



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



## Psychological flexibility in the context of COVID-19 adversity: Associations with distress

Emily B. Kroska<sup>\*</sup>, Anne I. Roche, Jenna L. Adamowicz, Manny S. Stegall

University of Iowa, Department of Psychological and Brain Sciences, USA

### ARTICLE INFO

#### Keywords:

Openness  
Awareness  
Engagement  
COVID-19  
Pandemic adversity  
Distress

### ABSTRACT

The COVID-19 pandemic has led to hardship for individuals across the globe, and research to-date has indicated a significant impact of the pandemic on mental health functioning. In order to promote psychological resilience during this time, it is important to understand modifiable targets for clinical intervention. The current study examined demographic characteristics, pandemic-related adversity, and psychological flexibility in relation to general and peritraumatic distress in a sample of United States survey respondents during May of 2020. Participants were recruited from Amazon Mechanical Turk (MTurk),  $N = 485$ . Participants completed measures of pandemic-related adversity, psychological flexibility components (openness to experience, behavioral awareness, and valued action), peritraumatic distress, and general distress. Hierarchical regression analyses examined whether demographic characteristics, pandemic-related adversity, and components of psychological flexibility were associated with general and peritraumatic distress. Results indicated that higher pandemic-related adversity, lower openness to experience, and lower behavioral awareness were significantly associated with higher general distress. Greater pandemic-related adversity, lower openness to experience, lower behavioral awareness, and higher valued action were significantly associated with higher peritraumatic distress. Adding the components of psychological flexibility to the model increased the amount of variance accounted for in both measures of distress. The results indicated that psychological flexibility components may be particularly important targets for prevention and intervention efforts in the midst of the COVID-19 pandemic. Transdiagnostic interventions, such as Acceptance and Commitment Therapy, that target psychological flexibility may be useful as the impact of the pandemic continues to unfold.

### 1. Psychological flexibility in the context of COVID-19 adversity: associations with distress

The COVID-19 global pandemic presents a variety of difficulties that impact mental health functioning. In addition to fears and challenges associated with contracting the coronavirus, individuals are facing financial difficulties, social isolation and loneliness, loss of childcare, changes in employment, problems accessing healthcare services, death of loved ones, and extreme uncertainty surrounding the trajectory of the pandemic. Though previous literature has indicated that both general life adversity (Kiely, Leach, Olesen, & Butterworth, 2015; Turner & Lloyd, 1995) and specific stressors during quarantine (Brooks et al., 2020) may be associated with psychological distress, limited research to-date has explored the specific impact of COVID-19-related adversity on mental health outcomes (Holmes et al., 2020; Rajkumar, 2020).

#### 1.1. COVID-19 and mental health

Current evidence suggests that the COVID-19 pandemic has a negative impact on mental health. Early research from China indicated that a majority of individuals regarded the psychological impact of the pandemic as moderate or severe (Wang et al., 2020) and that approximately one-third of people have experienced psychological distress during this time period (Qiu et al., 2020). Individuals report anxiety, depressive symptoms, and stress (Wang et al., 2020), as well as feelings of horror and apprehension in response to the pandemic (Zhang & Ma, 2020). Additionally, early longitudinal data suggest a likely enduring impact of the pandemic on mental health symptoms (Wang, Pan, Wan, Tan, Xu, McIntyre, et al., 2020). Studies conducted in China also identified a variety of potential risk factors for psychological difficulties during the pandemic: female gender, migrant worker status, age (18–30 and 60+), student status, higher levels of education, somatic symptoms

<sup>\*</sup> Corresponding author. G60 PBSB, 340 Iowa Ave, Iowa City, IA, 52242, USA.  
E-mail address: [emily-kroska@uiowa.edu](mailto:emily-kroska@uiowa.edu) (E.B. Kroska).

<https://doi.org/10.1016/j.jcbs.2020.07.011>

Received 1 June 2020; Received in revised form 10 July 2020; Accepted 30 July 2020

Available online 6 August 2020

2212-1447/© 2020 Association for Contextual Behavioral Science. Published by Elsevier Inc. All rights reserved.

(e.g., chills, cough, dizziness), and poor health (Qiu et al., 2020; Wang et al., 2020). Conversely, access to health information and engagement in certain preventive measures (e.g., hand washing) have been shown to be associated with fewer psychological difficulties (Wang et al., 2020).

Individuals in the United Kingdom (UK) are also reporting pandemic-related concerns, including concerns about isolation, social distancing, mental illness, employment/finances, and negative feelings (Holmes et al., 2020). Cumulative adverse experiences during the pandemic and cumulative worries were associated with anxiety and depressive symptoms in UK adults (Wright, Steptoe, & Fancourt, 2020). Similarly, fear of COVID-19 was related to depression and anxiety in an Iranian sample (Ahorsu et al., 2020). Newly termed “coronaphobia” contributed to depression, anxiety, and death anxiety over and above demographic characteristics and risk factors, indicating the importance of the fear of contracting the virus as a specific construct (Lee, Jobe, Mathis, & Gibbons, 2020). In contrast, results from a study in Italy suggested that social engagement may help to prevent mental health symptoms during isolation (Pancani, Marinucci, Aureli, & Riva, 2020). Additionally, physical activity, diet quality, and better sleep were identified as factors that may promote greater mental well-being during the pandemic in a Middle Eastern sample (Kilani et al., 2020).

Overall, early research across the globe has indicated that the COVID-19 pandemic is associated with psychological distress. In addition to prevalence and risk factor identification, it is equally important to identify targets for psychotherapeutic intervention. Given the array of challenges that may be experienced (e.g., anxiety, depression, trauma-related symptoms), one approach is to target transdiagnostic processes that are associated with a variety of mental health outcomes. Psychological flexibility, a key process targeted in multiple transdiagnostic psychotherapeutic interventions, has been previously identified as a modifiable target to promote general public health (Gloster, Meyer, & Lieb, 2017).

### 1.2. Adversity and psychological flexibility

A significant body of research has indicated that *experiential avoidance* (EA), or unworkable attempts to control or change unpleasant internal experiences (e.g., thoughts, emotions), is related to a variety of psychological outcomes (Chawla & Ostafin, 2007). Importantly, EA is associated with poorer psychological functioning following adverse life events (Plumb, Orsillo, & Luterek, 2004). Multiple studies have indicated that EA mediates the association between trauma exposure and adverse outcomes such as obsessive-compulsive and internalizing symptoms (Kroska, Miller, Roche, Kroska, & O'Hara, 2018), psychological distress (Marx & Sloan, 2002), posttraumatic stress symptoms (Orcutt, Pickett, & Pope, 2005), somatization (Kroska, Roche, & O'Hara, 2018), and problematic or risky health behaviors (Roche, Kroska, Miller, Kroska, & O'Hara, 2018).

In contrast, *psychological flexibility*, or the ability to remain in the present moment and engage in values-based behavior, even in the presence of unpleasant internal experiences, is associated with numerous aspects of psychological health (Kashdan & Rottenberg, 2010). Psychological flexibility has been shown to be related to lower levels of depression and posttraumatic stress in military personnel after returning from deployment (Bryan, Ray-Sannerud, & Heron, 2015) and to buffer the association between stress and a variety of health outcomes (Gloster et al., 2017), indicating that the process may protect against psychological distress following stressful experiences. Psychological flexibility has been characterized as being composed of three core interactive components: 1) *openness*, a willingness to have unpleasant internal experiences (e.g., feelings, memories) in service of what matters; 2) *awareness*, purposefully paying attention when engaging in behavior rather than being on “automatic pilot”; and 3) *engagement*, or identifying and engaging in valued actions that one finds meaningful and important (Francis, Dawson, & Golijani-Moghaddam, 2016; Strohsahl, Robinson, & Gustavsson, 2012). Psychological flexibility is not

unique to one specific condition or set of symptoms but is instead a transdiagnostic process that promotes mental health and well-being across a variety of psychological struggles. Thus, psychological flexibility has the potential to promote resilience in times of adversity.

### 1.3. Purpose of the current study

A first step toward prevention programs is to first characterize the relation between hardships and mental health, and second, identify modifiable psychotherapeutic mechanisms that explain psychological symptoms (Holmes et al., 2020). The current study cross-sectionally investigates associates of distress during the COVID-19 pandemic, including demographic characteristics, pandemic-related adversity, and components of psychological flexibility using hierarchical regression analyses. Components of psychological flexibility measured in this study include openness to experiences, behavioral awareness, and valued action. We hypothesized that components of psychological flexibility would significantly relate with distress over and above pandemic-related adversity.

## 2. Method

### 2.1. Participants

Participants ( $N = 523$ ) were recruited from MTurk in May 2020. Of the participants, 485 completed validity checks and were included in analyses. The sample was on average 37.42 years of age ( $SD = 11.46$ ), heterosexual (85.8%), and employed full-time (76.3%). Gender identity was relatively balanced (59.6% male). Racial identity was most commonly White (78.1%). Ethnicity was largely non-Hispanic (82.9%). On average, participants reported about 15.09 years of education ( $SD = 2.93$ ). See Table 1 for further information.

### 2.2. Procedure

Participants were recruited through MTurk's CloudResearch platform and were paid \$3.50 via Amazon Payments within three days of survey completion. CloudResearch blocks suspicious geolocations and screens for automated responding. Recruitment was limited to United States participants who had previously completed  $\geq 100$  tasks and had  $\geq 95\%$  approval rating. As this project aims to follow-up with these individuals longitudinally, our goal was to recruit users who were consistently participating in MTurk studies and had received high ratings on past participation.

Within the Qualtrics survey, validity checks were included to ensure that responders were high quality, engaged, and not automated. Google reCAPTCHA was the first question following consent, and if incomplete, the survey did not proceed. A simple arithmetic question that required user input was used to filter out internet bots. Attention checks verified reading of the questions. Participants who did not pass validity checks were excluded from analyses.

### 2.3. Measures

**Pandemic Adversity.** The Pandemic Adversity Measure (PAM) quantifies psychosocial adversity related to COVID-19. PAM was developed by the first author, and validation of this measure is underway. PAM quantifies hardship by creating a Total Adversity score across financial, home, work/business, health, and social domains. Several items are weighted to quantify the extent of the adversity (e.g., the percentage of lost income). Total scores range from 0 to 50. Internal consistency scores were not calculated, as items are scored categorically and not expected to correlate meaningfully.

**ACT Processes.** The Comprehensive assessment of Acceptance and Commitment Therapy processes (CompACT) measured three components of psychological flexibility: openness to experience, behavioral

**Table 1**  
Descriptive characteristics of the MTurk sample, N = 485.

	N (%)
Age, M(SD)	37.42 (11.46)
Race	
White	379 (78.1%)
African American or Black	58 (12%)
American Indian or Alaska Native	7 (1.4%)
Asian	27 (5.6%)
Biracial or Multiracial	13 (2.7%)
Did not disclose	1 (0.2%)
Ethnicity	
Non-Hispanic	402 (82.9%)
Hispanic	80 (16.5%)
Did not disclose	3 (0.6%)
Years of education, M(SD)	15.09 (2.93)
Employment Status	
Full-time	370 (76.3%)
Part-time	49 (10.1%)
Unemployed	52 (10.7%)
Did not disclose	14 (2.9%)
Gender Identity	
Female	192 (39.6%)
Male	289 (59.6%)
Transgender man	1 (0.2%)
Self-described	1 (0.2%)
Prefer not to disclose	1 (0.2%)
Did not disclose	1 (0.2%)
Sexual Orientation	
Heterosexual	416 (85.8%)
Homosexual	9 (1.9%)
Bisexual	56 (11.5%)
Self-described	3 (0.6%)
Prefer not to disclose	1 (0.2%)
Pandemic Adversity Measure, M(SD)	14.46 (10.91)
Openness to Experience, M(SD)	32.41 (11.33)
Behavioral Awareness, M(SD)	18.45 (8.66)
Valued Action, M(SD)	35.88 (8.16)
K10, M(SD)	22.67 (11.04)
Peritraumatic Distress Inventory, M(SD)	2.12 (0.98)

*Note.* Openness to Experience, Behavioral Awareness, and Valued Action were measured with the Comprehensive assessment of ACT processes. K10 is the Kessler Psychological Distress Scale-10. The Peritraumatic Distress Inventory composite is a mean of the 13 items.

awareness, and valued action (Francis et al., 2016). The measure demonstrated convergent, discriminant, and concurrent validity (Francis et al., 2016). Participants rate 23 items on a 7-point Likert scale. Higher scores indicate greater openness to experience, behavioral awareness, and valued action. In this sample, openness to experience ( $\alpha = 0.84$ ), behavioral awareness ( $\alpha = 0.93$ ), and valued action ( $\alpha = 0.90$ ) demonstrated adequate internal consistency.

**Peritraumatic Distress.** The Peritraumatic Distress Inventory (PDI) measured emotional and physiological distress during and immediately following a traumatic event. The PDI demonstrated test-retest reliability, convergent validity, and discriminant validity (Brunet et al., 2001). Participants rate 13 items on a 5-point Likert scale, and the mean is the composite score. Higher scores denote more distress. In this sample, the measure demonstrated high internal consistency ( $\alpha = 0.95$ ).

**Psychological Distress.** The Kessler Psychological Distress Scale-10 (K10) was used to measure anxiety and depressive symptoms in the past 30 days (Kessler et al., 2002). Participants rate 10 items on a 5-point Likert scale. Higher total scores denote more distress. In this sample, the K10 demonstrated high internal consistency ( $\alpha = 0.96$ ).

#### 2.4. Statistical analyses

All analyses were conducted in SPSS, version 25. Hierarchical linear regression analyses included two dependent variables: general distress (K10) and peritraumatic distress (PDI). Though general distress (K10) and peritraumatic distress (PDI) were highly correlated in the current

sample ( $r = 0.82, p < .001$ ), the measures are theoretically distinct. The K10 measures general distress, depression, and anxiety symptoms, while the PDI measures emotional and physiological symptoms associated with a specific acutely stressful (and potentially traumatic) event (in this case, the COVID-19 pandemic). Given the importance of understanding both factors that may influence general distress and factors that may influence acute stress during the pandemic, each measure was of unique interest, and scales were examined separately. Models included three steps to examine relations between demographic characteristics, pandemic-related adversity, and psychological flexibility components. Change in  $R^2$  statistics allowed for examination of the amount of variance contributed between steps, and of particular interest was the added variance from psychological flexibility.

Item-level missing data were imputed when  $\leq 20\%$  of items were missing in the following quantities: K10 (13), PDI (24), and CompACT (44). For the Adversity scale, total scores were calculated without the missing items (assuming 0, or absence of adverse experience) when  $\leq 20\%$  of items were missing.

### 3. Results

Data were examined for normality, skewness, and kurtosis. The skewness and kurtosis values were within the acceptable respective ranges, and thus, no transformations were conducted. Data were examined for outliers, and outliers' data were verified to ensure valid responding throughout the survey (including measures not utilized in the current analyses).

Demographic characteristics were examined for inclusion as covariates in analyses. For between-groups comparisons, Levene's equality of variances test was used, and if significant, the results were interpreted with equal variances not assumed and adjusted degrees of freedom. Gender identity (female, male) was not associated with differences in K10 ( $t(479) = -0.02, p = 0.99$ ) or PDI ( $t(479) = 0.33, p = 0.75$ ). Age related to K10 ( $r = -0.16, p < .001$ ) but not PDI ( $r = -0.07, p = .10$ ). Racial groups were combined for between-groups comparisons due to small sample in some groups. There were no significant differences between White and non-White individuals in K10 ( $t(152.87) = -0.04, p = 0.97$ ) or PDI ( $t(482) = -0.22, p = 0.83$ ). Individuals of Hispanic/Latino ethnicity (16.5%) and non-Hispanic/Latino ethnicity (82.9%) differed in K10 ( $t(480) = 6.01, p < .001$ ) and PDI score ( $t(101.34) = 5.66, p < .001$ ). Individuals of Hispanic/Latino ethnicity reported more symptoms (K10  $M = 29.31, SD = 10.84$ ; PDI  $M = 2.75, SD = 1.10$ ) than non-Hispanic/Latino individuals (K10  $M = 21.47, SD = 10.61$ ; PDI  $M = 1.99, SD = 0.91$ ). Years of education related to K10 ( $r = -0.11, p = .02$ ) and PDI score ( $r = -0.9, p = .046$ ).

Bivariate correlations among independent variables were examined. Openness to experience correlated with behavioral awareness ( $r = 0.68, p < .001$ ), valued action ( $r = 0.36, p < .001$ ), and pandemic-related adversity ( $r = -0.39, p < .001$ ). Behavioral awareness correlated with valued action ( $r = 0.31, p < .001$ ) and pandemic-related adversity ( $r = -0.57, p < .001$ ). Valued action correlated with pandemic-related adversity ( $r = -0.12, p = .009$ ).

Hierarchical regression analyses examined the amount of variance accounted for by independent variables (demographic characteristics, pandemic-related adversity, and psychological flexibility components) in relation to general distress (K10) and peritraumatic distress (PDI). Variance inflation factor statistics were examined to evaluate multicollinearity. With the outcome of general distress, the final model is conveyed in Table 2. The demographic characteristics of age, ethnicity, and education were not significant ( $ps > .05$ ). Pandemic-related adversity significantly related to general distress ( $\beta = 0.34, t(417) = 9.03, p < .001$ ). Openness to experiences significantly related to lower general distress ( $\beta = -0.25, t(417) = -5.90, p < .001$ ), as did behavioral awareness ( $\beta = -0.33, t(417) = -7.31, p < .001$ ). Valued action was not significantly related to general distress ( $\beta = -0.06, t(417) = -1.87, p = .06$ ). Variance inflation factors were less than 3 and deemed acceptable.

**Table 2**  
The role of demographic characteristics, pandemic adversity, and components of psychological flexibility in general distress.

Variable	B	SE	$\beta$	t	p	R2
<b>Model 1</b>						.11
Age	-.10	.04	-.11	-2.33	.02	
Ethnicity	8.75	1.38	.29	6.35	<.001	
Education	-.27	.18	-.07	-1.56	.12	
<b>Model 2</b>						.42
Age	-.12	.04	-.13	-3.32	.001	
Ethnicity	.73	1.24	.03	.59	.56	
Education	-.08	.14	-.02	-.56	.57	
Pandemic Adversity	.63	.04	.62	14.77	<.001	
<b>Model 3</b>						.64
Age	.01	.03	.01	.32	.75	
Ethnicity	.46	1.00	.02	.46	.64	
Education	-.09	.11	-.02	-.82	.41	
Pandemic Adversity	.35	.04	.34	9.03	<.001	
Openness to Experiences	-.23	.04	-.25	-5.90	<.001	
Behavioral Awareness	-.42	.06	-.33	-7.31	<.001	
Valued Action	-.08	.04	-.06	-1.87	.06	

Note. Openness to Experiences, Behavioral Awareness, and Valued Action are subscales of the Comprehensive Assessment of ACT processes.

Step 1 (demographic characteristics) accounted for 11% of the variance ( $R^2 = 0.11$ ). When adding in Step 2 (pandemic-related adversity), there was a significant change in  $R^2$  ( $R^2 = 0.42$ ,  $F$ -change (1, 420) = 218,  $p < .001$ ). Finally, when adding in Step 3 (psychological flexibility components), there was once again a significant change in  $R^2$  ( $R^2 = 0.64$ ,  $F$ -change (3, 417) = 82.96,  $p < .001$ ). The total variance accounted for by the final model was 63.5% (Table 2).

With the dependent variable of peritraumatic distress, ethnicity and education were not significantly related to peritraumatic distress ( $ps > .05$ ). Pandemic-related adversity associated with greater peritraumatic distress ( $\beta = 0.40$ ,  $t(428) = 9.90$ ,  $p < .001$ ). Openness to experience was associated with lower peritraumatic distress ( $\beta = -0.12$ ,  $t(428) = -2.74$ ,  $p = .006$ ), as was behavioral awareness ( $\beta = -0.38$ ,  $t(428) = -7.67$ ,  $p < .001$ ). Valued action significantly associated with greater peritraumatic distress ( $\beta = 0.08$ ,  $t(428) = 2.29$ ,  $p = .023$ ). Variance inflation factors were deemed acceptable. The demographic characteristics (Step 1) accounted for about 10% of the variance in peritraumatic distress ( $R^2 = 0.10$ ). Pandemic-related adversity significantly added to the model ( $R^2 = 0.42$ ,  $F$ -change (1, 431) = 233.37,  $p < .001$ ). The psychological flexibility components also significantly added to the model ( $R^2 = 0.56$ ,  $F$ -change (3,428) = 45.82,  $p < .001$ ). In total, the model accounted for 55.8% of the variance in peritraumatic distress (see Table 3).

**Table 3**  
The role of demographic characteristics, pandemic adversity, and components of psychological flexibility in peritraumatic distress.

Variable	B	SE	$\beta$	T	p	R2
<b>Model 1</b>						.10
Ethnicity	.80	.12	.31	6.71	<.001	
Education	-.02	.02	-.06	-1.34	.18	
<b>Model 2</b>						.42
Ethnicity	.09	.11	.03	.82	.42	
Education	-.01	.01	-.01	-.39	.70	
Pandemic Adversity	.06	.00	.63	15.28	<.001	
<b>Model 3</b>						.56
Ethnicity	-.01	.10	-.00	-.08	.93	
Education	-.00	.01	-.01	-.20	.84	
Pandemic Adversity	.04	.00	.40	9.90	<.001	
Openness to Experiences	-.01	.00	-.12	-2.74	.01	
Behavioral Awareness	-.04	.01	-.38	-7.67	<.001	
Valued Action	.01	.00	.08	2.29	.02	

Note. Openness to Experiences, Behavioral Awareness, and Valued Action are subscales of the Comprehensive Assessment of ACT processes.

#### 4. Discussion

Though research regarding the impact of the COVID-19 global pandemic on mental health continues to emerge, available evidence suggests serious psychological consequences (Qiu et al., 2020; Wang et al., 2020). Because early indications point to an enduring impact of the pandemic on mental health (Wang, Pan, Wan, Tan, Xu, McIntyre, et al., 2020), the identification of modifiable therapeutic processes is critical to the development of targeted interventions. Transdiagnostic processes are most efficient and broadly applicable, providing intervention across diagnoses and promoting functional improvement and well-being. Psychological flexibility, the target of several contextual behavioral interventions, including Acceptance and Commitment Therapy (ACT), is one modality that can promote vitality.

The current study examined components of psychological flexibility in association with general and peritraumatic distress. Hierarchical regression analyses allowed for examination of which components of psychological flexibility related with two distress outcomes, while controlling for both demographic characteristics and pandemic-related adversity. By including the psychological flexibility components in one step, the  $R^2$  statistic provides the total variance that can be attributed to psychological flexibility. Further, this procedure identifies the key components of psychological flexibility, while controlling for shared variance. Results indicated that COVID-19-related adversity was associated with greater general and peritraumatic distress, and adversity remained significant even when adding psychological flexibility components to the model. Higher openness to experience and behavioral awareness were associated with lower general and peritraumatic distress. These components of psychological flexibility were associated with general and peritraumatic distress over and above demographic characteristics and pandemic-related adversity. Valued action was not significantly associated with general distress but was positively associated with peritraumatic distress.

The current findings support the development and evaluation of psychotherapeutic interventions that promote psychological flexibility during the COVID-19 pandemic. Openness and awareness processes appear to be of particular importance. Specifically, remaining in the present moment and choosing actions intentionally (behavioral awareness) and being open to (rather than avoidant of) difficult thoughts and emotions (openness to experience) may be particularly relevant processes to promote emotional well-being. Notably, valued action was not significantly related to general distress, but was positively related to peritraumatic distress specific to COVID-19. This relation suggests that those with a greater ability to identify and engage in behaviors that are personally meaningful and important, even when challenging or stressful, are reporting greater emotional and physiological distress surrounding the pandemic. This finding may reflect that values-based behavior often comes with a variety of difficult internal experiences, particularly in stressful contexts. For example, an individual who visits grandparents weekly during the pandemic may experience distress for fear of infecting loved ones or oneself, and choosing to converse more frequently by phone may bring about painful guilt, isolation, and frustration, even if consistent with values. The healthcare worker spending 12 hours in personal protective equipment may experience a variety of difficult emotions, and yet, treating patients during COVID-19 may be important. While being exposed, healthcare professionals may have to limit physical contact with family and friends, bringing about further stress. Finally, given that the psychological flexibility processes are intricately interrelated, it is important to note that the analyses convey that openness and awareness seem to be most important during the current circumstances, but this considers the components as part of a whole. Openness involves willingness to engage in difficult experiences, but only in service of one's values. Similarly, awareness is contextualized within one's values and intentional, mindful decision-making. Ultimately, further research should continue to examine the interrelated psychological flexibility components and the relations with pandemic-

related distress.

Acceptance and Commitment Therapy (ACT) is a transdiagnostic, acceptance- and mindfulness-based behavioral intervention that may be well-suited to ameliorate the psychological impact of pandemic-related adversity. ACT targets both behavioral awareness and openness to experience. More specifically, ACT may help individuals take the perspective of an observer on thoughts (e.g., “this pandemic will never end”), emotions (e.g., frustration, fear), and physical sensations (e.g., racing heart). Cultivating awareness is in service of the pursuit of one’s values under the premise that when present in the moment, one can make intentional choices with awareness of the function of behavior. ACT aims to promote acceptance of internal experiences through helping individuals to notice the connection between difficult emotions and personal values (e.g., sadness surrounding loss of a loved one). By fostering these skills, individuals may choose to be present, respond workably to difficult internal experiences, and pursue values. Psychological flexibility involves meaningful action, even in the presence of adversity and emotional pain.

Given the likely longstanding problems related to the pandemic, future research should examine the impact of psychological flexibility interventions in the context of COVID-19. Such investigations should include tele-health interventions and outreach efforts to impact underserved populations with limited access to mental healthcare. Further, rigorous longitudinal evaluations of the relation between psychological flexibility and distress can inform understanding of these relationships regarding future global disasters.

The findings should be considered along with several limitations. First, respondents were recruited through MTurk. There are several concerns regarding this recruitment platform that necessitate validity questions and data screening (Chmielewski & Kucker, 2019). Validity checks were implemented to ensure integrity of the data. Recruitment through MTurk can also be limited by selection bias, as we likely included participants who are interested in responding to surveys, and we specifically recruited MTurk workers who had completed 100 surveys. This study also relied on self-report measures. While the included constructs (psychological flexibility, peritraumatic distress, adversity) are commonly measured via self-report in behavioral research, this remains a limitation. The study also measured participants at a single timepoint, so longitudinal conclusions cannot be drawn. The present findings cannot yield causal conclusions, but instead, suggest that psychological flexibility is related to distress during the COVID-19 pandemic. Finally, this study measured COVID-19 related hardship with the PAM, an unvalidated measure that was created in the context of COVID-19. Prior research examining the adversity of other collective traumas (e.g., natural disasters, infectious disease) on psychological functioning have used similar protocols. For example, investigators created measures of adversity to explore the impact of wildfires (McFarlane, 1987), ice storms (King & Laplante, 2005), and floods (Brock et al., 2014; Kroska et al., 2017) on participants. Though measuring COVID-19 related hardship with a valid measure would be optimal, the creation and use of an event-specific scale aligns with the previous literature. Nevertheless, this measure is not yet validated, and results should be interpreted with that in mind.

In conclusion, as the COVID-19 global pandemic endures, the identification of modifiable mechanisms to target with therapeutic interventions is critical. These findings suggest that psychological flexibility is one such process that may help to promote well-being and reduce psychological distress amidst COVID-19 adversity. Therefore, ACT, which aims to increase psychological flexibility, may be well-suited for those who are coping with hardship and experiencing distress. Future research should continue to examine these relations and, further, the efficacy of targeted transdiagnostic interventions for COVID-19 related hardship and associated distress.

## Declaration of competing interest

This work was supported in part by the National Institute of Health T32 pre-doctoral training grant: T32GM108540 (A.I.R., J.L.A) and by the University of Iowa’s Ballard Seashore Fellowship (A.I.R.). Neither the NIH nor the University of Iowa had any role in the study design, collection, analysis, or interpretation of the data, writing of the manuscript, or the decision to submit the paper for publication. The authors have no conflicts of interest to disclose.

## Acknowledgments

Thanks to members of the THRIVE Lab, including Nicole Dietrich, Paul Holdefer, Noah Martin, Justin Rhode, and Cole Toovey. Thanks to Michael O’Hara for review of the Pandemic Adversity Measure, and thanks to Paul Windschitl for consultation regarding MTurk research and validity screening.

## References

- Ahorsu, D. K., Lin, C.-Y., Imani, V., Saffari, M., Griffiths, M. D., & Pakpour, A. H. (2020). The fear of COVID-19 scale: Development and initial validation. *International Journal of Mental Health and Addiction*. <https://doi.org/10.1007/s11469-020-00270-8>.
- Brock, R. L., O’Hara, M., Hart, K., McCabe, J., Williamson, J., Laplante, D., et al. (2014). Partner support and maternal depression in the context of the Iowa floods. *Journal of Family Psychology*, 28(6), 832. <https://doi.org/10.1037/fam0000027>.
- Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., et al. (2020). The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. *The Lancet*, 395(10227), 912–920. [https://doi.org/10.1016/S0140-6736\(20\)30460-8](https://doi.org/10.1016/S0140-6736(20)30460-8).
- Brunet, A., Weiss, D., Metzler, T. J., Best, S., Neylan, T., Rogers, C., et al. (2001). The peritraumatic distress inventory: A proposed measure of PTSD criterion A2. *American Journal of Psychiatry*, 158(9), 1480–1485. <https://doi.org/10.1176/appi.ajp.158.9.1480>.
- Bryan, C. J., Ray-Sannerud, B., & Heron, E. A. (2015). Psychological flexibility as a dimension of resilience for posttraumatic stress, depression, and risk for suicidal ideation among Air Force personnel. *Journal of Contextual Behavioral Science*, 4(4), 263–268. <https://doi.org/10.1016/j.jcbs.2015.10.002>.
- Chawla, N., & Ostafin, B. (2007). Experiential avoidance as a functional dimensional approach to psychopathology: An empirical review. *Journal of Clinical Psychology*, 63(9), 871–890. <https://doi.org/10.1002/jclp.20400>.
- Chmielewski, M., & Kucker, S. C. (2019). An MTurk crisis? Shifts in data quality and the impact on study results. *Social Psychological and Personality Science*, 11(4), 464–473. <https://doi.org/10.1177/1948550619875149>.
- Francis, A. W., Dawson, D. L., & Golijani-Moghaddam, N. (2016). The development and validation of the comprehensive assessment of acceptance and commitment Therapy processes (CompACT). *Journal of Contextual Behavioral Science*, 5(3), 134–145. <https://doi.org/10.1016/j.jcbs.2016.05.003>.
- Gloster, A. T., Meyer, A. H., & Lieb, R. (2017). Psychological flexibility as a malleable public health target: Evidence from a representative sample. *Journal of Contextual Behavioral Science*, 6(2), 166–171. <https://doi.org/10.1016/j.jcbs.2017.02.003>.
- Holmes, E. A., O’Connor, R. C., Perry, V. H., Tracey, I., Wessely, S., Arseneault, L., et al. (2020). Multidisciplinary research priorities for the COVID-19 pandemic: A call for action for mental health science. *The Lancet Psychiatry*, 7(6), 547–560. [https://doi.org/10.1016/S2215-0366\(20\)30168-1](https://doi.org/10.1016/S2215-0366(20)30168-1).
- Kashdan, T. B., & Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. *Clinical Psychology Review*, 30(7), 865–878. <https://doi.org/10.1016/j.cpr.2010.03.001>.
- Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D. K., Normand, S. L. T., et al. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological Medicine*, 32(6), 959–976. <https://doi.org/10.1017/S0033291702006074>.
- Kiely, K. M., Leach, L. S., Olesen, S. C., & Butterworth, P. (2015). How financial hardship is associated with the onset of mental health problems over time. *Social Psychiatry and Psychiatric Epidemiology*, 50(6), 909–918. <https://doi.org/10.1007/s00127-015-1027-0>.
- Kilani, H. A., Bataineh, F., Al-Nawayseh, A., Obeid, O., Abu-Hilal, M. M., Alkilani, M., et al. (2020). *Healthy lifestyle behaviors are major predictors of mental wellbeing during COVID-19 pandemic confinement: A study on adult Arabs in higher educational institutions*. <https://doi.org/10.21203/rs.3.rs-37899/v1>.
- King, S., & Laplante, D. P. (2005). The effects of prenatal maternal stress on children’s cognitive development: Project Ice Storm. *Stress: The International Journal on the Biology of Stress*, 8(1), 35–45. <https://doi.org/10.1080/10253890500108391>.
- Kroska, E. B., Miller, M. L., Roche, A. I., Kroska, S. K., & O’Hara, M. W. (2018). Effects of traumatic experiences on obsessive-compulsive and internalizing symptoms: The role of avoidance and mindfulness. *Journal of Affective Disorders*, 225. <https://doi.org/10.1016/j.jad.2017.08.039>.
- Kroska, E. B., O’Hara, M. W., Elgbeili, G., Hart, K. J., Laplante, D. P., Dancause, K. N., et al. (2017). The impact of maternal flood-related stress and social support on

- offspring weight in early childhood. *Archives of Women's Mental Health*. <https://doi.org/10.1007/s00737-017-0786-x>.
- Kroska, E. B., Roche, A. L., & O'Hara, M. W. (2018). Childhood trauma and somatization: Identifying mechanisms for targeted intervention. *Mindfulness*, 1–12. <https://doi.org/10.1007/s12671-018-0927-y>.
- Lee, S. A., Jobe, M. C., Mathis, A. A., & Gibbons, J. A. (2020). Incremental validity of coronaphobia: Coronavirus anxiety explains depression, generalized anxiety, and death anxiety. *Journal of Anxiety Disorders*, 102268. <https://doi.org/10.1016/j.janxdis.2020.102268>.
- Marx, B. P., & Sloan, D. M. (2002). The role of emotion in the psychological functioning of adult survivors of childhood sexual abuse. *Behavior Therapy*, 33(4), 563–577. [https://doi.org/10.1016/S0005-7894\(02\)80017-X](https://doi.org/10.1016/S0005-7894(02)80017-X).
- McFarlane, A. C. (1987). Life events and psychiatric disorder: The role of a natural disaster. *British Journal of Psychiatry*, 151(SEPT), 362–367. <https://doi.org/10.1192/bjp.151.3.362>.
- Orcutt, H. K., Pickett, S. M., & Pope, E. B. (2005). Experiential avoidance and forgiveness as mediators in the relation between traumatic interpersonal events and posttraumatic stress disorder symptoms. *Journal of Social and Clinical Psychology*, 24(7), 1003–1029. <https://doi.org/10.1521/jscp.2005.24.7.1003>.
- Pancani, L., Marinucci, M., Aureli, N., & Riva, P. (2020). Forced social isolation and mental health: A study on 1006 Italians under COVID-19 lockdown. *PsyArXiv Preprints*. <https://psyarxiv.com/uacfj/>.
- Plumb, J. C., Orsillo, S. M., & Luterek, J. A. (2004). A preliminary test of the role of experiential avoidance in post-event functioning. *Journal of Behavior Therapy and Experimental Psychiatry*, 35(3), 245–257. <https://doi.org/10.1016/j.jbtep.2004.04.011>.
- Qiu, J., Shen, B., Zhao, M., Wang, Z., Xie, B., & Xu, Y. (2020). A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: Implications and policy recommendations. *General Psychiatry*, 33(2), Article e100213. <https://doi.org/10.1136/gpsych-2020-100213>.
- Rajkumar, R. P. (2020). COVID-19 and mental health: A review of the existing literature. *Asian Journal of Psychiatry*, 52, 102066. <https://doi.org/10.1016/j.ajp.2020.102066>.
- Roche, A. L., Kroska, E. B., Miller, M. L., Kroska, S. K., & O'Hara, M. W. (2018). Childhood trauma and problem behavior: Examining the mediating roles of experiential avoidance and mindfulness processes. *Journal of American College Health*, 1–10. <https://doi.org/10.1080/07448481.2018.1455689>.
- Strosahl, K., Robinson, P., & Gustavsson, T. (2012). *Brief interventions for radical change: Principles and practice of focused acceptance and commitment therapy*. New Harbinger Publications, Inc.
- Turner, R. J., & Lloyd, D. A. (1995). Lifetime traumas and mental health: The significance of cumulative adversity. *Journal of Health and Social Behavior*, 36(4), 360–376. <https://doi.org/10.2307/2137325>.
- Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., et al. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 Coronavirus Disease (COVID-19) epidemic among the general population in China. *International Journal of Environmental Research and Public Health*, 17(5), 1729. <https://doi.org/10.3390/ijerph17051729>.
- Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., McIntyre, R. S., et al. (2020b). A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain, Behavior, and Immunity*. <https://doi.org/10.1016/j.bbi.2020.04.028>.
- Wright, L., Steptoe, A., & Fancourt, D. (2020). How are adversities during COVID-19 affecting mental health? Differential associations for worries and experiences and implications for policy. *MedRxiv*. <https://doi.org/10.1101/2020.05.14.20101717>, 2020.05.14.20101717.
- Zhang, Y., & Ma, Z. F. (2020). Impact of the COVID-19 pandemic on mental health and quality of life among local residents in liaoning province, China: A cross-sectional study. *International Journal of Environmental Research and Public Health*, 17(7), 2381. <https://doi.org/10.3390/ijerph17072381>.