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RESILIENCE AFTER HURRICANE KATRINA AMONG PREGNANT AND POSTPARTUM WOMEN

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Background. **Although disaster causes distress, many disaster victims do not develop long-term psychopathology. Others report benefits after traumatic experiences (posttraumatic growth). The objective of this study was to examine demographic and hurricane-related predictors of resilience and posttraumatic growth.**

Methods. **We interviewed 222 pregnant southern Louisiana women and 292 postpartum women completed interviews at delivery and 8 weeks later. Resilience was measured by scores lower than a nonaffected population, using the Edinburgh Depression Scale and the Post-Traumatic Stress Checklist. Posttraumatic growth was measured by questions about perceived benefits of the storm. Women were asked about their experience of the hurricane, addressing danger, illness/injury, and damage. Chi-square tests and log-Poisson models were used to calculate associations and relative risks for demographics, hurricane experience, and mental health resilience and perceived benefit.**

Findings. **Thirty-five percent of pregnant and 34% of the postpartum women were resilient from depression, whereas 56% and 49% were resilient from posttraumatic stress disorder. Resilience was most likely among White women, older women, and women who had a partner. A greater experience of the storm, particularly injury/illness or danger, was associated with lower resilience. Experiencing damage because of the storm was associated with increased report of some perceived benefits.**

Conclusion. **Many pregnant and postpartum women are resilient from the mental health consequences of disaster, and perceive benefits after a traumatic experience. Certain aspects of experiencing disaster reduce resilience, but may increase perceived benefit.**

Background

Many studies indicate that natural disasters are associated with community-wide increases in mental health problems, especially posttraumatic stress disorder (PTSD), depression, and anxiety (Galea, Nandi, & Vlahov, 2005; Rubonis & Bickman, 1991). However, the vast majority of disaster victims do not develop long-lasting psychopathology (Galea et al., 2005), and in many cases do not report symptoms even in the short term (Bonanno, Galea, Bucciarelli, & Vlahov, 2006). This lack of symptoms or quick return to good mental health is quite common after disaster. Sixty-one percent of a large sample of New Yorkers were resilient after the September 11th attacks (defined

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Dr. Harville had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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as having a level of PTSD symptoms comparable with or lower than that seen in a nontraumatized population). Generally, more severe experience of the disaster is associated with reduced resilience (Bonanno & Mancini, 2008), although which aspects of disaster experience are most associated with resilience has not been examined extensively.

A related outcome is that of posttraumatic growth—going beyond baseline to an improved state of functioning after trauma (Carver, 1998). Up to 95% of people report posttraumatic growth in the aftermath of a disaster or traumatic event (Linley & Joseph, 2004), suggesting that some people experience both PTSD and posttraumatic growth after such events. Such growth can take the form of an increased sense of strength, self-reliance, expressiveness, and compassion, or improved relationships, changed priorities, feeling more spiritually in touch, or having a greater appreciation of life (Tedeschi, Park, & Calhoun, 1998). The relationship between degree of trauma and growth is not clear: a lower level of trauma may be insufficient to produce posttraumatic growth, whereas high levels are too traumatic to allow for growth (Butler et al., 2005; Linley & Joseph, 2004). Other research indicates that only very severe events produce posttraumatic growth (Morris, Shakespeare-Finch, Rieck, & Newbery, 2005).

Given that natural disasters will never be eliminated, reducing their impact is a worthwhile goal. It would be helpful for clinicians and disaster planners to learn what characterizes resilient people, so that it can be encouraged. In addition, some populations are of specific interest. Pregnant and postpartum women may be vulnerable to postdisaster psychopathology, and their mental health is of particular concern because of their special role in taking care of their children and their families (Ashman, Dawson, & Panagiotides, 2008; Cummings, Keller, & Davies, 2005; Johnson & Flake, 2007).

Little is known about resilience and posttraumatic growth among pregnant and postpartum women. Although some theorize that posttraumatic growth can protect against worsened mental health and contribute to resilience (Calhoun & Tedeschi, 2006), more research suggests the two are different axes of response to trauma (Tedeschi & Calhoun, 2004; Figure 1). Female gender has generally been associated with reduced resilience after disaster (Bonnano, Galea, Bucciarelli, & Vlahov, 2007), but greater posttraumatic growth (Linley & Joseph, 2004). After the Madrid train bombings, women reported more posttraumatic growth and positive changes, but also more negative changes and associated depression and anxiety (Val & Linley, 2006). Social support seems to be especially important for women in fostering resilience and posttraumatic growth (Swickert & Hittner, 2009; Vogt, Rizvi, Shipherd, & Resick, 2008). Women who are optimistic or hopeful prenatally, have social support, and do not have financial stress are less likely to develop postpartum depression (Grote & Bledsoe, 2007; Thio & Elliott, 2005), but we do not know whether those factors extend to a disaster situation. In this study, we examine the predictors of resilience and posttraumatic growth in pregnant and postpartum women after Hurricane Katrina.

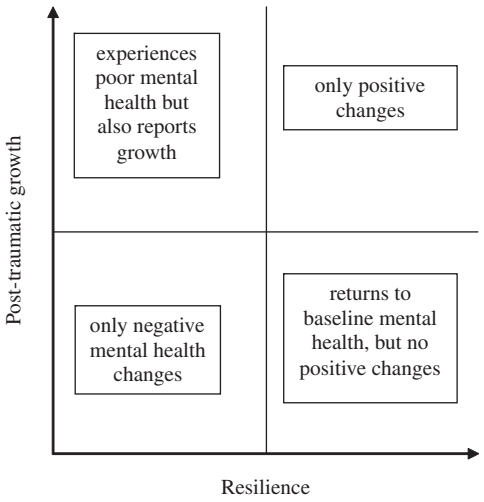

Figure 1. Resilience and posttraumatic growth as two axes of response to trauma.

Methods

Participants

Two related studies were conducted. Participants were recruited from Tulane Lakeside Hospital, Metairie, Louisiana, and Women's Hospital, Baton Rouge, Louisiana. Both hospitals see a wide variety of patients from their respective metro areas. Pregnant women were approached by a research assistant and recruited during a routine prenatal visit. Postpartum women were recruited on the postpartum wards or while receiving routine outpatient postpartum laboratory tests. All women were recruited between January 2006 and May 2007. Women recruited at the New Orleans site needed to have lived in the New Orleans area before Katrina. Women in Baton Rouge were recruited to be a less exposed comparison group, and so needed not have had a severe exposure to Katrina (defined as being forced to evacuate or having a relative die). Baton Rouge women were somewhat more likely to be nulliparous, married or living with a partner, and to have a college education or more; other demographic characteristics were similar. Surprisingly, site of recruitment was not associated with mental health outcomes (Harville, Xiong, Pridjian, Elkind-Hirsch, & Buekens, 2009), and variation in exposure to the hurricane was wider within than between groups. Thus, the two groups are combined for further analysis.

Pregnant participants completed a questionnaire and interview during their pregnancies. Postpartum women completed a questionnaire at recruitment and a telephone interview at approximately eight weeks postpartum. We recruited 295 pregnant women; and 222 (75%) completed the mental health questionnaire. We recruited 365 postpartum women; 292 (80%) completed the phone interview. Thirty women participated in both studies.

Measures

A summary of the measures and their timing is given in Table 1.

Resilience. The Edinburgh Postnatal Depression Scale was used to assess depression among the study participants. This is a widely used, 10-question scale that has been validated in both pregnant and postpartum women (Eberhard-Gran, Eskild, Tambs, Opjordsmoen, & Samuelsen, 2001). As in previous studies (e.g., Bonnano et al., 2007), resilience was defined as scoring at or below the mean level of symptoms in a non–trauma-exposed population. A study of a large sample of pregnant and postpartum women was chosen as a comparison group (Eberhard-Gran, Tambs, Opjordsmoen, Skrondal, & Eskild, 2004) with a mean value of four points. PTSD was measured using the PTSD checklist, a commonly used, 17-item inventory of PTSD-like symptoms, with response alternatives ranging from 1 (not at all) to 5 (extremely; Weathers, Ruscio, & Keane, 1999; Weathers, Litz, Herman, Huska, & Keane, 1993). Using a 5-point scale, respondents indicate how much they are bothered by each PTSD symptom in the past month. PTSD resilience was operationalized as not more than one symptom of PTSD, with a symptom defined as reporting "moderately" to one of the symptoms. Mental health was measured in the pregnancy sample and at 8 weeks for the postpartum sample.

Perceived benefit. Our measure of growth is based on perceiving benefits that arise from the storm, which has previously been used as a definition of posttraumatic growth (McMillen, Smith, & Fisher, 1997). Perceived benefit was assessed in two ways. First, we asked the woman, "Sometimes even the most awful events have their good outcomes, at least in part. Can you think of anything positive that came about as a result of the hurricane?" If she said yes, we asked what that positive thing was. We categorized the responses into six categories: the baby/getting pregnant; increased closeness with family or friends; the community pulling together; material benefits such as a new house or insurance money; and community benefits such as stronger levees. If a woman mentioned more than one benefit, we used the first one she mentioned; studies indicate that the benefit/no benefit distinction is most relevant to psychological and physical health (Nolen-Hoeksema & Davis, 2004). Next, we asked a series of questions about the respondent's personal growth, usefulness of previous learning and oral traditions, ability to make new friends, and confidence in the future (Vazquez, Cervellon, Perez-Sales, Vidales, & Gaborit, 2005). Factor analysis indicated that finding a way to feel better and discovering new ways to cope grouped on a single factor, whereas other questions did not. Perceived benefit was measured at baseline in the postpartum sample only.

Table 1. Timing of Measures in the Katrina Pregnancy and Postpartum Studies

Measure	Pregnancy Sample	Postpartum Sample	
Resilience	Prenatal		2 months postpartum
Perceived benefit		Delivery	
Hurricane experience	Prenatal	Delivery	
Social support	Prenatal	Delivery	2 months postpartum
Demographics	Prenatal	Delivery	

Hurricane experience. Hurricane experience was assessed using nine questions about threat, injury, and loss, which are domains that have been shown to be associated with mental health in previous disaster studies (Armenian et al., 2000; Ironson et al., 1997; Norris & Kaniasty, 1996; Norris, Perilla, Riad, Kaniasty, & Lavizzo, 1999). These were grouped after factor analysis into three categories: damage, injury/illness, and perceiving/experiencing danger. Hurricane experience was measured in the pregnancy sample and at baseline for the postpartum sample.

Social support. Perceived social support was measured using the Support Behaviors Inventory from the Perinatal Psychosocial Profile (Brown, 1986), which includes questions about perceived support from the woman's partner and support from others. Social support was measured in the pregnancy sample and at baseline for the postpartum sample.

Demographics. Demographic measures such as age, race, parity, income, marital status, and highest grade completed were reported by the participant.

Statistical analysis

Cross-tabulations and chi-square tests were used to examine the relationships among the predictors, mental health outcomes, perceived benefit, and hurricane experience. Multiple log-Poisson regression was used to model relative risk with control for potential confounders (Spiegelman & Hertzmark, 2005). We calculated 95% confidence intervals; $p = .05$ (two-sided)

Table 2. Description of Study Populations

	Pregnant Women ($n = 222$)		Postpartum Women ($n = 292$)	
	n	%	*n*	%
Age (yrs)				
18–22	41	19	44	15
>22–28	65	30	87	30
>28–33	52	24	84	29
>33	60	28	77	26
Race				
White	109	53	195	68
Black	90	44	83	29
Other	7	3	10	3
Education				
Less than high school	19	9	21	7
High school diploma	83	38	60	21
Some college/associate's degree	38	17	85	30
College degree	34	15	80	28
Higher than college	46	21	37	13
Parity				
First child	78	35	117	40
Has other children	144	65	175	60
Marital status at delivery				
Married/living with partner	162	78	245	84
Never married or separated	46	22	45	16
Income ($US)				
<20,000	56	26	61	21
20,000–60,000	89	42	136	48
>60,000	67	32	88	31
Residence before storm				
New Orleans area	157	71	207	71
Baton Rouge area	65	29	85	29
Damage to house/belongings of self or others				
Serious damage	89	42	122	42
Less damage	125	58	168	58
Illness/injury to self or others				
Yes	68	32	71	24
No	146	68	219	76
Perceived/experienced danger				
Yes	83	39	109	38
No	130	61	181	62
Depression				
Yes	42	19	53	18
No	178	81	236	82

was the criterion for statistical significance. Potential confounders were chosen from demographic predictors associated with exposure and outcome: age, race, parity, partnership status, and estimates were additionally adjusted for time since the hurricane.

All subjects gave written informed consent and the study protocols were approved by the Institutional Review Boards of Tulane Health Sciences Center and Woman's Hospital.

Results

The study population was largely in their late 20s and early 30s, White or Black, and had median 14 years of education (Table 2). By our definition, 35% of pregnant and 34% of the postpartum women were resilient from depression, whereas 56% and 49%, respectively, were resilient from PTSD. More than 70% of postpartum women reported perceived benefit or growth because of the storm (Table 3).

Demographic factors were not a large influence on resilience among pregnant women, with the exception that Black women were less likely to be resilient from PTSD. Among postpartum women, older women were more likely to be resilient from depression ($p < .01$); White women were more likely to be resilient from both depression and PTSD than Black women (40% vs. 22% [$p < .01$] for depression and 55% vs. 33% [$p < .01$] for PTSD); and partnered women were more likely than nonpartnered women to be resilient from PTSD (52% vs. 31%; $p = .01$). Low social support from a partner was associated with low resilience from depression (16% vs. 37%; $p < .01$). Overall, greater experience of the hurricane, especially illness/injury and danger, was associated with less resilience from both depression and PTSD ($p = .01$) among both pregnant and postpartum women. Adjusted results are listed in Table 4.

Patterns were somewhat different for perceived benefit. Older women were more likely to report any benefit ($p < .01$). Black women were more likely to report elders had helped them (73% vs. 59%; $p < .01$), and less likely to report making new friends (71% vs. 79%; $p = .06$). More educated women were more likely to report any benefit ($p = .02$) and new friends ($p = .03$), but less likely to report learning from elders ($p = .03$). Parous women were less likely to report making new friends (73% vs. 82%; $p = .04$). Low partner support was associated with a reduced likelihood of feeling prepared (62% vs. 87%; $p < .01$) and making new friends (64% vs. 79%; $p = .01$).

Experiencing damage during the storm was associated with increased report of any benefit (81% vs. 66%; $p < .01$) and finding ways to cope/feel better (82% vs. 72%; $p = .04$), learning from elders (73% vs. 59%; $p < .01$), but not making new friends. Injury/illness was associated only with lower reporting of feeling more prepared (75% vs. 86%; $p = .02$). Experiencing danger was not associated with increased or decreased likelihood of reporting perceived benefit. Adjusted results are given in Table 5.

Responses to the question, "Sometimes even the most awful events have their good outcomes, at least in part. Can you think of anything positive that came about as a result of the hurricane? What was it?" were examined in more detail. New Orleans women were more likely to name any benefit, to name the baby as a benefit, and to name material benefits; Baton Rouge women were more likely to name community benefits or closeness with family, friends, or community. Those with damage were more likely to report

Table 3. Perceived Benefit and Posttraumatic Growth Among 365 Postpartum Women

	n	%
Something good came of storm		
Yes	260	72
No	100	28
What was it?		
Baby/got pregnant	72	28
Closer to family/friends	59	23
Material benefit (new house, etc.)	62	24
Community closer	22	8
Community benefit (better levees, etc.)	27	10
Learn to rely on God	2	1
Better awareness of hurricanes	13	5
Found a way to feel better/better able to cope		
Yes	273	76
No	86	24
Feel more prepared to deal with future disasters		
Yes	300	83
No	61	17
Things learned before/from elders important		
Yes	232	65
No	127	35
Able to make new friends since storm		
Yes	276	77
No	82	23

material benefits, but less likely to report better awareness of hurricanes ($p < .01$). No association was seen with injury/illness. Women who experienced danger were more likely to report increased closeness with family/friends and less likely to report material benefits ($p = .04$).

Discussion

This study is among the first to consider specifically the experience of pregnant and postpartum women after disaster. Between one third and one half of these women met the criteria for resilience (mental health status at a normal level for the general population), and the vast majority, between 75 and 90%, endorsed having experienced various forms of benefits. In fact, more than twice as many women were resilient from depression and PTSD as met the criteria for those disorders (Harville et al., 2009). Among a mixed-gender group of New Yorkers 6 months after September 11, 65% had one or no PTSD symptoms (Bonanno et al., 2006); thus, our data are consistent with the idea that women are less likely to be resilient than men, but more likely to experience posttraumatic growth. It should be noted that the proportion meeting cutoffs for likely mental illness was not particularly high in this sample (Harville et al., 2009), suggesting that women are particularly prone to mid-level but not severe symptoms. We also confirm previous studies that indicate that low social support is associated with reduced resilience. Satisfaction with social support has also been associated with posttraumatic growth (Linley & Joseph, 2004; Siegel, Schrimshaw, & Pretter, 2005) and is supposed to be particularly important for women (Swickert & Hittner, 2009), which was only somewhat true in our data; low social support was generally associated with increased skills and confidence and likelihood of making friends, but not overall naming any perceived benefit.

Disaster experience was related differently to resilience than posttraumatic growth. Overall, greater experience of the hurricane, especially illness/injury and danger, was associated with less resilience, consistent with previous reports in general populations (Bonanno & Mancini, 2008). Experiencing damage during the storm was associated with several types of perceived benefit, but experiencing illness/injury or danger were not, for the most part (although they were not associated with decreased perceived benefit, either). This is consistent with the hypothesis that lower level of trauma is insufficient to produce posttraumatic

Table 4. Predictors of Resilience Among Southern Louisiana Pregnant and Postpartum Women After Katrina

	Pregnant Women				Postpartum Women			
	Depression Resilient		PTSD Resilient		Depression Resilient		PTSD Resilient	
	RR*	95% CI	RR	95% CI	RR*	95% CI	RR	95% CI
Residence before storm								
New Orleans area	1.00		1.00		1.00		1.00	
Baton Rouge area	0.81	(0.55–1.29)	1.14	(0.87–1.50)	0.92	(0.45–1.89)	0.59	(0.29–1.17)
Damage to house/belongings of self or others								
Serious damage	0.72	(0.48–1.08)	0.95	(0.72–1.25)	0.64	(0.33–1.25)	0.82	(0.46–1.48)
Less damage	1.00		1.00		1.00		1.00	
Illness/injury to self or others								
Yes	0.39	(0.22–0.71)	0.67	(0.47–0.97)	0.71	(0.32–1.56)	0.51	(0.23–1.13)
No	1.00		1.00		1.00		1.00	
Perceived/experienced danger								
Yes	0.55	(0.34–0.87)	0.50	(0.35–0.73)	0.51	(0.25–1.05)	0.38	(0.18–0.84)
No	1.00		1.00		1.00		1.00	

CI, confidence interval; PTSD, posttraumatic stress disorder; RR, relative risk.
Adjusted for age, race, parity, partnership status, and time since the hurricane.

Table 5. Predictors of Perceived Benefit Among Southern Louisiana Postpartum Women After Katrina

	Any Perceived Benefit		Found a Way to Feel Better/ Better Able to Cope		Feel More Prepared to Deal With Future Disasters		Things Learned Before/From Elders Important		Able to Make New Friends Since Storm	
	RR*	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
Residence before storm										
New Orleans area	1.13	0.95–1.33	1.02	0.87–1.20	0.94	0.84–1.04	1.01	0.82–1.26	0.89	0.79–1.00
Baton Rouge area	1.00		1.00		1.00		1.00		1.00	
Damage to house/belongings of self or others										
Serious damage	1.21	1.06–1.38	1.14	1.00–1.29	0.94	0.85–1.05	1.31	1.09–1.57	0.96	0.84–1.09
Less damage	1.00		1.00		1.00		1.00		1.00	
Illness/injury to self or others										
Yes	1.15	1.00–1.32	0.91	0.77–1.07	0.9	0.79–1.03	1.08	0.88–1.32	0.98	0.85–1.13
No	1.00		1.00		1.00		1.00		1.00	
Perceived/experienced danger										
Yes	1.02	0.89–1.17	1.06	0.93–1.21	1	0.90–1.11	1.12	0.93–1.36	0.93	0.81–1.07
No	1.00		1.00		1.00		1.00		1.00	

CI, confidence interval; RR, relative risk.
Adjusted for age, race, parity, partnership status, and time since hurricane.

growth, whereas high levels are too traumatic to allow for growth (Butler et al., 2005; Linley & Joseph, 2004). Butler et al. (2005) found a U-shaped relationship between posttraumatic growth and trauma symptoms, with the most growth occurring in the middle range. Theoretically, a low level of trauma might be too little to trigger the reassessing needed for growth, whereas a high level would be too overwhelming for growth. It has been reported that technological or man-made disasters are more traumatic than natural disasters (Paton, 2006) and less likely to lead to posttraumatic growth (McMillen et al., 1997); it may be that women who experienced damage were more likely to experience Katrina as a natural disaster (wind and flooding), whereas those who experienced danger and injury responded to it as a man-made/technological disaster (levee failure and slow response by officials). It also may be that even serious damage to material items is more often seen as a challenge, whereas while threats to one's person or health are less likely to trigger posttraumatic growth. We are unaware of other studies that have examined which aspects of disaster are most likely to contribute to posttraumatic growth.

Black women in our study were more likely to endorse some forms of benefit, consistent with research that ethnic minorities often report more posttraumatic growth than nonminorities (Park & Helgeson, 2006; Siegel et al., 2005). We did not find this for all forms of benefit, though, because Black women were less likely to report making new friends.

The limitations of the study need to be addressed. Women who were evacuated further than Baton Rouge and were unable to return to New Orleans are not included in our sample; these likely include some of the most exposed and traumatized women, limiting the interpretation of the data. Also, women were interviewed up to a year and a half after Hurricane Katrina. Thus, we are not able to differentiate those who initially experienced some distress, but later recovered (recovery), from those who remained at a relatively high level of functioning throughout the time period (resilience; Bonanno & Mancini, 2008), nor do we have information about resilience and posttraumatic growth in the immediate aftermath of the storm.

Resilience was measured based on standard, validated mental health measures and defined comparably with other studies (Bonnano et al., 2007). We measured posttraumatic growth only by self-report of perceived benefits; this method is open to several types of bias, and some people distinguish perceived benefit from posttraumatic growth (Sears, Stanton, & Danoff-Burg, 2003). Our questions were tied specifically to Katrina, and previous studies indicate this may underestimate posttraumatic growth (Smith & Cook, 2004). Also, our single, open-ended question of perceived benefit and our categorization of any versus no perceived benefit may be a stronger indicator of true posttraumatic growth than checklist measures (Nolen-Hoeksema & Davis, 2004).

Many people are resilient after terrible events, and even the worst events sometimes have a positive side. We observed both of these phenomena in this study of pregnant and postpartum women exposed to disaster. Pregnant and postpartum women seem to be both less prone to serious mental illness (Harville et al., 2009) and less likely to be completely resilient than other groups. However, they are clearly capable of resilience and growth even after very difficult experiences.

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