measures and tasks.

6.3 | COVID-19 behaviors and attitudes

To measure COVID-19 behaviors and attitudes we modified an existing scale about coronavirus (Gadarian et al., 2020), changed their dichotomous scales to continuous ones, reverse coded two behaviors, and added several attitudes. To measure COVID-19 behaviors, participants were asked *In the past two weeks how often have you*

done the following from 0 (less than I have ever done it) to 8 (more than I have ever done it): (a) *Washed hands*, (b) *Used sanitizer or disinfectant products*, (c) *Visited the doctor, pharmacy, or called a doctor's office*, (d) *Changed travel plans*, (e) *Had contact with others**, (f) *Gone to gatherings**,[1] (g) *Sought information on COVID-19*, (h) *Self-quarantined/been isolated*. Those that were higher on the scale stated they had done more behaviors consistent with reducing the spread of COVID-19.

We measured COVID-19 attitudes, which focused on concern about the virus, by asking participants to consider *How much do you agree that the following are concerns that people should be worried about regarding COVID-19 (coronavirus)*, on a scale from 0 (strongly disagree) to 8 (strongly agree): (a) *Estimating the number of deaths*, (b) *Businesses suffering\+*,[2] (c) *COVID-19 testing*, (d) *Getting sick*, (e) *Negative effect on economy*, (f) *Friend getting sick*, (g) *Returning to normal life*, (h) *Schools staying closed for a prolonged period*, (i) *Getting necessary items*, (j) *Supply of ventilators\+*, (k) *Supply of face masks for medical professionals\+*, (l) *Hospital capacities\+* and (m) *Amount of people that will die\+*. Those that are higher in COVID-attitudes expressed more concern about COVID-19.

6.3.1 | Emotional variables

Participants completed the PANAS, by asking them the extent to which they had felt positive and negative feelings in the past two weeks (Watson et al., 1988). To gauge people's emotional reactions to relevant actors in the COVID-19 pandemic, we asked participants to fill out classic "feeling thermometer" measures (Miller, 1980; Weisberg & Miller, 1980) on the following groups: Republicans, Democrats, scientists (along with rich people and poor people as filler items). For each, they provided a number from 0 to 100 where 0 represents very cold or unfavorable feelings and 100 represents very warm or favorable feelings. "If you don't feel particularly warm or cold toward a group, you would rate it at the 50-degree mark."

Participants also reported their feelings toward Republicans and Democrats more directly. Then they answered, yes or no for each emotion, whether the Republican and Democratic party made them feel *enthusiastic*, *frustrated*, *angry*, *proud*, *afraid*, or *hopeful*.

To measure emotional investment in one's party versus the opposition, we first recoded the Republican and Democrat feeling thermometers into congenial and uncongenial variables (See Sanchez & Dunning, in press for a thorough explanation). For example, for participants stating they were liberal, the Democrat thermometer was coded as their congenial thermometer and the Republican thermometer was their uncongenial thermometer. Then we took the congenial party thermometer and subtracted the uncongenial party thermometer. For the other emotions

reported, we took the net sum of the positive emotions toward the congenial party and subtracted the net sum of the emotions toward the uncongenial party. We standardized the net thermometer and the net of the emotions to put them on the same scale and added them together.

6.3.2 | Cognitive ability

To assess general cognitive ability, participants completed a 50-item version of the Ammons Quick Test of Intelligence (Ammons & Ammons, 1962), which correlates positively with the WAIS verbal scale (Cull & Colvin, 1970).

6.3.3 | Sociodemographic and political questions

Participants reported their highest level of education, gender, age, they state they lived in, their income, and political ideology from very liberal to very conservative. All participants were recoded as either liberal (coded as 1) or conservative (coded as 2) to form a political ideology variable.

We obtained these variables by asking the following questions: (a) *What is the highest level of education that you have* achieved? (less than high school/high school or GED/ some college/2 year degree/4 year degree/professional degree/doctorate) (b) *Please tell us your gender (male/female/do not wish to specify)*, (c) *Please tell us your age*, (d) *In what state do you live?*, (e) *Last year, what was your total income before taxes on all of the people living in your house or apartment?* (f) *Which if the following best describes your political view (strongly liberal/liberal/moderate/conservative/strongly conservative/other)?*

7 | RESULTS

All code and data are publicly available at https://osf.io/upxaq/. We excluded participants who scored three standard deviations below or above the mean on any of the following variables described below (COVID behaviors, COVID attitudes, emotional investment, PANAS, Republican thermometer, Democratic thermometer, scientist thermometer, and Ammons. We identified the following outliers: 11 in Ammons, 9 in COVID behaviors, 6 in COVID attitudes, and 6 in the science thermometer. This was the standard method of excluding outliers throughout all of our studies. We only excluded the participant data on the specific variable for which an outlier was detected and included their data on the other measures, this left us with $n = 404$ in Ammons, $n = 406$ in COVID behaviors, $n = 409$ in COVID attitudes, and $n = 409$ in the science thermometer.

First, we created composite COVID attitude ($\alpha = .90$) and a COVID behavior ($\alpha = .72$) scales. We also dichotomized political ideology and recoded them as 1 = liberal and 2 = conservatives. Then

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[1] The two items with a * were reverse coded.

[2] The items with a + represent additions from the original scale.

we created emotional investment variables. A higher number indicates more positive emotions toward their ingroup (political party) and more negative emotions toward the outgroup (opposing political party).

As can be seen in Table 1, only the scientist thermometer bore a relationship with both COVID attitudes (r (402) = .33, $p < .001$) and COVID behaviors (r (398) = .28, $p < .001$). We also tested each individual COVID behavior (e.g., washed hands) separately and correlated each with political ideology and found no significant differences, suggesting that differences in behaviors are not driven by mere political ideology.

Next, we tested individual COVID attitudes and behaviors and their relationship to the Republican thermometer, the Democratic thermometer, emotional investment, and the science thermometer. In terms of COVID attitudes, though overall COVID attitudes were related to the Democratic thermometer, r(407) = .12, p = .02, and not to the Republican thermometer, there were clear partisan differences. Those that felt warmer toward Republicans generally had the opposing concerns as those that felt warmth toward Democrats. Importantly again, the largest relationships were between COVID attitudes and how warm people felt toward scientists. Controlling for the intelligence does little to reduce the correlations between science thermometer and COVID-19 behaviors and attitudes.

For COVID behaviors, almost every question was related to how warm people felt toward scientists, indicating that scientific belief may be driving compliance with behaviors that will slow the growth of coronavirus (see Table 2).

In fact, the relationship between the warmth participants held toward scientists and COVID behaviors remains significant when controlling for intelligence, education, gender, age, income, political ideology, and confirmed cases in their state, b = 0.09, SE_b = 0.02, 95% CI [.05, 0.12], $p < .001$, η_p^2 = 0.05, while all of the other variables vanish to nonsignificance, with the exception of income, b = 0.37, SE_b = 0.18, 95% CI [.10, 0.73], p = .04, η_p^2 = 0.01, with those with higher income exhibiting more behaviors. Refer to Table 3.

Similarly, we did the same analysis for COVID attitudes, and found similar results, b = 0.23, SE_b = 0.04, 95% CI [.16, 0.31], $p < .001$, η_p^2 = 0.09, with all of the other variables becoming nonsignificant except age, b = 0.16, SE_b = .06, 95% CI [.04, 0.27], p = .009, η_p^2 = 0.02, with older participants expressing more concern. Refer to Table 4.

In sum, feelings toward scientists related to COVID behaviors and COVID attitudes. To be sure, warmth toward political parties did relate to certain COVID attitudes, with each having different specific concerns about the virus.

8 | STUDY 2: SCIENTISTS' ROLE IN COVID-19 BEHAVIORS AND ATTITUDES

In this next study, we sought to replicate the findings of the previous study that feelings toward scientists relate to COVID behaviors and attitudes. We also explored how optimism about hydroxychloroquine, an antimalarial drug that has been touted as a potential treatment for COVID-19 (Gautret et al., 2020), impacts COVID attitudes and behaviors.

Last, if feeling warm toward scientists increases the willingness to engage in COVID behaviors and attitudes, we tested whether watching a short video about a scientist, Dr. Anthony Fauci, would change COVID behaviors and attitudes. We thought listening to Fauci might be particularly effective at changing behaviors because his political identity is unknown.

9 | METHOD

9.1 | Participants

Participants (n = 199) from Turk Prime platform received $2.00 for their participation. In this study, we anticipated our intervention would produce a moderate effect, thus we anticipated at a total of n = 102 an 80% chance of detecting d = .5 when α = .05, two-tailed.

TABLE 1 Zero-order correlations between measures (Study 1)

| Variable | Mean | SD | Zero-order correlations | | | | | | |
			1	2	3	4	5	6	7
1. COVID behaviors	32.39	7.40							
2. COVID attitudes	83.14	14.73	0.43**						
3. Emotional investment	0	1.81	0.14*	0.06					
4. Scientist thermometer	78.64	20.42	0.28**	0.33**	0.09				
5. Cognitive ability	38.75	7.14	0.14*	0.07	0.08	0.28**			
6. PANAS	8.37	14.71	0.05	−0.06	0.03	0.003	0.01		
7. Political ideology	1.48	0.5	−0.01	−0.05	−0.01	−0.27**	−0.10	0.19*	

Note: All tests two-tailed.

*$p < .05$; **$p < .001$.

TABLE 2 Item correlations with thermometers and emotional investment (Study 1)

Variable	Mean	SD	Repub Therm	Demo Therm	Emo Invest	Sci Therm	Sci Therm control IQ
COVID-19 behaviors	32.4	7.4	0.02	0.08	0.14*	0.28**	0.25**
Sought information on COVID-19	6.6	1.7	−0.04	0.07	0.10*	0.38**	0.28**
Washed hands	6.6	1.7	−0.02	0.05	0.14*	0.33**	0.23**
Used sanitizer or disinfectant products	6.3	1.7	0.04	0.02	0.15*	0.33**	0.27**
Self-quarantined/been isolated	6.7	1.8	−0.04	0.06	0.10	0.30**	0.21**
Changed travel plans	5.1	2.3	0.04	−0.003	0.07	0.11*	0.04
Gone to gatherings*	1.1	1.8	−0.002	−0.10	−0.05	−0.16**	−0.09
Had contact with others*	1.4	1.5	−0.002	−0.04	−0.07	−0.16**	−0.14*
Visited the doctor, pharmacy, or called a doctor's office	3.0	1.9	0.01	−0.02	−0.04	−0.07	−0.09
COVID-19 attitudes	83.1	14.7	−0.002	0.12*	0.06	0.33**	0.32**
Returning to normal life	5.7	2.1	0.25**	−0.08	0.14*	0.08	0.03
Businesses suffering	6.4	1.9	0.18**	−0.16**	0.05	0.04	0.004
Negative effect on economy	6.6	1.8	0.15*	−0.10*	0.03	0.08	0.01
Amount of people that will die	6.4	2.0	−0.11*	0.12*	0.07	0.27**	0.25**
Supply of face masks for medical professionals	6.7	1.8	−0.12*	0.20**	0.05	0.40**	0.34**
Hospital capacities	6.9	1.7	−0.16**	0.18**	0.03	0.38**	0.36**
Supply of ventilators	6.7	1.7	−0.18**	0.21**	0.10*	0.35**	0.31**
COVID-19 testing	6.3	2.0	−0.20**	0.18**	0.09	0.35**	0.32**
Estimating the number of deaths	5.6	2.1	−0.05	0.15*	0.05	0.22**	0.22**
Friend getting sick	6.3	1.8	−0.07	0.05	0.07	0.32**	0.27**
Getting sick	6.4	1.8	−0.07	0.10*	0.10	0.35**	0.30**
Getting necessary items	6.2	1.8	−0.03	0.09	−0.02	0.24**	0.21**
Schools staying closed for a prolonged period	6.0	2.0	0.08	−0.01	−0.01	0.08	0.06

Note: All tests two-tailed.
*p < .05; **p < .001.

TABLE 3 COVID attitudes and feelings toward scientists in Study 1

Model	b	SE_b	p	95% Lower	95% Upper	η_p^2
Scientist thermometer	0.09	0.02	<.001	0.05	0.12	0.05
Cognitive ability	0.09	0.05	ns	−0.01	0.19	0.01
Education	0.04	0.290	ns	−0.50	0.6	0.00
Gender	0.12	0.6800	ns	−1.32	1.36	0.00
Age	0.02	0.03	ns	−0.04	0.07	0.00
Income	0.37	0.18	.04	0.10	0.73	0.01
Politics	1.23	0.75	ns	−0.25	2.71	0.01
Confirmed cases	−0.00001	0.0000	ns	0.00	0.00	0.00

However, using this platform we could recruit only a minimum of 100 per political group, instead of the 51 participants per political party our power analysis indicated that we needed. Thus, we aimed to recruit a total of 200 participants. Due to vagaries in the platform, we used though we aimed to recruit 200 participation but we were only able to recruit 199. Furthermore, we excluded 12 participants that did not spend at least three minutes watching the video in the study because they were not paying attention. In sum (n = 187), we

TABLE 4 COVID attitudes and feelings toward scientists in Study 1

| Model | Measure | | | | | |
	b	SE_b	p	95% Lower	95% Upper	η_p^2
Scientist thermometer	0.23	0.04	<.001	0.16	0.31	0.09
Cognitive ability	−0.13	0.10	ns	−0.33	0.07	0.005
Education	−0.68	0.59	ns	−1.83	0.48	0.00
Gender	1.48	1.40	ns	−1.27	4.22	0.00
Age	0.16	0.06	.008	0.04	0.27	0.02
Income	0.33	0.38	ns	−0.42	1.07	0.00
Politics	0.70	1.54	ns	−2.33	3.74	0.00
Confirmed cases	−0.0001	0	ns	0.00	0.00	0.01

collected 97 liberals, 68 conservatives, and the remaining 34 were classified as moderate or other. We excluded participants in the same manner as in the previous study.

9.2 | Procedure

Participants completed the following measures and tasks.

9.2.1 | Emotional measures

Participants completed the same thermometers and feelings about political parties used in the previous study.

9.2.2 | Scientific intervention

Participants were then randomly assigned to two conditions, one of which viewed a video featuring Dr. Fauci. In the Fauci condition participants were told,

> Next we would like you to watch a short video. If there is an advertisement on the page please ignore it. The video you will watch is of Dr. Anthony Fauci, Director of the National Institute of Allergy and Infectious Diseases. He is discussing the Coronavirus. Note: You will not be compensated if you do not watch this video.

They then watched a short video (about 3 min) of Fauci on CNBC discussing the 15 days of mitigation and how they may have resulted in flattening the curve and that another 30 days of mitigation are needed to prevent clusters from worsening.

In the control condition participants were instructed the following:

> Next we would like you to watch a short video. If there is an advertisement on the page, please ignore

it. The video you will watch is of a log burning. Note: You will not be compensated if you do not watch this video.

Then they watched a short video (about 3 min) of a log burning. Then all participants were told that

> We'd like you to answer some questions about your opinions of current events. Dr. Anthony Fauci, Director of the National Institute of Allergy and Infectious Diseases, has recommended that people do certain behaviors because of the coronavirus. On the next page tell us how likely you are to do these going forward.

9.2.3 | COVID-19

Then participants were asked how often they planned on doing the same COVID behaviors from Study 1 in the next two weeks. The COVID attitude scale was also identical to the previous study.

9.2.4 | Hydroxychloroquine

Then participants were asked, *As it pertains to coronavirus …… How strongly do you agree with the following statements*, from 1 (strongly disagree) to 7 (strongly agree): (a) *Doctors should prescribe hydroxychloroquine*, (b) *Hydroxychloroquine is the most effective treatment for coronavirus*, (c) *Other drugs besides hydroxychloroquine should be used to treat coronavirus**, (d) *Doctors should be mindful when prescribing hydroxychloroquine because there may be a shortage in it to treat lupus and arthritis**. The * indicates the items are reverse scored.

9.2.5 | General political questions

These questions are identical from study 1.

9.2.6 | Science knowledge

Then participants = answered 10 8th grade science questions that were modified to be placed on a six-option multiple choice (TIMSS, 2007 Assessment, 2009; TIMSS 2011 Assessment, 2013).

To measure science knowledge, participants were instructed the following: Now we will present you with a short knowledge test. Please try to answer these questions to the best of your abilities, without using external resources. Then they answered 10 8th grade science questions that were modified to be placed on a six-option multiple-choice format (e.g., The color of an apple is the same as the color of the light waves ... (a) that travel through the object, (b) that are the least colorful, (c) that are reflected by the object, (d) that travel around the object, (e) that vibrate through the object, (f) that are floating around the object; answer: that are reflected by the object) (TIMSS, 2007 Assessment, 2009; TIMSS 2011 Assessment, 2013).

9.2.7 | Approval of COVID-19 response

Finally, participants were told the following: *Tell us how good of a job you feel these people are doing. We would like to get your feelings about the coronavirus response toward three people using something we call the feeling thermometer.*

They reported their feelings about the coronavirus response for Fauci, Trump, and Cuomo.

10 | RESULTS

We identified the following outliers: three in COVID behaviors, five in COVID attitudes, and two in the science thermometer. Also, all of the data for 12 participants were excluded because they did not spend at least 3 min watching the videos. Also, we created a scale for the hydroxychloroquine questions ($\alpha = .52$). We added the hydroxychloroquine questions such that a higher number meant

people were more optimistic the drug could serve as a treatment for COVID-19.

To be sure, if we delete the following item from our scale: Other drugs besides hydroxychloroquine should be used to treat coronavirus*: ($\alpha = .72$). Deleting this item does not change the interpretation of our results in this study, with one notable exception, it declines the correlations between hydroxy attitudes and COVID behaviors to marginal significance, $r = -.12$, $p = .12$). In the subsequent analyses using the hydroxy scale, we used the original four-item scale to obtain more variability. However, the use of this scale does not change the interpretation of the results.

As in Study 1, we found those with greater warmth toward scientists were more likely to engage in COVID behaviors, $r(180) = .31$, $p < .001$, and had more COVID attitudes (indicating they expressed more concern), $r(179) = .23$, $p < .001$ (see Table 5).

The relationship between COVID behaviors and warm feelings toward scientists remained significant controlling for science knowledge and attitudes about hydroxychloroquine, $b = 0.11$, $SE_b = 0.03$, 95% CI [.05, 0.17], $p < .001$, $\eta_p^2 = 0.07$. We did a similar analysis focused on COVID attitudes and found similar results, $b = 0.16$, $SE_b = 0.05$, 95% CI [.06, 0.26], $p = .002$, $\eta_p^2 = 0.05$. See Table 6.

We also tested correlations between specific COVID attitudes and behaviors, political feelings (Cuomo COVID response, Trump COVID response, Democratic thermometer, and Republican thermometer), and scientific feelings (Fauci COVID response and the scientist thermometer). We found feelings toward science were the only dimensions correlated with both COVID attitudes and behaviors. See Table 7.

In terms of hydroxychloroquine, we found those that held more optimistic about hydroxychloroquine as a potential treatment for COVID-19 were less likely to engage in COVID behaviors, $r(185) = -.15$, $p = .04$, less warm toward scientists, $r(183) = -.28$, $p < .001$, had less science knowledge, $r(185) = -.15$, $p = .04$) and were conservative, $r(163) = .34$, $p < .001$.

To test the effect of the Fauci video on COVID attitudes and behaviors, we conducted a mixed model analysis, including condition

TABLE 5 Zero-order correlations between measures (Study 2)

| Variable | Mean | SD | Zero-order correlations | | | | | | |
			1	2	3	4	5	6	7
1. COVID behaviors	33.4	8.2							
2. COVID attitudes	84.5	12.4	0.32**						
3. Emotional investment	0.1	1.9	0.04	0.10					
4. Scientist thermometer	77.3	19.7	0.31**	0.23*	0.21*				
5. Science knowledge	7.5	2.4	0.24**	−0.01	0.07	0.23*			
6. Hydroxy attitudes	−1.6	3.7	−0.15*	−0.06	−0.01	−0.28**	−0.15*		
7. Political ideology	1.4	0.5	0.003	−0.11	−0.16*	−0.29**	−0.05	0.34**	

Note: All tests two-tailed.

*$p < .05$; **$p < .001$.

TABLE 6 COVID behaviors and attitudes with feelings toward scientists in Study 2

Model	b	SE_b	p	95% Lower	95% Upper	η_p^2
						Measure
COVID behaviors						
Scientist thermometer	0.11	0.03	<.001	0.05	0.17	0.07
Science knowledge	0.491	0.26	ns	−0.02	1.01	0.02
Hydroxy attitudes	−0.11	0.16	ns	−0.43	0.21	0.00
COVID attitudes						
Scientist thermometer	0.16	0.05	.002	0.06	0.26	0.07
Science knowledge	−0.38	0.41	ns	−1.2	0.44	0.02
Hydroxy attitudes	0.01	0.25	ns	−0.49	0.51	0.00

TABLE 7 Correlations between COVID measures and with feelings toward politicians and scientists (Study 2)

Variable	Mean	SD	COVID behaviors	COVID attitudes
Cuomo thermometer	58.1	28.8	0.19*	0.08
Fauci thermometer	74.9	24.5	0.33**	0.15*
Trump thermometer	40.7	38.7	−0.10	−0.14
Democrat thermometer	50.0	30.7	0.08	0.12
Republican thermometer	45.8	33.6	−0.01	−0.08
Scientist thermometer	77.3	19.7	0.31**	0.23*

Note: All tests two-tailed.
*$p < .05$; **$p < .001$.

as fixed variables and participant as a random variable. Watching the video did not significantly impact COVID behaviors, $b = -0.66$, $SE_b = 1.21$, $p =$ ns, or COVID attitudes, $b = -1.87$, $SE_b = 1.83$, $p =$ ns.

Overall, we replicated our main findings from Study 1, demonstrating those who felt warmer toward scientists were more likely to report engaging in COVID-19 behaviors, and expressed more concern about COVID-19. Furthermore, those that were optimistic about potential treatment, hydroxychloroquine, were less likely to engage in behaviors consistent with slowing the spread of COVID-19. Though the evidence for this was more mixed given that if you eliminated one item from our hydroxy scale the relationship between hydroxy attitudes and COVID behavior was marginal.

We did not find any effect of watching the Fauci video by the condition in terms of COVID behaviors or attitudes. However, this could be because in both conditions participants were instructed that Fauci recommended these behaviors and then we asked people how likely they would engage in these behaviors. In our next study, we sought to rule this out.

11 | STUDY 3: DR. FAUCI ON FOX NEWS

Last, we sought to create another intervention to increase compliance with COVID-19 behaviors based on what we learned in our previous studies. In the last study participants in both the intervention and control condition were instructed that Fauci believed they should be engaging in certain behaviors. It could be that at the time of the

study, people were already aware of Fauci and this impacted the results. For this next study, participants merely watched a video and were asked several questions about COVID behaviors, without being told that Fauci recommended the behaviors. Furthermore, we changed the news platform. In this study, participants watched Fauci on Fox News.

Previously, we found that conservatives were less likely to feel warm toward scientists, and those who felt less warm toward scientists were less likely to engage in COVID-19 compliant behaviors. Thus, for this study, we intended to increase COVID-19 compliant behaviors by showing a scientist, Fauci, speak specifically about hydroxychloroquine specifically on a conservative-oriented news platform (Fox News).

12 | METHOD

12.1 | Participants

Participants ($n = 300$) from Mechanical Turk using the Turk Prime platform received $3.00 for their participation. In this study, we anticipated the intervention would produce a moderate effect, an anticipated at $n = 102$ an 80% chance of detecting $d = .5$ when $\alpha = .05$, two-tailed. For the correlations, given our previous study, we estimated 100 respondents per political group would give us an 80% chance of detecting correlations of .20 when $\alpha = .05$, two-tailed. Thus, our sample consisted of aimed to recruit a total of 200 participants. However, we rounded up to 300 because we know that

we would exclude outliers. Furthermore, we conducted this study over two days and thus expected a higher dropout rate.

In sum across two days, there were 130 liberals, 136 conservatives, and the remaining 16 were classified as moderate or other. We excluded participants in the same manner as in the previous study.

12.2 | Day 1 procedure

Given the number of questions asked, we decided to conduct this study over two days. On Day 1, participants were compensated $1.

12.2.1 | Feeling thermometers

First, participants completed the feelings thermometer (i.e., Republicans, Democrats, rich people, scientists, poor people) we used in the previous study.

12.2.2 | General political questions

These questions were identical to the questions used in the previous study.

12.3 | Day 2 procedure

12.3.1 | Video conditions

Participants were then randomly assigned to a Fauci or control condition. In the Fauci condition, participants were told

> Next we would like you to watch a short video. If there is an advertisement on the page please ignore it. The video you will watch is of Dr. Anthony Fauci, Director of the National Institute of Allergy and Infectious Diseases. He is discussing the Coronavirus. Note: You will not be compensated if you do not watch this video.

They then watched a short video (about 3 min) of Fauci on Fox News talking about hydroxychloroquine. Specifically, in the video, Dr. Fauci is asked how effective he believes hydroxychloroquine is for COVID-19. In the video, Fauci indicated there is insufficient scientific evidence to reach a conclusion about its effectiveness for COVID-19.

In the control condition participants were instructed the following:

> Next we would like you to watch a short video. If there is an advertisement on the page, please ignore it. The video you will watch is of a log burning. Note:

> You will not be compensated if you do not watch this video.

Then they watched a short video (about 3 min) of a log burning.

Then all participants were told, *We'd like you to answer some questions about your opinions of current events*.

12.3.2 | COVID-19

Then participants were asked the same COVID-19 behaviors and attitudes questions that were used in Study 2.

12.3.3 | Hydroxychloroquine

The same hydroxychloroquine scale was used as in the previous study. Furthermore, three additional questions were added. The three questions included how strongly participants agreed, from strongly disagree (1) to strongly agree (7), with the following: (a) *Doctors should wait to prescribe hydroxychloroquine until the data from more rigorous studies are in about its effects**, (b) *Doctor's observations from their treatment of Covid-19 are sufficient in deciding whether hydroxychloroquine is an effective drug*, (c) *It is unwise to wait for more data about hydroxychloroquine while the Covid-19 pandemic is in progress*. These were coded in the same manner as the other hydroxychloroquine questions, such that a higher number expressed more optimism about the drug as a treatment.

12.3.4 | Science knowledge

Then participants answered the same test that was used in the previous study.

13 | RESULTS

We identified the following outliers: three in COVID behaviors, three in COVID attitudes, five in the science thermometer, one in a new hydroxy scale, two in congenial feelings, and five in the congenial thermometer. Also, data from 17 participants were excluded because they did not spend at least 3 min watching either videos. This left a total of 259 participants who completed the study over both days and that watched the video.

As in our previous studies, those with greater warmth toward scientists were more likely to engage in behaviors consistent with minimizing the spread of COVID-19, $r (253) = .20$, $p = .002$, and with attitudes, indicating that they were concerned with COVID-19, $r(253) = .27$, $p < .001$ (see Table 8).

Next, we explored reactions to watching Fauci on Fox News. To test these differences, first, we expanded the hydroxy scale we used in the previous study ($\alpha = .60$), and added the three additional

TABLE 8 Zero-order correlations between measures (Study 3)

| Variable | Mean | SD | Zero-order correlations | | | | | | | |
			1	2	3	4	5	6	7	8
1. COVID behaviors	32.3	7.7								
2. COVID attitudes	84.9	13.4	0.45**							
3. Emotional investment	0.0	1.8	0.13*	0.06						
4. Scientist thermometer	78.6	19.7	0.20*	0.27**	0.03					
5. Science knowledge	7.5	2.3	−0.06	−0.08	0.02	0.20**				
6. Hydroxy attitudes	−0.04	7.51	−0.07	−0.10	0.02	−0.36**	−0.10			
7. Political view	1.5	0.5	−0.05	−0.10	−0.07	−0.37**	−0.05	0.52**		
8. Video (1 = control; 2 = Fauci)	1.5	0.5	0.14*	0.05	−0.01	−0.07	−0.06	0.09	0	

Note: All tests two-tailed.

*$p < .05$; **$p < .001$.

TABLE 9 COVID Behavior across conditions Study 3

| Model | Measure | | | | | |
	b	SE_b	p	95% Lower	95% Upper	η_p^2
Condition	2.2299501	0.9652664	.02	0.33	4.13	0.02
Science knowledge	−0.320436	0.2160683	ns	−0.75	0.11	0.01
Hydroxy attitudes	−0.130391	0.1506356	ns	−0.43	0.17	0.00
Politics	−0.463742	0.5674199	ns	−1.58	0.65	0.00
Scientist Thermometer	0.0864274	0.027395	.002	0.03	0.14	0.04

questions we created ($\alpha = .82$). The new scale has better internal validity and did not yield different findings from using the original scale instead of in this study. Higher scores meant people endorsed more caution about the use of the drug.

Interestingly, watching Fauci discuss hydroxychloroquine did not change overall attitudes about the drug, $r = .09$, $p = $ ns, with conservatives ($M = 3.83$, $SD = 6.43$) expressing far more optimism compared to liberals ($M = −4.06$, $SD = 6.51$), $r (246) = .52$, $p < .001$.

As expected, we found that watching Fauci on Fox News led people to commit to engaging in preventative COVID-19 behaviors, $b = 2.23$, $SE_b = 0.97$, 95% CI [.33, 4.13], $p = .02$, $\eta_p^2 = 0.02$, even after controlling for science knowledge, the hydroxychloroquine attitudes, political views, and the scientist thermometer and using participant as a random effect. See Table 9.

Unexpectedly, we saw only the main effects. We did not find any significant ideology or thermometer interactions across conditions. See Table 6 for the means in all of the COVID behaviors across conditions. The * in Table 10 indicate reverse coding.

TABLE 10 Intended COVID behaviors between condition (Study 3)

| Variable | Control | | Fauci video | |
	Mean	SD	Mean	SD
COVID-19 behaviors	31.2	8.2	33.4	7.1
Seek information on COVID-19	5.7	1.9	6.1	1.7
Wash hands	6.5	1.6	7.0	1.3
Use sanitizer or disinfectant products	6.2	1.9	6.6	1.6
Self-quarantined/be isolated	6.7	1.8	6.9	1.6
Change travel plans	5.2	2.6	5.8	2.4
Go to gatherings*	1.0	1.7	0.6	1.1
Have contact with others*	1.2	1.6	1.1	1.6
Visit the doctor, pharmacy, or called a doctor's office	2.7	1.8	2.5	1.9

14 | DISCUSSION

Who is the least likely to be concerned about and engage in behaviors to reduce the spread of COVID-19? Our results suggest

that an emotional anti-scientist bias or sentiment is associated with expressing concern or engaging in COVID-preventative behaviors. Those who expressed warmth toward scientists expressed more

concern about the impact of the virus and reported engaging in more preventative behaviors, relative to those who felt colder toward the profession. This relationship emerged even after controlling for political partisanship.

However, we also found that these behaviors are not immutable. They can be moved. In Study 3, we found that showing a prominent scientist discuss a potential treatment for COVID-19 on Fox News led to a greater intention to conduct COVID behaviors. To be sure, we should point out that the video was intended to inform people about hydroxychloroquine in a factual manner. Interestingly it did not change attitudes about the drug, with conservatives expressing far more optimism about the drug compared to liberals. It could be that conservatives express less concern about scientific risks. Other research should explore this issue.

It is also important to note, at the time we ran these studies, that there were no known treatments or vaccines for COVID-19. However, many times politicians at the time speculated about potential treatments in order to give people hope. For example, hydroxychloroquine is one drug that has been touted by President Trump and other politicians (Grady & Kannapell, 2020). When these drugs become politicized, people in that political party may be more inclined to believe they are effective, and when people believe there are treatments, this may undermine behaviors that are consistent with behaviors and attitudes. That is, if people believe there is a cure, they may be more lax in their behaviors and attitudes.

At the end of the calendar year 2020, several vaccines had been developed and a few even approved, but not enough manufactured to give to the entire population (Goldhill, 2020). Ironically, this meant that although the pandemic might have reached the beginning of its end, people could potentially behave in ways that spread the pandemic because of their optimism toward vaccine, leading to a worsening of the pandemic until vaccinations were widely available. To be sure, our manuscript suggests that those who are warmer toward scientists may be more inclined to be vaccinated and to listen and engage in COVID behaviors. Therefore, it might be fruitful for scientists to clearly outline why people should continue to engage in COVID behaviors until a vaccine is readily available to the public. It also suggests a new issue for this phase of the pandemic: Those holding cold views of scientists may be the most likely to be vaccine-hesitant, contributing to delays in attaining the herd immunity levels needed to control and potentially eradicate the virus from daily life.

Finally, our studies have several limitations. First, these studies were done in the midst of the coronavirus pandemic. As such, they may show history effects, and these effects may not be as pronounced in the absence of a pandemic. Second, our studies were conducted on MTurk and may not constitute representative samples of Americans. Further, studies 1–2 were correlational in nature and did not measure actual behaviors but rather self-reported behaviors. We found that those that felt colder toward scientists were less likely to engage in COVID behaviors, but we cannot infer causality in the relationship between feeling about scientists and COVID-related behaviors. Also, across all of our studies, political conservatives were more likely to feel cold toward scientists, and feeling cold toward

scientists related to being less likely to engage in COVID behaviors. We do now know why this might be the case.

Last, we do not know why watching a scientist discuss COVID on Fox News led to greater endorsement of COVID behaviors (study 3) but why watching a scientist discuss COVID on a different network (study 2) did not. It could have been the name of the network or the specific issues and arguments that were discussed in the videos that led to greater endorsement of COVID behaviors in the former case but not the latter. Certain scientists may have greater appeal than others as well. Future research should explore these issues.

However, we believe this study makes an important contribution. Our results suggest that an anti-scientist bias leads people to engage in behaviors and attitudes that spread a pandemic. However, scientific experts can remedy noncompliance with their recommendations by seeking out news outlets to discuss appropriate health behaviors.

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