Routledge
Taylor & Francis Group

Health Communication

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/hhth20

Protection Motivation and the COVID-19 Virus

Robin M. Kowalski & Kelly J. Black

To cite this article: Robin M. Kowalski & Kelly J. Black (2021) Protection Motivation and the COVID-19 Virus, Health Communication, 36:1, 15-22, DOI: 10.1080/10410236.2020.1847448

To link to this article: https://doi.org/10.1080/10410236.2020.1847448

Published online: 16 Nov 2020.

Submit your article to this journal

Article views: 1774

View related articles

View Crossmark data

Citing articles: 1 View citing articles

Full Terms & Conditions of access and use can be found at
https://www.tandfonline.com/action/journalInformation?journalCode=hhth20

HEALTH COMMUNICATION
2021, VOL. 36, NO. 1, 15–22
https://doi.org/10.1080/10410236.2020.1847448

Routledge
Taylor & Francis Group

Check for updates

Protection Motivation and the COVID-19 Virus

Robin M. Kowalski[a] and Kelly J. Black[b]

[a]Department of Psychology, Clemson University; [b]Department of Psychology, North Seattle College

ABSTRACT

The current study examined the role of the components of the Protection Motivation Theory of Health (PMT) in predicting protective health behaviors related to the COVID-19 virus. Through a snowball sampling procedure, in Wave 1 424 respondents completed a survey in March 2020. One hundred thirteen of these participants completed the same survey in Wave 2 in May 2020. Consistent with research on SARS, females and older individuals engaged in the behaviors more often than men and younger individuals. After accounting for these variables in predicting frequency of protective health behaviors, components of the PMT accounted for an additional 12% of the variance in Wave 1 and 16% in Wave 2, with perceived severity and outcome efficaciousness correlating positively with frequency. Anticipatory regret mediated the relationship between PMT and protective health behavior frequency. The results suggest that public health announcements that are tailored toward the severity of the virus and the efficacy of the health behaviors in decreasing the spread of the virus may meet with more success than those that heighten people's vulnerability to the disease.

Coronavirus 2019 (COVID-19) is not the first global pandemic. In 2003, SARS (Severe Acute Respiratory Syndrome) originated in Asia and spread to 29 countries, resulting in 8,098 confirmed cases, with 774 deaths (Centers for Disease Control and Prevention (CDC), 2020d). Between 2014 and 2016, the Ebola outbreak in West Africa affected primarily three countries: Guinea, Sierra Leone, and Liberia. The prevalence rate in these three most hard-hit African nations was 28,652 cases, with 11,325 deaths (Centers for Disease Control and Prevention (CDC), 2020a). At the time of this writing (6–23-2020), Johns Hopkins University (2020) reported over 9.1 million confirmed cases of COVID-19 and over 470,000 deaths worldwide. In the United States, there are over 2,302,000 confirmed cases and over 120,000 deaths (Centers for Disease Control and Prevention (CDC), 2020b).

The primary symptoms of COVID-19 include fever, cough, and shortness of breath. The disease is believed to be spread through close human-to-human contact via respiratory droplets transmitted through coughs or sneezes or via droplets left on surfaces that are then touched by another person. While anyone can contract the virus, certain groups are at particularly high risk including the elderly, people with diabetes, people with cardiovascular disease, and individuals who are immunocompromised. The Centers for Disease Control (Centers for Disease Control and Prevention (CDC), 2020c) have issued recommendations for behaviors to reduce the spread of the virus including washing hands frequently, using hand sanitizer with at least 60% alcohol, engaging in social distancing (6 feet or more), self-quarantining, wearing a mask, and disinfecting surfaces on a regular basis.

In response to these recommendations, in Spring 2020 most state governors in the United States issued Stay-At-Home (SAH) orders and restricted the gathering of groups to 10 or fewer people. Citizens were encouraged to engage in social distancing when around others with whom they did not live. Sporting events, including Major League Baseball and the National Basketball Association, were canceled due to concerns about the virus spreading in large crowds. Public and private schools were closed, and colleges held classes completely online. Many businesses implemented a work from home (WFH) policy and only businesses deemed "essential" by their state governments were allowed to stay open (e.g., Washington State Coronavirus Response, 2020).

Compliance with recommended risk-reducing strategies

In the absence of a vaccine for COVID-19, the best practices to avoid contracting the virus involve people proactively engaging in the behaviors recommended by the CDC and World Health Organizations as with other pandemics (Brug et al., 2009). While the SAH orders and mandates to close any non-essential business were intended to "flatten the curve" to slow the rate of infection by COVID-19 until a treatment and/or a vaccine could be developed, the success of any recommendations is dependent largely on the willingness of individual citizens to comply with the orders and recommendations. However, studies have traditionally reported noncompliance with handwashing protocols even among healthcare staff (e.g., Muto et al., 2000).Research with previous pandemics, such as SARS and H1N1 flu, examined demographic and psychological factors that influence people's willingness to engage in protective health behaviors designed to prevent disease transmission (e.g., Bish & Michie, 2010; de Zwart et al., 2008). According to

CONTACT Robin M. Kowalski rkowals@clemson.edu Department of Psychology, 418 Brackett Hall, Clemson University, Clemson, SC 29634, USA
© 2020 Taylor & Francis Group, LLC

Bish and Michie (2010), health behaviors in response to pandemics fall into one of three categories: preventive, avoidant, and management of disease behaviors. Preventive behaviors across pandemics, including COVID-19, include handwashing, mask-wearing, coughing into one's sleeve, and getting vaccinations. Avoidant behaviors include social distancing, sheltering in place, and quarantining. Management of disease behaviors refers to measures taken once a person thinks they are sick and includes taking medication and visiting a doctor (Bish & Michie, 2010). Many of the health behaviors in response to SARS were similar to those recommended to prevent the spread of COVID-19 including frequent handwashing, social distancing, and self-quarantining (Lee-Bagley et al., 2004).

Studies examining demographic correlates of protective health behaviors in relation to pandemics have focused predominantly on age, gender, and race. Relative to younger individuals, older people were more likely to engage in preventive and avoidant health behaviors in relation to the SARS health threat (Lau et al., 2003; Leung et al., 2003). Similarly, Jones and Salathe (2009) observed that older individuals were more likely to wash their hands in response to the H1N1 flu. Women in Hong Kong and Singapore were more likely than men to report preventive behaviors during the SARS pandemic (Lau et al., 2003). Women in the United Kingdom also engaged in more preventive and avoidant behaviors in response to the swine flu threat (Jones & Salathe, 2009; Rubin et al., 2009). Fewer studies have examined ethnic differences in protective health behaviors. However, those that have been conducted with pandemics have suggested that nonwhite respondents are more likely to take preventive and avoidant actions than White respondents (Rubin et al., 2009).

Expectancy-value models have been used to predict behaviors in response to health-threats. Among these models is the Protection Motivation Theory of Health (PMT; Rogers, 1975, 1983). The PMT was originally created to understand the role of fear-based communications on health-related behaviors (Floyd et al., 2000). In its current form, the model states that individuals' willingness to begin a health-promoting behavior or to terminate a health-compromising behavior is a function of four factors: perceived vulnerability to the health threat, perceived severity of the health threat, outcome efficaciousness of behaviors that would reduce the health threat, and self-efficacy (Brug et al., 2009; Rogers, 1975; 1983; Rogers & Prentice-Dunn, 1997). Using the PMT as a basis to predict protective behaviors, it follows that those who will be most likely to engage in recommended COVID-19 protective behaviors would be those who believe their own vulnerability to the disease is high, believe that the virus is serious, believe that engaging in recommended behaviors will significantly reduce their risk of contracting the virus, and believe that they are capable of following through with recommended risk-reducing practices. Conversely, those who believe their risk is low, that the disease is mild, and who do not believe that the measures are effective and/or that they are unable to engage in the measures would report the lowest frequency of engagement in protective behaviors.

While useful, the PMT by itself focuses solely on people's cognitive evaluations of the consequences of the health-related choices that they make. Other researchers have suggested that factors that increase people's behavioral intentions or behaviors in response to health threats must include, in addition to risk perceptions, *anticipatory* emotions, such as worry and anxiety, and *anticipated* emotions, such as regret (Brewer et al., 2016; Janssen & Waters, 2019; Leppin & Aro, 2009; Lowenstein et al., 2001; Sheeran et al., 2014). Whereas anticipatory emotions are experienced in the moment, anticipated emotions are expected in the future (Lowenstein et al., 2001). Some individuals engage in risk prevention to allay anxiety and because they anticipate that not engaging in these health behaviors will lead to regret at some time in the future (anticipatory regret; Brewer et al., 2016). For example, Janssen and Waters found that intentions to engage in physical activity were greater among individuals with higher anticipated regret, greater perceptions of health risk, and greater worry. In another study, affect mediated the relationship between cognitive perceptions of risk and intentions to receive a colonoscopy (Klasko-Foster et al., 2020). According to Klasko-Foster et al., affective elements of risk, such as fear or anxiety over testing positive for a particular condition, can motivate engagement in protective health behaviors. Brown-Kramer and Kiviniemi (2015) examined the contributions of both cognitive and affective predictors in predicting breast and testicular self-examination. They found a positive relationship of both cognitive beliefs and affective feelings to breast and testicular self-examinations. In addition, affective associations fully mediated the relationship between cognitive beliefs and testicular self-examinations. No evidence for mediation was obtained with breast self-examinations.

Assessing people's perceptions of risk and protective health behaviors relative to a health threat, particularly a novel health threat, is important at any time, but particularly important during the initial disease stages. During the initial stages of pandemics when no vaccines are available, perceptions of risk are likely to be highest, emotional reactions of anxiety and fear most likely to accompany these perceptions of risk, and control of the disease most reliant on people choosing to engage in protective health behaviors (Leppin & Aro, 2009). The COVID-19 crisis has presented a situation with precisely these characteristics. Thus, the purpose of the current study was to test the efficacy of the components of the PMT in predicting engagement in protective health behaviors to thwart the spread of the COVID-19 virus. In addition, anticipated and anticipatory emotions were examined for their role in mediating the relationship of PMT predictors to health behaviors. Thus, the current study allows us to examine both cognitive and affective contributors to the frequency with which people engage in protective health behaviors related to the COVID-19 crisis in a longitudinal two-wave design. Previous research has highlighted the fact that perceptions of health threat, outcome efficacy, and self-efficacy are influenced by health communications provided to and among people at risk (Brug et al., 2009). Understanding the cognitive and affective variables that best predict engagement in protective health behaviors can help tailor health communications for maximal effectiveness without unnecessarily heightening anxiety. Health communications that target variables that appear less significant in influencing people's willingness to comply with recommended behaviors will likely be ineffective.

Hypotheses

Hypothesis 1: We predict that those for whom the perceived threat of COVID-19 is greatest combined with perceptions that the virus is serious, the belief in the efficacy of the recommended behaviors, and belief in one's own ability to carry out those behaviors will show the highest frequency of engagement with the recommended behaviors.

Hypothesis 2: Participants who are older, female, and nonwhite will be more likely to engage in the behaviors.

Hypothesis 3: The frequency with which people engage in protective behaviors will increase from Wave 1 to Wave 2 as the virus spreads and more information becomes available.

Hypothesis 4: The role of both cognitive and affective variables will be tested in mediational models. (a) During both Wave 1 and Wave 2, Protection Motivation is expected to be positively related to both regret and anxiety. (b) Protection Motivation is also expected to have a direct effect on protective health behaviors, even with regret and anxiety in the model. (c) The affective variables of regret and anxiety are hypothesized to predict protective health behaviors. (d) Anticipatory regret and anxiety are expected to mediate the relationship between protection motivation and performance of health behaviors intended to thwart the spread of COVID-19, as tested by the indirect effect in the mediational analysis.

Method

Participants

In a repeated measures design, participants completed a survey in March 2020 (Wave 1), and were invited to complete the survey again in May 2020 (Wave 2). The purpose of administering the survey twice to the same group of individuals was to detect changes in compliance with recommended behaviors among participants, particularly as the incidence of cases of COVID-19 increased. For Wave 1, a total of 477 individuals clicked on a link that allowed them to provide a permanent e-mail address where they could be reached to complete Wave 2 of the study. This page also provided them with an additional link to the actual survey. Of these 477 respondents, 425 clicked on the link to the actual survey and completed it. One participant was under 18 and had to be removed from the data set, leaving a total of 424 respondents. Of the group that responded in Wave 1, 113 (26.4%) of these individuals participated in Wave 2. Because this study was a repeated measures design, respondents created a code that they would be able to replicate when they completed subsequent phases of the study.

Among the respondents who completed the Wave 1 survey, 84% were female, 15% male, and 1% indicated that they were gender variant/preferred not to answer. Almost 95% (94.8%) of the sample was White, 1.4% Black/African American, 2.4% American Indian/Alaska Native, 1.2% Asian, and .2% Native Hawaiian/Pacific Islander. Almost 95% (94.7%) of the respondents in the second wave were White, with 85.8% being female.

Procedure

Following approval of the study by the Institutional Review Board, participants were recruited for the initial survey (Wave 1) through a Facebook Page published by the authors. This page included information about the study, the authors, and links to the survey. The page was shared publicly, and a snowball sampling procedure used whereby viewers were encouraged to share the page with their friends. Facebook ads were created to target audiences that showed low levels of participation, primarily minorities and men.

Materials

The survey assessed participants' perceptions and frequency of behaviors related to the COVID-19 virus. Demographic questions determined sex, race, and age. To assess exposure to the COVID-19 virus, participants were asked if they had been tested for the COVID-19 virus, if they had been exposed to the COVID-19 virus, if they had self-quarantined because of exposure to the COVID-19 virus, and if they had self-quarantined because of fear of being exposed to the COVID-19 virus. Participants responded to all four questions with a "no" or "yes." Participants also responded to a single item question asking how knowledgeable they were about the virus (1 = *not at all*; 5 = *extremely*). Participants reported, using a no/yes response format, whether they had experienced any of nine physical and psychological symptoms within the previous two weeks: runny nose, cough, fever, shortness of breath, stomach upset, trouble sleeping, anxiety, headache, and sore throat.

Participants also answered questions assessing the PMT, including "How serious would it be for you if you got the COVID-19 virus within the next two months?", "How likely do you think you are to get the COVID-19 virus within the next two months?", and "To what extent do you think you can take effective actions to prevent getting the COVID-19 virus?" Outcome efficaciousness was determined by asking participants how likely it was that each of 6 public health recommendations could reduce the probability of contracting the COVID-19 virus (Washing my hands, using hand sanitizer, maintaining social distance – at least 6 feet, disinfecting, self-quarantining, and wearing a mask). To determine the frequency with which people engaged in the protective health behaviors, participants indicated how often they engaged in each of the six health behaviors. Responses were averaged across the six behaviors to yield an overall index of protective health behavior.

To assess anxiety and anticipatory regret, participants completed two questions. First, participants indicated how nervous they were about the spread of COVID-19 virus (1 = *not at all*; 5 = *extremely*). They also indicated their agreement with the following statement: "If I were not to engage in behaviors thought to reduce the likelihood of spreading or contracting COVID-19, I would later regret it." A 5-point response format was used to indicate agreement (1 = *strongly disagree*; 5 = *strongly agree*).

Results

Of the participants who completed Wave 1 of the survey, 3.1% had been tested for the COVID-19 virus[1]. Only 1 respondent

(0.2%) had been diagnosed with the virus. Eight percent reported having self-quarantined because of exposure to someone with the virus; 61.6% indicated they had self-quarantined because of fear of exposure to the virus. Many participants reported experiencing some type of symptomatology within the previous two weeks including runny nose (42%), headache (52%), sore throat (27%), shortness of breath (12%), fever (6%), cough (34%), stomach upset (29%), trouble sleeping (52%), and anxiety (69%).

Similar percentages were reported by Wave 2 respondents: 8% had been tested for the virus, 1% had been diagnosed, 7% had self-quarantined because of exposure to someone with the virus, and 67.3% had self-quarantined because of fear of being exposed to the virus. With the exception of individuals in Wave 2 who reported stomach upset (23%), trouble sleeping (54.9%), and anxiety (60.2%), other symptomatology decreased: runny nose (23%), headache (44.2%), sore throat (14.2%), shortness of breath (11.5%), fever (1.8%), and cough (13.3%).

To ensure that those who completed both Wave 1 and Wave 2 surveys were not qualitatively different from those who completed only Wave 1, comparisons were conducted on all study variables. Comparisons were made using the responses from Wave 1 for two groups: those who completed both waves (W1&2) and those who completed only Wave 1 (W1). W1 and W1&2 groups were dummy-coded and conceptually related variables entered into multivariate analyses of variance for comparison to keep the Type I error rate down. Univariate ANOVAS were examined. Significant differences were obtained on only four variables out of all those tested: frequency of mask wearing [W1&2 (M = 1.95; SD = 1.37); W1 (M = 1.65; SD = 1.18)], the perception that disinfecting will decrease the likelihood of contracting the virus [W1&2 (M = 3.82; SD = .98); W1 (M = 3.97; SD = .85)], trouble sleeping [W1&2 (M = 1.60; SD = .49); W1 (M = 1.48; SD = .50)], and anticipatory regret [W1&2 (M = 4.54; SD = .83); W1 (M = 4.29; SD = 1.03)], $ps < .05$. Based on the findings, it was determined that, while these differences were statistically significant, the magnitude of the differences was small (η^2 for all four effects was .01). The finding that nonsignificant differences were obtained on the majority of variables suggests that W1&2 participants and W1 respondents do not differ in a meaningful way from one another.

Wave 1 to Wave 2 comparisons

A comparison of responses for Wave 1 and Wave 2 protective health behavior questions was conducted. As shown in Table 1, at both waves of data collection, when asked about the frequency with which they engage in behaviors designed to prevent the spread of the COVID-19 virus, participants were most likely to say that they engage in a combination of preventive (e.g., hand-washing) and avoidant (e.g., social distancing) behaviors. In Wave 1, mask-wearing was the least frequently endorsed behavior; however, this changed in Wave 2 when mask-wearing paralleled the frequency of self-quarantining. These results directly paralleled the perceived effectiveness of the behaviors for preventing the spread of the virus (see Table 1). Repeated measures ANOVAs to determine whether there was a significant change in the frequency and perceived effectiveness of the behaviors from Wave 1 to Wave 2 showed that hand-washing [$F(1, 112) = 6.15$, $p < .02$, $\eta^2 = .05$], social distancing [$F(1, 112) = 11.73$, $p < .001$, $\eta^2 = .10$], and self-quarantining [$F(1, 112) = 8.92$, $p < .003$, $\eta^2 = .07$] decreased from Wave 1to Wave 2, although the frequency was still high. Mask wearing, however, significantly increased in frequency from Wave 1 to 2, $F(1, 111) = 270.55$, $p < .001$, $\eta^2 = .71$. Perceived effectiveness ratings changed for only mask-wearing, which was rated as more effective at Wave 2 than at Wave 1, $F(1, 112) = 44.68$, $p < .001$, $\eta^2 = .29$.

Participants did not show a significant change in level of anticipatory regret from Wave 1 (M = 4.27; SD = 1.12) to Wave 2 (M = 4.18; SD = 1.01). In both waves, respondents were likely to say that they would later regret not engaging in behaviors they thought would reduce the likelihood of spreading or contracting the virus. Self-ratings of knowledge about the COVID-19 virus did not change from Wave 1 (M = 3.58; SD = .76) to Wave 2 (M = 3.58; SD = .82), $p > .05$.

Test of protection motivation theory

Perceived severity of the COVID-19 virus, perceived vulnerability to contracting the COVID-19 virus, outcome efficaciousness, and self-efficacy were entered as predictors in two hierarchical linear regression analyses, one conducted with all participants in Wave 1 and the second with participants in Wave 2. In the analysis with Wave 1 participants, engagement in protective health behaviors was regressed onto "Participation" (W1&2 and W1only, dummy coded) in Step 1, age and participants' sex in Step 2[2], knowledge about the COVID-19 virus in Step 3, and the PMT predictors in Step 4. Age ($\beta = .127$, $p < .009$), sex ($\beta = .213$, $p < .001$), and knowledge ($\beta = .11$, $p < 03$), were all significant predictors of the frequency of engagement in protective health behaviors (see Table 2). Adding the components of the PMT to the model accounted

Table 1. Frequency of engaging in health-protective behaviors and the effectiveness rating of the behaviors.

	Reported Frequency				Effectiveness Rating	
Variable	Wave 1 (total)	Wave 1-R	Wave 2-R	Wave 1 (total)	Wave 1-R	Wave 2-R
Washing hands	4.52 (.76)	4.63_a (.62)	4.45_a (.69)	4.23 (.87)	4.26 (.84)	4.27 (.70)
Hand sanitizing	3.59 (1.36)	3.53 (1.30)	3.71 (1.16)	3.65 (.98)	3.64 (3.78)	3.78 (1.02)
Social distancing	4.59 (.72)	4.65_b (.60)	4.38_b (.84)	4.14 (.89)	4.19 (.89)	4.04 (.88)
Self-quarantining	4.11 (1.12)	4.24_c (.97)	3.88_c (1.24)	4.44 (.85)	4.46 (.88)	4.31 (.95)
Disinfecting	3.87 (1.02)	3.75 (1.13)	3.66 (1.07)	3.93 (.91)	3.82 (.97)	3.70 (.91)
Mask-wearing	1.92 (1.36)	1.66_d (1.18)	3.87_d (1.24)	2.80 (1.12)	2.66_e (1.04)	3.51_e (1.11)

Note. Means in single row that share a common subscript differ significantly, $p < .05$. R = Responders in Wave 1 who also completed Wave 2.

Table 2. Predictors of COVID-19 protective behaviors – Wave 1.

		B	SE *b*	*Beta*	*p*
Step 1	(Constant)	3.783	0.034		0.001
	Participation	−0.035	0.065	−0.027	0.589
Step 2	(Constant)	3.081	0.147		0.001
	Participation	−0.023	0.063	−0.017	0.718
	Age	0.005	0.002	0.127	0.009
	Sex	0.253	0.057	0.213	0.001
Step. 3	(Constant)	2.822	0.186		0.001
	Participation	−0.034	0.063	−0.026	0.59
	Age	0.005	0.002	0.119	0.014
	Sex	0.233	0.058	0.196	0.001
	Knowledge	0.089	0.039	0.11	0.024
Step. 4	(Constant)	1.629	0.247		0.001
	Participation	−0.022	0.06	−0.017	0.708
	Age	0.003	0.002	0.068	0.16
	Sex	0.21	0.055	0.175	0.001
	Knowledge	0.052	0.038	0.065	0.167
	Perceived Severity	0.077	0.028	0.133	0.006
	Perceived Vulnerability	0.018	0.034	0.025	0.591
	Outcome Efficaciousness	0.156	0.044	0.178	0.001
	Self-Efficacy	0.133	0.038	0.175	0.001

Note. R^2 for Step 1 = .001, $p > .58$; $\triangle R^2$ for Step 2 =.06, $p < .001$; $\triangle R^2$ for Step 3 = .01, $p < .02$; $\triangle R^2$ for Step 4 = .12, $p < .001$

for an additional 12% of variance, with perceived severity (β = .133, $p < .006$), outcome efficaciousness (β = .178, $p < .001$), and self-efficacy (β = .175, $p < .001$) emerging as significant predictors.

The hierarchical regression analysis for Wave 2 data mirrored that for Wave 1 except there was no entry for "Participation." As shown in Table 3, age (β = .19, $p < .04$) and knowledge (β = .30, $p < .001$) significantly predicted protective health behaviors. Adding the components of the PMT to the model accounted for an additional 16% of the variance, with perceived severity (β = .25, $p < .009$) and outcome efficaciousness (β = .29, $p < .004$) significantly predicting frequency of engagement in the behaviors.

To test the extent to which anticipatory regret mediated the relationship between protection motivation and the frequency of engaging in protective health behaviors, two mediation analyses were conducted using Hayes Process model of analysis (Hayes, 2018). The analysis for Wave 1 revealed a significant indirect effect of protection motivation on frequency of protective health behaviors through anticipatory regret, $b = .077$, 95% CI [.03, .13], $p < .001$ (see Figure 1a). Similarly, for Wave 2, anticipatory regret mediated the relationship between protection motivation and protective health behavior frequency, $b = .18$, 95% CI [.04, .43], $p < .001$ (see Figure 1b). As can be seen in Figure 1, in both of these mediational models, protection motivation was positively related to regret, protection motivation predicted engagement in protective health behaviors even with regret in the model, and regret positively predicted protective health behaviors.

Table 3. Predictors of COVID-19 protective behaviors – Wave 2.

		B	SE *b*	*Beta*	*p*
Step 1	(Constant)	3.175	0.3		0.001
	Age	0.008	0.004	0.19	0.042
	Sex	0.238	0.129	0.171	0.067
Step 2	(Constant)	2.421	0.364		0.001
	Age	0.007	0.004	0.149	0.096
	Sex	0.235	0.123	0.168	0.06
	Knowledge	0.234	0.069	0.3	0.001
Step 3	(Constant)	1.621	0.447		0.001
	Age	0.002	0.004	0.034	0.709
	Sex	0.131	0.116	0.094	0.259
	Knowledge	0.155	0.069	0.199	0.028
	Perceived Severity	0.151	0.057	0.254	0.009
	Perceived Vulnerability	−0.051	0.081	−0.057	0.531
	Outcome Efficaciousness	0.272	0.093	0.293	0.004
	Self-Efficacy	0.01	0.08	0.012	0.898

Note. R^2 for Step 1 = .07, $p < .02$; $\triangle R^2$ for Step 2 = .09, $p > .001$; $\triangle R^2$ for Step = .16, $p < .001$.

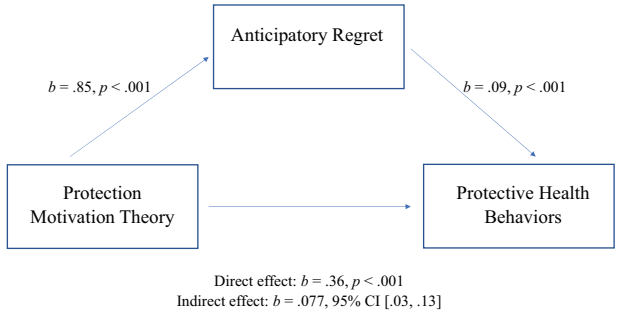
Similar mediational analyses were conducted with nervousness about the COVID-19 virus as the mediating variable. The results for the indirect effect for Wave 1 ($b = .03$, 95% CI [−.03, .08]) and Wave 2 ($b = .10$, 95% CI [−.06, .26]) showed no evidence for mediation. In addition, in neither Wave 1 ($b = .03$, 95% CI [−.03, .08], $t = .86$, $p > .38$), nor Wave 2 ($b = .08$, 95% CI [−.05, .22), $t = 1.24$, $p > .21$) did anxiety significantly predict engagement in protective health behaviors. However, as shown in Figure 2, in both Wave 1 and Wave 2, protection motivation was significantly positively related to anxiety, and protection motivation had a direct effect on the engagement in protective health behaviors with anxiety in the model.

Discussion

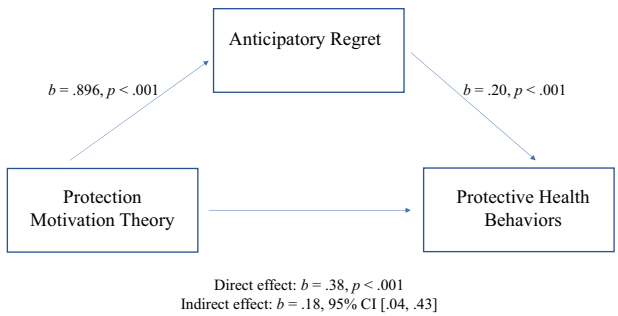
The purpose of this study was to determine the level of compliance with CDC recommended behaviors for reducing the risk of infection with the COVID-19 virus, and to test the ability of the components of the PMT to predict compliance with those behaviors when the pandemic was first considered a serious public health threat in the United States (Wave 1), and again when quarantining and social distancing had been applied across the country for several weeks (Wave 2). As will be discussed, the hypotheses of the study were largely supported.

Protection motivation theory

Consistent with Hypothesis 1, after accounting for age, sex, and knowledge of the COVID-19 virus, protection motivation accounted for an additional 12% of the variance in protective health behavior frequency in Wave 1 and 16% of the variance in Wave 2. In neither the model for Wave 1 nor the model for Wave 2, however, did perceived vulnerability emerge as a significant predictor. Further examination showed there was little variance across participants with most respondents in both waves thinking they were slightly to moderately vulnerable. Outcome efficaciousness and perceived severity significantly predicted engagement in the behaviors in both waves. People who perceived the behaviors to be more effective in reducing the spread of the virus and who evaluated the virus as more severe were more likely to report frequently engaging in the protective health behaviors recommended by the CDC. While news reports have already touted the severity of the COVID-19 virus, these results suggest that more and better communication could be provided to highlight the effectiveness of the CDC recommended behaviors in thwarting the spread of the virus. Previous research and the results of the current study suggest that attempts to heighten perceptions of severity or outcome efficaciousness might benefit from

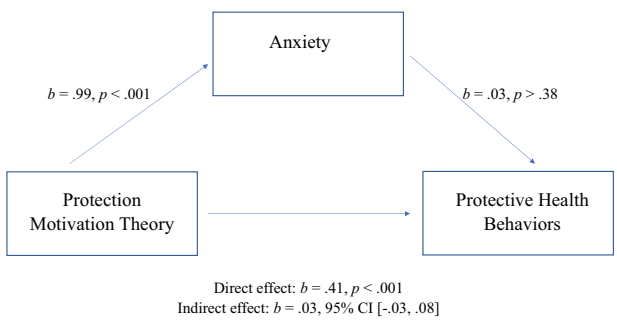


(a)

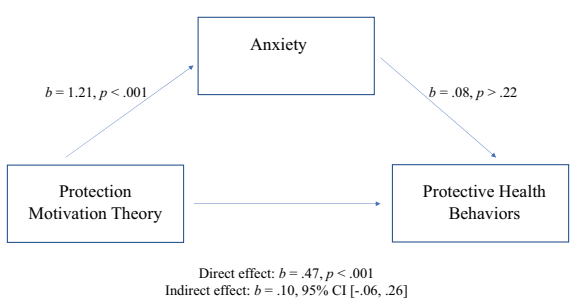


(b)

Figure 1. Relationship between PMT and protective health behaviors mediated by anticipatory regret. (a) Wave 1. (b) Wave 2.



(a)



(b)

Figure 2. Relationship between PMT and protective health behaviors mediated by anxiety. (a) Wave 1. (b) Wave 2.

simultaneously increasing awareness of emotions such as anticipatory regret (Sheeran et al., 2014).

As predicted by Hypothesis 2, age and sex significantly predicted engagement in protective health behaviors with women and older individuals being more likely to perform the behaviors. This is consistent with previous research on other health threats (e.g., Jones & Salathe, 2009; Lau et al., 2003). Unlike previous research, however, we did not include race as a predictor because of the homogeneous nature of our sample. Future research with a more heterogeneous population should investigate the role of race in predicting health behavior.

Compliance with recommended behaviors

When comparing responses about compliance with recommended risk-reducing behaviors, the frequency declined significantly for five of the six recommended behaviors: social distancing, handwashing, hand sanitizer use, disinfecting, and self-quarantining, disconfirming Hypothesis 3. It is important to note, however, that, even though the frequency of these behaviors decreased, the frequency was still high. One explanation for the decrease in reported frequency of the behaviors may be that many people had been subject to stay at home orders, so felt less need to engage in the behaviors during the second wave of the study compared to the first. However, this explanation is seemingly countered by the stark increase in frequency of mask wearing from Wave 1 to Wave 2. This finding is not all that surprising, however, given the change in recommendations from public health officials. In March 2020 when Wave 1 data were collected, the CDC recommended that citizens *not* wear a face mask because the supply was limited and health-care workers needed the masks. By May 2020, when Wave 2 data were collected, citizens were encouraged to wear cloth masks to reduce the risk of infecting others if one was an asymptomatic carrier of the virus. Thus, it follows that the self-reported frequency of mask wearing increased from Wave 1 to Wave 2.

Anticipatory regret and anxiety

The role of anticipatory regret in mediating the relationship between the PMT and the frequency of health-promoting behaviors was confirmed in both waves of the study (Hypothesis 4). Research on regret suggests that people are more likely to regret inactions as opposed to actions (Feldman et al., 1999). Clearly, part of the motivation for people's health-related behaviors is concern that they might, at some point in the future, regret not having taken action that could have thwarted a health threat (Janssen & Waters, 2019; Lowenstein et al., 2001). Consistent with this, Rivis et al. (2009) found a correlation of .45 between emotions such as regret and behavioral intentions. The CDC recommended behaviors are within the control of people to perform, so would be expected among individuals who perceive COVID-19 to be serious and believe in their ability to perform the behaviors. Anticipatory regret may be heightened among individuals who know someone who has been exposed to the virus or perhaps died from the virus. Although we did not directly test this idea in the current study, it would be an interesting line of investigation for future research.

Contrary to our hypothesis and previous research, anxiety did not mediate the relationship between the PMT and protective health behaviors. The majority of participants in both Wave 1 (86.7%) and Wave 2 (82.3%) reported at least moderate anxiety about the spread of the virus. This ceiling effect may explain why anxiety did not bear a significant relationship with protective health behaviors in either of the mediation analyses.

Limitations and future research

The results support not only the value of the PMT in predicting health behaviors but are also consistent with previous research examining the role of the PMT in predicting behaviors related to other health threats such as SARS (e.g., de Zwart et al., 2008). However, some limitations do surround the study. First, our response rate for Wave 2 of the study was only 26%. While this is a fourth of the original sample, and the individuals in this group do not differ in meaningful ways from the overall sample in Wave 1, we would have liked a larger response rate for Wave 2. Second, the study relied on surveys as the sole method of data collection. However, this method was appropriate given the design of the study. Third, the composition of the sample did not allow us to examine race as a predictor. In addition, because the sample was predominantly female, results related to sex should be interpreted with caution. Fourth, even though the COVID-19 virus is a worldwide pandemic, the current study focused on participants in the United States. An examination of the efficacy of the PMT in predicting health behaviors related to COVID-19 across cultures would be informative. Fifth, we used single-item assessments of anticipatory regret and of anxiety. While this is in keeping with previous research using anticipatory and anticipated emotions as mediating variables (e.g., Klasko-Foster et al., 2020), it may call into question the reliability of these measures. Lastly, our research asked about the frequency with which people were engaging in the health-protective behaviors without inquring specifically about the reasons why they were or were not engaging in those behaviors (e.g., they didn't need to because they weren't leaving the house, they were ordered to, they were tired of the COVID-19 situation and did not want to comply anymore). Future research should investigate not only the frequency of engagement in health behaviors but also the reasons for choosing to or not to engage in the behaviors.

The COVID-19 virus has presented the world with a situation unparalleled for those living today. The magnitude of the physical, psychological, and economic toll will not be fully known for some time. However, there is much to be learned from the virus and people's responses to it. This study represents just a small foray into what can be gleaned from the experience. The results suggest that public health announcements that focus on increasing perceptions of people's vulnerability to the virus may have little impact on changing health behaviors designed to stop the spread of the virus. Messages, however, tailored toward the severity of the virus and the efficacy of the health behaviors in decreasing the spread of the virus may meet with more success.

Notes

1. Data are available upon request.
2. Because of the small number of nonwhite respondents, race was not entered as a predictor in the regression analyses.

Acknowledgments

The authors would like to acknowledge the work of Rachel J. Kyes, Jill Enobo, Jewlia Meischke, Jean Salava, McKenzie Goff, and Piper Elwood and their professor, David Sattler, Ph.D. of Western Washington University, Bellingham WA, whose class project was the source of inspiration for this study.

References

Bish, A., & Michie, S. (2010). Demographic and attitudinal determinants of protective behaviours during a pandemic: A review. *British Journal of Health Psychology*, *15*(4), 797–824. https://doi.org/10.1348/135910710X485826

Brewer, N. T., DeFrank, J. T., & Gilkey, J. T. (2016). Anticipated regret and health behavior: A meta-analysis. *Health Psychology*, *35*(11), 1264–1275. https://doi.org/10.1037/hea0000294

Brown-Kramer, C. R., & Kiviniemi, M. T. (2015). Affective associations and cognitive beliefs relate to individuals' decisions to perform testicular and breast self-exams. *Journal of Behavioral Medicine*, *38*(4), 664–672. https://doi.org/10.1007/s10865-015-9641-6

Brug, J., Aro, A. R., & Richardus, J. H. (2009). Risk perceptions and behaviour: Towards pandemic control of emerging infectious diseases. *International Journal of Behavioral Medicine*, *16*(1), 3–6. https://doi.org/10.1007/s12529-008-9000-x

Centers for Disease Control and Prevention (CDC). (2020a, March 30). *2014-2016 Ebola outbreak distribution in West Africa*. https://www.cdc.gov/vhf/ebola/history/2014-2016-outbreak/distribution-map.html

Centers for Disease Control and Prevention (CDC). (2020b, June 23). *CDC COVID data tracker*. https://www.cdc.gov/covid-data-tracker/

Centers for Disease Control and Prevention (CDC). (2020c, March 30). *Corona virus 2019 (COVID-19)*. https://www.cdc.gov/coronavirus/2019-ncov/community/index.html

Centers for Disease Control and Prevention (CDC). (2020d, March 30). *Severe acute respiratory syndrome (SARS)*. https://www.cdc.gov/sars/about/fs-sars.html

de Zwart, O., Veldhuijzen, I. K., Elam, G., Aro, A. R., Abraham, T., Bishop, G. D., Voeten, H. A. C. M., Richardus, J. H., & Brug, J. (2008). Perceived threat, risk perception, and efficacy beliefs related to SARS and other (emerging) infectious diseases: Results of an international study. *International Journal of Behavioral Medicine*, *16*(1), 30–40. https://doi.org/10.1007/s12529-008-9008-2

Feldman, J., Miyamoto, J., & Loftus, E. F. (1999). Are actions regretted more than inactions? *Organizational Behavior and Human Decision Processes*, *78*(3), 232–255. https://doi.org/10.1006/obhd.1999.2833

Floyd, D., Prentice-Dunn, S., & Rogers, R. (2000). A meta-analysis of research on protection motivation theory. *Journal of Applied Social Psychology*, *30*(2), 407–429. https://doi.org/10.1111/j.1559-1816.2000.tb02323.x

Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (2nd ed.). Guilford.

Janssen, E., & Waters, E. A. (2019). Physical activity: The relative associations with cognitive and affective risk beliefs. *Psychology & Health*, *34*(11), 1294–1313. https://doi.org/10.1080/08870446.2019.1604954

Johns Hopkins University. (2020, June 23). *COVID-19 dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins*. https://coronavirus.jhu.edu/map.html

Jones, J. H., & Salathe, M. (2009). Early assessment of anxiety and behavioural response to novel swine-origin influenza A (H1N1). *PLoS One*, *4*(12), e:8032. https://doi.org/10.1371/journal.pone.0008032

Klasko-Foster, L. B., Kiviniemi, M. T., Jandorf, L. H., & Erwin, D. O. (2020). Affective components of perceived risk mediate the relation between cognitively-based perceived risk and colonoscopy screening. *Journal of Behavioral Medicine*, *43*(1), 121–130. https://doi.org/10.1007/s10865-019-00049-w

Lau, J., Yang, X., Tsui, H., & Kim, J. H. (2003). Monitoring community responses to the SARS epidemic in Hong Kong: From day 10 to day 62. *Journal of Epidemiological Community Health*, *57*(11), 864–870. https://doi.org/10.1136/jech.57.11.864

Lee-Bagley, D., DeLongis, A., Voorhoeave, P., & Greenglass, E. (2004). Coping with the threat of severe acute respiratory syndrome: Role of threat appraisals and coping responses in health behaviors. *Asian Journal of Social Psychology*, *7*(1), 9–23. https://doi.org/10.1111/j.1467-839X.2004.00131.x

Leppin, A., & Aro, A. R. (2009). Risk perceptions related to SARS and Avian influenza: Theoretical foundations of current empirical research. *International Journal of Behavioral Medicine*, *16*(1), 7–29. https://doi.org/10.1007/s12529-008-9002-8

Leung, G. M., Lam, T. H., Ho, L. M., Ho, S. Y., Chan, B. H. Y., Wong, I. O. L., & Hedley, A. J. (2003). The impact of community psychological responses on outbreak control for severe acute respiratory syndrome in Hong Kong. *Journal of Epidemiology and Community Health*, *57*(11), 857–863. https://doi.org/10.1136/jech.57.11.857

Lowenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological Bulletin*, *127*(2), 267–286. https://doi.org/10.1037/0033-2909.127.2.267

Muto, C. A., Sistrom, M. G., & Farr, B. M. (2000). Hand hygiene rates unaffected by installation of dispensers of a rapidly acting hand antiseptic. *American Journal of Infection Control*, *28*(3), 273–276. https://doi.org/10.1067/mic.2000.103242

Rivis, A., Sheeran, P., & Armitage, C. (2009). Expanding the normative and affective components of the theory of planned behaviour: A meta-analysis of anticipated affect and moral norms. *Journal of Applied Social Psychology*, *39*(12), 2985–3019. https://doi.org/10.1111/j.1559-1816.2009.00558.x

Rogers, R. (1975). A protection motivation theory of fear appeals and attitude change. *Journal of Psychology*, *91*(1), 93–114. https://doi.org/10.1080/00223980.1975.9915803

Rogers, R. (1983). Cognitive and physiological processes in fear-based attitude change: A revised theory of protection motivation. In J. Cacioppo & R. Petty (Eds.), *Social psychophysiology: A sourcebook* (pp. 153–176). Guilford Press.

Rogers, R., & Prentice-Dunn, S. (1997). Protection motivation theory. In D. S. Gochman (Ed.), *Handbook of health behavior research I: Personal and social determinants* (pp. 113–132). Plenum Press.

Rubin, G. J., Amlot, R., Page, L., & Wessely, S. (2009). Public perceptions, anxiety and behavioural change in relation to the swine flu outbreak: A cross-sectional telephone survey. *British Medical Journal*, *339*, b2651. https://doi.org/10.1136/bmj.b2651

Sheeran, P., Harris, P. R., & Epton, T. (2014). Does heightening risk appraisals change people's intentions and behavior? A meta-analysis of experimental studies. *Psychological Bulletin*. *140*(2), 511–543. https://doi.org/10.1037/a0033065

Washington State Coronavirus Response. (2020, April 7). https://coronavirus.wa.gov/what-you-need-know/safe-start