

Adherence to Recommended Preventive Behaviors During the COVID-19 Pandemic: The Role of Empathy and Perceived Health Threat

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Abstract

Background Coping via empathic responding may play a role in preventive behavior engagement during the COVID-19 pandemic, and unlike trait empathy, is a potentially alterable target for changing health behavior.

Purpose Our goal was to examine the role of empathic responding in preventive behavior engagement during the COVID-19 pandemic, independent of trait empathy and perceived threat of COVID-19.

Methods Participants ($N = 2,841$) completed a baseline survey early in the pandemic, and a follow-up survey approximately 2 weeks later ($M = 13.50$ days, $SD = 5.61$). Preventive health behaviors, including physical distancing and hygiene practices, were assessed at both timepoints. Hierarchical linear regression examined the contributions of trait empathy, perceived threat of COVID-19, and empathic responding at baseline to preventive behaviors at follow-up.

Results Controlling for baseline levels of preventive behaviors and demographic covariates, trait empathy and threat of COVID-19 at baseline were each independently associated with preventive behaviors at follow-up. An interaction between perceived threat and empathic responding indicated that those perceiving high threat of COVID-19 at baseline tended to report engaging in preventive behaviors at follow-up regardless of their levels of empathic responding, whereas for those reporting low levels of perceived threat, higher levels of empathic responding were associated with higher engagement in preventive behavior.

Conclusions When perceived threat of COVID-19 was low, higher empathic responding was associated with increased engagement in preventive behaviors regardless of trait empathy, suggesting that empathic responding can serve as an actionable target for intervention to promote preventive behavior during the pandemic.

Keywords: Threat · Empathy · Empathic responding · COVID-19 · Coping · Preventive behavior

Introduction

Collective action on a global scale has been required to curb the spread of the novel SARS-CoV-2 virus. Since being declared a pandemic by the World Health Organization (WHO) on March 11, 2020, preventive health behaviors such as physical distancing and improved hygiene practices have been key mechanisms championed for controlling the virus' spread [1]. Such behavioral precautions are critical to controlling any novel infectious disease outbreak and identifying factors that contribute to the rapid uptake and engagement in these behaviors over time is crucial.

Multiple studies have found perceptions of COVID-19 health threat to be associated with increased engagement in preventive behaviors [2–9]. This is consistent with research completed during prior infectious disease outbreaks [10–13], as well as research documenting prospective associations between perceived health threat and engagement in protective health behaviors more generally [14, 15]. In addition, these findings align with preeminent models of health behavior that emphasize the role of health threat appraisals in prompting preventive action and are widely used to guide public health interventions [16, 17]. As such, public health messaging that adequately communicates the risk posed by COVID-19

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has been a crucial component of the pandemic response [18]. However, the association between perceived threat and preventive behavior is not clear-cut, as individual and social-contextual factors have the capacity to impact the relationship between threat appraisals and behavioral responses [19, 20]. Perceived threat can also incite helplessness and distrust and inhibit engagement in adaptive health behavior [18, 21]. Therefore, examining additional predictors of engagement in preventive behavior and how they interact with perceived threat is necessary to tailor communication strategies and develop interventions to promote preventive behavior during the COVID-19 pandemic and in the context of future infectious disease outbreaks.

Given the inherently communal nature of the COVID-19 pandemic, appealing to prosocial motivations has been identified as a means of promoting adherence to COVID-19 preventive behaviors [22, 23]. A well-established contributor to engagement in prosocial behavior is empathy [24, 25]. Focusing on preventive behaviors as prosocial acts has led researchers to examine the role of empathy in predicting preventive behaviors. Although multiple definitions of empathy exist, the construct can be broadly conceptualized as the affective and cognitive capacity to understand and emulate the subjective emotional experience of another [26]. Experiencing empathy is impacted by both individual characteristics and situational factors such that empathy varies both between individuals, and within individuals across contexts [26]. For instance, while the general propensity to experience empathy, or *trait empathy*, remains relatively stable over time, experiences of empathy in a given context are also influenced by situational and interpersonal factors [27]. Positive associations between assessments of trait empathy and self-reported engagement in COVID-19 preventive behaviors have been documented [28–30]. Multiple studies have also reported positive cross-sectional associations between experiences of empathy toward individuals vulnerable to COVID-19 and intention to engage in preventive behaviors [7, 31, 32]. One study also found that inducing a state of empathy in an experimental setting was associated with increased motivation to engage in physical distancing and wear a face mask [31]. As such, closer examination is warranted of how both trait empathy and transient experiences of empathy in response to the COVID-19 pandemic contribute to engagement in preventive behaviors.

High levels of stress generated by the ongoing pandemic have been documented globally [33]. Applying the transactional model of stress and coping [34–37] to the pandemic suggests a process in which individuals both engage in a cognitive appraisal of COVID-19 threat and cope with such threat. Threat appraisals and coping responses are theorized to occur as an ongoing, interactive process, and these factors need to be considered jointly to

predict stress outcomes. In this model, coping responses can be expected to moderate the impact of stress [34]. By conceptualizing of threat of infection as a stressor and examining use of a coping strategy known as *empathic responding*, we can glean insight into how empathy impacts engagement in preventive behaviors. Empathic responding takes a process-oriented view of empathy and involves drawing upon empathy in the face of stress in order to respond to another individual's concerns [37]. In the context of threat of infectious disease, prior research applied the transactional model to predict engagement in adaptive health behaviors, and found empathic responding to be a key coping response associated with adaptive health behavior [11–13]. Specifically, the role of empathic responding in coping with the threat of SARS [11, 12], H1N1 [13], and West Nile Virus [11] was examined. In these studies, both empathic responding and perceived threat of infectious disease were associated with greater engagement in preventive behaviors such as handwashing and disinfectant use [11–13]. In the case of SARS and West Nile Virus, the effect of empathic responding in infection-control behavior was specific to adaptive preventive measures, such as disinfectant use, but not maladaptive health behaviors, such as avoiding healthcare professionals for fear of disease transmission [11, 12]. With H1N1, a synergistic effect was found between empathic responding and perceived threat such that perceived threat predicted preventive behaviors (vaccination intention and disinfectant use) only when levels of empathic responding were also high [13]. This finding underscores the importance of using a transactional framework to evaluate how perceived threat comes to impact behavioral outcomes. Further supporting this model are findings from a study conducted during the COVID-19 pandemic. In the study, researchers found that empathic responding mediated the association between perceived threat and preventive behaviors [38]. A limitation of past work examining these issues is that the studies have been cross-sectional. To examine how empathic responding and perceived threat are associated with change in preventive behavior over time, longitudinal methodologies are needed.

Another limitation of prior work is that no study has examined the effect of empathic responding while controlling for levels of trait empathy. Without controlling for trait empathy, it remains plausible that any behavioral outcomes associated with empathic responding are entirely attributable to the general tendency to experience empathy. In the current context, this translates to the inability to ascertain whether use of empathic responding in the face of COVID-19 threat can increase one's propensity to engage in preventive behaviors over and above the level predicted by trait empathy alone. Closer examination of this distinction is crucial given that coping responses are modifiable and therefore key

targets for intervention [39, 40]. In contrast, trait levels of empathy remain relatively stable across the lifespan and are less amenable to change [27]. Examining this distinction with data collected during the COVID-19 pandemic will provide insight into whether empathic responding can be considered an actionable target for intervention. Such findings may be useful for promoting preventive behavior in the context of future infectious disease outbreaks and threats to public health.

In the present study, we examined the association between empathic responding and preventive behaviors by controlling for trait empathy and examining outcomes over time. Specifically, we sought to examine how empathic responding interacted with perceived personal threat of illness to predict engagement in preventive behaviors during the COVID-19 pandemic. In line with prior work conducted in the context of the pandemic [4, 6], we hypothesized that perceived threat would predict subsequent engagement in preventive behaviors such as physical distancing and improved hygiene practices, controlling for baseline engagement in such behaviors at the outset of the pandemic. Given work documenting an association between trait empathy and preventive behavior [28–30], we also expected trait empathy to predict preventive behavior. Finally, in line with the transactional model of stress and coping, we expected empathic responding and perceived personal threat of COVID-19 to interact such that engaging in protective behaviors would be higher when empathic responding was high, even when perceived personal threat of COVID-19 was low. For instance, even if an individual does not feel personally threatened by COVID-19, responding empathically to someone who does feel threatened by risk of infection may be sufficient to elicit preventive behavior. We examined this interaction while statistically controlling for trait empathy. This was done to examine whether engagement in empathic responding would explain significant variance in preventive behavior engagement, over and above that attributable to trait empathy alone.

Method

Data Collection and Participants

Data collection for the present study took place between March 18 and May 23, 2020 as part of an ongoing longitudinal study assessing psychosocial and behavioral responses to the COVID-19 pandemic. At the time of data collection, the WHO had issued international guidance on the use of hygiene measures and physical distancing practices to control the virus' spread [1, 41]. Participation in the study was not restricted based on region and sample size was determined by the number of participants involved in the study at the time of data

analysis. Recruitment was done via social media, university websites, and radio interviews in English, primarily within North America. News and social media outlets provided a link to the study webpage where participants could complete the baseline survey (T1). The follow-up survey (T2) was distributed by email 1 week after baseline survey completion to those who indicated their willingness to be part of a longitudinal study in the baseline survey. Included in the analytic sample are participants who completed both the baseline and follow-up survey within a 30-day period. This brief time interval was chosen to provide insight into potential avenues to promote rapid uptake of preventive behavior during the COVID-19 pandemic. A total of 3,183 participants completed the T1 and T2 surveys, leaving an analytic sample of 2,841 after using listwise deletion to handle missing data. An additional 664 participants completed the T1 survey within the same timeframe as the analytic sample but did not go on to complete the T2 survey. Survey questions were adapted from a questionnaire previously developed to capture psychosocial and behavioral responses to infectious disease outbreaks [11–13] and were administered on the survey platform Qualtrics (www.qualtrics.com). Informed consent was obtained from all participants and the study protocol was approved by the UBC Behavioural Research Ethics Board. A subset of data from the present study examining mental health during the pandemic has been reported elsewhere [42].

Measures

COVID-19 preventive behaviors

COVID-19 preventive behaviors were assessed at T1 and T2 by having participants identify behaviors they had engaged in over the past week to avoid getting COVID-19. Participants were provided with a list of nine preventive behaviors recommended by the WHO that included both hygiene practices and physical distancing behaviors [41]. Participants were asked to select the behaviors they engaged in over the past week, which were then tallied to create a composite score ranging from zero to nine. Items included in the composite score were “avoided public transit,” “minimized or avoided social contact,” “canceled or avoided travel,” “avoided crowds,” “avoided public places,” “washed my hands more often than usual,” “took more care about cleanliness,” “avoided touching my face,” and “used disinfectants.” Mask wearing was assessed but was not included in the composite score because at the time of data collection, the guidance on routine mask wearing in public settings provided by the WHO was inconsistent [43]. Similar measures have been used in other studies examining adherence to recommended health behaviors during the COVID-19 pandemic [2–5].

Perceived threat of COVID-19

Perceived threat of COVID-19 was measured at T1 using a scale developed to assess threat during prior infectious disease outbreaks and adapted to refer to COVID-19 [11–13]. The scale involved participants rating how true a series of statements felt for them at the present moment. The scale contained five items including “I don’t really think I could get COVID-19,” “I feel nervous about getting COVID-19,” “COVID-19 is threatening my health,” “I don’t feel worried about getting COVID-19,” and “my daily routine has been disrupted due to thoughts about COVID-19” rated on a five-point Likert scale ranging from 1 (*Not at all true*) to 5 (*Extremely true*). Internal consistency of the scale was acceptable ($\alpha = 0.73$).

Empathic responding

A brief form of the Relationship Focused Coping Scale [37] has been used to assess empathic responding in the context of prior infectious disease outbreaks [11–13]. In the present study, the four-item measure was adapted to assess empathic responding in the context of COVID-19. At T1, participants rated the extent to which they had engaged in empathic responding in the past week in response to an individual concerned about COVID-19 on a four-point scale ranging from 0 (*Not at all*) to 3 (*A great deal*). Scale items included: “Tried to understand the other person’s concerns about COVID-19,” “tried to understand how the other person felt about COVID-19,” “tried to help the other person by listening to their concerns about COVID-19,” and “tried to help the other person by doing something for them.” Scale internal consistency was high ($\alpha = 0.88$).

Trait empathy

Trait empathy was assessed at T1 using the Toronto Empathy Questionnaire (TEQ) [44]. The TEQ is a 16-item measure that asks respondents to rate the general frequency of various experiences on a five-point Likert scale ranging from 1 (*Never*) to 5 (*Always*), and includes statements such as “it upsets me to see someone being treated disrespectfully” [44]. The TEQ has been used in multiple regions and has good psychometric properties as a unidimensional measure of trait empathy [45]. Scores were derived by summing participants’ responses on all items. Internal consistency was high ($\alpha = 0.84$).

Covariates

Demographics including age, gender, location, and income were assessed at T1. Scores on these measures were controlled for in analyses given previous work documenting an association between these factors and the tendency to engage in COVID-19 preventive behaviors [46, 47]. In addition, given that demographic

variables can influence both one’s risk of developing COVID-19 as well as illness severity, these variables were included in the model to disentangle the role of perceived threat in predicting preventive behaviors independent of known risk factors for severe illness [48]. In the analyses, gender was coded using dummy coding with other as the reference level such that men and women were compared to those who reported their gender as other. While study recruitment was not restricted based on region, the majority of our sample resided in North America, with 69.7% and 24.9% of participants residing in Canada and the United States, respectively. Because of this, location was coded as a binary variable (North America vs. other). The majority of those in the “other” category resided in the United Kingdom (1.4%), and Australia (0.5%), with the remaining 3.5% of participants spread across 33 different countries. Income was assessed with a multiple-choice question and is coded as a numeric variable ranging from 1 (*Less than \$25,000*) to 8 (*\$200,000 or more*).

As with demographic controls, health was assessed at T1 and included in the analyses to explore the effects of cognitive appraisals of threat while holding known risk factors for more severe COVID-19 illness constant. Health status was measured by asking participants to rate their health on a six-point scale ranging from *very poor* to *excellent*. Similar measures have proven effective in predicting morbidity and mortality in a wide range of prior studies [49, 50]. Given the rapidly evolving nature of the pandemic, a variable was also included in the model to control for the effect of date of entry into the study. The “time” variable corresponds to the number of days elapsed since the pandemic was declared (March 11, 2020) at baseline survey completion [1].

Analyses

We first examined descriptive statistics and compared the analytic sample to those who dropped out of the study on all key variables. We used independent sample *t*-tests and chi-square tests on continuous and categorical variables, respectively. We then examined bivariate relationships among the analytic sample before using hierarchical regression modeling to explore how perceived threat of COVID-19 and empathic responding at T1 interacted to predict engaging in COVID-19 preventive behaviors at T2. We ran the regression models two ways, both using listwise deletion and using full information maximum likelihood (FIML) to treat for missing values. Our findings were equivalent across the two missing data treatments thus only the findings from the listwise deletion model are reported here. Results from the model using FIML are reported in [Supplementary Table S1](#). In step one, we entered predetermined covariates (income,

location, age, gender, health, and time) into the model. We also included preventive behaviors at T1 in this step to increase confidence in the temporal ordering of the relationship between threat and empathic responding at T1 with preventive behavior at T2. In step two, we added T1 psychological variables to the model (perceived threat, empathic responding, and trait empathy). In the final step, we added the interaction term (perceived threat \times empathic responding). To account for interdependence within regions, we also ran a multilevel model nested within continents. Results from this model are outlined in [Supplementary Table S2](#). We conducted our analyses using R version 4.1.0 and RStudio version 1.4.1106.

Results

Univariate and Bivariate Statistics

Descriptive statistics for all of the study variables are presented in [Table 1](#) along with results of *t*-tests and chi-square tests conducted to compare the dropout and analytic samples. The analytic sample was significantly

older, higher income, and more likely to reside in North America than the dropout sample. The gender breakdown also differed between samples and those in the analytic sample scored higher on trait empathy. Among the analytic sample, the mean length of time between T1 and T2 survey completion was 13.50 days ($SD = 5.61$). The mean age of participants in the analytic sample was 44.30 ($SD = 15.34$). The sample was also mostly women (83.4%), with 14.9% and 1.7% identifying as men and other, respectively. The majority of respondents resided in North America (94.6%) and the modal income bracket reported was \$100,000 to \$149,999 with 41.4% reporting a yearly income of \$100,000 or above.

We compared preventive behaviors at both timepoints and found that scores at T1 ($M = 7.15$, $SD = 1.67$) were significantly higher than at T2 ($M = 6.96$, $SD = 1.83$), $t(2840) = 6.15$, $p < .001$. Proportions of the sample engaging in each of the preventive behaviors at both timepoints are outlined in [Supplementary Table S3](#). As expected, preventive behavior scores at both timepoints were highly correlated. Threat, empathic responding, and trait empathy were significantly positively correlated with preventive behaviors at both timepoints. Gender was also associated with engaging in preventive behavior. Analyses

Table 1. Comparison of summary statistics between the dropout and analytic samples

Variable	Dropout ($n = 664$) ^a		Analytic ($n = 2841$)		t/χ^2	p
	M (SD) or % (n)		M (SD) or % (n)			
T1 Preventive behaviors	7.25	(1.76)	7.15	(1.67)	$t(953.01) = -1.34$.180
T2 Preventive behaviors	–		6.96	(1.83)		
T1 Perceived threat	3.65	(0.72)	3.71	(0.67)	$t(928.70) = 1.92$.055
T1 Empathic responding	1.90	(0.70)	1.92	(0.72)	$t(991.89) = 0.88$.377
T1 Trait empathy	48.59	(7.49)	49.60	(6.39)	$t(871.97) = 3.19$.001
Health	4.57	(1.02)	4.63	(0.96)	$t(956.74) = 1.45$.148
Age	34.85	(13.66)	44.30	(15.34)	$t(1087.30) = 15.66$	<.001
Gender					$\chi^2(2) = 27.28$	<.001
Women	74.5%	(495)	83.4%	(2370)		
Men	23.0%	(153)	14.9%	(422)		
Other	1.8%	(12)	1.7%	(49)		
Missing	0.6%	(4)	–			
Income ^b	4.31	(2.23)	4.74	(2.03)	$t(848.06) = 4.44$	<.001
Location					$\chi^2(1) = 61.57$	<.001
North America	85.5%	(568)	94.6%	(2687)		
Other	14.2%	(94)	5.4%	(154)		
Missing	0.3%	(2)	–			
Time	22.66	(16.25)	22.19	(15.79)	$t(977.12) = -0.69$.492

Note. Welch Two Sample *t*-test was used with continuous variables and Pearson's chi-square test was used with categorical variables. Time = Days elapsed since pandemic declared by WHO (March 11, 2020) at T1 assessment.

^aDropout sample includes those who completed the baseline survey within the same timeframe as the analytic sample but did not complete a follow-up survey.

^bIncome was coded: 1 = Less than \$25,000; 2 = \$25,000 to \$34,999; 3 = \$35,000 to \$49,999; 4 = \$50,000 to \$74,999; 5 = \$75,000 to \$99,999; 6 = \$100,000 to \$149,999; 7 = \$150,000 to \$199,999; 8 = \$200,000 or more.

of variance indicated significant differences between genders at both T1 ($F(2, 2838) = 9.34, p < .001$) and T2 ($F(2, 2838) = 9.15, p < .001$). Post hoc Tukey tests revealed that at both timepoints, women were significantly more likely to engage in preventive behaviors than were men ($p < .001$) and at T2, those identifying their gender as other were also significantly more likely to engage in preventive behaviors than were men ($p = .01$). Time was negatively correlated with preventive behavior such that those who completed the survey later in the pandemic reported engaging in fewer preventive behaviors. As expected, trait empathy and empathic responding were positively associated, indicating that those with higher levels of trait empathy were more likely to engage in empathic responding. In addition, perceived threat was positively associated with empathic responding supporting the conceptualization of empathic responding as a coping mechanism employed in response to heightened perceived threat. These and other zero-order correlations between study variables among the analytic sample are outlined in Table 2.

Multivariate Analyses

Results of the hierarchical linear regression model are outlined in Table 3. In step one, covariates (income, location, age, gender, health, and time) as well as COVID-19 preventive behaviors at T1 explained 36.0% of the variance in COVID-19 preventive behaviors at T2. Preventive behaviors at T1 independently predicted preventive behaviors at T2 as did gender, such that those identifying their gender as other were more likely to engage in preventive behavior than those identifying as women or men. Time of baseline survey completion was also independently associated with T2 preventive behaviors such that those who completed the survey later in the pandemic

were less likely to engage in preventive behaviors at T2. In step two, the addition of perceived threat, empathic responding, and trait empathy to the model explained an additional 1.7% of the variance in T2 preventive behavior, $F(3, 2829) = 26.53, p < .001$. Both trait empathy and perceived threat were independently associated with higher engagement in T2 preventive behaviors. While empathic responding had no main effect in step two, the addition of the interaction term (threat \times empathic responding) in step three was independently associated with T2 preventive behaviors and improved model fit explaining an additional 0.1% of variance, $F(1, 2828) = 5.27, p = .02$. Tests of simple slopes indicated a moderator effect that is presented in Fig. 1. Both slopes for perceived threat were significant and positive (at -1 SD and $+1$ SD of empathic responding). We found that those reporting high levels of perceived threat at T1 were likely to engage in preventive behavior regardless of whether they engaged in empathic responding ($p < .001$). However, for those reporting low levels of perceived threat at T1, engaging in high levels of empathic responding at T1 was associated with higher engagement in preventive behaviors at T2 ($p < .001$). We also ran the model including both perceived threat \times trait empathy and perceived threat \times empathic responding. In this model, the perceived threat \times empathic responding interaction remained significant ($p = .036$). In addition, we ran a model to examine psychological predictors in predicting T2 preventive behaviors in isolation of all other variables. This model included only perceived threat, trait empathy, empathic responding, and the interaction between perceived threat and empathic responding. In this pared-back model, all predictors were significant ($p < .001$), and the model accounted for 11.1% of variance in preventive behavior at T2.

Table 2. Bivariate correlations for study variables among the analytic sample

Variable	1	2	3	4	5	6	7	8	9
1 T1 Preventive behaviors									
2 T2 Preventive behaviors	.58***								
3 T1 Perceived threat	.27***	.27***							
4 T1 Empathic responding	.23***	.19***	.11***						
5 T1 Trait empathy	.20***	.17***	.16***	.35***					
6 Age	-.04*	-.02	-.10***	.04*	-.01				
7 Health	.02	.03	-.17**	.02	.01	-.04*			
8 Income	.05**	.03	.07***	-.03	-.02	.05*	.21***		
9 Location (North America)	.03	.02	.08***	.02	.05**	.06**	.03	.19***	
10 Time	-.04*	-.17***	-.00	-.09***	.02	.03	-.06**	.01	-.06**

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 3. Hierarchical regression results predicting COVID-19 preventive behaviors at T2

Variable	B	95% CI for B		SE B	β	R^2	ΔR^2
		LL	UL				
Step 1						.360***	
Constant	0.54*	0.05	1.02	0.25	.29*		
T1 Preventive behaviors	0.62***	0.59	0.66	0.02	.57***		
Income	0.01	-0.02	0.03	0.01	.01		
Location (North America) ^a	-0.06	-0.31	0.18	0.12	-.04		
Age	0.00	-0.00	0.01	0.00	.01		
Gender (Women) ^b	-0.46*	-0.88	-0.04	0.21	-.25*		
Gender (Men) ^b	-0.64**	-1.08	-0.19	0.22	-.35**		
Health	0.02	-0.04	0.08	0.03	.01		
Time	-0.02***	-0.02	-0.01	0.00	-.15***		
Step 2						.377***	.017***
Constant	0.53*	0.05	1.01	0.24	.29*		
T1 Preventive behaviors	0.57***	0.54	0.61	0.02	.52***		
Income	-0.00	-0.03	0.03	0.01	-.00		
Location (North America) ^a	-0.15	-0.39	0.09	0.12	-.08		
Age	0.00	-0.00	0.01	0.00	.02		
Gender (Women) ^b	-0.38	-0.79	0.04	0.21	-.21		
Gender (Men) ^b	-0.48*	-0.92	-0.04	0.22	-.26*		
Health	0.07*	0.01	0.12	0.03	.03*		
Time	-0.02***	-0.02	-0.01	0.00	-.15***		
T1 Trait Empathy	0.01*	0.00	0.02	0.00	.04*		
T1 Perceived Threat	0.34***	0.25	0.43	0.04	.13***		
T1 Empathic Responding	0.07	-0.01	0.15	0.04	.03		
Step 3						.378***	.001*
Constant	0.54*	0.06	1.02	0.24	.30*		
T1 Preventive behaviors	0.57***	0.54	0.60	0.02	.52***		
Income	-0.00	-0.03	0.03	0.01	-.00		
Location (North America) ^a	-0.15	-0.39	0.09	0.12	-.08		
Age	0.00	-0.00	0.01	0.00	.02		
Gender (Women) ^b	-0.38	-0.79	0.03	0.21	-.21		
Gender (Men) ^b	-0.48*	-0.92	-0.05	0.22	-.26*		
Health	0.06*	0.01	0.12	0.03	.03*		
Time	-0.02***	-0.02	-0.01	0.00	-.15***		
T1 Trait empathy	0.01*	0.00	0.02	0.00	.04*		
T1 Perceived threat	0.34***	0.25	0.42	0.04	.12***		
T1 Empathic responding	0.07	-0.01	0.15	0.04	.03		
T1 Empathic responding	-0.12*	-0.23	-0.02	0.05	-.03*		
* T1 Perceived threat							

Note. $N = 2,841$. *CI* confidence interval; *LL* lower limit; *UL* upper limit. Time = Days elapsed since pandemic declared by WHO (March 11, 2020) at T1 assessment. All continuous predictor variables standardized.

^aReference group = participants residing outside of North America.

^bReference group = participants identifying their gender as other.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

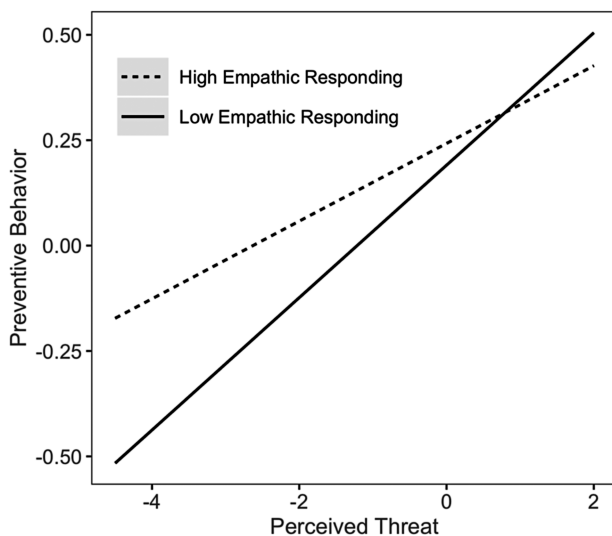


Fig. 1. Interaction between perceived threat of COVID-19 and empathic responding at T1 predicting COVID-19 preventive behaviors at T2. *Note.* All variables standardized. Lines represent scores one standard deviation above and below the mean on T1 empathic responding. Those who reported high perceived personal threat of COVID-19 at T1 were likely to engage in preventive behavior at T2 regardless of their level of empathic responding at T1. Among those who felt less threatened at T1, use of empathic responding at T1 was associated with higher engagement in preventive behavior at T2.

Discussion

Consistent with the transactional model of stress and coping [34–37], our results indicate that both cognitive appraisals of personal threat of COVID-19 and coping responses played key roles in WHO-recommended preventive behavior engagement during the early months of the COVID-19 pandemic. By examining empathic responding, our results suggest that empathy, a major contributor to prosocial behavior [24, 25], can be employed as a coping mechanism and serve as an actionable target for intervention. In addition, the model held up after controlling for a range of demographic factors as well as prior engagement in preventive behavior thus providing additional support for the findings.

In support of our first hypothesis, results revealed that heightened perceived personal threat of COVID-19 at the start of the pandemic was associated with subsequent engagement in preventive behaviors, even after controlling for baseline levels of such behaviors. Our findings support the role that threat perception plays in health behaviors and are consistent with numerous models of health behavior [16, 17, 20]. This finding is also consistent with research conducted during the COVID-19 pandemic indicating that heightened threat at one point in time is associated with greater engagement in preventive behavior at a later date [4–6, 8]. Such findings provide support for public health interventions

that aim to raise threat perception to appropriate levels to promote engagement in recommended behavioral precautions. Indeed, such measures have played a crucial role in the COVID-19 pandemic response [18].

Supporting our second hypothesis, we found that high trait empathy was independently associated with greater engagement in preventive behavior. This finding is also in line with work conducted during the COVID-19 pandemic indicating a positive association between trait empathy and engagement in an array of preventive measures [28–30]. While such insight is useful, to capitalize on empathy to promote preventive behavior, the construct must be considered in process-oriented terms that allow for fluctuation over time and across situations. Situation-specific experiences of empathy have been associated with intentions to engage in preventive behaviors during the COVID-19 pandemic [7, 31, 32]. Our examination of empathic responding expands on this process-oriented view of empathy by modeling how the use of empathy as a coping response interacts with perceived threat of COVID-19 to predict preventive behavior.

In line with our third hypothesis, an interaction between empathic responding and perceived threat emerged indicating that coping with fears of COVID-19 via empathic responding early in the pandemic was associated with higher levels of engagement in preventive behavior at follow-up, but that this effect was contingent on level of perceived threat. Specifically, the interaction revealed, as expected, that those feeling personally threatened by COVID-19 were likely to engage in preventive behavior regardless of their level of empathic responding. In contrast, for those who perceived COVID-19 as less personally threatening, high levels of empathic responding were associated with increased likelihood of subsequently engaging in preventive behavior. This finding points to empathic responding as a key predictor of engagement in preventive health behavior at times when one does not feel personally threatened. As expected, trait empathy and empathic responding were positively correlated such that those with high levels of trait empathy were more likely to engage in empathic responding; however, the observed effect of empathic responding remained after controlling for trait empathy. Empathic responding has been found to fluctuate over time and be amenable to change [37], unlike trait empathy which is relatively stable [27]. Therefore, our results suggest that public health measures designed to increase empathic responding may be an effective point of intervention to promote preventive behavior even among those who do not feel personally threatened by the prospect of developing COVID-19. Furthermore, the benefits of such public health interventions may not be limited to those who exhibit a particularly high capacity for empathy as assessed by trait measures.

Therefore, in addition to public health messages aimed at increasing perceived threat of infection, our findings

point to prosocial messaging aiming to increase use of empathic responding as a potential mechanism to promote preventive behavior. For instance, interventions could promote support provision as a means to cope with one's own stress while simultaneously easing the burden of friends and neighbors. Our findings highlight the nuance necessary in evaluating the efficacy of such interventions by considering for whom, and under what conditions, such interventions may be effective. This need is underscored by research that found prosocial messaging to be more effective at promoting adherence to physical distancing recommendations for individuals who were less fearful of COVID-19 [51].

Our results also indicated several demographic factors associated with engagement in COVID-19 preventive behaviors. Gender was associated with engaging in preventive behavior at both timepoints. Specifically, we found that identifying as a woman was positively associated with engagement in preventive behavior, and identifying as a man was negatively associated with engaging in preventive behavior. These findings are in line with prior work demonstrating that women are more likely to engage in COVID-19 preventive behavior [23, 52], as well as in protective health behaviors more generally [53]. While the majority of the bivariate associations among study variables were in the expected direction, paradoxically, we found a small but significant negative correlation between perceived threat and both health and age such that those who were older or rated their health as poorer reported lower levels of perceived threat. This finding was unexpected given that older individuals and those with preexisting health conditions are at greater risk for serious COVID-19 illness [1]. However, the findings highlight the importance of distinguishing between risk factors for severe illness and perceived threats to health. This is consistent with the transactional model of stress and coping in that it illustrates the importance of considering threat appraisals as distinct from objective risk in their capacity to influence coping responses and behavioral outcomes [54]. In some cases, threats to health can predict preventive health behaviors better than objective risk [55], further underscoring the importance of examining the effect of perceived threat independent of known demographic risk factors.

The longitudinal methodology of our study and the brief interval between timepoints allowed us to examine how preventive behaviors changed during the early pandemic period. We found that preventive behaviors at baseline, shortly after the pandemic was declared, were significantly higher than those at follow-up less than a month later. Decreasing engagement in preventive behaviors over the course of the pandemic has been documented elsewhere and has been partially attributed to a phenomenon that has come to be referred to as “pandemic fatigue” [56]. That we found evidence for this

effect even over the short time period so early in the pandemic is concerning. Data for our study were collected shortly after the WHO declared COVID-19 a pandemic during which time COVID-19 cases were on the rise and no vaccine was available. Continued follow-up assessments will be required to assess if this decline continued, or if preventive behavior engagement stabilized. It is plausible that this initial drop in preventive behavior was specific to the early pandemic period when mechanisms of virus transmission were unclear and public health recommendations were in flux [57]. Interestingly, we also found that less than 34% of the variance in preventive behavior at T2 was explained by preventive behavior at T1. This result suggests that much of the variability in T2 preventive behavior was explained by factors not accounted for by the T1 assessment, such as the psychosocial factors examined here. The finding also suggests that this early pandemic period could be a key time for intervention and promotion of habit formation.

The findings from the present study are in line with prior applications of the transactional model in the context of other infectious diseases. During the SARS and West Nile Virus outbreaks [11, 12] and the H1N1 pandemic [13] both perceived threat and empathic responding emerged as important predictors of preventive behaviors. In the context of the H1N1 pandemic, a synergistic effect also emerged between perceived threat and empathic responding [13]. A cross-sectional study conducted during the COVID-19 pandemic also examined the associations between perceived threat, empathic responding, and preventive behavior and found a positive association between perceived threat and preventive behavior that was mediated by empathic responding [38]. Our study expands on these findings by using a longitudinal methodology and modeling how perceived threat and empathic responding come together to predict behavioral outcomes over time.

Similar to much of the research on health behaviors pertaining to COVID-19, we used online data collection, a valuable method for quickly reaching large samples during the pandemic [58]. This unfortunately did not result in a representative sample. The sample was comprised disproportionately of women and those with an above average income, making it unrepresentative of the global population. However, our results held controlling for several key demographic factors. It remains possible that the findings from our study do not generalize to groups underrepresented in our sample. For example, there may be constraints on coping responses among economically marginalized populations. However, evidence also suggests that prosocial behavior is an adaptive response that is highly prevalent among such populations [59]. However, future research is needed that examines the role of empathy in behavioral responses to the pandemic among more diverse samples.

Our study also focused on a short time period early in the pandemic when COVID-19 cases were growing rapidly. From March 18 to May 23, 2020 (when data collection occurred), COVID-19 cases reported globally rose from approximately 200,000 [60] to over 5,000,000 [61]. Future research should examine whether empathic responding continues to play a role in preventive behavior during the later stages of the pandemic. As the pandemic has progressed, perceived threat of infection has declined [62], as has engagement in preventive behavior [56]. As such, despite the limited time period captured, indication that empathic responding may predict preventive behavior under conditions of lower perceived threat is of immense value. Consideration should also be given to whether other coping responses identified as beneficial in the context of the pandemic [63] can similarly promote engagement in preventive behavior, even when perceived personal threat is low. This need is demonstrated by work examining how various models of health behavior can jointly contribute to preventive behavior during the COVID-19 pandemic [64]. Such insights will be valuable in promoting maintenance of preventive behavior for the duration of the COVID-19 pandemic. Insights gleaned will also be crucial in dealing with future novel infectious disease outbreaks as human-induced factors such as climate change and globalization make their emergence increasingly common [65].

Supplementary Material

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

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Compliance with Ethical Standards

Authors' Statement of Conflict of Interest and Adherence to Ethical Standards Authors Talia Morstead, Jason Zheng, Nancy L. Sin, David B. King, and Anita DeLongis declare that they have no conflict of interest.

Authors' Contributions All authors contributed to study design and implementation. Talia Morstead, Anita DeLongis, and Jason Zheng wrote the first draft of the manuscript and conducted the analyses. Nancy L. Sin and David B. King, provided critical feedback on the manuscript and assisted with subsequent drafts. All authors approved the final version of the manuscript for submission.

Ethical Approval: All procedures 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.

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