Published in final edited form as:

Soc Psychiatry Psychiatr Epidemiol. 2013 November ; 48(11): 1721–1727. doi:10.1007/s00127-013-0684-0.

Pre-Typhoon Socioeconomic Status Factors Predict Post-typhoon Psychiatric Symptoms in a Vietnamese Sample

Ruth C. Brown, Ph.D.¹, Stephen K. Trapp, M.Ed.², Erin C. Berenz, Ph.D.¹, Tim Bernard Bigdeli, Ph.D.¹, Ron Acierno, Ph.D.³, Trinh Luong Tran, MD⁴, Lam Tu Trung, MD⁵, Nguyen Thanh Tam, MSc⁶, Tran Tuan, PhD⁷, La Thi Buoi, MD⁷, Tran Thu Ha, MPH⁷, Tran Duc Thach, MPH⁷, and Ananda B. Amstadter, Ph.D.¹

¹Virginia Institute for Psychiatric and Behavioral Genetics, Virginia Commonwealth University, Richmond, VA, USA

²Virginia Commonwealth University, Department of Psychology, Richmond, VA, USA

³Medical University of South Carolina, Department of Psychiatry and Behavioral Sciences, Charleston, SC, USA

⁴Health Department of Da Nang City, Vietnam

⁵Da Nang Mental Health Hospital, Da Nang City, Vietnam

⁶Vietnam Veterans of America Foundation, Washington, DC, USA

⁷Research and Training Center for Community Development, Hanoi, Vietnam

Abstract

Purpose—Exposure to natural disasters has been associated with increased risk for various forms of psychopathology. Evidence indicates that socioeconomic status (SES) may be important for understanding post-disaster psychiatric distress; however, studies of SES-relevant factors in non-Western, disaster-exposed samples are lacking. The primary aim of the current study was to examine the role of pre-typhoon SES-relevant factors in relation to post-typhoon psychiatric symptoms among Vietnamese individuals exposed to Typhoon Xangsane.

Methods—In 2006, Typhoon Xangsane disrupted a mental health needs assessment in Vietnam in which the Self Reporting Questionnaire-20 (SRQ-20) and the Demographic and Health Surveys Wealth Index, a measure of SES created for use in low-income countries, were administered pre-typhoon. The SRQ-20 was re-administered post-typhoon.

Results—Results of a linear mixed model indicated that the covariates of older age, female sex, and higher levels of pre-typhoon psychiatric symptoms were associated with higher levels of post-typhoon psychiatric symptoms. Analysis of SES indicators revealed that owning fewer consumer goods, having lower quality of household services, and having attained less education were associated with higher levels of post-typhoon symptoms, above and beyond the covariates, whereas quality of the household build, employment status, and insurance status were not related to post-typhoon psychiatric symptoms.

Conclusion—Even after controlling for demographic characteristics and pre-typhoon psychiatric symptoms, certain SES factors uniquely predicted post-typhoon psychiatric distress. These SES

Correspondence concerning this article should be addressed to: Ananda Amstadter, PhD., Virginia Institute for Psychiatric and Behavioral Genetics, Virginia Commonwealth University, 800 East Leigh Street, Biotech 1, Suite 101, Richmond VA 23219-1534, Telephone (804) 828-4046, Telefax (804) 828-1471, abamstadter@vcu.edu.

Conflict of Interest: The authors have no conflicts of interest to report at this time.

characteristics may be useful for identifying individuals in developing countries who are in need of early intervention following disaster exposure.

Keywords

Vietnam; epidemiology; socioeconomic status; natural disaster; mental health

Natural disasters are associated with the development of a number of forms of psychopathology (e.g., anxiety disorders, mood disorders)[1–3], with some estimates indicating that as many as 21.8% of disaster survivors meet criteria for posttraumatic stress disorder (PTSD), 21.5% for phobias, and 16.1% for depression up to two years post disaster [4]. Relatively high rates of post-disaster psychopathology represent a public health concern [5]. Enhanced understanding of the factors associated with elevated risk for psychopathology following disaster exposure is crucial for improving secondary prevention and early intervention efforts.

Low socioeconomic status (SES) is one such factor that may increase risk for postdisaster psychopathology. A strong relationship between low SES and psychiatric morbidity has been established in both developed and developing nations of high, medium, and low-income status [6–8]. Research in non-disaster samples has found that SES indices such as education attainment, poverty, housing quality, and unemployment are related to elevated risk for chronic stress [9, 10] and psychological disorders [11–15]. Furthermore, individuals with, compared to without, a history of chronic stress have demonstrated altered psychobiological (e.g., immunoregulatory, endocrine) and psychological responses when confronted with an acute stressor [16–19]. Lack of insurance, another SES-related factor, similarly has been related to poorer physical and behavioral health outcomes, such as under-utilization of preventative and acute healthcare services [20, 21].

In post-disaster samples from Western countries, lower SES is related to greater levels of post-disaster psychiatric distress [22–24]. For example, a five-year follow-up of Hurricane Katrina survivors found that enduring psychological distress was especially high among individuals of low SES pre-disaster, while individuals with higher SES pre-hurricane had faster recoveries [25]. Similarly, among individuals in Mexico assessed following severe storms that resulted in flooding and landslides, wealth indices such as low income and low consumer ownership (i.e., ownership of durable goods such as televisions, telephones, bicycles, etc.) have been found to be predictive of higher levels of post-disaster psychiatric symptoms [26].

SES variables, such as education and indices of wealth, also have been associated with post-disaster mental health functioning in non-Western samples [27]. For example, in a prospective study examining PTSD symptoms and quality of life before and three years after a major earthquake in Taiwan, researchers found that years of education significantly predicted psychopathology post-disaster, where higher levels of educational attainment were predictive of lower levels of psychopathology [23, 28]. To our knowledge, no studies have examined the relationship between SES factors and post-disaster psychiatric symptoms using a pre-post design in non-Western samples, nor has any one investigation examined a range of SES-relevant factors in relation to psychiatric symptoms. Furthermore, much of the disaster research utilizes non-representative subject selection [24, 29].

The present study used a unique pre-post design in a representative sample of typhoon-exposed Vietnamese adults. The primary aim of the current study was to examine the role of SES-relevant factors (i.e., health insurance status, education, employment status, indices of wealth) assessed pre-typhoon in relation to post-typhoon psychiatric symptoms, above and

beyond the variance accounted for by pre-typhoon psychiatric symptoms and demographic characteristics. It was hypothesized that lower SES would predict greater endorsement of post-typhoon psychiatric symptoms.

Method

A brief overview of the methodology is delineated below; for a comprehensive account of the study procedures see Amstadter and colleagues' initial report on the post-disaster findings [30]. This report represents one component of a larger multi-component study. In August 2006, 1,914 households in the DaNang & Khanh Hoa provinces of Vietnam were surveyed by professional interviewers for the purposes of establishing prevalence estimates of mental health problems and associated needs of individuals in Vietnam. All research activities involving human subjects were reviewed and approved by appropriate ethics committees. The initial data collection (referred to hereafter as Wave 1) occurred between August and October of 2006, with Typhoon Xangsane striking Da Nang province on October 26th. Participant recruitment and interviewing were halted, and study personnel consulted with the Disaster Research Education and Mentoring Center (DREM), a National Institute of Mental Health-funded research advisory group. The research design was adapted so that a randomly selected sample of approximately 800 participants who had been screened prior to the typhoon were re-assessed following the event, this time with diagnostic data (Wave 2), conducted between January 8 and January 15, 2007, in 21 of the 28 communes in Da Nang. These procedures yielded a total of 798 completed post-typhoon interviews within 534 households, with between 1 and 5 respondents per household (median = 2, mode = 1 per household). Full data were available for 782 participants. Although clinical diagnostic interviews were administered post-typhoon [30], they were not administered pre-typhoon, thus they were not examined in these analyses. The present investigation utilizes the post-typhoon (Wave 2) Self Reporting Questionnaire-20 (SRQ-20) data, as well as pre-typhoon SRQ-20 and self-report SES and demographic data (Wave 1).

Variables

Demographic Variables (Wave 1)—Sex was defined as 1 = male, 2 = female. Age was measured categorically (18–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75–96).

Socioeconomic status-relevant factors (Wave 1)—Six factors related to SES were examined: health insurance status, education, employment status, and three indices of wealth. Health insurance status was measured dichotomously in which the participants reported a presence or absence of current health insurance. Education (highest level attained) was measured in eight levels ranging from no school to completed college/university/post-graduate school. Employment status was measured dichotomously in which the participants reported a presence or absence of current employment. Participants were classified as unemployed if they indicated they were unable to work or were receiving unemployment. Participants who were retired, too young to work, students, or who worked in the home were classified as employed.

The indices of wealth were measured by a modified version of the Demographic and Health Surveys (DHS) Wealth Index, a tool co-constructed by the World Bank and Macro International [31–33]. The indices include consumer durables, housing services, and housing qualities. Each of the indices was comprised of the scaled sum of the number of specific commodities owned or accessible to the participants so that possible scores ranged from 0–1 following DHS Wealth Index scoring guidelines [33].

1. Consumer durables: bicycle, motorbike, black and white television, color television, VCR/DVD player, washing machine, telephone, and refrigerator.

2. Housing services: potable water, toilet, and fuel source.
3. Housing qualities: wall integrity, roof integrity, and floor integrity.

Similar factors to the Wealth Index Measurement Tool (e.g., wall material, floor material, roof material, availability of electricity, type of sewerage and water facilities) have been used in other large non-disaster epidemiological studies in multiple countries in Latin America and in Ghana [34, 35], and Southeast-Asian-samples [31].

Self-Reporting Questionnaire-20 (Waves 1 and 2)—The SRQ-20 is a 20-item self-report measure developed by the World Health Organization as a screening tool for psychiatric disorders [36, 37]. Participants are instructed to indicate whether there has been a presence or absence of 20 psychiatric symptoms (e.g., “Do you feel nervous, tense or worried?”, “Do you cry more than usual?”) over a 30-day recall period. The current study utilized the total SRQ-20 scores assessed pre- and post-typhoon in the primary analyses. SRQ-20 probable “caseness” was defined using a 7/8 cut score as recommended in the literature [38, 39]. In a community Vietnamese sample, the sensitivity of the SRQ-20 was 73%, specificity was 82%, and AUC = .84 [40]. The SRQ-20 has been shown to be reliable and valid in Vietnamese samples [41], and maintained high internal reliability in the present study (Cronbach’s $\alpha = .87$).

Data Analytic Plan

Analyses were conducted in SPSS version 19.0. First, zero-order correlations were obtained among the primary variables of interest. Second, a linear mixed model analysis was conducted to evaluate the relationship between the SES variables and post-typhoon psychiatric symptoms. A null model was first evaluated to estimate the amount of variance in post-typhoon SRQ-20 scores. The criterion variable was Wave 2 (i.e., post-typhoon) SRQ-20 score. Next, a reduced model with the covariates of age, sex, and Wave 1 (i.e., pre-typhoon) SRQ-20 score entered as fixed effects was examined to estimate the amount of variance accounted for by the covariates. Lastly, a full model that included the covariates and SES variables was examined to estimate the amount of variance accounted for above and beyond the covariates. Individuals were clustered within households ($n = 534$), and following, household was included as a random effect to adjust for correlated errors among household members in each analysis.

Results

The current study consisted of 798 participants (56.4% female; $M_{age} = 44.8$ years, $SD = 16.5$, Range = 18–96), of which 782 had complete data pre- and post-typhoon. See Table 1 for descriptive statistics and zero-order correlations. Of the sample, 12.1% reported being unemployed or unable to work, and 47.6% reported being uninsured. Nearly half (48.5%) had a primary school education or less. Another quarter completed secondary education (24.6%), 16.7% completed high school, and 5.2% completed college. With regard to psychiatric symptoms, 20.5% ($n = 160$) of the sample met criteria for probable pre-typhoon psychopathology caseness and 27.2% ($n = 213$) met criteria for probable post-typhoon psychopathology caseness, as reported in a previous report from this dataset [31].

The SES-relevant variables of consumer durables, housing quality, housing services, and highest level of education were significantly, moderately correlated in the expected directions for the majority of variables, with the strongest association being observed between housing services and consumer durables ($r = .39$). Employment status and insurance status were not significantly related to post-typhoon SRQ-20 score post-typhoon, and therefore not included in the regression model. All other SES variables were

significantly negatively correlated with post-typhoon SRQ-20 score, with lower/poorer consumer durables, housing quality, housing services, and education level pre-typhoon being associated with greater psychiatric symptoms post-typhoon. The covariates of age, sex, and pre-typhoon SRQ-20 score were significantly correlated with post-typhoon SRQ-20 score, with individuals endorsing greater levels of post-typhoon psychiatric symptoms being more likely to be of younger, female, and endorsing greater levels of pre-typhoon psychiatric symptoms.

As shown in Table 2, all models included household as a random effect to control for the effects of individuals clustered within households. This effect was significant for all models, indicating that a significant amount of variance was accounted for by family-level factors. The reduced, covariate-only model accounted for a significant 27.69% of variance in post-disaster psychiatric symptoms over the null model, with age, sex, and Wave 1 SRQ-20 scores being significant positive predictors of Wave 2 SRQ-20 scores.

The full linear mixed model significantly predicted 32.19% of variance in Wave 2 SRQ-20 scores, accounting for a significant 4.5% of variance, above and beyond the covariates ($F(4, 789) = 12.5, p < .001$). Specifically, lower pre-typhoon levels of education, consumer durables (e.g., bike, television), and quality of household services (e.g., water source, toilet) were related to greater post-typhoon SRQ-20 scores. Sex dropped from significance in the full model, indicating that once SES was taken into account, sex no longer predicted post-typhoon symptoms. The residual variance remained significant in the full model, indicating that there is significant variance that is not accounted for by the variables in the model.

Discussion

The current study examined the relationship between several indicators of SES and psychiatric symptoms within a sample of Vietnamese survivors of typhoon Xangsane in a unique pre-post disaster design. One notable strength of this design is that it affords the examination of the temporal ordering of the effects of pre-disaster psychological and demographic variables on post-disaster psychiatric symptoms.

Controlling for age, sex, and pre-typhoon psychiatric symptoms, we found a significant, albeit small, effect of select SES-relevant factors on post-typhoon psychiatric symptoms. First, poorer housing services (e.g., fuel, water, toilet) and lower ownership of consumer durables were predictive of greater levels of post-typhoon psychiatric symptoms. Decreased access to such goods and services may contribute towards greater levels of chronic stress pre-typhoon, which decreased individuals' ability to cope with the acute stressor of the disaster itself [16–19].

Second, lower levels of education were related to greater levels of post-typhoon psychiatric symptoms, which is consistent with previous research [23, 27]. Although much research has identified this link, the mechanism through which lower education may confer risk for psychiatric symptoms in response to a natural disaster has been largely speculative (e.g., knowledge of and ability to access coping resources [42, 43]) and presents itself as an area in need of further research. It is note worthy that the relationship between sex and post-typhoon psychiatric symptoms was no longer significant when SES-relevant factors was taken into account, given that the link between sex and post-stressor psychiatric symptoms has been well established [44]. One possible explanation is the covariance between sex and education. In this sample, women had less educational attainment on average than men, and thus may have been more likely to experience the influence of low education on post-disaster psychiatric symptoms. More research is needed to understand the relationship between sex, education, and post-disaster adjustment.

The quality of the housing structure was not a significant predictor of post-typhoon symptoms; however, the range of housing quality was restricted in this sample, with the majority of the sample having housing structures with sturdy floors, walls and roofs. It is possible, therefore, that the variability in SES was better captured by the quality of housing utility services, and to some extent consumer durables.

Neither employment nor health insurance status was associated with psychiatric symptoms in the immediate aftermath (i.e., 2–3 months) of the typhoon at the zero-order level. The lack of relationship between employment and post-disaster distress is consistent with previous research [23]. Given that employment was not correlated with other indices of SES, employment, as a binary variable, may not serve as a useful indicator of SES in Vietnamese samples. The absence of a relationship between health insurance status and post-disaster psychiatric symptoms may be due to several factors including strain on health system infrastructure and the influx of first-responders, volunteers, and non-governmental organizations (NGOs) in the aftermath of disaster [45]. Given that this sample was collected in the short-term aftermath of the typhoon, it is possible that the role of employment status and health insurance would play a greater role as aid workers leave [45].

The effects of natural disasters can be catastrophic to large segments of the population, and the devastating economic and emotional effects can last years. The most economically disadvantaged members of an affected community may be most vulnerable to the negative effects of a natural disaster, including poorer mental health outcomes, compared to individuals of higher SES [25]. Identification of specific SES variables that are most associated with poor post-disaster mental health outcomes is important for early responders to better identify those in need of secondary prevention or early intervention following a disaster.

These findings should be considered in light of certain limitations. First, the post-disaster assessment occurred within a two- to three-month period post-disaster; therefore results might reflect acute responses to disaster rather than long-term effects. However, past research has found effects of SES on psychopathology three [23] and five years [25] post-disaster. Second, the data were self-report in nature. Future studies utilizing multi-method measurement are needed. Third, the SRQ-20 is a screening tool, as opposed to a diagnostic tool, and thus provides a rough estimate of psychiatric symptoms. Nevertheless, the SRQ-20 has been shown to be reliable and valid in Vietnamese samples [31, 38]. Fourth, the current study examined a number of SES-relevant factors; however, there are multiple ways to assess SES. Although the DHS Wealth Index has been developed and validated for use in developing, non-Western countries [31–33], continued research focused on understanding ideal methods for quantifying SES in non-Western samples is needed. Despite these limitations, the ability to examine factors associated with psychiatric symptoms before and after disaster in a large epidemiological sample presents compelling results that contribute to our growing knowledge of specific SES factors and their role in psychiatric symptoms following natural disasters.

Taken together, the findings of this study are largely consistent with theories suggesting that individuals with poorer mental health functioning and lower SES are more likely to have reduced personal, social, and/or economic resources to draw upon in the face of a disaster [46–48]. Although multiple indicators of SES were significant predictors of post-disaster psychiatric symptoms, it is worth noting that there was still significant variance not accounted for by SES and the covariates. The significant effect of household in the current study suggests that family-level factors, above and beyond shared SES, are important for understanding post-disaster mental health. Indeed, research has found that both shared family environment and genetic factors are associated with psychiatric distress following

traumatic experiences [49–51]. Response to acute stress, such as a natural disaster, is a complex process that we are only beginning to understand. Continued research is needed to understand micro- and macro-level factors associated with post-disaster mental health functioning, and the interplay between such factors.

Acknowledgments

This research was supported by a grant from Atlantic Philanthropies to the Community Health Centers of Da Nang and Khanh Hoa, Vietnam, with personnel and technical support from the Veterans for America Foundation. Special thanks to Anne Seymour for her assistance in coordinating international efforts of the research team.

References

1. Fan F, Zhang Y, Yang Y, Mo L, Liu X. Symptoms of posttraumatic stress disorder, depression, and anxiety among adolescents following the 2008 Wenchuan earthquake in China. *J Trauma Stress*. 2011; 24(1):44–53. [PubMed: 21351164]
2. Galea S, Brewin CR, Gruber M, Jones RT, King DW, King LA, et al. Exposure to hurricane-related stressors and mental illness after Hurricane Katrina. *Archives of General Psychiatry*. 2007; 64(12): 1427–1434. [PubMed: 18056551]
3. Onder E, Tural U, Aker T, Kilic C, Erdogan S. Prevalence of psychiatric disorders three years after the 1999 earthquake in Turkey: Marmara Earthquake Survey (MES). *Soc Psychiatry Psychiatr Epidemiol*. 2006; 41(11):868–874. [PubMed: 16906439]
4. Meewisse ML, Olff M, Kleber R, Kitchiner NJ, Gersons BPR. The course of mental health disorders after a disaster: Predictors and comorbidity. *J Trauma Stress*. 2011; 24(4):405–413. [PubMed: 21815216]
5. IFRC. International Federation of Red Cross and Red Crescent Societies World disaster report 2004. New York: Oxford University Press; 2004.
6. Lund C, Breen A, Flisher AJ, Kakuma R, Corrigall J, Joska JA, et al. Poverty and common mental disorders in low and middle income countries: A systematic review. *Soc Sci Med*. 2010; 71(3):517–528. [PubMed: 20621748]
7. Kessler RC, Chiu WT, Demler O, Walters EE. Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*. 2005; 62(6):617. [PubMed: 15939839]
8. Andrade L, Caraveo-Anduaga J, Berglund P, Bijl R, Kessler R, Demler O, et al. Cross-national comparisons of the prevalences and correlates of mental disorders. *Bull World Health Organ*. 2000; 78(4):413–426. [PubMed: 10885160]
9. Baum A, Garofalo J, Yali A. Socioeconomic status and chronic stress: Does stress account for SES effects on health? *Ann N Y Acad Sci*. 1999; 896(1):131–144. [PubMed: 10681894]
10. Pampel FC, Krueger PM, Denney JT. Socioeconomic disparities in health behaviors. *Annu Rev Sociol*. 2010; 36:349–370. [PubMed: 21909182]
11. Ritsher JEB, Warner V, Johnson JG, Dohrenwend BP. Inter-generational longitudinal study of social class and depression: a test of social causation and social selection models. *Br J Psychiatry*. 2001; 178(40):s84–s90.
12. Weich S, Lewis G. Poverty, unemployment, and common mental disorders: population based cohort study. *BMJ*. 1998; 317(7151):115–119. [PubMed: 9657786]
13. Hudson CG. Socioeconomic status and mental illness: tests of the social causation and selection hypotheses. *Am J Orthopsychiatry*. 2005; 75(1):3–18. [PubMed: 15709846]
14. Fryers T, Melzer D, Jenkins R. Social inequalities and the common mental disorders. *Soc Psychiatry Psychiatr Epidemiol*. 2003; 38(5):229–237. [PubMed: 12719837]
15. Stansfeld SA, Clark C, Rodgers B, Caldwell T, Power C. Repeated exposure to socioeconomic disadvantage and health selection as life course pathways to mid-life depressive and anxiety disorders. *Soc Psychiatry Psychiatr Epidemiol*. 2011; 46(7):549–558. [PubMed: 20383489]

16. Pike JL, Smith TL, Hauger RL, Nicassio PM, Patterson TL, McClintick J, et al. Chronic life stress alters sympathetic, neuroendocrine, and immune responsivity to an acute psychological stressor in humans. *Psychosom Med*. 1997; 59(4):447–457. [PubMed: 9251165]
17. Gold S, Zakowski S, Valdimarsdottir H, Bovbjerg D. Stronger endocrine responses after brief psychological stress in women at familial risk of breast cancer. *Psychoneuroendocrinology*. 2003; 28(4):584–593. [PubMed: 12689614]
18. Valdimarsdottir HB, Zakowski SG, Gerin W, Mamakos J, Pickering T, Bovbjerg DH. Heightened psychobiological reactivity to laboratory stressors in healthy women at familial risk for breast cancer. *J Behav Med*. 2002; 25(1):51–65. [PubMed: 11845558]
19. James GD, Berge-Landry H, Valdimarsdottir HB, Montgomery GH, Bovbjerg DH. Urinary catecholamine levels in daily life are elevated in women at familial risk of breast cancer. *Psychoneuroendocrinology*. 2004; 29(7):831–838. [PubMed: 15177698]
20. Xiong GL, Iosif AM, Bermudes RA, McCarron RM, Hales RE. Preventive medical services use among community mental health patients with severe mental illness: The influence of gender and insurance coverage. *Prim Care Companion J Clin Psychiatry*. 2010; 12(5)
21. Wells KB, Sherbourne CD, Sturm R, Young AS, Audrey Burnam M. Alcohol, drug abuse, and mental health care for uninsured and insured adults. *Health Serv Res*. 2002; 37(4):1055–1066. [PubMed: 12236383]
22. Chen ACC, Keith VM, Airriess C, Li W, Leong KJ. Economic vulnerability, discrimination, and Hurricane Katrina: Health among black Katrina survivors in eastern New Orleans. *J Am Psychiatr Nurses Assoc*. 2007; 13(5):257–266.
23. Tsai KY, Chou P, Chou FHC, Su TTP, Lin SC, Lu MK, et al. Three-year follow-up study of the relationship between posttraumatic stress symptoms and quality of life among earthquake survivors in Yu-Chi, Taiwan. *J Psychiatr Res*. 2007; 41(1):90–96. [PubMed: 16325854]
24. Kohn R, Levav I, Garcia ID, Machuca ME, Tamashiro R. Prevalence, risk factors and aging vulnerability for psychopathology following a natural disaster in a developing country. *Int J Geriatr Psychiatry*. 2005; 20(9):835–841. [PubMed: 16116578]
25. Paxson C, Fussell E, Rhodes J, Waters M. Five years later: Recovery from post traumatic stress and psychological distress among low-income mothers affected by Hurricane Katrina. *Soc Sci Med*. 2011
26. Jones EC, Gupta SN, Murphy AD, Norris FH. Inequality, Socioeconomic Status, and Social Support in Post-Disaster Mental Health in Mexico. *Hum Organ*. 2011; 70(1):33–43.
27. Xu J, He Y. Psychological health and coping strategy among survivors in the year following the 2008 Wenchuan earthquake. *Psychiatry Clin Neurosci*. 2012; 66(3):210–219. [PubMed: 22443243]
28. Seplaki CL, Goldman N, Weinstein M, Lin YH. Before and after the 1999 Chi-Chi earthquake: Traumatic events and depressive symptoms in an older population. *Soc Sci Med*. 2006; 62(12): 3121–3132. [PubMed: 16423437]
29. Norris FH, Friedman MJ, Watson PJ, Byrne CM, Diaz E, Kaniasty K. 60,000 Disaster Victims Speak: Part 1 An Empirical Review of the Empirical Literature 1981–2001. *Psychiatry*. 2002; 65(3):207–239. [PubMed: 12405079]
30. Amstadter AB, Acierno R, Richardson LK, Kilpatrick DG, Gros DF, Gaboury MT, et al. Posttyphoon prevalence of posttraumatic stress disorder, major depressive disorder, panic disorder, and generalized anxiety disorder in a Vietnamese sample. *J Trauma Stress*. 2009; 22(3):180–188. [PubMed: 19455707]
31. Richardson LK, Amstadter AB, Kilpatrick DG, Gaboury MT, Tran TL, Trung LT, et al. Estimating mental distress in Vietnam: The use of the SRQ-20. *Int J Soc Psychiatry*. 2010; 56(2):133. [PubMed: 20207676]
32. Gwatkin, DR.; Rutstein, S.; Johnson, K.; Suliman, E.; Wagstaff, A.; Amouzou, A. Socio-economic differences in health, nutrition, and population within developing countries An overview. Washington DC: World Bank; 2007.
33. Rutstein, S.; Johnson, K. DHS Comparative Reports No. 6. Calverton, Maryland: ORC Macro; 2011. The DHS Wealth Index. 2004 Editor (Ed.), ^ (Eds)

34. Arias E, Vos S. Using housing items to indicate socioeconomic status: Latin America. *Soc Indic Res.* 1996; 38(1):53–80.
35. Fiadzo ED, Houston JE, Godwin DD. Estimating housing quality for poverty and development policy analysis: CWIQ in Ghana. *Soc Indic Res.* 2001; 53(2):137–162.
36. Organization, WH. A Users Guide to the Self Reporting Questionnaire (SRQ). World Health Organization; Geneva, Switzerland: 1994.
37. A User's Guide to the Self-Reporting Questionnaire (SRQ). World Health Organization; Geneva: 1994.
38. Tuan T, Harpham T, Huong N. Validity and reliability of the self-reporting questionnaire 20 items (SRQ20) in Vietnam. *Hong Kong Journal of Psychiatry.* 2004; 14:15– 18.
39. Harpham T, Reichenbaum M, Oser R, Thomus E, Hamid N, Jaswal S, et al. How to do (or not to do...) Measuring mental health in a cost effective manner. *Health Policy and Planning.* 2003; 18:344–349. [PubMed: 12917276]
40. Tuan T, Harpham T, Huong N. Validity and reliability of the self- reporting questionnaire 20 items (SRQ20) in Vietnam. *Hong Kong J Psychiatry.* 2004; 14:15–18.
41. Giang KB, Allebeck P, Kullgren G, Nguyen VT. The Vietnamese version of the self reporting questionnaire 20 (SRQ20) in detecting mental disorders in rural Vietnam: A validation study. *International Journal of Social Psychiatry.* 2006; 52:175–184. [PubMed: 16615249]
42. Asgary A, University of Tarbiat M; Willis KG, University of Newcastle upon T. Household Behaviour in Response to Earthquake Risk: An Assessment of Alternative Theories. *Disasters.* 2002; 21(4):354–365. [PubMed: 9455007]
43. von dem Knesebeck O, Mnich E, Daubmann A, Wegscheider K, Angermeyer MC, Lambert M, et al. Socioeconomic status and beliefs about depression, schizophrenia and eating disorders. *Soc Psychiatry Psychiatr Epidemiol.* 2012:1–8.
44. Olff M, Langeland W, Draijer N, Gersons BPR. Gender differences in Posttraumatic Stress Disorder. *Psychol Bull.* 2007; 133:183–204. [PubMed: 17338596]
45. Johnson J, Galea S. *Disasters and Population Health.* 2009:281–326.
46. Freedy JR, Saladin ME, Kilpatrick DG, Resnick HS, Saunders BE. Understanding acute psychological distress following natural disaster. *Journal of Traumatic Stress.* 1994; 7(2):257–273. [PubMed: 8012746]
47. Freedy JR, Shaw DL, Jarrell MP, Masters CR. Towards an understanding of the psychological impact of natural disasters: An application of the conservation resources stress model. *J Trauma Stress.* 2006; 5(3):441–454.
48. Acierio R, Amstadter AB, Gros DF, Richardson L, Kilpatrick DG, Trung LT, et al. A pre-/post-disaster epidemiological study of mental health functioning in Vietnam's Da Nang Province following Typhoon Xangsane. *International Perspectives in Victimology.* 2009; 4(1):78–85. [PubMed: 20523909]
49. Amstadter AB, Aggen SH, Knudsen GP, Reichborn-Kjennerud T, Kendler KS. Potentially traumatic event exposure, posttraumatic stress disorder, and Axis I and II comorbidity in a population-based study of Norwegian young adults. *Soc Psychiatry Psychiatr Epidemiol.* 2012:1–9.
50. Koenen KC, Harley R, Lyons MJ, Wolfe J, Simpson JC, Goldberg J, et al. A twin registry study of familial and individual risk factors for trauma exposure and posttraumatic stress disorder. *J Nerv Ment Dis.* 2002; 190(4):209–218. [PubMed: 11960081]
51. Stein MB, Jang KJ, Taylor S, Vernon PA, Livesley WJ. Genetic and environmental influences on trauma exposure and posttraumatic stress disorder: A twin study. *A J Psychiatry.* 2002; 159(10): 1675–1681.

Table 1

Descriptive Statistics and Zero-Order Correlations (n = 782)

Variable ^a	1	2	3	4	5	6	7	8	9	Mean (SD) or %	Observed Range
1. Age										44.8 (16.5)	18–96
2. Sex	-.02**									56.4% female	
3. Wave 1 SRQ-20	.25***	.10**								4.3 (4.3)	0–20
4. Consumer durables	-.09**	.06	-.32***							.62 (.25)	0–1
5. Housing Quality	.02	-.05	-.04	.18***						.98 (.12)	0–1
6. Housing Services	-.06	.00	-.27***	.39***	.14***					.86 (.23)	.33–1
7. Education	-.36***	-.18***	-.31***	.35***	.09*	.17***				2.7 (1.5)	1–6
8. Employment	.17***	.21***	-.05	.02	-.01	-.12**	.00			87.9% employed	
9. Health Insurance	.14***	.05	.03	-.04	-.01	.05	.06	.07*		52.3% insured	
10. Wave 2 SRQ-20	.31***	.12**	.57***	-.33***	-.11**	-.32***	-.36***	-.01	.05	4.8 (4.6)	0–20

Note:

*
 $p < .05$ **
 $p < .01$ ***
 $p < .001$;

^a Age was measured categorically (1 = 18–24, 2 = 25–34, 3 = 35–44, 4 = 45–54, 5 = 55–64, 6 = 65–74, 7 = 75–96); Sex (1 = male, 2 = female); Wave 1 SRQ-20[37] measured pre-typhoon psychiatric symptom; Consumer durables, housing quality and housing services represent scaled means ranging from 0–1. Education (highest level attained) was measured in eight levels ranging from no school to completed college/university/post-graduate school; Employment (0 = no, 1 = yes); Health Insurance (0 = 1, 1 = yes); Wave 2 SRQ-20[37] measured post-typhoon psychiatric symptom count.

Table 2

Linear Mixed Model Estimates: Socioeconomic Predictors of Post-typhoon Psychiatric Distress

Predictor	Null Model	Reduced Model	Full Model
Fixed effects			
Intercept	4.81***	1.10***	8.11***
Age		.51***	.40***
Sex		-.60*	-.38
Wave 1 SRQ		.54***	.46***
Consumer durables			-1.74*
Housing Quality			-2.09
Housing Services			-2.73***
Education			-.41***
Variance Components			
Residual	13.83***	10.00***	9.38***
Household	7.81***	3.82***	3.44***
Pseudo R^2 and Goodness of Fit ^b			
R^2		.2769***	.3219***
ΔR^2			.045***
BIC		4351.901	4206.920

Note:

*
 $p < .05$ **
 $p < .01$ ***
 $p < .001$; $n = 797$.

^a Age was measured categorically (1 = 18–24, 2 = 25–34, 3 = 35–44, 4 = 45–54, 5 = 55–64, 6 = 65–74, 7 = 75–96); Sex (1 = male, 2 = female); Wave 1 SRQ-20[37] measured pre-typhoon psychiatric distress; Education (highest level attained) was measured in seven levels ranging from no school to completed college/university/post-graduate school; Wave 2 SRQ-20[37] measured post-typhoon psychiatric distress.

^b R^2 represents reduction of residual variance due to inclusion of fixed effects in the model compared to the null model. ΔR^2 represents reduction of residual variance in the full model compared to the reduced (covariate only) model.