Traumatology

Modeling Resilience, Meaning in Life, Posttraumatic Growth, and Disaster Preparedness With Two Samples of Tornado Survivors

Marcela C. Weber, Jeffrey M. Pavlacic, Emily A. Gawlik, Stefan E. Schulenberg, and Erin M. Buchanan

Online First Publication, June 20, 2019. http://dx.doi.org/10.1037/trm0000210

CITATION

Weber, M. C., Pavlacic, J. M., Gawlik, E. A., Schulenberg, S. E., & Buchanan, E. M. (2019, June 20). Modeling Resilience, Meaning in Life, Posttraumatic Growth, and Disaster Preparedness With Two Samples of Tornado Survivors. *Traumatology*. Advance online publication. http://dx.doi.org/10.1037/trm0000210

American Psychological Association
GREEN CROSS Academy of Traumatology
Traumatology

© 2019 American Psychological Association
1085-9373/19/$12.00
http://dx.doi.org/10.1037/trm0000210

Modeling Resilience, Meaning in Life, Posttraumatic Growth, and Disaster Preparedness With Two Samples of Tornado Survivors

Marcela C. Weber, Jeffrey M. Pavlacic, Emily A. Gawlik, and Stefan E. Schulenberg
University of Mississippi

Erin M. Buchanan
Harrisburg University of Science and Technology

A multitude of relationships have been identified through correlational data between meaning in life, resilience, and posttraumatic growth following natural hazards, such that a cohesive and replicable model is needed across diverse samples. Further, additional research is needed on the link between resilience and disaster preparedness. The objective of the article is to develop a cohesive and replicable model of positive factors (i.e., meaning in life, resilience, posttraumatic growth, and disaster preparedness) in the context of tornadoes and to replicate this model across two samples. The first sample consisted of students at a university in a tornado-prone region, and the second was a sample of faculty and staff at the same university. Structural equation modeling was used to analyze the data. Across both studies, meaning in life positively predicted resilience and posttraumatic growth. Resilience positively predicted disaster preparedness, and the model supported the theory that resilience and posttraumatic growth are distinct constructs (Comparative Fit Index = .947 for study 1 and .974 for study 2; Standardized Root Mean Square Residual = .050 for study 1 and .045 for study 2; Root Mean Square Error of Approximation = .070 for study 1 and .074 for study 2, with 90% confidence interval [.053, .088] for study 1 and [.047, .103] for study 2). Meaning in life is positively related to both resilience and posttraumatic growth in tornado survivors. Psychological resilience is related to disaster preparedness behaviors, so considering resilience within the context of natural hazards is essential.

Keywords: meaning in life, resilience, posttraumatic growth, disaster preparedness, tornadoes

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Within the past decade, the Federal Emergency Management Agency has recognized more than 2,000 natural hazards (Federal Emergency Management Agency, 2018). Tornadoes, a specific type of natural hazard, are one of the most frequently occurring disasters in the United States (National Weather Service, 2016). Tornadoes result in environmental, economic, physical, and structural impacts (Drescher, Schulenberg, & Smith, 2014), with the impact and severity of tornadoes apparently on the rise (Strader, Ashley, Pingel, & Krmenec, 2018). Indeed, tornadoes in the United States have become 5.5% more powerful each year since 1996 (Elsner, Fricker, & Schroder, 2019). Data from the 1960s onward show that tornado outbreaks, or a series of tornadoes in quick succession, have become increasingly common each year (Tippett, Lepore, & Cohen, 2016).

Tornadoes and Climate Change

Studies on tornado severity (Tippett et al., 2016) and tornado frequency (Molloy & Paul, 2018) have concluded that data are insufficient to infer that the increased severity in tornadoes thus far has been due to climate change, but they both recommended continued analysis of the link between climate change and tornadoes. More recently, Elsner et al. (2019) showed that increased tornado severity can only partly be accounted for by long-term storm trends, and that it may be in part due to anthropogenic climate change (i.e., climate change due to human activity). Moreover, projections anticipate that tornadoes will become increasingly severe with climate change (Molloy & Paul, 2018), and that climate change may alter the "location, timing, and frequency" of tornadoes, such as moving tornadoes northward (Kalkenstein, 2019). In accord with the projection that climate change in North America may move tornadoes northward, McBean (2005) concluded that climate change brings new risks and uncertainties for natural hazards and that increased tornado preparedness efforts are needed in Canada and other areas where tornadoes may become more prevalent. Thus, as climate change continues, it is critical to examine the factors predicting preparedness for tornadoes and resilient responses to tornadoes, as well as other natural hazards that may be worsened by climate change.

Posttraumatic Stress From Natural Hazards

Individuals who experience natural hazards like tornadoes are at an increased risk for posttraumatic stress and depression (Houston et al., 2015). Posttraumatic stress disorder (PTSD) symptoms are generally characterized into the following four clusters: reexperiencing, behavioral avoidance, negative affectivity, and hyperarousal (American Psychiatric Association, 2013). Most individuals who experience a traumatic event embark on a resilience

Marcela C. Weber, Jeffrey M. Pavlacic, Emily A. Gawlik, and Stefan E. Schulenberg, Clinical-Disaster Research Center, and Department of Psychology, University of Mississippi; Erin M. Buchanan, Department of Analytics, Harrisburg University of Science and Technology.

Correspondence concerning this article should be addressed to Marcela C. Weber, Clinical-Disaster Research Center, Department of Psychology, University of Mississippi, 203 Kinard Hall, MS 38677. E-mail: marcela.c.weber@gmail.com

trajectory (i.e., do not develop PTSD symptoms; Galatzer-Levy, Huang, & Bonanno, 2018). However, some individuals go on to develop PTSD. In the United States and in Europe, the annual prevalence rate of PTSD due to any form of trauma is between 2.0 and 3.5% (Wittchen et al., 2011). More individuals present with subclinical symptoms of posttraumatic stress, depression, and anxiety (Drescher et al., 2014). Varying rates of PTSD and subclinical posttraumatic stress symptoms (PTS) have been observed for people affected by other hazards including floods (Dursun, Steger, Bentele, & Schulenberg, 2016), earthquakes (Wang et al., 2009), and oil spills (Aiena, Buchanan, Smith, & Schulenberg, 2016). More generally, rates following natural hazards range from low to high (i.e., 3% to as high as 59%; Garrison et al., 1995; Madakasira & O'Brien, 1987).

Posttraumatic Growth

Posttraumatic growth (PTG) refers to the positive psychological changes individuals undergo following traumatic experiences (Tedeschi, Shakespeare-Finch, Taku, & Calhoun, 2018). Research consistently shows that the five main domains of PTG are Spiritual/Existential Change, Relating to Others, Appreciation of Life, New Possibilities, and Personal Strength (Tedeschi et al., 2018). Tedeschi and Calhoun (2004) initially investigated positive changes stemming from bereavement and interpersonal violence; since then, PTG has been studied extensively across a wide range of traumatic events, including tornadoes and other natural hazards. For example, greater severity of tornado experience and posttraumatic stress predicted PTG in a sample of disaster survivors (First, First, Stevens, Mieseler, & Houston, 2018). The authors noted that this link between severity, stress, and growth could be mediated by perceived meaning in life, a relationship requiring more research. Using latent profile analysis, a study of children and adolescent earthquake survivors found that even though 15% of survivors experienced PTG and clinically significant PTSD, three quarters of survivors (76.2%) experienced moderate PTG with only mild levels of PTS. This suggests that although posttraumatic stress and PTG are often correlated, stress is not necessary for growth to occur. Thus, an important step in the research is to examine perceived meaning in life as a facilitator of PTG (Dursun et al., 2016).

PTG and Meaning in Life

Meaning in life broadly refers to the ability of an individual to understand his or her life situation while engaging in values congruent, goal-directed behavior (e.g., purpose; Frankl, 1959/2006). Recent conceptualizations of meaning in life suggest that there are multiple aspects to consider, such as significance (i.e., a sense of mattering), purpose (i.e., values congruent, goal-directed behavior), and coherence (i.e., the extent to which one's life makes sense; Martela & Steger, 2016). In the current studies, we examined tornado survivors' perceived meaning in life as broadly conceived, encompassing aspects of significance, purpose, and coherence.

Disasters are a significant threat to perceived meaning in life, as survivors of disasters wrestle with making sense of the event (Davis et al., 2019; van Tongeren, Aten, Davis, Davis, & Hook, in press). In their meaning-making model for disaster recovery, Park and Blake (in press) explained that disasters affect whole communities, and by definition are sudden and catastrophic. Natural hazards are not intentionally caused by humans, but humans sometimes bear responsibility for the impact of a disaster. Park theorized that these features of disasters lead survivors to question why the disaster occurred or why it impacted themselves and their communities. Therefore, although meaning-making may facilitate PTG more broadly for many forms of trauma, in theory it should be central to growth after a disaster. Individuals who perceive life as meaningful after a natural hazard tend to experience increased levels of PTG (Dursun et al., 2016). Recent research on PTG places a greater emphasis on understanding life's meaning as a way for individuals to grow from trauma (Tedeschi et al., 2018). Thus, meaning-making is relevant to the disaster context.

Psychological Resilience

In addition to predicting PTG, a sense of meaning in life may be a crucial link to resilience (Weathers, Aiena, Blackwell, & Schulenberg, 2016). Contemporary conceptualizations of resilience suggest a dynamic process by which individuals recover from stressful events (Waugh & Koster, 2015). The consensus in the research has moved toward resilience as a process, with the American Psychological Association adopting this conceptualization (American Psychological Association, 2018). Using this conceptualization, resilience is defined as the ability to adapt to stressful or traumatic situations, maintaining homeostatic psychological functioning despite the apparent risk factors for distress and impaired functioning (Windle, 2011). Thus, resilience is relevant to disaster survivors because experiencing disasters increases their risk for psychopathology.

Although disasters are debilitating for many individuals who experience them, most people do "bounce back"; individuals who experience traumatic events are more often resilient than not (Bonanno, 2004; Bonanno & Mancini, 2012; Southwick & Charney, 2018). Disaster survivors tend to have higher rates of resilience than survivors of other forms of trauma (Bonanno, Brewin, Kaniasty, & Greca, 2010; Galea, Tracy, Norris, & Coffey, 2008; Pietrzak et al., 2012). However, systematic reviews of resilience trajectories pertaining to tornadoes or other natural hazards, specifically, are lacking. For example, Galatzer-Levy et al. (2018) discussed nomothetic trajectories in resilience across different forms of trauma, but did not comment on trajectories specifically pertaining to natural disasters.

Those who are resilient to disasters or other forms of trauma draw from social and environmental resources (Abramson et al., 2015). In doing so, individuals are able to restore a sense of perceived meaning and subsequently experience positive growth in the aftermath of a disaster (van Tongeren et al., in press). In their recent book on psychological resilience, Southwick and Charney (2018) identified perceived meaning and purpose in life as one of 10 major factors correlated with resilience across many studies. For example, an increased perception of meaning or purpose in life is predictive of resilience for Gulf of Mexico coastal residents who experienced a disaster (Aiena et al., 2016). Similarly, in their chapter on the role of perceived meaning in life in resilience and trauma, Park, Currier, Harris, and Slattery (2017) summarized the current research that suggests enhanced perceived meaning in life prior to and after trauma appears to contribute to resilience. The current literature suggests that perceived meaning is a key component of resilient outcomes. However, more research is needed to confirm

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

that perceived meaning in life contributes to resilience for disasters, and for tornadoes, specifically.

Disaster Preparedness and Resilience

Research on psychological resilience and disasters emphasizes the ways in which individuals bounce back from disasters or adapt to the stressors and changes that the disaster introduces. Outside of the discipline of psychology, disaster research has emphasized the concepts of structural resilience (Godschalk, 2003) and community resilience, or "the ability of community members to take meaningful, deliberate, collective action to remedy the effect of a problem, including the ability to interpret the environment, intervene, and move on" (Pfefferbaum, Reissman, Pfefferbaum, Klomp, & Gurwitch, 2008, p. 349).

In this way, actions taken to prepare for a disaster are actions toward community resilience, such that community resilience has been closely linked to community-level disaster preparedness (Gil-Rivas & Kilmer, 2016). One model for assessing community resilience identifies Preparedness for Emergencies as one of five factors of community resilience, the others being Leadership, Collective Efficacy, Place Attachment, and Social Trust (Cohen, Leykin, Lahad, Goldberg, & Aharonson-Daniel, 2013). In another model of community resilience, Disaster Management is a domain of resilience, alongside Connections and Caring, Resources, and Transformative Potential (Pfefferbaum et al., 2013). Disaster-prepared, resilient communities possess qualities such as "strong ties with neighbors, knowing the name of the block captain or local fire chief, and having experience working together with local NGOs [non-governmental organizations]" (Aldrich & Meyer, 2014, p. 10). Researchers of community preparedness for flooding highlighted that effective collaboration between agencies and organizations is a key component of community resilience (López-Marrero & Tschakert, 2011). Taken together, the literature on community resilience suggests it is closely tied to community preparedness, but the link between individual preparedness and individual resilience has received less attention.

In a broad review of the resilience literature, Bhamra, Dani, and Burnard (2011) concluded that the concept of resilience was consistent even when applied to different forms, such as infrastructure, organizational, and individual (i.e., psychological) resilience. Resilient infrastructure includes, for example, buildings withstanding the stress of physical forces exacted during a natural hazard; therefore, individual or community resilience is a metaphor drawn from the physical resilience of structures (Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008). In 2011, Bhamra, Dani, and Burnard called for research on the relationships between organizational and individual resilience. Similarly, Gil-Rivas and Kilmer (2016) recommended an ecological systems approach, in which the link between resilience and disaster preparedness is examined at the individual level, family level, organizational level, and community level. There is a need to strengthen the empirical basis of the relationship between individuals being resilient to disasters psychologically and preparing for disasters in tangible, external ways.

At the individual level, disaster preparedness is generally considered to involve (a) having adequate material supplies for a disaster (e.g., three days of water, a first aid kit, supplies for children or pets), (b) having an emergency plan in place, (c) knowing information about hazards that are likely in the area, and (d) participating in training exercises (Howe, 2016). These preparedness behaviors may be specific to a certain hazard—such as identifying an interior, bottom-story room to go to during a tornado or knowing where the building's fire extinguisher is—or they may be general, like having a flashlight or extra batteries on hand.

Effects of Severe Impact and Posttraumatic Stress

Although research on resilience and growth following tornadoes is currently emerging, especially regarding the link to disaster preparedness, much more is known regarding the role of posttraumatic stress and severity of a disaster's impact. The more severely a person is affected by a disaster, the more prepared they are for subsequent disasters; this pattern has been identified in a study of university faculty and staff's general preparedness for natural hazards (Weber, Schulenberg, & Lair, 2018) and in two reviews of individual-level preparedness for natural hazards (Kohn et al., 2012; Wachinger, Renn, Begg, & Kuhlicke, 2013). Numerous studies have also found that PTG commonly co-occurs with posttraumatic stress (see Shakespeare-Finch & Lurie-Beck, 2014, for a meta-analysis), and posttraumatic stress has been theorized as an "engine" of PTG (Joseph, Murphy, & Regel, 2012). According to Park's meaning-making model, those who wrestle to make sense of an event tend to have posttraumatic stress, followed by PTG (Park & Ai, 2006; Park et al., 2017). Considering the abundance of evidence that severity of impact predicts increased disaster preparedness and that PTSD correlates with posttraumatic growth, both stress and impact should be accounted for in models of disaster preparedness and PTG.

Present Study

A multitude of correlational relationships have been identified between perceived meaning in life, resilience, the severity of impact of natural hazards, and PTG following a natural hazard. Likewise, previous research has established an association between the severity of impact of a natural hazard and disaster preparedness. The relationship between psychological resilience and disaster preparedness has a theoretical basis but has been insufficiently examined. A cohesive model is needed for these interconnected relationships between resilience, disaster preparedness, PTG, and perceived meaning in life. Developing such a model could illuminate targets for improving both disaster preparedness and mental health. Because posttraumatic stress and severity of impact are known to affect PTG, and disaster preparedness, we controlled for these variables in our model.

The goal of this study was to develop a cohesive model of positive factors (i.e., perceived meaning in life, PTG, resilience, and disaster preparedness) in the context of tornadoes—a natural hazard prevalent in the region of study—and replicate this model across two samples. The first sample was drawn from students at a university in a tornado-prone region, and the second was a sample of faculty and staff at the same university. Two separate samples were used because the preparedness actions that faculty and staff should take differed from those of students. For instance, students were asked whether they knew the emergency meeting place in their residence, and faculty and staff were asked whether they knew the emergency meeting place in the main buildings

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

where they work. Additionally, we chose to include two samples to ensure a replicable and cohesive model. Such a model would be conducive to enhanced generalizability.

The following hypotheses were made:

Hypothesis 1: Perceived meaning in life would predict increased levels of resilience and PTG.

Hypothesis 2: Resilience would predict disaster preparedness behaviors.

Hypothesis 3: Tornado impact would predict increased PTG.

We expected that both samples would show these patterns and that the faculty and staff sample would replicate the student sample.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Study 1

Method

Participants. Data ($N = 412$) were collected with both undergraduate (73.1%) and graduate (26.9%) students. Participants were included in the study if they marked their primary role at the university as being a student (rather than faculty or staff), even if they were only enrolled part-time. Each participant reported having experienced at least one tornado. Participants identified as mostly White (85.0%), with 8.5% identifying as Black, 2.9% as Asian, 1.7% as multiracial, 1.0% as "other," 0.5% Hispanic/Latino/a, and 0.5% as Native American. In the year data were collected, a total of 19,428 students were enrolled at the university (redacted for anonymity of participants). Because some of the larger student population has a primary role as faculty and staff, our sample was 2.1% or more of the target population.

Procedure. Data were collected between October and November 2015 at a U.S. university. Students were recruited via a link on the university news web page. Additionally, a mass e-mail was sent to students requesting that they participate in the study. Students completed a 10-min online survey via Qualtrics survey software. No incentives were offered for participation.

Measures.

Impact of Events Scale—Six-Item Version. The Impact of Events Scale—Six-Item Version (IES-6; Thoresen et al., 2010) is a six-item brief measure of PTS, adapted from the 22-item Impact of Events Scale—Revised (Weiss & Marmar, 1997). It employs a 5-point Likert-type scale format. Scores range from 0 to 24, with higher scores indicating greater frequency and severity of PTS. Based on DeVellis's (2003) cutoffs, the IES-6 had good internal consistency with survivors of the 2004 tsunami in Southeast Asia, $\alpha = .80$ (Thoresen et al., 2010), and with victims of an Italian bank robbery, $\alpha = .88$ (Giorgi et al., 2015). IES-6 scores demonstrated convergent validity in the original validation study via significant correlations with other self-report measures of posttraumatic stress, and scores have been associated with more severe impact in a study of the 2015 Ebola outbreak in Sierra Leone (Jalloh et al., 2018).

The Purpose in Life Test—Short Form. The Purpose in Life Test—Short Form (PIL-SF; Schulenberg, Schnetzer, & Buchanan, 2011) is a four-item measure adapted from the original Purpose in Life test (Crumbaugh & Maholick, 1964, 1969). It employs a 7-point Likert-type scale format. Scores range from 4 to 28, with higher scores indicating an increased perception of meaning and purpose. The α levels for the PIL-SF are generally reported to be in the .80s. Higher scores on the PIL-SF positively correlate with desired psychological outcomes and negatively correlate with psychological distress (Schulenberg et al., 2011). Internal consistency was good for the student sample, $\alpha = .82$.

The Brief Resilience Scale. The Brief Resilience Scale (BRS; Smith et al., 2008) is a six-item measure that employs a 5-point Likert-type scale. Scores range from 6–30, with higher scores indicating increased perceived resilience. The α levels range from .80 to .91, indicating good to excellent internal consistency (Smith et al., 2008). A systematic review of psychological resilience measures found that the BRS had the strongest internal and external validity of the measures studied (Windle, Bennett, & Noyes, 2011). In the present study, internal consistency was good for the student sample, $\alpha = .89$.

Posttraumatic Growth Inventory—Short Form. The Posttraumatic Growth Inventory—Short Form (PTGI-SF; Cann et al., 2010) consists of 10 items across five subscales. It employs a 6-point Likert-type response format. The PTGI-SF assesses growth after a negative life event such as a disaster in this case. Two questions comprise each specific subscale, representing the five domains of PTG in Tedeschi and Calhoun's model (described previously). The PTGI-SF has good internal consistency overall, $\alpha = .86$ (Cann et al., 2010). Responses to individual PTGI-SF items are totaled, yielding an overall score ranging from 0 to 50. Higher scores indicate greater perceived PTG relating to the event under study. Internal consistency was excellent for the student sample, $\alpha = .96$.

Tornado impact. For purposes of this study, participants completed a yes/no questionnaire designed to examine whether or not each participant had been exposed to specific situations as a result of the tornado experience (listed in Table 1). Participants indicated whether they had experienced the given situation with responses of "Yes" (scored 1) or "No" (scored 0). Higher scores suggest greater tornado impact.

Tornado experience. Participants completed a measure of the types of disasters they had personally experienced, including how many tornadoes they had experienced in their lifetime, and how long it had been since the last tornado experience had occurred.

Disaster preparedness. Participants completed questions designed specifically for this study that gauged whether specific emergency preparedness measures had been taken after experiencing a tornado. This brief questionnaire posed nine potential preparedness behaviors (listed in Table 3). Participants indicated whether they had engaged in a preparedness behavior with responses of "Yes" (scored 1) or "No" (scored 0).

Results

Data screening. Data were screened for accuracy errors, missing data, outliers, and assumptions. Participants were removed from analysis if they were missing 40% of their data, if they completed the survey in less than 1 min, or if they marked their primary role as faculty or staff. Ultimately, 965 responses were removed, mostly because many students abandoned the survey after only a few questions, leaving $N = 412$ complete responses. No outliers were excluded using Mahalanobis distance. Data met

Table 1
Significant Pearson Correlations Between Forms of Tornado Impact and Posttraumatic Growth for the Student Sample

Form of tornado impact	PTGI-SF total score	
	Pearson's *r*	*p*
Saw others injured or killed	.24	<.001***
Provided first aid	.23	<.001***
Lost electricity for 3 or more days	.21	<.001***
Felt a direct threat to your life	.19	<.001***
Had to leave home for 3 or more days	.14	.005**
Could not get to a store for 3 or more days	.12	.020*
Could not get in touch with other family members	.12	.022*
Were forced to leave community or neighborhood due to an evacuation order	.11	.026*
Had to leave work/school for 3 or more days	.10	.040*
Lost a significant amount of material possessions	.10	.047*
Was separated from members of your immediate family	.10	.049*
None of the above	−.22	<.001***

Note. $N = 386$. PTGI-SF = Posttraumatic Growth Inventory—Short Form.
* $p < .05$. ** $p < .01$. *** $p < .001$.

assumptions of linearity, normality, homogeneity, and homoscedasticity (Tabachnick & Fidell, 2007).

Bivariate correlations. Pearson correlations were conducted to examine general relationships between scales and items in the structural equation modeling (SEM) model. Self-reported resilience was significantly correlated with perceived meaning in life, $r = .23$, $p < .001$, and with posttraumatic stress from tornadoes, $r = -.13$, $p = .012$. PTG was significantly correlated with perceived meaning in life, $r = .18$, $p = .001$. All five domain subscales for PTG were significantly correlated with tornado impact (see Table 1). The total sum score for tornado impact was significantly correlated with four disaster preparedness behaviors (see Table 2). Additionally, individuals who had been injured due to a tornado or who had been forced to evacuate due to a tornado were more likely to have taken a disaster mental health course (see Table 2). With regard to resilience, students were more likely to perceive themselves as resilient if they had conducted first aid or cardiopulmonary resuscitation (CPR) in response to a tornado, if they knew their residential emergency meeting place, if they knew the location of and had tested their fire extinguisher, and if they knew the location of and had tested their smoke alarm (see Table 3).

Path analysis. An exploratory path analysis of the relationship between perceived meaning, resilience, disaster preparedness, tornado impact, and PTG in students with at least one tornado experience (see Figure 1) was conducted using the *lavaan* package in *R* (Rosseel, 2012). PTG was treated as a latent variable composed of five factors (see Study 1 Measures above). Perceived meaning in life was measured by the PIL-SF, psychological resilience was assessed by the BRS, and disaster preparedness was determined by questions regarding specific preparedness behaviors (e.g., I am currently certified in first aid/CPR training). Tornado impact was measured by whether participants had experienced certain problems or stressors during a tornado or because of a tornado.

The following fit indices were calculated to examine model fit: the root mean square error of approximation (RMSEA; Steiger, 1998), the standardized root mean square residual (SRMR; Hu & Bentler, 1999), and the comparative fit index (CFI; Bentler, 1990). Small values (<.06) are desirable for both RMSEA and SRMR, and values closer to 1 indicate excellent model fit for CFI. Generally, our model demonstrated excellent fit using CFI and SRMR criteria (CFI = .947, SRMR = .050) and good fit using RMSEA criteria (RMSEA = .070, 90% confidence interval [.053, .088]).

Table 2
Significant Pearson Correlations Between Having Been Impacted by a Tornado and Disaster Preparedness Behavior for the Student Sample

Form of disaster preparedness	Forms of tornado impact					
	Sum score		Injured		Forced to evacuate	
	r	*p*	*r*	*p*	*r*	*p*
Trained in Psychological First Aid	.14	.004**	.07	.165	.23	<.001***
Participated in an interactive weather drill	.10	.040*	.09	.083	.03	.557
Knew residential emergency meeting place	.13	.011*	.10	.035*	.02	.766
Took disaster mental health college course	.16	.001**	.38	<.001***	.24	<.001***

Note. $N = 413$.
* $p < .05$. ** $p < .01$. *** $p < .001$.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Table 3
Significant Pearson Correlations Between Forms of Disaster Preparedness and Self-Reported Resilience for the Student Sample

Type of disaster preparedness	BRS mean score	
	r	*p*
I know where the closest fire extinguisher is in my residence AND I know how to use it	.22	<.001***
I am currently certified in first aid/CPR training	.16	.002**
I have an established emergency meeting place outside of my residence	.14	.004**
I have tested the smoke alarms in my residence AND they are in good working order	.14	.006**
I have taken Psychological First Aid (PFA)	.09	.083
I have taken PSY (psychology) 417 Disasters and Mental Health	.08	.094
I have participated in an interactive drill relating to weather in the last 6 months	.07	.148
I have downloaded a smart phone app for use other than checking the daily weather reports	.04	.461
I have participated in an interactive drill relating to building/residential fire in the last 6 months	.04	.482

Note. $N = 410$. BRS = Brief Resilience Scale; CPR = cardiopulmonary resuscitation.
** $p < .01$. *** $p < .001$.

Perceived meaning in life predicted both psychological resilience ($b = 0.32$, $SE = 0.06$, $p < .001$) and PTG ($b = 0.14$, $SE = 0.03$, $p < .001$). As perceived meaning and resilience increased, PTG also increased. Psychological resilience positively predicted disaster preparedness behaviors ($b = 0.08$, $SE = 0.02$, $p < .001$), as did tornado impact ($b = 0.15$, $SE = 0.05$, $p = .004$). Both tornado impact ($b = 0.40$, $SE = 0.06$, $p < .001$) and posttraumatic stress positively predicted PTG. Lastly, tornado impact positively predicted posttraumatic stress ($b = 0.29$, $SE = 0.14$, $p < .035$).

Conclusions of Study 1

Our SEM for Study 1 corroborates the previous correlational research by identifying perceived meaning in life as a predictor of both resilience and PTG. Our analyses further suggest that resilience and PTG are distinct processes, in accord with previous literature. Even though perceived meaning in life predicts both resilience and PTG, and both significantly predict increased disaster preparedness behaviors, resilience and PTG were not significantly correlated with each other, and neither resilience nor PTG predicted the other in the path analysis. A promising new finding from this study was psychological resilience as a predictor of disaster preparedness behaviors; this finding suggests that individuals who have better equipped themselves to face disasters are perceiving themselves as being more able to adapt and bounce back from stressors. Additionally, exploratory correlations at the item level suggest that severe forms of tornado impact—personal injury and having evacuated—are specifically predictive of PTG. This relationship corroborates the literature that has found that PTG is more likely to occur when the traumatic event more severely impacted the individual.

Study 2

Method

Participants. For the second study, faculty and staff of a university in a tornado-prone region ($N = 388$) were surveyed; over half the faculty and staff who responded ($N = 225$) had

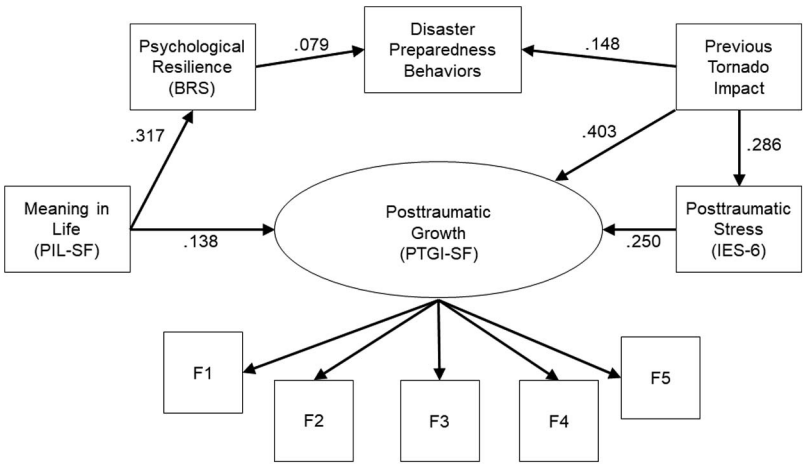

Figure 1. Path model for student sample (Study 1). F1 is Relating to Others, F2 is New Possibilities, F3 is Personal Strength, F4 is Spiritual Growth, and F5 is Appreciation of Life. Coefficients shown are unstandardized regression coefficients. BRS = Brief Resilience Scale; PIL-SF = Purpose in Life Test—Short Form; PTGI-SF = Posttraumatic Growth Inventory—Short Form; IES-6 = Impact of Events Scale—Six-Item Version.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

experienced at least one tornado in their lifetime. Participants were included if they marked their primary role at the university as being faculty or staff; participants whose primary role was as a student were excluded from the study even if they worked for the university (e.g., work-study students, graduate assistants). The majority (87.6%) of faculty and staff identified as White/non-Hispanic, 5.2% as Black, 3.6% as Asian, 1.8% as multiracial, 1.0% as "other," 0.5% as Hispanic/Latino/a, and 0.3% as Alaskan Native. In the year data were collected, a total of 4,230 people were employed by the university (redacted for anonymity of participants). Because some of these faculty and staff had a primary role as a student, our sample was 9.0% or more of the target population.

Procedure. Faculty and staff were recruited via a link on the university news web page. Additionally, an e-mail was sent to faculty and staff requesting that they participate in the study. Faculty and staff participants completed a 10-min online survey via Qualtrics survey software. Data were collected in April 2016 at the same university where data for Study 1 were collected. No incentives were offered for participation.

Measures. The measures used to collect data for the faculty and staff sample were the same as those used for the student sample, with two exceptions. First, the IES-6 was not administered to faculty and staff due to time constraints. Second, the Purpose in Life Test—Short Form was replaced with the Meaning in Life Questionnaire—Presence subscale (MLQ-P; Steger, Frazier, Oishi, & Kaler, 2006). These studies were part of larger surveys covering other research questions, so this change was made because the MLQ-P had a better congruence of fit with the larger battery for the second sample. For the faculty and staff sample, internal consistency was excellent for the MLQ-P ($\alpha = .90$), good for the BRS ($\alpha = .88$), and excellent for the PTGI-SF ($\alpha = .96$).

The Meaning in Life Questionnaire—Presence of Meaning Subscale. The MLQ-P (Steger et al., 2006) is a five-item self-report measure of perceived current meaning in life. Responses are given via a 7-point Likert-type scale. The scale score is summed, with total scores ranging from 5 to 35. Higher scores indicate greater levels of perceived meaning in life. The internal consistency of MLQ-P scores ranges from good to excellent, $\alpha s = .81$ to .93 (Schulenberg, Strack, & Buchanan, 2011). MLQ-P scores demonstrate convergent validity through correlations with measures of satisfaction with life, autonomy, and relatedness (Kobau, Sniezek, Zack, Lucas, & Burns, 2010).

Data screening. Data screening procedures for Study 2 were the same as for Study 1. A total of 60 responses were removed due to completing the survey in less than 1 min, missing data for 40% or more of the questions, or marking their primary role as "student," leaving $N = 225$ for the final sample. No outliers were excluded and data met all assumptions (Tabachnick & Fidell, 2007).

Results

Bivariate correlations. Pearson correlations were calculated to examine general relationships between scales and items in the structural equation model. Just as perceived meaning in life and resilience were correlated for Study 1, perceived meaning in life and resilience were correlated for Study 2, $r = .25$, $p < .001$. Likewise, overall PTG was correlated with perceived meaning in life, $r = .14$, $p = .047$. Resilience and PTG were not significantly correlated with each other. The total PTG sum score and the five domain subscales were significantly correlated with overall tornado impact (see Table 4). Two items for disaster preparedness behaviors were significantly, positively correlated with psychological resilience: having participated in a weather drill in the past 6 months, $r = .15$, $p = .005$, and being certified in first aid or CPR, $r = .14$, $p = .007$.

Table 4
Pearson Correlations Between Domains of Posttraumatic Growth and How Much Tornadoes Had Impacted University Employees

Posttraumatic growth scale or subscale	Form of tornado impact			
	Impact sum score		Perceived direct threat to life	
	r	*p*	*r*	*p*
Sum score	.24	<.001***	.06	.394
F1 Relating to Others	.23	.001**	.04	.599
F2 New Possibilities	.17	.015*	.01	.873
F3 Personal Strength	.25	<.001***	.06	.389
F4 Spiritual Growth	.18	.010*	.04	.595
F5 Appreciation of Life	.28	<.001***	.14	.040*

Note. $N = 212$ to 448.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Path analysis. An exploratory path analysis of the relationships between perceived meaning, psychological resilience, disaster preparedness, tornado impact, and PTG in university faculty and staff with at least one tornado experience was conducted (see Figure 2), replicating Study 1 with two changes (described above): (a) perceived meaning in life was measured by the MLQ-P, and (b) posttraumatic stress was not included in the model because it was not assessed.

Our model demonstrated excellent fit using CFI and SRMR criteria (CFI = .974, SRMR = .045) and good fit using RMSEA criteria (RMSEA = .074, 90% confidence interval [.047, .103]). Perceived meaning in life predicted both psychological resilience ($b = 0.14$, $SE = 0.05$, $p = .004$) and PTG ($b = 0.07$, $SE = 0.03$, $p = .022$). As perceived meaning and psychological resilience increased, PTG also increased. Psychological resilience positively predicted disaster preparedness behaviors ($b = 0.06$, $SE = 0.02$, $p < .001$). In contrast to Study 1, for Study 2, tornado impact did not significantly predict disaster preparedness for faculty and staff ($b = 0.02$, $SE = 0.04$, $p = .657$). Still, tornado impact positively predicted PTG ($b = 0.43$, $SE = 0.04$, $p = .001$).

Conclusions of Study 2

Our SEM from Study 2 corroborates Study 1 and the previous correlational research by identifying general perceived meaning in life as a predictor of both resilience and PTG. The replication of results in Study 2 further confirms that resilience and PTG are distinct processes, in accord with previous literature. Study 2 replicated the patterns of Study 1 in that perceived meaning in life predicted PTG and resilience, whereas resilience and PTG were uncorrelated. Furthermore, neither resilience nor PTG predicted each other in the path analysis. Again corroborating Study 1, psychological resilience was predictive of disaster preparedness behaviors. Considering that different preparedness behaviors were

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

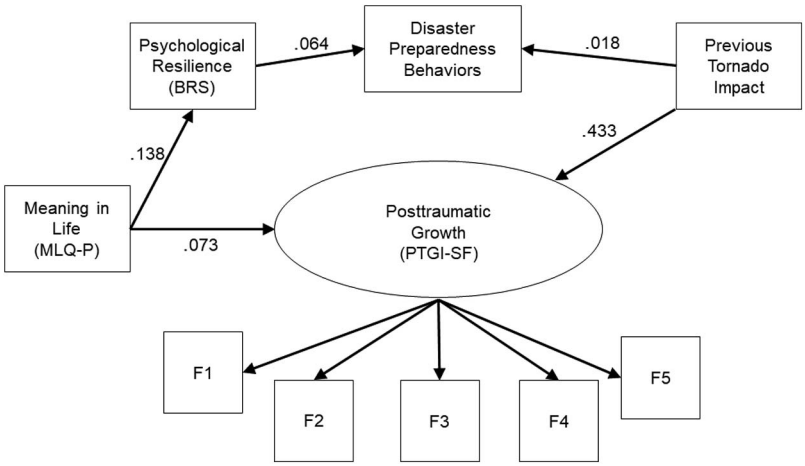

Figure 2. Path model for faculty and staff sample (Study 2). F1 is Relating to Others, F2 is New Possibilities, F3 is Personal Strength, F4 is Spiritual Growth, and F5 is Appreciation of Life. BRS = Brief Resilience Scale; MLQ-P = Meaning in Life Questionnaire—Presence subscale; PTGI-SF = Posttraumatic Growth Inventory—Short Form.

measured for Study 2 that were appropriate for faculty and staff instead of students, this finding suggests further generalizability of the relationship between self-perceived psychological resilience and engaging in behaviors to withstand or mitigate the effects of a disaster.

Taken together with Study 1, exploratory correlations on the subscale and item level illustrate specific ways that forms of tornado impact affect outcomes: Faculty and staff who had perceived a direct threat to their lives due to a tornado were more likely to report increased Appreciation of Life. This result not only corroborates the literature on the correlation between the impact of the trauma and increased growth, but shows how certain aspects of the traumatic event may lead to certain forms of growth.

Discussion

Implications for Meaning in Life and Posttraumatic Outcomes

Previous research shows that perceived meaning in life predicts better psychological outcomes after various disasters (i.e., resilience and PTG; Aiena et al., 2016; Dursun et al., 2016). Regarding resilience, this finding suggests that individuals who have a perceived sense of meaning will be more likely to adapt and bounce back after experiencing a tornado, even a high-impact tornado. Individuals who experienced tornadoes were more likely to indicate they grew from the experience if they perceived meaning in life. The current study supports the theory that perceived meaning in life is positively related to both resilience and PTG.

In our studies, controlling for the severity of tornado impact, perceived meaning in life predicted both resilience and PTG, even though resilience and PTG were not significantly associated with one another. This corroborates previous research showing that resilience and PTG are distinct constructs (Tedeschi & Calhoun, 1998), which are not always correlated (Elderton, Berry, & Chan, 2017). Because meaning in life predicted both resilience and PTG in our studies, building and fostering meaning in life could be an important component of interventions with individuals who have experienced tornado-related hardships. When working with tornado survivors, mental health and disaster response professionals and volunteers should consider the extent to which a person is struggling to find meaning and the way this struggle is resolved may be a risk factor for their psychological outcomes after the tornado (Park, 2016).

Implications for Disaster Preparedness

Controlling for the impact of tornadoes that students and university faculty and staff had experienced, psychological resilience predicted disaster preparedness in both studies. Thus, our results show how perceived psychological growth and adaptation are intertwined with concrete increases in preparing for hazards that might occur. Individuals who had been more severely impacted by tornadoes were more likely to practice preparedness behaviors that would better equip them for future disasters. Psychological resilience as a predictor of preparedness behaviors suggests that tornado survivors' perceptions of their adaptation to stressful situations corresponds to taking actions that could be of help when a hazard occurs in the future. Individuals who self-reported resilience following such adversity were more likely to have completed First Aid/CPR and Psychological First Aid training, participated in interactive weather drills, established a meeting place to go to at their residence if a tornado or other disaster occurred, taken a disaster-related class at the university (e.g., Disasters and Mental Health), and installed a mobile app with weather alert notifications. The role of psychological resilience as a predictor of disaster preparedness behavior suggests that individuals who perceive themselves as adapting to stressors tend to take steps to adapt to living in a tornado-prone region; they are more likely to engage in behaviors that would mitigate the effects of a future tornado, thereby enhancing the likelihood of experiencing a return to typical functioning. Perceived meaning not only contributes to posi-

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

tive psychological outcomes following a disaster, but to positive practical and concrete changes in behavior as well.

Despite the theoretical grounds for the link between psychological resilience and disaster preparedness (Bhamra et al., 2011; Norris et al., 2008), few studies thus far have investigated the role of resilience in disaster preparedness at the individual level. Our studies demonstrate that individual resilience is linked to individual disaster preparedness, similarly to the link between community resilience and community disaster preparedness that has been established in the larger literature (Aldrich & Meyer, 2014; Gil-Rivas & Kilmer, 2016; Leykin, Lahad, Cohen, Goldberg, & Aharonson-Daniel, 2013; López-Marrero & Tschakert, 2011; Pfefferbaum et al., 2013). The replication of this finding across both studies provides a promising empirical basis for this relationship. Future research is warranted to investigate this relationship in varied disaster-related contexts, as well as with other relevant disaster preparedness behaviors, such as having supplies on hand at home or in one's vehicle.

Implications for Climate Change

As explained above, tornadoes have already increased in severity over the past 70 years (Tippett et al., 2016), by about 5.5% annually in at least the past 20 years (Elsner et al., 2019). Climate change may already be increasing the severity of tornadoes (Elsner et al., 2019). With future climate change, tornado severity is expected to continue to increase (Molloy & Paul, 2018). Furthermore, climate change may result in tornadoes moving northward in the United States and Canada (Kalkenstein, 2019), meaning a greater percent of the North American population needs to prepare for tornadoes (McBean, 2005). Thus, improving tornado preparedness is critical to mitigate the effects of climate change. Likewise, efforts to improve psychological resilience in response to tornadoes could potentially mitigate the effects of climate change on psychological well-being.

Implications for Research

A natural outgrowth of this research could be to explore whether meaning, when taken together with PTG or resilience, is additive in facilitating positive outcomes; in other words, whether a resilient individual who reports higher meaning might experience better outcomes postdisaster than a resilient individual who does not report as much meaning in life. Additionally, and as briefly mentioned, Martela and Steger (2016) theorized multiple aspects of meaning: significance (i.e., perceived meaning), purpose, and coherence. Although the current study primarily focused on the broad, general concept of meaning, future research might benefit from examining each of these unique meaning-based components as predictors of postdisaster outcomes.

Furthermore, there is still much to be explored specifically regarding predictors of the five different domains of PTG: Relating to Others, New Possibilities, Personal Strength, Spiritual/Existential Change, and Appreciation of Life (Tedeschi et al., 2018). In both studies, we found that all five domains of PTG were correlated positively with meaning/purpose in life and with several of the more severe forms of tornado impact (e.g., having seen others killed). However, we also saw that certain kinds of traumatic exposure led to growth in specific domain areas more frequently. For example, perceiving a direct threat to one's life predicted an increase in one's Appreciation of Life in both studies. It follows, then, that continuing research in this vein should look more closely at these five domains of PTG independently, especially regarding their relationships to different levels of disaster impact. Different levels of impact (e.g., evacuation, witnessing death) may be more relevant to certain aspects of PTG than others. Because each disaster occurs in its own unique, socio-political-economic context, with a differential impact (Weber et al., 2018), it would be useful to know whether and how these results will replicate across samples in different disaster-related contexts. Finally, the literature would benefit from longitudinal studies examining trajectories of meaning or resilience after the experiencing of a natural hazard, given that trajectory research is becoming increasingly common (Galatzer-Levy et al., 2018).

Strengths and Limitations of the Study

By using theory-driven predictors and outcomes, an SEM analysis, and by replicating findings from the student sample with the faculty and staff sample, our conclusions are promising. Still, as with any studies of a cross-sectional design, causal inferences are not warranted. A second limitation is that, due to additional time constraints present in Study 2, a measure of posttraumatic stress was not included. Our model should be replicated with other populations to examine the extent these findings are generalizable. Examples include adolescents and retired adults (both populations being outside the range of our samples), survivors of other disasters, and other regions of the United States and internationally. The successful replication of our findings across two samples that differ in age is a strength of our study, especially considering the lack of previous research on the relationship between disaster preparedness and psychological resilience.

Summary Conclusion

For both university students and faculty and staff who had experienced tornadoes, our study found that having a sense of meaning in life was related to increased resilience and PTG. This relationship held when controlling for how severely tornadoes had affected the participants and controlling for posttraumatic stress in the student study. Resilience and PTG emerged as distinct constructs from each other. For students, posttraumatic stress mediated the effect of tornado impact on PTG. These findings suggest that survivors who are the most severely impacted by tornadoes or other natural hazards tend to grow the most from the experience. Still, even for people with higher levels of posttraumatic stress, it appears that survivors who perceived themselves as leading meaningful lives report higher levels of PTG across both samples. Likewise, individuals who bounce back without posttraumatic stress have greater perceived meaning in life.

Controlling for severity of tornado impact, psychological resilience predicted engaging in more disaster preparedness behaviors across both samples. Individuals who have better equipped themselves to face disasters perceive themselves as being more able to adapt and bounce back from stressors. Because the disaster preparedness behaviors measured were different for students and faculty and staff, the replication suggests that psychological resilience is linked to many forms of individual disaster preparedness.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

References

Abramson, D. M., Grattan, L. M., Mayer, B., Colten, C. E., Arosemena, F. A., Bedimo-Rung, A., & Lichtveld, M. (2015). The resilience activation framework: A conceptual model of how access to social resources promotes adaptation and rapid recovery in post-disaster settings. *The Journal of Behavioral Health Services and Research, 42,* 42–57. http://dx.doi.org/10.1007/s11414-014-9410-2

Aiena, B. J., Buchanan, E. M., Smith, C. V., & Schulenberg, S. E. (2016). Meaning, resilience, and traumatic stress after the Deepwater Horizon oil spill: A study of Mississippi coastal residents seeking mental health services. *Journal of Clinical Psychology, 72,* 1264–1278. http://dx.doi.org/10.1002/jclp.22232

Aldrich, D. P., & Meyer, M. A. (2014). Social capital and community resilience. *American Behavioral Scientist, 59,* 1–16. http://dx.doi.org/10.1177/0002764214550299

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

American Psychological Association. (2018). *The road to resilience*. Retrieved from http://www.apa.org/helpcenter/road-resilience.aspx

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107,* 238–246. http://dx.doi.org/10.1037/0033-2909.107.2.238

Bhamra, R., Dani, S., & Burnard, K. (2011). Resilience: The concept, a literature review and future directions. *International Journal of Production Research, 49,* 5375–5393. http://dx.doi.org/10.1080/00207543.2011.563826

Bonanno, G. A. (2004). Loss, trauma, and human resilience: Have we underestimated the human capacity to thrive after extremely aversive events? *American Psychologist, 59,* 20–28. http://dx.doi.org/10.1037/0003-066X.59.1.20

Bonanno, G. A., Brewin, C. R., Kaniasty, K., & Greca, A. M. (2010). Weighing the costs of disaster consequences, risks, and resilience in individuals, families, and communities. *Psychological Science in the Public Interest, 11,* 1–49. http://dx.doi.org/10.1177/1529100610387086

Bonanno, G. A., & Mancini, A. D. (2012). Beyond resilience and PTSD: Mapping the heterogeneity of responses to potential trauma. *Psychological Trauma: Theory, Research, Practice, and Policy, 4,* 74–83. http://dx.doi.org/10.1037/a0017829

Cann, A., Calhoun, L. G., Tedeschi, R. G., Taku, K., Vishnevsky, T., Triplett, K. N., & Danhauer, S. C. (2010). A short form of the posttraumatic growth inventory. *Anxiety, Stress, and Coping, 23,* 127–137. http://dx.doi.org/10.1080/10615800903094273

Cohen, O., Leykin, D., Lahad, M., Goldberg, A., & Aharonson-Daniel, L. (2013). The conjoint community resiliency assessment measure as a baseline for profiling and predicting community resilience for emergencies. *Technological Forecasting and Social Change, 80,* 1732–1741. http://dx.doi.org/10.1016/j.techfore.2012.12.009

Crumbaugh, J. C., & Maholick, L. T. (1964). An experimental study in existentialism: The psychometric approach to Frankl's concept of noogenic neurosis. *Journal of Clinical Psychology, 20,* 200–207. http://dx.doi.org/10.1002/1097-4679(196404)20:2<200::AID-JCLP2270200203>3.0.CO;2-U

Crumbaugh, J. C., & Maholick, L. T. (1969). *The Purpose-in-Life Test*. Munster, IN: Psychometric Affiliates.

Davis, E. B., Kimball, C. N., Aten, J. D., Andrews, B., Van Tongeren, D. R., Hook, J. N., . . . Park, C. L. (2019). Religious meaning making and attachment in a disaster context: A longitudinal qualitative study of flood survivors. *The Journal of Positive Psychology*. Advance online publication. http://dx.doi.org/10.1080/17439760.2018.1519592

DeVellis, R. F. (2003). *Scale development: Theory and applications* (2nd ed.). Thousand Oaks, CA: Sage.

Drescher, C. F., Schulenberg, S. E., & Smith, C. V. (2014). The Deepwater Horizon oil spill and the Mississippi Gulf Coast: Mental health in the context of a technological disaster. *American Journal of Orthopsychiatry, 84,* 142–151. http://dx.doi.org/10.1037/h0099382

Dursun, P., Steger, M. F., Bentele, C., & Schulenberg, S. E. (2016). Meaning and posttraumatic growth among survivors of the September 2013 Colorado floods. *Journal of Clinical Psychology, 72,* 1247–1263. http://dx.doi.org/10.1002/jclp.22344

Elderton, A., Berry, A., & Chan, C. (2017). A systematic review of posttraumatic growth in survivors of interpersonal violence in adulthood. *Trauma, Violence and Abuse, 18,* 223–236. http://dx.doi.org/10.1177/1524838015611672

Elsner, J. B., Fricker, T., & Schroder, Z. (2019). Increasingly powerful tornadoes in the United States. *Geophysical Research Letters, 46,* 392–398. http://dx.doi.org/10.1029/2018GL080819

Federal Emergency Management Agency. (2018). *Disaster declarations by year [government website]*. Retrieved from https://www.fema.gov/disasters/year

First, J., First, N., Stevens, J., Mieseler, V., & Houston, J. B. (2018). Post-traumatic growth 2.5 years after the 2011 Joplin, MO tornado. *Journal of Family Social Work, 21,* 5–21. http://dx.doi.org/10.1080/10522158.2017.1402529

Frankl, V. E. (2006). *Man's search for meaning* (Rev. ed.). Boston, MA: Beacon Press. (Original work published 1959)

Galatzer-Levy, I. R., Huang, S. H., & Bonanno, G. A. (2018). Trajectories of resilience and dysfunction following potential trauma: A review and statistical evaluation. *Clinical Psychology Review, 63,* 41–55. http://dx.doi.org/10.1016/j.cpr.2018.05.008

Galea, S., Tracy, M., Norris, F., & Coffey, S. F. (2008). Financial and social circumstances and the incidence and course of PTSD in Mississippi during the first two years after Hurricane Katrina. *Journal of Traumatic Stress, 21,* 357–368. http://dx.doi.org/10.1002/jts.20355

Garrison, C. Z., Bryant, E. S., Addy, C. L., Spurrier, P. G., Freedy, J. R., & Kilpatrick, D. G. (1995). Posttraumatic stress disorder in adolescents after Hurricane Andrew. *Journal of the American Academy of Child and Adolescent Psychiatry, 34,* 1193–1201. http://dx.doi.org/10.1097/00004583-199509000-00017

Gil-Rivas, V., & Kilmer, R. P. (2016). Building community capacity and fostering disaster resilience. *Journal of Clinical Psychology, 72,* 1318–1332. http://dx.doi.org/10.1002/jclp.22281

Giorgi, G., Fiz Perez, F. S., Castiello D'Antonio, A., Mucci, N., Ferrero, C., Cupelli, V., & Arcangeli, G. (2015). Psychometric properties of the Impact of Event Scale-6 in a sample of victims of bank robbery. *Psychology Research and Behavior Management, 8,* 99–104. http://dx.doi.org/10.2147/PRBM.S73901

Godschalk, D. R. (2003). Urban hazard mitigation: Creating resilient cities. *Natural Hazards Review, 4,* 136–143. http://dx.doi.org/10.1061/(ASCE)1527-6988(2003)4:3(136)

Houston, J. B., Spialek, M. L., Stevens, J., First, J., Mieseler, V. L., & Pfefferbaum, B. (2015). 2011 Joplin, MO tornado experience, mental health reactions, and service utilization: Cross-sectional assessments at approximately 6 months and 2.5 years post-event. *PLoS Currents*. Advance online publication. http://dx.doi.org/10.1037/tra0000455

Howe, P. (2016). *Geographic variation in disaster preparedness across U.S. states and metropolitan areas*. Retrieved from https://ssrn.com/abstract=2830690. http://dx.doi.org/10.2139/ssrn.2830690

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1–55. http://dx.doi.org/10.1080/10705519909540118

Jalloh, M. F., Li, W., Bunnell, R. E., Ethier, K. A., O'Leary, A., Hageman, K. M., . . . Redd, J. T. (2018). Impact of Ebola experiences and risk perceptions on mental health in Sierra Leone, July 2015. *British Medical Journal Global Health, 3,* e000471. http://dx.doi.org/10.1136/bmjgh-2017-000471

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Joseph, S., Murphy, D., & Regel, S. (2012). An affective-cognitive processing model of post-traumatic growth. *Clinical Psychology and Psychotherapy, 19,* 316–325. http://dx.doi.org/10.1002/cpp.1798

Kalkenstein, A. J. (2019). Defining climate change: What to expect in a warmer world. In F. Galgano (Ed.), *The environment-conflict nexus: Climate change and the emergent national security landscape* (pp. 47–57). New York, NY: Springer. http://dx.doi.org/10.1007/978-3-319-90975-2_3

Kobau, R., Sniezek, J., Zack, M. M., Lucas, R. E., & Burns, A. (2010). Well-being assessment: An evaluation of well-being scales for public health and population estimates of well-being among U.S. adults. *Applied Psychology Health and Well-Being, 2,* 272–297. http://dx.doi.org/10.1111/j.1758-0854.2010.01035.x

Kohn, S., Eaton, J. L., Feroz, S., Bainbridge, A. A., Hoolachan, J., & Barnett, D. J. (2012). Personal disaster preparedness: An integrative review of the literature. *Disaster Medicine and Public Health Preparedness, 6,* 217–231. http://dx.doi.org/10.1001/dmp.2012.47

Leykin, D., Lahad, M., Cohen, O., Goldberg, A., & Aharonson-Daniel, L. (2013). Conjoint community resiliency assessment measure-28/10 items (CCRAM28 and CCRAM10): A self-report tool for assessing community resilience. *American Journal of Community Psychology, 52,* 313–323. http://dx.doi.org/10.1007/s10464-013-9596-0

López-Marrero, T., & Tschakert, P. (2011). From theory to practice: Building more resilient communities in flood-prone areas. *Environment and Urbanization, 23,* 229–249. http://dx.doi.org/10.1177/0956247810396055

Madakasira, S., & O'Brien, K. F. (1987). Acute posttraumatic stress disorder in victims of a natural disaster. *Journal of Nervous and Mental Disease, 175,* 286–290. http://dx.doi.org/10.1097/00005053-198705000-00008

Martela, F., & Steger, M. F. (2016). The three meanings of meaning in life: Distinguishing coherence, purpose, and significance. *The Journal of Positive Psychology, 11,* 531–545. http://dx.doi.org/10.1080/17439760.2015.1137623

McBean, G. A. (2005). Risk mitigation strategies for tornadoes in the context of climate change and development. In C. E. Haque (Ed.), *Mitigation of natural hazards and disasters: International perspectives* (pp. 25–34). Dordrecht, the Netherlands: Springer. http://dx.doi.org/10.1007/1-4020-4514-X_2

Molloy, M. S., & Paul, B. K. (2018). Analyzing tornadic frequency and regional climate change relationships in Kansas, 1950–2016. *Geographical Bulletin, 59,* 103–115. Retrieved from https://www.researchgate.net/publication/329465348_Analyzing_Tornadic_Frequency_and_Regional_Climate_Change_Relationships_in_Kansas_1950-2016

National Weather Service. (2016). *National hazard statistics: Weather fatalities*. Retrieved from http://www.nws.noaa.gov/om/hazstats.shtml

Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F., & Pfefferbaum, R. L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American Journal of Community Psychology, 41,* 127–150. http://dx.doi.org/10.1007/s10464-007-9156-6

Park, C. L. (2016). Meaning making in the context of disasters. *Journal of Clinical Psychology, 72,* 1234–1246. http://dx.doi.org/10.1002/jclp.22270

Park, C. L., & Ai, A. L. (2006). Meaning making and growth: New directions for research on survivors of trauma. *Journal of Loss and Trauma, 11,* 389–407. http://dx.doi.org/10.1080/15325020600685295

Park, C. L., & Blake, E. C. (in press). Resilience and recovery following disasters: The meaning making model. In S. E. Schulenberg (Ed.), *Disaster mental health and positive psychology*. Cham, Switzerland: Springer International.

Park, C. L., Currier, J. M., Harris, J. I., & Slattery, J. M. (2017). *Trauma, meaning, and spirituality: Translating research into clinical practice*. Washington, DC: American Psychological Association. http://dx.doi.org/10.1037/15961-000

Pfefferbaum, B. J., Reissman, D. B., Pfefferbaum, R. L., Klomp, R. W., & Gurwitch, R. H. (2008). Building resilience to mass trauma events. In L. S. Doll, S. E. Bonzo, D. A. Sleet, J. A. Mercy, & E. N. Haas (Eds.), *Handbook of injury and violence prevention* (pp. 347–358). Boston, MA: Springer.

Pfefferbaum, R. L., Pfefferbaum, B., Van Horn, R. L., Klomp, R. W., Norris, F. H., & Reissman, D. B. (2013). The communities advancing resilience toolkit (CART): An intervention to build community resilience to disasters. *Journal of Public Health Management and Practice, 19,* 250–258. http://dx.doi.org/10.1097/PHH.0b013e318268aed8

Pietrzak, R. H., Tracy, M., Galea, S., Kilpatrick, D. G., Ruggiero, K. J., Hamblen, J. L., . . . Norris, F. H. (2012). Resilience in the face of disaster: Prevalence and longitudinal course of mental disorders following hurricane Ike. *PLoS ONE, 7,* e38964. http://dx.doi.org/10.1371/journal.pone.0038964

Rosseel, Y. (2012). Lavaan: An R package for structural equation modeling. *Journal of Statistical Software, 48,* 1–36. http://dx.doi.org/10.18637/jss.v048.i02

Schulenberg, S. E., Schnetzer, L. W., & Buchanan, E. M. (2011). The Purpose in Life Test—Short Form: Development and psychometric support. *Journal of Happiness Studies, 12,* 861–876. http://dx.doi.org/10.1007/s10902-010-9231-9

Schulenberg, S. E., Strack, K. M., & Buchanan, E. M. (2011). The Meaning in Life Questionnaire: Psychometric properties with individuals with serious mental illness in an inpatient setting. *Journal of Clinical Psychology, 67,* 1210–1219. http://dx.doi.org/10.1002/jclp.20841

Shakespeare-Finch, J., & Lurie-Beck, J. (2014). A meta-analytic clarification of the relationship between posttraumatic growth and symptoms of posttraumatic distress disorder. *Journal of Anxiety Disorders, 28,* 223–229. http://dx.doi.org/10.1016/j.janxdis.2013.10.005

Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., & Bernard, J. (2008). The Brief Resilience Scale: Assessing the ability to bounce back. *International Journal of Behavioral Medicine, 15,* 194–200. http://dx.doi.org/10.1080/10705500802222972

Southwick, S., & Charney, D. (2018). *Resilience: The science of mastering life's greatest challenges* (2nd ed.). Cambridge, United Kingdom: Cambridge University Press. http://dx.doi.org/10.1017/9781108349246

Steger, M. F., Frazier, P., Oishi, S., & Kaler, M. (2006). The Meaning in Life Questionnaire: Assessing the presence of and search for meaning in life. *Journal of Counseling Psychology, 53,* 80–93. http://dx.doi.org/10.1037/0022-0167.53.1.80

Steiger, J. H. (1998). A note on multiple sample extensions of the RMSEA fit index. *Structural Equation Modeling, 5,* 411–419. http://dx.doi.org/10.1080/10705519809540115

Strader, S. M., Ashley, W. S., Pingel, T. J., & Krmenec, A. J. (2018). How land use alters the tornado disaster landscape. *Applied Geography, 94,* 18–29. http://dx.doi.org/10.1016/j.apgeog.2018.03.005

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston, MA: Allyn & Bacon/Pearson Education.

Tedeschi, R. G., & Calhoun, L. G. (1998). Posttraumatic growth: Future directions. In R. G. Tedeschi, C. L. Park, & L. G. Calhoun (Eds.), *Posttraumatic growth: Positive changes in the aftermath of crisis* (pp. 217–240). Mahwah, NJ: Routledge.

Tedeschi, R. G., & Calhoun, L. G. (2004). Posttraumatic growth: Conceptual foundations and empirical evidence. *Psychological Inquiry, 15,* 1–18. http://dx.doi.org/10.1207/s15327965pli1501_01

Tedeschi, R. G., Shakespeare-Finch, J., Taku, K., & Calhoun, L. G. (2018). *Posttraumatic growth: Theory, research, and applications*. New York, NY: Routledge. http://dx.doi.org/10.4324/9781315527451

Thoresen, S., Tambs, K., Hussain, A., Heir, T., Johansen, V. A., & Bisson, J. I. (2010). Brief measure of posttraumatic stress reactions: Impact of

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Event Scale-6. *Social Psychiatry and Psychiatric Epidemiology, 45,* 405–412. http://dx.doi.org/10.1007/s00127-009-0073-x

Tippett, M. K., Lepore, C., & Cohen, J. E. (2016). More tornadoes in the most extreme U.S. tornado outbreaks. *Science, 354,* 1419–1423. http://dx.doi.org/10.1126/science.aah7393

van Tongeren, D. R., Aten, J. D., Davis, E. B., Davis, D. E., & Hook, J. N. (in press). Religion, spirituality and meaning in the wake of disasters. In S. E. Schulenberg (Ed.), *Disaster mental health and positive psychology*. New York, NY: Springer.

Wachinger, G., Renn, O., Begg, C., & Kuhlicke, C. (2013). The risk perception paradox—Implications for governance and communication of natural hazards. *Risk Analysis, 33,* 1049–1065. http://dx.doi.org/10.1111/j.1539-6924.2012.01942.x

Wang, L., Zhang, Y., Wang, W., Shi, Z., Shen, J., Li, M., & Xin, Y. (2009). Symptoms of posttraumatic stress disorder among adult survivors three months after the Sichuan earthquake in China. *Journal of Traumatic Stress, 22,* 444–450. http://dx.doi.org/10.1002/jts.20439

Waugh, C. E., & Koster, E. H. (2015). A resilience framework for promoting stable remission from depression. *Clinical Psychology Review, 41,* 49–60. http://dx.doi.org/10.1016/j.cpr.2014.05.004

Weathers, L. N., Aiena, B. J., Blackwell, M. A., & Schulenberg, S. E., (2016). The significance of meaning to conceptualizations of resilience and posttraumatic growth: Strengthening the foundation for research and practice. In P. Russo-Netzer, S. E. Schulenberg, & A. Batthyany (Eds.), *Clinical perspectives on meaning* (pp. 149–169). Cham, Switzerland: Springer International Publishing. http://dx.doi.org/10.1007/978-3-319-41397-6_8

Weber, M. C., Schulenberg, S. E., & Lair, E. C. (2018). University employees' preparedness for natural hazards and incidents of mass violence: An application of the extended parallel process model. *International Journal of Disaster Risk Reduction, 31,* 1082–1091. http://dx.doi.org/10.1016/j.ijdrr.2018.03.032

Weiss, D. S., & Marmar, C. R. (1997). The Impact of Event Scale-Revised. In J. P. Wilson & T. M. Keane (Eds.), *Assessing psychological trauma and PTSD* (pp. 399–411). New York, NY: Guilford Press.

Windle, G. (2011). What is resilience? A review and concept analysis. *Reviews in Clinical Gerontology, 21,* 152–169. http://dx.doi.org/10.1017/S0959259810000420

Windle, G., Bennett, K. M., & Noyes, J. (2011). A methodological review of resilience measurement scales. *Health and Quality of Life Outcomes, 9,* 8. http://dx.doi.org/10.1186/1477-7525-9-8

Wittchen, H. U., Jacobi, F., Rehm, J., Gustavsson, A., Svensson, M., Jönsson, B., . . . Steinhausen, H. C. (2011). The size and burden of mental disorders and other disorders of the brain in Europe 2010. *European Neuropsychopharmacology, 21,* 655–679. http://dx.doi.org/10.1016/j.euroneuro.2011.07.018

Received January 25, 2019
Revision received April 29, 2019
Accepted May 7, 2019 ■

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.