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Relations between Loss of Services and Psychiatric Symptoms in Urban and Non-Urban Settings following a Natural Disaster

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Abstract

Disasters have been associated with both acute and prolonged distress and significant post-disaster psychiatric symptoms. These outcomes may be further complicated by extended periods without vital services and supplies, such as electricity and drinking water. The present study investigated the relations between post-disaster loss of services and psychiatric symptoms in urban/non-urban disaster victims. Random-digit-dial methodology was used to interview 1,249 victims of Hurricane Ike, a strong storm that hit Galveston, TX in 2008. Findings demonstrated significant relations between loss of services and post-disaster symptoms of posttraumatic stress disorder (PTSD), depression, and worry. These relations varied by urban/non-urban settings; there were significant positive relations between loss of services and symptoms of depression in non-urban settings, but not in urban settings. Similarly, a stronger relation between loss of services and symptoms of PTSD also was demonstrated in non-urban compared to urban settings. Findings highlight the potential importance of pre-disaster preparation, post-disaster restoration of services, and post-disaster community support in post-disaster psychiatric outcomes, with a particular emphasis in non-urban settings.

Keywords

PTSD; Depression; Worry; Preparedness; Disaster; Urban; Non-urban

Disasters are a unique form of stressor in that they impact wide swaths of the population at once and may be accompanied by a number of possible deleterious outcomes (e.g., mass casualties, displacement, and property damage; Norris et al. 2002a). Although acute stress in the immediate aftermath of a disaster is virtually universal and considered normative (Davidson and McFarlane 2006; Foa et al. 2006), disaster research has demonstrated that 39 % of disaster victims report severe to very severe post-disaster psychological distress and impairment (Norris et al. 2002b). Common post-disaster mental health symptoms include posttraumatic stress disorder (PTSD), generalized anxiety and worry, depression, and substance abuse (Caruana 2009; Foa et al. 2006; Norris et al. 2002a). In addition to acute disaster exposure, post-event factors may serve to further prolong disaster-related distress, such as prolonged community disruption, utility outage, and job loss (Caruana 2009; Davidson and McFarlane 2006; Foa et al. 2006). Greater understanding of these and other factors related to post-disaster psychiatric symptoms is needed to improve both pre-disaster preventative measures and post-disaster response.

Disaster location has been identified as one of the most significant predictors of the severity of post-disaster impairment (Norris 2002). The majority of this research has focused on differences between the United States, other developed countries, and developing countries, with increased risk of impairment found in individuals from developing countries (Norris et al. 2002a; b). These findings were in part due to the more severe disasters studied in developing countries as well as lower resources available for recovery in these settings (Norris et al. 2002b). These findings may have implications for various regions within developed countries, such as the United States. For example, urban and non-urban settings differ with regard to community resources that are related to disaster-related loss of services, disaster preparedness, and post-disaster restoration of services (Norris 2002). More specifically, Norris (2002) hypothesized that the resources afforded by an urban setting (e.g., access to services) may offset some of the risks associated with disasters (e.g., interpersonal conflict, insufficient support, psychiatric symptoms). Disaster preparedness also may influence these relations. Many characteristics associated with heightened preparedness (e.g., higher income, higher education, great access to knowledge) are associated with residing in an urban setting (Ormond et al. 2000; McFarlane 2005; Norris et al. 2002a) and with better post-disaster outcomes (Ormond et al. 2000; McFarlane 2005; Norris et al. 2002a). However, no available research can be identified that directly investigates differences in psychiatric symptoms between disaster victims residing within urban and non-urban settings during a single disaster.

In order to address this paucity of research in the literature, the present study investigated the relations between disaster-related loss of services, urban/non-urban residence, and post-disaster psychiatric symptomatology in victims of Hurricane Ike. Hurricane Ike was a strong Category 2 storm that hit Galveston, TX in 2008, and was the third costliest hurricane in US history, resulting in 84 American deaths (Centers for Disease Control and Prevention 2008). Post-disaster psychiatric symptoms of interest included symptoms of PTSD, depression, and worry, as these symptoms are common in post-disaster populations (Caruana 2009; Foa et al. 2006; Norris et al. 2002a). Based on the previous findings regarding predictors of loss of services, preparedness, and urban/non-urban differences (Baker 2011; Kim and Kang 2010; Ormond et al. 2000) and the hypothesized offsetting factors in urban settings (Norris 2002), we hypothesized that urban/non-urban setting would moderate the relations between loss of services and post-disaster psychiatric symptomatology. Loss of services were hypothesized

to be related to post-disaster symptomatology in participants in non-urban settings, but not urban settings.

Method

Participants

The sample consisted of 1,249 adults residing in households with traditional landline telephones in Galveston and Chambers counties in Eastern Texas when Hurricane Ike made landfall. Galveston (280 people per square mile; 54.4 % of area is covered by water) and Chambers (43 people per square mile; 31.3 % of area is covered by water) counties are both located along the Gulf Coast of the United States and were the areas hardest hit by Hurricane Ike. Random-digit-dial methodology was used for recruitment to maximize generalizability of the data. Local telephone banks within each geographic area were systematically selected using the comprehensive database of telephone hundred banks containing three or more listed residential phone numbers. Once a block had been selected, a two-digit random number in the range of 00–99 was appended to the block to form a ten-digit telephone number. Participants eligible for recruitment were at least 18 years old; lived in Galveston or Chambers counties at the time of Ike's landfall on September 13, 2008; and had internet access at home to participate in an online post-disaster intervention as part of the larger project (Ruggiero et al. 2012). Interviews were conducted between September 10th and October 12th, 2009. Up to 21 attempts were made to contact an adult at each landline phone number ($M=4.6$, $SD=4.0$). The overall cooperation rate, calculated according to American Association for Public Opinion Research industry standards (i.e., [completed interviews + screen outs] divided by [completed interviews + screen outs + refusals]), was 50.2 %.

Procedure

All procedures were approved by the local institutional review board. Computer-assisted structured telephone interviews were conducted by Abt SRBI (New York, NY), a survey research organization with an extensive background in health research, including numerous surveys with disaster- and violence-affected populations. Interviews included assessments of demographics (age, racial/ethnic status, sex, education, and income), loss of services, and psychiatric symptoms (PTSD, depression, and worry). Supervisors conducted random checks of data entry accuracy and interviewers' adherence to assessment procedures. The telephone interview averaged 21 min in duration. Respondents were paid \$10 for their participation.

Measures

Loss of services—Questions were modified from earlier research with adults affected by Hurricane Hugo in 1994 and the Florida Hurricanes in 2004 (Freedy et al. 1994). Questions assessed the number of days that participants were without: 1) electricity, 2) enough drinking water, 3) enough food, 4) shelter, 5) enough clean clothes, 6) enough transportation, and 7) sufficient money for living expenses. An example item from this measure is, “As a result of Hurricane Ike, how many days, if any, did you feel you were without electricity?” The variable of interest in the present study was defined as the mean number of days without services.

Center for Epidemiological Studies-Depression Scale—The Center for Epidemiological Studies-Depression Scale (CES-D; Radloff 1977) is a 20-item measure designed to identify current depressive symptomatology related to clinical depression in adults and adolescents. Each item is rated on a 4-point scale (1=*rarely or none of the time*; 4=*most or all of the time*). An example item from this measure is, “I felt depressed.” The

CES-D is one of the most widely used measures of depressive symptoms, with repeated support for its reliability and validity in the literature (Edwards et al. 2010). The present study used the CES-D-10, which is a 10-item revised version of the CES-D with similar support in the literature (Cheung et al. 2007). Internal reliability was acceptable in the present study ($\alpha=0.87$).

Penn State Worry Questionnaire—The Penn State Worry Questionnaire (PSWQ; Meyer et al. 1990) is a 16-item measure designed to assess the chronic, excessive worry. Each item is rated on a 5-point scale (1=*not at all typical of me*; 5=*very typical of me*). An example item from this measure is, “Once I start worrying, I can’t stop.” Meyer et al. (1990) reported excellent internal consistency and good test-retest reliability. Internal reliability was acceptable in the present study ($\alpha=0.81$).

PTSD Checklist—The PTSD Checklist (PCL; Blanchard et al. 1996) is a 17-item measure designed to assess PTSD symptom severity. Each item is rated on a 5-point scale (1=*not at all*; 5 *extremely*). An example item from this measure is, “Avoiding thinking about or talking about Hurricane Ike or avoiding having feelings related to it?” The PCL has been shown to have excellent internal consistency, test-retest reliability, and convergent validity with alternative measures of PTSD (Orsillo 2001). Internal reliability was acceptable in the present study ($\alpha=0.94$).

Data Analytic Plan

The moderating effect of setting (urban or non-urban) on the association between loss of services and psychiatric symptoms (PTSD, depression, worry) was examined with a series of hierarchical regressions. The first step included demographic covariates (age, income, race, and gender) to investigate and control for potential demographic differences between the two settings. Race was entered as a dummy coded variable such that 0 corresponded to Caucasian and 1 corresponded to Non-Caucasian. This approach was used due to the small number of recruited ethnic minorities in the sample ($n=293$) relative to Caucasians ($n=956$). Gender was treated in the same way such that females were coded 0 and males were coded as 1. The second step included the main effects for setting and loss of services. Regional status was dummy coded such that 0 corresponded to Urban and 1 corresponded to Non-Urban. The third step tested for moderation by including an interaction between setting and loss of services. Moderation refers to the strength of a relation between two variables being conditional on the level of a third variable. For the present study, it was hypothesized that the strength of the association between loss of services and psychiatric outcomes would be conditional upon region (urban/non-urban).

Bootstrapping procedures with 5000 replications and bias correction were used to generate 95 % confidence intervals. This approach has been shown to provide less biased estimates in working with highly skewed data, which was the case for the psychiatric symptoms and loss of services (Delucchi and Bostrom 2004; Neal and Simons 2007; Pollack et al. 1994).

Results

Descriptives

Participants averaged 45.8 years old ($SD=17.3$), married (69.1 %; 10.9 % divorced; 6.3 % widowed; 5.9 % never married), Caucasian (75.5 %; 13.0 % African American; 5.9 % Hispanic), employed (59.5 %), and lived in a non-urban setting (83.4 %). Urban/non-urban distinctions were based on the census definitions of metropolitan statistical areas (MSA). Both Galveston and Chambers counties fall within the Houston, TX MSA. Participants were classified as urban if they live within a place designated as “urbanized” and non-urban if

they live outside the urbanized area. Half (51.7 %) were men, and one third completed some college as their highest level of education (33.9 %; 28.0 % college graduate; 18.9 % graduate work; 12.5 % high school graduate). One in five (21.2 %) had household incomes below \$40,000; 12.9 % had incomes between \$40,000 and \$60,000; 13.8 % between \$60,000 and \$80,000; 10.8 % between \$80,000 and \$100,000; and 26.3 % over \$100,000. The mean age of the sample was greater than that of the area and so all subsequent analyses were weighted for age.

Demographic, loss of service, and psychiatric symptom variables were compared across urban and non-urban settings to assess for group differences (Table 1). Kruskal-Wallis Analyses of Rank were used to compare loss of service variables due to the strong positive skew in the data. Although no differences were found for demographic variables ($p > .05$), urban participants reported a significantly greater time without electricity, food, water, shelter, clean clothing, and transportation ($p < .01$). There was no significant difference in the amount of time without access to money for living expenses. Urban participants also reported significantly worse symptoms of PTSD on the PCL, depression on the CES-D-10, and worry on the PSWQ ($p < .01$). The means for PTSD, depression, and worry symptoms in both samples were roughly consistent with means reported in unselected samples in the previous literature, with slight elevations in symptoms of depression (Molina and Borkovec 1994; Ruggiero et al. 2003).

Moderation

The moderating effect of setting (urban or non-urban) on the association between loss of services and psychiatric symptoms (PTSD, depression, worry) was examined with a series of hierarchical regressions (Table 2)

Posttraumatic Stress Disorder—For PTSD symptoms (as assessed by PCL), there were significant main effects for residence ($b = -2.17$, $p < .05$, $CI_{95\%} = -3.76 - -.15$) and loss of services ($b = .07$, $p < .01$, $CI_{95\%} = .05 - .10$). These main effects were qualified by a significant interaction ($b = .07$, $p < .01$, $R^2_{\Delta} = .06$, $CI_{95\%} = .02 - .10$). The interaction was probed by separately examining the association between loss of services and PTSD symptoms for participants in urban and non-urban settings. There was a significant positive relation between loss of services and PTSD symptoms for those in non-urban settings ($b = .08$, $p < .01$, $R^2_{\Delta} = .20$, $CI_{95\%} = .06 - .11$). Furthermore, the association between loss of services and PTSD symptoms was significant for those in urban settings, albeit with a slightly weaker relation ($b = .03$, $p < 0.05$, $R^2_{\Delta} = .05$, $CI_{95\%} = .01 - .07$) (Fig. 1).

Depression—For depression symptoms (as assessed by CES-D-10), there was not a significant main effects for residence ($b = -.58$, $p = .13$, $CI_{95\%} = -1.30 - .16$), but there was a significant main effect for loss of services ($b = .02$, $p < .01$, $CI_{95\%} = .02 - .03$). These effects were qualified by a significant interaction ($b = .02$, $p < .01$, $CI_{95\%} = .01 - .03$, $R^2_{\Delta} = .02$). The interaction was probed by separately examining the association between loss of services and depression for participants in urban and non-urban settings. There was a significant positive relation between loss of services and depression for those in non-urban settings ($b = .03$, $p < .01$, $R^2_{\Delta} = .10$, $CI_{95\%} = .02 - .03$). However, the association between loss of services and depression was not significant for those in urban settings ($b < .01$, $p = .45$, $R^2_{\Delta} < .01$, $CI_{95\%} = .00 - .01$) (Fig. 1).

Worry—For worry symptoms (as assessed by PSWQ), there was a significant main effect for loss of services ($b = .03$, $p < .01$, $CI_{95\%} = .02 - .05$) but not for residence ($b = -2.43$, $p = .16$, $CI_{95\%} = -5.85 - .91$). The interaction for these variables was not significant ($b = .02$, $p = 0.29$,

$CI_{95\%} = -.01 - .06$, $R^2_{\Delta} < 0.01$). As such, increased worry was associated with an increased loss of services. However, this effect did not vary across urban and non-urban settings

Discussion

The present study investigated the moderating effects of urban/non-urban setting on the relations between post-disaster loss of services and psychiatric symptoms in a sample of 1,249 victims of Hurricane Ike in two counties in Eastern Texas. Loss of services was related to increased post-disaster symptoms of PTSD, depression, and worry. However, as hypothesized, the relations for PTSD and depression were moderated by urban/non-urban residence. There were significant positive relations between PTSD and loss of services in non-urban settings and urban settings. However, the relation was stronger in non-urban settings. Furthermore, depression was related to loss of services in non-urban settings, but not in urban settings.

The relations between loss of services and psychiatric symptoms were particularly relevant for participants living in non-urban settings. Unlike participants in urban settings, non-urban participants reliably demonstrated a relation between loss of services and post-disaster symptoms of depression. A stronger relation between loss of services and symptoms of PTSD also was demonstrated in the non-urban compared to the urban settings. Interestingly, these findings did not appear to be associated with the length of time without these services, as greater days without services were reliably reported in the urban sample. One possible explanation for these findings is that urban settings involve closer proximity to neighbors and stronger community ties in contrast to non-urban settings, which may promote increased support and sharing of limited supplies. This explanation also was proposed previously in the literature (Norris 2002). However, given that participants in urban settings demonstrated both longer loss of services and more severe psychiatric symptoms than participants in non-urban settings, additional research is needed to better understand these relations, including investigations of pre- and post-disaster symptomatology (e.g., symptoms of PTSD and depression) and post-disaster behaviors (e.g., community support and gatherings).

Another interesting finding was the different relations in urban/non-urban settings between the symptoms of depression, PTSD, and worry and loss of services. Despite significant relations between the symptoms and loss of services as well as a large overlap in the symptoms of depression, PTSD, and worry (Gros et al. 2012; Gros et al. 2010), the interaction with urban/non-urban setting varied across the groups of symptoms, with the largest effect for depression, a more modest effect for PTSD, and non-significant effect for worry. Related to the discussion above, urban and non-urban differences in social/community support also may contribute to differences observed in these interactions. More specifically, social support has been shown to influence post-disaster symptoms of depression (Kaniasty and Norris 1993) and PTSD (Adams and Boscarino 2006); however, similar findings have not been identified for symptoms of worry. Thus, the closer proximity to neighbors and stronger community ties in urban settings (i.e., social support) may serve as a protective factor in depression and PTSD, but not in worry, leading to the differential interaction findings across these symptoms. However, once again, the present study did not include a measure of social support and so these hypotheses require investigation in future research.

Although many of the items in the present study were more focused on loss of services, rather than the success at which community disaster preparedness prevented loss of services, these data still may be helpful in understanding the influence of disaster preparedness in reducing post-disaster psychiatric symptoms. As discussed above, extended loss of services have been shown to prolong post-disaster distress (Caruana 2009; Davidson and McFarlane

2006; Foa et al. 2006), which is common in major disasters such as hurricanes (Norris et al. 2002a). In fact, participants in the present study reported an average of over 12 days without electricity and over 2.5 days without enough drinking water following the hurricane. However, participants with fewer total days without vital services reported significantly less severe psychiatric symptoms, possibly due in part to sufficient pre-disaster preparation of Hurricane kits (e.g., stores of clean drinking water, food, clothing, cash, backup generators). Together, these findings may highlight the significance of thorough pre-disaster citizen preparation and post-disaster restoration of services for disaster victims in reducing post-disaster psychiatric sequelae.

These findings suggest that improved pre-disaster citizen preparation and post-disaster restoration of community services and support may improve post-disaster psychiatric symptoms. Consistent with this finding, Kim and Kang (2010) demonstrated positive relations between pre- and during-hurricane citizen and community preparation and integrated connectedness to a storytelling network (ICSN; e.g., local media that reinforces links to other outlets, such as community organizations). Further, during-hurricane preparation was associated with neighborhood belonging (i.e., residents' feelings of attachment to an area that inspires everyday acts of neighborliness). The authors suggested that pre-disaster interventions targeting improvements to both ICSN and neighborhood belonging would improve post-disaster outcomes. When taken with the present study, the incorporation of interventions designed to improve ICSN and neighborhood belonging may be most effective in non-urban settings, which may be most at risk for poor post-disaster psychiatric outcomes due to reduced pre-disaster citizen preparation, slower restoration of services, and decreased community support.

The present study has several limitations that temper relevant policy recommendations and subsequently should be addressed in future research. First as noted earlier, the measure of loss of services *indirectly* assessed pre-disaster preparedness by querying loss of services and supplies on hand. Loss of these resources may have been a result of the effects of the storm, public utilities service gaps, and/or an individual's lack of pre-disaster preparation; additional items are needed to assess the mechanisms of these losses. Second, the study involved retrospective reporting of loss of services and did not assess pre-disaster psychiatric symptomatology. Third, the data were limited to an urban/non-urban separation, potentially limiting its relevance to rural settings. Additionally, the urban sample was substantially smaller ($n=208$) than the non-urban sample ($n=1013$). Although the current analyses were sufficiently powered to detect the observed effects for the moderation in the total sample and the observed effects in the non-urban sample, there was insufficient power to detect the observed effects in the urban sample. Despite evidence that the relation between loss of services and psychiatric outcomes differs amongst urban and non-urban participants, the significance of the association in urban participants is unclear. Replication of these findings in a larger sample of urban participants is needed to confirm the findings obtained in the current study. Fourth, the study measures were limited to PTSD, depression, and worry, suggesting additional measures of the symptoms of anxiety, including physiological anxiety, should be included in future research (Gros et al. 2007). Finally, the study sample only included individuals with internet access, which may limit the generalizability of these findings.

In conclusion, the present study identified urban/non-urban residence as an important moderator in the relations between post-disaster loss of services and symptoms of PTSD, depression, and worry in a large sample of disaster victims. The findings highlight loss of services and lack of supplies as significant risk factors for post-disaster psychiatric symptoms in non-urban settings and emphasize the need for interventions that may improve pre-disaster individual and community preparedness and support in the future.

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References

- Adams RE, Boscarino JA. Predictors of PTSD and delayed PTSD after disaster: the impact of exposure and psychosocial resources. *The Journal of Nervous and Mental Disease*. 2006; 194:485–493. [PubMed: 16840844]
- Baker EJ. Household preparedness for the aftermath of hurricanes in Florida. *Applied Geography*. 2011; 31:46–52.
- Blanchard EB, Jones-Alexander J, Buckley TC, Forneris CA. Psychometric properties of the PTSD Checklist (PCL). *Behaviour Research and Therapy*. 1996; 34:669–673. [PubMed: 8870294]
- Caruana C. Life in the aftermath: a summary of the literature on individual and family functioning following natural disasters. *Family Relationships Quarterly*. 2009; 14:3–7.
- Centers for Disease Control and Prevention. Hurricane Ike rapid needs assessment. *Morbidity and Mortality Weekly Report*. 2008; 58:1066–1071.
- Cheung YB, Liu KY, Yip PSF. Performance of the CES-D and its short forms in screening suicidality and hopelessness in the community. *Suicide & Life-Threatening Behavior*. 2007; 37:79–88. [PubMed: 17397282]
- Davidson JRT, McFarlane AC. The extent and impact of mental health problems after disaster. *The Journal of Clinical Psychiatry*. 2006; 67:9–14. [PubMed: 16602810]
- Delucchi KL, Bostrom A. Methods for analysis of skewed data distributions in psychiatric clinical studies: working with many zero values. *The American Journal of Psychiatry*. 2004; 161(7):1159–1168. [PubMed: 15229044]
- Edwards MC, Cheavens JS, Heiy JE, Cukrowicz KC. A reexamination of the factor structure of the center for epidemiologic studies depression Scale: is a one-factor model plausible? *Psychological Assessment*. 2010; 22:711–715. [PubMed: 20822284]
- Foa EB, Stein DJ, McFarlane AC. Symptomatology and psychopathology of mental health problems after disaster. *The Journal of Clinical Psychiatry*. 2006; 67:15–25. [PubMed: 16602811]
- Freedy JR, Saladin M, Kilpatrick DG, Resnick HS, Saunders BE. Understanding acute psychological distress following natural disaster. *Journal of Traumatic Stress*. 1994; 7:257–273. [PubMed: 8012746]
- Gros DF, Antony MM, Simms LJ, McCabe RE. Psychometric properties of the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA): comparison to the State-Trait Anxiety Inventory (STAI). *Psychological Assessment*. 2007; 19:369–381. [PubMed: 18085930]
- Gros DF, Simms LJ, Acierio R. Specificity of post-traumatic stress disorder (PTSD) symptoms: an investigation of comorbidity between PTSD and depression in treatment-seeking veterans. *The Journal of Nervous and Mental Disease*. 2010; 198:885–890. [PubMed: 21135640]
- Gros DF, Price M, Magruder KM, Frueh BC. Symptom overlap in posttraumatic stress disorder and major depression. *Psychiatry Research*. 2012
- Kaniasty K, Norris FH. A test of the social support deterioration model in the context of natural disaster. *Journal of Personality and Social Psychology*. 1993; 64:395–408. [PubMed: 8468668]
- Kim Y, Kang J. Communication, neighborhood belonging and household hurricane preparedness. *Disasters*. 2010; 34:470–488. [PubMed: 19878261]
- McFarlane, AC. Psychiatric morbidity following disasters: Epidemiology, risk, and protective factors. In: Meyers, D.; Wee, DF., editors. *Disaster mental health services: a primer for practitioners*. New York, NY: Routledge Press; 2005. p. 37-63.

- Meyer TJ, Miller ML, Metzger RL, Borkovec TD. Development and validation of the Penn State worry questionnaire. *Behaviour Research and Therapy*. 1990; 28:487–495. [PubMed: 2076086]
- Molina, S.; Borkovec, TD. The Penn State Worry Questionnaire: Psychometric properties and associated characteristics. In: Davey, GCL.; Tallis, F., editors. *Worrying: perspectives on theory, assessment, and treatment*. New York: Wiley; 1994. p. 265-283.
- Neal DJ, Simons JS. Inference in regression models of heavily skewed alcohol use data: a comparison of ordinary least squares, generalized linear models, and bootstrap resampling. *Psychology of Addictive Behaviors*. 2007; 21(4):441–452.10.1037/0893-164x.21.4.441 [PubMed: 18072826]
- Norris FH. Disasters in urban context. *Journal of Urban Health*. 2002; 79:308–314. [PubMed: 12200499]
- Norris FH, Friedman MJ, Watson PJ, Byrne CM, Diaz E, Kaniasty K. 60,000 disaster victims speak: part I. An empirical review of the empirical literature 1981–2001. *Psychiatry*. 2002a; 65:207–239. [PubMed: 12405079]
- Norris FH, Friedman MJ, Watson PJ. 60,000 disaster victims speak: Part II. Summary and implications of the disaster mental health research. *Psychiatry*. 2002b; 65:240–260. [PubMed: 12405080]
- Ormond BA, Zuckerman S, Lhila A. Rural/urban differences in healthcare are not uniform across states. A report prepared for Assessing the New Federalism (Series B, No B-11). 2000
- Orsillo, SM. Measures for acute stress disorder and posttraumatic stress disorder. In: Antony, MM.; Orsillo, SM.; Roemer, L., editors. *Practitioner's guide to empirically based measures of anxiety*. New York: Springer; 2001. p. 255-307.
- Pollack S, Bruce P, Borenstein M, Lieberman J. The resampling methods of statistical-analysis. *Psychopharmacology Bulletin*. 1994; 30:227–234. [PubMed: 7831460]
- Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. *Applied Psychological Measurement*. 1977; 1:385–401.
- Ruggiero KJ, Ben KD, Scotti JR, Rabalais AE. Psychometric properties of the PTSD Checklist – Civilian Version. *Journal of Traumatic Stress*. 2003; 16:495–502. [PubMed: 14584634]
- Ruggiero KJ, Gros KS, McCauley JL, Resnick HS, Morgan M, Kilpatrick DG, Acierno R. Mental health outcomes among adults in Galveston and Chambers counties after Hurricane Ike. *Disaster Medicine and Public Health Preparedness*. 2012; 6:26–32. [PubMed: 22490934]

Fig. 1.
Simple effects of the association between mental health symptoms and loss of services for urban and non-urban participants

Table 1

Descriptive statistics and demographic variables for Urban and Non-Urban Participants

Variable	Urban sample (n=208)	Non-Urban (n=1041)	<i>p</i> -value
% Caucasian	70.1	77.5	0.02 ^a
Age	47.10 (17.99)	45.54 (17.13)	0.23 ^b
% Male	54.3	51.1	0.40 ^a
Total Loss of Service (in days)	56.12 (102.81)	22.15 (52.70)	< 0.01 ^b
Electricity	26.43 (34.50)	10.42 (20.69)	< 0.01 ^c
Water	7.50 (25.05)	1.82 (7.62)	< 0.01 ^c
Food	2.19 (6.94)	0.76 (3.10)	< 0.01 ^c
Shelter	4.29 (21.49)	1.17 (11.48)	< 0.01 ^c
Clean Clothing	5.10 (22.57)	1.31 (4.81)	< 0.01 ^c
Transportation	4.26 (24.57)	2.09 (22.43)	< 0.01 ^c
Money	9.49 (38.09)	4.79 (22.71)	0.32 ^c
PCL	25.70 (11.12)	22.12 (9.71)	< 0.01 ^b
CES-D-10	18.81 (4.32)	18.00 (4.36)	< 0.01 ^b
PSWQ	49.82 (11.25)	44.40 (11.32)	< 0.01 ^b

^a=chi-square test of independence.^b=independent sample *t*-test.^c=Kruskal – Wallis Analysis of Ranks. Values in parentheses are standard deviations

Table 2

Urban/non-urban moderation of the association between loss of services and psychiatric symptoms

Moderation effects				
DV	Predictor	<i>b</i>	Bootstrap 95 % confidence intervals	
			Lower	Upper
PTSD				
$R^2_{\Delta}=0.06^{**}$	Gender ²	-2.18**	-3.34	-1.06
	Income	-0.97**	-1.32	-0.57
	Age	0.02	-0.02	0.06
	Racial Status ¹	3.60**	1.76	5.64
	Urban/Non-Urban ³	-2.17*	-3.76	-0.15
	Loss of Services	0.07**	0.05	0.10
	Interaction	0.07**	0.02	0.10
Depression				
$R^2_{\Delta}=0.04^{**}$	Gender ²	-1.44**	-1.94	-0.90
	Income	-0.24**	-0.39	-0.08
	Age	0.01	-0.02	0.02
	Racial Status ¹	1.27**	0.49	2.08
	Urban/Non-Urban ³	-0.58	-1.30	0.16
	Loss of Services	0.02**	0.02	0.03
	Interaction	0.02**	0.01	0.03
Worry				
$R^2_{\Delta}=0.04^{**}$	Gender ²	-5.22**	-7.58	-2.69
	Income	-0.27	-0.96	0.40
	Age	-0.03	-0.12	0.06
	Racial Status ¹	3.21*	0.54	5.89
	Urban/Non-Urban ³	-2.43	-5.85	0.91
	Loss of Services	0.03**	0.02	0.05
	Interaction	0.02	-0.01	0.05
Explication of Moderation Effects Across Urban and Non-Urban				
PTSD				
Urban; $R^2=0.01$	Gender ²	-5.35**	-8.43	-2.29
	Income	-1.61**	-2.52	-0.50
	Age	-0.09	-0.19	0.00
	Racial Status ¹	-0.89	-4.79	3.13
	Loss of Services	0.03*	0.01	0.07
Non-Urban; $R^2=0.11^{**}$	Gender ²	-1.59**	-2.79	-0.47
	Income	-0.83**	-1.20	-0.41
	Age	0.05*	0.01	0.09
	Racial Status ¹	4.56**	2.50	6.70

Moderation effects				
DV	Predictor	<i>b</i>	<u>Bootstrap 95 % confidence intervals</u>	
			Lower	Upper
Depression	Loss of Services	0.08**	0.06	0.11
	Urban; $R^2 < 0.01$			
	Gender ²	-1.61*	-2.92	-0.33
	Income	-0.52*	-0.89	-0.13
	Age	-0.02	-0.06	0.03
	Racial Status ¹	-0.44	-2.20	1.45
	Loss of Services	< 0.01	-0.01	0.01
	Non-Urban; $R^2 = 0.10^{**}$			
	Gender ²	0.01**	-1.99	-0.87
	Income	-0.18*	-0.35	-0.01
	Age	1.66	-0.01	0.03
	Racial Status ¹	-1.43**	0.75	2.59
	Loss of Services	0.03**	0.02	0.03

¹ = Caucasian is reference group.

² = Female is reference group.

³ = Non-urban is reference group