

Psychological Preparedness for Natural Disasters – Improving Disaster Management Theory and Practice

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Abstract

Natural disasters considerably impact on human lives across the world. As a result of exposure to natural disasters, some individuals develop psychological problems, including severe anxiety, depression, or Post-Traumatic Stress Disorder. While many disaster preparedness programs are in place, these mostly involve advice on how to prepare physically, often neglecting the psychological aspects of disaster preparedness. Successfully preparing for natural disasters, however, includes both physical and psychological preparedness. The current research highlights the importance of the psychological aspects of disaster preparedness and explores the role the construct psychological preparedness can play in disaster management theory and practice. The purpose of this research was to define psychological preparedness as a construct and to develop and validate a measure of psychological preparedness, the Psychological Preparedness for Disaster Threat Scale (PPDTS). This newly developed measure was then administered to a total of 1,143 student and staff members of universities in Queensland, Australia. A series of exploratory and confirmatory factor analyses, as well as scale reliability were performed. The psychometric properties of the PPDTS demonstrated that the scale is a valid and reliable measure of psychological preparedness. The definition of psychological preparedness and the new PPDTS scale can aid in shaping and evaluating the effectiveness of current disaster preparedness programs and through this may support the fostering of long-term resilience, enabling particularly residents in identified disaster zones to better cope in the aftermath of disasters.

Introduction

Natural disasters are a world-wide concern, having shaped and modified human behavior, changing the way people live with, and respond to, the environment (Woolf, Schneider, & Hazelwood, 2013). The 2004 Indian Ocean Tsunami caused numerous casualties in Thailand, Indonesia, Sri Lanka and India, in 2005, Category 5 Hurricane Katrina devastated large parts of Louisiana, USA; likewise in 2008, a powerful earthquake shook Sichuan, China. In 2011 an earthquake and tsunami destroyed large parts of north-eastern Japan, and the same year several earthquakes impacted Christchurch, New Zealand. Recent notable natural disasters in Australia include the 2009 Black Saturday bushfires, and 2013 New South Wales bushfires, and widespread floods in Queensland from 2011 to early 2013 (Woolf et al., 2013). While natural disasters occur around the world, North America has been most affected by extreme weather events in the past decade and has seen the largest increase in extreme weather event property loss worldwide (MunichRe, 2012). Hurricane Katrina constituted the costliest extreme weather event ever recorded in North America, in terms of loss of property, as well as loss of lives (MunichRe, 2012).

As anthropogenic climate change progresses, research indicates that associated natural disaster occurrences, such as storms and floods, will increase in their frequency or intensity (IPCC, 2012; Middlemann, 2007; Woolf et al., 2013). Further notable changes to the climate are inevitable if greenhouse gas emissions continue at the current level (IPCC, 2012; Palutikof et al., 2013) and these changes can impact flora and fauna, as well as living conditions for humans (Altizer, Ostfeld, Johnson, Kutz, & Harvell, 2013; Ebi, 2010).

Natural Disasters in Australia

Australia's unique climate and vegetation make it highly prone to a multitude of natural disasters (Australian Government, 2008). Annually, over 500,000 Australians are affected by natural disasters, with historical records in Australia indicating that disasters have occurred at least since the 1850s (Maddougall, Ryzman, & Zwar, 2002). Bushfires, tropical cyclones and severe storms, and often with accompanying floods, have caused the most severe destruction and the greatest loss of life in the last century (Brown, 2002). Such natural disasters have helped shape Australia's history, culture, way of life and the peoples' understanding of nature (Brown, 2002).

Tropical cyclones occur seasonally and pose a regularly occurring threat to Australians living in cyclone-prone regions, such as the north and north-east of Australia (Australian Bureau of Statistics, 2008). Cyclones develop over the warm oceans of northern Australia and can produce very destructive winds, rains, and storm tides, with the annual *cyclone season* mainly occurring between November and April (Australian Bureau of Statistics, 2008). Since 1839, tropical cyclones have caused over 2,100 deaths in Australia and affected more than 250,000 people, and the average annual cost of tropical cyclones in Australia is an estimated AU\$266 million (Blong, 2005). The Australian population is especially vulnerable to severe storms, cyclones and floods with 81% of people living within 50 km of the coast line, near rivers or creeks, which are either hit directly when a cyclone makes landfall, or are affected by accompanying storm surges (Blong, 2005). During the annual cyclone season, weather warnings and cyclone bulletins are issued frequently, with many cyclone warning situations not culminating in actual cyclone impacts

(ABS, 2008). Although these early warning systems are in place for cyclones, storms, and floods, often preventing loss of life, some people exposed to natural disaster impacts develop symptoms of post-traumatic stress and other psychological problems as a result (Ebi, 2010). This problem highlights the necessity for a focus on better psychological preparedness for disaster management practices (Bryant, 2009; Reser & Morrissey, 2005).

Natural Disaster Impact on Mental Health

Exposure to disasters can lead to a variety of long-term health effects and risks. Apart from physical effects, exposure to natural disasters can also cause psychological symptoms, such as amnesia, anxiety (including Generalized Anxiety Disorder), phobias, substance abuse, insomnia, post-traumatic stress disorder (PTSD), hyper arousal, acute stress disorder (ASD), depression and at times suicide, and other mental illnesses (Fan et al., 2011; Hussain, Weisaeth, & Heir, 2011; Keskinen-Rosenqvist, Michélsen, Schulman, & Wahlström, 2011; Neria, Nandi, & Galea, 2008; Norris, 2001). Symptoms might not be detected immediately after the disaster strikes and delayed symptom development might occur after the first few weeks following disaster exposure (Wahlström, 2010). This makes mental health, social support and crisis interventions after a disaster extremely difficult (Wahlström, 2010). At times, even relatively mild exposure to natural disasters can lead to the development of psychological distress (Gifford, 2007; Reser, 2007). Furthermore, not only *primary victims*, those directly exposed to the disaster, may suffer from psychological symptoms, but others, such as grieving relatives and friends of the primary victims may be affected by association (*secondary*

victims). Emergency personnel, including rescue workers, fire, police, psychologists, as well as mental health and social workers may also be affected by the disaster indirectly. These indirect impacts can include vicarious traumatization and compassion fatigue or burnout (Paton, Violanti, Dunning, & Smith, 2004; Prati, Pietrantonio, & Cicognani, 2011).

Even community members not immediately involved in the disaster may also experience different levels of distress (Schmuckler, 2004). Gifford (2007) cited a 17% increase in general psychopathology after the occurrence of a disaster. In addition, recent reports suggest that the toll on individuals following extreme disasters, such as Hurricane Katarina, may continue to rise for many years following the disaster (Dass-Brailsford, 2008, 2009; Kessler et al., 2008).

Due to the development of psychological symptoms following disasters, a large portion of disaster research has focused on the prevention of the development of these symptoms. Little research in the disaster area has focused on psychologically preparing individuals, instead concentrating on how to adequately prepare individuals or groups physically for natural disaster impacts (McCabe et al., 2012; McCabe et al., 2013). However, a study by Schneider (1990) illustrated how physical preparedness might not be sufficient in order to successfully cope with a disaster experience. Even though residents had been generally prepared for the Loma Prieta earthquake in San Francisco in 1989, many residents still had difficulty in coping with the ramifications of this disaster. Therefore enhanced psychological preparedness is needed to help decrease psychological distress.

The Construct Psychological Preparedness

While the term *psychological preparedness* has been referred to in the disaster literature for several years (Morrissey & Reser, 2003; Reser 1996) the current study constitutes the first attempt to operationalize this term and to develop a valid and reliable scale to measure this construct. According to Reser (Reser & Morrissey, 2009), psychological preparedness involves several intertwined within-individual processes and capacities, such as awareness, knowledge, anticipation, concern, thinking, feeling, experienced stress, motivation, intentions and decision making, and management of, or coping with one's thoughts, feelings, and actions. To date there has been only one published study addressing psychological preparedness to natural disaster. Reser and Morrissey conducted a community survey in Cairns, Northern Queensland in 1996. The study investigated participants' knowledge of cyclones, preparedness measures and emotional responses to the approaching cyclone season. The results showed that participants who had received a cyclone information guide were better able to predict, identify and manage their feelings during this cyclone season (Morrissey & Reser, 2003). While showing promising results, this study lacked a clear and operationalized definition of the construct, as well as a valid and reliable measuring instrument.

Key Focus of this Research

The focus of this research is on mitigating the psychological impact of natural disasters occurring in Australia, which currently constitutes a significant gap in current disaster management practices in the preparedness stage. The current research therefore addresses is the absence of psychological

preparedness in disaster preparedness theory and practice. In order to achieve effective overall disaster preparedness, a psychological focus in the disaster preparedness field needs to be established. Therefore psychological preparedness needs to be defined, measured and implemented as a fundamental component in disaster preparedness measures and training. Individuals need to be better prepared, psychologically, to successfully manage a disaster warning situation or disaster impact. So far, disaster mitigation has been unsuccessful in preparing individuals psychologically for the emotional stress that a natural disaster threat or impact can cause. The incorporation of psychological preparedness into disaster management and more specifically disaster preparedness procedures will strengthen disaster management practices overall.

Aims

This research aimed to make a significant contribution to the effectiveness of natural disaster preparedness. It aspired to contribute to fundamental knowledge in regard to the psychological component of disaster preparedness. The aims of this research were:

1. To provide a systematic and comprehensive review of psychological preparedness, arriving at an operationalized definition.
2. To develop a valid, sensitive and reliable scale to measure this construct and psychological state.

Prior to the commencement of the research, ethical approval was obtained from Griffith University's Human Research Ethics Committee, ethics

protocol number: PSY/27/10/HREC. All data were analyzed using the Statistical Package for Social Sciences (SPSS) version 22.0 and AMOS version 22.0.0.

Unless otherwise stated, all significance tests were analyzed using an alpha level of .05.

Study 1

Method

This study employed a mixed-methods approach in order to explore the construct of psychological preparedness by identifying themes that emerged in relation to literature related to psychological preparedness, using thematic analysis (Owen, 1984). Based on these themes, an operationalized definition of the construct was developed and a new instrument to measure psychological preparedness was constructed. The rationale for using both qualitative and quantitative data is that an encompassing instrument of psychological preparedness could only be constructed after attaining an in-depth understanding of the concept of psychological preparedness, so thus to arrive at its definition, and to develop a scale. This complementary mixed methods approach is often used when a researcher cannot rely on either a qualitative or a quantitative research method to successfully address the research aims (Bryman, 2004).

Thematic Analysis Data Collection Procedure

Data collection and familiarization were carried out through literature searches, conducted over a period of 8 months, as Howitt and Cramer (2011) emphasize its importance in thematic analysis data collection. The discipline of psychology guided the literature search and existing literature on psychological

preparedness formed the basis of the literature search. The search for literature focused on document searches, including peer-reviewed academic literature, such as journal articles, research reports and books. The document searches were carried out using the Griffith University library, and internet searches, using data bases PsycInfo, ProQuest, Science Direct, and Google scholar. In total, 620 documents were collected.

Thematic Analysis Data Analysis Procedure

The literature differs in the exact procedure of thematic analysis (Braun & Clarke, 2006; Elliott & Timulak, 2005; Gibson & Brown, 2009; Howitt & Cramer, 2011) and it is the researcher's choice on how to conduct it. The documents from the literature search were analyzed using Owen's (1984) approach to the identification of themes in literature, and following three criteria: recurrence (implicit recurrence), repetition (repetition of exact wording), and forcefulness (focus on passages through formatting in written reports). Braun and Clarke (2006) reasoned that concrete rules of best practice do not exist and that a theme merely has to capture something important in the data in relation to the research question. Recurrence and repetition were detected in the documents during the current data analysis, as Owen (1984) suggested. As forcefulness of certain themes in academic texts is usually conveyed through the emphasis or elaboration of a point (Howitt & Cramer, 2011), the criterion of forcefulness was assessed in this manner in the present analysis.

Results of the Thematic Analysis

The themes that have emerged from the thematic analysis have informed the operationalized definition of psychological preparedness, as well as the item construction for the psychological preparedness scale.

In the context of a serious threatening event or disaster warning situation, psychological preparedness is a heightened state of awareness, anticipation, and readiness for: (1) the uncertainty and emotional arousal in expectation of the occurrence of the threat, (2) one's own psychological response to the unfolding situation, and (3) the ability to manage the demands of the situation. Three sub-domains are thought to contribute to psychological preparedness:

- 1** Awareness and anticipation of one's own probable psychological responses to the uncertainty and stress of a disaster warning situation or event, including the ability to recognise particular stress-related thoughts and feelings. This also includes an individual's perception, appraisal, and understanding of the risk communication and threatening event.
- 2** Capacity, confidence, and competence to manage one's psychological response to the unfolding warning situation or event, and to manage one's social environment.
- 3** Perceived knowledge and confidence and competence to manage one's external physical situation and circumstances in the context of the warning situation.

Scale Item Testing

Procedure

Aiken and Groth-Marnat (2006) emphasized the importance of assessing reliability for any new instrument, to see whether it measures what it intends to measure. To test both face and content validity, 12 experts were provided with the initial 51-item version of the PPDTS and were asked to identify which sub-domain they believed the item belonged to and to rate each item's fit with the particular sub-domain using a 4-point Likert-type scale. Face validity was also assessed by 10 university students, who rated the items for clarity. The PPDTS was revised in light of recommendations by experts and university students and the entire survey was pilot tested on five different university students.

Participants

Content and face validity were assessed using ratings by 12 experts, as is common in test construction and part of the validation process (Gregory, 2011; Urbina, 2004). Experts included practicing psychologists, university academics, and six doctoral-level students. Face validity was subsequently also assessed by recruiting 10 university students. Five different university students then pilot tested the entire survey.

Results

Items were considered to match the sub-domain sufficiently well if at least eight of the 12 raters (at least 66%) agreed upon the sub-domain for a particular item. Only items that both matched the sub-domain that they were

intended for and were rated three or above for fit, as well as a rating of 3 and above for clarity were included in the final version of the scale. The measure was revised in light of the feedback by experts and students, reducing the final PPDTS scale to 40 items.

Study 2

Method

Procedure

The 40-item PPDTS scale and overall survey was administered to students and staff members of universities in Queensland, using both paper and online versions, using online service SurveyMonkey.

Participants

Participants were invited to take part in the study via email, and overall 1,494 students and university staff members Universities in Queensland, Australia, responded to the survey. While 1,494 participants commenced the online survey, due to each item requiring a response in order to proceed, 351 participants logged off prior to completing the survey. Therefore, a total of 1,143 participants completed the survey online. Participants were asked to provide information on gender, age, highest level of education, whether English was their first language or not, and their type of accommodation (rented or owned). Furthermore, participants were asked to provide their suburb, postcode, and the number of years they have been residing in Queensland or Northern New South Wales. Since participants were unable to omit items, no missing data was found in the online survey. Table 2 lists the participant characteristics.

Exploratory Factor Analysis

Prior to the analyses, the data set was examined for accuracy of data entry and assumptions for all planned analyses were assessed (i.e. normal distribution, complete data, collinearity), as suggested by psychometric assessment experts (Field, 2009; Tabachnick & Fidell, 2001). Four items that were extremely skewed and four other items that showed extremely low inter-item correlations were excluded from factor analysis. Bartlett's test of Sphericity was significant, $\chi^2(496) = 10436.579$, $p < .000$, allowing for the sample to be investigated through factor analysis (Field, 2009; Hair et al., 2006), and sampling adequacy was excellent, with a Kaiser–Myer–Olkin measure value of $KMO = .95$ (Field, 2009). The data set was then randomly split to provide two separate data sets for the exploratory (EFA) and first confirmatory factor analysis (CFA 1), and the second confirmatory factor analysis (CFA 2), as is common in scale development practices (Byrne, 2001). The method chosen for the exploratory factor analysis was Principal Axis Factoring (PAF). This method was specifically chosen because it was not assumed that all variances among the variables were common, as is most often the case with real-life data (Byrne, 2001; Field, 2009). Rather, it was believed that some variance was common (Field, 2009). An oblique rotation (direct oblimin) was chosen, as the underlying factors were believed to related (Field, 2009).

Confirmatory Factor Analyses

A series of confirmatory factor analyses were performed in order to confirm and support the hypothesized structure of the scale (Byrne, 2001; Hair et al., 2006). The samples for the CFA procedures consisted of $n = 579$

participants (CFA1), and $n = 580$ participants (CFA2) respectively. The measurement model fit was tested and then confirmed on a separate sample (sample CFA 2), in order to demonstrate that the model solution applied in two separate samples. Model fit was assessed using a variety of fit indices. Besides the recommended key fit indices of χ^2 , an incremental fit index and an absolute fit index (Hair et al., 2006), it was decided to include other fit indices considered to be important, such as the RMR, SRMR, TLI, PCFI, Lo90, Hi90, and the AIC. Hair et al. (2006) pointed out that for these fit indices, there are no absolute values for goodness of fit, there are only guidelines. Thus, the guidelines were followed, and the fit of the sum of the fit indices, rather than solely individual ones, were considered when deciding on the best fitting model.

Results

The exploratory factor analysis (EFA) revealed a final factor structure consisting of 26 items, which loaded onto four factors. Factor 1, with 13 items; Factor 2, with 7 items; Factor 3 with three items; and Factor 4 with three items. All four factors together accounted for 57.39% of the total variance. All factors correlated at a moderate level indicating that the factors are associated with each other and are part of the same construct. The final factor structure and factor loadings are displayed in Table 2.

When conducting confirmatory factor analyses, several different models are often tested when a new scale is developed, in order to ensure that the model presents good conceptual representation. First, the model fit of a one factor solution was tested in order to verify that the scale is not unidimensional, but instead a multi-dimensional measure (Byrne, 2001). Subsequently, three

factor structure suggested by the three sub-domains of the definition of psychological preparedness was tested. Finally, the EFA solution was tested for model fit. The EFA solution with 4 factors and 26 items showed good model fit. Subsequently, a second CFA was performed with the best fitting EFA model, in order to confirm and support the theorized structure of the scale (Hair et al., 2006). Again, all fit indices reached the recommended values indicative of good fit. The CFA model fit results are listed in Table 3.

The PPDTS scale showed excellent scale reliability, with a Cronbach's alpha value of .93. The Cronbach's alpha if item deleted section showed that deleting one item would increase the reliability, however merely by .01. While this improves the reliability, the improvement is minimal, and the case was made to retain this item.

Table 1

Participant characteristics (N = 1159)

Characteristics	<i>n</i> (%)
Demographic characteristics	
Males	289 (24.9%)
Females	870 (75.1%)
English as the first language	1042 (89.9%)
Highest level of education	
Primary School	2 (0.2%)
Secondary School	414 (35.7%)
TAFE or other college	176 (15.2%)
University	567 (48.9%)
Accommodation type	
Owned	622 (53.7%)
Rented	537 (46.5%)

Table 2

EFA final solution pattern matrix

No.	Item description	Factor				
		1	2	3	4	5
34	I am familiar with the severe storm or cyclone preparedness materials available to me.	.85				
38	I am familiar with the disaster warning system messages used for extreme weather events.	.84				
35	I know which household preparedness measures are needed to stay safe in a very severe storm or cyclone situation.	.77				
31	I would be able to locate the severe storm or cyclone preparedness materials in a cyclone warning situation easily.	.76				
39	I know what the difference is between a cyclone warning and a cyclone watch situation.	.75				
32	I know how to adequately prepare my home for the forthcoming storm or cyclone season.	.72				
33	I know where I can quickly find the emergency contact information in a severe weather situation.	.69				
37	I know what to look out for in my home and work place if an emergency weather situation should develop.	.68				
29	I regularly monitor news bulletins and Met Bureau advice during storm season.	.67				
36	I am familiar with the weather signs of an approaching storm or cyclone.	.62				
40	I am knowledgeable about the impact that very severe storms or cyclones can have on my home.	.60				
30	I am confident that I know what to do and what actions to take in a severe weather situation.	.57				
3	I can assess the likelihood of a cyclone crossing the coast.	.50				
2	I have a good sense of the risks posed by a very severe storm or an impending cyclone.	.41				
18	I think I am able to manage my feelings pretty well in difficult and challenging situations.		.83			
20	I seem to be able to stay cool and calm in most difficult situations.		.76			
16	I feel reasonably confident in my own ability to deal with stressful situations that I might find myself in.		.76			
17	In a severe storm or cyclone situation I would be able to cope with my anxiety and fear.		.67			
19	When necessary, I can talk myself through challenging situations.		.66			

27	If I found myself in a severe storm or cyclone situation I would know how to manage my own response to the situation.	.50	
25	I know which strategies I could use to calm <i>myself</i> in a severe storm or cyclone situation.	.49	
26	I know which strategies I could use to calm <i>others</i> in a severe storm or cyclone warning situation.		.83
22	If others are in distress, I would know how to calm them down.		.79
21	I would be able to tell easily if those/others around me are in distress.		.53
12	During severe storms or cyclones I would notice if I am feeling anxious or stressed.		.55
13	I usually prepare mentally for situations that might be difficult or stressful.		.52
9	I am able to identify my feelings pretty well in challenging situations.		.51

Table 3
CFA model fit

Model	Factors	Items	χ^2	Df	χ^2/df	RMR	SRMR	TLI	CFI	PCFI	RMSEA	Lo90	Hi90	AIC
1 Factor	1	32	3434.85	464	7.40	.05	.094	.67	.71	.66	.105	.10	.11	3562.85
3 Factors	3	32	2215.02	461	4.81	.05	.080	.81	.83	.77	.081	.08	.09	2349.02
PAF solution	4	26	880.81	130	2.01	.03	.06	.90	.96	.83	.059	.06	.06	1016.81
CFA 2	4	26	863.50	290	2.99	.03	.052	.92	.93	.83	.059	.06	.06	985,496

Limitations

Several limitations may have affected the results, as well as the generalizability of the findings of the current study. The context in which the testing took place varied according to participant and is unknown to the researchers (Urbina, 2004). This could have potentially led to the disruption of the participant's concentration while the survey was completed, or influence from others near the participant at the time of completion. However, since participants were anonymous in both studies this potential issue is beyond the control of the researchers, which is often the case with self-completion questionnaires. In addition, test-retest reliability of the PPDTS was not assessed. However, future studies will investigate the test-retest reliability of the PPDTS scale, as this is an important validity criterion (Urbina, 2004).

Conclusion

Disaster preparedness, while forming an integral part of disaster management, is still often unsuccessful in preventing the development of psychological symptoms in disaster victims. In order to improve the successful preparation for natural disasters, a more complete approach is needed, including a physical, as well as a psychological component. This research has highlighted the important contributions that psychology can make in the field of disaster preparedness, in theory, as well as in practice. These will hopefully be taken onboard by organizations, as well as governments whose preparedness measures still concentrate merely on physical preparation, or focus on providing psychological services to those in need in the aftermath of a disaster. It is in no way suggested that these current practices be replaced, but solely that psychological preparedness should be added to physical preparedness measures undertaken, in order to improve overall preparedness. This relative absence of research in the area of psychological preparedness for disasters, as well as the lack of

a validated and reliable measure, makes it difficult to successfully evaluate the effectiveness of the various existing preparedness programs. The operationalized definition of psychological preparedness, as well as the newly developed scale can aid in these evaluations, leading to more successful programs overall. Especially in developing countries, where access to preparedness materials and programs are often not readily available, it is important that the existing preparedness programs be efficient in achieving overall preparedness. This may then support the fostering of long-term resilience, enabling particularly residents in disaster-prone areas to better cope in the aftermath of disasters and leading to a reduction in psychological distress.

Natural disasters may increase in severity in the next few decades, leading to more individuals affected by the impacts of natural disasters, physically as well as psychologically. The incorporation of psychological preparedness into disaster management and more specifically disaster preparedness procedures can strengthen disaster management practices overall. The operationalized definition of the construct psychological preparedness and the newly developed and validated PPDTS scale are thus a significant contribution to the field. Researchers in Indonesia (Syiah Kuala University), the Philippines (University of Santo Tomas), and Japan (Miyagi Women's University) are currently undertaking research using the PPDTS scale, which will further validate the PPDTS scale on geographically diverse samples.

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