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Exploring the Impact of Personal and Social Media-Based Factors on Judgments of Perceived Skepticism of COVID-19

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Abstract: Skepticism of COVID-19 has consequences for public health. We examined several variables that we reasoned were related to skepticism, including demographic factors, people's perceptions and experiences related to COVID-19, and social media usage. The sample consisted of 294 participants recruited in April of 2020. Participants filled out a survey that included questions related to demographics, social media use, COVID-19 anxiety, COVID-19 interference, and COVID-19 skepticism. In the main, biological sex, ethnicity, and social media use were not significantly associated with skepticism regarding COVID-19. Alternatively, older participants and those who experienced greater anxiety related to the pandemic were less skeptical of COVID-19. Interestingly, people who experienced more interference in their lives because of COVID-19 were more skeptical of the pandemic. Finally, social media use moderated the influence of anxiety and interference on skepticism. The negative effect of anxiety on skepticism became weaker as people's use of social media increased. The positive effect of interference related to COVID-19 on skepticism became stronger as people used more social media. Our findings underscore the importance of personal beliefs, attitudes, and experiences when explaining skepticism of the pandemic.

Keywords: COVID-19; skepticism; anxiety; interference; social media use



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1. Introduction

According to the World Health Organization [1], there have been more than 770 million documented cases and almost 7 million deaths due to COVID-19 since the start of the global pandemic. Despite many people resuming normal daily activities, those numbers continue to rise, and new variants continue to develop. Beyond illness and death, the pandemic caused numerous disruptions in people's lives, including anxiety about the disease, isolation from friends and family, completion of school and work responsibilities from home, often without childcare, and economic uncertainty [2,3]. Approximately one-quarter of the participants in a meta-analysis conducted early in the pandemic reported experiencing anxiety and depression related to COVID-19 [4]. The COVID-19 pandemic represents an unprecedented situation related to which people did not know how to behave or what to believe.

In the early stages of the pandemic, there was substantial agreement about the necessity of protocols, and people largely adhered to recommendations. For example, 95% of people agreed that it was necessary to restrict international travel, 90% of people thought it was necessary to close schools, and even 71% of people felt it was necessary for non-essential businesses to close [3]. Yet, despite the obvious costs related to life, happiness, and economic gains, one response related to COVID-19 was skepticism. Often referenced when discussing climate change, researchers have documented a resurgence in skepticism surrounding science [5], and such skepticism abounds related to COVID-19. We follow the lead of previous research and define skepticism related to COVID-19 as “the denial of the seriousness of the illness and the perception that the pandemic is overblown or a hoax” [6]. Such skepticism is not random. For example, in February of 2021, 82% of

Democrats, compared to only 41% of Republicans, felt that COVID-19 represented a major threat to the health of the U.S. population [3]. One reason for the skepticism might be the amount of misinformation spread about the pandemic. Along these lines, some estimates suggest that approximately one-quarter of the information shared on Twitter about COVID-19 contained misinformation, and another 17% contained unverifiable information [7]. Understanding skepticism related to COVID-19 is important because belief in COVID-19 conspiracy theories significantly reduces adherence to social distancing measures [8] and intentions to get vaccinated [9]. In contrast, taking COVID-19 seriously and trusting science predicted compliance with COVID-19 prevention guidelines [10,11]. This study seeks to go beyond politics to identify factors that explain people's skepticism regarding COVID-19.

Although the COVID-19 pandemic has waned into an epidemic, important lessons remain to be learned. Understanding the factors that correspond with or explain skepticism related to COVID-19 is one such lesson because there are public health consequences to being skeptical about a global pandemic. Global issues such as bioterrorism and climate change, another politicized issue, increase the likelihood that future pandemics will occur, and some researchers contend that the risk for future pandemics is both increasing and inevitable [12]. Marani et al. [13] observed that the probability of experiencing a pandemic like COVID-19 in any given year is about 2%, which means that the probability of experiencing a similar pandemic during a person's lifetime is about 38%. However, these risks are increasing in probability. Identifying factors associated with skepticism is a first step to understanding why people are unconcerned about a global pandemic. Skepticism surrounding a public health issue represents an obstacle to adherence to protective health measures [9]. Accordingly, identifying factors that correspond with skepticism surrounding a pandemic provides necessary foundational knowledge that can be used to decrease the consequences skepticism might have on public health. It also provides a worthwhile look into human cognition by attempting to understand how people can doubt the seriousness of a virus that has killed over six million people to date. To that end, the current study focuses on several explanatory factors related to skepticism, including demographic factors, people's perceptions and experiences related to COVID-19, and social media usage. We extend previous work on this topic by examining different variables and interactions among those variables. This paper begins by reviewing the concept of COVID-19 skepticism and related research. Potential predictors of skepticism will then be discussed, and the remainder of the paper will report a study designed to explore this phenomenon.

1.1. Literature Review

Skepticism can be defined as a negatively valenced attitude or doubt toward a piece of information [14]. Previous research has explored several types of skepticism, such as skepticism related to climate change [15], science [16], and the media [17]. More recently, researchers have documented skepticism related to COVID-19 [18]. In fact, Latkin et al. [6] observed that 16.7% of their sample agreed or strongly agreed that the health risk of COVID-19 was exaggerated, and 3.1% of the sample believed that COVID-19 was a hoax. Thus, a non-trivial portion of the population appears to be skeptical about COVID-19, though less is known about what variables explain the likelihood of being skeptical.

Although skepticism can bring about positive outcomes in some situations [19], being skeptical towards science largely elicits negative outcomes. For example, skepticism of science has been found to correspond with advocating for or endorsing conspiracy theories [20,21]. People who are more skeptical of COVID-19 are also less likely to believe that people close to them will die from the virus [6]. Conversely, worrying about COVID-19 and its risks is associated with increased intentions to engage in and actual engagement in health protective behaviors, such as avoiding crowds and handwashing [22–24]. In addition, perceptions of the severity of COVID-19 predict behaviors like social distancing and staying home [25].

The outcomes associated with being skeptical of COVID-19 have motivated recent research to explore factors that could explain this skepticism. Merolla et al. [26] observed that personal, relational, and media-related variables all influence how people view the

pandemic. Several studies have found that a variety of sociodemographic factors, such as age, political ideology, religiosity, and education, are associated with doubt about the seriousness of COVID-19 [15,27,28]. Other studies documented that subjective health, proportion of friends engaging in social distancing, mask-wearing, knowing people who died of COVID-19, and news consumption all shape people's beliefs about COVID-19 [27,29,30]. In summary, previous research has identified both demographic traits along with more specific perceptual and behavioral variables that are related to attitudes and beliefs about COVID-19. We extend that work by focusing explicitly on the variables that explain people's skepticism of COVID-19. In addition to examining sociodemographic predictors of skepticism, this study explores how people's perceptions and experiences related to COVID-19 and their communication on social media influence skepticism. In the following sections, we first review several sociodemographic factors that may be associated with COVID-19 skepticism. Then, we discuss the influence that anxiety, the extent to which COVID-19 interfered with one's daily life, and communication on social media may have on skepticism regarding COVID-19. Doing so is valuable because it provides researchers with a more informed understanding of the range of factors that shape skepticism of public health concerns.

1.2. Sociodemographic Factors

Previous studies have investigated the associations between sociodemographic variables and skepticism of different domains of science (i.e., vaccine skepticism, climate change skepticism, etc.), observing that different kinds of skepticism are predicted by different sociodemographic factors [15,28]. For example, Ecklund et al. [15] found that religiosity had a stronger association with skepticism related to evolution than climate change. Similarly, Rutjens et al. [28] found that although both spirituality and scientific literacy predicted vaccine skepticism, only scientific literacy predicted reduced skepticism regarding genetic modification. Therefore, it is important to identify sociodemographic factors that explain skepticism about the seriousness of COVID-19.

Existing studies have identified several sociodemographic factors that predict people's doubts about the seriousness of COVID-19. These factors include political ideology [6,31], level of education [6], and age [27]. In this study, we seek to provide further evidence regarding the associations between sociodemographic factors and COVID-19 skepticism by examining age, ethnicity, and sex. We focus on these variables because COVID-19 is a more significant threat to some age groups and ethnic backgrounds than others [32]. We also investigate the association between sex and skepticism because the pandemic has been found to have a different impact on people depending on their biological sex [33,34].

During the COVID-19 pandemic, several sources of health information indicated that older individuals and individuals of ethnic minority status are at higher risk for COVID-19 than other groups [32]. For example, Black and Hispanic individuals are about twice as likely to need to be hospitalized for COVID-19 than non-Hispanic white people, and Native Americans are almost three times more likely to be hospitalized. The reasons for this disproportionate impact are numerous and include racism, comorbidities, location, the types of work different people perform, and access to healthcare [35]. People who are older and an ethnic minority, therefore, are at an objectively higher risk of experiencing some symptoms of COVID-19. Previous research suggests that people's perceptions of personal risk are associated with vaccination behavior, such that as people perceive that they are at higher risk, they are more likely to be vaccinated [36]. In other words, people at higher risk (i.e., older individuals and individuals of ethnic minority background) are expected to be less skeptical about the seriousness of COVID-19 because their demographic factors place them at a higher risk for the virus. Thus, we propose the following hypotheses:

H1: *Age is negatively associated with skepticism of COVID-19.*

H2: *When compared to white people, ethnic minorities are less skeptical of COVID-19.*

Current research shows conflicting results regarding how biological sex may be associated with skepticism of COVID-19. Several studies have found that men may be more susceptible to contracting COVID-19 than women [33,37,38]. Furthermore, a recent meta-analysis reported that men have higher intentions to get vaccinated against COVID-19 than women [39]. Based on these findings, it seems reasonable to assume that men take COVID-19 more seriously than women. Nevertheless, there is evidence suggesting that compared to women, men were more likely to endorse misinformation regarding COVID-19 and downplay the seriousness of the pandemic [23]. Men are also less concerned about their own and others' health [40]. Due to the conflicting evidence regarding the effects of sex, we ask the following research question:

RQ1: *What is the association between sex and skepticism of COVID-19?*

1.3. COVID-19 Anxiety and Interference

Previous research has focused primarily on the associations between sociodemographic factors and doubts about COVID-19 [18]; however, we seek to identify more substantive predictors of skepticism. Doing so can help to identify other variables that should be targeted in efforts to reduce skepticism and increase adherence to public health in the face of future pandemics or illnesses. Both cognitions and personal experience with COVID-19 can influence how people appraise the seriousness of the pandemic. In the current study, we investigate the influence of anxiety due to COVID-19 and perceptions that the pandemic is interfering with a person's daily life.

There is evidence suggesting that heightened anxiety about COVID-19 corresponds with greater prepping behaviors [41] and greater adherence to self-protective health behaviors, even those that are not mandatory [10]. Greater levels of health anxiety associated with COVID-19 have even impacted people's interpersonal communication and relationships, eliciting more destructive and distracted communication [26,42]. People who are anxious because of the pandemic experience not only communication challenges but also self-imposed behaviors like isolation and an excessive avoidance of public places above and beyond any official recommendations from the Centers for Disease Control and Prevention [43]. Because anxiety is associated with behaviors that can minimize the risk of contracting the virus, it is likely that people who are anxious about COVID-19 are less skeptical about the seriousness of the pandemic. Thus, we propose the following hypothesis:

H3: *Anxiety about COVID-19 is negatively associated with skepticism of COVID-19.*

People's experiences with COVID-19 vary. For educators, the pandemic could be seen as an opportunity to innovate how they teach, yet such innovations were usually perceived as burdensome [44]. Parents had to support their children's new routines and online schooling, often while balancing their own work lives [45]. For people who contracted COVID-19, the process of recovering and readjusting to daily life was often challenging based on risks to their friends and family, along with the stigma of having caught COVID-19 [46]. Thus, the pandemic has generally been seen as a disruption, creating challenges in everyday activities, which can influence how individuals perceive its seriousness.

Theoretical frameworks on coping have suggested that people's cognitive and emotional responses to a stressor are associated with a wide range of actions that aim at changing people's relationship with the stressor [47]. For example, people's perceptions of and emotional responses to a stressor may make them downplay the seriousness of the stressor. The COVID-19 pandemic is often described as a stressful event that is unfamiliar to most people and disrupts their normal routines [45,48]. Thus, people's appraisals or perceptions of how much the pandemic is interfering with their lives may serve as a predictor of how much they downplay the seriousness of the pandemic. In other words, we seek to investigate how perceptions of COVID-19 interference may influence people's skepticism towards the pandemic.

The perception that the pandemic is interfering with daily life can influence how people appraise the seriousness of COVID-19; however, the direction of this influence is unclear.

Li and Lyu [49] found that the extent to which people feel that their stress is unpredictable, uncontrollable, and overwhelming was associated with greater risk perception. Similarly, Commodari and La Rosa [50] found that Italian adolescents residing in areas with more restrictions reported higher perceived COVID-19 seriousness than those residing in areas with fewer restrictions. In other words, interference from COVID-19 might correspond with less skepticism. Conversely, research has also found that feeling a lack of control predicted endorsement of COVID-19 conspiracy theories [51]. Similarly, worry about restrictions and personal freedom (e.g., being unable to meet with friends) has been found to correspond with lowered intentions to engage in health-protective behavior [24]. In other words, the uncertainty that comes with the pandemic may yield a reactive mechanism within individuals, making them more inclined to minimize the seriousness of COVID-19. Due to the conflicting results, we ask the following research question:

RQ2: *How is interference from COVID-19 associated with skepticism of COVID-19?*

1.4. Social Media Use

Beyond personal characteristics and experiences, people's patterns of communication likely shape their views of the pandemic. Along these lines, Latkin et al. [27] noted the importance of social norms and the media in shaping people's skepticism regarding COVID-19. Especially when people were in lockdown, face-to-face contact was minimized, thereby making social media a main conduit of both informed content and misinformation about the pandemic. Indeed, Pennington [52] observed that when people were isolated during the pandemic, they utilized social media to connect with other people.

Research on the effects of using social media during COVID-19 has produced mixed results. Exposure to social media has been found to correspond with misperceptions regarding basic facts about COVID-19 [53]. There is also evidence suggesting that using social media as a source of information about COVID-19 was negatively associated with the enactment of behaviors designed to protect health [54]. This association between social media use and outcomes that may oppose public health may be attributed to people's exposure to false information online. More than half of those who rely on social media for news have encountered made-up information about the COVID-19 pandemic [55].

On the other hand, the use of social media during a pandemic may yield less skepticism. Some research has documented that the use of social media to gain information about a topic is associated with less skepticism related to the topic of a search [56]. In the context of COVID-19, commenting on content seen online increased fact-checking of COVID-19 fake news [57]. The use of social media was also associated with greater levels of perceived information sufficiency and greater intention to get vaccinated [58]. Other research documents that beliefs and trust in technology correspond with positive evaluations of information found in Google searches of potentially controversial topics [59]. Because research documents both positive and negative effects of communication on social media related to COVID-19, we propose a research question to investigate the influence of using social media on skepticism towards COVID-19:

RQ3: *How is people's use of social media associated with COVID-19 skepticism?*

Finally, rather than existing in isolation, we suggest that how people use social media might interact with their personal experiences related to COVID-19 (i.e., anxiety and interference) to shape their perceptions of skepticism. For anxious individuals, going online to gain information about COVID-19 may be associated with less skepticism. During the pandemic, people used social media to quickly obtain government announcements, access pandemic-related infographics, and communicate directly with healthcare leaders [60]. Despite the proliferation of false information online, most people engaged with and shared accurate information about the pandemic more often than they did false information [61,62]. Because anxious people seek greater amounts of information to reduce uncertainty [63], they might use social media to gain more accurate information about the pandemic and be more aware of the seriousness of the pandemic compared to those who use social media less frequently.

In other words, it is possible that greater use of social media might make individuals with greater anxiety about COVID-19 even less skeptical about the seriousness of the pandemic.

Alternatively, there is evidence to suggest that anxious individuals are more likely to believe any information they come across, including misinformation, fact-checks, and accurate information [64]. They are also more likely to acquire information from poor-quality sources and are less likely to fact-check the information they receive [65]. This lack of critical news consumption among anxious individuals, coupled with the proliferation of misinformation about COVID-19 [66,67], might make people question the seriousness of the pandemic. Thus, greater use of social media might make individuals with greater anxiety about COVID-19 more skeptical of the seriousness of the pandemic. For similar reasons, the association between perceptions of COVID-19 interference and skepticism might also depend on how much people use social media during the pandemic, in part because the effects of social media usage may be varied. To investigate how people's use of social media combines with their beliefs and experiences to shape their skepticism, we propose a final research question:

RQ4: *Does social media use combine non-additively with either (a) anxiety or (b) interference related to COVID-19 to impact COVID-19 skepticism?*

2. Method

2.1. Procedure and Sample

Participants ($N = 294$) were sampled via Qualtrics online sampling services in April 2020, and data collection continued for approximately one week. Participants were compensated by Qualtrics, and all procedures were approved by the institutional review board. Participants were generally white (71.8%, $n = 211$), female (63.3%, $n = 186$), and middle-aged ($M = 42.33$, $SD = 15.28$) (see also Table 1). Most subjects reported using social media every day ($n = 248$, 84.4%) and that they had been using social media for at least 5 years ($n = 230$, 78.2%). Finally, a substantial portion of participants reported having had COVID-19 or knowing someone else who had been infected with the virus, i.e., a variable we term COVID-19 proximity ($n = 128$, 43.5%).

Table 1. Sociodemographic Characteristics of the Sample ($N = 294$).

Demographics	<i>n</i>	%
Sex		
Male	108	36.7%
Female	186	63.3%
Other		
Ethnicity		
White/Anglo/Caucasian/Middle Eastern	211	71.8%
Black/African American	39	13.3%
Asian	25	8.5%
American Indian or Alaskan Native	1	0.3%
Hispanic or of Latino origin	15	5.1%
Other	3	1.0%
Job status		
Working full-time	124	42.2%
Working part-time	36	12.2%
Graduate student	7	2.4%
Undergraduate student	13	4.4%
Homemaker	29	9.9%
Unable to work	23	7.8%
Unemployed/Retired	62	21.1%

2.2. Instrumentation

Demographic variables. To investigate the numerous hypotheses and RQs, three demographics of interest were collected (i.e., age, ethnicity, and biological sex). In addition,

a one-item measure of COVID-19 proximity was also included in the analyses (i.e., whether subjects had COVID-19 or knew someone else who had been infected with the virus). A decision was made to include this variable given its relevance to the criterion variable (i.e., COVID-19 skepticism) and given our interest in providing a more complete analysis of these data [68].

Social media use. Respondents were asked to report on how frequently (on average) they engaged in the following behaviors during the past week: (1) looked at posts, (2) liked or commented on others' posts, and (3) posted on social media. This was a 3-item measure, and response options ranged from 1 = less than 10 min to 6 = more than 3 h ($M = 2.85$, $SD = 1.38$, $\alpha = 0.85$, skewness = 0.76, kurtosis = -0.23).

COVID-19 anxiety. The extent to which COVID-19 made respondents anxious was measured using two items. These two items were, "The coronavirus (COVID-19) pandemic makes me anxious and nervous" and "I am worried about the coronavirus (COVID-19)". Responses to these items ranged from 1 = strongly disagree to 7 = strongly agree ($M = 5.08$, $SD = 1.62$, $\alpha = 0.85$, skewness = -0.84 , kurtosis = 0.02).

COVID-19 interference. The extent to which COVID-19 constituted an interference in participants' lives was measured with two items. These items were, "The coronavirus (COVID-19) pandemic has made it harder for me to organize my life" and "The coronavirus (COVID-19) pandemic has made it difficult for me to enjoy my normal day-to-day activities". Responses to these items ranged from 1 = strongly disagree to 7 = strongly agree ($M = 4.45$, $SD = 1.73$, $\alpha = 0.78$, skewness = -0.38 , kurtosis = -0.77).

COVID-19 skepticism. The extent to which subjects were skeptical about the seriousness of COVID-19 was measured using three items. Example items include, "People are overestimating the severity of the coronavirus (COVID-19)" and "The seasonal flu is more problematic than the coronavirus (COVID-19)". Responses to these items ranged from 1 = strongly disagree to 7 = strongly agree ($M = 3.39$, $SD = 1.90$, $\alpha = 0.81$, skewness = 0.21, kurtosis = -1.19).

3. Results

3.1. Measurement Model

Before conducting the main analyses, confirmatory factor analysis (CFA) was implemented to ascertain the validity of the measures. These analyses were performed using the *lessR* package in the R software (Version 4.4.0) environment [69,70]. Factor loadings were obtained using iterated centroid estimation procedures, and the internal consistency and parallelism theorems were used to evaluate the validity of each item, i.e., these theorems were implemented to assess the extent to which obtained item correlations deviated from expected item correlations. Large discrepancies, or model residuals, were indicative of construct invalidity. If items were flagged as invalid, they were removed from the analysis [71]. Model fit was evaluated further with the comparative fit index (CFI) and standardized root mean square residual (SRMR), which were produced following the use of maximum likelihood estimation in *lavaan* in the R software (Version 4.4.0) environment [70,72].

Evaluation of the initial measurement model indicated less-than-desirable fit, $\chi^2 (29) = 155.22$, CFI = 0.90, SRMR = 0.10. An inspection of the residual matrix indicated that the source of error was due primarily to one COVID-19 skepticism item. Consequently, this invalid item was removed, and a subsequent analysis was performed on the trimmed model. Analysis of this model produced decidedly better model fit, $\chi^2 (21) = 47.08$, CFI = 0.98, SRMR = 0.04. Standardized alpha coefficients were also adequate (α : 0.78–0.85). Thus, this measurement model was preferred because it contained valid measures of the constructs of interest. Correlations between the factors and reliability coefficients are reported in Table 2.

Table 2. Means, SDs, Alpha, and Uncorrected Correlations (Listwise N = 292).

	1	2	3	4	5	6	7	8	<i>M</i>	<i>SD</i>
(1) Age	(--)								42.33	15.28
(2) Sex	−0.07	(--)							--	--
(3) Ethnicity	0.29	0.04	(--)						--	--
(4) Social media use	−0.31	0.02	−0.25	(0.85)					2.85	1.38
(5) COVID-19 proximity	−0.10	0.02	−0.08	0.07	(--)				--	--
(6) COVID-19 anxiety	−0.16	0.18	−0.03	0.16	0.17	(0.85)			5.08	1.62
(7) COVID-19 interference	−0.32	0.06	−0.13	0.27	0.16	0.59	(0.78)		4.45	1.73
(8) COVID-19 skepticism	−0.24	−0.10	−0.02	0.16	0.07	−0.14	0.22	(0.81)	3.39	1.90

Note. Standardized alpha coefficients are included in the diagonals; ethnicity is coded such that white = 1 and other = 0; sex is coded as male = 0 and female = 1.

3.2. Main Effects

The main analyses were performed using ordinary least-squares regression analyses [73]. To reiterate, COVID-19 skepticism constituted the main dependent variable, and all other variables in the regression model constituted the independent variables of interest. Analyses proceeded by first testing all of the main effects, and then proceeding to inspect whether the two non-additive effects of interest produced significant effects. Of note, each of the variables included in the analysis was standardized before inspecting the magnitude of its effects. This procedure was performed because it yields accurate estimates of the standardized non-additive effects [73]. In addition, the ethnicity variable was recoded, such that white = 1 and other = 0. This decision was made given that a large proportion of respondents were white (i.e., 71.8%) and because this conceptualization aligned with our RQ.

Analyses began by inspecting whether any of the demographic variables impacted judgments of COVID-19 skepticism. In doing so, we report standardized regression coefficients (i.e., β), 95% confidence intervals (i.e., 95% CI), and corresponding p values. In the main, older participants were less skeptical about COVID-19, $\beta = -0.18$, 95% CI $[-0.30, -0.06]$, $p = 0.003$, whereas biological sex, ethnicity, and COVID-19 proximity had negligible effects on COVID-19 skepticism (the effect of sex was $\beta = -0.07$, 95% CI $[-0.18, 0.03]$, $p = 0.180$. The effect of ethnicity was $\beta = 0.10$, 95% CI $[-0.01, 0.21]$, $p = 0.080$. The effect of COVID-19 proximity was $\beta = 0.06$, 95% CI $[-0.05, 0.17]$, $p = 0.272$). Thus, although older subjects reported less COVID-19 skepticism, no discernable patterns emerged for biological sex, ethnicity, or COVID-19 proximity. These results provide strong support for H1 but fail to support H2. In addition, these results shed light on the effects of biological sex on judgments of COVID-19 skepticism (i.e., RQ1).

Regarding the effects of COVID-19 anxiety, interference, and social media use, numerous effects were evident. Specifically, although COVID-19 anxiety had a negative main effect on COVID-19 skepticism, $\beta = -0.40$, 95% CI $[-0.53, -0.27]$, $p < 0.001$, COVID-19 interference had a positive main effect, $\beta = 0.38$, 95% CI $[0.25, 0.52]$, $p < 0.001$. In addition, social media use produced an effect that trended positive, $\beta = 0.09$, 95% CI $[-0.02, 0.20]$, $p = 0.114$, but failed to reach conventional levels of statistical significance. Overall, these results indicate that those who are anxious about COVID-19 are less likely to be skeptical about the virus, which provides strong support for H3. Alternatively, those who experienced COVID-19-related interference were more likely to be skeptical about the severity of the virus. Finally, the effect of social media use was generally trivial. Importantly, these results help answer RQ2 and RQ3.

3.3. Non-Additivity

To assess the extent to which social media use combined non-additively with COVID-19 anxiety or COVID-19 interference to impact responses (i.e., RQ4), interaction terms were created by multiplying the anxiety and interference variables with the social media use

variable (i.e., 2 non-additive terms). In addition, when inspecting the size of the non-additive effects, the main effects were controlled for statistically [73].

Social media use and COVID-19 anxiety combined non-additively to impact COVID-19 skepticism in a positive manner, $\beta = 0.13$, 95% CI [0.00, 0.25], $p = 0.050$. Similar effects were evident when inspecting the social media use $\times$ COVID-19 interference variable, but this effect failed to reach conventional levels of statistical significance, $\beta = 0.10$, 95% CI [−0.03, 0.22], $p = 0.118$. A summary of these effects is in Table 3. Of note, when applicable, the non-significant main effects (e.g., ethnicity) were removed from the final regression model in the interest of estimating more accurate regression parameters [73].

Table 3. Ordinary least squares regression models.

	Model 1		Model 2	
	β	95% CI	β	95% CI
Age	−0.15	[−0.27, −0.04]	−0.16	[−0.27, −0.04]
Social media use	0.08	[−0.04, 0.19]	0.07	[−0.04, 0.18]
COVID-19 anxiety	−0.41	[−0.53, −0.28]	−0.39	[−0.51, −0.26]
COVID-19 interference	0.39	[0.25, 0.52]	0.39	[0.26, 0.52]
Social media use $\times$ anxiety	--	--	0.13	[0.00, 0.25]
Social media use $\times$ interference	--	--	0.10	[−0.03, 0.22]

Note. All variables have been standardized; COVID-19 skepticism is the dependent variable. All other variables constitute the independent variables retained for the final regression analysis.

In visualizing the two interaction effects, simple slopes were calculated at different levels of social media use (i.e., −1 SD, mean, +1 SD). Both visualizations can be seen in Figures 1 and 2. As can be seen, the negative effect of COVID-19 anxiety on COVID-19 skepticism becomes attenuated as social media use increases (i.e., when social media use is low: $B = -0.51$, $p < 0.001$; at the mean: $B = -0.39$, $p < 0.001$; and high: $B = -0.26$, $p = 0.004$). Similarly, the effect of COVID-19 interference on COVID-19 skepticism becomes increasingly positive as social media use increases (i.e., when social media use is low: $B = 0.29$, $p = 0.002$; at the mean: $B = 0.39$, $p < 0.001$; and high: $B = 0.49$, $p < 0.001$). The implications of these results are discussed below.

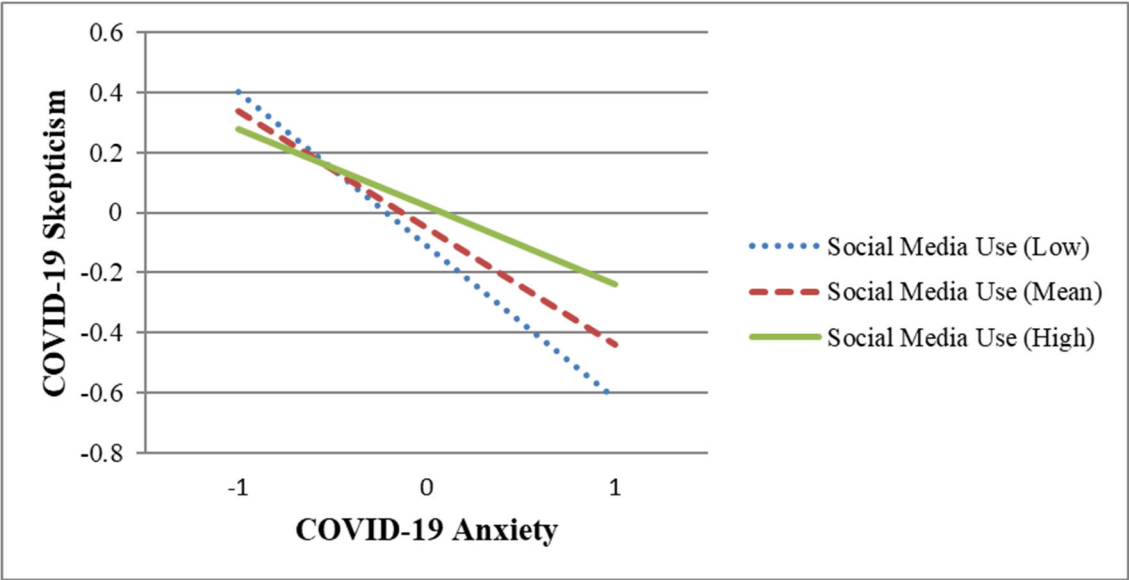


Figure 1. Interaction between COVID-19 anxiety and social media use. Note. The effect of COVID-19 anxiety on COVID-19 skepticism as social media use changes from low ($B = -0.51$, $p < 0.001$) to mean ($B = -0.39$, $p < 0.001$) to high ($B = -0.26$, $p = 0.004$).

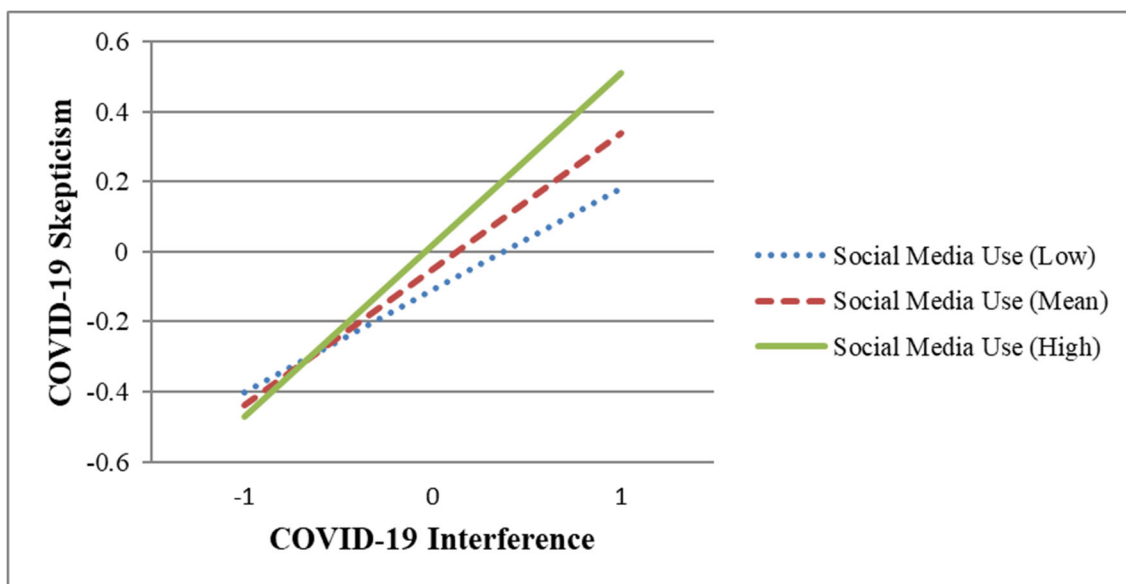


Figure 2. Interaction between COVID-19 interference and social media use. Note: The effect of COVID-19 interference on COVID-19 skepticism as active social media use changes from low ($B = 0.29$, $p = 0.002$) to mean ($B = 0.39$, $p < 0.001$) to high ($B = 0.49$, $p < 0.001$).

4. Discussion

The current study provides a better understanding of the factors that contribute to people's skepticism of a global pandemic. Given the increasing likelihood of similar pandemics over time, knowledge of the factors that produce skepticism may be useful. Once correlates of skepticism are identified, they can be targeted in campaigns that are designed to improve public health. Biological sex, ethnicity, and social media use were not significantly associated with skepticism regarding COVID-19. In contrast, older and anxious participants were less skeptical of COVID-19. Alternatively, people who experienced more interference in their lives because of COVID-19 were more skeptical. Although not significant as a main effect, the amount of time people spent on social media shaped the influence of anxiety and interference on skepticism. That is, the negative influence of anxiety on skepticism was attenuated as people's use of social media increased, whereas the positive effect of interference related to COVID-19 on skepticism became stronger as people used more social media. Importantly, our results suggest that skepticism about the seriousness of COVID-19 was more strongly explained by people's anxiety and perceptions that the pandemic interfered with their daily lives than their socio-demographics. Data for this study were collected during the pandemic; therefore, these variables represent a snapshot of the factors that shape skepticism related to the pandemic.

4.1. Contributions

Consistent with previous research, we found that older age is associated with less skepticism regarding COVID-19 [27,74]. In other words, older individuals in our sample did not downplay the seriousness of the pandemic. That older people are less skeptical about the seriousness of COVID-19 is expected because, during the pandemic, several health sources emphasized that older individuals and individuals with other existing health conditions were more susceptible to COVID-19 [32]. Of course, the converse of these results suggests that younger people were more skeptical of COVID-19, which might have limited their adherence to public health measures. We also found that people who were anxious about COVID-19 were less skeptical about the seriousness of the pandemic. Again, the converse is also true. People who were less anxious about COVID-19 felt more skeptical about it. Importantly, when controlling for anxiety and interference, the effects of sociodemographic variables, except for age, were negligible. In other words,

skepticism about the seriousness of COVID-19 was more strongly explained by people's anxiety and experiences with the pandemic than their socio-demographics. Although prior research focused on demographic characteristics, our findings underscore the importance of personal beliefs, attitudes, and experiences when explaining skepticism of the pandemic.

Interestingly, interference related to COVID-19 increased skepticism. That is, people who reported more challenges in their daily lives because of the pandemic were more skeptical of it. One possibility is that the restrictions and lockdowns that were designed to mitigate the spread of COVID-19 might cause reactance in some people. The theory of psychological reactance contends that some means of persuasion create an impulse to reject or counteract persuasion. The experience of reactance involves both a perceived threat to freedom and an effort to restore that freedom [75]. Increasing skepticism of COVID-19 might be a form of reactance for people who have grown weary of the daily interference caused by the pandemic. Another explanation is that people's experiences of interference, although present, were sufficiently minor in magnitude that they felt the protections were overblown. Approximately 98.2% of the people who contract COVID-19 fully recover from it [76]. The chances of a full recovery vary based on a host of characteristics, however, one of which is age. Older people struggle more with recovering from COVID-19 than younger people. The average age of the current sample was 42 years old, which might indicate relatively healthy adults who exhibited few problems with recovery.

Finally, as people's use of social media increased, the negative association between anxiety and skepticism became weaker. Interacting with others on social media is a double-edged sword. Although social media can be a prominent source of social capital and support that people might not be able to access elsewhere [77], they can also be sites of rampant and unchecked misinformation [8]. For these reasons, some people describe social media as being echo chambers, where the same ideas are repeated and amplified over time. If people start to become skeptical of the severity of COVID-19, perhaps based on mild daily interferences related to the pandemic, they might look to social media to confirm their thinking. Over time, and with increased use of social media, this thinking becomes stronger. Similarly, the association between anxiety and skepticism becoming weaker as people spend more time on social media may be attributed to the potential exposure to false information therein. Along these lines, Allington et al. [54] observed that greater use of certain sources of information about the pandemic decreased people's engagement in behaviors designed to protect public health. Although some of these ideas remain speculative, users of social media should be wary of the capacity for these channels to spread misinformation and sow skepticism related to a pandemic. Future research would help shed light on this general matter, as well as contribute to the extensive body of research that is starting to amass in this arena, some of which addresses the related problems of social media usage during the pandemic [78,79], the effect of social media usage on mental health [78,80], and the manner in which online information seeking impacts COVID-19 vaccination intentions [81].

4.2. Limitations and Future Directions

Although we contend that the results presented herein are of decided worth, we also concede that there are limitations that limit the size of their contribution. First, although a certain causal ordering is assumed for the purposes of testing the hypotheses, we note that causal inferences cannot be made using cross-sectional data. For example, these data cannot be used to conclude that COVID-related anxiety causes COVID-related skepticism. Future research initiatives can address this limitation by exploring whether these associations manifest similarly when modeled longitudinally [82].

Second, the extent to which these results replicate in other samples remains unclear. For example, although online panel samples are generally lauded for their diversity [83], our sample was decidedly White and middle-aged. It was also a non-probability sample. As such, the extent to which these results generalize to other samples remains unclear. This limitation can be addressed partially by investigating whether these results replicate

when using more diverse samples, e.g., in minority populations that have been impacted more severely by the COVID-19 pandemic [84]. Ultimately, such investigations will be important because they will help increase the generalizability and credibility of the findings presented herein.

Finally, and relatedly, these data were collected during the first months of the pandemic. It is unclear whether these findings generalize to other time periods, such as two to three years into the pandemic. Thus, more research is needed to understand how COVID-19 skepticism and predictors of COVID-19 skepticism may or may not have changed since the beginning of the pandemic.

5. Conclusions

The results of this investigation suggest that numerous factors impact the extent to which people believe COVID-19 constitutes a serious threat. Specifically, the results of this investigation suggest that age, anxiety due to COVID-19, and interference due to COVID-19 all have varied effects on whether someone is skeptical of COVID-19. Moreover, the use of social media may either amplify or attenuate the effects of anxiety and interference due to COVID-19. Future research endeavors can extend these findings by examining the extent to which other factors impact judgments of COVID-19 skepticism (e.g., socioeconomic status). Future research endeavors may also examine whether other factors combine non-additively with COVID-related anxiety or interference to impact related outcomes. Such investigations will be of marked worth because they will uncover the factors responsible for people's skepticism regarding COVID-19. They will also contribute substantially to other related bodies of research, such as research on social media during the pandemic [78–81]. Ultimately, such investigations are necessary precursors to future interventions that attempt to understand the skepticism of stressors that may exact a significant toll on public health and welfare.

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