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Predicting personal protective equipment use, trauma symptoms, and physical symptoms in the USA during the early weeks of the COVID-19 lockdown (April 9–18, 2020)

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A R T I C L E I N F O

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A B S T R A C T

The COVID-19 pandemic created a complex psychological environment for Americans. In this study, 450 MTurk workers completed measures of sociodemographic characteristics, perceived risk for COVID-19, general perceived vulnerability to disease, intolerance of uncertainty, and psychological flexibility. These variables were used to predict COVID-19 preventive health behaviors (PPE use), psychological distress, and physical symptoms. The surveys were completed between April 9, 2020 and April 18, 2020 which is a period that corresponded to the first 2–3 weeks of lockdown for most participants.

A demographically diverse sample of participants was recruited. A substantial number of participants reported a reduction employment status and 69% were in self-isolation. Participants reported a high degree of perceived vulnerability to COVID-19. PPE mask wearing was variable: 16% "not at all," 20% "some of the time," 42% "a good part of the time," and 26 "most of the time." Using clinical cutoff on the post-trauma scale, 70% of the sample would be considered to have symptoms consistent with PTSD. Physical symptom reporting was also high.

Intolerance of uncertainty and psychological inflexibility were significant predictors of psychological distress and physical symptoms. Psychological flexibility moderated the relationship between intolerance of uncertainty and psychological distress/physical symptoms. The relationship between intolerance of uncertainty and psychological distress/physical symptoms was stronger among participants with lower levels of psychological flexibility. These findings indicate psychological flexibility can reduce distress associated with COVID-19. Additionally, these results support the workability of the Unified Flexibility and Mindfulness Model as a framework for studying health behavior.

1. The COVID-19 social and psychological context in early 2020

The COVID-19 pandemic brought about rapid and dramatic changes in organizational, social, family, and individual behavior. After China confirmed the presence of COVID-19 in Wuhan on December 31, 2019 (WHO, 2020), United States citizens were assured by White House and coadjutor communications that COVID-19 the threat would be confined to China (Poynter Institute, 2020). A national emergency declaration was made by the White House on March 13, 2020. At the same time and for weeks thereafter, contradictory communications and recommendations were widespread among some top Federal government leaders and policymakers. These contradictory messages focused on key COVID-19 prevention and containment issues such as: mask wearing, hydroxychloroquine use, social distancing, COVID-19 testing, and the need for lockdowns.

Through January and February, the CDC communicated that COVID-19 risk was minimal and that no specific preventive actions were needed other than avoiding travel to and from affected countries (CDC, 2020). It is now recognized that during this time many undiagnosed cases of COVID-19 were present and spreading in the USA (Deng et al., 2020;

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Shear et al., 2020). In March and April, the CDC issued recommendations that more clearly articulated the degree of COVID-19 risk and generated preventive health recommendations that included lockdowns, social distancing, testing, contact tracing, and personal protective equipment (PPE) use (CDC, 2020).

While governmental communications and recommendations were contradictory, news media sites were emphasizing threat. USA infection rates and death counts were prominently featured along with extensive reporting of the scarcity of medical resources, a possible economic catastrophe, and the social impact of COVID-19 (Ioannidis, 2020). Oftentimes, the headlines were marked by fear-evoking terms such as "apocalyptic." Our search of Newspaper.com on June 18, 2020, yielded 80,5873 print stories on "COVID-19 and Death" compared to 3974 stories on "COVID-19 and survival."

By mid to late March, the magnitude of health threat posed by COVID-19 prompted declarations of states of emergency, quarantines, closing of businesses and schools, and social distancing guidelines. By late April, most USA states had implemented COVID-19 quarantine and social distancing procedures. As such, most persons in the USA were confined to homes and residences, no longer working, attending school, and prohibited from participating in many reinforcing social and recreational activities.

A similar, albeit less severe, set of circumstances occurred with the H1N1 pandemic in 2009. Taha and colleagues (Taha, Matheson, Anisman, 2013a, Taha, Matheson, Cronin, & Anisman, 2014) explored the interplay between governmental responses, public health official communications, and media reporting. Their research indicated that inconsistencies across these entities likely contributed to higher levels of anxiety, mistrust, and poor adoption of preventive health behaviors such as vaccination. In a prescient cautionary statement, Taha, Matheson, and Anisman (2013b) noted "Although the risk for contracting H1N1 has subsided, virologists have suggested another pandemic will occur again … that will increase transmission and/or lethality. This means that the public may again have to contend with a health threat with largely uncertain consequences." (p. 149). Taha et al. (2014) added "clearly governmental agencies and media outlets need to ensure that they have one voice, so that the delicate balance between conveying the potential severity of a pandemic on the one hand, and preventing panic on the other, can be negotiated" (p. 603).

Taha and colleagues' research indicates that inconsistency in messaging across governmental, public health, and media entities exerted adverse impact on health behavior and coping. They likely did not envision the degree of inconsistency that was presented to the American public during the COVID-19 pandemic or that key leaders would recommend and model *noncompliance* with rational and evidence-based public health recommendations.

Perceived uncertainty, unpredictability, and inconsistency of information regarding effective prevention actions under conditions of threat exposure have been reliably linked to psychological distress (Carleton, 2016b; Contrada & Baum, 2011). The introduction of significant lifestyle restrictions associated with quarantines and lockdown would intensify this distress due to a reduction in social, recreational, financial, and occupational reinforcement (Ahmeda et al., 2020). The combined effects of information and recommendation inconsistency, threat magnification via media reporting, and significant lifestyle changes created a complex and likely harmful psychological environment for many Americans.

2. A functional contextual behavioral approach to preventive health behavior

Exposure to verbal or visual health threat information, combined with beliefs that (a) one is vulnerable and (b) uncertainty is unsafe, can evoke negative psychophysiological activation that is experienced as an aversive emotional state (Contrada & Baum, 2011; Duncan, Schaller, & Park, 2009; Hyde, Ryan, & Waters, 2019; Morris et al., 2019). This aversive state has sometimes been labeled perceived vulnerability and it has been associated with engagement in preventive health behaviors (Brewer et al., 2007; O'Brien et al., 1995; Sheeran, Harris, & Epton, 2014). Under conditions of health threat and the concomitant increase in perceived vulnerabillity, avoidance and escape behaviors will likely be generated. Avoidance and escape behaviors that lead to a reduction in perceived vulnerability are more apt to be repeated via negative reinforcement.

Avoidance and escape behaviors can be cognitive and/or behavioral - more specifically overt-motor (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996). Cognitive avoidance and escape behaviors can include information seeking, problem solving, rumination, and worry. These cognitive responses are labeled experiential avoidance because they provide a means for diverting attention away from aversive imagery or emotional experiencing of threat information (Boulanger, Hayes, & Pisterello, 2010). Cognitive avoidance and escape responses can be adaptive or workable to the extent that they promote engaging in behaviors that lead to a better quality of life or thriving (e.g., generating effective solutions). They can also be maladaptive and unworkable to the extent that they lead to a poorer quality of life and lack of thriving (e.g., persistent ruminating and immobilization).

Overt-motor avoidance and escape responding under conditions of general threat and health threat has been well-researched in the psychological literature (e.g., Dymond, Schlund, Roche, De Houwer, & Freegard, 2012; Tannenbaum et al., 2015). Related to health threat information, adaptive and workable overt-motor avoidance and escape behaviors include engaging in effective preventive health actions, seeking social support, and engaging in meaningful activity. Alternatively, maladaptive behaviors include those that reduce quality of life and thriving such as noncompliance with preventive actions and substance abuse.

Applied to COVID-19, a functional contextual behavioral perspective would suggest that exposure to health threat information combined with perceived vulnerability and a belief that uncertainty is unsafe would prompt an increase in aversive emotional activation and the concomitant motivation to engage in avoidance and escape responses. Cognitive and overt-motor avoidance and escape responses that bring about a reduction in objective risk and simultaneously reduce the intensity, duration, and/or frequency of perceived vulnerability are more workable than responses that do not reduce objective risk (Presti, McHugh, Gloster, Karekla, & Hayes, 2020). PPE use and social distancing can reduce the objective risk of COVID-19 transmission and infection (Eikenberry et al., 2020). They could thus be viewed as adaptive and values-congruent committed actions.

There is a paucity of research using the hexaflex or a functional contextual model to predict health behaviors. Psychological flexibility is a construct that is particularly relevant to a functional contextual framework related to COVID-19. Psychological flexibility has been characterized by intentional awareness and a present moment focus where external information and internal experiences are acknowledged and observed from a nonreactive and nonjudgmental perspective (Rogge & Daks, 2020; Shapiro, Carlson, & Freedman, 2006). Researchers have reported that higher levels of psychological flexibility were associated with higher levels of safety behavior and preventive health actions in health contexts (O'Brien, Horan, et al., 2019; 2019b), physical activity and diet (Gilbert & Waltz, 2010), and quality of life and medical compliance among diabetics (Bogusch and O'Brien, 2018).

Rogge and Daks (2020) presented a cogent argument that mindfulness-related constructs can be mapped onto the hexaflex model of psychological flexibility (Hayes, Luoma, Bond, Masuda, & Lillis, 2006; Hayes, Strosahl, & Wilson, 2011). Rogge and Daks (2020) based their argument on a series of studies where they and their colleagues demonstrated that items taken from multiple mindfulness scales along with commonly used measures from the contextual science domain could be empirically combined via structural equation modeling and item response theory analyses into a coherent set of constructs that generally conform with the 12 dimensions of the hexaflex model (Rogge, Daks, Dubler, & Saint, 2019; Rolffs, Rogge, & Wilson, 2016; Stabbe, Rolffs, & Rogge, 2019). Rogge and Daks (2020) posited that these hexaflex components can also be organized into a process model labeled the Unified Flexibility and Mindfulness Model (UFM) which is composed of Mindfulness Lenses and Filtering Experiences (e.g., intentional awareness, present moment focus, mindful observing, mindful describing), Flexible Responses to Difficult Experiences (e.g., acceptance, non-judgement, defusion), Life Enriching Value Driven Behavior (e.g., committed action), and Global Individual Functioning (e.g., distress).

The Unified Flexibility and Mindfulness Model can be applied to the extant research linking psychological flexibility to preventive health behavior related to COVID-19. Based on this model, it can be argued that the Mindful Lenses and Filtering Experiences combined with Flexible Responses to Difficult Experiences would be associated with (a) higher rates of COVID-19 PPE use (Values Driven Behaviors) and (b) lower levels of COVID-19 related distress.

3. Summary

The genesis of this investigation occurred during the emergence of the COVID-19 pandemic in China. The social and psychological context was unprecedented. A highly transmissible, poorly understood, lethal virus was rapidly spreading across the United States. Media reporting of hospitalizations and deaths were extensive and dramatic. Vulnerability information and recommendations on how to reduce risk were fractionated. Ultimately, self-isolation and quarantine were developed and enforced with varying levels of support from leadership. With the self-isolation and quarantines, large numbers of people experienced a significant loss of opportunities to engage in reinforcing occupational, social, recreational, and physical activities.

This project was developed as an effort to document levels of distress experienced by persons in the USA during the early stages of lockdown. We sought to use a functional contextual perspective to examine the extent to which objective risk for COVID-19, perceived vulnerability, intolerance of uncertainty, and psychological flexibility predicted COVID-19 PPE use, psychological distress, and physical symptoms. We also tested the position that psychological flexibility moderated the relationship between perceived vulnerability and PPE use, perceived vulnerability and psychological distress, and perceived vulnerability and physical symptoms.

4. Methods

4.1. Participants

This project was approved by the Bowling Green State University Institutional Review Board on March 30, 2020 (#1562479–4). Amazon Mechanical Turk Workers were enrolled through CloudResearch \(Litman, Robinson, Abberbock, 2017). Six hundred thirty-five participants initially responded to the survey from April 9, 2020 to April 18, 2020. Of these, 116 started the survey but discontinued quickly (all 116 participants completed less than 20% of the survey items and 105 completed less than 10% of the items). Data quality for the remaining 519 participants was examined. Participant data was deleted if any of the following were detected: (a) less than 75% of items completed (n = 15), duplicate IP address (n = 26), (b) failing two of three attention check items (n = 27), or (c) an unusually long time (231 min) to complete the survey (n = 1). This resulted in a final total sample of 450 participants.

The demographic characteristics of participants are summarized in Table 1. The mean age was 36.68 (range 18–76) and 37% of the participants were female. The sample was predominantly Caucasian (55.3%) followed by Black/African American (22.9%) and Asian (4.4%). About half (55.6%) participants reported obtaining a Bachelor's degree and 26.5% reported obtaining a Master's degree or higher. Most (77%) participants reported that they were married, in a long-term

Table 1
Descriptive statistics for Study Measures.

	Descriptive Statistics (n = 450)		
	M	*SD*	%
Age	36.68	11.27	
Gender			38
Female			62
Male			
Marital Status			20
Single			69
Married			5
Cohabitating			3
In Long Term Relationship (Not Cohabitating)			1
Divorced			1
Widowed			
Employment Status Before COVID-19			16
Employed 1–23 h/week			24
Employed 24–39 h/week			53
Employed ≥ 40 h/week			2
Not employed/looking			2
Not employed/not looking			1
Retired			1
Disabled			
Employment Status After COVID-19			22
Employed 1–23 h/week			30
Employed 24–39 h/week			36
Employed ≥ 40 h/week			5
Not employed/looking			5
Not employed/not looking			1
Retired			2
Disabled			
Race/Ethnicity			11
Hispanic/Latinx			55
White			23
Black/African American			4
Asian			1
Pacific Islander			1
American Indian or Alaska Native			3
Two or more			2
Not reported			
Educational Attainment			4
High School			8
Some College			6
Associates Degree			56
Bachelors Degree			27
Masters Degree			2
Beyond Masters			
Religious Affiliation			18
Catholic			53
Protestant			3
Jewish			2
Muslim			1
Buddhist			1
Taoist			1
Hindu			6
Agnostic			5
Atheist			6
Nothing in Particular			4
Other			
Have One or More Children			68
Number of Children	1	1	
Annual Income in Dollars	66,226	68,515	
Currently have NonCOVID-19 Illness			15
Currently Taking Medication			15
Currently In Isolation			69
Number of days in Isolation	20	14	
Quarantine Status			31
Current Under Quarantine Order			25
Finished Quarantine			40
Not Under Quarantine			
Number of Times Leave Home per Day	2	3	
Exposed to COVID (yes)?			40%
Perceived Vulnerability to Disease (range 15–75)	46.72	6.02	
General Perceived Vulnerability (range 4–20)	17.49	4.09	
Perceived Lack of Immunity (range 5–25)	13.30	4.18	
Germ Aversion (range 3–15)	11.53	2.16	

(*continued on next page*)

Table 1 (*continued*)

	Descriptive Statistics (n = 450)		
	M	*SD*	%
Perceived Vulnerability to COVID-19 (range 1–5)	2.85	1.06	
Psychological Flexibility (range 20–98)[1]	61.42	9.30	
PF – UFM Mindful Lenses (range 9–45)	31.86	5.01	
PF – UFM Responses (range 5–25)	17.96	3.79	
PI – UFM Mindful Lenses (range 5–25)	14.23	5.12 4.25	
PI – UFM Responses (range 5–25)	13.29		
Intolerance of Uncertainty (range 12–60)	39.81	9.88	
Preventive Action Taken Scale (range 8–32)	24.02	4.02	
PPE Use (range 3–12)	8.09	2.45	
Avoid Public Settings and Contact w/People (5–20)	15.93	3.00	
Impact of Events Scale (range 0–88)	44.63	23.50	
Patient Health Questionnaire – 15 (range 0–28)	9.77	7.11	

Note: PF = Psychological Flexibility, UMF = Unified Flexibility and Mindfulness Model, Mindful Lenses = Mindful Lenses Filtering Experiences, Responses = Flexible Responding to Difficult Experiences. 1 – The PF total was calculated by summing (PF UMF Mindful Lenses/2) with the remaining three PF variables.

relationship, or cohabitating and that they had one or more children. Religious affiliations were reported to be Protestant (18%), Roman Catholic (53%, an unexpectedly higher percentage), and Atheist/Agnostic/Nothing in Particular (17%). These statistics indicate that relative to census data, there was a higher proportion of males, Black/African Americans, and persons with higher educational attainment www.census.gov(U.S. Census Bureau, 2020).

4.2. Measures

4.2.1. Demographics

Participants completed items that provided information about basic demographic characteristics: age, sex, race, ethnicity, marital status, educational attainment, number of children, living circumstances. They also provided information about employment (job type, hours per week, changes in job since COVID-19). Participants reported whether they were experiencing any medical conditions and listed medications they were taking.

4.3. Self-isolation, quarantine, and COVID-19 risk exposure

Participants reported whether they were engaged in self-isolation or quarantine. They also reported the number of times they left their residence in a typical day. Finally, participants reported whether they had been in any setting in the last 14 days that they would consider to be risky for contracting COVID-19 (yes, no).

4.4. Perceived vulnerability to disease (PVD)

The PVD is a 15-item scale designed to measure general perceptions of risk for illness (Duncan et al., 2009). Each item (e.g., "In general, I am very susceptible to colds, flu, and other infectious diseases.") is rated on a scale that ranges from 1 ("Strongly disagree") to 5 ("Strongly agree"). Higher scores indicated a higher level of perceived vulnerability. Our analysis of the internal consistency of the subscales recommended by Duncan et al. (2009) revealed suboptimal Cronbach's alphas ($\alpha = 0.57$ for infectibility and $\alpha = 0.54$ for germ aversion). We therefore conducted an exploratory factor analysis with an oblimin rotation to identify subscales that fit the current sample. Kaiser's rule indicates that components with eigenvalues greater than 1 should be retained for factor analyses (Kaiser, 1970). A principal component analysis extracted 3 components with eigenvalues greater than 1. A scree test was also conducted to aid factor extraction (Williams, Onsman, & Brown, 2010). The scree plot indicated that a three-factor model fit data well. These three factors cumulatively accounted for 56.44% of the variance (factor 1 = 30.96%, factor 2 = 13.87%, factor 3 = 11.62%).

Item loadings were evaluated. If an item loaded more than 0.40 on a single factor and there was at least a 0.20 difference in loadings on any other factor (Hinkin, 1998), it was retained. If an item loaded at 0.32 or higher on two or more factors it was considered cross-loaded and removed. Four items were removed due to low factor loadings or cross loadings. The remaining 11 items all had high loadings (>0.69) one of the three factors. An examination of items indicated that factor one (4 items) was measuring *general perceived vulnerability to disease* (e.g., "In general, I am very susceptible to colds, flu, and other infectious diseases"), factor 2 (4 items) was measuring *perceived lack of immunity* (e.g., "my immune system protects me from most illnesses that other people get" – these items were reversed coded) and factor 3 (3 items) was measuring *germ aversion* (e.g., "I don't like to write with a pencil someone else has obviously chewed on"). The correlations among the three factors were low indicating limited overlap in constructs: general vulnerability and lack of immunity, $r = -.29$; general vulnerability and germ aversion, $r = -0.004$; and lack of immunity and germ aversion, $r = -0.02$. The internal consistencies of the three subscales were: susceptibility ($\alpha = 0.87$), lack of immunity ($\alpha = 0.71$), and germ aversion ($\alpha = 0.56$). The low reliability of the germ aversion factor could not be improved by adding or deleting items. A total score was calculated for entire PVD and each subscale. Higher totals indicated higher perceived vulnerability, less perceived immunity, and higher germ aversion. The possible range of values for the total PVD was 15–75. The possible range of values for perceived vulnerability and perceived lack of immunity was 4–20. The possible range of values for germ aversion was 3–15.

4.5. Perceived vulnerability to COVID-19

A single item was constructed to assess specific perceived vulnerability to COVID-19. The item was worded "How likely is it that you will contract COVID-19?" Response options ranged from 1 ("No chance") to 5 ("Certain") using a 5-point scale. The possible range of scores for this measure was 1–5.

4.6. Psychological flexibility (PF)

The 24 item Five Factor Mindfulness Questionnaire was designed to measure mindfulness in daily life (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). It can also be used to measure psychological flexibility (Rogge & Daks, 2020). Participants rated each item using a 5-point Likert-type scale that ranged from 1 ("never or very rarely true") to 5 ("very often or always true"). The internal consistency across all items was Cronbach's alpha = .79. The FFMQ-24 generated five subscales: awareness (5 items), observe (4 items), describe (5 items), nonjudgment (5 items), and nonreactivity (5 items). The internal consistencies of each subscale were: Awareness ($\alpha = 0.87$), Observe ($\alpha = 0.72$), Describe ($\alpha = 0.61$, Nonjudge ($\alpha = 0.80$), and Nonreactivity ($\alpha = 0.80$).

The five FFMQ subscales were used measure four constructs of the UFM (Rogge & Daks, 2020). To measure Psychological Flexibility associated with the Mindful Lenses Filtering Experiences (PF – UFM Mindful Lenses), we summed the FFMQ Observe and the FFMQ Describe subscales. Higher scores indicated higher levels of Psychological Flexibility (PF). To measure Psychological Inflexibility (PI) associated with the Mindful Lenses and Filtering Experiences (PI – UFM Mindful Lenses), we used the non-reverse scored FFMQ awareness subscale. This is consistent with the UFM because (a) the awareness subscale contains items that were directly taken from the Mindful Attention and Awareness Scale and (b) participant agreement with the items indicates a lack of mindful attention and awareness (e.g., "I do jobs or tasks automatically without being aware of what I'm doing"). Higher scores indicated higher levels of PI. To measure PF associated with the Flexible Responses to Difficult Experiences (PF – UFM Responses), we used the FFMQ nonreactivity subscale. Higher scores indicated higher levels of PF. Finally, to measure PI associated with the Flexible Responses to Difficult

Experiences (PI – UFM Responses), we used the non-reverse scored FFMQ nonjudgement subscale. This is also consistent with the UFM because participant agreement with the items indicates the presence of fusion, judgement, and self-as-content (e.g., "I make judgments about whether my thoughts are good or bad"). Higher scores indicated higher levels of PI. The total possible range of scores were as follows: PF - UFM Mindful Lenses, 9 to 45; PI – UFM Mindful Lenses, 5 to 25; PF – UFM Responses, 5 to 25; PI – UFM Responses, 5 to 25.

A PF Total score was calculated by combining the two PF - UFM measures with the two PI - UFM measures as follows: PF Total = [(PF – UFM Mindful Lenses/2) + PF – UFM Responses + ((PI – UFM Mindful Lenses x (−1)) + ((PI – UFM Responses x (−1))]. The UFM Mindful Lenses was divided by two because it combined two FFMQ subscales. This assured that the four components were equally weighted in the total. The PI measures were reverse scored so that they could be added to the PF measures. Higher PF Total scores indicated greater overall psychological flexibility.

4.7. Intolerance of uncertainty (IUS)

The 12-item version of the intolerance of uncertainty scale (Carleton, Collimore, & Asmundson, 2010; Carleton, Norton, & Asmundson, 2007) was used to assess psychological distress associated with ambiguity and unpredictability (e.g., "unforeseen events upset me greatly," "when I am uncertain, I can't function very well"). Each item was rated on a 5-point scale that ranged from 1 ("Not at all characteristic of me") to 5 ("Entirely characteristic of me"). The IUS has been evaluated in student and community samples (Hale et al., 2016) with results indicating that it measures inhibitory anxiety and prospective anxiety. The internal consistency of the IUS was very good (Cronbach's $\alpha = 0.91$). A total score was calculated for the IUS. Higher scores indicated greater intolerance of uncertainty. The possible range of values for the IUS total was 12–60.

4.8. Preventive actions taken scale (PATS)

The PATS was developed in late January 2020 based on recommendations generated by then-available COVID-19 research findings. The original 12-item measure assessed the extent to which participants in a China community survey reported engaging in behaviors to prevent COVID-19 infection at two levels; a recommended level (e.g., "I wear a mask outside of home") and an excessive level (e.g., "I wear a mask everywhere"). Each item is rated on a scale that ranges from 1 ("Does not apply to me at all") to 4 ("applies to me very much or most of the time").

We modified the PATS by taking out two items that were not as relevant to COVID-19 transmission in the USA (eating wild animal, eating any meat). We also eliminated two redundant items measuring mask and glove wearing. The remaining 8 items were factor analyzed using an oblimin rotation to identify subscales and item adequacy. Factors with eigenvalues greater than 1 were retained for factor analyses (Kaiser, 1970). A principal component analysis extracted 3 components with eigenvalues greater than 1. A scree plot was also generated aid factor extraction (William et al., 2010). Visual inspection of the scree plot indicated that a two -factor model fit data well. The two factors cumulatively accounted for 58.14% variance (factor 1 = 32.81%, factor 2 = 25.32%).

Item loadings were examined. If an item loaded more than 0.40 on a single factor and there was at least a 0.20 difference in loadings on any other factor it was retained (Hinkin, 1998; Tabachnick & Fidell, 2007). No items were removed based on the factor analysis. The remaining 8 items all had high loadings (>0.68) on one of the two factors. Factor one (5 items) measured *avoiding public settings and contact with people* (e.g., "I avoid public events and crowded places"), factor 2 (3 items) measured *PPE use* ("I wear a mask everywhere"). The correlation among the two factors was low, $r = 0.08$. The internal consistencies of the two subscales were good: avoiding public settings and contact with people, Cronbach's $\alpha = 0.76$; PPE, Cronbach's $\alpha = 0.77$.

A total score was calculated for each subscale. Higher scores indicated more engagement in preventive behavior. The possible range of values for avoiding public settings and contact with people was 5–20. The possible range of scores for PPE use was 3–12. At the time of data collection, quarantine and lockdown restrictions varied as a function of local laws and essential worker status. The PATS avoiding public settings and contact with people was thus affected by local laws and essential worker status. These variables were not measured in this study. Because of this, we opted to only use the PATS PPE Use measure in analyses.

4.9. Psychological distress

The Impact of Events Scale – Revised (IES-R) was used to measure psychological post-traumatic stress symptoms (Weiss & Marmar, 1997). The IES-R has been extensively used as a measure of post-traumatic stress symptoms in community and clinical samples (e.g., Beck, et al., 2008). The scale contains 22 items (e.g., "I thought about it when I didn't mean to") that were responded to on a 5point Likert scale that ranged from 0 ("not at all") to 4 ("extremely"). The instructions preceding the items read: "The following is a list of difficulties people sometimes have after stressful life events. Please read each item, and then indicate how distressing each difficulty has been for you during the past 7 days with respect to the Coronavirus situation." The internal consistency of the scale was high (Cronbach's $\alpha = 0.97$). A total IES-R score was calculated. Higher scores indicated greater trauma symptoms. The possible range of scores for the IES-R was 0–88.

4.10. Physical symptoms

The Patient Health Questionnaire-15 (PHQ-15, Kroenke, Spitzer, & Williams, 2002) was used to measure physical symptoms associated with stress. We removed the single item measuring menstrual symptoms given that it was only applicable to a subset of participants. For each item (e.g., "dizziness"), participants rated the degree of being bothered in the prior month using a 3-point Likert scale that ranged from 0 ("not bothered at all") to 2 ("bothered a lot"). Kocalevent, Hinz, and Brähler (2013) evaluated the psychometric properties of the PHQ-15 and reported that it was characterized by satisfactory internal consistency validity. The internal consistency of the PHQ-15 in this study was high (Cronbach's $\alpha = 0.92$). A total score was calculated for the PHQ-15. Higher scores indicated more physical symptoms. The possible range of values for the PHQ-15 total was 0–28.

4.11. Procedure

An announcement was placed on Amazon Mechanical Turk on April 9, 2020. The announcement read "The COVID-19 situation is creating worldwide challenges. In this survey study, university researchers hope to gain important useful information about how people are reacting to COVID-19 and coping with COVID-19. The survey is intended to be taken by individuals who are at least 18 years old who reside in the United States. The survey should take around 20 min to complete. You will receive $1.00 for completing the survey." Interested participants were then directed the informed consent form which was linked to the survey. The survey contained 3 attention check items and 3 captcha items. If a participant did not answer a survey item, they were asked if they intended to skip the item(s) before being able to move on to the next page of the survey.

5. Results

5.1. Descriptive statistics characterizing the sample

Analyses of frequencies and measures of central tendency were conducted to characterize participant reports of living circumstances, COVID-19 risk exposure, health status, employment, perceived vulnerability, intolerance of uncertainty, psychological flexibility, preventive actions, psychological distress, and physical symptoms. These data are presented in Table 1.

5.2. Living circumstances, health, and employment

Most of the participants reported self-isolation with over a third reporting they were currently under quarantine orders. Despite isolation and quarantine, many (40%) reported that they felt they were exposed to COVID-19. Sixty-six (15%) of the participants reported having one or more medical condition. The more commonly reported conditions were cardiovascular disease, diabetes, lung diseases (COPD, asthma), and autoimmune diseases. The number of participants reporting that they were unemployed or less than half-time employed (1–24 h) doubled from pre-COVID-19 to post-COVID-19. Conversely, the number of full-time workers decreased by 36% from pre COVID-19 to post COVID-19. This reflected the impact of COVID-19 on employment rates among persons in this sample.

5.3. Perceived vulnerability, intolerance of uncertainty, and psychological flexibility

The means and standard deviations for the predictor variables are presented in Table 1. All of the variables were normally distributed. The mean rating for perceived vulnerability to COVID-19 was high and with 4% (n = 19) of the participants reporting that they felt "certain" they would contract COVID-19, 27% (n = 121) reporting they felt it was "likely," 29% (n = 131) reporting they felt there was a 50/50 likelihood, 29% (n = 130). Thus, most participants perceived themselves to be a high risk for contracting COVID-19.

5.4. Preventive actions, psychological distress, and physical symptoms

The means and standard deviations for the outcome variables are presented in Table 1. All of the variables were normally distributed. The means for *PPE use* and *avoiding public settings and contact with people* were, respectively was 2.70 (SD = 0.82) and 3.19 (SD = 0.60). The difference between the two ratings was significant with a large effect size (F (1, 449) = 112.48, $p < .001$; $\eta^2 = 0.20$) indicating that PPE use was a less frequently used preventive action relative to avoidance of public spaces and contact with others.

An item level analysis of the PPE use indicated that 16% of the participants reported that wearing a mask "does not apply to me at all/ none of the time," 20% reported "applies to me some degree or some of the time," 42% reported "applies to me a considerable degree or a good part of the time," and 26% reported "applies to me very much or most of the time." Similar levels of endorsement were observed for the "wear gloves" and "precautionary purchases" items (respectively: 21%, 15%, 45%, 19%; 10%, 27%, 42%, 21%).

Items for avoiding public settings and contact with people showed higher rates of endorsement with over 40% reporting "applies to me very much or most of the time" to all items (avoiding public events, public transportation, traveling to highly affected cities, and physical contact with others). This high level of endorsement likely reflected the impact of governmental (state and local level) mandated quarantine orders as well as public health recommendations.

Using the clinical cutoffs for the IES-R (0.91 sensitivity, 0.82 specificity) reported by Creamer, Bell, and Failla (2002), 70% of the participants would be classified as reporting symptom levels that are consistent with PTSD. Over 35% of the participants reported being "moderately" to "quite a bit" for every item. The mean level of physical symptoms was also high and corresponded to the 89–92 percentile range of physical symptoms on the PHQ-15 (95% confidence interval) relative to normative data reported by (Kocalevent, Hinz, & Brähler, 2013). As with the IES-R, high levels of endorsement were observed for every symptom with the highest being back pain, fatigue, and sleep difficulties. In summary, this was a diverse sample of participants who were experiencing reporting high levels of vulnerability to COVID-19, psychological distress, and physical symptoms.

5.5. Correlations among measures

Bivariate correlations among all measures are presented in Table 2. Correlations were flagged if the p-value fell below 0.001 (medium to large correlations). This was done to highlight more meaningful relationships. Among the many observed correlations, several are particularly relevant to the focus of this paper. Demographic variables were significantly correlated with some predictors and outcome variables at varying levels of magnitude. Thus, in regression and moderation analyses they were entered as control variables. PPE use was positively correlated with education level and intolerance of uncertainty. Psychological distress was positively correlated with education level, perceived vulnerability to COVID-19, and intolerance of uncertainty. Physical symptom reporting was positively correlated with perceived vulnerability to COVID-19, and intolerance of uncertainty. The PF measures were significantly and negatively correlated with psychological distress and physical symptoms. The PI measures were significantly and positively correlated with psychological distress and physical symptoms.

5.6. Predicting PPE use

Hierarchical regression analyses were used to predict PPE use (see Table 3). In the first step (model 1), demographic and risk variables (age, sex, education, current medical conditions) were entered as predictors. In the second step (model 2), we added the PVD total, perceived vulnerability to COVID-19, and intolerance of uncertainty. In the third step (model 3) we added the four UFM measures (PF – UFM Mindful Lenses, PF – UFM Responses, PI – UFM Mindful Lenses, PI – UFM Responses). A Bonferroni correction was used to keep the family-wise error level to 0.05. The Bonferroni correction yielded a $p < .004$ as the threshold for classifying a result as significant.

All three models were significant (Model 1, $R^2 = 0.21$, F (4, 441) = 29.97, $p < .001$; Model 2, $R^2 = 0.33$, F (7, 438) = 30.72, $p < .001$; Model 3, $R^2 = 0.42$, F (11, 434) = 27.95, $p < .001$). The addition of variables in models 2 and 3 were associated with significant (all $p < .001$) increases in R^2 (Respectively $\Delta R^2 = 0.12$ and 0.09). An examination of the contribution of individual variables in model 3 indicated that reporting a medical condition was significantly associated with *less* PPE use ($\beta = -0.19$, $p < .001$) and education level was associated with significantly more PPE use ($\beta = 0.14$, $p < .001$). None of the other demographic variables, vulnerability measures, or intolerance of uncertainty accounted for significant proportions of variance. PF – UFM Responses was significantly positively associated with PPE use ($\beta = 0.16$, $p < .001$). PI – UFM Responses was also significantly positively associated with PPE use ($\beta = 0.25$, $p < .001$).

5.7. Predicting psychological distress

Hierarchical regression analyses were used to predict IES-R scores (see Table 3). The same variables that were used to predict PPE were used in these analyses. For the IES-R, all three models were significant (Model 1, $R^2 = 0.21$, F (4, 441) = 29.06, $p < .001$; Model 2, $R^2 = 0.61$, F (7, 438) = 102.05, $p < .001$; Model 3, $R^2 = 0.76$, F (11, 434) = 130.79, $p < .001$). The addition of variables in models 2 and 3 were associated with significant (all $p < .001$) increases in R^2 (Respectively $\Delta R^2 = 0.41$ and 0.15).

In model 3, none of the demographic variables were significantly associated with the IES-R. Increases in intolerance of uncertainty were significantly associated with higher IES-R scores ($\beta = 0.32$, $p < .001$). Increases in PI – UFM Mindful Lenses ($\beta = 0.31$, $p < .001$) and PI – UFM Responses ($\beta = 0.27$, $p < .001$) were significantly associated with higher

Table 2
Correlations among predictor and outcome variables.

		M (SD) Range	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Age	Correlation Range	36.68 (11.27) 18–76	–														
2. Sex (1 = female, 2 = male)	Correlation Range	–	-.03	–													
3. Education	Correlation Range	–	-.14	.10	–												
4. Illnesses (y = 1, n = 0)	Correlation Range	–	.12	-.13	-.20*	–											
5. Perceived Vulnerability to COVID-19	Correlation Range	2.85 (1.06) 1–5	-.05	.01	.14	-.01											
6. PVD	Correlation Range	46.72 (6.03) 15–45	-.01	-.13	-.06	.23*	.15*										
7. IUS	Correlation Range	39.81 (9.88) 12–60	-.13	.09	.35*	-.10	.29*	.20*	–								
8. PF – UFM Mindful Lenses	Correlation Range	31.86 (5.01) 9–45	.14	-.03	-.02	.04	-.12	-.04	-.08	–							
9. PF – UFM Responses	Correlation Range	17.96 (3.79) 5–25	.03	.09	.10	.14	.11	.04	.30*	.42*	–						
10. PI – UFM Mindful Lenses	Correlation Range	14.23 (4.25) 5–25	-.16*	.08	.39*	-.19*	.31*	.10	.66*	.22*	.28*	–					
11. PI – UFM Responses	Correlation Range	13.29 (4.25) 5–25	-.18*	.12	.34*	-.19*	.28*	.17*	.62*	-.03	.38*	.11	–				
12. PF Total	Correlation Range	61.42 (9.30) 24–120	.22*	-.07	-.34*	.15*	-.28*	-.13	-.54*	.57*	.19*	.-.82*	.70*	–			
13. PATS PPE Use	Correlation Range	8.09 (2.45) 3–12	−20*	.18*	.34*	-.30*	.12	.12	.44*	-.02	.34*	.48*	.54*	-.38*	–		
14. IES-R	Correlation Range	44.63 (23.50) 0–88	-.18*	.16*	.40*	-.24*	.31*	.12	.75*	-.14	.34*	.79*	.76*	-.68*	.61*	–	
15. PHQ-15	Correlation Range	9.77 (7.11) 0–28	-.11	.09	.29*	-.09	.38*	.10	.55*	-.12	.23*	.57*	.52*	-.50*	.33*	.62*	–

Note: PVD = Perceived Vulnerability to Disease, IUS = Intolerance of Uncertainty Scale, PF = Psychological Flexibility, PI = Psychological Inflexibility, Mindful Lenses = Unified Flexibility and Mindfulness Model Mindful Lenses Filtering Experiences, Responses = Unified Flexibility and Mindfulness Model Flexible Responses to Difficult Experiences, PATS = Preventive Action Taken Scale, IES = Impact of Events Scale, PHQ-15 = Patient Health Questionnaire.

IES-R scores.

5.8. *Predicting physical symptoms*

Hierarchical regression analyses were used to predict PHQ-15 scores (see Table 3). The same variables that were used to predict the IES-R were used in these analyses. For the PHQ-15, all three models were significant (Model 1, $R^2 = 0.09$, F (4, 441) = 11.17, $p < .001$; Model 2, $R^2 = 0.36$, F (7, 438) = 35.58, $p < .001$; Model 3, $R^2 = 0.43$, F (11, 434) = 29.53, $p < .001$). The addition of variables in models 2 and 3 were associated with significant (all $p < .05$) increases in R^2 (Respectively $\Delta R^2 = 0.27$ and 0.07).

In model 3, none of the demographic variables were significantly associated with the PHQ-15. Increases in perceived vulnerability to COVID-19 ($\beta = 0.18$, $p < .001$) and intolerance of uncertainty ($\beta = 0.23$, $p < .001$) were significantly associated with higher PHQ-15 scores. Increases in PI – UFM Mindful Lenses ($\beta = 0.23$, $p < .001$) and PI – UFM Responses ($\beta = 0.19$, $p < .009$) were significantly associated with higher PHQ-15 scores, although the latter significance test did not meet the Bonferroni threshold.

5.9. *The moderating effect of psychological flexibility*

The moderating effects of psychological flexibility were tested using a hierarchical linear regression approach. Because correlations indicated that the subscales for perceived vulnerability to disease and mindfulness were strongly correlated and because research has shown that centering does not adequately address problems with multicollinearity among correlated variables in moderated regression (Dalal and Zickar, 2011), we opted for a conservative approach in which total scores for perceived vulnerability and psychological flexibility were used (rather than the separate subscales).

For each moderation analyses, dependent variables (PPE use, IES-R, and PHQ-15) were regressed onto predictors in a four-step hierarchical regression. Demographic control variables were entered in step 1. Overall perceived vulnerability to disease, perceived vulnerability to COVID-19, and intolerance of uncertainty were entered in step 2. PF Total was entered in step 3. The interaction terms were entered in step 4 (PF Total x PVD, PF Total x Vulnerability to COVID-19, and PF Total x Intolerance of Uncertainty). A Bonferroni threshold of 0.004 was used for significance testing. Criteria for significant moderation was based on changes in variance explained from step three to step four and the significance of standardized beta weights for the interaction terms. The

Table 3
Predicting PPE, psychological distress, and physical symptoms.

	PPE	Psychological Distress	Physical Symptoms
Predictor	*β*	*B*	*B*
Age	-.10	-.01	.01
Sex	.10	-.05	.03
Education	.14*	.04	.04
Medical Conditions	-.19*	-.07	.04
Perceived COVID-19 Vulnerability	-.07	.03	.18*
Perceived Vulnerability to Disease	.12*	-.01	-.03
Intolerance of Uncertainty	.08	.32*	.23*
PF - UFM Mindful Lenses	-.03	-.06	-.05
PF - UFM Responses	.16*	.06	.04
PI - UFM Mindful Lenses	.09	.31*	.23*
PI - UFM Responses	.25*	.27*	.15
R^2	.42*	.76*	.43*

Note. * indicates significance $p < .004$ which was the Bonferroni-corrected alpha threshold; PF = Psychological Flexibility; PI = Psychological Inflexibility; UFM = Unified Mindfulness and Flexibility Model; Mindful Lenses = Mindful Lenses Filtering Experiences; Responses = Flexible Responses to Difficult Experiences; FFMQ = Five Factor Mindfulness Scale; Mindful PF- UFM Mindful Lenses = FFMQ Observe + Describe subscales; PF – UFM Responses = FFMQ nonreactivity subscale; PI - UFM Mindful Lenses = FFMQ awareness subscale non-reversed (higher scores indicate less mindful awareness, less-present moment focus); PI – UFM Responses = FFMQ nonjudgement subscale non-reversed (higher scores indicate more judgment, higher self-as content).

Aiken and West (1991) method was used to plot and interpret the strength and direction of effects for significant moderators.

The moderation analysis results for PPE use can be found in Table 4. The step 4 model explained more variance in PPE use than the step 3 model, $F(3, 434) = 2.74$, $\Delta R^2 = 0.01$, $p = .05$). However, it did not meet the Bonferroni threshold for significance indicating that there was no significant moderation.

The moderation analysis for the IES-R can be found in Table 4. The step 4 model explained significantly more variance in psychological distress than the step 3 model, $F(3, 434) = 4.90$, $\Delta R^2 = 0.01$, $p = .002$). The standardized regression coefficients indicated that the PF Total significantly moderated the intolerance of uncertainty – IES-R relationship ($\beta = -0.57$, $p < .001$). The unstandardized simple slope for participants 1 *SD* below the mean on the PF Total was 1.19 and significant ($p = .01$). The unstandardized simple slope for participants 1 *SD* above the mean of the PF Total was 0.62 and nonsignificant ($p = .40$). Fig. 1 depicts the moderation result. Among individuals with higher levels of PF Total, the relationship between intolerance of uncertainty and psychological distress was weaker. Thus, in the presence of the distressing experience of uncertainty intolerance (in a highly uncertain time), persons with more psychological flexibility were less apt to experience higher levels of trauma-related symptoms.

Table 4
Moderation analyses results for PPE, psychological distress, and physical symptoms.

	PPE	Psychological Distress	Physical Symptoms
Predictor	*β*	*B*	*B*
Age	-.11	-.05	-.01
Sex	.13	.07	.04
Education	.14*	.06	.04
Medical Conditions	-.23*	-.11	.04
Perceived COVID-19 Vulnerability	.34	-.28	.24
Perceived Vulnerability to Disease	.45	-.22	-.57
Intolerance of Uncertainty	.71	1.19*	1.14*
PF Total	-.37	-.36	-.42
PF Total x Perceived Covid-19 Vulnerability	-.38	.31	-.17
PF Total x Perceived Vulnerability (General)	-.81	.31	.78
PF Total x Intolerance of Uncertainty	-.39	-.57*	-.67*
R^2	.35*	.70*	.42*

Note. * indicates significance $p < .004$ which was the Bonferroni-corrected alpha threshold; PF = Psychological Flexibility.

The moderation analysis for the PHQ-15 can be found in Table 4. The step 4 model explained significantly more variance in physical symptoms than the step 3 model, $F(4, 434) = 4.26$, $\Delta R^2 = 0.02$, p = .006). Although the p value did not fall below the Bonferroni criterion of .004, the moderation ΔR^2 was equivalent to that observed for psychological distress. Therefore, the moderation was explored. The standardized regression coefficients indicated that the PF Total significantly moderated the intolerance of uncertainty - physical symptoms relationship ($\beta = -0.67$, $p = .003$).

For the intolerance of uncertainty– PHQ-15 analysis, the unstandardized simple slope for participants 1 *SD* below the mean on the PF Total was 1.14 and significant ($p < .001$). The unstandardized simple slope for participants 1 *SD* above the mean on the PF Total was 0.47 and nonsignificant ($p = .15$). Fig. 2 depicts the moderation result. Among individuals with higher levels of PF Total, the relationship between intolerance of uncertainty and physical symptoms was weaker. Thus, in the presence of the distressing experience of uncertainty intolerance (in a highly uncertain time), persons with more psychological flexibility were less apt to report experiencing higher levels physical symptoms.

6. Discussion

The participants in this study reported substantial reductions in employment levels and most reported they were in self-isolation. Despite these isolation efforts, most participants reported they felt significantly at risk for contracting COVID-19. Most participants reported some PPE use, but a sizable minority (36%) reported none to minimal PPE use. High levels of psychological distress were reported with 70% of the scores on the IES-R exceeding clinical cutoffs for PTSD. Physical symptom reporting was also high.

These results indicate that this sample of adults reported a loss of access to work and income, a loss of access to reinforcing activity, and exposure to real and/or perceived COVID-19 risk. Given the social and psychological context of the measurement period, they were also being exposed to frequent, intense, and contradictory messaging about danger and appropriate risk reduction strategies. Isolation, loss of reinforcement, intense exposure to threat information, and amplification of uncertainty have been associated with psychological distress. When combined, they would be a potent mix for creating widespread and

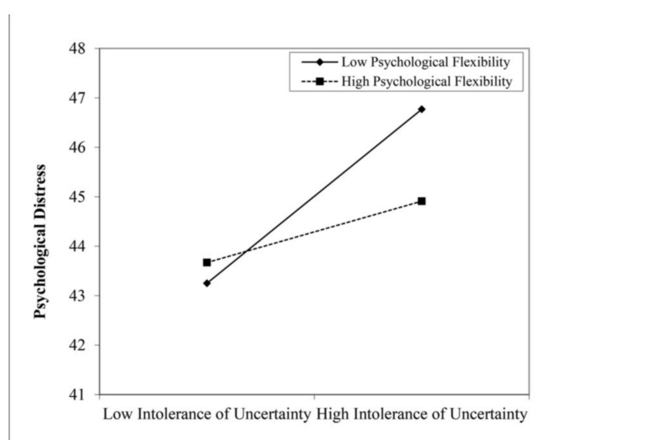

Fig. 1. Psychological flexibility moderates the relationship between intolerance of uncertainty and psychological distress.

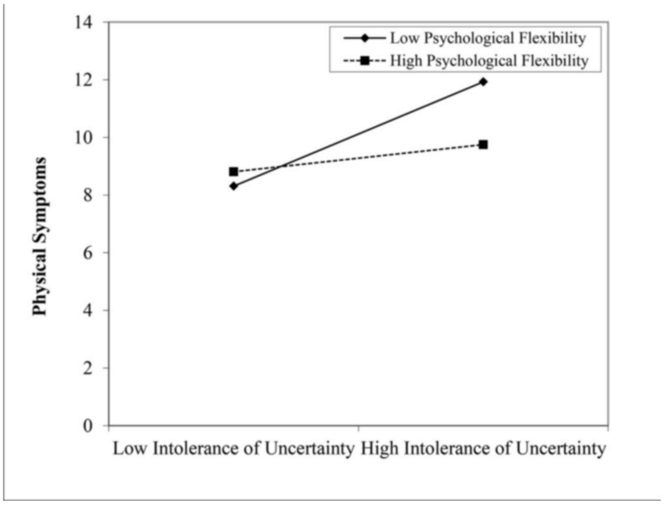

Fig. 2. Psychological flexibility moderates the relationship between intolerance of uncertainty and physical symptoms.

substantial psychological distress. This was evident in the current sample where high levels of PTSD symptoms and physical health symptoms were reported.

Higher risk participants – older and those with a current medical condition, were *less* likely to report using PPE. We investigated whether these inverse correlations were due to older persons and those with medical conditions being more likely to self-isolate and avoid contact with others in which case they would have a diminished need for PPE use. We also explored the possibility that low income might interfere with mask and glove purchases. We thus regressed PPE on age, sex, medical condition, education, income, self-isolation, the number of times participants home in the past month. Results indicated that age and current medical condition continued to be significantly and inversely associated with PPE use (age, $\beta = -0.13$, $t = 2.96$, $p = .003$; medical condition, $\beta = -0.17$, $t = 3.89$, $p < .001$). Education and sex also continued to be significantly and positively associated with PPE use (education, $\beta = 0.24$, $t = 5.62$, $p < .001$; sex $\beta = 0.13$, $t = 3.10$, $p = .002$. Income was not significantly associated with PPE use ($\beta = 0.04$, $t = 0.93$, $p = .353$).

The negative relationship between medical condition and use of PPE could be due to other third variables such as a general lack of engagement in preventive health behaviors. This speculation is based on the possibility that the many of the reported medical conditions in this sample (e.g., diabetes, hypertension) could be linked to self-care behaviors. Thus, lower levels of general self-care would predict both medical condition and reduced PPE use.

Perceived vulnerability predicted more PPE use. These findings are consistent with the preventive health behavior literature (Brewer et al., 2007). Higher levels of vulnerability would create a greater motivation to engage in preventive health behavior from a functional contextual perspective. Further, the negative reinforcement value of a preventive action would be increased among persons who experience both higher levels of vulnerability (Carelton 2016b; Carleton, 2016a).

The positive relationship between psychological inflexibility and PPE use provides an interesting result that demonstrates the double-edged nature of psychological flexibility in this specific context. Higher levels of PI would be expected to predict less preventive health behaviors given that PI is typically associated with adverse outcomes (Rogge & Daks, 2020). Further, Salas and colleagues (2019) conducted a meta-analysis of studies that evaluated relationships between mindfulness measures and health behaviors. They presented aggregated effect sizes for the FFMQ nonjudgement scale (scored with the items reversed such that higher scores indicated greater nonjudgment) and found that it was reliably, albeit minimally, associated with health behaviors such as physical activity ($r = 0.07$), eating ($r = 0.12$) and sleep ($r = 0.06$). In the current study we observed a stronger relationship in the opposite direction between PI (measured with the nonreversed FFMQ items) and PPE use. An examination of the nonjudgement scale items (e.g., "I make judgments about whether my thoughts are good or bad," "I disapprove of myself when I have illogical ideas") provides insight into how *agreement* with these statements could be associated with less more PPE use. We suggest that participants reporting stronger fusion with the "rightness and wrongness" of thoughts, feelings, and actions would be more apt to adhere to COVID-19 health recommendations related to PPE use – to the extent that they believed that the COVID-19 health recommendations were "right." Measurement of COVID-19-related beliefs about the trustworthiness COVID-19 research and public health expert recommendations would provide insight into the complex relationships between PI and PPE that might be nested within different relational frames. For example, fusion with beliefs that the COVID-19 science was wrong and/or that personal liberty is more important than community wellbeing would likely yield a finding that higher levels of PI would be associated with less PPE use.

Psychological distress and physical symptoms were strongly predicted by intolerance of uncertainty. Participants were (and continue to be) living in a social context where frequent and intense threat information was being generated by news media. Exacerbating this exposure to ubiquitous threat were the leadership responses that were frequently at odds with research-supported medical recommendations. There is ample research evidence indicating that threat combined with uncertainty and lack of control creates psychophysiological reactions that can result in many adverse outcomes including reduced immunity (Contrada & Baum, 2011; Taha et al., 2013a, 2013b; Taha et al., 2014). Thus, the high levels of psychological distress and physical health symptoms in this sample can plausibly be linked not only to the uncertainties of COVID-19 but also intensely threatening media coverage combined with a shambolic leadership response.

PI was a significant, important, and consistent predictor of psychological distress and physical symptoms. This finding aligns with theoretical positions and empirical research in ACT and the UFM model (Rogge & Daks, 2020). Stabbe and colleagues suggested that the strength and consistency of relationships between PI and psychological distress as well as physical symptoms supported viewing it as a potential "poison pill" (p. 116) that may exert adverse effects via less effective problem solving and distress management.

The moderator analyses for psychological distress and physical symptoms indicated that the link between intolerance of uncertainty and psychological distress was weaker among persons with higher levels of psychological flexibility. The relationship between intolerance of uncertainty and physical symptoms was also weaker among persons with higher psychological flexibility. These findings are consistent with those recently reported by Pakenham et al. (2020). In their investigation, the relationships between COVID-19 stress risk factors (e.g., living circumstances, location, high risk work, history of mental health problems, a personal or family occurrence of COVID-19 infection, etc.) and psychological symptoms (anxiety, depression, COVID-19 peritraumatic stress) were weaker among persons characterized by higher levels of psychological flexibility. This weakened linkage among persons with higher levels of psychological flexibility could indicate the operation of more well-developed Mindful Lenses and Filtering Experiences skills and/or Flexible Responses to Difficult Situations (e.g., higher acceptance, higher levels of defusion).

Psychological flexibility might produce a salutary effect on psychological distress and physical symptoms via indirect pathways such as engaging in more effective problem solving and distress reducing behaviors (Kashdan & Rottenberg, 2010; Zhang & Wu, 2014). Direct pathways could also be involved. Consistent with the neurovisceral integration model (Thayer, Hansen, Saus-Rose, & Johnson, 2009) and Porges' Polyvagal Theory (Porges, 2011), it may be that psychological flexibility promotes activation of ancient evolutionary-based bidirectional vagal (parasympathetic) – limbic – prefrontal nervous system pathways that are associated with safety, social engagement, empathy, and compassion (Di Bello et al., 2020; Petrocchi & Cheli, 2019). Hence, despite the presence of frequent and chronic COVID-19 threat cues, persons with higher levels of psychological flexibility would be characterized by higher vagal activation which, in turn, would promote higher levels of interoceptive feelings of calm, safety, and social connection (Di Bello et al., 2020). This possibility is supported by research in non-COVID-19 contexts where higher levels of psychological flexibility have been reliably associated higher levels of vagal activation (Allen et al., 2018). Additional research examining links between psychological flexibility and vagal activation can provide important insight into the mechanism through which variables in the UFM confer psychophysiological benefits.

The psychological and physical health of persons in the USA as well as the adoption of life-saving COVID-19 prevention behaviors can be improved with the introduction of consistent, measured, and research-supported messaging from governmental leadership, public health officials, and media sources. Additionally, accurate vulnerability information combined with research-guided information about the effectiveness of various preventive health behaviors can aid in improving adherence to behaviors that can reduce COVID-19 incidence. Interventions targeting increased psychological flexibility may reduce psychophysiological distress associated with COVID-19.

6.1. Limitations

The survey was completed at a single point in time which limits causal inference. We are proposing a temporal sequence where COVID-19 objective risk exposure, demographic and health risk factors, and individual differences predict PPE use, post-trauma symptoms, and physical symptoms. However, the temporal sequence could have a different form. It could be that higher levels of distress, could cause a person to perceive themselves to be more vulnerable, more intolerant of uncertainty, and less mindful. A time series approach would help determine the plausibility of this argument.

A second set of limitations is related to the participant selection process and the use of MTurk workers. In terms of the former, it may be that persons who were experiencing higher levels of distress were more inclined to participate in the study. As a result, it cannot be determined how well the descriptive statistics and regression findings generalize to a broader USA population. In relation to the latter limitation, there have been extensive analyses of the representativeness and characteristics of MTurk samples relative to other participant recruitment strategies (see Chandler & Shapiro, 2016). MTurk samples are more representative than college students and convenience samples drawn from small university communities, but less diverse in some ways than national probability samples. However, Chandler and Shapiro (2016) noted that the national probability samples are biased in that they rely on telephone methods which skews their results to older and more conservative participants. Additionally, as was evidbent in our sample, MTurk workers tend to have higher educational attainment and are more likely to be male. Finally, MTurk workers have been demonstrated to report higher levels of distress relative to other types of samples (Chandler & Shapiro, 2016).

There are some strengths to the use of an MTurk sample as well. The collection of data from a heterogeneous sample allows us to be more certain that effects do not solely pertain to a single geographic location, occupation, or type of participant. Although some research has shown that participants recruited through MTurk can display higher rates of anxiety and depression, this phenomenon is at least partially combatted through screening for response quality (Ophir, Sisso, Asterhan, Tikochinski, & Reichart, 2019). Additionally, this feature of our data may have helped us avoid range restriction in our sample thus observing relationships between variables throughout the full possible range of distress scores. Finally, although researchers have identified various threats to validity that may be possible in research conducted on a crowdsourced platform, such as subject inattentiveness, demand characteristics, and repeated participation, the present study utilized best practices to mitigate such threats. Specifically, the study utilized attention checks, data screening, and avoiding signaling cues (Cheung, Burns, Sinclair, & Sliter, 2017).

Declaration of competing interest

None.

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