Explaining Disaster and Pandemic Preparedness at the Nexus of Personal Resilience and Social Vulnerability: An Exploratory Study

Original Research

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Abstract

Objective: The purpose of this research was a pilot examination to identify and assess relationships among social vulnerability, personal resilience, and preparedness for a sample of US residents living in the Gulf South, who had experienced climate-related disaster (e.g., hurricanes) and the COVID-19 pandemic.

Methods: Binary logistic regression was conducted using primary survey data collected in 2020 (n = 744) to identify statistically significant explanatory variables of sociodemographic characteristics and resilience, measured by the CD-RISC 10, of climate-related disaster, and pandemic preparedness.

Results: Results indicate that respondents who identified as white, had more education, were in a relationship, and spoke English as a first language, as well as respondents who had exhibited greater resilience, were more likely to prepare for a climate-related disaster. Respondents who spoke English as a first language, had more education, and greater resilience were found to be statistically significant explanatory variables of pandemic preparedness. Respondents who prepared for disaster were also more likely to prepare for the pandemic.

Conclusions: These findings provide insights into protective factors related to preparedness, including linkages between resilience and preparedness that can aid public health professionals in supporting resilience and preparedness efforts for impacted communities.

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Introduction

Disasters are increasing in frequency and severity due to the effects of climate change, impacting people living in highly populated, urbanized, and low-lying coastal areas.[1] Such a region is the Gulf Coast of the Southeastern US, which experiences an annual hurricane season from June through November.[2] The rise in the number of people who experience disasters and the regularity and difficulty with which they experience them, makes disaster preparedness of vital importance.[3]

Preparedness has a range of definitions, and for the purposes of this article, is understood as collecting a set of supplies and/ or creating a plan that can be deployed when a disaster is either imminent or encountered.[4,5] Individuals continue to be unprepared for disaster, particularly in areas with increasing urbanization and population growth.[6] For example, research suggests most US residents have not prepared an emergency kit, created an emergency meeting plan, nor developed a communication plan.[7,8] Before and concurrent to the pandemic, many have faced climate-related disasters, including those living on the US Gulf Coast. Little research has investigated preparedness related to infectious disease and climate change-induced disasters.[9] Although the idea of pandemic preparedness is relatively new in the US, the novel Coronavirus 2019 (COVID-19) pandemic has spurred a growing body of research. Insights from such research can help inform mitigation and adaptation efforts through increasing preparedness to reduce harmful impacts from the current pandemic as well as future ones.[10]

Furthermore, social vulnerability factors that negatively affect a community's ability to respond to a disaster may also impact preparedness since it may limit an individual's access to resources and assets.[11,12] Research demonstrates that socially vulnerable populations are more likely to be impacted by disasters and have difficulty recovering from them.[13] For instance, homeownership,[14] and higher educational attainment lead to greater disaster preparedness,[15] while the roles of race and ethnicity in preparedness remain complex and difficult to decipher.[16,17] Although research findings have been mixed regarding the relationship between

age and preparedness, recent research has found that young and middle-aged adults (18 - 49), and seniors aged 75 and over, were more likely to prepare for disaster than those aged 65 - 74.[18]

With the increase in disasters and the number of people affected by them, an important but understudied question is how personal resilience may affect preparedness for disasters occurring sequentially or simultaneously, particularly for socially vulnerable populations. Personal resilience is understood as a person's ability to cope with adversity.[19] Adapting the 3 models of resilience from stress-resistant theory (compensatory, challenge, and protective factors) to preparedness,[20] this study completed 2 research objectives: (1) to explore patterns of social vulnerability factors on disaster and pandemic preparedness; and (2) to identify the effect of resilience on disaster and pandemic preparedness.

Theoretical framework: adapting models of resiliency to preparedness

Resilience is an interdisciplinary term that refers to the ability to cope with adversity.[21,22] The nature and definition of resilience continues to be debated given the ambiguity of the term, unclear differences in general or specific forms of resilience,[23] disagreements over its interpretations,[24] and the perception of putting the responsibility of 'bouncing back' on an individual rather than focusing on systemic structures.[25] Although its meaning has been debated, resilience continues to be an important concept in understanding how to manage and cope with adversity. Personal resilience,[26,27] is an understudied area of disaster research which has tended to focus analysis at macro scales.[28] Recent scholarship suggests that there is a significant link between increased personal resilience and increased disaster preparedness.[29] However, the pathways of resilience and their relationships to preparedness are not yet well-understood.

There are 3 models of resilience within stress-resilient theory (i.e., compensatory, challenge, and protective) that describe the impacts of stress on an individual's adaptation.[20,29–32] A compensatory model describes a promotive factor, such as strong community ties, that counteracts a risk factor, such as unemployment.[33] The challenge model describes when a risk factor, experienced at moderate levels, may enhance successful adaptation,[34] that is when individuals experience enough of a risk to overcome it, but not so much that it leads to a negative adaptation. The third model of resilience is a protective model in which access to resources or assets by an individual reduces the effects of a risk, thus, increasing adaptation.[35]

Although each of these models describe a different pathway between risk and protective factors, they have rarely been applied to disasters, particularly those associated with climate change-induced hazards such as hurricanes and flooding, or those from an infectious disease disaster such as a pandemic. Building on this research, in this study, we revise these conceptual models to include disaster preparedness and to add to the literature, in order to better understand the relationship between resilience and preparedness during disaster. We do this by specifying preparedness as an adaptation strategy to an emerging threat as illustrated in Figure 1.[4]

Given the theoretical models elucidated above, it could be the case that social vulnerability could increase preparedness through 'challenges,'[34] or post-traumatic growth.[36] Moreover, it is also possible that personal resilience, as a compensatory factor that has an independent and direct effect on preparedness,[33] increases the likelihood of preparedness, as some research at the community level suggests.[37] Finally, the lack of social vulnerability, as individuals with access to resources, could point towards a protective factor model of preparedness.[20] The current study seeks to test these potential relationships.

Pandemic preparedness

Although there are some similarities between preparedness for disasters associated with climate change and pandemic preparedness, there are some key differences.[38] For instance, there are no clear temporal and geographic boundaries for the COVID-19 pandemic as opposed to the end of a hurricane season.[39] This nature of a pandemic may require individuals to prepare in unique ways necessitating this study.

There is a growing body of research into pandemic preparedness due to the COVID-19 pandemic.[40–43] For instance, Huang *et al.*[40] found that countries who had experience with previous epidemics such as Severe Acute Respiratory Syndrome (SARS) or Middle Eastern Respiratory Syndrome (MERS) were more likely to have a lower COVID-19 incidence rate in 2020, suggesting an association between countries prior exposure to epidemics and their performance of containing the COVID-19 pandemic. Some prior disaster research suggests that positive adaptation was likely a result of skill development established during previous epidemic exposure.[44] Yet, the relationship between pandemic and climate-related disaster preparedness remains unclear.

Hypotheses

Based on the literature reviewed above, we developed the following hypotheses:

1) Hypothesis 1a: Socially vulnerable residents (i.e., less educational attainment, English as a second language, and racial minority) are less likely to prepare for a disaster associated with climate change (e.g., hurricanes, flooding).
2) Hypothesis 1b: However even socially vulnerable individuals (i.e., less educational attainment, English as a second language, and racial minority) who exhibit greater resilience (as measured by the CD-RISC 10) are more likely to prepare for a disaster associated with climate change (e.g., hurricanes, flooding).
3) Hypothesis 2a: Socially vulnerable residents (i.e., less educational attainment, English as a second language, and racial minority) are less likely to prepare for a pandemic.
4) Hypothesis 2b: Individuals exhibiting greater resilience are more likely to prepare for a pandemic.
5) Hypothesis 3: Individuals who prepare for disasters are more likely to prepare for a pandemic.

To examine these research hypotheses, the current study employed binary logistic regression to analyze a non-probability sample of adults across the US Gulf Coast who have experienced at least 1 climate-related disaster (n = 744) in order to examine 3 theoretical models of resilience and to investigate the relationship among social vulnerability, resilience, and preparedness.

Methods

This study used convenience sampling to recruit a sample of 744 adults during the COVD-19 pandemic and the 2020 Hurricane Season. Recent research suggests such approaches are important for exploratory studies into sub-populations,[45] while such a
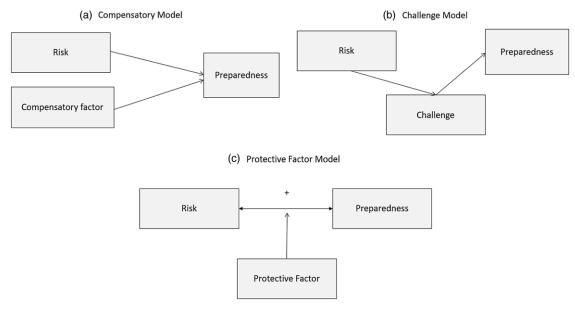
Figure 1. Conceptual model for stress-resistant theory of preparedness adapted from resiliency models of compensatory, challenge, and protective factors in Fergus & Zimmerman, 2005.

sampling strategy is often useful during a crisis given that it can be difficult to reach potential participants.[46] Cross-sectional data were collected over a 12-month period from an online survey which was launched in the first week of April, 2020 and remained open until the last week of March, 2021. Following studies into other kinds of disasters,[47] the survey was left open for this time period to account for an entire hurricane season in the Gulf South of the US during the COVID-19 pandemic. The study was approved by the Tulane University Social/Behavioral Institutional Review Board (approval number 2020-556). Distribution of the online survey was through personal social media accounts and advertisement on the Tulane University School of Social Work social media outlets and website for a period of 12 months. Consent was obtained through the online survey by agreeing to participate in the study and no identifying information was collected. Inclusion criteria required participants to be older than 18 years and living in the Southeastern US, residing within the Gulf Coast region. The survey included constructs focused on participants and their (a) disaster preparedness, (b) personal resilience, and (c) personal and household demographics. The online Qualtrics survey took an estimated 10 minutes to complete.

Measures

Dependent variable

The study was guided by 2 dichotomous dependent variables drawn from prior research.[48,49] The first variable focused on whether an individual has ever prepared for disasters to natural hazards such as hurricanes and floods (i.e., 'Have you prepared for a natural disaster such as hurricanes, floods, etc.?' coded as 1 = yes and 2 = no). The second question focused on whether an individual prepared for the COVID-19 pandemic (i.e., 'Have you prepared for the COVID-19/ Coronavirus pandemic?' coded as 1 = yes, 2 = no).

Independent variables

To assess the level of personal resilience, this study included the total score for the 10-item Connor Davidson Resilience Scale (CD-RISC 10), which evidences high internal consistency, construct validity, and test-retest reliability.[19,50] The CD-RISC 10 has been used with diverse samples across gender, age, and race/ethnicity categories.[51] The scale utilizes an ordinal level, 5-point Likert scale ranging from 1 for 'not at all' to 5 for 'nearly all the time,' asking respondents to rate their own resilience by responding to 10 statements. Examples of some of the items are: (1) 'I am able to adapt when changes occur;' and (2) 'I can deal with whatever comes my way.' (All statements included in CD-RISC 10 can be found in Connor and Davidson.[19]). The total score ranges from 0-40.

Social vulnerability was assessed using socio-demographic characteristics frequently used in disaster research.[12–18] These characteristics include age, gender (dichotomized as men and women), race (dichotomized as white and non-white), and ethnicity (dichotomized as not of Hispanic, Latino, or Spanish origin and of such origin), as well as relationship status (dichotomized as not in a relationship and in a relationship), employment (dichotomized as employed or not employed), English as a first language (dichotomized as yes or no)/ education (dichotomized as college or advanced degree and less than college education), and residential status (dichotomized as home ownership or not).

Data analysis

Binary logistic regression was conducted to examine factors associated with disaster and pandemic preparedness. In models 1 and 2 – social vulnerability variables including age, gender, race, and ethnicity, as well as English as a second language, relationship status, employment status, and education; in addition to residential status and resilience– were included to investigate predictors of group membership based on 2 outcomes: climate-related disaster preparedness and pandemic preparedness, respectively. Model 3 investigated the relationship between disaster preparedness and pandemic preparedness. Binary logistic regression is estimated using maximum likelihood estimation.[52] All analyses were performed using SPSS 28 (IBM Corp., Armonk, New York, USA).

Results

Descriptive statistics of the sample are presented in Table 1. The sample had an age range from 18 to 91 years of age with a mean of 47.68 years (SD = 15.35) and was mostly made up of women (80.9%, n = 602). The majority of the sample identified as white (83.1%, n = 602), 10.3% as Black (n = 77), 1.9% as mixed or bi-racial (n = 14), and 1.6% as other (n = 12), with 1.3% as Middle Eastern (n = 10), 1.1% as Asian (n = 8), and 0.7% as Native American or Alaska Native (n = 5). Regarding ethnicity, 94.5% of the sample reported they were not of Hispanic, Latino, or Spanish origin (n = 703). English as a second language was present among 17.7% of the sample (n = 132). In terms of relationship status, most participants indicated they were in a relationship (71.2%, n = 530). The majority of the sample was employed at the time of study participation (73.2%, n = 544). For education, only 1.7% had less than a high school diploma (n = 13), 4.4% of the sample indicated they had a high school diploma or GED equivalent (n = 33), 9.3% with some college (n = 69), 3.9% with an associate degree (n = 29), and 19.1% with a bachelor's degree (n = 142) while 61.6% with a graduate degree (n = 458). More than 66.7% of the sample owned their home with 67.9% reporting homeownership (n = 505). Regarding preparedness, 75.4% of respondents reported that they had prepared for disaster (n = 561) and 80.6% reported that they were prepared for COVID-19 (n = 600). For resilience, the sample had a mean score of 30.75 (SD = 5.57), with a range from 9 to 40 on the CD-RISC 10.

Predicting preparedness to climate-change induced disaster

Table 2 presents results of the binary logistic regression model for disaster preparedness. These models sought to test hypotheses 1a and 1b – that social vulnerability characteristics and resilience predict disaster preparedness. For model 1, a test of the full model against a constant-only model was statistically significant ($x^2 = 98.772$, $df = 10$, $P = 0.001$). Prediction success for the cases used in the development of the model was moderate, with a moderate overall success rate of 75.4%.

5 of the predictor variables: race (*Wald* $\chi^2 = 6.312$, $df = 1$, $P = 0.012$, $CI_{.95} = 1.060, 1.6$), English as a second language (*Wald* $\chi^2 = 46.826$, $df = 1$, $P = 0.01$, $CI_{.95} = 3.204, 8.159$), relationship status (*Wald* $\chi^2 = 4.501$, $df = 1$, $P = 0.034$, $CI_{.95} = 1.01, 1.20$), education (*Wald* $\chi^2 = 11.59$, $df = 1$, $P = 0.001$, $CI_{.95} = 1.11, 1.48$) and resilience (*Wald* $\chi^2 = 10.11$, $df = 1$, $P = 0.001$, $CI_{.95} = 1.02, 1.09$); were statistically significant predictors of group membership based on disaster preparedness. Based on the model, respondents who identified as white were 1.3 times more likely to report being prepared for a disaster than those who did not identify as white. Respondents who spoke English as a first language were 5.1 times more likely to prepare for disasters than those who spoke English as a second language. Respondents who were in a relationship were 1.11 times more likely to prepare for a disaster than those who were not in a relationship. Respondents with a college degree or advanced degree were 1.28 times more likely to prepare for a disaster than respondents with less education. Lastly, respondents who reported higher levels of resilience were 1.05 times more likely to prepare for a disaster than those who did not exhibit such levels of resilience.

Predicting preparedness to pandemic

To test hypotheses 2a and 2b (that social vulnerability characteristics and resilience predict pandemic preparedness), we performed a second binary logistic regression. Results from this model are presented in Table 3. In model 2, a test of the full model against a constant-only model was statistically significant ($x^2 = 33.31$, $df = 10$, $P = 0.002$). Prediction success for the cases used in the development of the model was modest, with an overall success rate of 81.1%. 3 of the independent variables including

Table 1. Demographic characteristics of the sample

Characteristic	Participants (n = 744)		
	Mean/ %	n Range	SD
Age (in years)	47.68	744 18 - 91	15.35
Gender			
Male	18.7	139	
Female	80.9	602	
Other	0.3	3	
Race			
White	83.1	618	
Black	10.3	77	
Native American/Alaska Native	0.7	5	
Asian	1.1	8	
Middle Eastern	1.3	10	
Mixed or Bi-Racial	1.9	14	
Other	1.6	12	
Ethnicity			
Not Hispanic, Latino or Spanish	94.5	703	
Yes, of Hispanic, Latino or Spanish heritage	5.5	41	
English First Language			
No	17.7	132	
Yes	82.3	612	
Relationship			
In a relationship	71.2	530	
Single	28.8	214	
Employment			
Employed	73.2	544	
Unemployed	27.8	200	
Education			
Less than 12 years/No HS Diploma	1.7	13	
HS Diploma/GED	4.4	33	
Some College	9.3	69	
Associate Degree	3.9	29	
Bachelor Degree	19.1	142	
Graduate Degree	61.6	458	
Residential			
Own House	67.9	505	
Rent	32.1	239	
Natural Disaster Preparedness			
Yes	75.4	561	
No	24.6	183	
COVID-19 Preparedness			
Yes	80.6	600	
No	19.4	144	
Individual Resilience (CD)			
CD	30.75	744	5.57

Table 2. Logistic regression analysis of sociodemographic characteristics and natural disaster preparedness

	B	S.E.	Wald	Sig.	Exp (B)	95% C.I for EXP (B) Lower	Upper
Age	0.012	0.007	2.713	0.100	1.012	0.998	1.027
Gender	0.017	0.208	0.007	0.933	1.018	0.677	1.529
Race*	0.265	0.105	6.312	0.012	1.303	1.060	1.602
Ethnicity	0.874	0.511	2.926	0.087	2.397	0.880	6.529
English First Language***	1.632	0.238	46.826	0.001	5.113	3.204	8.159
Relationship*	0.098	0.046	4.501	0.034	1.103	1.007	1.207
Employment	0.074	0.086	0.726	0.394	1.076	0.909	1.275
Education***	0.251	0.074	11.590	0.001	1.285	1.112	1.484
Residential	0.111	0.174	0.406	0.524	1.117	0.794	1.571
CD-RISC10****	0.055	0.017	10.111	0.001	1.056	1.021	1.093
Constant	− 7.171	1.196	35.956	0.001	0.001		

Note: n = 735.
a. df = 10, *P < 0.05, ** P < 0.01, *** P < 0.001.

Table 3. Logistic regression analysis of sociodemographic characteristics and pandemic preparedness

	B	S.E.	Wald	Sig.	Exp (B)	95% C.I for EXP (B) Lower	Upper
Age	0.008	0.008	1.191	0.275	1.008	0.993	1.024
Gender	0.165	0.224	0.545	0.460	1.179	0.761	1.828
Race	− 0.051	0.082	0.379	0.538	0.951	0.809	1.117
Ethnicity	0.829	0.529	2.455	0.117	2.290	0.812	6.457
English First Language ***	0.798	0.245	10.632	0.001	2.221	1.375	3.588
Relationship	0.051	0.047	1.155	0.282	1.052	0.959	1.154
Employment	− 0.035	0.086	0.164	0.686	0.966	0.816	1.143
Education†	0.149	0.076	3.796	0.051	1.160	0.999	1.348
Residential	0.285	0.186	2.350	0.125	1.330	0.924	1.915
CD-RISC10**	0.046	0.018	6.612	0.010	1.047	1.011	1.084
Constant	− 4.107	1.18	12.098	0.001	0.016		

Note: n = 735.
a. df = 10, P < 0.1†, P < 0.05, ** P < 0.01, *** P < 0.001.

English as a second language (*Wald* $\chi^2 = 10.63$, $df = 1$, $P = 0.001$, $CI_{.95} = 1.375, 3.588$), education (*Wald* $\chi^2 = 3.796$, $df = 1$, $P = 0.051$, $CI_{.95} = 0.999, 1.348$), and resilience (*Wald* $\chi^2 = 6.612$, $df = 1$, $P = 0.010$, $CI_{.95} = 1.011, 1.084$), were statistically significant predictors of group membership based on pandemic preparedness. According to this model, there is a 2.21 times greater likelihood of a respondent who speaks English as a first language to prepare for a pandemic compared to respondents who speak English as a second language. Respondents with more educational attainment were 1.16 times more likely to report pandemic preparedness than respondents with less educational attainment. Also, respondents who exhibited greater resilience were 1.05 times more likely to report pandemic preparedness when compared to respondents who exhibited less resilience.

Disaster preparedness predicts pandemic preparedness

To test hypothesis 3 (that individuals who prepare for disaster are more likely to prepare for a pandemic), we performed a third logistic binary regression. Results from this model are presented in Table 4. In model 3, a test of the full model against a constant-only model was statistically significant ($x^2 = 39.402$, $df = 1$, $P < 0.001$).

Prediction success for the cases used in the development of the model was modest, with an overall success rate of 80.6%. The independent variable, disaster preparedness (*Wald* $\chi^2 = 40.541$, $df = 1$, $P < 0.001$, $CI_{.95} = 2.377, 5.134$), was a statistically significant predictor of group membership based on pandemic preparedness. According to this model, respondents who report preparing for climate change-related disaster are 3.49 times more likely to prepare for a pandemic than those who did not prepare for a climate-related disaster.

Discussion

The findings here provide preliminary evidence for the theoretical relationships between preparedness as described above, although the support is not even across the models. The strongest empirical support was found for the hypothesis that social vulnerability predicts less disaster and pandemic preparedness. This study also provides preliminary empirical support for the role resilience plays in preparedness. These findings suggest that Gulf Coast residents who reported having higher levels of resilience, identifying as white, having more education, and being in a relationship, all while

Table 4. Logistic regression analysis of disaster preparedness and pandemic preparedness

	B	S.E.	Wald	Sig.	Exp (B)	95% C.I for EXP (B)	
						Lower	Upper
Disaster preparedness***	1.251	0.196	40.541	0.001	3.493	2.377	5.134
Constant	0.573	0.154	13.831	0.001	1.773		

Note: n = 744.
a. df = 1, *** $P < 0.001$

speaking English as a first language, were strong predictors of disaster preparedness. In many respects, such findings make sense as the study took place in the Gulf South in the United States; given the rate of structural racism across the US,[53] the Gulf South, as part of the Southeastern US, is rife with underserved communities amongst which social vulnerability is most prevalent.[35]

Importantly, resilience, in helping people adapt to a disaster by increasing their likelihood of preparing for disaster, may serve to counteract risk factors.[20] Understanding this relationship between resilience and preparedness could be key to adaptation strategies for climate change-induced disasters.[9,54,55] For instance, strategies and interventions that increase residents' resilience may increase the chances that they will prepare for not just one disaster but for multiple disasters, a new reality that is expected to become more common for more and more people.[1] Better preparation for disasters may be considered a compensatory factor, in part because preparation for one kind of disaster (e.g., hurricane) may spillover into preparation for another (e.g., pandemic), which probably has some ameliorating effect on impacts from vulnerabilities due to sociodemographic characteristics.[56] Moreover, the results of the logistic regression analysis suggest that increased personal resilience increases preparedness, which confirms research at the community-level,[37] while preparedness, may in turn, increase resilience.[57]

Our findings suggest that resilience also likely increases preparedness regardless of whether a disaster stems from climate change or a pandemic. This point is further supported by the finding that respondents who reported preparing for a disaster were more likely to prepare for the pandemic. Given that research into community resilience and preparedness suggests collaboration and connections of care are necessary to increase disaster preparedness,[58] it is possible that similar connections are also needed on the individual or personal level in order to enhance preparedness. Though more research is needed to test this insight, these findings have practical implications. For instance, a personal resilience toolkit could be developed like the one to enhance community resilience for disaster preparedness developed for Los Angeles County, which focused on access to resources and self-sufficiency[59] and which may have impacts beyond just one kind of disaster. Additional research is needed to unpack personal resilience and identify its key mechanisms, which could aid in developing such a toolkit.

Our research also offers preliminary empirical support for the protective factor model of preparedness as it relates to resilience (see Figure 1 above). We found that being in a relationship also increased the likelihood of disaster preparedness. It could be the case that relationship status serves as a protective factor, as a couple may have more resources, such as more combined income or more social connections which they can draw from than those not in a relationship. Our study found that individuals with more education were more likely to prepare for both disasters associated

with climate change (i.e., hurricanes, floods, etc.), similar to prior research,[35,51] and a pandemic. This study found that English as a first language was a protective factor that increased preparedness. This empirical finding makes intuitive sense given that English is the primary language used in the Southeastern US and many preparedness resources are provided almost exclusively in English as many places across the US unevenly address language access and inclusion.[60] It is important, given the link between language and disaster preparedness, that government and non-profit disaster preparedness organizations work to share information and resources in languages other than English.[61] Finally, we found that whiteness may work as a protective factor as it may increase access to resources because of racial hierarchies within the US,[53] and thus increase the likelihood of preparedness.[35]

Policies and interventions should aim to bolster residents from other racial categories as well by drawing on a range of mechanisms, such as increasing support and access to resources, and an increase in education with the aim to increase resilience. For instance, some research suggests increased education can be a protective factor against risk,[62,63] meaning that an increase in public funding for community colleges, such as the proposed free community college plan proposed by the Biden Administration and the Cares Act of 2021 for Historically Black Colleges and Universities in the US,[64] could help promote preparedness via increased access to higher education. Additionally, such initiatives support Sustainable Development Goal (SDG) #4, which is to 'ensure inclusive and equitable quality education and promote life-long learning opportunities for all.'[65]

Limitations

There are several limitations to the current study. Although this research is important for gaining a better understanding of the relationship among social vulnerability, resilience, and preparedness; this study uses a cross-sectional design. Thus, we are unable to identify direct causality between explanatory and outcome variables. The sampling strategy, although important for gaining an understanding of sub-populations particularly for an exploratory study such as this,[45] and well suited to conducting research during an unfolding and evolving crisis,[66] led to a non-representative sample, with a selection bias for educated, employed, white women. Another limitation was that the survey was only distributed in English, thus limiting who could participate in the study. Given the data and sampling limitations, findings should be interpreted cautiously. Future research should consider collecting data from a more representative sample including specific questions on preparedness actions and behaviors, making surveys available in languages other than English, and using longitudinal analyses to better study the impacts of disaster on resilience and preparedness.

Conclusions

In sum, our study found some support for the compensatory and protective models of preparedness and did not find any support for the challenge model, because our analysis did not find that social vulnerability (i.e., Black and/ or English as Second language) promoted preparedness.[35] There are limitations to this preliminary research, and it is possible that there are aspects of the theory that are not captured with this set of participants, research questions, and variables. Future research should build on this pilot exploration to consider both qualitative methods and refined quantitative approaches to better assess the role challenges play in both resilience and in promoting preparedness.

Author contribution. RJF contributed to the conceptualization, data curation, investigation, and formal analysis of this study, as well as the methodology and writing of the original draft; CEBC took part in the conceptualization, writing of the original draft, review, and editing of the finished work; FPB contributed to the conceptualization, methodology, investigation, and writing of the original draft, as well as the review and editing. TD took part in the writing of the original draft.

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