



# Americans' Attitudes Toward COVID-19 Preventive and Mitigation Behaviors and Implications for Public Health Communication

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## Abstract

**Purpose:** Identifying drivers of behavior is essential to develop effective messaging around COVID-19 prevention and mitigation. Our study assessed for behavioral antecedents of social distancing, wearing face coverings, and sheltering in place during the onset of the COVID-19 pandemic. Although ours is an early assessment, understanding motivation for behavior will remain critical as U.S. vaccination uptake has stalled and variants continue to pose a health threat.

**Design:** Cross-sectional survey; Setting: Online assessments in April 10–13 and 17–20, 2020; Subjects: 2,279 U.S. adults identified through a national, probability-based web panel (34% response rate). Measures: self-reported behavior, perceived effectiveness and risk, worry, social norms, and knowledge.

**Analysis:** Multivariable regression analyses

**Results:** Most Americans reported social distancing (91%) and sheltering in place (86%). Just over half reported wearing face coverings (51%), whereas more (77%) said they intended to do so. Perceived effectiveness of the behavior was consistently associated with each outcome (OR = 2.34, 1.40, 2.11, respectively; all  $P < .01$ ). Perceptions about the extent to which others should comply with behavior (social norms) were strongly associated with intentions to wear a face covering only (OR = 6.30, 95% CI 4.34–9.15;  $P < .001$ ) and worry about getting COVID-19 was associated with sheltering in place and social distancing (OR = 2.63, 95% CI 1.15–5.00; 4.91, 95% CI 1.66, 14.50, respectively; all  $P < .05$ ).

**Conclusion:** Behavioral constructs were strongly associated with COVID-19 preventive and mitigation behaviors and have implications for communication.

## Keywords

COVID-19, behavior, public health, communication

## Purpose

Emergence of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and its associated disease (COVID-19) rapidly escalated to become an unprecedented worldwide pandemic. On March 13, 2020, the White House declared a national emergency.<sup>1</sup> The lack of a vaccine and effective treatment for COVID-19 at that time required that the public adopt non-pharmaceutical prevention and community mitigation strategies to slow the spread of disease and “flatten the curve.”<sup>2</sup> Many of these behavioral strategies and recommendations, such as wearing face coverings, practicing social distancing, or following mandates to shelter in place, were novel or difficult for some individuals to implement.

Early reports suggested that adoption of many of the recommended prevention and mitigation behaviors was high,<sup>3–5</sup> although estimates varied across samples and

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timeframes during this swiftly evolving public health crisis. Other evidence suggested that some vulnerable subgroups, such as black adults, those with comorbid conditions or low health literacy, had certain knowledge gaps about COVID-19 or questioned the value of preventive behaviors.<sup>3-6</sup> These groups may also have disparate risk factors that affect their exposure to COVID-19, such as close living or working conditions. Of more recent concern is the possibility for “behavioral fatigue,” where people become less motivated or less capable of following recommendations over sustained periods or when behavior recommendations are intermittently relaxed and then re-enforced.<sup>7</sup> Motivation to engage in preventive behaviors further may be impaired when people are presented with conflicting or inconsistent messaging, and introduction of an effective vaccine may also have this undesired effect on preventive behavior.<sup>8</sup>

Because managing the COVID-19 crisis continues to require large-scale behavior change, particularly wearing face coverings in many public settings, insights from social and behavioral science can be instrumental in guiding the development of effective intervention and communication efforts.<sup>9</sup> Previous studies have shown that behavioral constructs have a strong influence on COVID-19-related behaviors, including beliefs about the effectiveness of a prevention strategy<sup>10</sup> and beliefs about the social norms around the behavior, that is, what they perceive or observe that others are doing.<sup>11,12</sup> Emotion and worry may also motivate preventive behaviors around COVID-19, but at the expense of increased anxiety.<sup>13</sup>

The primary objective of our study was to identify behavioral antecedents of COVID prevention and control behaviors, namely social distancing, sheltering in place and wearing face coverings. We also explored sociodemographic determinants of these behaviors to identify subgroups who may be less likely to engage in these behaviors. Our study comes from a national survey of U.S. households on attitudes, knowledge, and behaviors related to COVID-19. We conducted our survey in April 2020, when most U.S. states had recently issued shelter-in-place orders. On April 3, 2020, just prior to fielding our survey, the White House Coronavirus Task Force and U.S. Centers for Disease Control and Prevention (CDC) announced a new recommendation to wear face coverings when in public in attempt to help slow the spread of the disease.<sup>14</sup> Prior to this announcement, the guidance on who should wear face coverings was evolving. Although our assessment provides insight to public behavior at one early timepoint during the pandemic’s trajectory, identifying the underlying influences of these behaviors and the communication recommendations that arise from our findings remains highly relevant, as adherence to preventive and mitigative behaviors will remain critical during dissemination of the COVID-19 vaccine and potentially beyond, as variants continue to pose a health threat.

## Methods

### Design

We conducted an online, cross-sectional survey of U.S. households from April 10–13 and 17–20, 2020. The RTI International Institutional Review Board reviewed the study protocol and determined it to be exempt from human subjects review.

### Sample

We used a pre-recruited, address-based web panel consisting of 55,000 members to identify study participants. The panel is based on a probability sampling of the U.S. population. Households received a computer and/or internet access if needed to be part of the panel. The resulting panel includes households with listed and unlisted telephone numbers, telephone and non-telephone households, cell phone-only households, and households with and without internet access. Study participants’ provided consent to participate in the online survey upon receiving the emailed invitation. From a random sample of 6710 panel members meeting initial eligibility criteria (adults aged 18 and over), a total of 2279 respondents completed the survey, yielding a 34% stage completion rate.<sup>15</sup> To prevent the possibility for misinformation, we provided all respondents with the link to the CDC website at the end of the survey.

### Measures

We developed measures based on key behavioral theories, including the protection motivation theory<sup>16,17</sup> and the health belief model,<sup>18</sup> and the emerging COVID-19 scientific evidence from authoritative sources such as the CDC and the World Health Organization. We selected constructs that were potential drivers of behavior in the current COVID-19 context, based on theory and empirical evidence.<sup>3,5,9-13</sup> Due to survey length constraints, we assessed most behavioral constructs with one or two items, with the exception of COVID-19 related knowledge, which used a 16-item index.

### Behavior

We assessed behavior with one item: “Which of the following actions, if any, are you currently taking to protect yourself from the coronavirus?” Respondents could check all behaviors that applied. Our analysis focused on three behaviors: (1) sheltering in place referring to orders to stay at home, (2) practicing social distancing, and (3) wearing a cloth face covering while in public. Because guidelines recommending face coverings coincided with the timing of our data collection, we also assessed intentions to engage in the behavior by asking respondents their level of agreement with the statement *I plan to*

wear a cloth face covering in public settings on a 4-point Likert scale (from 1 = strongly disagree to 4 = strongly agree).

### Perceptions and Attitudes

We measured perceptions and attitudes using well-known behavioral constructs. Responses were on 4- or 5-point Likert scales with higher values reflecting higher agreement with or level of the outcome being assessed. We assessed the following constructs with one item each: perceived susceptibility (*I am likely to get the coronavirus*); perceived severity (*If I get the coronavirus, chances are I will recover*; item reverse coded), worry (*I am worried about getting the coronavirus*), self-efficacy to prevent COVID-19 (*I feel confident I can prevent myself and my family from becoming infected with the coronavirus*), and negative outcome expectations (*What I do on a day-to-day basis will not affect how many people in my community get the coronavirus*). We assessed perceived effectiveness of each of the three behaviors with a single item each (*How effective do you think each of the following will be in protecting you and your family from getting the coronavirus?*). We assessed social norms with two items ( $\alpha=.67$ ) (e.g., *Everyone, including people who do not have symptoms, should wear a cloth face covering if they leave their home to prevent possible transmission of the coronavirus*). We also asked respondents their level of agreement with the statement *I would rather risk getting the coronavirus than lose my job* on a 4-point Likert scale. Respondents also reported their level of household resistance to social distancing through three items (e.g., *it is hard to get people in my household to stay home*).

### Knowledge

We developed a 16-item index assessing knowledge around COVID-19 across four domains: transmission (e.g., *The coronavirus is spread through coughing and sneezing*), susceptibility (e.g., *People of all ages can become infected with the coronavirus*), treatment or prevention (e.g., *Antibiotics can be used to prevent infection from the coronavirus*), and morbidity and mortality (e.g., *Most people who are infected with the coronavirus die from it*). Item responses were true/false/don't know. Higher scores on the index reflected greater knowledge about COVID-19. The knowledge index had a Cronbach alpha of .85, indicating high internal consistency.<sup>6</sup>

### Socio-Demographic and Medical Characteristics

We collected sociodemographic information from all respondents as covariates: age, sex, education, annual household income, region of country, and race/ethnicity. The panel's dataset also included responses (within a year old) on political leaning, employment status, and health insurance status. We assessed respondents' potential risk for severe disease through

a series of self-reported items on the presence or absence of conditions and comorbidities associated with higher morbidity from COVID-19, per CDC's website at the time of data collection.

### Analysis

We used a post-stratification process to adjust for survey nonresponse and for any noncoverage, undersampling, or oversampling resulting from the study-specific sample design based on the Current Population Survey<sup>19</sup> and weighted all respondents to these distributions. We conducted analyses in SAS version 9.3 and incorporated the survey weights to extrapolate to the U.S. population. We used multivariable

**Table 1.** Sample Demographic Characteristics (n = 2279).

Characteristic	Unweighted		Weighted	
	N	%	N	%
Sex				
Male	1176	51.6	1103	48.4
Female	1103	48.4	1176	51.6
Age				
18–24	192	8.4	237	10.4
25–34	358	15.7	399	17.5
35–49	543	23.8	548	24.1
50–64	672	29.5	693	26.0
65+	514	22.6	502	22.0
Race/ethnicity				
White, Non-Hispanic	1489	65.3	1440	63.2
Black, Non-Hispanic	174	7.6	269	11.8
Hispanic	453	19.9	374	16.4
Other, Non-Hispanic	163	7.2	196	8.6
Education				
High school or less	785	34.4	886	38.9
Some college	621	27.3	634	27.8
Bachelor's degree or higher	873	38.3	759	33.3
Income				
<\$25,000	261	11.5	308	13.5
\$25,000–\$49,999	419	18.4	415	18.2
\$50,000–\$99,999	736	32.3	707	31.0
\$100,000–\$149,999	398	17.5	375	16.5
≥\$150,000	465	20.4	474	20.8
Employed				
Yes	1508	66.2	1480	64.9
No	771	33.8	799	35.1
Geographic region				
Midwest	481	21.1	474	20.8
Northeast	399	17.5	399	17.5
South	787	34.5	864	37.9
West	612	26.9	542	23.8
Have one or more chronic conditions				
Yes	1031	47.1	1038	47.5
No	1156	52.9	1148	52.5

logistic regression analyses on the weighted sample to examine associations between behaviors and our constructs. Results of the multivariable analysis report the weighted, adjusted odds ratios (ORs) and 95% confidence intervals (CIs). The multivariable model included the following sociodemographic variables: age, sex, education, income, region of country, race/ethnicity, risk for severe disease, political leaning, employment status, and health insurance status.

## Results

Characteristics of the weighted and unweighted survey analytic sample ( $n = 2279$ ) are shown in Table 1. Respondents (unweighted) were about one-half male, 65% White, Non-Hispanic, 38% college educated, 23% were aged 65 or over, and 66% were employed. All four U.S. geographic regions were represented, with 35% coming from the South. Almost half (47%) reported the presence of one or more comorbid conditions that put them at risk for severe COVID-19 disease.

Figure 1 shows the proportion of respondents who reported engaging in the recommended behaviors. Most respondents reported following social distancing (91%) and sheltering in place (86%) measures. When asked about intentions to wear face coverings in public, 77% said they agreed or strongly agreed with this statement; only 51% were currently wearing face coverings in public at the time of this survey. Table 2 shows multivariable results and adjusted odds ratios for association between behavioral constructs and recommended behaviors separately, controlling for sociodemographic variables. We report findings related to respondents' intentions to wear face coverings rather than their reported behavior; the latter was a less useful outcome for study due to the recency of recommendations about face coverings at the time of data collection.

## Sheltering in Place

Behavioral factors associated with a greater likelihood to report sheltering in place were higher degree of worry (OR = 2.63, 95% CI 1.15–6.00;  $P = .022$ ) and stronger perceived effectiveness of the behavior (OR = 1.40, 95% CI 1.08–1.82;  $P = .012$ ). Greater knowledge about COVID-19 was moderately associated with this behavior (OR = 1.02, 95% CI 1.01–1.03  $P < .001$ ). Those who strongly agreed (OR = .28, 95% CI .14–.56;  $P < .001$ ) or agreed (OR = .33, 95% CI .20–.56;  $P < .001$ ) compared to strongly disagreed that they would rather risk getting the disease than lose their job were less likely to shelter in place. Those who agreed compared to strongly disagreed that COVID-19 was severe were also less likely to report the behavior (OR = .33, 95% CI .12–.95;  $P = .040$ ). Respondents who reported more resistance to social distancing among members of their household were less likely to report sheltering in place (OR = .49, 95% CI .37–.66,  $P < .001$ ). Measured behavioral variables not associated with sheltering in place were perceptions of susceptibility to COVID-19, negative outcome expectations, self-efficacy to prevent disease, and social norms (all  $P > .05$ ).

Men were less likely than women (OR = .62, 95% CI .43–.90;  $P = .011$ ) to report sheltering in place, as were those with less than a college education (high school or less: OR = .29, 95% CI .17–.49;  $P < .001$ ; some college: OR = .47, 95% CI .28–.78;  $P = .003$ ) compared with those with a college education or more; and those who were employed (OR = .37, 95% CI .23–.61;  $P < .001$ ) compared with those who were unemployed. Those at higher risk for serious disease were more likely (OR = 1.70, 95% CI 1.17–2.47;  $P = .005$ ) than those who were not at higher risk to report sheltering in place.

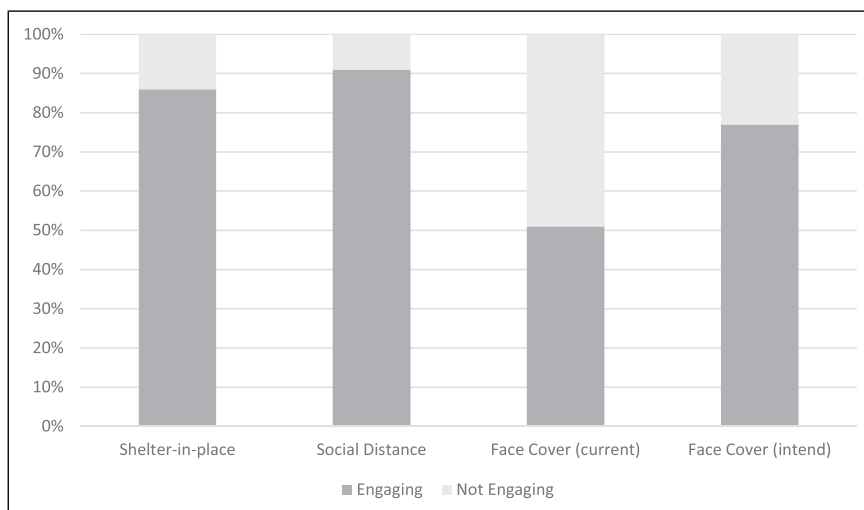


Figure 1. Proportion of Americans Engaging in Protective and Mitigation Behaviors, April 10-13 and 17-20, 2020.

**Table 2.** Multivariable Analyses of Behavioral and Sociodemographic Constructs.

Variable	Sheltering in place		Social distancing		Face covering	
	Adjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value
<b>Behavioral Constructs</b>						
Perceived susceptibility						
Strongly agree	.49 (.18, 1.33)	.164	.31 (.10, .93)	.037	3.54 (.88, 14.27)	.075
Agree	.91 (.45, 1.86)	.800	.67 (.27, 1.62)	.372	1.06 (.55, 2.05)	.864
Disagree	.91 (.48, 1.74)	.781	1.18 (.51, 2.72)	.692	1.01 (.54, 1.88)	.973
Strongly disagree	REF		REF			REF
Perceived severity <sup>a</sup>						
Strongly agree	.40 (.014, 1.19)	.098	.12 (.04, .33)	<.001	.70 (.21, 2.27)	.551
Agree	.33 (.12, .95)	.040	.10 (.03, .27)	<.001	.55 (.17, 1.79)	.323
Disagree	.38 (.12, 1.20)	.102	.18 (.06, .57)	.004	.37 (.10, 1.40)	.146
Strongly disagree	REF		REF			REF
Perceived effectiveness	1.40 (1.08, 1.82)	.012	2.34 (1.77, 3.09)	<.001	2.11 (1.66, 2.70)	<.001
Negative outcome expectations						
Strongly agree	1.39 (.63, 3.07)	.415	.82 (.31, 2.13)	.682	.46 (.26, .80)	.006
Agree	.53 (.26, 1.05)	.067	.65 (.27, 1.55)	.333	1.03 (.62, 1.72)	.903
Disagree	.69 (.36, 1.34)	.274	.88 (.37, 2.06)	.764	1.43 (.92, 2.24)	.113
Strongly disagree	REF		REF			REF
Self-efficacy						
Strongly agree	2.11 (.61, 7.30)	.237	2.75 (.66, 11.37)	.163	1.67 (.42, 6.64)	.464
Agree	2.23 (.68, 7.32)	.186	1.21 (.34, 4.35)	.765	1.67 (.44, 6.40)	.452
Disagree	2.06 (.62, 6.89)	.240	2.18 (.55, 8.62)	.266	1.47 (.39, 5.61)	.568
Strongly disagree	REF		REF			REF
Social norms (scale)	1.28 (.94, 1.75)	.122	1.26 (.87, 1.83)	.221	6.30 (4.34, 9.15)	<.001
Worry about getting coronavirus						
Strongly agree	2.63 (1.15, 6.00)	.022	4.91 (1.66, 14.50)	.004	2.16 (.91, 5.13)	.081
Agree	3.06 (1.50, 6.24)	.002	4.36 (1.66, 11.48)	.003	1.61 (.73, 3.56)	.240
Disagree	2.59 (1.32, 5.10)	.006	2.40 (.96, 6.00)	.062	1.38 (.63, 3.00)	.416
Strongly disagree	REF		REF			REF
Employment Risk Appraisal						
Strongly agree	.28 (.14, .56)	<.001	.54 (.20, 1.49)	.236	.70 (.33, 1.51)	.366
Agree	.33 (.20, .56)	<.001	.43 (.21, .88)	.020	1.00 (.63, 1.60)	.988
Disagree	.94 (.59, 1.52)	.815	.54 (.27, 1.07)	.077	1.33 (.89, 1.98)	.169
Strongly disagree	REF		REF			REF
Household resistance to social distancing (scale)	.49 (.37, .66)	<.001	.53 (.37, .77)	.001	.85 (.65, 1.11)	.234
Knowledge (index)	1.02 (1.01, 1.03)	<.001	1.02 (1.00, 1.03)	.011	.99 (.98, 1.01)	.405
<b>Medical/Demographics</b>						
Sex						
Male	.62 (.43, .90)	.011	.82 (.53, 1.28)	.382	.67 (.49, .93)	.015
Female	REF		REF			REF
Age						
18–24	1.05 (.43, 2.58)	.919	1.11 (.47, 2.64)	.816	.36 (.17, .76)	.008
25–34	.89 (.41, 1.89)	.755	.55 (.27, 1.14)	.110	.28 (.16, .50)	<.001
35–49	.78 (.38, 1.60)	.501	.88 (.43, 1.81)	.735	.26 (.15, .44)	<.001
50–64	.80 (.41, 1.58)	.524	1.78 (.84, 3.77)	.130	.56 (.33, .95)	.032
65+	REF		REF			REF
Race/ethnicity						
White, non-Hispanic	REF		REF			REF
Black, non-Hispanic	.98 (.47, 2.02)	.950	.98 (.42, 2.30)	.965	.99 (.52, 1.89)	.980
Hispanic	1.34 (.84, 2.15)	.223	.58 (.32, 1.06)	.078	1.10 (.69, 1.75)	.699

(continued)

Table 2. (continued)

Variable	Sheltering in place		Social distancing		Face covering	
	Adjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value
Other	1.06 (.53, 2.13)	.871	.89 (.34, 2.34)	.809	1.21 (.63, 2.31)	.567
Education						
High school or less	.29 (.17, .49)	<.001	.78 (.39, 1.54)	.472	.55 (.36, .84)	.006
Some college	.47 (.28, .78)	.003	.64 (.34, 1.23)	.181	.62 (.41, .94)	.023
Bachelor's degree or higher	REF		REF			REF
Income						
<\$25,000	1.10 (.50, 2.41)	.812	.98 (.40, 2.41)	.968	1.42 (.72, 2.84)	.314
\$25,000–\$49,999	.92 (.47, 1.78)	.795	.72 (.31, 1.67)	.444	.87 (.51, 1.48)	.595
\$50,000–\$99,999	.93 (.51, 1.70)	.816	1.27 (.59, 2.77)	.540	1.18 (.74, 1.87)	.494
\$100,000–\$149,999	.72 (.40, 1.31)	.285	.96 (.43, 2.17)	.928	1.56 (.95, 2.56)	.081
≥\$150,000	REF		REF			REF
Employed						
Yes	.37 (.23, .61)	<.001	1.53 (.92, 2.54)	.101	.90 (.60, 1.35)	.626
No	REF		REF			REF
Region						
Northeast	1.31 (.72, 2.36)	.374	.77 (.38, 1.54)	.459	1.35 (.81, 2.25)	.252
Midwest	1.20 (.69, 2.07)	.519	.70 (.37, 1.34)	.280	.46 (.30, .71)	<.001
South	.76 (.48, 1.20)	.242	.66 (.36, 1.18)	.162	.62 (.42, .93)	.021
West	REF		REF			REF
Have one or more chronic conditions						
Yes	1.70 (1.17, 2.47)	.005	1.22 (.76, 1.96)	.414	.87 (.64, 1.18)	.367
No	REF		REF			REF
Political leanings						
Liberal/extremely liberal	REF		REF			REF
Slightly liberal	1.09 (.54, 2.19)	.808	1.30 (.59, 2.85)	.510	.60 (.33, 1.08)	.086
Moderate/middle of the road	1.16 (.67, 1.98)	.599	1.67 (.87, 3.19)	.122	.81 (.50, 1.31)	.389
Slightly conservative	1.88 (.91, 3.89)	.088	2.97 (1.27, 6.95)	.012	.67 (.37, 1.23)	.197
Conservative/extremely conservative	1.50 (.85, 2.66)	.165	1.85 (.94, 3.65)	.075	.58 (.35, .97)	.038

<sup>a</sup>item was reverse coded such that higher perceived severity reflects lower perceptions of recovering from COVID should one contract the disease.

### Social Distancing

Stronger perceived effectiveness (OR = 2.34, 95% CI 1.77–3.09;  $P < .001$ ) and higher levels of worry (OR = 4.91, 95% CI 1.66–14.50;  $P = .004$ ) were strongly associated with social distancing behavior. Greater knowledge about the disease was moderately associated with social distancing behavior (OR = 1.02, 95% CI 1.00–1.03;  $P = .011$ ). Those who perceived COVID-19 as more severe were much less likely to report social distancing (OR = .12, 95% CI .04–.33;  $P < .001$ ), as were those who strongly agreed compared to strongly disagreed with the statement about perceived susceptibility to COVID (OR = .31, 95% CI .10–.93,  $P = .037$ ). Respondents who agreed compared to strongly disagreed with the statement *I would rather risk getting the coronavirus than lose my job* were less likely to engage in the behavior (OR = .43, 95% CI .21–.88,  $P = .020$ ) as were those who reported more resistance to social distancing among members of their household (OR = .53, 95% CI .37–.77,  $P = .001$ ). Measured behavioral variables

not associated with social distancing were negative outcome expectations, self-efficacy to prevent disease, and social norms (all  $P > .05$ ).

Medical and sociodemographic variables were not associated with social distancing (all  $P > .05$ ), with one exception. Those who reported slightly more conservative political beliefs were more likely to report social distancing compared with those with very liberal beliefs (OR = 2.97, 95% CI 1.27–6.95,  $P = .012$ ); this association was not present when compared with those with very conservative beliefs ( $P > .05$ ).

### Plans to Wear Face Covering

Higher social norms around mitigation behaviors were strongly associated with intentions to wear a face covering (OR = 6.30, 95% CI 4.34–9.15;  $P < .001$ ), as were stronger perceptions of the behavior's effectiveness (OR = 2.11, 95% CI 1.66–2.70;  $P < .001$ ). Respondents that strongly agreed



compared to strongly disagreed that behavior does not affect the larger community had lower intentions to wear face coverings (OR = .46, 95% CI .26–.80;  $P = .006$ ). Measured behavioral variables not associated with intentions to wear a face covering were perceptions of susceptibility, severity, self-efficacy, worry, employment risk appraisal, household resistance to social distancing, and knowledge.

Male sex (OR = .67, 95% CI .49–.93;  $P = .015$ ), lower education (high school or less: OR = .55, 95% CI .36–.84;  $P = .006$ ; some college: OR = .62, 95% CI .41–.94;  $P = .023$ ), younger age (age 18–24: OR = .36, 95% CI .17–.76,  $P = .008$ ; age 25–34: OR = .28, 95% CI = .16–.50,  $P < .001$ ; age 35–49: OR = .26, 95% CI .15–.44,  $P < .001$ ; age 50–64: OR = .56, 95% CI .33–.95,  $P = .032$ ), living in the Midwest (OR = .46, 95% CI .30–.71;  $P < .001$ ) or South regions (OR = .62, 95% CI .42–.93;  $P = .021$ ), and reporting highly conservative political beliefs (OR = .58 95% CI .35–.97;  $P = .038$ ) were associated with lower intentions to wear a face covering.

## Discussion

Our survey provides insight into Americans' self-reported behaviors during the early period of the COVID-19 pandemic. We fielded the survey in mid-April 2020, one week after CDC and the White House Coronavirus Task Force issued a new recommendation to wear face coverings in public<sup>14</sup> and when most U.S. states had recently issued shelter-in-place orders. Our findings showed that half of respondents reported wearing face coverings and more (77%) said that they intended to adopt this behavior. Most, but not all participants reported sheltering in place (86%) and social distancing (91%). Lower intentions and actual adherence to wearing face covering may have been partly due to the recency of the recommendation and because it was reversal of previous guidance by public health leaders.

Our study suggests that behavioral constructs strongly influenced COVID-19 behaviors, above and beyond the influence of standard sociodemographic measures. Social norms, which refers to respondents' perceptions about the extent to which other people should be expected to perform a behavior, were very strongly associated with intentions to wear face coverings in our study and is consistent with recent COVID-19 studies.<sup>11,12</sup> Other behavioral factors associated with greater intentions to perform this behavior were the belief that the behavior is effective for disease prevention or mitigation and the belief that a person's day-to-day behaviors around COVID-19 can affect the larger community. Public health messaging that emphasizes these key points is more likely to promote the desired behaviors around face coverings.

Stronger belief about the effectiveness of the recommended behaviors was the only measured variable that was consistently associated with each of our outcomes, and the influence of this factor on COVID-19 behavior has been shown in other research.<sup>10,11</sup> This finding emphasizes the

importance of clearly communicating that these behaviors are scientifically proven to prevent and mitigate the spread of COVID-19 in attempt to motivate behavior. Respondents who reported more worry about contracting COVID-19 were much more likely to engage in social distancing and sheltering in place, but greater perceptions of risk were not consistently associated with these behaviors. This finding suggests that worry about disease, which evokes a more emotional response, is potentially more motivating than a person's perceptions of their vulnerability to disease. This finding is consistent with research suggesting that fear and emotion are primary motivators of protective behavior in the context of the current pandemic.<sup>13</sup>

Stronger perceptions about the potential severity of COVID-19 should one get the disease was inversely related to engaging in these same two behaviors. This somewhat counterintuitive finding may suggest a fatalistic attitude toward disease for some. More likely, this inverse finding may be an example of reverse causation due to the cross-sectional nature of the data, such that people who were not able to shelter in place or socially distance due to work or family household considerations held more fatalistic attitudes towards the disease. Consistent with other research,<sup>13</sup> self-efficacy for preventing COVID-19 was not associated with any of the measured behaviors, suggesting that instilling confidence in one's ability to perform the recommended behaviors is unlikely to influence outcomes. Knowledge about COVID-19 prevention and transmission had only a moderate influence on behavior, suggesting that knowledge is an important but not sufficient catalyst for behavior change.

Male gender, younger age, and lower education were associated with less engagement in COVID-19 protective behaviors, particularly intentions to wear face coverings. Political leaning was not a reliable predictor of behavior in our study once controlling for other factors. Similarly, likelihood of engaging in preventive behaviors was not influenced by race and ethnicity, once controlling for other factors. This finding is encouraging, as it may suggest that messaging around COVID-19 behaviors may be reaching some vulnerable populations. However, it is plausible that messaging may still be problematic for other vulnerable populations, including those with low health literacy.<sup>3</sup> Participants in our study who reported having comorbid conditions that put them at risk for severe disease were no more likely than healthy individuals to engage in preventive behaviors, suggesting that greater effort may be needed to mobilize behavior for those who may benefit the most.<sup>5</sup>

We note some limitations to our findings. Our study assessed the influence of selected behavioral constructs that were actionable from a communication perspective. Therefore, other factors not measured in our survey may have influenced behavior, including low health literacy, living in multigenerational households, and close-contact working conditions. The cross-sectional design precludes us from determining the directionality of the findings, for example,

inability to perform a behavior due to living or work conditions may have in turn influenced attitudes towards the behavior. Social desirability could have inflated self-report of the recommended behaviors. Although survey response was moderate, we used a population-based sample and weighted the analysis to ensure generalizability.

In conclusion, our findings suggest that behavioral constructs, including perceptions of the effectiveness of a given behavior, the social norms around behavior, worry about COVID, and the belief that individual action has little effect on the health of the community, influence the public's likelihood of engaging in COVID-19 prevention and mitigation behaviors, above and beyond the influence of medical and socio-demographic factors. Communication strategies should also consider targeting male gender, younger age groups, and those with lower educations. Additionally, those who are at highest risk for severe COVID-19 disease due to comorbid conditions may require more careful approaches to motivate protective behavior.

## SO WHAT

### *What is already known on this topic?*

Strategies for communicating COVID-19 prevention and mitigation behaviors are needed, as vaccination efforts have stalled in many areas of the US, and variants continue to pose a health threat.

### *What does the article add?*

Behavioral constructs were strongly associated with COVID-19 prevention and mitigation behaviors, above and beyond medical and sociodemographic factors, and have implication for communication.

### *What are the implications for health promotion practice or research?*

Messaging to support continued practice of COVID-19 prevention and mitigation behaviors should focus on strengthening perceptions around the effectiveness of the recommended behaviors. Addressing social norms around face coverings should also be prioritized, as well as emphasizing how individual's day-to-day behaviors can have an influence on the larger community. Those with comorbid health conditions that put them at risk for severe COVID-19 disease may require more effort to motivate protective behavior.

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## Author Contributions

Thompson—analysis and interpretation; drafted manuscript; approval of final version. Squires—concept/design, data acquisition, analysis and interpretation, drafted manuscript; approved final version. Frasier—concept/design, data acquisition, critically revised manuscript, approved final version. Bann—concept/design, analysis, critically revised manuscript, approved final version. Bevc—concept/design, data acquisition, critically revised manuscript, approved final version; MacDonald—concept/design, interpretation, critically revised manuscript, approved final version; McCormack—concept/design, interpretation, critically revised manuscript, approved final version

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## IRB Review

The RTI International Institutional Review Board determined this study to be exempt IRB review. Study participants provided their consent to participate in the survey.

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