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The role of race, religion, and partisanship in misperceptions about COVID-19

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Abstract

Concerns about misperceptions among the public are rampant. Yet, little work explores the correlates of misperceptions in varying contexts – that is, how do factors such as group affiliations, media exposure, and lived experiences correlate with the number of misperceptions people hold? We address these questions by investigating misperceptions about COVID-19, focusing on the role of racial/ethnic, religious, and partisan groups. Using a large survey, we find the number of correct beliefs held by individuals far dwarfs the number of misperceptions. When it comes to misperceptions, we find that minorities, those with high levels of religiosity, and those with strong partisan identities – across parties – hold a substantially greater number of misperceptions than those with contrasting group affiliations. Moreover, we show other variables (e.g., social media usage, number of COVID-19 cases in one's county) do not have such strong relationships with misperceptions, and the group-level results do not reflect acquiescence to believing any information regardless of its truth value. Our results accentuate the importance of studying group-level misperceptions on other scientific and political issues and developing targeted interventions for these groups.

Keywords

COVID-19, misinformation, misperceptions, partisan social identity, race, religiosity

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> "The most astonishing thing about the pandemic was the complete mystery which surrounded it. Nobody seemed to know what the disease was, where it came from or how to stop it. Anxious minds are inquiring today . . . In spite of the repeated statement that [some information] has been discredited, there are many

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> well-informed persons who believe [it]."
>
> – Major George A. Soper (1919, pp. 501, 503)

This statement from a 1919 *Science* article on the Spanish Flu could most certainly apply to the COVID-19 pandemic. Like the Spanish Flu, COVID-19 has upended health, economic, and social systems. Yet, one notable difference is the information environment in which we live today. While misinformation and misperceptions were obviously a concern a century ago – as is mentioned in the quotation – the speed with which misinformation can spread today is unprecedented. Misperceptions about COVID-19 can have severe consequences. People ignore health advice that can delay economic recovery and become hostile to groups they misattribute as being responsible (Van Bavel et al. 2020, p. 464; also see Swire-Thompson & Lazer, 2020). Not surprisingly, these concerns have led to a large number of explorations into COVID-19 misinformation and misperceptions (e.g., Cinelli et al., 2020; Krause et al., 2020; Li et al., 2020; Pennycook et al., 2020; Ricard & Medeiros, 2020; Singh et al., 2020); however, most of this work focuses on social media and misinformation spread. While certainly a crucial topic, much less work explores who holds misperceptions (Romer & Jamieson, 2020). Isolating those more likely to believe inaccurate information allows communities and practitioners to identify such individuals and apply targeted interventions for enhancing accurate information (e.g., Pennycook et al., 2020; Van Bavel et al., 2020, p. 464).

In this article, we explore the group-level correlates of misperceptions about COVID-19 in the United States. Our focus on groups stems from a concern that inter-personal dynamics and shared belief systems often generate vulnerability to misinformation (Scheufele & Krause, 2019). Identifying groups that are most likely to hold misperceptions can guide entities interested in working on interventions to benefit these distinct communities.

We begin in the next section by generating three hypotheses. The first two hypotheses, recognizing that COVID-19 is a scientific topic, draw on work on science misperceptions to predict a relationship between COVID-19 misperceptions and, independently, being a racial or ethnic minority (Hypothesis 1) and religiosity (Hypothesis 2). The third hypothesis accounts for the extreme politicization of COVID-19 in the United States (Allcott et al., 2020; Gollwitzer et al., 2020; Druckman et al., 2020), predicting – based on work on political misperceptions – that those with stronger partisan identities will hold more misperceptions (relative to those with weaker identities). We also derive a hypothesis that partisan identity will exhibit a stronger relationship with misperceptions among Republicans than Democrats (due to the behaviors of Republican elites with regard to COVID-19).

We test our hypotheses with a large data set of more than 18,000 individuals from across the United States (and weighted to be representative of the country). Our data also allow us to investigate a host of other relevant factors such as mental health (i.e., major depressive symptoms), media exposure (e.g., to Fox News, social media), and COVID-19 experiences (e.g., having had the virus). We find that most in the population hold substantially more correct beliefs than misperceptions – misperceptions are not pervasive. Even so, we also show that populations more vulnerable to the disease and its consequences tend to be the most vulnerable to misperceptions. Perhaps most notably, African-Americans, who have been otherwise disproportionally affected by the disease, tend to hold significantly more misperceptions. The disproportionate impact of the virus on African-American communities stems from discrimination, inadequate healthcare access and utilization, disproportionate representation in high-risk occupations such as healthcare and farming, education, income, and wealth gaps that limit an ability to leave high-risk jobs, and more dense housing conditions (see https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/racial-ethnic-minorities.html). Our findings highlight the importance of taking steps to ensure vulnerable populations are suitably informed when managing the disease, particularly if they are, for structural reasons, more vulnerable.

We also find substantial relationships between the number of misperceptions held and religiosity as well as partisan identity (particularly among Republicans). With a disease that quickly became politicized in the United States, these individuals are vulnerable because they tend to rely on identity affirmation rather than systematic assessment of information (Achen & Bartels, 2017). All of these group-level results, too, dwarf the relationship between misperceptions and other variables such as social media usage and direct experiences with COVID-19. Our results offer a crucial portrait of those susceptible to the consequences of misperceptions about COVID-19 in the United States. They also contribute to knowledge on misperceptions more generally. Our results clarify the need for future work on group-level correlates of misperceptions in other countries and on other issues.

Misinformation and Misperceptions

Misinformation refers to a communication that is "false, misleading, or [based on] unsubstantiated information" (Nyhan & Reifler, 2010, p. 304). This comes in various guises: rumors, conspiracy theories, fake news, etc. Misperceptions, in contrast, are "cases in which people's beliefs about factual matters are not supported by clear evidence and expert opinion – a definition that includes both false and unsubstantiated beliefs about the world" (Nyhan & Reifler, 2010, p. 305; also see Levy et al., n.d.).

Misinformation about science poses a particularly perplexing problem. Science seeks to provide systematic knowledge to improve decision-making (Dietz, 2013), but the present American media environment undermines the privileged cultural authority of science by allowing anyone to claim to be "scientific" (Bauer et al., 2018; Lupia, 2017). When people hold scientific misperceptions, it can lead to disastrous individual decision-making and collective consequences that could undercut the well-being and economies of societies. The COVID-19 pandemic, insofar as it involves medical science, has brought this reality into even starker relief. Misinformation filled the communication space quickly, as an early paper on the social consequences of COVID-19 explained: "Fake news and misinformation about COVID-19 have proliferated widely on social media, with potentially dangerous consequences" (Van Bavel et al., 2020, p. 464). These concerns, more generally, have led to a cottage industry of social scientists exploring the nature of misinformation and its spread on social media (e.g., Allcott et al., 2019; Bode & Vraga, 2018; Grinberg et al., 2019; Guess et al., 2019; Pennycook & Rand, 2019) and/or investigating tactics to correct misperceptions that stem from misinformation (e.g., Flynn et al., 2017; Jerit & Zhao, 2020).

Here, we ask a distinct question: what group-level characteristics correlate with an increased number of COVID-19 misperceptions? Our focus on groups reflects the reality that inter-personal relations, socio-economic realities, and shared belief systems all can contribute to misperceptions among particular social groups (Scheufele & Krause, 2019). Indeed, our survey respondents ranked "family and social groups" as their second-most important source of COVID-19-related news, just behind local television. Moreover, identifying group correlates of the number of misperceptions is a crucial question if we are to target interventions to ameliorate misperceptions and their consequences (Scheufele & Krause, 2019). It is also an area that has received less general attention than work on social media transmission. This is particularly the case with COVID-19. We next turn to general work on *scientific misperceptions* that informs expectations when it comes to COVID-19, which, at its essence, involves perceptions or misperceptions about science (Van Bavel et al., 2020, p. 464). This is followed by a pointed discussion concerning the politicized nature of COVID-19, where we draw on work on *political misperceptions*. This speaks to the reality that in the United States, COVID-19 quickly became politicized (e.g., Allcott et al., 2020; Gollwitzer et al., 2020; Druckman et al., 2021).

One of the more notable disparities in scientific attitudes and information revolves around

racial and ethnic affiliation. For example, racial and ethnic minorities often report significantly less confidence in science and are less scientifically literate, as measured by factual knowledge (Allum et al., 2018; National Academies of Sciences, Engineering, and Medicine, 2016; Plutzer, 2013). The exact group-level rationale for these differences remains somewhat unclear, as they do not seem to stem from variations in education/knowledge, religion, or economic circumstance (e.g., Allum et al., 2018). Possible explanations include less access to medical and scientific professionals (Katz et al., 2012) and distinct media/information ecologies (Kim et al., 2018; Walter et al., 2018). There is also circumstantial evidence of anti-vaccine movements – which may have some connection to COVID-19 misinformation campaigns (Bernard et al., 2020, p. 5) – explicitly targeting minorities, particularly African-Americans, by exploiting past egregious scientific exploitations (Schumaker, 2019).[1] These prior findings and possible mechanisms lead to the expectation that, in the case of scientific information about COVID-19, relative to Whites, racial and ethnic minorities will hold a greater number of misperceptions, all else being constant (Hypothesis 1).

Another group-level identity factor shown to explain variance in science attitudes and information is religiosity – that is, the extent to which one defines him/herself as a religious person (regardless of his/her religious denomination). Those who hold stronger religious beliefs tend to be less scientifically literate (Sherkat, 2011) and less deferential to scientists (Blank & Shaw, 2015). One possible underlying mechanism is that religiosity correlates with intuitivist thinking that privileges faith and symbols over the systematic/analytical empirical observation that defines science (Oliver & Wood 2018; Rutjens & Preston, 2020). Moreover, other work suggests that those whose cognitive skills are less analytic exhibit a greater likelihood of believing false news (Bronstein et al., 2019). Similarly, religious people tend to require less evidence when a claim is presented in a non-scientific context (McPhetres & Zuckerman, 2017), which may cohere with how they receive information about COVID-19 (e.g., from acquaintances or news programs rather than scientific or medical authorities). This leads to the expectation that, relative to less religious individuals, religious individuals will hold a greater number of misperceptions about COVID-19, all else being constant (Hypothesis 2).

A final group-level dynamic relevant to COVID-19 in the United States concerns partisanship. COVID-19 was quickly politicized, with Democratic politicians, relative to Republican ones, expressing greater concern about the virus, imploring the public to take more precautions, and supporting more restrictive policies (Lipsitz & Pop-Eleches, 2020). President Trump – with his dismissal of the virus, demands to reopen the economy, and refusal to wear a mask – is the apotheosis of this trend, but is far from the only example of it, as Democratic governors typically took swifter and more public actions to combat the virus than did most Republican governors (Fowler et al., 2020). These elite cues affected partisans' behaviors with Democrats engaging in more precautionary measures and Republicans doing the reverse – a trend, for both parties, that was particularly notable for strong partisans (e.g., those with high levels of affective polarization) (Druckman et al., 2021).

This leads us to turn to a related but distinct misperception literature – one focused on politics rather than science (e.g., Grinberg et al., 2019). This work suggests two political dynamics. First, when a scientific issue becomes politicized, as with COVID-19, partisan group identity becomes especially relevant (Lupia, 2013). This matters most for those with strong partisan identities – that is, the extent to which one identifies with their party (e.g., thinks in terms of "we" rather than "they") (Huddy et al., 2015). When one has such a strong group identity, a primary motivation becomes distinguishing oneself from the other group (Kahan, 2015). Those with strong identities are then more likely to accept congenial information, regardless of its accuracy, if it coheres with their stances. They assess information for identity congruence rather than factual accuracy (Druckman, 2012). The exact role of

partisan social identity, then, depends on the nature of the misinformation and which party's side it agrees with, but overall, holding the partisan slant of information constant, relative to those with weaker partisan identities, those with stronger partisan identities will hold a greater number of misperceptions about COVID-19, all else being constant (Hypothesis 3).

As mentioned, in the case of COVID-19, partisanship was asymmetric, with Republican elites being much more amenable, spreading misinformation and contradicting, if not directly ridiculing, scientific advice (Calvillo et al., 2020; Romer & Jamieson, 2020).[2] Not surprisingly, early evidence suggests that, compared to Democrats (or liberals), Republicans (or conservatives) tended to hold more misperceptions about COVID-19 (Calvillo et al., 2020). Building on our prior hypothesis, though, we predict not just a partisan distinction but rather that the aforementioned relationship with partisan social identity (Hypothesis 3) will be stronger among Republicans than among Democrats, all else being constant (Hypothesis 4).

Of course, these three group-level factors – race/ethnicity, religiosity, and partisan social identity – neither exhaust relevant group features nor other attributes that correlate with holding misperceptions. Nonetheless, they capture crucial group dynamics that encompass possible targeted groups for misinformation campaigns, a style of thinking, and motivations for group identity. Studying these group dynamics also fills lacunae in the literature and provides guidance for targeting interventions with those groups.

Finally, as we discuss below, there is a set of other correlates widely studied when it comes to misperceptions, including media usage, direct experiences (e.g., with COVID-19), and mental health. We will study these variables as correlates as well and compare their relationships against those of the group-level measures.

Methods

Our data come from an online survey with a national sample, collected via the panel management company PureSpectrum. The data are weighted to represent the country on key demographics, including gender, age, race and ethnicity, education, and United States region. Descriptive characteristics of the sample, along with means and standard deviations of predictors and the comparison variables included in our models, are available in Table 2 below. We collected the data from May 16, 2020, to June 1, 2020, and a total of 18,132 respondents completed the survey.

Identifying what misperceptions to query is not straightforward as there is no defined population of "misperceptions" generally or about COVID-19 specifically (see, e.g., Druckman & Leeper, 2012; Nyhan, 2020, p. 222). We opted to focus on pieces of misinformation that were in clear circulation (a la mass media, social media) at the time of the survey; thus, we study pieces of information about which individuals are more likely to hold misperceptions (as compared to those that receive little general attention). This is the approach – either implicitly or explicitly – taken in most studies of misperceptions, but it has the consequence of offering an upper bound on the number of misperceptions.

We selected potential misperceptions in two stages. First, we accessed the World Health Organizations' (WHO's) "Mythbusters" webpage (https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/myth-busters) that identifies and debunks what the WHO deem to be prevalent pieces of misinformation. While we could not locate their exact selection method, we presume they select information that they view as widely circulating globally. From that page, we selected nine pieces of misinformation that, based on web searches (via Google) at the time of the survey, showed a particular prevalence of those items in the United States. Second, to ensure the inclusion of other stories that were prominent in the United States, we conducted dedicated searches, at the time of the survey, of coverage of COVID-19 "misinformation" or "rumors" and identified four specific pieces of misinformation that were prevalent (clearly being highlighted as problematic in news coverage) but not on the WHO page.

Table 1. Percentage believing each outcome variable.

Misperceptions about facts about COVID-19	
Only people older than 60 are at risk for coronavirus	20%
Mosquito bites can transmit coronavirus	6%
Coronavirus was created as a weapon in a Chinese lab	19%
Holding your breath for 10 seconds without coughing shows you do not have coronavirus	8%
President Trump shared plans to declare martial law	11%
Humans originally got coronavirus by eating bats	17%
Coronavirus is linked to the use of 5G wireless	4%
Average count	.85 (SD = 1.12)
Misperceptions about preventing COVID-19	
Flu vaccines	16%
Pneumonia vaccines	12%
Hot air hand dryers	16%
Taking antibiotics	15%
Rinsing your nose with saline	12%
Applying sesame oil to your skin	3%
Average count	.73 (SD = 1.22)
Correct beliefs about facts about COVID-19	
President Trump has declared a national emergency	66%
The coronavirus outbreak and measures taken against it caused a spike in unemployment numbers	88%
There is currently no vaccine against the coronavirus	80%
Average count	2.34 (SD = 0.82)
Correct beliefs about preventing COVID-19	
Wearing a face mask	79%
Staying away from other people	91%
Washing your hands with soap	95%
Average count	2.64 (SD = .73)

This approach led us to include two misperception batteries, as detailed in Table 1, that connected to the aforementioned sources of misinformation. One includes inaccurate factual declarations about the nature of COVID-19 – this battery contains seven inaccurate statements, including that the virus was created as a weapon in a Chinese lab, that President Trump shared plans to declare martial law, etc. (see Table 1). Such misperceptions could result in problematic beliefs (e.g., attributing blame to China or believing the risks are different than they actually are). The second battery focused on the ineffectiveness of ways to prevent COVID-19, such as taking a flu vaccine or using a hot air hand dryer. This included six inaccurate statements that, if believed, could lead to damaging health behaviors.

Within each battery, we also included a set of (three) accurate statements/effective prevention approaches (e.g., a national emergency has been declared, unemployment has spiked, a vaccine currently does not exist, and wearing a face mask is a preventive measure).[3] Here we relied on the WHO's listing of essential information (https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public) and, again, a search of recent US events regarding COVID-19 reactions. We use these in our analyses to ensure any results about misperceptions do not simply reflect an acquiescence bias, such that certain individuals are more likely to agree with statements generally. The correct and incorrect statements were presented to participants in a randomized order. We display the full set of statements in Table 1.[4] In the appendix (see online supplemental material), we provide the source for each piece of inaccurate and accurate information (i.e., each statement).

The first two panels of the table show that the percentage of respondents holding each misperception varied across items, ranging from only 3% believing that applying sesame oil to your skin is an effective treatment to 20% believing *only* people older than 60 years are at risk for the virus (presumably reflecting confusion about high risk versus any risk). Overall, though, the average number of misperceptions held by each person is modest (e.g., the percentages for each item are all under a quarter of the respondents). Consider an index where we count the number of misperceptions each respondent holds *across* the two batteries: the average respondent holds 1.57 ($SD = 1.89$) misperceptions. Figure 1 displays the distribution of the number of misperceptions: 34% have no misperceptions and only 22% of the sample holds three or more misperceptions.[5] The median respondent holds just one misperception – thus, the extent of misperceptions is limited, which itself is interesting, given widespread concerns. That said, we emphasize that even some misperceptions – such as a belief in taking ineffective and possibly hazardous antidotes – can be extremely damaging. Romer and Jamieson (2020) report a relationship between COVID-19 conspiracy beliefs (which constitute a type of misperception) and resistance to preventive behaviors and future vaccinations.

Interestingly, when it comes to correct beliefs, people are generally on target, as displayed in the last two panels of Table 1. The range is 66% when it comes to the declaration of a national emergency to 95% knowing that washing one's hands constitutes an effective defense. The average respondent holds 4.99 (1.22) out of 6 correct beliefs (across the two batteries). Figure 2 displays the distribution, showing 41% correctly endorse all the correct statements, and 76% of the sample correctly identify at least five pieces of information. The median respondent correctly identifies 5 out of 6 statements. Overall, the median respondent holds only 1 out of 13 misperceptions and 5 out of 6 correct beliefs. The population as a whole does not hold many misperceptions and does hold many correct beliefs. Nonetheless even one misperception (e.g., needlessly taking an ineffective vaccine that can have side effects) can have negative consequences, and thus, understanding the correlates remains important.

The survey contained measures of our main explanatory variables, as displayed in Table 2. First, for racial/ethnic group, we asked respondents to identify the group that best describes them, from which we created variables to identify Hispanic, African-American, and Asian-American respondents. (We recognize the bluntness of our racial/ethnic classifications and encourage future work to explore intersectional dynamics more carefully.) Second, for religiosity, we asked respondents the frequency with which they attend religious services on a six-point scale ranging from never to more than once a week; a common measure to capture religious devotion (see, e.g., the General Social Survey). We are confident in the validity of the measure even though it was taken during the pandemic. Evidence at the time suggests that most congregations continued to offer services (often virtually and sometimes in person with social distancing) (see Pew Research Center, 2020). Further, we find no correlation ($r = .0056$) between the measure and concern about personally contracting COVID-19 (another

Figure 1. Distribution of misperceptions.

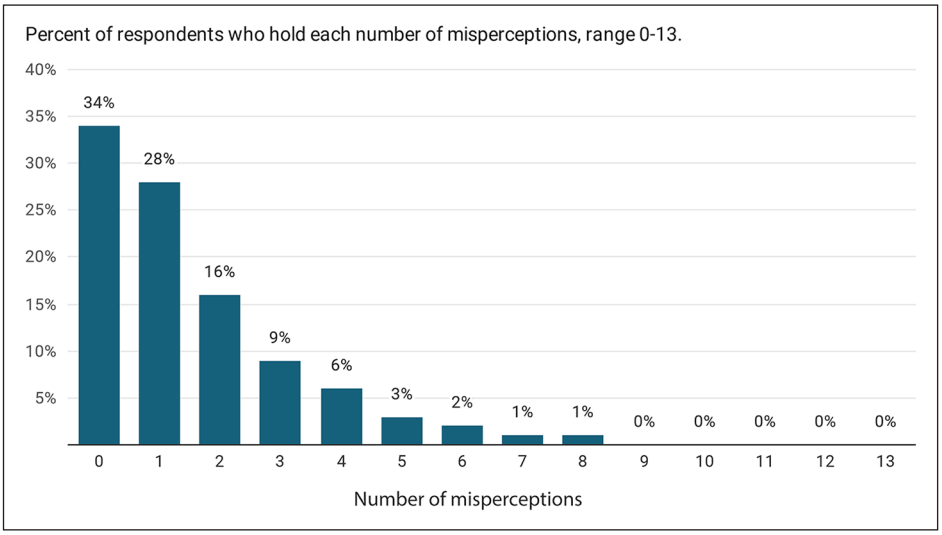
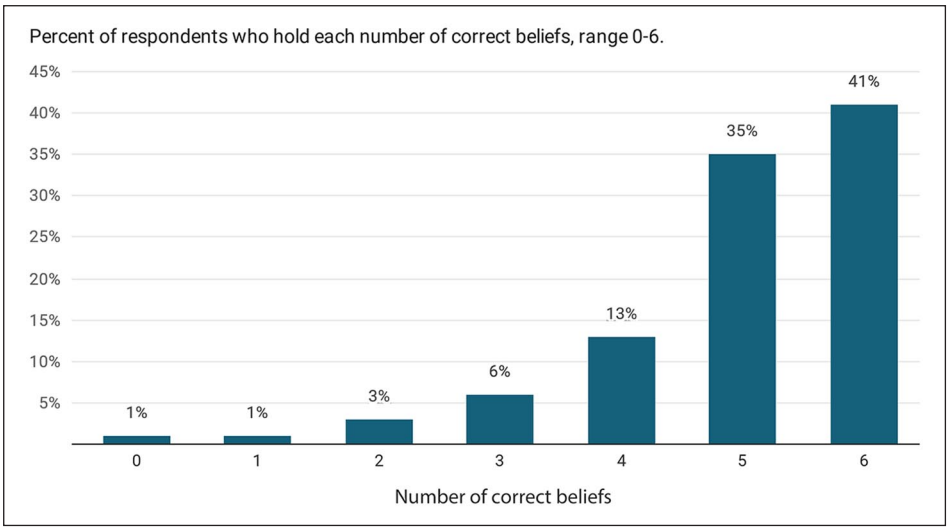


Figure 2. Distribution of correct beliefs.



measure on our survey), which means it is not confounded with personal worry. This all suggests that respondents answered this question in terms of their habitual attendance rather than concerning alterations caused by COVID-19. [6]

Finally, we asked people to report their partisan affiliation, and then, to measure partisan identity, we asked partisans a four-item partisan as social identity scale. This asked, for example, how often they talk about their party using "we" instead of "they", and the personal importance of being a member of the given party (Huddy et al., 2015).[7]

As mentioned, we also explore other sources of misperceptions, including individual attributes,

Table 2. Independent variables.

Variable	Measure	Average (*SD*) / percentage
Group variables		
Minority status: African-American, Hispanic, Asian-American	Dichotomous variables for racial/ethnic group	African-American: 12% Hispanic: 15% Asian-American: 6%
Religiosity	Six-point scale measuring frequency of attending religious services	2.79 (1.72)
Partisanship (Republican)	Seven-point scale of partisan affiliation	3.78 (2.11)
Partisan Social Identity	Average of four five-point scale items (alpha = .86) with higher scores indicating stronger partisan identity (Huddy et al., 2015)	3.27 (0.91)
Comparison variables		
Major depressive symptoms	Average of nine four-point scale PHQ-9 items (alpha = .92) with higher scores indicating greater depressive symptom frequency/severity	1.73 (0.74)
Exposure to Fox News	Dichotomous variable for obtaining COVID-19 information from the network in the last 24 hours	33%
Exposure to MSNBC	Dichotomous variable for obtaining COVID-19 information from the network in the last 24 hours	17%
COVID-19 cases in county	Number of county COVID-19 cases	557.09 (2627.65)
Had COVID-19	Dichotomous variable if believed had COVID-19	12%
Vulnerable to COVID-19	Dichotomous variable indicating if a health conditions creates vulnerability to COVID-19	18%
Other variables		
Female	Dichotomous variable indicating if female	52%
Age	Self-reported age	46.50 (18.08)
Education	Seven-point scale from low to high education	2.97 (1.15)
Rural setting	Six-point scale indicating extent of ruralness (using the Center for Disease Control's urban–rural county classification scheme)	2.82 (1.54)
COVID-19 information	Four-point scale indicating closeness of following COVID-19 news	3.15 (0.79)
Discussion on COVID-19	Six-point scale indicating how often talk about COVID-19	4.13 (1.33)
CNN	Dichotomous variables for obtaining COVID-19 information from each network in the last 24 hours	34%
Trump Press Briefing	Dichotomous variables for obtaining COVID-19 information from Trump's press briefing in the last 24 hours	22%
Social media	Dichotomous variables for obtaining COVID-19 information from social media website or mobile instant message app in the last 24 hours	46%

the communication environment, and the COVID-19 situation – all of which we have reason to suspect may affect misperceptions and serve as interesting points of comparison with the group-level variables (i.e., we refer to these as "comparison" variables). Of particular interest with individual-level variables is one's mood; Scheufele and Krause (2019, p. 7665) explain there "is some evidence that a person's emotional state can shape the accuracy of his or her [scientific] beliefs". Yet, exactly how this works remains understudied. We focus here on major depressive symptoms as a manifestation of emotionality – an extremely salient factor when it comes to COVID-19, given levels of major depressive disorder in the US are three times what they were relative to pre-COVID-19 times (Ognyanova et al., 2020).

For communication, we focus on exposure to Fox News, given that prior work demonstrates it is a key source of misperceptions about COVID-19 (Motta et al., 2020; Simonov et al., 2020). We also, for ideological symmetry, include exposure to the liberal channel MSNBC; early work on COVID-19 displayed a sharp contrast between Fox News and MSNBC viewers and, more generally (Jurkowtiz & Mitchell, 2020), MSNBC often serves as a partisan contrast with Fox News (Barrios & Hochberg, 2020). We also include a measure to capture social media access for COVID-19 information, given concerns about misinformation on social media (e.g., Cinelli et al., 2020).[8]

Finally, we look at COVID-19 situational factors that may affect information consumption. The idea here is that individuals more affected by the relevant science – i.e., issue publics – are more motivated to seek out and obtain more accurate information (e.g., Brenes Peralta et al., 2017; Hutchings, 2003). In some instances, individual attributes drive acute issue interest (e.g., age and Medicare), but in other cases, context acts as the determinative factor. For instance, those who experience extreme climate anomalies have relatively accurate perceptions of them – they are acutely affected and, thus, update their beliefs accordingly (Ripberger et al., 2017). We capture these dynamics with three variables, including the number of COVID-19 cases in one's county,[9] if the respondent believes he/she had or has COVID-19, and if the respondent has a medical condition that makes him/her particularly vulnerable to COVID-19.

Aside from these "comparison" variables, we measured variables that have otherwise been shown to affect levels of science literacy and misperceptions (e.g., Allum et al., 2018; Scheufele & Krause, 2019, pp. 7663–7666), including gender, age, education, living in rural settings, self-reported amount of information on COVID-19, amount of inter-personal discussion about COVID-19, and exposure to CNN and Trump's COVID-19 press conferences.[10] The full list of explanatory variables, along with descriptive statistics, appears in Table 2.

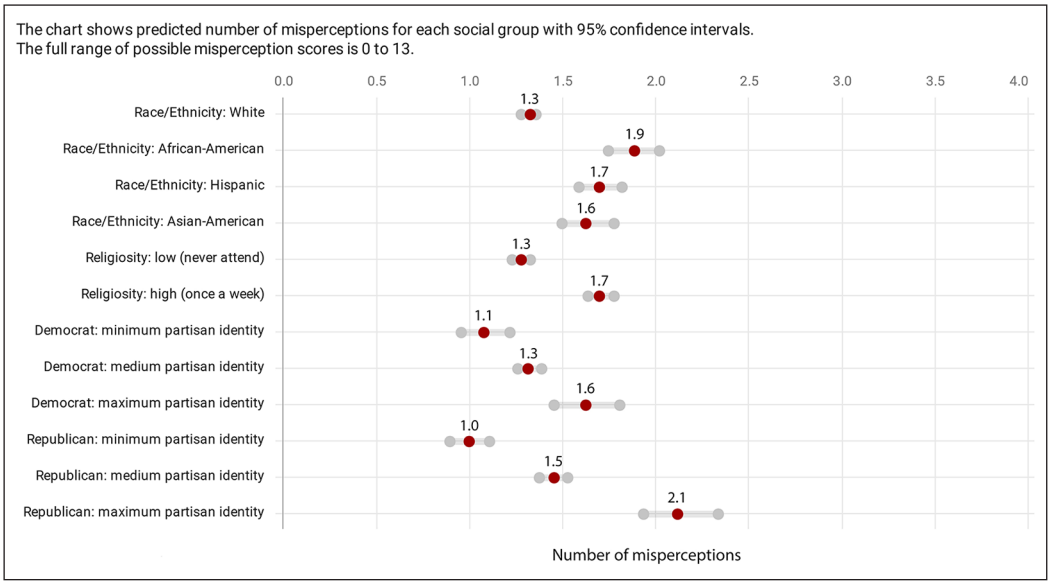
Results

We test our hypotheses by merging the two misperception modules, as we did above in Figure 1. Specifically, we count the number of misperceptions a respondent endorsed as true/accurate. We do the same with the correct belief modules. (We present the results for each module separately in the online appendix; they largely replicate the merged results.) We then regress these counts (using Poisson regressions) on the explanatory variables. All models cluster the standard errors based on county. Also, all results are robust to including state fixed effects.[11]

We present the regression results in the online appendix, focusing here on the predicted number of misperceptions/correct belief items by the relevant groups, holding all other variables at their mean values, along with 95% confidence intervals.[12] It is worth noting that our sample size is so large that statistical significance on its own is not particularly meaningful, which is why we focus on the substantive movements in the figures.[13]

For presentational purposes, we present figures with the predicted number of misperceptions and correct beliefs using truncated scales. We do this for misperceptions (in Figures 3 and 5) with scales running from 0 to 4, rather than from 0 to 13, since 93% of the respondents fall in

Figure 3. Predicted number of misperceptions by group.



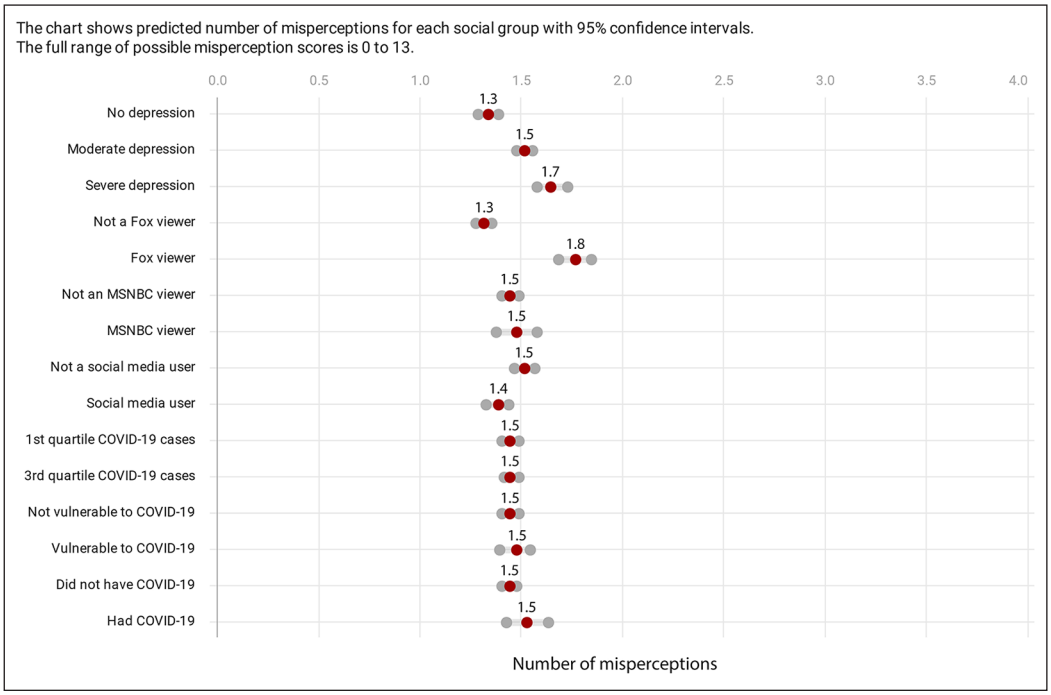
that range. For correct beliefs (Figures 4 and 6), we use a scale of 3 to 6, rather than 0 to 6, since 95% of respondents fall in that range. This graphing approach inflates the ostensible differences relative to the full scale, but the alternative is to present figures that largely include "blank space" of ranges in which virtually no respondents fall. The figures also report the precise predicted number of misperceptions or correct beliefs for the given variable.

Figure 3 shows strong support for our hypotheses. Specifically, per Hypothesis 1, we see substantial disparities across racial/ethnic groups, all else being constant, in the predicted values of the number of misperceptions from our main model. The average White respondent holds 1.3 of the 13 misperceptions; yet, that significantly increases for African-Americans, Hispanics, and Asian-Americans with respective scores of 1.9, 1.7, and 1.6 ($p < .01$ for all three groups, relative to Whites). Given that well over half of the sample holds 0 or 1 misperceptions, the disparity of tending towards 2 is meaningful and potentially consequential. To assess which particular misperceptions underlie the relationship, we analyze each independently in the online appendix. We find fairly uniform relationships across individual items. No particular item drives the racial/ethnic group findings, and they are fairly consistent across both the facts and prevention items. Put another way, it is *not* the case that groups are susceptible to specific misperceptions, but rather that there tends to be a general group tendency.

Next, turning to religiosity, for presentational purposes, we compare those who never attend religious services (35% of the sample) against those who attend once a week (19% of the sample).[14] We again see a notable and significant jump from 1.3 misperceptions to 1.7 ($p < .01$) – consistent with Hypothesis 2. This significant relationship holds for the entire scale as well (see the online appendix regression).[15] When we look at the individual items (see the online appendix), we find religiosity is positively associated with every item.

Finally, we turn to partisan identity, which presents perhaps the most striking results. Figure 3 displays (for presentational purposes), for each party, those with the lowest level of partisan identity (just 1% of the sample), those strictly at the median level (12% of the sample), and those with

Figure 4. Predicted number of misperceptions by comparison variables.



the highest level (5% of the sample).[16] For both parties, we find stronger partisan identity is associated with significant increases in misperceptions a la Hypothesis 3. Among Democrats, as partisan identity varies from weakest to strongest, the number of misperceptions increases from 1.1 to 1.6. Among Republicans, the corresponding increase is notably larger, from 1.0 to 2.1, representing the largest movement in the data. (The coefficient for partisan social identity is significant at the .01 level for both parties.) Consistent with Hypothesis 4, the increase among Republicans is significantly greater than that among Democrats ($p < .05$). These partisan identity results all hold for the entire scale as well (see the online appendix regression).[17]

For partisans, in contrast to our other findings, we find particular items stand out (see the online appendix). Specifically, Democrats with strong identities are particularly likely to accept as true that COVID-19 can be transmitted via mosquito bites and 5G wireless usage, as well as accepting as effective several of the ineffective antidotes, including the flu and pneumonia vaccines and applying sesame oil. It is not clear to us why strongly identified Democrats tended to hold these particular misperceptions. Strongly identified Republicans endorse the belief that the virus was created as a weapon in a Chinese lab and the belief about the usefulness of taking antibiotics. This relationship is much clearer than the Democratic one insofar as these beliefs cohere with President Trump's statements, such as when he stated in late April 2020 that he has a "high degree of confidence" that COVID-19 originated in a Chinese laboratory (Cohen et al. 2020).

In Figure 4, we present results for the comparison variables. Results for all other variables appear in the online appendix. Beginning with mental health, the figure shows that moving from no depressive symptoms to moderate and then to severe depression (as defined by standard PHQ-9 cut-points; see Kroenke et al., 2001) correlates with a significant increase in misperceptions

($p < .01$) (and this too holds for the entire scale). Of course, the causal status of this relationship is ambiguous, as it could be that misperceptions stimulate anxiety and depression, but, regardless, it is an intriguing dynamic that suggests depressive symptoms may make one more vulnerable to act on incorrect information that could further exacerbate mental health challenges.

Turning to media consumption, the results show that exposure to Fox News correlates with an increase in the number of misperceptions ($p < .01$), while MSNBC exposure has no relationship with misperceptions. Perhaps most unexpected is that consuming news about COVID-19 via social media is associated with a small but significant decrease in misperceptions from 1.5 to 1.4 ($p < .01$). This is contrary to common narratives about the spread of misinformation in social media, although it coheres with other evidence that misperceptions are often highly concentrated within such networks. It also may be that, in the case of COVID-19, social media allows for the sharing of direct experiences that counter information from other mass communication outlets such as Fox News or messages from President Trump.[18] Regardless, the finding certainly warrants further investigation, given it does counter what one may expect.

Finally, we see no direct relationship with the number of cases in one's county or increased vulnerability to the virus on susceptibility to misperceptions. Having had COVID-19 is linked to a marginal increase in holding misperceptions (although it is not entirely evident in the figure, the change is .08), possibly reflecting cognitive impairment that may affect the ability to fact-check (that said, this is an intriguing finding in need of further exploration as the virus spreads). Overall, though, direct experience with the disease has much smaller relationships than the group-level variables discussed above. Furthermore, the sizes of all these variables, with the exception of Fox News, is dwarfed by the group-level variables (the Fox News variable size rivals that of the group variables). This makes clear that group-level variables are, in our data, more salient in their relationship with misperceptions.

We next turn to our analysis of correct information to assess whether the misperception results stem from acquiescence bias, with particular respondents merely endorsing beliefs more often regardless of their veracity. Figure 5 presents the predicted number of correct beliefs by groups, with 95% confidence intervals. It clearly shows that the above results reflect actual misperception dynamics and not acquiescence bias. For instance, African-Americans and Hispanics hold significantly fewer correct beliefs than Whites, while Asian-Americans do not differ from Whites. We see that more religious individuals hold significantly fewer correct beliefs; as partisan identity becomes stronger, the trend, albeit not statistically significant, is also toward fewer correct beliefs. Overall, it is clear that the group bases of misperceptions established above are authentic results, and, in several cases, individuals from the same groups that hold higher numbers of misinformed beliefs also hold fewer correct beliefs.

In Figure 6, we present results on the other variables, which reveal the same dynamics insofar as their relationships with correct beliefs are largely the inverse of their relationships with misperceptions. For example, exhibiting more depressive symptoms correlates with significantly less correct information, while social media use correlates with marginally more correct beliefs. We also see watching Fox News connects with fewer correct beliefs, as does stronger partisan social identity, although it is not statistically significant here. MSNBC exposure has no relationship. Again, we see little evidence of the COVID-19 variables mattering in terms of cases, vulnerability, or having the disease.[19]

Conclusion

Misperceptions about science are a major concern as they can undermine efforts for a healthy and productive society. This is clearly the case when it comes to COVID-19. One notable finding in our data, though, is that, on average, Americans do not hold a substantial number of misperceptions about COVID-19, while they do hold many correct beliefs. This pattern echoes

Figure 5. Predicted number of correct beliefs by group.

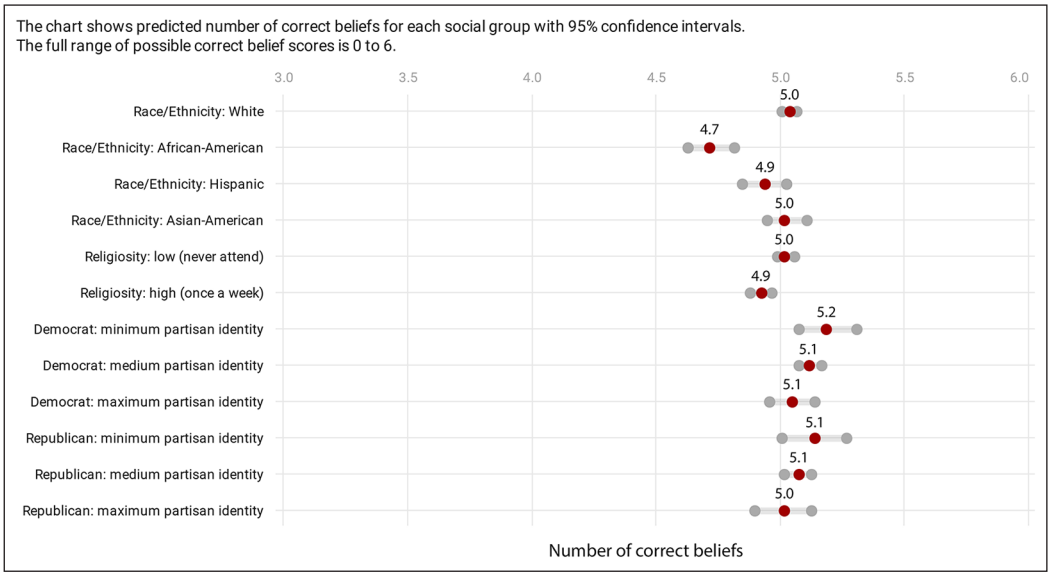
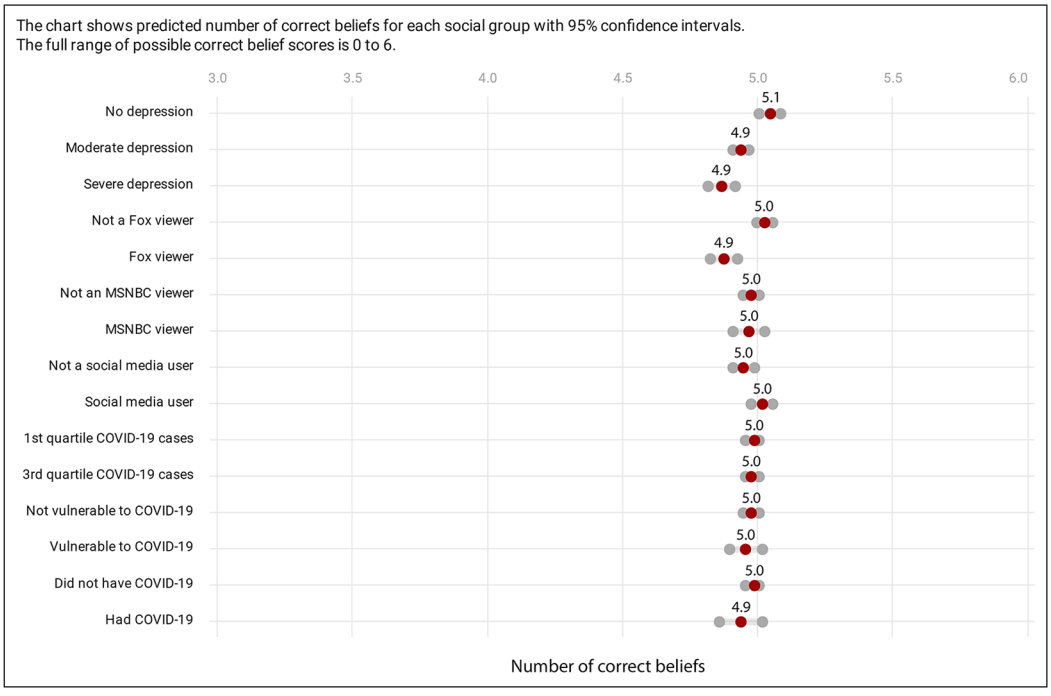


Figure 6. Predicted number of correct beliefs by comparison variables.



work on political misperceptions that suggests holding and spreading false beliefs is more concentrated than often portrayed (e.g., Allen et al., 2020; Grinberg et al., 2019). Moreover, as discussed, studies such as this one, in some sense, are aiming for an upper bound since the focus is on misperceptions that have received notable attention in the media/information landscape.

Nonetheless, even a small number of misperceptions can have deleterious effects, leading people to engage in harmful health or social behaviors that could aggregate in ways that could have massive societal consequences (e.g., Romer & Jamieson, 2020). Here, we took a distinct focus – different from the bulk of work that studies the spread of misinformation on social media and ways to correct misperceptions – to look at group-level correlates of misperceptions regarding COVID-19. Our focus on group-level variables is particularly meaningful as the mechanisms reflect relations, contextual situations, and/or belief systems. Further, information on group dynamics provides guidance on where to intervene. For example, our results suggest that engaging with opinion leaders in the relevant communities, such as religious faith leaders, can be a way to combat misperceptions (e.g., Barua et al., 2020). This also suggests a line of future inquiry of looking at precise religious affiliations; for instance, some work suggests a correlation between religious fundamentalism and a belief in false information (Bronstein et al., 2019).

While we recognize limitations in our data – such as the use of a cross-sectional non-probability (but weighted) sample in the United States, and the possibility of incomplete selection of the specific misinformation stories on which we focused – our findings nonetheless offer some important insights that we hope will stimulate scholarship on the group-level correlates of misperceptions on other issues and in other countries. Specifically, we find that minorities, particularly African-Americans, hold significantly more misperceptions and fewer correct beliefs relative to Whites. While the precise mechanism at work remains unclear, the finding itself is of immediate relevance in light of the disproportionate impact of COVID-19 on minority communities. As mentioned, factors other than misperceptions, such as living situation, work circumstances, and health conditions, explain the disproportionate impact; however, ensuring correct information can help address the high incidence in these populations. We also find that religiosity and partisan social identity – two measures of group affiliations – have significant positive relationships with holding misperceptions about COVID-19. In these cases, we suspect a style of thinking that relies on empirical observation/science (for religiosity), and a need to identify with the group (for party) drives the findings. Of course, further work is needed to pinpoint the mechanisms. Indeed, we acknowledge the unique nature of COVID-19 and, thus, an obvious question for future work concerns the extent to which these same dynamics hold when it comes to other health or scientific issues. As more and more scientific issues become politicized (e.g., Lupia, 2013; Finkel et al., 2020), it will become necessary to consider not only the parallel processes behind scientific and political misperceptions, as we do, but also their intersection.

Regardless, the findings here provide guidance about which communities would most benefit from better information messaging. There are a host of challenges to implementing public health measures during the COVID-19 pandemic, ranging from the politicization of the virus to physical and social challenges. Misperceptions about the virus itself add to the hurdles; misperceptions can impede adherence to closures, mask-wearing, and the application of a vaccine. Clearly, public health policymakers need to account for factors such as race/ethnicity, religiosity, and partisan identity to develop strategies to minimize the damages of misperceptions.

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Supplemental material

Supplemental material for this article is available online.

Notes

1. There also is evidence of targeting African-Americans in political misinformation campaigns (e.g., Yonder, 2018).
2. This coheres with a general trend of Republicans or conservatives being less trusting of science (e.g., Gauchat, 2012).
3. We recognize that technically a vaccine existed, but none were sufficiently developed to be marketed and distributed to the public (at the time of data collection).
4. The particular items offered three response items – accurate/effective, inaccurate/not effective, and not sure. We count someone as holding a misperception on an item if they choose accurate or effective when in fact, the statement is inaccurate/ineffective. We do this because we are interested in who holds clearly false beliefs (or not), rather than degrees of uncertainty. This is particularly relevant for several of the items which are not "demonstrably false" but rather simply unsubstantiated to-date (Flynn et al., 2017), meaning "not sure" is not always wholly inaccurate. We take the same approach in accounting correct information – counting it as correct only if the respondent said accurate or effective when it was so. If we instead treated the responses as a scale from inaccurate/ineffective to not sure to accurate/effective, our main results are largely the same (see the appendix in the online supplemental material).
5. Figure 1 rounds percentages and, thus, there is a smattering of respondents who hold nine or more misperceptions but, collectively (i.e., holding nine or more), it amounts to about one half of one percent of the sample.
6. We also find that the distribution of our measure mirrors that of the 2018 General Social Survey and that the socio-economic correlates that explain religiosity echo long-standing relationships reported in the literature (e.g., Beeghley et al., 1981).
7. The distributions of partisan social identity by party are similar. The means (on the five-point scale) for the Democrats and Republicans, respectively, are 3.25 (SD = 0.89) and 3.29 (0.93). The medians are both 3.25.
8. Many point to social media as a culprit in spreading misinformation, even though extant empirical evidence suggests this is fairly concentrated (e.g., Grinberg et al., 2019; Guess et al., 2019). With scientific topics that introduce risk, though, there are additional layers of concern since uncertainties become multiplied, leading to the potential of a "misinfodemic" (Krause et al., 2020). As one *New York Times* article put it: "Surge of virus misinformation stumps Facebook and Twitter" (Frenkel et al., 2020).
9. The mean number of cases is 592.61 (SD = 2745.56), and the median is 31.57.
10. We excluded income due to significant item nonresponse, but our results are robust to including it; it does not have a significant relationship with misperceptions, but we find that higher income correlates with more correct beliefs.
11. The models that generate the partisan identity results differ from the others insofar as, for those, we exclude pure Independents, as is typical when exploring partisan social identity and related concepts (e.g., Druckman & Levendusky, 2019).
12. We derived the predicted values based on *Clarify* (Tomz et al., 2003).
13. In the online appendix, we present models without and then with our hypothesized variables, finding in all cases that adding the hypothesized variables significantly improves the models. We also assess to see whether our hypotheses remain significant when correcting for multiple comparisons using the Bonferroni correction (and an α = .05), and they do remain highly significant.
14. The more religious category includes those who attend more than once a week, but that constitutes only 7% of the sample.
15. The relationship with religion seems monotonic, with there being roughly a .10 increase in the number of misperceptions for each category of attendance.

16. Recall partisan social identity is measured by taking the average across four distinct items each on a five-point scale, and thus the percentages at particular values are more spread out (i.e., there are more than five categories).
17. The bivariate correlations between misperceptions and our main variables – African-American, Hispanic, Asian-American, religiosity, partisan social identity, and Republican partisan social identity – are, respectively, .09, .07, .04, .13, .12, and .11 ($p < .01$ in all cases).
18. The survey included another item about consuming news from media websites; when added to the model, this has a significant negative relationship with misperceptions, but the social media variable remains significant. Thus, it is not simply a proxy for online news consumption.
19. The online appendix tables show a significant relationship with cases for both misperceptions and correct beliefs, but the substantive sizes of these coefficients are minuscule. Otherwise, when it comes to the comparison variables not presented here: the most consistent results are predictably that women, older individuals, and more educated individuals hold significantly fewer misperceptions and significantly more correct beliefs. Watching Trump news conferences correlates with more misperceptions but has no relationship with correct beliefs, as does CNN (which jumps from 1.50 to 1.58). More inter-personal discussion about COVID-19 and following COVID-19 information closely correlates with more correct beliefs but has no relationship with misperceptions.

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