

## Original Research

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### Keywords:

disasters; person with a disability; psychological distress; risk; self-efficacy

### Abbreviations:

ADA, Americans with Disabilities Act; EPSE, Emergency Preparedness Self-Efficacy; K6, Kessler 6; PMT, Protection Motivation Theory

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# Perceived Threat of Disaster, Efficacy, and Psychological Distress Among Individuals with a Physical Disability: A Longitudinal Model

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## Abstract

**Objective:** Individuals with physical disabilities experience distress when faced with the threat of human-made and natural disasters, yet little is known about how to reduce that distress. This study used Protection Motivation Theory to longitudinally test the relationships between psychological distress and disaster-related cognitive appraisals, including perceived threat, emergency preparedness self-efficacy, and response efficacy, in a sample of individuals with physical disabilities.

**Methods:** A nationwide convenience sample of 106 adults completed 2 surveys approximately 5 years apart. Structural equation modeling was used to assess effects of perceived threat, self-efficacy, and response efficacy on psychological distress across the 2 waves.

**Results:** Our results suggest that the associations of proximal perceived threat and self-efficacy with psychological distress remain stable across time, while the effect of response efficacy is variable and may be more context-specific. Importantly, individuals who reported an increase in self-efficacy over time also reported (on average) a decrease in psychological distress.

**Conclusions:** In addition to broadening our understanding of factors related to psychological distress, these results have potentially important intervention implications; for example, to the extent that self-efficacy is a malleable construct, one way of reducing disaster-related psychological distress may be to increase an individual's self-efficacy.

Psychological distress, also known as *emotional suffering*, includes general symptoms of stress, anxiety, and depression. It is a transdiagnostic component of several mental disorder diagnoses, including anxiety and depression, and is linked to both mental illness<sup>1</sup> and poor health outcomes, even at low to moderate levels of distress.<sup>2,3</sup> This is particularly concerning given that approximately 23% of adults in the United States have experienced some level of psychological distress in recent years<sup>4</sup> and have reported even higher rates during the coronavirus disease (COVID-19) pandemic.<sup>5</sup> Unfortunately, individuals with physical disabilities are even more likely to experience psychological distress, potentially because of stressors related to societal stereotypes, environmental accessibility challenges, and financial difficulties.<sup>6,7</sup>

Human-made disasters (eg, terrorism, technological) and natural disasters (eg, earthquakes, hurricanes, pandemics) can occur with little warning and result in severe consequences, including loss of life, physical injury, property damage, and psychological distress. These negative outcomes are multiplying as the frequency and severity of disasters have markedly increased this century.<sup>8,9</sup> Awareness of disasters and anticipation about their occurrence can also lead to significant psychological distress.<sup>10,11</sup> Indeed, previous studies have found a positive association between perceived threat and distress across a variety of disaster and crisis events.<sup>12,13</sup>

Individuals with disabilities have been disproportionately impacted by the negative effects of disasters<sup>14–17</sup> and often have greater difficulty recovering from disasters.<sup>18,19</sup> Thus, it is likely that individuals with disabilities may be particularly vulnerable to psychological distress when they perceive current or future disaster threats. Given that over 1 billion individuals (or 15%) across the world live with some form of disability,<sup>20</sup> it is crucial to identify ways to impact the role of disaster threat on those individuals' distress.

Fortunately, other disaster-related factors, such as perceived self-efficacy, may attenuate psychological distress. Self-efficacy, which refers to individuals' belief in their ability to achieve a specific goal, can help individuals cope effectively in stressful situations.<sup>21,22</sup> Indeed, self-efficacy has been shown to have a direct negative relationship with distress<sup>23,24</sup> and has also been found to moderate the relationship between stressors and mental health outcomes, with better outcomes at higher levels of self-efficacy.<sup>25–27</sup> A disaster domain-specific type of self-efficacy—emergency preparedness self-efficacy—is defined as individuals' perception of their ability to prepare for and deal with emergency situations<sup>28,29</sup> and may similarly decrease disaster-related

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distress. While there has been relatively little research on the role of emergency preparedness and self-efficacy among people with physical disabilities, existing research suggests that individuals with disabilities tend to have lower self-efficacy, in general, due to poor health and mobility limitations.<sup>30,31</sup>

Perceived response efficacy, defined as an individual's perception that suggested actions will be effective in achieving desired outcomes, can also impact psychological distress. Indeed, recent research has linked higher levels of response efficacy to lower psychological distress during the COVID-19 pandemic.<sup>32</sup> Similarly, Zhang et al.<sup>33</sup> found that both response efficacy and self-efficacy mediated the relationship between perceived susceptibility to COVID-19 and anxiety, such that individuals who perceived a greater likelihood of infection believed that actions to avoid COVID-19 would be less effective, and in turn experienced greater distress. Limited research has investigated response efficacy among individuals with disabilities, but current findings suggest that this population tends to report lower levels of response efficacy with regard to disaster situations.<sup>30,34</sup> Fortunately, efficacy beliefs are malleable,<sup>21,35</sup> and emergency preparedness self-efficacy and response efficacy represent potential targets to decrease disaster-related psychological distress among individuals with physical disabilities.

Recent research has adapted Protection Motivation Theory (PMT) when modeling the additive effects of perceived threat, self-efficacy, and response efficacy on emotional responses. In its original formulation, PMT provides a basic model for understanding how individuals' appraisals of risk and efficacy result in protective actions.<sup>36</sup> According to the PMT, an assessment of threat (severity and vulnerability) and efficacy (response and self-efficacy) operates on protection motivation additively. Kim et al.'s<sup>37</sup> work extended the PMT by proposing that such appraisals can elicit emotional responses such as hope or fear, which in turn can influence future protective behavior. In line with this suggestion, a recent study found that college students who perceived greater susceptibility to COVID-19 also reported lower perceived efficacy to cope with this threat, which in turn predicted higher levels of anxiety.<sup>33</sup>

The current research seeks to extend past work on the PMT by examining the relationship between disaster-related cognitive appraisals and negative affective responses in greater detail. Research to date linking perceived threat, self-efficacy, and response efficacy to psychological distress has been exclusively correlational, which can only suggest causal relationships. Findings may guide future interventions to mitigate disaster-related psychological distress among individuals with disabilities. Therefore, the present research used structural equation modeling to examine a 2-wave longitudinal model of these linkages among 106 individuals with physical disabilities (Figure 1). That model was used to test the following research questions and hypotheses:

#### RQ1

Do threat, self-efficacy, and response efficacy each independently relate to psychological distress? We hypothesized that at both waves (ie, cross-sectionally), higher psychological distress would be independently associated with higher levels of perceived threat and with lower levels of perceived self-efficacy and response efficacy.

#### RQ2

Do the independent effects of threat, self-efficacy, and response efficacy on psychological distress differ at different points in time? The stability of these relationships over time has been largely unexplored in existing literature; therefore, this question was examined without a specific hypothesis.

#### RQ3

Is *change* in perceived threat, self-efficacy, and response efficacy related to *change* in psychological distress? We hypothesized that across the 2 waves (ie, longitudinally), increased psychological distress would be independently associated with increased perceived threat and reduced self-efficacy and response efficacy.

#### RQ4

Are there distal (ie, cross-wave) effects of threat, self-efficacy, and response efficacy on psychological distress, independent of any proximal (ie, within-wave) effects? We hypothesized that higher Wave 2 psychological distress would be independently associated with higher perceived threat (at both waves), lower self-efficacy (at both waves), and lower response efficacy (at both waves).

## Methods

### Sample

Data were collected from 106 individuals with a physical disability in 2015 (Wave 1)<sup>38</sup> and again in 2020 (Wave 2). Participants were recruited nationwide with the help of various organizations that serve individuals with disabilities. Individuals were eligible for participation if they: (1) were 18 years of age or older, (2) self-identified as someone with a physical disability as defined by the Americans with Disabilities Act (ADA), and (3) resided in the United States.

### Measures

#### Perceived threat of disaster

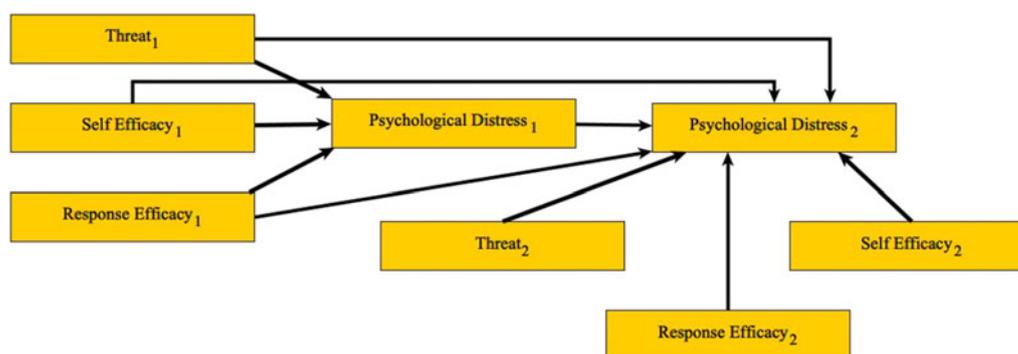
Based on the PMT's conceptualization of risk perception,<sup>36</sup> participants were asked about the estimated likelihood of disaster (*In your view, what is the likelihood of a natural or human-made disaster in your city or town in the next six months?*) and the estimated severity of disaster (*In your view, how negative would the consequences be for you if a natural or human-made disaster occurred in your city or town in the next six months?*). Answers were reported on a 5-point Likert scale, ranging from 1 ("None") to 5 ("Extreme"). In line with past research, perceived likelihood and severity were then combined into a composite perceived threat of disaster variable by multiplying the variables together and performing a square root transformation.<sup>39</sup>

#### Emergency preparedness self-efficacy

The Emergency Preparedness Self-Efficacy (EPSE) scale was used to assess self-efficacy beliefs regarding disaster preparedness activities.<sup>28,29</sup> This scale includes 7 items, such as "I can protect myself and my property in an emergency" and "I can maintain food and water supplies in an emergency." Participants rate their confidence in their ability to successfully complete each of the items in emergency events other than the COVID-19 pandemic on a 5-point Likert scale from 1 ("Not at all capable") to 5 ("Totally capable"). Previous research has found strong internal consistency (Cronbach's  $\alpha = 0.89$ ) and test-retest reliability ( $r = 0.83$ ,  $P < 0.001$ ) for this measure.<sup>28,40</sup> Internal consistency was also strong in this study (Cronbach's  $\alpha = 0.81$ ).

#### Response efficacy

This 3-item measure is rated on a 5-point Likert scale and asks participants about the extent to which they believe that emergency preparedness actions will effectively mitigate the negative effects of



**Figure 1.** The proposed model.

disaster events. For example, participants rated the extent to which they believed that “following emergency preparedness recommendations will be effective in reducing the impact of disasters.” Internal consistency for this measure was strong in the present study (Cronbach’s  $\alpha = 0.80$ ).

#### *Psychological distress*

The Kessler 6 scale (K6)<sup>41</sup> was administered to assess for non-specific psychological distress. This 6-item measure is rated on a 5-point Likert scale and asks participants about how frequently they have experienced various symptoms of psychological distress in the past 30 days. Internal consistency for this measure was strong in past research (Cronbach’s  $\alpha = 0.89$ )<sup>41</sup> and in the current research (Cronbach’s  $\alpha = 0.82$ ).

#### *Disability severity*

The World Health Organization’s Disability Assessment Schedule (WHODAS 2.0) was administered to assess for functional disability in day-to-day life.<sup>42</sup> This 36-item measure is rated on a 5-point Likert scale and asks participants to rate their difficulty across 6 life domains, including communication, mobility, self-care, interpersonal skills, household responsibilities, and participation in society. Example items include “In the last 30 days, how much difficulty did you have in taking care of your household responsibilities?” and “In the last 30 days, how much difficulty did you have in moving around inside your home?” The average general disability and domain scores can be used to more clearly interpret the severity of functional impacts based on the WHODAS 5-point scale, which ranges from 1 (“None”) to 5 (“Extreme”).<sup>43</sup> These scores can be calculated by summing the responses for either the entire measure or the desired domain and dividing by the total number of items in either the whole measure or the specified domain. Internal consistency for this measure was strong in past research (Cronbach’s  $\alpha = 0.98$ )<sup>42</sup> and in the current study (Cronbach’s  $\alpha = 0.95$ ).

#### *Procedure*

At Wave 1, participants were recruited nationally with the help of various organizations that serve individuals with disabilities, such as United Cerebral Palsy, the DC Office of Disability Rights, and the American Association on Health and Disability.<sup>38</sup> These organizations advertised the study through website posts, social media and networking sites (Twitter, Facebook, LinkedIn, Instagram, MeetUp.com), and emails. Individuals were eligible for participation if they: (1) were 18 years of age or older, (2) self-identified as someone with a physical disability as defined by the ADA, and (3) resided in the United States.<sup>38</sup> Eligible participants received a link to

the Qualtrics survey or arranged a time for a telephone interview, depending on participant preference. Participants who completed the survey were compensated with a \$10 gift card.

The follow-up data collection occurred 5 years after the original data collection, from June to September 2020. From the original Wave 1 sample of 294 individuals, 277 indicated that they were interested in participating in future research and consented to be contacted again in the future. Out of these 277 potential participants, 61 had invalid contact information, for a total contactable sample of 216 individuals. Upon IRB approval, each of these 216 individuals were re-contacted to ask whether they would like to participate in a follow-up study. Potential participants who did not respond were contacted again approximately 2 weeks after initial contact, and those who did not respond again were re-contacted for a final time approximately 2 weeks after the second contact. In response to these emails, 136 individuals indicated that they were interested in participating, and 4 individuals indicated that they did not want to participate. Interested participants were sent an email link to the Qualtrics survey, structured similarly to that in the original study.<sup>38</sup> Upon completion of the survey, participants were compensated for their time with a \$10 gift card that was electronically sent or physically mailed, depending on each participant’s preference.

#### *Statistical Analysis*

All analytical procedures were completed in SAS 9.4. Data were examined for outliers, missing data, or errors and corrected, if possible, prior to testing the hypotheses. Four participants who reported not having a physical disability at Time 2 were excluded from the analysis. Additionally, participants with missing data on any of the key variables at either time point were excluded from the analysis, for a final analytical sample of 106 participants who completed the survey at both Wave 1 and Wave 2. Internal reliabilities and test-retest correlations were calculated for all multi-item scales. PROC CALIS in SAS was used to test the full model specified in Figure 1. Because inclusion of demographic control variables (age, education, gender, and race) did not significantly alter the results, the unadjusted parameter estimates are presented here for the sake of parsimony.

## **Results**

### *Sociodemographic Characteristics of the Sample*

Demographic characteristics of the sample are presented in Table 1. At the time of interview completion, the sample was predominantly

**Table 1.** Sample Characteristics

Characteristic	%
<b>Gender</b>	
Male	26.4
Female	73.6
<b>Relationship Status</b>	
Single	58.5
Married/Living with partner	41.5
<b>Density</b>	
Urban	35.9
Suburban	49.1
Rural	15.1
<b>Home Ownership</b>	
Own	57.6
Rent	42.5
<b>Occupancy</b>	
Live by myself	29.3
Live with others	70.8
<b>Parental Status</b>	
Parent	42.5
Not a parent	57.6
<b>Education</b>	
High school diploma	6.6
Some college	10.4
Trade school/vocational school	2.8
Associate's degree	10.4
Bachelor's degree	23.6
Some graduate school	9.4
Master's degree	26.4
Doctoral degree	8.5
Other	1.9
<b>Income</b>	
\$7,499 or less	9.4
\$7,500 to \$14,999	16.0
\$15,000 to \$24,999	11.3
\$25,000 to \$34,999	14.2
\$35,000 to \$49,999	12.3
\$50,000 to \$74,999	12.3
\$75,000 to \$99,999	9.4
\$100,000 or over	3.8
<b>Children Under 18</b>	
0	79.3
1	9.4
2	6.6
3	3.8
4	0.9
<b>Ethnicity<sup>1</sup></b>	
Black	7.6
Native American	2.8
Asian	0.9
White	88.7
Latina/o	2.8
Pacific Islander	0.9

<sup>1</sup>Respondents could specify more than one ethnicity.

single (59%), lived in a suburban area (49%), identified as female (74%), owned their home (58%), lived with others (71%), was not a parent (58%), had earned at least a bachelor's degree (68%), earned at least \$35 000 (38%), had no children living with them (79%), and was white (89%). The average age was 46. The average general disability severity within the sample was mild to moderate (mean = 2.25, SD = 0.66). The average mobility-related impairment was moderate (mean = 2.92, SD = 0.96).

### *Univariate Characteristics and Bivariate Relationships Among Key Study Variables*

Means, standard deviations, and bivariate relationships among the central variables employed in the study are presented in [Table 2](#). Increased averages from Wave 1 to Wave 2 were observed in perceived threat (difference = 0.26,  $t = 3.70$ ,  $P < 0.001$ ), perceived self-efficacy (difference = 1.33,  $t = 2.80$ ,  $P < 0.01$ ), response efficacy (difference = 0.28,  $t = 1.01$ ,  $P > 0.05$ ), and psychological distress (difference = 0.80,  $t = 2.02$ ,  $P < 0.05$ ). Positive Wave 1 to Wave 2 correlations were found for perceived threat ( $r = 0.41$ ,  $P < 0.001$ ), perceived self-efficacy ( $r = 0.57$ ,  $P < 0.001$ ), response efficacy ( $r = 0.40$ ,  $P < 0.001$ ), and psychological distress ( $r = 0.58$ ,  $P < 0.001$ ).

At Wave 1, psychological distress was positively correlated with perceived threat ( $r = 0.28$ ,  $P < 0.01$ ) and negatively correlated with perceived response efficacy ( $r = -0.20$ ,  $P < 0.05$ ) and self-efficacy ( $r = -0.40$ ,  $P < 0.001$ ). At Wave 2, perceived threat ( $r = 0.27$ ,  $P < 0.01$ ) and self-efficacy ( $r = -0.45$ ,  $P < 0.001$ ) showed significant correlations with psychological distress. In contrast, the correlation between psychological distress and response efficacy ( $r = -0.16$ ), which was statistically significant at Wave 1, dropped to non-significance ( $P > 0.05$ ) at Wave 2, suggesting the possibility of non-stability in that relationship across time.

### *RQ1 and RQ2: Do Threat, Self-Efficacy, and Response Efficacy Each Independently Relate to Psychological Distress, and Are These Relationships Stable Across Time?*

Standardized parameter estimates of psychological distress regressed on perceived threat, response efficacy, and self-efficacy are presented in [Table 3](#), separately by wave. The estimate for perceived threat at the first ( $b = 0.27$ ,  $P < 0.001$ ) and second ( $b = 0.25$ ,  $P < 0.001$ ) waves were very similar. This similarity extended to the estimates for self-efficacy at Wave 1 ( $b = -0.28$ ,  $P < 0.001$ ) and at Wave 2 ( $b = -0.32$ ,  $P < 0.001$ ). However, the significant estimate for response efficacy at Wave 1 ( $b = -0.19$ ,  $P < 0.05$ ) dissipated to non-significance at Wave 2 ( $b = -0.04$ ,  $P > 0.05$ ), suggesting the possible instability of this effect across time.

### *RQ3: Is Change in Perceived Threat, Self-Efficacy, and Response Efficacy Related to Change in Psychological Distress?*

In order to address Research Question 3, the difference in psychological distress (Wave 2–Wave 1) was regressed on the difference in perceived threat, the difference in response efficacy, and the difference in self-efficacy. The results revealed that, on average, the difference in psychological distress was positively associated with the difference in perceived threat ( $b = 1.95$ ,  $P < 0.001$ ) and negatively associated with the difference in

**Table 2.** Descriptive Statistics and Bivariate Correlations

	Psychological Distress, Wave 1	Perceived Threat, Wave 1	Response Efficacy, Wave 1	Emergency Preparedness Self Efficacy, Wave 1	Psychological Distress, Wave 2	Perceived Threat, Wave 2	Response Efficacy, Wave 2	Emergency Preparedness Self Efficacy, Wave 2
Correlations								
Perceived Threat, Wave 1	.28**	–	–	–	–	–	–	–
Response Efficacy, Wave 1	–.20*	.17	–	–	–	–	–	–
Emergency Preparedness Self Efficacy, Wave 1	–.40***	–.24*	.21*	–	–	–	–	–
Psychological Distress, Wave 2	.58***	.10	–.03	–.27**	–	–	–	–
Perceived Threat, Wave 2	.09	.41***	.15	–.27**	.27**	–	–	–
Response Efficacy, Wave 2	–.20*	.06	.40***	.09	–.16	.10	–	–
Emergency Preparedness Self Efficacy, Wave 2	–.36***	–.15	.16	.57***	–.45***	–.22*	.26**	–
Average	5.37	2.78	10.09	16.09	6.17	3.06	10.38	17.43
Standard Deviation	3.98	0.67	2.25	5.33	4.76	0.82	2.90	5.20
Minimum	0.00	1.00	4.00	1.00	0.00	1.41	3.00	2.00
Maximum	21.00	4.47	15.00	28.00	24.00	5.00	15.00	28.00

Note: \* p<.05 \*\*p<.01 \*\*\*p<.001.

self-efficacy ( $b = -0.21, P < 0.01$ ) but not significantly related to the difference in response efficacy ( $b = -0.10, P > 0.05$ ).

**RQ4: Are There Distal (that is, cross-wave) Effects of Threat, Self-efficacy, and Response Efficacy on Psychological Distress, Independent of Any Proximal (that is, within-wave) Effects?**

In order to address Research Question 4, the full structural equation model depicted in Figure 1 was examined and tested. The results are presented in Table 4 and summarized in Figure 2. Of the 4 primary measures (psychological distress, perceived threat, response efficacy, and self-efficacy), only psychological distress ( $b = 0.57, P < 0.0001$ ) and perceived threat ( $b = -0.20, P = 0.017$ ) from Wave 1 were found to independently relate to Wave 2 psychological distress. Proximal Wave 2 measures of perceived threat ( $b = 0.26, P < 0.002$ ) and self-efficacy ( $b = -0.31, P < 0.001$ ) were also found to be significantly related to Wave 2 psychological distress.

**Discussion**

Although cross-sectional research has shown that perceived levels of self-efficacy and response efficacy protect individuals against the psychological distress accompanying the perceived threat of stressors,<sup>33,44–47</sup> the stability of these relationships across time has remained largely unexplored. In a 2-wave longitudinal study spanning 5 years, we investigated the proximal and distal effects of perceived threat, self-efficacy, and response efficacy on reported symptoms of psychological distress among individuals with physical disabilities—a population for whom psychological distress is known to be significantly higher than the general population.<sup>6</sup>

Our results suggest that the association of proximal perceived threat and emergency preparedness self-efficacy with psychological distress remains stable across time, while the effect of response efficacy may be more context-specific, and therefore more variable across time. Because Wave 2 data were collected at the beginning of the COVID-19 pandemic, it is possible that response efficacy would be impacted by political beliefs or trust in government given the politicization of this event. Indeed, recent research has found that political conservatism was associated with lower levels of response efficacy during the COVID-19 pandemic.<sup>48</sup> However, this effect was stronger among US citizens relative to those from other countries,<sup>49</sup> which suggests that the specific effects of response efficacy depend on contextual factors, like the strong politicization of COVID-19 in the United States. To the extent that response efficacy is context-specific, its effect on psychological distress may vary across time.

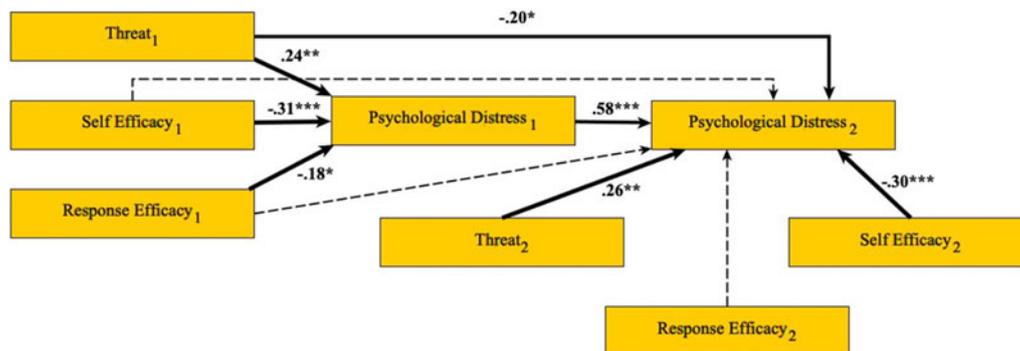
In contrast to response efficacy, self-efficacy appears to have a more stable relationship with psychological distress across time. Regardless of wave, the level of perceived emergency preparedness self-efficacy consistently negatively predicted psychological distress. Of particular note, individuals who reported an increase in self-efficacy across the 2 waves of the study also reported (on average) a decrease in psychological distress. In addition to broadening our understanding of factors related to psychological distress, this result has potentially important intervention implications: Given that self-efficacy is a malleable construct, 1 way of reducing psychological distress may be to increase an individual’s self-efficacy level. Past research suggests that there are 4 major methods of improving self-efficacy beliefs, including mastery performance, vicarious experience (modeling), verbal persuasion, and physiological arousal.<sup>44</sup> Therefore, interventions

**Table 3.** Parameter Estimates: Cotemporaneous Model

	Parameter Estimate (b)	Standard Error	t Value	Pr >  t
Psychological Distress, Wave 1				
Perceived Threat	0.27	0.07	3.65	0.0003
Response Efficacy	-0.19	0.08	-2.52	0.0118
Emergency Preparedness Self Efficacy	-0.28	0.08	-3.70	0.0002
Psychological Distress, Wave 2				
Perceived Threat	0.25	0.07	3.37	0.0007
Response Efficacy	-0.04	0.08	-0.50	>.05
Emergency Preparedness Self Efficacy	-0.32	0.08	-4.08	0.0001

**Table 4.** Parameter Estimates: Full Model

	Parameter Estimate (b)	Standard Error	t Value	Pr >  t
Psychological Distress, Wave 1				
Perceived Threat, Wave 1	0.25	0.09	2.89	0.004
Response Efficacy, Wave 1	-0.18	0.09	-2.08	0.038
Emergency Preparedness Self Efficacy, Wave 1	-0.31	0.09	-3.55	<.001
Psychological Distress, Wave 2				
Perceived Threat, Wave 1	-0.20	0.08	-2.39	0.017
Response Efficacy, Wave 1	0.12	0.08	1.40	>.05
Emergency Preparedness Self Efficacy, Wave 1	0.14	0.09	1.53	>.05
Psychological Distress, Wave 1	0.57	0.07	8.01	<.0001
Perceived Threat, Wave 2	0.26	0.08	3.13	0.002
Response Efficacy, Wave 2	-0.03	0.08	-0.42	>.05
Self Efficacy, Wave 2	-0.31	0.09	-3.51	<.001

**Figure 2.** Final model.

that aim to improve emergency preparedness self-efficacy and, in turn, decrease disaster-related psychological distress, could do so by creating opportunities to practice preparedness behavior, observe peers engage in preparedness behavior, and receive verbal encouragement. In addition to promoting better mental health by promoting self-efficacy, such interventions may also promote general resilience to disasters, as prior research has found a positive link between self-efficacy and preparedness behavior.<sup>25,38</sup>

The results of this study also underscore the stable association of perceived threat with the level of psychological distress across time. Regardless of wave, a higher perceived threat was associated with greater psychological distress, and an increased perceived threat across waves was associated, on average, with increased

psychological distress. This highlights the importance of coping mechanisms (such as self-efficacy) to overcome the barrier imposed by perceived threat.

These results also suggest that any distal effects of Wave 1 emergency preparedness self-efficacy are mediated by Wave 1 psychological distress. Once prior distress level and the proximal effects of threat and emergency preparedness self-efficacy have been accounted for, there is no indication that distal effects of emergency preparedness self-efficacy have any direct bearing on psychological distress. In particular, there is no suggestion from these results of any lagged effect of emergency preparedness self-efficacy.

Interestingly, the results show distal effects of Wave 1 perceived threat on Wave 2 psychological distress even after accounting for

prior distress level and proximal effects of perceived threat and emergency preparedness self-efficacy. Specifically, there is a significant negative relationship between Wave 1 perceived threat and Wave 2 psychological distress. This is unexpected, given that past studies have found a positive association between perceived threat and psychological distress.<sup>10,12,13</sup> Although stressors, such as perceived threat, are often associated with increased psychological distress, extant research has also found evidence for stress-related growth, in which individuals who are able to cope successfully with stressful events report positive adjustments in their lives.<sup>50–52</sup> Participants in the current study may have experienced such stress-related growth and found positive strategies to cope with their perceived threat over the 5 years between waves, resulting in a negative distal effect of Wave 1 perceived threat on Wave 2 psychological distress. These findings highlight the importance of finding ways to promote stress-related growth in order to support positive psychological outcomes in the long term.

### Limitations

These results should be interpreted with caution. They are based on 106 individuals with physical disabilities and may not generalize to other populations (including populations with different socio-demographic characteristics). All measures were based on self-reports. The 5-year time span between waves did not permit a more fine-tuned longitudinal analysis; additional waves of data would have permitted more insight into factors affecting individual trajectories of psychological distress across time. Although the analysis of differences across time is suggestive of a causal effect of threat and self-efficacy on psychological distress, experimental studies are needed to confirm the plausibility of the implied causal model. It should also be noted that Wave 2 data collection occurred shortly after the onset of the COVID-19 pandemic. The extent to which COVID-19 affected the relationships reported here—if at all—is unclear.

### Conclusions

These concerns, notwithstanding the results of this study, suggest perceived threat and emergency preparedness self-efficacy may impact the psychological distress of individuals with physical disabilities in a consistent manner across time. In line with Kim et al.'s<sup>37</sup> work, these findings suggest that the PMT should be extended to consider how disaster-related cognitive appraisals may impact negative affective responses, like psychological distress. This study is the first known attempt to examine this extension of the PMT longitudinally and within a sample of individuals with disabilities. Overall, these results suggest the potential importance of perceived threat and self-efficacy in the etiology of disaster-related psychological distress among individuals with a physical disability and indicate possible avenues for intervention to prevent or mitigate this distress.

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### References

1. Swartz JA, Jantz I. Association between nonspecific severe psychological distress as an indicator of serious mental illness and increasing levels of medical multimorbidity. *Am J Public Health*. 2014;104(12):2350–2358. doi: [10.2105/AJPH.2014.302165](https://doi.org/10.2105/AJPH.2014.302165)
2. Barry V, Stout ME, Lynch ME, et al. The effect of psychological distress on health outcomes: a systematic review and meta-analysis of prospective studies. *J Health Psychol*. 2020;25(2):227–239. doi: [10.1177/1359105319842931](https://doi.org/10.1177/1359105319842931)
3. McLachlan KJ, Gale CR. The effects of psychological distress and its interaction with socioeconomic position on risk of developing four chronic diseases. *J Psychosom Res*. 2018;109:79–85. doi: [10.1016/j.jpsychores.2018.04.004](https://doi.org/10.1016/j.jpsychores.2018.04.004)
4. Daly M. Prevalence of psychological distress among working-age adults in the United States, 1999–2018. *Am J Public Health*. 2022;112(7):1045–1049. doi: [10.2105/AJPH.2022.306828](https://doi.org/10.2105/AJPH.2022.306828)
5. Twenge JM, Joiner TE. Mental distress among US adults during the COVID-19 pandemic. *J Clin Psychol*. 2020;76(12):2170–2182. doi: [10.1002/jclp.23064](https://doi.org/10.1002/jclp.23064)
6. Noh JW, Kwon YD, Park J, et al. Relationship between physical disability and depression by gender: a panel regression model. *PLoS One*. 2016;11(11):e0166238. doi: [10.1371/journal.pone.0166238](https://doi.org/10.1371/journal.pone.0166238)
7. Turner RJ, McLean PD. Physical disability and psychological distress. *Rehabil Psychol*. 1989;34(4):225–242. doi: [10.1037/h0091727](https://doi.org/10.1037/h0091727)
8. De Smet H, Lagadec P, Leysen J. Disasters out of the box: a new ballgame? *J Contingencies Crisis Manag*. 2012;20(3):138–148. doi: [10.1111/j.1468-5973.2012.00666.x](https://doi.org/10.1111/j.1468-5973.2012.00666.x)
9. Eshghi K, Larson RC. Disasters: lessons from the past 105 years. *Disaster Prev Manag Int J*. 2008;17(1):62–82. doi: [10.1108/09653560810855883](https://doi.org/10.1108/09653560810855883)
10. Grupe DW, Nitschke JB. Uncertainty and anticipation in anxiety: an integrated neurobiological and psychological perspective. *Nat Rev Neurosci*. 2013;14(7):488–501. doi: [10.1038/nrn3524](https://doi.org/10.1038/nrn3524)
11. Bults M, Beaujean DJ, Richardus JH, Voeten HA. Perceptions and behavioral responses of the general public during the 2009 influenza A (H1N1) pandemic: a systematic review. *Disaster Med Public Health Prep*. 2015;9(2):207–219.
12. Li X, Lyu H. Epidemic risk perception, perceived stress, and mental health during COVID-19 pandemic: a moderated mediating model. *Front Psychol*. 2021;11:1–9. doi: [10.3389/fpsyg.2020.563741](https://doi.org/10.3389/fpsyg.2020.563741)
13. Suzuki Y, Yabe H, Yasumura S, et al. Psychological distress and the perception of radiation risks: the Fukushima health management survey. *Bull World Health Organ*. 2015;93:598–605. doi: [10.2471/BLT.14.146498](https://doi.org/10.2471/BLT.14.146498)
14. Castro CP, Sarmiento JP, Edwards R, et al. Disaster risk perception in urban contexts and for people with disabilities: case study on the city of Iquique (Chile). *Nat Hazards*. 2017;86(1):411–436. doi: [10.1007/s11069-016-2698-x](https://doi.org/10.1007/s11069-016-2698-x)
15. Chou YJ. Who is at risk of death in an earthquake? *Am J Epidemiol*. 2004;160(7):688–695. doi: [10.1093/aje/kwh270](https://doi.org/10.1093/aje/kwh270)
16. Quail J, Barker R, West C. Experiences of individuals with physical disabilities in natural disasters: an integrative review. *Aust J Emerg Manag*. 2018;33(3):58–63. doi: [10.3316/ielapa.793049280261310](https://doi.org/10.3316/ielapa.793049280261310)
17. Van Willigen M, Edwards T, Edwards B, Hesse S. Riding out the storm: experiences of the physically disabled during Hurricanes Bonnie, Dennis, and Floyd. *Nat Hazards Rev*. 2002;3(3):98–106. doi: [10.1061/\(ASCE\)1527-6988\(2002\)3:3\(98\)](https://doi.org/10.1061/(ASCE)1527-6988(2002)3:3(98))
18. Roubhan B. Natural hazards: enhancing disaster preparedness and resilience of people with disabilities. In: *Crises, Conflict, and Disability: Ensuring Equality*. Routledge; 2014:75–83.
19. Sodhi MS. Natural disasters, the economy and population vulnerability as a vicious cycle with exogenous hazards. *J Oper Manag*. 2016;45(1):101–113. doi: [10.1016/j.jom.2016.05.010](https://doi.org/10.1016/j.jom.2016.05.010)
20. Disability Fact Sheet. World Health Organization. Published 2022. Accessed December 12, 2022. <https://www.who.int/en/news-room/fact-sheets/detail/disability-and-health>
21. Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev*. 1977;84(2):191. doi: [10.1037/0033-295X.84.2.191](https://doi.org/10.1037/0033-295X.84.2.191)

22. Rabani Bavojdan M, Towhidi A, Rahmati A. The relationship between mental health and general self-efficacy beliefs, coping strategies and locus of control in male drug abusers. *Addict Health*. 2011;3(3-4):111-118.
23. Abramson D, Stehling-Ariza T, Garfield R, Redlener I. Prevalence and predictors of mental health distress post-Katrina: findings from the Gulf Coast Child and Family Health Study. *Disaster Med Public Health Prep*. 2008;2(2):77-86. doi: [10.1097/DMP.0b013e318173a8e7](https://doi.org/10.1097/DMP.0b013e318173a8e7)
24. Duygulu S, Kuruca-Ozdemir E, Erdat Y, Kocoglu-Tanyer D. University students' risk perception, protective measures, and general health during the COVID-19 pandemic in Turkey. *Disaster Med Public Health Prep*. Published online August 22, 2022.
25. Ejeta LT, Ardalan A, Paton D. Application of behavioral theories to disaster and emergency health preparedness: a systematic review. *PLoS Curr*. 2015;7. doi: [10.1371/currents.dis.31a8995ced321301466db400f1357829](https://doi.org/10.1371/currents.dis.31a8995ced321301466db400f1357829)
26. Ryan MT, Rohrbeck CA, Wirtz PW. The importance of self-efficacy in parental emergency preparedness: a moderated mediation model. *Disaster Med Public Health Prep*. 2018;12(3):345-351. doi: [10.1017/dmp.2017.80](https://doi.org/10.1017/dmp.2017.80)
27. Thormar SB, Sijbrandij M, Gersons BPR, et al. PTSD symptom trajectories in disaster volunteers: the role of self-efficacy, social acknowledgement, and tasks carried out: PTSD symptom trajectories in volunteers. *J Trauma Stress*. 2016;29(1):17-25. doi: [10.1002/jts.22073](https://doi.org/10.1002/jts.22073)
28. Burns KM. Emergency Preparedness Self-Efficacy and the Ongoing Threat of Disasters. [PhD thesis]. Washington, DC, USA: The George Washington University; 2014. <http://proxygw.wrlc.org/login?url=http://search.proquest.com/docview/1614471823?accountid=11243>
29. Wirtz PW, Rohrbeck CA, Burns KM. Anxiety effects on disaster precautionary behaviors: a multi-path cognitive model. *J Health Psychol*. 2019;24(10):1401-1411. doi: [10.1177/1359105317720277](https://doi.org/10.1177/1359105317720277)
30. Adams RM, Eisenman DP, Glik D. Community advantage and individual self-efficacy promote disaster preparedness: a multilevel model among persons with disabilities. *Int J Environ Res Public Health*. 2019;16(15):2779. doi: [10.3390/ijerph16152779](https://doi.org/10.3390/ijerph16152779)
31. Sullivan-Wiley KA, Gianotti AGS. Risk perception in a multi-hazard environment. *World Dev*. 2017;97:138-152. doi: [10.1016/j.worlddev.2017.04.002](https://doi.org/10.1016/j.worlddev.2017.04.002)
32. Ambelu A, Birhanu Z, Yitayih Y, et al. Psychological distress during the COVID-19 pandemic in Ethiopia: an online cross-sectional study to identify the need for equal attention of intervention. *Ann Gen Psychiatry*. 2021;20(1):22. doi: [10.1186/s12991-021-00344-4](https://doi.org/10.1186/s12991-021-00344-4)
33. Zhang W, Xiong S, Zheng Y, Wu J. Response efficacy and self-efficacy mediated the relationship between perceived threat and psychic anxiety among college students in the early stage of the CoViD-19 pandemic. *Int J Environ Res Public Health*. 2022;19(5):2832. doi: [10.3390/ijerph19052832](https://doi.org/10.3390/ijerph19052832)
34. **Preparedness in America: Research Insights to Increase Individual, Organizational, and Community Action.** Federal Emergency Management Agency. Published 2014. Accessed December 12, 2022. [https://www.ready.gov/sites/default/files/2020-08/Preparedness\\_in\\_America\\_August\\_2014.pdf](https://www.ready.gov/sites/default/files/2020-08/Preparedness_in_America_August_2014.pdf)
35. Bandura A. Social cognitive theory: an agentic perspective. *Annu Rev Psychol*. 2001;52(1):1-26. doi: [10.1111/1467-839X.00024](https://doi.org/10.1111/1467-839X.00024)
36. Maddux JE, Rogers RW. Protection motivation and self-efficacy: a revised theory of fear appeals and attitude change. *J Exp Soc Psychol*. 1983;19(5):469-479. doi: [10.1016/0022-1031\(83\)90023-9](https://doi.org/10.1016/0022-1031(83)90023-9)
37. Kim J, Yang K, Min J, White B. Hope, fear, and consumer behavioral change amid COVID-19: application of protection motivation theory. *Int J Consum Stud*. 2022;46(2):558-574. doi: [10.1111/ijcs.12700](https://doi.org/10.1111/ijcs.12700)
38. Marceron JE, Rohrbeck CA. Disability and disasters: the role of self-efficacy in emergency preparedness. *Psychol Health Med*. 2019;24(1):83-93. doi: [10.1080/13548506.2018.1492730](https://doi.org/10.1080/13548506.2018.1492730)
39. Vacondio M, Priolo G, Dickert S, Bonini N. Worry, perceived threat and media communication as predictors of self-protective behaviors during the COVID-19 outbreak in Europe. *Front Psychol*. 2021;12:577992. doi: [10.3389/fpsyg.2021.577992](https://doi.org/10.3389/fpsyg.2021.577992)
40. Marceron JE, Rohrbeck CA, Burns KM. A self-efficacy measure for both human-made and natural disasters. In: *Poster Session for the Annual Federal Alliance for Safe Homes Conference*. Lake Buena Vista, FL, USA; 2013.
41. Kessler RC, Andrews G, Colpe LJ, et al. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychol Med*. 2002;32(6):959-976. doi: [10.1017/S0033291702006074](https://doi.org/10.1017/S0033291702006074)
42. Üstün TB, Kostanjsek N, Chatterji S, Rehm J. Measuring health and disability: manual for WHO disability assessment schedule WHODAS 2.0. World Health Organization; 2010.
43. Üstün TB. Measuring health and disability: manual for WHO disability assessment schedule WHODAS 2.0. World Health Organization; 2010.
44. Bandura A. *Self-efficacy: the exercise of control*. W. H. Freeman; 1997.
45. Ding Y, Xu J, Huang S, et al. Risk perception and depression in public health crises: evidence from the COVID-19 crisis in China. *Int J Environ Res Public Health*. 2020;17(16):5728. doi: [10.3390/ijerph17165728](https://doi.org/10.3390/ijerph17165728)
46. Mireault GC, Bond LA. Parental death in childhood: perceived vulnerability, and adult depression and anxiety. *Am J Orthopsychiatry*. 1992;62(4):517-524. doi: [10.1037/h0079371](https://doi.org/10.1037/h0079371)
47. Myall BR, Hine DW, Marks AD, et al. Assessing individual differences in perceived vulnerability in older adults. *Pers Individ Differ*. 2009;46(1):8-13. doi: [10.1016/j.paid.2008.08.015](https://doi.org/10.1016/j.paid.2008.08.015)
48. Winter T, Riordan BC, Scarf D, Jose PE. Conspiracy beliefs and distrust of science predicts reluctance of vaccine uptake of politically right-wing citizens. *Vaccine*. 2022;40(12):1896-1903. doi: [10.1016/j.vaccine.2022.01.039](https://doi.org/10.1016/j.vaccine.2022.01.039)
49. Stroebe W, vanDellen MR, Abakoumkin G, et al. Politicization of COVID-19 health-protective behaviors in the United States: longitudinal and cross-national evidence. *PLoS One*. 2021;16(10):e0256740. doi: [10.1371/journal.pone.0256740](https://doi.org/10.1371/journal.pone.0256740)
50. Park C, Fenster J. Stress-related growth: predictors of occurrence and correlates with psychological adjustment. *J Soc Clin Psychol*. 2004;23:195-215. doi: [10.1521/jscp.23.2.195.31019](https://doi.org/10.1521/jscp.23.2.195.31019)
51. Tedeschi RG, Calhoun LG. Posttraumatic growth: conceptual foundations and empirical evidence. *Psychol Inq*. 2004;15(1):1-18. doi: [10.1207/s15327965pli1501\\_01](https://doi.org/10.1207/s15327965pli1501_01)
52. Weinrib AZ, Rothrock NE, Johnsen EL, Lutgendorf SK. The assessment and validity of stress-related growth in a community-based sample. *J Consult Clin Psychol*. 2006;74(5):851. doi: [10.1037/0022-006X.74.5.851](https://doi.org/10.1037/0022-006X.74.5.851)