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BRIEF REPORT

# The Role of Risk Perceptions and Affective Consequences in COVID-19 Protective Behaviors

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## Abstract

**Background** Slowing the spread of the novel coronavirus (COVID-19) requires behavioral changes such as physical distancing (e.g., staying a 6-foot distance from others, avoiding mass gatherings, reducing houseguests), wearing masks, reducing trips to nonessential business establishments, and increasing hand washing. Like other health behaviors, COVID-19 related behaviors may be related to risk representations. Risk representations are the cognitive responses a person holds about illness risk such as, identity (i.e., label/characteristics of risk), cause (i.e., factors causing condition), timeline (i.e., onset/duration of risk), consequences (i.e., intrapersonal/interpersonal outcomes), behavioral efficacy (i.e., if and how the condition can be controlled/treated), and illness risk coherence (i.e., extent to which representations, behaviors, and beliefs are congruent). The current study applies the Common-Sense Model of Self-Regulation (CSM-SR) to evaluate how risk representations may relate to COVID-19 protective and risk behaviors.

**Methods** Participants include 400 workers from Amazon's Mechanical Turk aged ≥ 18 years and US residents. Participants completed an online survey measuring risk representations (B-IPQ) and COVID-19 related behaviors, specifically, physical distancing, hand washing, and shopping frequency.

**Results** Risk coherence, consequences, timeline, emotional representation, and behavioral efficacy were related to risk and protective behaviors.

**Conclusions** Risk representations vary in their relationship to COVID-19 risk and protective behaviors. Implications include the importance of coherent, targeted, consistent health communication, and effective health policy in mitigating the spread of COVID-19.

**Keywords** Risk perceptions · Risk representations · Health-risk behaviors · Risk behavior · Protective behavior · Common sense model of self-regulation · COVID-19 · Coronavirus

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## Introduction

COVID-19, a novel coronavirus, is the cause of a worldwide outbreak of respiratory illness that started in late 2019 and has had pervasive health, political, social, and economic impacts. Current Center for Disease Control and Prevention (CDC) recommendations to effectively slow the spread of COVID-19 are social distancing (e.g., maintaining a distance of 6 ft away from others, avoiding mass gatherings, reducing houseguests), wearing masks, hand washing, reducing travel and trips to nonessential businesses, and following local or state orders of sheltering-in-place [1]. Non-compliance to these guidelines may facilitate the spread of COVID-19 and increase the number of COVID-19 related deaths. Given the fast nature of the pandemic, it is urgent to identify key factors that promote COVID-19 protective behaviors. Consequently, the present research aims to examine potential factors associated with adherence to such directives.

Current research focuses on the biomedical and epidemiological aspects of COVID-19 [2, 3], but there is little known about the psycho-behavioral factors that relate to COVID-19 risk and protective behaviors. The literature on other diseases suggests that illness risk representations (hereafter risk representations), or the cognitive representations a person holds about illness risk, are important in understanding health behavior [4, 5]. For example, risk representations are positively associated with behaviors that prevent illness and that reduce illness severity once diagnosed [6]. In this regard, risk representations may also be important predictors of COVID-19 related risk and protective behaviors.

The Common-Sense Model of Self-Regulation (CSM-SR) [7] can elucidate how risk representations relate to risk and protective behaviors [8, 9]. The CSM-SR posits that in response to a health-related event, people form dynamic characterizations of illness risk. These characterizations form the basis of risk representations and include dimensions such as risk identity (severity), illness timeline, emotional representation, control, efficacy, and coherence (consistency across risk beliefs). According to CSM-SR, risk representations shape reasoned and emotional responses to health threats, which in turn, guide behaviors to avoid or mitigate negative health consequences [10, 11]. The potential influence of these risk representations on protective and risk behaviors may be useful to the development of an effective public response to slow the spread of COVID-19.

The current study uses data collected in April 2020 to investigate how risk representations predict the probability of having houseguests within the past 5 days, going on hikes, walks, or bike rides with others, staying 6 ft away from others, hand washing, and shopping frequency. It is hypothesized that higher risk representations will be associated with (1) lesser likelihood of having houseguests, (2) lesser likelihood of going on hikes, walks, or bike rides with others, (3) greater likelihood of staying 6 ft from others, (4) increased hand washing, and (5) lower shopping frequency.

## Method

Participants were recruited using Amazon's Mechanical Turk (MTurk), a marketplace where individuals complete paid tasks for various organizations. Although MTurk samples are prone to data quality concerns, there is evidence that attentive MTurk participants provide more reliable responses than traditional subject pool samples [12]. However, to maximize the probability of obtaining attentive MTurk participants, we employed a two-stage recruitment process, with the first stage being deployed on April 13, 2020. In this first stage, we recruited 936 participants who were 18 years or older and US residents to take a brief survey on opinions and behaviors related to COVID-19. The second stage was deployed one week later when participants were re-contacted and invited to take a follow-up one-item questionnaire resulting in a final sample of 400 participants. A power analysis suggested that the study sample of 400 was powered (0.80) to detect moderate effect sizes (OR 1.28) [13]. This study was considered exempt by the university's Institutional Review Board of Human Subjects Research.

### Measures

#### Covariates

Measures included items for age, gender, race/ethnicity (recoded as 0 = non-Hispanic White; 1 = other), education (0 = less than high school; 7 = postgraduate degree), high risk for severe COVID-19 (0 = no; 1 = yes), essential worker status (0 = no; 1 = yes), and whether the respondent lived under a shelter-in-place order (0 = no; 1 = yes).

#### Risk Representations

The 9-item Brief Illness Perception Questionnaire [14] assessed participants' cognitive and emotional risk representations of becoming infected with COVID-19. The risk representations were measured as follows: (1) *Identity*, "How severe do you think your symptoms would be if you became infected with COVID-19?"; (2) *Timeline*, "How long do you think the risk of being infected with COVID-19 will last?"; (3) *Consequences*,

"How much has the risk of being infected with COVID-19 affected your life?"; (4) *Personal control*, "How much control do you feel you have over whether or not you get infected with COVID-19?"; (5) *Perceived behavioral efficacy*, "How helpful do you think keeping 6-feet from others is in decreasing your risk of being infected with COVID-19?" and "How helpful do you think washing your hands is in decreasing your risk of being infected with COVID-19?"; (6) *Concern*, "How concerned are you about your risk of being infected with COVID-19"; (7) *Emotional representation*, "How much does the risk of being infected with COVID-19 affect you emotionally?"; and (8) *Risk coherence*, "How well do you feel you understand the risk of being infected with COVID-19?". Responses ranged from 0 = *not at all/no control* to 10 = *severely/extremely*, with the exception of timeline, which ranged from 0 = *one week* to 10 = *forever.* Scores were calculated such that higher scores indicated a greater perception of risk or greater risk coherence, with the exception of personal control. For personal control, a high score would indicate a greater sense of personal control, which translates to reduced risk perception.

#### Outcomes

There were five COVID-19 behavioral outcomes. Three variables measured risk behaviors, including (1) having houseguests within the past 5 days (0 = no; 1 = yes); (2) going on hikes, walks, or bike rides with non-household members (hereafter going on hikes; 0 = no; 1 = yes); and (3) the number of days participant went shopping in a week. The number of days of shopping (shopping frequency) was averaged across seven different venues, including grocery stores, pharmacies, liquor stores, retails stores, bulk buy stores, fast food restaurants, and hardware stores. There were two additional protective behavioral outcomes: (1) staying 6 ft away from others when outside of the home (0 = no; 1 = yes) and 2) hand washing frequency since first hearing of COVID-19. Hand washing frequency was coded on a 3-point scale (0 = less than before; 1 = about the same as before; and 2 = more than before).

#### Statistical Analyses

Logistic analyses (Table 1) were performed to examine the relationships between all risk representations and three dichotomous outcomes: having houseguests, going on hikes, and staying 6 ft from others. Linear regression analyses (Table 2) were utilized to examine the relationship between all risk representations and two non-dichotomous variables: hand washing frequency and shopping frequency. Education level, whether a shelter-in-place order was in effect, age, race/ethnicity, essential worker status, and COVID-19 high-risk status, were included in analyses as covariates.

## Results

### Demographics

US participants ($N = 400$) had a mean age of 37.98 ($SD = 12.38$), were 50.5% female, identified as being non-Hispanic White (75.1%), and held a bachelor's degree or above (70.5%). On average, participants reported living with 3.22 ($SD = 1.88$) household members. Those who had houseguests within the past 5 days had an average of 6.23 ($SD = 11.09$) guests over. A shelter-in-place order was under effect for 70% of participants at the time of the survey, and 38.5% of participants identified as essential workers. The majority of participants were not at high risk for severe COVID-19 (71.3%).

### COVID-19 Risk Behaviors

#### Houseguests Within the Past 5 Days

Among risk representations; consequences, emotional representation, and risk coherence were significantly related to having houseguests within the past 5 days. Perceiving higher COVID-19 negative consequences, higher coherence of COVID-19 risks, and identifying as an essential worker were related to lower odds of having houseguests. Meanwhile, increased emotions regarding COVID-19 risk, as well as being at high risk for severe COVID-19, were associated with greater odds of having had a houseguest (Table 1).

#### Going on Hikes

Among risk representations, only risk coherence was significantly related to going on hikes with others. Higher coherence of COVID-19 risks, as well as being non-White and an essential worker were associated with reduced odds of going on hikes with others. Being at high risk for severe COVID-19 and higher education were associated with greater odds of going on hikes with others (Table 1).

#### Shopping Frequency

Among risk representations; perceptions of long-term COVID-19 risk, perceptions of personal control over COVID-19, emotional representation, perceived

**Table 1** Logistic regression results for risk representations and having houseguests, going on hikes, and staying 6 ft from others

| Houseguests within the past 5 days | Odds ratio | 95% CI | | *p* value |
|---|---|---|---|---|
| Consequences | .879 | .776 | .996 | .042 |
| Timeline | 1.121 | .967 | 1.300 | .130 |
| Personal control | 1.110 | .995 | 1.238 | .062 |
| Identity | .966 | .847 | 1.101 | .601 |
| Concern | .968 | .839 | 1.117 | .654 |
| Emotional representation | 1.214 | 1.062 | 1.388 | .005 |
| Behavioral efficacy-6 ft from others | .991 | .855 | 1.148 | .903 |
| Behavioral efficacy-hand washing | 1.006 | .872 | 1.160 | .936 |
| Risk coherence | .847 | .731 | .981 | .026 |
| Education | 1.109 | .914 | 1.346 | .294 |
| Shelter-in-place | .900 | .513 | 1.580 | .715 |
| High risk for COVID-19 | 2.159 | 1.143 | 4.080 | .018 |
| Essential worker | .388 | .239 | .629 | .000 |
| Race/ethnicity | .654 | .353 | 1.212 | .177 |
| Age | 1.002 | .981 | 1.025 | .830 |
| Going on hikes, walks, or bike rides with others | | | | |
| Consequences | .927 | .800 | 1.0742 | .314 |
| Timeline | 1.129 | .951 | 1.341 | .167 |
| Personal control | 1.066 | .940 | 1.210 | .320 |
| Identity | 1.053 | .903 | 1.229 | .511 |
| Concern | 1.084 | .917 | 1.282 | .345 |
| Emotional representation | 1.072 | .918 | 1.252 | .379 |
| Behavioral efficacy-6 ft from others | .964 | .812 | 1.145 | .678 |
| Behavioral efficacy-hand washing | .933 | .796 | 1.093 | .391 |
| Risk coherence | .757 | .639 | .896 | .001 |
| Education | 1.314 | 1.041 | 1.658 | .022 |
| Shelter-in-place | 1.457 | .758 | 2.803 | .259 |
| High risk for COVID-19 | 3.563 | 1.794 | 7.077 | .000 |
| Essential worker | .345 | .200 | .596 | .000 |
| Race/ethnicity | .468 | .229 | .957 | .037 |
| Age | .980 | .9552 | 1.005 | .116 |
| Staying 6 ft from others | | | | |
| Consequences | .980 | .787 | 1.221 | .858 |
| Timeline | .832 | .640 | 1.082 | .170 |
| Personal control | .831 | .660 | 1.046 | .114 |
| Identity | .824 | .644 | 1.055 | .125 |
| Concern | 1.296 | .989 | 1.700 | .060 |
| Emotional representation | .797 | .607 | 1.047 | .104 |
| Behavioral efficacy-6 ft from others | 1.731 | 1.336 | 2.242 | .000 |
| Behavioral efficacy-hand washing | .923 | .736 | 1.156 | .484 |
| Risk coherence | 1.199 | .941 | 1.527 | .142 |
| Education | .990 | .677 | 1.447 | .957 |
| Shelter-in-place | 8.747 | 3.258 | 23.488 | .000 |
| High risk for COVID-19 | 9.275 | 1.046 | 82.233 | .045 |
| Essential worker | .444 | .179 | 1.101 | .080 |
| Race/ethnicity | .546 | .188 | 1.585 | .266 |
| Age | .983 | .943 | 1.026 | .436 |

**Table 2** Linear regression results for risk representations and hand washing and shopping frequency

| Model | Unstandardized coefficients | | *p* value |
|---|---|---|---|
| Hand washing | *β* | Std. error | |
| (intercept) | 2.127 | .194 | .000 |
| Consequences | .003 | .013 | .797 |
| Timeline | −.002 | .015 | .917 |
| Personal control | −.016 | .011 | .140 |
| Identity | −.011 | .013 | .402 |
| Concern | .006 | .015 | .705 |
| Emotional representation | −.015 | .013 | −1.12 |
| Behavioral efficacy-6ft from others | .008 | .015 | .590 |
| Behavioral efficacy-hand washing | .046 | .015 | .002 |
| Risk coherence | .035 | .015 | .019 |
| Education | −.002 | .020 | .910 |
| Shelter-in-place | .127 | .060 | .034 |
| High risk | − .081 | .069 | .240 |
| Essential worker | .014 | .051 | .777 |
| Race/ethnicity | −.070 | .063 | .268 |
| Age | .002 | .002 | .325 |
| Shopping frequency | | | |
| (intercept) | 3.971 | .632 | .000 |
| Consequences | −.035 | .041 | .398 |
| Timeline | .167 | .049 | .001 |
| Personal control | .205 | .036 | .000 |
| Identity | .077 | .044 | .078 |
| Concern | .049 | .048 | .306 |
| Emotional representation | .101 | .043 | .020 |
| Behavioral efficacy-6ft from others | −.018 | .050 | .710 |
| Behavioral efficacy-hand washing | −.155 | .049 | .002 |
| Risk coherence | −.171 | .049 | .001 |
| Education | .077 | .065 | .238 |
| Shelter-in-place | −.646 | .194 | .001 |
| High risk | .991 | .223 | .000 |
| Essential worker | −1.096 | .166 | .000 |
| Race/ethnicity | −.086 | .205 | .677 |
| Age | −.011 | .008 | .148 |

effectiveness of hand washing, and coherence of COVID-19 risk were significantly related to shopping frequency (Table 2). Timeline, personal control, emotional representation, and being at high risk for severe COVID-19 were positively related to shopping frequency. Perceived behavioral efficacy (hand washing) and risk coherence were negatively related to shopping frequency. Both an active shelter-in-place order and being an essential worker were negatively associated with shopping frequency. The full model explained a significant amount of variance in shopping frequency ($R^2 = 0.43$, $F[15, 325] = 17.89$, $p < 0.001$).

## COVID-19 Protective Behaviors

### Staying 6 ft from Others When Outside the Home

Among risk representations, perceived behavioral efficacy (maintaining a 6-ft distance) was significantly related to staying 6 ft from others when outside of the home (Table 1). Perceived effectiveness of maintaining a 6-ft distance from others, as well as living under a shelter-in-place order and being at high risk for severe COVID-19, were associated with higher odds of staying 6 ft from others when outside of the home.

### Hand Washing

Among risk representations, perceived behavioral efficacy (hand washing) and risk coherence were significantly related to hand washing frequency (Table 2). Perceived effectiveness of hand washing, coherence of COVID-19 risk, and an active shelter-in-place order were positively associated with hand washing frequency. The full model explained a significant amount of variance in hand washing frequency ($R^2 = 0.09$, $F[15, 325] = 3.14$, $p < 0.001$).

## Discussion

The current study emphasizes the complex nature of promoting COVID-19 protective behaviors. Among risk representations, COVID-19 risk coherence emerged as one of the most consistent factors underlying COVID-19 related behaviors. A coherent understanding of COVID-19 risks was associated with reduced engagement in COVID-19 related risk behaviors (e.g., having houseguests, going on hikes, and shopping) as well as increased protective behavior (e.g., hand washing). Additionally, greater perceived consequences of COVID-19 was associated with a reduced likelihood to have houseguests. These results are consistent with existing literature that discusses increased risk perceptions and coherence relating to protective behaviors and effective health responses [6, 15]. They also demonstrate the importance of consistent and coherent health communications in promoting adherence to COVID-19 behavioral guidelines.

In contrast to our hypotheses, emotional representation was positively associated with COVID-19 related risk behaviors (e.g., having houseguests and shopping). This was contrary to our expectation that increased emotions would deter COVID-19 risk behaviors. One way to interpret this finding is increased emotions surrounding COVID-19 risk, as an affective response, is related to heightened anxiety [16, 17], which may spark coping behaviors that include connecting with others or shopping/amassing

supplies. Indeed, those who identified as being at high risk for severe COVID were more likely to have had houseguests and go on hikes with others. Moreover, longer timelines associated with the pandemic were also related to shopping frequency, potentially an indication of panic buying. These results are consistent with social coping literature [18, 19] such that those who feel vulnerable are more likely to engage in coping behaviors to address negative affect (not necessarily to address their risk). The complex nature of risk representations and COVID-19 behaviors stress the importance of a nuanced approach to health communications. Future research would benefit from including self-efficacy and locus of control variables, as these are factors that relate to affective response and risk perception [20, 21]. Moreover, health messages would do well to increase risk perception on a cognitive level but also decrease some of the potential risk-related anxiety, perhaps by increasing self-efficacy [22].

The current study also demonstrated that policies are powerful tools in curbing the pandemic. Participants who were under a shelter-in-place order were more likely to engage in protective behaviors (e.g., staying 6 ft from others and increased hand washing) and less likely to engage in risk behaviors (decreased shopping frequency). This suggests that the shelter-in-place order plays a vital role in the American public's behavioral responses to COVID-19. What remains to be seen is how shelter-in-place might play an ongoing role in behaviors and risk representations. Over the course of the pandemic, shelter-in-place orders have come and gone across various regions in the USA. In this regard, it is important to also understand how fluctuating policies might impact perceptions and how those fluctuations might impact long-term adherence to pandemic guidelines.

The cross-sectional design of the current study limits the ability to assign temporal relationships between the behaviors or examine how reappraisal could be influencing the variables of interest. In addition to this limitation, this data is based on an online sample, which does not reflect the US population. However, due to the current guidelines of social distancing, collecting online data is the most effective way to reach the broadest participant pool. It is also important to keep in mind that due to the rapidly evolving nature of the COVID-19 pandemic, guidelines, and strategies may rapidly shift. For example, the current study took place prior to masking recommendations or the emergence of viable vaccines and thus did not include variables related to masks or vaccination. Still, the current findings may demonstrate future relevance in dealing with COVID-19 or other similar widespread diseases.

Potential limitations of the study are contrasted by its strengths. The present study is one of few that examines psychological and behavioral factors relating to COVID-19 and presents novel findings and discussion surrounding the COVID-19 pandemic. Additionally, the current study highlights the utility of theory-driven empirical research to better understand health behaviors, and consequently, better inform policies and public health strategies. Future studies may wish to mirror this approach for emerging COVID-19 interventions such as public health campaigns surrounding COVID-19 vaccination.

Overall results suggest that certain risk representations, such as increased coherence, behavioral efficacy, and perceived consequences, may promote COVID-19 related protective behaviors, but others may facilitate potential risk behavior due to fear-arousal responses. Considering the relationships between shelter-in-place and spread-reducing behaviors, accompanied by the relationships between risk representations and these same behaviors, a joint effort of comprehensive health communication and public health policy can relate to effective mitigation of the spread of COVID-19.

## Declarations

**Ethical Approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

**Conflict of Interest** The authors declare that they have no conflicts of interest.

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