Current Psychology (2022) 41:7918–7926
https://doi.org/10.1007/s12144-020-01211-3

Behavioral and psychosocial factors associated with COVID-19 skepticism in the United States

Carl A. Latkin[1] · Lauren Dayton[1] · Meghan Moran[1] · Justin C. Strickland[2] · Karina Collins[1]

Accepted: 17 November 2020 / Published online: 6 January 2021

Abstract

COVID-19 skepticism can be conceptualized as the denial of the seriousness of the illness and the perception that the pandemic is overblown or a hoax. In the current study, we examined the association between COVID-19 skepticism and frequency of engaging in COVID-19 prevention behaviors, political ideology, social norms about distancing, COVID-19 information-seeking behaviors, and COVID-19 conspiracy theories. A survey was administered from May 5th–14th. At that time, there were over 1 million COVID-19 cases in the US. Participants were recruited online through MTurk. The three outcome variables were handwashing, mask wearing, and social distancing. Injunctive and descriptive norms were assessed as well as measures of perceived risk to self and others. There were 683 participants in the analyses. In the multiple logistic regression model, those who were of younger age (aOR = 0.97, $p < 0.05$), better health (aOR = 0.56, $p < 0.01$), and more politically conservative (aOR = 1.32, $p < 0.01$) were more likely to endorse COVID-19 skepticism statements. People who reported higher Skepticism were also less likely to that believe people close to them would die from COVID-19 (aOR = 4.2, $p < 0.01$), engage in COVID-19 prevention behaviors, including spending time inside to prevent coronavirus (aOR = 0.33, $p < 0.01$) and frequently wear a mask outside (aOR = 0.44, $p < 0.01$). Those who were more skeptical about COVID-19 were also more likely to believe the conspiracy theory that China purposefully spread the virus (aOR = 6.38 $p < 0.01$). COVID-19 Skepticism was strongly associated with reduced engagement in COVID-19 prevention behaviors. These findings bolster the arguments for making these public health recommendations mandatory.

Keywords Covid-19 · SARS-CoV-2 · Skepticism · Prevention · Social distance · Conspiracy theory · Social norms

COVID-19 Skepticism can be conceptualized as the denial of the seriousness of the illness and the perception that the pandemic is overblown or a hoax. This perspective is of great concern, as people who do not perceive COVID-19 to be a threat to their health and the health of others may thwart efforts to reduce transmission. Individuals who discount the seriousness of COVID-19 may become critical disease vectors if they become infected and engage in high contact behaviors or travel to areas with low infection rates. In the current study, we were interested in examining the correlates of COVID-19 Skepticism. Specifically, we were interested in (1) the association between frequency of engaging in COVID-19 prevention behaviors and COVID-19 Skepticism; (2) the association between COVID-19 Skepticism and political ideology, social norms about distancing, COVID-19 perceived risk, and COVID-19 information seeking behaviors; and (3) associations between endorsement of COVID-19 conspiracy theories and COVID-19 Skepticism.

Prior research suggests that correlates of skepticism of science differ by issues. Research from other domains indicates that political ideology may be associated with skepticism. For example, political ideology is a strong predictor of climate change skepticism and associated with science skepticism, but there are mixed findings on the relationship between political ideology and vaccine skepticism and little relationship with genetically modified food skepticism (Baumgaertner, Carlisle, & Justwan, 2018; Featherstone, Bell, & Ruiz, 2019; Kahan, 2015; Long, Chen, & Rohla, 2020; Rabinowitz, Latella, Stern, & Jost, 2016; Scott, Inbar, & Rozin, 2016). Economic interests can also influence political ideologies and skepticism. Associations between political ideology and

✉ Carl A. Latkin
carl.latkin@jhu.edu

[1] Department of Health, Behavior and Society, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, MD, USA

[2] Behavioral Pharmacology Research Unit, Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, Baltimore, MD, USA

economic interests with climate change skepticism are well documented: economic interests have motivated the promotion of climate change skepticism, with a handful of scientists paid by the oil and gas industry to question firm scientific data (Lejano & Dodge, 2017). A meta-analysis of 171 studies firmly establishes the link between political ideology and climate change skepticism (Hornsey, Harris, Bain, & Fielding, 2016). This dynamic of economic interests, political ideologies, and climate change skepticism has led to climate change and environmental issues becoming politically polarized and has greatly impeded the government from addressing climate change in the US. COVID-19-related science may similarly run counter to political and economic values. In the US and Brazil, conservative media and associated political groups tended to downplay the epidemic when it was in its early stages (Faiola & Lopes, 2018). Promotion of COVID-19 Skepticism may also be motivated by political and economic interests, as social distancing policies to reduce the spread of COVID-19 have adverse financial impacts such as reduced spending, particularly in restaurants, retail, and air travel sectors (Baker, Farrokhnia, Meyer, Pagel, & Yannelis, 2020).

Perceptions of health and illness often have a strong social component, with social norms influencing perceived risk and health behaviors (Sheeran et al., 2016). Specifically, COVID-19 Skepticism may be influenced by the COVID-19 attitudes and behaviors of others in one's social group. Social norms have also been linked to climate change skepticism (Van Boven, Ehret, & Sherman, 2018). In addition to social norms influencing behaviors, people with the same behaviors and attitudes about COVID-19 may affiliate together, especially those who do not social distance, which can reinforce normative beliefs and behaviors.

According to health behavior theories such as Precaution Adoption Theory, perceptions of personal risk may also influence health behaviors (Cahill, Lancaster, & Green, 2010), such that those who perceive themselves to be at lower risk are more likely to be skeptical about the seriousness of COVID-19. A key tenant of the Precaution Adoption Theory is that for individuals to engage in behavior change, they need to perceive the risk and believe that they are personally at risk. Due to optimism bias, people often perceive a risk but do not view themselves to be personally at risk. This casual pathway between COVID-19 skepticism and perceived risk may be bidirectional. Those who are skeptical of the severity of COVID-19 are likely to downplay their personal risk of getting and suffering from the disease. Similarly, if people do not feel that they are at risk of a disease, they may not view it as a serious threat to their health or the health of others. In the current analyses, based on the Precaution Adoption Theory, we examined perceived risk to self, perceived risk to important others, and perceived risk to the population of COVID-19.

Scientific skepticism has been found to be associated with advocating or endorsing conspiracy theories (Goldberg & Richey, 2020; Lewandowsky, Gignac, & Oberauer, 2013). Furthermore, beliefs in conspiracy theories related to health behaviors have been linked to engagement in social media sources that may promote inaccurate news (Blankenship et al., 2018; Chan, Jamieson, & Albarracin, 2020; Hornsey, Finlayson, Chatwood, & Begeny, 2020). A study by Lewandowsky found that greater endorsement of conspiracy theories was associated with opposition to genetically modified foods, vaccinations, and climate science (Lewandowsky et al., 2013). Additionally, in a large international study of antivaccination attitudes, Hornsey et al. (2016) found associations between antivaccination attitudes and conspiratorial thinking as well as a low tolerance for infringements on their freedoms and individualistic and hierarchical worldviews (Hornsey et al., 2016). COVID-19 Skepticism may also be fueled by engagement with scientific information, or exposure to and reliance on misinformation. Rumors, false information, and conspiracy theories have been well documented during the COVID-19 pandemic (Ahmed, Vidal-Alaball, Downing, & Seguí, 2020; Ball & Maxmen, 2020; Hornsey & Fielding, 2017; Shahsavari, Holur, Tangherlini, & Roychowdhury, 2020). False information is known to circulate in environments of little information and low trust in governmental and other institutions (Sunstein, 2009). Shortly after its discovery in late December 2019, COVID-19 rapidly spread around the globe, causing rising death tolls and widespread uncertainty about mitigation strategies and economic stability (Sohrabi et al., 2020). This environment of uncertainty provided fertile ground for misinformation, as state actors, as well as purveyors of conspiracy theories and propaganda sites, used social media channels to diffuse information, which rapidly outpaced the slower development and dissemination of scientific evidence (Ahmed et al., 2020; Ball & Maxmen, 2020; Del Vicario et al., 2016).

In the current study, we examined whether people who endorsed COVID-19 Skepticism beliefs would engage in less frequent COVID-19 prevention behaviors (mask wearing and social distancing). In addition, we explored the relationship between COVID-19 Skepticism and political ideology, social norms about distancing, COVID-19 perceived risk, and COVID-19 information seeking behaviors. Finally, we examined whether COVID-19 Skepticism may be linked to COVID-19 conspiracy theories.

Methods

Study respondents participated in an online two-wave longitudinal study. The first survey was administered from March 24th -27th, after many Governors had declared states of emergency and had enacted social distancing policies. The

second survey was administered from May 5th–14th. At that time, there were over 1 million cases and over 65,000 deaths in the US, and of the states that had instituted Stay at Home Orders, the majority still had them in effect. Study participants were recruited through Amazon's Mechanical Turk (MTurk) service. Study populations recruited through MTurk are not nationally representative, but they outperform other web-based opinion sampling on several dimensions (Huff & Tingley, 2015). Previous research has supported the reliability of data from MTurk participants (Follmer, Sperling, & Suen, 2017). Study protocols were designed following MTurk's best practices (Chandler & Shapiro, 2016; Strickland & Stoops, 2019; Young & Young, 2019). Participants' eligibility included being age 18 or older, living in the United States, English speaking and reading, having heard of the coronavirus or COVID-19, and provision of informed consent. The enrollment criteria for the Mturk platform included 97% or higher prior approval rate and greater than 100 HITs completed. Following recommendations proposed by Rouse and colleagues (Rouse, 2015), we embedded checks to mitigate inattentive and random responding. We repeated questions to ensure consistency. Additionally, we included survey questions that had exceedingly low probability, such as the frequency of deep-sea fishing in Alaska and the number of appendages removed. We also examined the amount of time for completing the survey and the completeness of the data. Participants were compensated $2.50 for the completion of the first survey, the equivalent of an $11.20 hourly wage. For the second survey, they received $3.00. The study protocols were approved by the Johns Hopkins Bloomberg School of Public Health IRB. The baseline survey recruited 809 valid responses, of which 794 provided contact information, and 683 (86%) completed the follow-up assessment.

Measures COVID-19 skepticism was assessed by the three survey items, "The health risks from coronavirus have been exaggerated," "The coronavirus is a hoax," and "The coronavirus isn't any worse than the flu." The response categories were "Strongly agree," "Agree," "Neither agree nor disagree," "Disagree," and "Strongly disagree." These three items were summed as a scale and had a Cronbach's alpha of .85. We also examined COVID-19 Skepticism as a dichotomous measure based on the distribution. For a dichotomous measure of COVID-19 Skepticism, individuals who endorsed "Strongly Agree" or "Agree" for any of the three items were considered to score high on COVID-19 Skepticism, whereas all others were considered low scores.

To assess COVID-19 prevention behaviors, participants were asked, "Are you spending more time in your house to prevent getting the coronavirus?" (yes/no), and "Do you wear a face mask when you are outside?" with the response categories "Never," "Sometimes," and "Always."

Social norms were assessed with the question, "What percent of your friends do you think are socially distancing?" The response options were ten categories, with 10% increments from 0 to 10% to 90–100%. This variable on friends' social distancing was recoded into three groups based on the distribution: less than 70%, 70–80%, and more than 80%.

Perceived risk was assessed based on perceptions of COVID-19 risk to others and self. Two questions assessed the perceived risk to others. One question asked, "What percent of people in the country do you think will get the coronavirus" and was recoded to 20% or less, 20–40%, and 40% or more based on the distribution. A second question included "People I'm close to may die from the coronavirus." The response categories were "Strongly agree," "Agree," "Neither agree nor disagree," "Disagree," and "Strongly disagree." The perceived personal risk of COVID-19 was assessed with the question, "How likely do you think it is that you will get the coronavirus?" with choices, "Extremely unlikely," "Unlikely," "Neutral," "Likely," and "Extremely likely." Responses were recoded as likely (likely and extremely likely) versus unlikely. We also assessed whether participants perceived that they were currently infected, had been infected, or had been tested for the coronavirus.

Endorsement of conspiracy theory was assessed with the question, "China purposely spread the coronavirus." The response categories were "Strongly agree," "Agree," "Neither agree nor disagree," "Disagree," and "Strongly disagree." For the analyses, the categories "Strongly Agree" and "Agree" were compared to "Neither agree nor disagree," "Disagree," and "Strongly disagree."

Perceived health status was assessed with the question, "In general, would you say that your health is excellent, good, fair, or poor?" For the analyses, the categories of "Excellent" and "Good" were compared to "Fair" and "Poor." Gender was used for all participants except one who did not report binary gender, and biological sex at birth was used. We also assessed COVID-19 testing and whether respondents believed that they had COVID-19.

All analyzed questions were from the follow-up survey, except for six items from the baseline, which assessed the frequency of COVID-19 information seeking as well as demographic characteristics including political ideology, income, education, gender, and age. Frequency of COVID-19 information seeking was assessed with the question, "On average, how often do you watch, listen, or read news about the coronavirus?" The response categories were "Multiple times an hour," "Every 1-2 hours," "A couple of times a day," "Once a day," and "Less than once a day." Political ideology was assessed with the item, "Where would you place yourself on a scale running from "Very liberal" to "Very conservative?" The response categories were "Very Liberal," Liberal," Slightly Liberal," "Moderate," "Slightly Conservative," "Conservative," and "Very Conservative."

Family income was dichotomized at less than $60,000 versus $60,000 or more. Education was classified as a bachelor's degree and higher versus associate degree or less. Age was assessed as a continuous variable.

Analyses The analyses were cross-sectional, with all key variables from wave two, except for political conservatism and demographic variables, which were collected at wave one. We conducted the analyses with primarily cross-sectional data at follow-up, since this was well into the pandemic in the US, whereas at baseline, there had been a relatively small number of recorded cases and deaths. We examined COVID-19 Skepticism as both a dichotomous and continuous variable. Bivariate logistic regression models were used to examine the relationship between the independent variables and the level of COVID-19 Skepticism. For the multivariate analyses, ordinary least squares (OLS) regression and multivariate logistic regression models were used. For the latter approach, a stepwise model was employed, with first entering demographic variables and then using forward stepwise to remove variables that were not statistically significant $p < .10$, as the statistical significance was set at $p < 0.1$. This approach was use both to obtain a parsimonious model and to remove variables that may be partially or fully redundant in accounting for the variance. The statistical power for the OSL regression was 0.97, which was calculated based on 11 predictors, a significance level of .05, multiple partial correlation coefficient of .2, and a sample size of 683. Two individuals had missing data. Given the small number, we removed these two cases.

Results

There were 683 participants in the analyses (Table 1). Most (55.5%) of the respondents were female. 42.8% were married, 29% single, and 20.5% were in a committed relationship. 26.2% were currently required to work outside the home; 12% had a high school education or less, 31.9% had completed some college, technical school or an associate degree, 40.3% had a bachelor's, and 15.8% a graduate school degree; 77.3% were White, 7.5% Black, 3.8% Hispanic, 8.3% Asian, and 3.1% Other; 58.7% were employed full-time, and 14.1% part-time. The mean age was 39.1 (SD = 11.5). Most (79.8%) respondents rated their health as excellent or good, with 18.4% rating their health as fair, and only 1.8% as poor.

A minority of the sample (18%) endorsed one or more of the COVID-19 Skepticism items, with 16.7% agreeing or strongly agreeing that the COVID-19 health risk had been exaggerated, 7.8% agreeing or strongly agreeing that the COVID-19 is not worse than the flu, and 3.1% agreeing or strongly agreeing that COVID-19 is a hoax. For the COVID-19 Skepticism scale, the mean was 5.3 (SD = 2.70, range 3–15). Regarding prevention behaviors, 92.5% reported spending more time inside to prevent transmission, and 82% wore a mask outside sometimes or always (Table 2). Almost half (43.6%) of participants perceived that 80–100% of their friends were socially distancing. Regarding the risk of COVID-19 infection, 38.5% expected that 40–100% of the US population would become infected with COVID-19, and 18% reported that it was very likely or likely that they would become infected. No one in the sample reported testing positive for COVID-19, whereas 3.2% attempted to test for the virus, and 6.9% reported that they might have had or currently have COVID-19. About half (50.4%) of the respondents agreed or strongly agreed that people that they are close to might die from COVID-19 (Table 2). The vast majority (95.8%) of study participants reported accessing COVID-19-related news once a day or more. Some participants (13.3%) endorsed the conspiracy belief that China spread the virus purposefully.

Table 1 Demographic Variables by COVID-19 Skepticism, $N = 683$

Demographics	Total % (n)	Low Skepticism ($n = 560$) %	High Skepticism ($n = 123$) %
Sex			
Male	45.5 (304)	43.2	50.4
Female	55.5 (379)	56.8	49.6
Income			
≤ $60,000	55.2 (377)	56.1	51.2
> $60,000	44.8 (306)	43.9	48.8
Education			
< Bachelor's Degree	43.9 (300)	43.9	43.9
Bachelor's Degree or greater	56.1 (383)	56.1	56.1
Ethnicity/Race			
White	77.3 (528)	81.4	18.6
Non-Hispanic Black	7.5 (51)	80.4	19.6
Hispanic	3.8 (26)	88.5	11.5
Asian	8.3 (57)	82.5	17.5
Other	3.1 (21)	90.5	9.5
Mean Age (±SD)	39.1 (11.5)	39.4 (±11.6)	37.7 (±11.0)

In the bivariate logistic regression analysis, COVID-19 Skepticism was found to be associated with subjective health, the proportion of friends social distancing, people close to them dying from COVID-19, the proportion of people in the US anticipated acquiring COVID-19, perception of the number of friends social distancing, prevention behaviors of staying in one's house and wearing a mask, and frequency of acquiring news about COVID-19 (Table 3). Although we did not find that the demographic variables of age, gender, education, or income were associated with COVID-19 Skepticism in the bivariate logistic regression models, we retained them in the multivariate logistic regression models. After adjusting for race, gender, education, and income, age

Table 2 Health and COVID-19 Belief Variables, N = 683

	Total % (n)	Low Skepticism (n = 560)%	Low Skepticism (n = 560)%
Spent More Time in Home			
Yes	92.5(632)	95.5	78.9
Face Mask Use			
Never	18.0 (123)	12.1	44.7
Sometimes	42.8 (292)	45.2	31.7
Always	39.2 (268)	42.7	23.6
Percent of Friends Socially Distancing			
0–70%	33.5 (229)	29.8	50.4
70–80%	22.8 (156)	24.1	17.1
80–100%	43.6 (298)	46.1	32.6
Expected USA Infection Total			
0–20%	29.9 (204)	26.4	45.5
20–40%	31.6 (216)	32.3	28.5
40–100%	38.5 (263)	41.3	26.0
Mortality Risk of Those Close			
Strongly Disagree	7.3(50)	3.2	26.0
Disagree	12.6 (86)	9.1	28.5
Neither agree nor disagree	29.7 (203)	31.3	22.8
Agree	40.7 (278)	45.5	18.7
Strongly Agree	9.7(66)	10.9	4.1
Perceived COVID-19 Infection Likelihood			
Likely or extremely likely	18.0 (123)	18.8	14.6
COVID-19 News Consumption Frequency			
Multiple times an hour	13.2 (90)	13.9	9.8
Every 1–2 h	24.9 (170)	25.2	23.6
A couple times a day	45.7 (312)	46.1	43.9
Once a day	2.0 (82)	11.6	13.8
Less than once a day	4.2 (29)	3.2	8.9
China Spread Virus Purposefully			
Agree or strongly agreed	13.3 (91)	7.3	40.7

was the only demographic variable associated with an increased likelihood to endorse skepticism. Those of younger age (aOR = 0.97, $p < 0.05$), better health (aOR = 0.56, $p < 0.01$), and who identified as more politically conservative (aOR = 1.32, $p < 0.01$) were more likely to endorse COVID-19 Skepticism statements. People who reported higher skepticism were also less likely to believe people close to them would die from COVID-19 (aOR = 0.418, $p < 0.01$).

Furthermore, greater skepticism of COVID-19 was associated with reduced engagement in COVID-19 prevention behaviors, including spending time inside to prevent coronavirus (aOR = 0.33, $p < 0.01$) and frequency of reporting wearing a mask outside (aOR = 0.44, $p < 0.01$). Individuals who endorsed COVID-19 skepticism reported fewer friends social distancing (aOR = 0.70, $p < 0.01$). Those who were more skeptical about COVID-19 were also more likely to believe the conspiracy theory that China purposefully spread the virus (aOR = 6.380 $p < 0.01$).

Assessing COVID-19 skepticism as a scale in the OLS regression model provided similar results to the dichotomous assessment in the logistic regression model. The OLS model R^2 was .46, and the adjusted R^2 was .45. For the OLS regression model, there were 5 outliers with the standardized residuals ranging from −3.03 to 3.23, and two outliers at one end of the distribution and three at the other. Removing these cases did not change the results. We tested the assumptions for OLS regression by examining the residuals' distribution. The residuals were normally distributed with no evidence of homoscedasticity. In both models, the perceived risk of COVID-19 was significant in the multivariate model but not in the unadjusted logistic regression model.

Table 3 Behavioral and psychosocial factors associated with COVID-19 Skepticism, N = 683

	Logistic Regression (Dichotomous Scoring)		OLS Regression (Continuous Scoring)
Variable	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Standardized Beta (95% CI)
Age (years)	0.987 (0.970, 1.004)	0.974 (0.950, 0.998)*	−0.112*(−0.040, −0.012)
General Health	0.547 (0.395, 0.756)**	0.563 (0.371, 0.855)**	0.081* (0.152, 0.939)
Liberal-Conservatism	1.586 (1.411, 1.781)**	1.321 (1.137, 1.536)**	0.215** (0.228, 0.415)
Spent More Time in Home	0.174 (0.097, 0.315)**	0.333 (0.152, 0.728)**	0.186**(1.311, 2.507)
Face Mask Use	0.371 (0.279, 0.493)**	0.437 (0.330, 0.680)**	−0.169 (−0.854, −0.402)
Friends Socially Distancing	0.638 (0.508, 0.801)**	0.702 (0.518, 0.951)*	−0.106**(−0.508, −0.143)
Expected USA Infection Total	0.599 (0.470, 0.764)**		−0.089* (−0.497, −0.084)
Mortality Risk of Those Close	0.383 (0.312, 0.470)**	0.418 (0.320, 0.546)**	−0.268** (−0.849, −.0526)
COVID-19 Infection Likelihood	1.346 (0.78, 2.317)	0.446 (0.208, 0.955)*	−0.042 (−0.727–0.141)
COVID-19 News Frequency	1.276 (1.045, 1.558)*		0.051 (−0.019,0.299)
China Spread Virus	8.670 (5.364, 14.014)**	6.379 (3.442, 11.821)**	0.218** (1.259, −2.203)

Adjusted models control for race, gender, education, and income. Coding consistent with descriptions in Table 2

* $p < .05$; ** $p < .01$

Discussion

COVID-19 Skepticism was strongly associated with reduced engagement in COVID-19 prevention behaviors, including spending time in one's household as a social distancing measure and wearing a face mask. These findings are of great concern. Given the extensive spread of SAR-CoV-2, if people are skeptical about the dangers of COVID-19 and do not engage in prevention behaviors, they are more likely to become infected and transmit the virus.

This dynamic may also be exacerbated by the reports that those who had high levels of COVID-19 Skepticism had a lower proportion of friends who were also social distancing. There was also a strong negative association between COVID-19 skepticism and the perceived risk of others close to the respondent dying from the virus.

Those who endorsed COVID-19 Skepticism were also much more likely to believe that China purposely spread the virus. It is interesting to consider why the discounting of the threat of COVID-19 might be linked to this conspiracy theory. One potential explanation is that news sources for those who endorsed COVID-19 Skepticism may be different from those consumed by people who did not endorse such skepticism. For example, these individuals may be exposed to different news sources, such as Fox (Bursztyn, Rao, Roth, & Yanagizawa-Drott, 2020), that have promoted these beliefs, or maybe consuming social media sources in which COVID-19 conspiracy theories have flourished. Another potential explanation is similar to what has been seen with antivaccine beliefs, which are more prevalent among individuals who score high on measures of reactance and express intolerance when others, including those in government or public health fields, encourage them to think or act in a certain way (Brehm & Brehm, 2013; Steindl, Jonas, Sittenthaler, Traut-Mattausch, & Greenberg, 2015). Individuals high in reactance may thus be prone to accept conspiracy theories because they may be viewed as outside-the-mainstream or independent perspectives. The finding that COVID-19 Skepticism was associated with political conservativism may also be explained by sources of news that these participants consume and more negative attitudes toward government spending on public health among conservatives compared to liberals (Blendon, Benson, SteelFisher, & Connolly, 2010; Motta, Stecula, & Farhart, 2020).

The association between subjective health status and skepticism revealed that those who reported better health were less likely to endorse COVID-19 Skepticism. One explanation for this association is that those who perceive that they are in better health also believe that COVID-19 will not impact them and hence discount COVID-19 as a factor that could threaten their health, which has been documented with other health conditions (Hay, Coups, & Ford, 2006; Lucas-Wright et al., 2014).

There were few differences between the OLS and logistic regression models. In the OLS model, the survey item on the percent of the country anticipated to be infected with COVID-19 was associated with COVID-19 Skepticism. This variable was not significant in the logistic regression model, which is likely due to its overlap with other independent variables and the use of a dichotomous variable in the logistic regression model. It was noteworthy that the perceived likelihood of getting COVID-19 was significant in the logistic regression model but not in the OLS model. We did not find that demographic or social-economic status variables were associated

with COVID-19 Skepticism. The one exception was age. Although not statistically significant in the bivariate model, in the adjusted model, younger age was associated with a greater likelihood of COVID-19 Skepticism. It may be that younger individuals are receiving COVID-19 information from different sources such as Twitter or other social media platforms, or they may be less likely to interact with individuals who have high mortality risks and hence do not view COVID-19 risk as seriously compared to older adults.

These data suggest that a proportion of the population is skeptical about the severity of COVID-19. This group is also less likely to engage in behaviors to prevent the transmission of SARS-CoV-2. A distrust in mainstream media and propensity to believe conspiracy theories may also lead to downplaying the dangers of COVID-19. A common response to address unscientific attitudes is explication, which refers to the process of explaining evidence in clear language (Hornsey & Fielding, 2017). This approach is based on the assumption that evidence and data drive attitudes (Hornsey & Fielding, 2017). However, evidence suggests that people develop attitudes and then find evidence to support those attitudes (Hornsey & Fielding, 2017). Interventions that attempt to refute antivaccination myths have not been successful (Horne, Powell, Hummel, & Holyoak, 2015; Nyhan, Reifler, Richey, & Freed, 2014) and may lead to a boomerang effect (Betsch & Sachse, 2013). If this group is similar to those who hold antivaccination beliefs, it is not likely that additional information is likely to change their beliefs (Horne et al., 2015). It may be a better use of resources to target health education interventions at individuals who have a greater latitude of acceptance for COVID-19 information as compared to those who have more extreme views (Hameiri, Idan, Nabet, Bar-Tal, & Halperin, 2020; Horne et al., 2015). Unfortunately, this finding suggests that mandatory prevention behaviors, such as mask wearing, may be needed since some people are downplaying the severity of the disease.

As we found that COVID-19 Skepticism is associated with political conservativism, it is critical is associated with political conservativism, it is critical to have conservative leaders speak out about the dangers of COVID-19 and the role of government to protect its citizens. An economic conservative may be concerned that prevention efforts have a profound negative impact on the economy. It is also important to address the economic consequences of COVID-19, as they are disproportionately impacting disadvantaged populations and a salient concern of political conservatives. Many of the current public health recommendations for addressing the pandemic ignore the social and economic factors that also impact health. For example, there are few recommendations on how government funding related to the economic impact of COVID-19 can be used to reduce physical and mental health disparities caused and exacerbated by COVID-19. Although political conservativism was found to be associated with COVID-19 Skepticism, we do not know if other political attitudes such as alienation and distrust of government are also associated with COVID-19 Skepticism, which should be assessed in future studies.

There are several study limitations that should be noted. The study population was not a representative sample, which limits external validity. The sample did have demographic characteristics similar to other crowdsourcing studies (Berinsky, Huber, & Lenz, 2012; Huff & Tingley, 2015; Paolacci & Chandler, 2014). Prior studies have found that MTurk samples tend to be younger, more educated, less religious, and less likely to be a racial minority, conservative, or fully employed than those in a nationally representative study (Berinsky et al., 2012; Huff & Tingley, 2015; Paolacci & Chandler, 2014). We followed guidelines of best practices for using crowdsourcing data collection to enhance the survey's validity and included validity checks in the survey. Moreover, prior research has found that comparisons of MTurk to other forms of non-random sampling suggests that MTurk participants are no more or less likely to engage in dishonest or disingenuous behavior (Necka, Cacioppo, Norman, & Cacioppo, 2016). In this study, we assessed the frequency of accessing COVID-19 information. We, therefore, do not know whether participants were accessing information based on science or misinformation. Future research should assess the source and content of COVID-19 information and how these are associated with COVID-19 Skepticism. Respondents who endorsed COVID-19 Skepticism also reported that their friends were less likely to engage in social distancing. We do not know if these individuals tend to affiliate with others similar to themselves, or if they simply assume that their friends are engaging in behaviors that are similar to their own behaviors. In addition, the measure of COVID-19 Skepticism was brief and may not have captured different dimensions of this construct. Moreover, the survey did not assess vaccine attitudes and intentions.

These data do suggest that it is important to monitor and assess COVID-19 Skepticism with a national random sample due to its link to COVID-19 transmission risk behaviors. Since individuals who endorse COVID-19 Skepticism beliefs are less likely to follow COVID-19 prevention guidelines such as mask wearing and social distancing, these findings bolster the arguments for making these public health recommendations mandatory. Moreover, as certain beliefs, such as antivaccine beliefs, are exceedingly difficult to change, it is critical to develop approaches that promote COVID-19 prevention behaviors that may be inconsistent with individuals' beliefs. However, governmental and non-governmental organizations should also ensure that everyone has adequate resources to prevent and treat COVID-19 as well as address the negative economic and mental health consequences of the pandemic.

Acknowledgements Study participants.

Funding This study was funded by R01DA040488 and the Johns Hopkins Alliance for a Healthier World.

Data Availability The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Compliance with Ethical Standards

Conflict of Interest No conflict exists.

Financial Disclosures None.

Ethics Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Consent to Participate Informed consent was obtained from all individual participants included in the study.

References

Ahmed, W., Vidal-Alaball, J., Downing, J., & Seguí, F. L. (2020). COVID-19 and the 5G conspiracy theory: Social network analysis of twitter data. *Journal of Medical Internet Research, 22*(5), e19458.

Baker, S. R., Farrokhnia, R. A., Meyer, S., Pagel, M., & Yannelis, C. (2020). *How does Household Spending Respond to an Epidemic? Consumption during the 2020 Covid-19 Pandemic (BFI* working paper*).* Retrieved October 12, 2020 from https://bfi.uchicago.edu/working-paper/how-does-household-spending-respond-to-an-epidemic-consumption-during-the-2020-covid-19-pandemic/.

Ball, P., & Maxmen, A. (2020). The epic battle against coronavirus misinformation and conspiracy theories. *Nature, 581*(7809), 371–374. https://doi.org/10.1038/d41586-020-01452-z.

Baumgaertner, B., Carlisle, J. E., & Justwan, F. (2018). The influence of political ideology and trust on willingness to vaccinate. *PLoS One, 13*(1), e0191728.

Berinsky, A. J., Huber, G. A., & Lenz, G. S. (2012). Evaluating online labor markets for experimental research: Amazon.com's mechanical Turk. *Political Analysis, 20*(3), 351–368.

Betsch, C., & Sachse, K. (2013). Debunking vaccination myths: Strong risk negations can increase perceived vaccination risks. *Health Psychology, 32*(2), 146–155.

Blankenship, E. B., Goff, M. E., Yin, J., Tse, Z. T. H., Fu, K. W., Liang, H., ... Fung, I. C. (2018). Sentiment, contents, and retweets: A study of two vaccine-related twitter datasets. *The Permanente Journal, 22*, 17-138. https://doi.org/10.7812/TPP/17-138.

Blendon, R. J., Benson, J. M., SteelFisher, G. K., & Connolly, J. M. (2010). Americans' conflicting views about the public health system, and how to shore up support. *Health Affairs, 29*(11), 2033–2040.

Brehm, S. S., & Brehm, J. W. (2013). *Psychological reactance: A theory of freedom and control.* Cambridge: Academic Press.

Bursztyn L, Rao A, Roth C, Yanagizawa-Drott D. (2020). Misinformation during a pandemic (working paper no. 2020-44.) Retrieved October 12, 2020 from https://bfi.uchicago.edu/wp-content/uploads/BFI_WP_202044.pdf.

Cahill, K., Lancaster, T., & Green, N. (2010). Stage-based interventions for smoking cessation. *Cochrane Database of Systematic Reviews,* (11), CD004492. https://doi.org/10.1002/14651858.CD004492.pub4.

Chan, M. S., Jamieson, K. H., & Albarracin, D. (2020). Prospective associations of regional social media messages with attitudes and actual vaccination: A big data and survey study of the influenza vaccine in the United States. *Vaccine, 38*(40), 6236–6247.

Chandler, J., & Shapiro, D. (2016). Conducting clinical research using crowdsourced convenience samples. *Annual Review of Clinical Psychology,12*, 53–81.

Del Vicario, M., Bessi, A., Zollo, F., Petroni, F., Scala, A., Caldarelli, G., ... Quattrociocchi, W. (2016). The spreading of misinformation online. *Proceedings of the National Academy of Sciences of the United States of America, 113*(3), 554-559. https://doi.org/10.1073/pnas.1517441113.

Faiola A & Lopes M. (2018). 'Just like Trump': Bolsonaro leads brazil's presidential race with right-wing populist pitch. Retrieved October 12, 2020 from https://www.washingtonpost.com/world/the_americas/just-like-trump-bolsonaro-leads-brazils-presidential-race-with-right-wing-populist-pitch/2018/10/04/c4ba3728-c65c-11e8-9c0f-2ffaf6d422aa_story.html.

Featherstone, J. D., Bell, R. A., & Ruiz, J. B. (2019). Relationship of people's sources of health information and political ideology with acceptance of conspiratorial beliefs about vaccines. *Vaccine, 37*(23), 2993–2997.

Follmer, D. J., Sperling, R. A., & Suen, H. K. (2017). The role of MTurk in education research: Advantages, issues, and future directions. *Educational Researcher, 46*(6), 329–334.

Goldberg, Z. J., & Richey, S. (2020). Antivaccination beliefs and unrelated conspiracy theories. *World Affairs, 183*(2), 105–124.

Hameiri, B., Idan, O., Nabet, E., Bar-Tal, D., & Halperin, E. (2020). The paradoxical thinking 'Sweet spot': The role of recipients' latitude of rejection in the effectiveness of paradoxical thinking messages targeting anti-refugee attitudes in Israel. *Journal of Social and Political Psychology, 8*(1), 266–283.

Hay, J., Coups, E., & Ford, J. (2006). Predictors of perceived risk for colon cancer in a national probability sample in the United States. *Journal of Health Communication, 11*(S1), 71–92.

Horne, Z., Powell, D., Hummel, J. E., & Holyoak, K. J. (2015). Countering antivaccination attitudes. *Proceedings of the National Academy of Sciences of the United States of America, 112*(33), 10321–10324. https://doi.org/10.1073/pnas.1504019112.

Hornsey, M. J., & Fielding, K. S. (2017). Attitude roots and Jiu Jitsu persuasion: Understanding and overcoming the motivated rejection of science. *American Psychologist, 72*(5), 459–473.

Hornsey, M. J., Finlayson, M., Chatwood, G., & Begeny, C. T. (2020). Donald Trump and vaccination: The effect of political identity, conspiracist ideation and presidential tweets on vaccine hesitancy. *Journal of Experimental Social Psychology, 88*, 103947. https://doi.org/10.1016/j.jesp.2019.103947

Hornsey, M. J., Harris, E. A., Bain, P. G., & Fielding, K. S. (2016). Meta-analyses of the determinants and outcomes of belief in climate change. *Nature Climate Change, 6*(6), 622–626.

Huff, C., & Tingley, D. (2015). "Who are these people?" evaluating the demographic characteristics and political preferences of MTurk survey respondents. *Research & Politics, 2*(3), 2053168015604648. https://doi.org/10.1177/2053168015604648.

Kahan, D. M. (2015). Climate science communication and the measurement problem. *Political Psychology, 36*, 1–43.

Lejano, R. P., & Dodge, J. (2017). The narrative properties of ideology: The adversarial turn and climate skepticism in the USA. *Policy Sciences, 50*(2), 195–215.

Lewandowsky, S., Gignac, G. E., & Oberauer, K. (2013). The role of conspiracist ideation and worldviews in predicting rejection of science. *PLoS One, 8*(10), e75637.

Long, E. F., Chen, M. K., & Rohla, R. (2020). Political storms: Emergent partisan skepticism of hurricane risks. *Science Advances, 6*(37), eabb7906.

Lucas-Wright, A., Bazargan, M., Jones, L., Vadgama, J. V., Vargas, R., Sarkissyan, M., Smith, J., Yazdanshenas, H., & Maxwell, A. E. (2014). Correlates of perceived risk of developing cancer among African-Americans in South Los Angeles. *Journal of Community Health, 39*(1), 173–180.

Motta, M., Stecula, D., & Farhart, C. (2020). How right-leaning media coverage of COVID-19 facilitated the spread of misinformation in the early stages of the pandemic in the US. *Canadian Journal of Political Science, 53*(2), 335–342. https://doi.org/10.1017/S0008423920000396.

Necka, E. A., Cacioppo, S., Norman, G. J., & Cacioppo, J. T. (2016). Measuring the prevalence of problematic respondent behaviors among MTurk, campus, and community participants. *PloS One, 11*(6) Article e0157732. https://doi.org/10.1371/journal.pone.0157732.

Nyhan, B., Reifler, J., Richey, S., & Freed, G. L. (2014). Effective messages in vaccine promotion: A randomized trial. *Pediatrics, 133*(4), e835–e842. https://doi.org/10.1542/peds.2013-2365.

Paolacci, G., & Chandler, J. (2014). Inside the turk: Understanding mechanical Turk as a participant pool. *Current Directions in Psychological Science, 23*(3), 184–188.

Rabinowitz, M., Latella, L., Stern, C., & Jost, J. T. (2016). Beliefs about childhood vaccination in the United States: Political ideology, false consensus, and the illusion of uniqueness. *PLoS One, 11*(7), e0158382.

Rouse, S. V. (2015). A reliability analysis of mechanical Turk data. *Computers in Human Behavior, 43*, 304–307.

Scott, S. E., Inbar, Y., & Rozin, P. (2016). Evidence for absolute moral opposition to genetically modified food in the United States. *Perspectives on Psychological Science, 11*(3), 315–324.

Shahsavari, S., Holur, P., Tangherlini, T. R., & Roychowdhury, V. (2020). Conspiracy in the time of corona: Automatic detection of covid-19 conspiracy theories in social media and the news. *arXiv Preprint arXiv:2004.13783,*

Sheeran, P., Maki, A., Montanaro, E., Avishai-Yitshak, A., Bryan, A., Klein, W. M., et al. (2016). The impact of changing attitudes, norms, and self-efficacy on health-related intentions and behavior: A meta-analysis. *Health Psychology, 35*(11), 1178–1188.

Sohrabi, C., Alsafi, Z., O'Neill, N., Khan, M., Kerwan, A., Al-Jabir, A., et al. (2020). World health organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). *International Journal of Surgery*, *76*, 71–76.

Steindl, C., Jonas, E., Sittenthaler, S., Traut-Mattausch, E., & Greenberg, J. (2015). Understanding psychological reactance. *Zeitschrift Für Psychologie*, *223*(4), 205–214.

Strickland, J. C., & Stoops, W. W. (2019). The use of crowdsourcing in addiction science research: Amazon mechanical Turk. *Experimental and Clinical Psychopharmacology, 27*(1), 1–18.

Sunstein, C. (2009). Conspiracy theories: Causes and cures*: Symposium on conspiracy theories. *Journal of Political Philosophy, 17*(2), 202–227.

Van Boven, L., Ehret, P. J., & Sherman, D. K. (2018). Psychological barriers to bipartisan public support for climate policy. *Perspectives on Psychological Science, 13*(4), 492–507.

Young, J. A., & Young, K. M. (2019). Don't get lost in the crowd: Best practices for using Amazon's mechanical Turk in behavioral research. *Journal of the Midwest Association for Information Systems*, *2019*(2), 2. https://doi.org/10.17705/3jmwa.000050.