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REGULAR ARTICLE

Adherence to Social Distancing Guidelines Throughout the COVID-19 Pandemic: The Roles of Pseudoscientific Beliefs, Trust, Political Party Affiliation, and Risk Perceptions

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Abstract

Background: Adherence to COVID-19 social distancing guidelines varies across individuals.

Purpose This study examined the relations of pseudoscientific and just world beliefs, generalized and institutional trust, and political party affiliation to adherence to COVID-19 social distancing guidelines over three months, as well as the explanatory role of COVID-19 risk perceptions in these relations.

Methods A U.S. nationwide sample of 430 adults (49.8% women; *mean* age = 40.72) completed a prospective online study, including an initial assessment (between March 27 and April 5, 2020), a 1 month follow-up (between April 27 and May 21, 2020), and a 3 month follow-up (between June 26 and July 15, 2020). We hypothesized that greater pseudoscientific and just world beliefs, lower governmental, institutional, and dispositional trust, and Republican Party affiliation would be associated with lower initial adherence to social distancing and greater reductions in social distancing over time and that COVID-19 risk perceptions would account for significant variance in these relations.

Results Results revealed unique associations of lower governmental trust, greater COVID-19 pseudoscientific beliefs, and greater trust in the Centers for Disease Control and Prevention (CDC) to lower initial adherence to social distancing. Whereas greater COVID-19 risk perceptions and CDC trust were associated with less steep declines in social distancing over time, both Republican (vs. Democratic) Party affiliation and greater COVID-19 pseudoscientific beliefs were associated with steeper declines in social distancing over time (relations accounted for by lower COVID-19 risk perceptions).

Conclusions Results highlight the utility of public health interventions aimed at improving scientific literacy and emphasizing bipartisan support for social distancing guidelines.

Keywords: COVID-19 · Social distancing · Political party · Pseudoscience · Trust · Just world beliefs

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In late 2019, an emerging infectious disease called coronavirus disease 2019 (COVID-19) spread rapidly across the globe and became an unprecedented public health event [1, 2]. Characterized by the World Health Organization (WHO) as a pandemic in March 2020, over 97.5 million confirmed cases of COVID-19 have been reported and over 2,000,000 people have died from the disease worldwide, with the USA reporting the highest morbidity and mortality rates [1, 3]. The rapid spread of COVID-19, combined with its long incubation period, ease of transmission, and relatively high mortality rate (compared to the seasonal flu [4, 5]), has prompted the implementation of extraordinary social distancing interventions to slow the spread of community transmission [1, 3].

Within the USA in particular, the President declared COVID-19 a national emergency on March 13, 2020, the federal government issued social distancing recommendations on March 16, 2020, and the first statewide stay-at-home order was issued by California on March 19, 2020. Furthermore, although no federal stay-at-home or other social distancing orders have been issued since the start of the pandemic (and multiple federal government officials have been criticized for delivering misinformation on both the threat posed by COVID-19 and the importance of social distancing and other risk mitigation strategies [6, 7]), the Centers for Disease Control and Prevention (CDC) has been recommending social distancing since late February 2020 [8] and some form of social distancing intervention has been in place across the USA since early April 2020. Although the breadth, specifics, and enforceability of these guidelines differ across states and over time, most individuals in the USA have been and continue to be under some social distancing orders or recommendations [9], with an emphasis on limiting the size of social gatherings and maintaining ≥6 feet distance from others. Indeed, research indicates that population movement decreased during the first 3 months of the pandemic regardless of state of residence (although states with mandatory stay-at-home orders had greater decreases in population movement than those without such orders) [10].

Yet, it is becoming increasingly clear that people differ in their adherence to social distancing recommendations [11] and that the easing of strict stay-at-home orders in May 2020 was associated with an increase in noncompliance with such recommendations [10, 12]. Indeed, the CDC and other government agencies have issued numerous warnings in the past months about the significant negative consequences of widespread noncompliance with social distancing guidelines, which are not being followed by a sizable subset of the U.S. population [11]. Furthermore, emerging research on the construct of COVID fatigue (i.e., mental and/or physical tiredness as a result of the ongoing pandemic that reduces motivation to follow rules or recommendations for reducing risk of COVID-19 infection or transmission [13]) suggests that this noncompliance with social distancing guidelines may increase as the pandemic persists [12, 14].

Given both the variability in compliance with social distancing recommendations [9] and the importance of social distancing for limiting the further spread of COVID-19, it is imperative to identify factors that relate to lower adherence to social distancing guidelines throughout the pandemic. Prominent models of health behavior that seek to explain individual differences in engagement in health protective behaviors emphasize the importance of risk perceptions to engagement in these behaviors [15–17]. For example, the Health Belief Model (HBM) [15, 18, 19] posits that four central beliefs are responsible for engagement in health protective behaviors, including perceived barriers to and benefits of the behavior and perceptions of both threat and susceptibility for the negative health outcome (i.e., risk perceptions). In applying this model to the COVID-19 pandemic, the HBM would predict lower levels of engagement in social distancing behaviors among individuals who perceive more barriers to than benefits of social distancing and who have lower risk perceptions of COVID-19 [20]. Four individual difference characteristics expected to influence risk perceptions of COVID-19 and related engagement in social distancing during the pandemic are pseudoscientific beliefs, just world beliefs, generalized and institutional trust, and political party affiliation. Each of these is discussed below.

Pseudoscientific Beliefs

Pseudoscientific beliefs can be defined as "cognitions about material phenomena that claim to be 'science' yet use nonscientific evidentiary processes (pg. 473)" [21]. Denial of science and scientific evidence are consistent with this definition [22]. This construct has particular relevance to the current pandemic as researchers have noted an increase in pseudoscientific claims regarding methods for preventing and treating COVID-19 [23]—misinformation that can interfere with effective preventative behaviors for reducing the spread of infection [24, 25]. For example, social media is being used to disseminate pseudoscientific beliefs about COVID-19, including messages that COVID-19 does not exist, is harmless, is curable, and is being used to justify an imminent police state [26]. Notably, similar pseudoscientific beliefs in the context of other pandemics and epidemics (e.g., HIV, Ebola, and H1N1) have been found to relate to less support for and engagement in health protective behaviors (including self-quarantine recommendations) [27–32]. Moreover, COVID-19-specific pseudoscientific beliefs have been found to predict lower social distancing over time [33]. Thus, we expected that pseudoscientific beliefs, both in general and pertaining to COVID-19 specifically, would lower risk perceptions of COVID-19 and related adherence to social distancing guidelines.

Belief in a Just World

One set of beliefs found to relate to both lower risk perceptions and riskier behaviors is just world beliefs or beliefs that the world is fair and people tend to get what they deserve and deserve what they get [34, 35]. For example, just world beliefs are associated with lower risk perceptions [36, 37], less frequent engagement in HIV-protective behaviors [38], and lower intentions to engage in HIV-protective behaviors via reduced risk perceptions of HIV [37]. Likewise, given that just world beliefs are also positively associated with judgments of illness causes as fair [39], these beliefs may relate negatively to engagement in behaviors, such as social distancing aimed at protecting others (in addition to oneself), as heightened just world beliefs would be expected to be positively related to the tendency to hold others responsible for contracting COVID-19 [39]. Thus, just world beliefs may reduce both the perceived personal risks of COVID-19 and adherence to social distancing guidelines aimed at protecting the self and others.

Generalized and Institutional Trust

Trust in the government and relevant public health institutions to manage a pandemic has been identified as a key factor in adherence to governmental policies and recommendations aimed at curbing the spread of a pandemic [40], including COVID-19 [41]. Both governmental and institutional trust have been positively associated with engagement in health protective behaviors (including social distancing) in the context of other public health emergencies [42, 43], and governmental trust was associated with greater engagement in health protective behaviors during the H1N1 pandemic [44]. Notably, conflicting information on COVID-19 from federal and state government officials during the COVID-19 pandemic has been suggested to undermine trust in both governmental institutions and their recommendations for reducing COVID-19 risk, contributing to reduced adherence to social distancing guidelines [7]. Furthermore, although dispositional trust (i.e., an individual's propensity to trust others in general) has been examined less often in relation to health protective behaviors in the context of public health emergencies than governmental or institutional trust, research suggests that dispositional trust is positively associated with citizenship behaviors (i.e., altruism, conscientiousness, and compliance [45]) that would likely overlap with adherence to social distancing in the context of a pandemic.

Political Party Affiliation

Political polarization has been identified as one factor that may influence both risk perceptions of COVID-19 and adherence to governmental recommendations for social distancing and other health protective behaviors in the context of this pandemic [41]. For example, Republican (vs. Democratic) Party affiliation was associated with lower risk perceptions and engagement in health protective behaviors (e.g., vaccination) in the context of the H1N1 pandemic [46, 47]. Furthermore, both Republican Party affiliation and adherence to more conservative political beliefs have been significantly negatively associated with COVID-19 risk perceptions and related fear and concern [48, 49]. Notably, one factor that could account for the lower risk perceptions and related engagement in health protective behaviors of Republicans (vs. Democrats) in the context of public health emergencies is Republicans' greater endorsement of pseudoscientific beliefs [50–53]. Furthermore, the impact of conflicting information from federal and state government officials regarding the risks of COVID-19 [7] is expected to vary as a function of party affiliation, with Republicans more likely to be influenced by top Republican officials and conservative political pundits who downplayed the risks of COVID-19 and need for social distancing than Democrats [54–56]. Thus, Republican Party affiliation was expected to relate to both lower risk perceptions of COVID-19 and lower adherence to social distancing guidelines.

Present Study

This study examined the relations of pseudoscientific and just world beliefs, generalized and institutional trust, and political party affiliation to both initial adherence to social distancing guidelines (reported at the onset of stay-at-home orders in most states) and change in adherence to social distancing guidelines over the next 3 months, as well as the role of COVID-19 risk perceptions in these relations. To this end, we used hierarchical linear modeling to examine the factors associated with both the intercept and slope of adherence to social distancing guidelines at baseline, 1 month follow-up, and 3 month follow-up in a U.S. nationwide sample of adults. We hypothesized that greater pseudoscientific and just world beliefs, lower governmental, institutional, and dispositional trust, and Republican (vs. Democratic or Independent) Party affiliation would be associated with both lower initial adherence to social distancing guidelines and greater reductions in social distancing over a 3 month period. We also hypothesized that lower COVID-19 risk perceptions would account for significant variance in the relations of greater pseudoscientific and just world beliefs, lower generalized and institutional trust, and Republican Party affiliation to lower adherence to social distancing guidelines.

Method

Participants

Participants included a nationwide community sample of 430 adults from 44 U.S. states who completed a prospective online study of health and coping in response to COVID-19 through an internet-based platform (Amazon's Mechanical Turk; MTurk). Participants completed an initial assessment from March 27 through April 5, 2020. Follow-up assessments were completed between April 27 and May 21, 2020 for the Time 2 assessment and between June 26 and July 15, 2020 for the Time 3 assessment. The study was posted to MTurk via CloudResearch (cloudresearch.com). MTurk is an online labor market that provides "workers" with the opportunity to complete tasks (e.g., surveys) in exchange for monetary compensation. Data collected via MTurk have been found to be as reliable as data collected through more traditional methods [57]. For the present study, inclusion criteria consisted of: (a) U.S. resident, (b) ≥95% approval rating as an MTurk worker, (c) completion of ≥5,000 previous MTurk tasks, and (d) valid responses on questionnaires (assessed via multiple attention check items).

Participants (49.8% women; 49.1% men; 0.5% nonbinary; 0.7% other) ranged in age from 20 to 74 years (*mean* = 40.72 ± 11.83, *median* = 38) at the initial assessment. All U.S. states were represented, with the exception of Delaware, Nebraska, New Hampshire, North Dakota, Vermont, and West Virginia. Most participants identified as White (85.8%), followed by Black/African-American (8.4%), Asian/Asian-American (6.6%), Latinx (4.0%), and Native American (1.6%). With regard to other participant demographics at the initial assessment, 10.7% of participants had completed high school or received a GED, 37.4% had attended some college or technical school, 42.3% had graduated from college, and 8.8% had advanced graduate or professional degrees. Most participants were employed full-time (68.6%), followed by employed part-time (16.0%) and unemployed (15.3%). Annual household income varied, with 30.2% of participants reporting <$35,000, 33.3% reporting $35,000–$64,999, and 36.5% reporting ≥$65,000 (*median* annual household income = $50,000–$65,000). Sample demographics were generally consistent with those of the U.S. population (49.2% male, 50.8% female; *median* age = 38; *median* annual household income = $65,712 [58]), although our sample had less racial/ethnic diversity and greater educational attainment than the general U.S. population (i.e., 72% White, 12.8% Black/African-American, 5.9% Asian American, 18.4% Latinx; 26.9% high school or equivalent, 20% some college, 20.3% college graduate, and 12.8% advanced degree [58]).

Measures

Demographics

A demographic form collected information on age, sex, racial/ethnic background, state of residence, political party affiliation, and current medical conditions that could increase COVID-19 risk.

Pseudoscientific beliefs

Pseudoscientific beliefs were measured using the pseudoscience subscale of the Belief survey developed by Lobato et al. [22], which assesses general pseudoscientific beliefs (e.g., "Childhood vaccines are one causal factor in the development of autism"). This subscale was supplemented with seven items assessing pseudoscientific beliefs related to COVID-19 (e.g., "The coronavirus [COVID-19] was engineered in a Chinese lab," "Wearing certain face masks can lead to serious health problems"); these items were based on COVID-19 "myths" compiled by the WHO [2]. All items are rated on a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating greater acceptance of pseudoscientific beliefs. The pseudoscience subscale has demonstrated adequate reliability and construct and convergent validity [22]. Internal consistency in the present sample was acceptable for both the general and COVID-19-specific pseudoscientific beliefs subscales (αs = .83).

Belief in a just world

Dispositional belief in a just world was measured using the Procedural and Distributive Just World Beliefs scales (PDJW) [59]. Participants rate their agreement with eight statements (e.g., "People generally deserve the things that they are accorded") on a Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree), with higher scores indicating greater just world beliefs. For the purposes of the present study, all eight items were summed and analyzed as one overall index of belief in a just world [60] (α = .96 in this sample). The PDJW demonstrates good construct, convergent, and divergent validity [59–61].

Dispositional and governmental trust

Dispositional and governmental trust were measured using scales developed by PytlikZillig et al. [62]. The dispositional trust scale consists of nine items (e.g., "Generally speaking, I would say that most people can be trusted") measuring the propensity to trust people in general. The governmental trust scale consists of six items (e.g., "I can trust the state government to do their job well") measuring trust in various levels of government. Items are rated on a Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). Both scales have demonstrated good reliability and construct and convergent validity [62]. Internal consistency of both scales in the present sample was acceptable (αs > .85).

Trust in the CDC

As part of a larger measure assessing COVID-19 experiences, participants were asked about their confidence in the CDC to manage the pandemic (i.e., “To what extent do you feel confident that the Centers for Disease Control can manage COVID-19?”). Participants rated this item on a five-point scale ranging from 1 (not at all) to 5 (very).

COVID-19 risk perceptions

COVID-19 risk perceptions were assessed using a two-item measure created for this study. Participants were asked to rate their current risk of (a) contracting COVID-19 and (b) dying from COVID-19 on a five-point scale ranging from 1 (not at all likely) to 5 (very likely). Research using similar self-report items [63, 64] has found that these types of risk perception assessments are highly correlated with behavioral intentions and health behaviors. These items were summed to create a COVID-19 risk perception index (α = .73 in this sample).

Adherence to social distancing guidelines

Adherence to COVID-19 social distancing guidelines was assessed using a five-item self-report measure created for this study and derived from the theory of planned behavior [65, 66]. Participants were asked to report on engagement in recommended social distancing behaviors (i.e., avoiding public places, avoiding public transportation, avoiding large gatherings, staying 6 feet away from others, and staying at home unless absolutely necessary) over the past 2 weeks on a five-point Likert-type scale ranging from 1 (never) to 5 (always). Prior research has demonstrated that self-reported behaviors are highly correlated with observed behaviors and are better than observed behaviors at predicting future behavior [67]. Likewise, research on movement behavior during the COVID-19 pandemic has found that self-reported social distancing is predictive of actual movement behavior assessed through objective measures (e.g., smartphone pedometers and GPS coordinates) [68]. For this study, items were summed to create an overall index of adherence to social distancing recommendations at Times 1, 2, and 3 (αs > .82 in this sample).

Procedure

All procedures received approval from the university’s institutional review board. At the initial assessment, to ensure that the study was not being completed by a bot, participants first responded to a Completely Automatic Public Turing Test to Tell Computers and Humans Apart (CAPTCHA) prior to providing informed consent. On the consent form, participants were also informed that “…we have put in place a number of safeguards to ensure that participants provide valid and accurate data for this study. If we have strong reason to believe your data are invalid, your responses will not be approved or paid and your data will be discarded.” Initial data were collected in blocks of nine participants at a time and all data, including attention check items and geolocations, were examined by researchers before compensation was provided. Attention check items included three explicit requests embedded within the questionnaires (e.g., “If you are paying attention, choose “2” for this question”), two multiple-choice questions (e.g., “How many words are in this sentence?”), a math problem (e.g., “What is 4 plus 2?”), and a free-response item (e.g., “Please briefly describe in a few sentences what you did in this study”). Participants who failed one or more attention check items were removed from the study (n = 53 of 553 completers). Participants who completed the initial assessment and whose data were considered valid (based on attention check items and geolocations; n = 500) were compensated $3.00.

Participants were contacted via CloudResearch to complete follow-up assessments both 1 month (Time 2) and 3 months (Time 3) following completion of the initial assessment. Of the 500 participants who completed the initial assessment, 76% (n = 382) completed the Time 2 assessment and 75% (n = 374) completed the Time 3 assessment. There were no significant differences in baseline adherence to social distancing between participants who completed (vs. did not complete) the Time 2 or Time 3 assessments ($ps \geq .10$). Time 2 assessments were completed, on average, 32.3 days (standard deviation [SD] = 5.5) following the initial assessment (*median* = 30 days; *range* = 29–53 days; 87% completed within 1 week of their scheduled assessment). Time 3 assessments were completed, on average, 93.2 days (SD = 3.7) following the initial assessment (*median* = 91.9 days; *range* = 90–111 days; 91% completed within 1 week of their scheduled assessment).

Procedures for assessing the validity of the follow-up data were similar to those used for the initial assessment. Participants who failed two or more attention check items at the follow-up were removed from the study (n = 3 at Time 2 and n = 0 at Time 3); the remainder were compensated $3.00 for completing the Time 2 assessment and $5.00 for completing the Time 3 assessment. In addition, five participants were excluded for nonreconcilable differences in demographic data between the initial and Time 2 assessment and four were excluded for nonreconcilable differences in demographic data between the initial and Time 3 assessment. Participants who completed at least one follow-up assessment in addition to the initial assessment were included in the present study, resulting in a final sample size of 430.

Data Analytic Plan

To examine the relations of pseudoscientific and just world beliefs, generalized and institutional trust, political party affiliation, and COVID-19 risk perceptions to both initial adherence to social distancing guidelines and change in adherence to these guidelines over the next 3 months, a series of hierarchical linear models were tested in MPlus v.8.1 statistical software [69, 70]. These models accommodate the nested data [71], with Level 1 modeling within-person variability in adherence to social distancing guidelines over time (Times 1, 2, 3) and Level 2 modeling between-person variability and the associations between adherence to social distancing and the hypothesized predictors. Political party affiliation was dummy-coded as three separate variables indicating Democratic, Independent, and Other, with Republicans as the reference group. All other predictors were grand mean centered. Time (centered at Time 1) was included as a covariate in all models, along with age (grand mean centered), sex (1 = female; 0 = male), and the presence (vs. absence) of a medical condition that could increase COVID-19 risk. Racial/ethnic background was not significantly associated with the outcomes and, thus, was not included as a covariate. To ensure that all participants included in this study could contribute to model estimates of both intercept and slope, only participants with valid data at two or more time points (i.e., those who completed the initial assessment and at least one follow-up) were included in analyses (n = 430). Missing data were handled using full information maximum likelihood.

A baseline unconditional linear growth model was first fit to the data. After entering covariates as a block, the contributions of individual predictors were tested by adding them individually and comparing fit of the nested models. After the final model was determined, variables that did not predict social distancing intercept or slope were trimmed from the model. To permit a comparison of the magnitude of each predictor in the model, we computed d (raw parameter coefficient/random effect SD from the null model) for each predictor [72, 73]. Next, to examine if lower COVID-19 risk perceptions account for significant variance in the relations of the predictors to lower adherence to social distancing, individual 2-2-1 multilevel structural equation models [74] were fit to the data for relevant predictors (i.e., those significantly associated with both COVID-19 risk perceptions and adherence to social distancing guidelines). Because the reliability of the estimations decreases with the addition of multiple predictors, each model included only the relevant predictor, COVID-19 risk perceptions, and the covariates. Further details on the analytic approach and models can be found in the Supplementary Material.

Results

Preliminary Analyses

Descriptive statistics for and correlations among all included variables are presented in Table 1. All participants completed at least two assessments; 119 participants did not complete one of the follow-up assessments and 67 were missing data on at least one predictor. Participants who did not complete one of the follow-ups (vs. those who completed both) were younger, $t(428) = 4.17$, $p < .001$, and included disproportionately more males, $\chi2(1) = 5.68$, $p = .017$. We confirmed that findings were comparable when excluding participants with missing data and when including participants who completed only the initial assessment.

In the baseline linear model, across all participants, the average level of adherence to social distancing guidelines at the initial assessment was significantly different than zero ($\gamma_{00} = 22.94$, standard error [SE] = 0.14, $p < .001$). Individuals were relatively stable in their adherence to social distancing, although there was a small but significant decline in adherence over time ($\gamma_{10} = -0.65$, $SE = 0.09$, $p < .001$). There was significant variability within both initial levels of adherence to social distancing guidelines ($\tau_{00} = 5.19$, $SE = 0.62$, $p < .001$) and change in adherence to social distancing guidelines over time ($\tau_{11} = 1.58$, $SE = 0.29$, $p < .001$).

Primary Analyses

Final hierarchical linear model

For information on the final model, see Table 2 (see Supplementary Table 1 for fit comparison statistics of all models tested). Dispositional trust and just world beliefs were trimmed from the final model because they did not explain any unique variance in either intercept or slope. This model explained 28.74% of the total variance in initial levels of adherence to social distancing guidelines and 31.30% of the total variance in change in adherence to social distancing guidelines over time. The pattern of findings was comparable when (a) restricting analyses to participants with complete data and (b) including all participants who completed the initial assessment (n = 500), with the exception that sex became significantly negatively associated with the slope, ps = .036 and .032, respectively, and trust in the CDC became only marginally associated with the intercept, ps = .050.

Initial levels of adherence to social distancing guidelines

As shown in Table 2, both sex (d = .426) and age (d = .018) were significantly uniquely associated with initial adherence to social distancing in the final model, with female

Table 1. Descriptive statistics for and correlations among study variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Age	1	.16**	.13**	.33***	.07	.01	.07	.15**	.11**	−.08	.14**	−.08	−.02	−.06	.17**	.20***	.18***	.11*
2. Sex		1	.01	.16**	.06	−.12*	−.01	.03	−.07	−.10**	.05	.06	−.11**	.01	.18***	.18***	.19***	.03
3. Race			1	.01	−.14**	−.04	.10	.17**	.05	−.02	.11*	−.14**	.04	.03	.08	.05	.04	−.05
4. Medical				1	−.02	−.08	−.05	.05	.004	.04	−.05	.14**	−.07	−.09	.37***	.10**	.16**	.14**
5. Gen. pseudo					1	.61***	.25***	−.11*	.18***	.02	.26***	−.27***	.67	−.01	−.07	−.19***	−.28***	−.30***
6. COVID pseudo						1	.34***	−.02	.30***	−.02	.35***	−.32***	.05	−.01	−.18***	−.27***	−.28***	−.34***
7. BJW							1	.42***	.55***	.24***	.44***	−.27***	−.10	−.02	−.19***	−.01	−.04	−.10
8. Disp. trust								1	.45***	.21***	.14**	.02	−.12*	−.07	−.09	.11*	.11	.08
9. Govt. trust									1	.43***	.41***	−.19***	−.12*	−.09	−.05	.02	.13*	.08
10. CDC trust										1	.04	.08	−.11*	−.04	.05	−.08	.08	.13*
11. Republican											1	−.48***	−.34***	−.09	−.12*	.04	−.03	−.12*
12. Democrat												1	−.60***	−.16**	.19***	−.01	.10	.12*
13. Independ.													1	−.12*	−. 06	−.004	−.05	.01
14. Other politic.														1	−.12*	−.05	−.07	−.06
15. Risk percep.															1	.05	.12*	.22***
16. T1 Soc. dist.																1	.64***	.48***
17. T2 Soc. dist.																	1	.62***
18. T3 Soc. dist.																		1
M (*SD*) or *n* (%)	40.71 (11.82)	217 (50.5%)	369 (85.8%)	76 (17.7%)	24.25 (8.54)	11.67 (5.11)	32.65 (11.92)	39.68 (13.06)	20.79 (8.25)	2.78 (1.09)	78 (18.1%)	168 (39.1%)	110 (25.6%)	11 (2.6%)	4.65 (1.77)	22.75 (2.89)	22.79 (3.12)	21.43 (4.01)
Range	20–74	–	–	–	12–48	7–28	7–28	9–63	6–42	1–5	–	–	–	–	2–10	10–25	9–25	5–25

SD standard deviation.

Sex (0 = male, 1 = female). Race = racial/ethnic background (0 = racial/ethnic minority, 1 = White). Medical = medical condition that could increase COVID-19 risk (0 = absent, 1 = present). Gen pseudo = general pseudoscientific beliefs. COVID pseudo = COVID-19 specific pseudoscientific beliefs. BJW = belief in a just world. Disp. trust = dispositional trust. Govt. trust = governmental trust. CDC = Centers for Disease Control. Independ. = Independent political orientation. Other politic. = other political party affiliation. Risk percep. = COVID-19 risk perceptions. Soc. dist. = adherence to social distancing guidelines. Each political party affiliation variable (Republican, Democrat, Independent, and Other) was coded such that the indicated party affiliation was coded as 1 and all other party affiliations were coded as 0.

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Table 2. Final hierarchical linear model examining factors associated with adherence to social distancing guidelines initially and over time

	Final	
	Est (SE)	*p*
Model fit		
2LL (#parameters)	20,739.36 (50)	
$\Delta\chi^2$ (Δdf)	5,783.04 (8)	<.001
Fixed effects		
Intercept, γ_{00}	22.78 (0.36)	<.001
Age, γ_{01}	0.04 (0.01)	.001
Sex, γ_{02}	0.97 (0.27)	<.001
Medical, γ_{03}	0.30 (0.37)	.420
General pseudo, γ_{04}	−0.04 (0.02)	.050
COVID-19 pseudo, γ_{05}	−0.14 (0.04)	<.001
BJW, γ_{06}	–	–
Disp. trustγ_{07}	–	–
Govt. trust, γ_{08}	0.05 (0.02)	.009
CDC trust, γ_{09}	−0.29 (0.14)	.038
Democrat[a], γ_{010}	−0.64 (0.40)	.112
Independent[a], γ_{011}	−0.26 (0.41)	.524
Other political[a], γ_{012}	−1.12 (0.85)	.190
Risk perception, γ_{013}	−0.10 (0.08)	.234
Time slope, γ_{10}	−0.98 (0.25)	<.001
Age, γ_{11}	−0.01 (0.01)	.271
Sex, γ_{12}	−0.34 (0.18)	.059
Medical, γ_{13}	0.11 (0.25)	.661
General pseudo, γ_{14}	−0.03 (0.01)	.051
COVID-19 pseudo, γ_{15}	−0.01 (0.02)	.546
BJW, γ_{16}	–	–
Disp. trust, γ_{17}	–	–
Govt. trust, γ_{18}	0.03 (0.01)	.063
CDC trust, γ_{19}	0.25 (0.09)	.008
Democrat[a], γ_{110}	0.62 (0.28)	.026
Independent[a], γ_{111}	0.63 (0.28)	.023
Other political[a], γ_{112}	0.57 (0.57)	.315
Risk perception, γ_{113}	0.19 (0.06)	.001
Random effects		
Intercept, τ_{00}	3.70 (0.53)	<.001
Time slope, τ_{11}	1.08 (0.26)	<.001

SE standard error.

Sex (0 = male, 1 = female). Medical = medical condition that could increase COVID-19 risk (0 = absent, 1 = present). pseudo = pseudoscientific beliefs. BJW = belief in a just world. Disp. trust = dispositional trust. Govt. trust = governmental trust. Other political = other political party affiliation. Risk perception = COVID-19 risk perceptions.

[a]Republican served as the reference category in dummy-coded variables of political party affiliation.

(vs. male) and older (vs. younger) participants reporting higher initial levels of social distancing. Likewise, three of the hypothesized predictors were significantly uniquely associated with lower initial adherence to social distancing, including greater COVID-19-specific pseudoscientific beliefs, lower governmental trust, and, unexpectedly, *greater* trust in the CDC. Notably, the strongest association was found for trust in the CDC (d = −.127), followed by COVID-19 pseudoscientific beliefs (d = −.061) and governmental trust (d = .022). Neither general pseudoscientific beliefs (d = −.018; p = .050) nor Republican Party affiliation (vs. all other political party affiliations; ds = −.114 to .492) was significantly uniquely associated with initial levels of adherence to social distancing guidelines.

Change in adherence to social distancing guidelines over time

In the final model (see Table 2), political party affiliation was most strongly associated with change in adherence to social distancing guidelines over time, with both Democrats (d = .494) and Independents (d = .502) reporting significantly less steep declines in adherence to social distancing guidelines than Republicans. Greater trust in the CDC (d = .199) and higher COVID-19 risk perceptions (d = .151) were also significantly associated with less steep declines in adherence to social distancing guidelines. When controlling for all of the other variables in the model, general pseudoscientific beliefs (d = −.024; p = .051), governmental trust (d = .024; p = .063), and COVID-19-specific pseudoscientific beliefs (d = −.008; p = .546) were not significantly uniquely associated with change in adherence to social distancing guidelines over time.

Models examining explanatory role of COVID-19 risk perceptions

Next, we examined whether COVID-19 risk perceptions accounted for significant variance in the relations between two specific predictors (i.e., COVID-19 pseudoscientific beliefs and political party affiliation) and adherence to social distancing intercept and slope (see Table 3).

COVID-19-specific pseudoscientific beliefs

In contrast to the final hierarchical linear model presented above, greater COVID-19-specific pseudoscientific beliefs were significantly associated with both lower initial levels of adherence to social distancing and steeper declines in adherence to social distancing over time in this model (Table 3). Furthermore,

Table 3. Models examining explanatory role of COVID-19 risk perceptions in the relations of COVID-19 pseudoscientific beliefs and political party affiliation to adherence to social distancing guidelines

	COVID-19 pseudoscientific beliefs		Political party affiliation	
	Est (SE)	*p*	*Est (SE)*	*p*
Model fit				
2LL (#parameters)	13,728.98 (27)	–	12,263.46 (37)	–
Fixed effects				
Intercept	22.42 (0.20)	<.001	22.44 (0.34)	<.001
Age	0.05 (0.01)	<.001	0.04 (0.01)	<.001
Sex	0.94 (0.27)	<.001	1.06 (0.27)	<.001
Medical condition	0.22 (0.38)	.557	0.26 (0.39)	.515
Risk perceptions	−0.13 (0.09)	.138	−0.06 (0.09)	.496
COVID-19 pseudoscience	−0.14 (0.03)	<.001	–	–
Democrat[a]	–	–	−0.10 (0.38)	.785
Independent[a]	–	–	−0.06 (0.40)	.890
Other political[a]	–	–	−0.84 (0.89)	.343
Time slope	−0.42 (0.14)	.002	−0.90 (0.23)	<.001
Age	−0.01 (0.01)	.114	−0.01 (0.01)	.213
Sex	−0.52 (0.18)	.005	−0.46 (0.18)	.013
Medical condition	0.19 (0.26)	.450	0.15 (0.25)	.560
Risk perceptions	0.20 (0.06)	<.001	0.20 (0.05)	<.001
COVID-19 pseudoscience	−0.05 (0.02)	.010	–	–
Democrat[a]	–	–	0.65 (0.25)	.009
Independent[a]	–	–	0.48 (0.27)	.071
Other political[a]	–	–	0.42 (0.57)	.464
Indirect effects				
a paths:				
COVID-19 pseudoscience	−0.06 (0.02)	<.001	–	–
Democrat[a]	–	–	0.79 (0.23)	.001
Independent[a]	–	–	0.27 (0.26)	.300
Other political[a]	–	–	−0.77 (0.56)	.165
a × *b* paths, intercept:		–		
COVID-19 pseudoscience	0.01 (0.01)	.170	–	
Democrat[a]	–	–	−0.05 (0.07)	.504
Independent[a]	–	–	−0.02 (0.07)	.569
Other political[a]	–	–	0.05 (0.08)	.541
a × *b* paths, slope:				
COVID-19 pseudoscience	−0.01 (0.01)	.012	–	–
Democrat[a]	–	–	0.16 (0.07)	.015
Independent[a]	–	–	0.05 (0.05)	.321
Other political[a]	–	–	−0.16 (0.12)	.196
Random effects				
Intercept, τ_{00}	4.05 (0.55)	<.001	4.50 (0.58)	<.001
Time slope, τ_{11}	1.28 (0.28)	<.001	1.28 (0.27)	<.001

SE standard error.

Sex (0 = male, 1 = female). Medical condition = medical condition that could increase COVID-19 risk (0 = absent, 1 = present). Other political = other political party affiliation.

[a]Republican served as the reference category in dummy-coded variables of political party affiliation.

although COVID-19 risk perceptions were not significantly associated with initial levels of adherence to social distancing, higher COVID-19 risk perceptions were significantly associated with less steep declines in adherence to social distancing over time. Consistent with hypotheses, results revealed a significant indirect relation of greater COVID-19 pseudoscientific beliefs to steeper declines in adherence to social distancing over time through lower COVID-19 risk perceptions (Table 3).

Political party affiliation

Consistent with results of the final hierarchical linear model reported above, Republicans did not differ significantly from individuals affiliated with any other political party in their initial adherence to social distancing guidelines (see Table 3). However, compared to Republicans, Democrats had significantly less steep declines in adherence to social distancing guidelines over time, with a similar (albeit nonsignificant) trajectory among Independents (p = .071). Furthermore, although Independents and members of other political parties did not differ significantly from Republicans in their COVID-19 risk perceptions, Democrats reported significantly higher COVID-19 risk perceptions than Republicans, and higher COVID-19 risk perceptions were significantly associated with less steep declines in adherence to social distancing over time. Finally, providing partial support for study hypotheses, results revealed a significant indirect relation of Democratic (vs. Republican) Party affiliation to less steep declines in adherence to social distancing over time through higher COVID-19 risk perceptions.

Exploratory analyses

In light of the findings presented above and given the significant positive correlation between Republican Party affiliation and COVID-19 pseudoscientific beliefs, we explored whether COVID-19 pseudoscientific beliefs accounted for significant variance in the relation between political party affiliation and adherence to social distancing intercept and slope using an individual 2-2-1 multilevel structural equation model (see Supplementary Table 2). Consistent with the results of the correlation analyses, Republicans reported greater COVID-19 pseudoscientific beliefs than individuals affiliated with any other political party. Furthermore, results revealed significant indirect relations of Democratic (vs. Republican) Party affiliation to both greater initial adherence to social distancing and less steep declines in adherence to social distancing over time through lower COVID-19-specific pseudoscientific beliefs.

Discussion

Public health interventions focused on promoting social distancing are essential to limiting the spread of COVID-19 and related morbidity and mortality [75–78]. Yet, evidence suggests that there is wide variability in the extent to which individuals in the USA are adhering to social distancing guidelines [11]. In order to identify both individuals at risk for nonadherence to these guidelines and potential targets for national public health campaigns aimed at increasing acceptance of and compliance with these guidelines, it is important to identify individual difference characteristics that relate to lower adherence to social distancing guidelines. Thus, consistent with the HBM [15, 18, 19], this study examined four such characteristics expected to influence adherence to social distancing via reduced risk perceptions of COVID-19.

Study hypotheses were partially supported. In particular, and consistent with hypotheses, greater COVID-19-specific pseudoscientific beliefs and lower governmental trust were uniquely associated with lower initial adherence to social distancing guidelines. Likewise, Republican (vs. Democratic or Independent) Party affiliation, lower COVID-19 risk perceptions, and greater COVID-19 pseudoscientific beliefs (albeit only in the smaller individual 2-2-1 multilevel models) were associated with steeper declines in adherence to social distancing guidelines over time. Finally, and providing partial support for study hypotheses, although greater trust in the CDC was unexpectedly associated with lower initial adherence to social distancing guidelines (when accounting for the other variables in the model), it was also associated with significantly less steep declines in social distancing over time (consistent with hypotheses). These findings are consistent with past research linking greater pseudoscientific beliefs, lower governmental and institutional trust, lower risk perceptions, and Republican Party affiliation to lower engagement in health protective behaviors in the context of pandemics and epidemics [27, 30–32, 42, 44, 46, 47].

Notably, although dispositional trust was significantly positively correlated with initial adherence to social distancing and just world beliefs were significantly negatively correlated with COVID-19 risk perceptions, neither dispositional trust nor just world beliefs explained unique variance in initial adherence to social distancing guidelines or change in adherence to these guidelines over time. These findings suggest that these more general tendencies and ways of viewing the world may be less relevant to concrete actions in the context of the current pandemic than beliefs and trust specific to particular domains and institutions related to COVID-19. Alternatively, given past findings of positive associations between just world beliefs and both pseudoscientific beliefs [79] and Republican Party affiliation [80], as well as the moderate positive correlations between just world beliefs and both COVID-19-specific pseudoscientific beliefs and Republican Party affiliation in this study, it may be that the association of just world beliefs in particular with adherence to social distancing guidelines is better explained by their shared relations to COVID-19 pseudoscientific beliefs and Republican Party affiliation.

With regard to the theorized role of COVID-19 risk perceptions in the relations between the characteristics of interest and adherence to social distancing, results provided partial support for hypotheses. Specifically, and consistent with the emphasis on the role of risk perceptions in engagement in health protective behaviors within the HBM [15, 18, 19] results revealed significant indirect relations of both greater COVID-19 pseudoscientific beliefs and Republican (vs. Democratic) Party affiliation to steeper declines in adherence to social distancing guidelines over time through lower COVID-19 risk perceptions, suggesting that lower COVID-19 risk perceptions account for significant variance in the relations of these particular characteristics to decreased engagement in social distancing over time. Conversely, other factors may explain the relations of governmental and institutional (i.e., CDC) trust to adherence to social distancing guidelines during this pandemic, such as one's sense of civic duty or social norms [41, 81].

Together, results of this study highlight the relevance of pseudoscientific beliefs, governmental and institutional (vs. dispositional) trust, political party affiliation (Republican vs. Democratic or Independent), and risk perceptions to adherence to social distancing guidelines during the COVID-19 pandemic. Findings also highlight possible factors that may explain the association of Republican Party affiliation to lower adherence to social distancing. Specifically, in addition to providing support for the hypothesized explanatory role of lower COVID-19 risk perceptions in the relation of Republican (vs. Democratic) Party affiliation to steeper declines in adherence to social distancing over time, results of exploratory analyses suggested that the greater COVID-19 pseudoscientific beliefs endorsed by Republicans may partially account for the relation of Republican (vs. Democratic) Party affiliation to lower adherence to social distancing guidelines initially and over time. These findings are consistent with past literature suggesting that one way in which political party affiliation may influence engagement in health protective behaviors during public health emergencies is through varying levels of trust in different sources of information [82], with Democrats more likely to defer to scientific evidence when it comes to policy decisions than Republicans [51, 83], and Republicans and conservatives more likely to distrust scientists and endorse pseudoscientific beliefs [50, 51, 84]. Indeed, not only was Republican Party affiliation significantly associated with greater pseudoscientific beliefs in the present sample, it was also significantly associated with trust in the current government but not trust in the CDC. Thus, differences in the relative trust placed in the current government, CDC, and scientists in general may help explain the differences in adherence to social distancing guidelines as a function of political party affiliation in the COVID-19 pandemic.

Notably, the results of this study are consistent with emerging literature on COVID fatigue, which suggests that adherence to social distancing guidelines and other health protective behaviors in the context of this pandemic may decrease over time, as motivation for and patience with these behaviors wane as the pandemic persists [12, 85, 86]. Specifically, findings that, across all participants, adherence to social distancing guidelines declined significantly over time provide preliminary support for the presence of COVID fatigue among U.S. adults and its relevance to adherence to social distancing during this pandemic. Findings also highlight characteristics that may increase susceptibility to the behavioral manifestations of COVID fatigue, including endorsement of pseudoscientific beliefs and Republican Party affiliation. Likewise, results of this study are in line with recommendations to develop and implement wide-scale public health interventions focused on educating the public, debunking myths, increasing confidence in the CDC and other public health institutions, and decreasing the politicization of health protective behaviors in the context of pandemics to increase widespread acceptance of and adherence to public health recommendations during these times [41, 87]. Furthermore, findings highlighting the relevance of greater COVID-19 pseudoscientific beliefs to lower adherence to social distancing guidelines lend support to the suggestion by the WHO [88] that the COVID-19 pandemic has been accompanied by an "infodemic" involving the widespread dissemination of misinformation via social media platforms downplaying the severity of COVID-19 and encouraging individuals to disregard social distancing guidelines [89].

Several limitations of this study warrant consideration. First, although the use of a socioeconomically diverse U.S. nationwide community sample is a strength of this study, the generalizability of our findings to the larger U.S. population and racial/ethnic minorities in particular remains unclear. Replication of our findings in other nationwide samples, including more ethnically and racially diverse samples, is needed. Another limitation is the exclusive reliance on self-report questionnaire data, which may be influenced by social desirability biases or recall difficulties. Future research should incorporate timeline follow-back procedures or ecological momentary assessment to assess the factors relating to changes in adherence to social distancing guidelines over time.

Furthermore, although our use of a prospective design facilitates the examination of factors associated with changes in adherence to social distancing guidelines during the first few months of the COVID-19 pandemic, future research should examine these relations over more extended time periods, as well as explore the extent to which the nature and strength of these relations change as the pandemic persists and COVID fatigue increases. In particular, research incorporating the repeated assessment of all the constructs of interest across the next stages of the pandemic is needed to clarify the precise interrelations among these factors over time, including their likely reciprocal influences (e.g., through cross-lagged panel models). For example, it is possible that initial levels of social distancing could influence COVID-19 risk perceptions, which, in turn, could motivate future social distancing. Likewise, although we were able to examine if COVID-19 risk perceptions accounted for significant variance in the relations of the other factors to adherence to social distancing guidelines over time, the simultaneous assessment of both the individual difference characteristics of interest and risk perceptions precludes the investigation of the temporal relations among these factors and whether the characteristics of interest influence COVID-19 risk perceptions. Finally, although the focus on social distancing was of primary interest in the first few months of this pandemic and remains imperative to curbing the spread of the virus and related morbidity and mortality [90, 91] future research should expand the assessment of health protective behaviors during this pandemic to include adherence to mask-wearing recommendations and receiving vaccination.

Overall, results of this study suggest the potential utility of targeted public health interventions aimed at debunking myths and misperceptions of COVID-19, improving scientific literacy and trust in science, and emphasizing bipartisan support for social distancing guidelines in order to increase widespread adherence to these guidelines and curb the spread of the virus. Results also provide further support for the downsides of the COVID-19 infodemic that has emerged alongside the pandemic, highlighting the tangible negative public health consequences in terms of nonadherence to social distancing guidelines of the COVID-19 pseudoscientific beliefs that are being spread through social media.

Supplementary Material

Supplementary material is available at *Annals of Behavioral Medicine* online.

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Compliance With Ethical Standards

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Authors' Contributions KLG and MTT developed the study concept and worked with JRR to design the study. KMS collected the data. KLG, MTT, and JPR generated study hypotheses and SEW and KLDG analyzed the data. KLG drafted the manuscript, with assistance from JRR, KMS, JPR, SEW, KLDG, and MTT. All authors provided critical revisions of the manuscript and approved the final manuscript for submission.

Ethical Approval All procedures involved in this study received approval from the University of Toledo's institutional review board.

Informed Consent All participants provided informed consent prior to participating in this study.

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