A Pre-/Post-Disaster Epidemiological Study of Mental Health Functioning in Vietnam's Da Nang Province Following Typhoon Xangsane

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Abstract

In 2006, typhoon Xangsane struck Vietnam and disrupted a large-scale mental health needs analysis in the Da Nang province of Vietnam. Recruitment of new participants was halted, and the design of study was altered to that of a pre-/post-event investigation in which 798 of the original 4,982 participants were re-interviewed. This produced the first pre-post disaster epidemiological study. Specifically, risk and protective factors were evaluated with respect to probable mental health "caseness" on the bases of the World Health Organization Short Response Questionnaire (SRQ-20) 7/8 cutoff (i.e., scores of 8 or more). Caseness prevalence was 20.7% pre-disaster and 27.1% post-disaster. Specific risk factors associated with mental health caseness included poor health, extreme peri-disaster fear, and experienced injury. Religious affiliation appeared to be a protective factor. In contrast to US samples, gender was not predictive of outcome.

Exposure to natural disasters may increase the risk of developing both physical and emotional problems (for review, see Briere & Elliott, 2000; Norris, 2005; Norris, Freidman, & Watson, 2002a, 2002b; Sajid, 2007). In a series of research reviews spanning the last 20 years, Norris and colleagues critically outlined effects of disasters on various psychiatric outcomes (e.g., posttraumatic stress disorder [PTSD], major depression disorder [MDD], generalized anxiety disorder [GAD], panic disorder [PD], substance use disorders), nonspecific distress (e.g., stress-related psychological and psychosomatic symptoms, sleep problems), reports of health problems (e.g., somatic complaints, medical conditions), chronic problems in living (e.g., troubled interpersonal relationships), and psychosocial resources (e.g., social support, self-efficacy, and perceived control). The authors highlighted a number of areas in need of additional study, including theory-driven research on basic processes and effects of natural disasters on health, complex studies of family systems and community-level processes, longitudinal studies, and ultimately, studies on diverse populations outside of the United States (Norris et al., 2002a, 2002b). Norris and colleagues placed particular emphasis on future investigations highlighting risk and protective factors for mental health problems in victims of disasters to inform treatment and prevention strategies.

Recent increases in hurricane frequency and intensity in the United States have directed attention to mental health

outcomes of those exposed to such events (Acierno, Ruggiero, Kilpatrick, Resnick, & Galea, 2006; Weisler, Barbee, & Townsend, 2006; Acierno et al. 2007; Galea et al., 2007; Kahn, Markert, Johnson, Owen, & Krane, 2007; Rhoads, Pearman, & Rick, 2007; Weems et al., 2007). As expected, hurricane researchers replicated previous findings of increased prevalence of negative mental health outcomes secondary to natural disasters (Acierno et al., 2007; Galea et al., 2007) in those exposed to hurricanes. Additionally, Acierno et al. (2007) identified risk factors for specific outcomes, including previous exposure to traumatic events, high fear during the hurricane itself, and low social support. Despite attempts to address previously identified limitations in the literature noted by Norris et al. (2002b), these investigations were limited to cross-sectional, rather than longitudinal research designs.

To date, no prospective psychiatric epidemiological disaster research (i.e., research that collects mental health-related data from the same individuals at both pre-disaster and post-disaster time points) exists. However, such an opportunity was serendipitously presented on October 26, 2006 when typhoon Xangsane (equivalent to a Category 4 hurricane), struck Vietnam during an epidemiological study of mental health. Despite an extraordinarily successful evacuation, Xangsane was responsible for at least 72 deaths, hundreds of severe injuries, and at least US$629 million in damages in Vietnam (Iglesias, 2006; Chaudhry & Ruysschaert, 2007). The storm destroyed over 300,000 homes, leaving hundreds of thousands of Vietnamese homeless (Chaudhry & Ruysschaert, 2007). As mentioned, typhoon Xangsane struck during a joint government – non-governmental organization (NGO) effort to assess mental health in the Da Nang region of Vietnam, thereby providing the first opportunity to study risk and protective factors associated with exposure to a natural disaster in a longitudinal format.

We hypothesized that affected Vietnamese individuals would respond to disaster in a manner similar to that of their US and European counterparts, with an elevated risk of negative mental health outcomes associated with lower self-reported health status, increased exposure or property loss from the typhoon, and displacement from the family home. We predicted that religious affiliation would be a proxy to social support and would, thus, be protective against negative outcomes.

Method

In 2006, the Da Nang Department of Health and the Khanh Hoa Health Service, in cooperation with several NGOs (i.e., the Research and Training Centre for Community Development [RTCCD], the Vietnam Veterans of America Foundation [VVAF], and the Atlantic Philanthropies) were conducting a mental health needs assessment of residents in their respective provinces. This epidemiological study sought to obtain prevalence data regarding general mental health problems using the World Health Organization 20-item Short Response Questionnaire (SRQ-20) (World Health Organization, 1994), for which a cutoff of 7/8 (eight or more items endorsed) has been established as indicative of "probable mental illness." The initial data collection (Wave 1) occurred between August and October of 2006, with typhoon Xangsane striking Da Nang province on October 26. Participant recruitment and interviewing were halted, and NGO study personnel consulted with the Disaster Research Education and Mentoring Center (DREM), a National Institute of Mental Health-funded research advisory group staffed by faculty from the Medical University of South Carolina and the University of Michigan, to determine how the study design should be modified.

Following DREM suggestions and training, the Vietnamese research team altered their original cross sectional study design so that 800 participants who had been interviewed prior to the typhoon were re-assessed following the event, thereby achieving a pre-disaster post-disaster study. Wave 2 was conducted between January 8 and January 15, 2007 in 21 of the 28 communes in Da Nang. Wave 1 and 2 measures were peer reviewed by Vietnamese experts and consultants in the United States prior to administration.

Participants

Wave 1 participants were recruited through a four-stage cluster sampling strategy. Initially, 30 communes were randomly selected from each province. Second, three hamlets were randomly chosen at each selected commune. Third, 30 households were randomly selected at each chosen hamlet, and finally, all household members aged 11 or older were selected for potential study. When Typhoon Xangsane struck Da Nang province, the Wave 1 survey had been implemented in 21 of the selected 30 communes. Of the remaining nine communes, seven inland communes were accessible after the typhoon, and were interviewed. Two coastal communes were not accessible after the typhoon and these were unable to be interviewed. Therefore, the final sample for Wave 1 included 4,981 adults aged 18 years or older.

A subsample ($N = 798$) of adults living in Da Nang who participated in Wave 1 were surveyed again following the typhoon for Wave 2 data collection. The sub-sample was selected using a three-stage sampling strategy. First, a sample frame was compiled by pooling details of all persons aged 18 and over who were surveyed at Wave 1 and were living in one of the 21 selected communes. Next, 800 persons were randomly selected from the above sample frame using computer random command resulting in the selection of an average of 38 persons at each commune. In addition, a list of 20 substitutes per commune was generated in case the index person was not available. These procedures yielded a total of 798 completed interviews. However, data were missing for one person, thus, the final sample size for Wave 2 was 797.

For Wave 1, Vietnamese lay interviewers from Da Nang and Khanh Hoa received six days of training. The training included information regarding the purpose of the study, the research design, the specific questionnaires, an interview training protocol, and information about depression, anxiety, alcohol abuse, sleep problems, chronic fatigue, and somatic symptoms. During this training, interviewers practiced administering the measures. Interviewers were given one day following training to review the measures prior to administration in the field. The top 40% of interviewers were selected to collect study data. Surveys were completed within each household with interviews lasting approximately two hours per participant. To be considered a member of a household, individuals must have had eaten and lived together for at least six months prior to the date of the interview. Interviewers received ongoing supervision by a designated team leader.

For Wave 2, lay interviewers were joined by eight physician interviewers to measure concordance between the two interviewer classes with the SRQ-20 and other mental health indices. All interviewers and physicians in Wave 2 received the same training as interviewers in Wave 1. There was no difference in rates of SRQ-20 caseness between interviewer types, and full reports of these concordance analyses are given elsewhere.

Variables

Selection of factors associated with increased risk of negative mental health outcomes was based on existing mental health epidemiological studies (Freedy, Saladin, Kilpatrick, Resnick, & Saunders, 1994; Galea et al., 2002; Acierno et al., 2007), as well as research on US and European populations in general. These investigations indicated that risk and protective factors should include gender, health status, degree of storm exposure (e.g., damage to one's residence, displacement from one's home, and personal or familial injury), and extreme fear during hurricane exposure. Unfortunately, an important protective factor, social support, was not directly studied; however what might be considered a proxy for social support, religious affiliation, was assessed.

General Health Status (Wave 1)

As used in the previous literature (Acierno et al., 2007; Galea et al., 2007), Item #1 of the World Health Organization, Short Form 36 (SF-36 Version 2) (World Health Organization, 1994) was administered to estimate health status in this sample. Participants were asked to rate the following question, "In general, would you say your health is Excellent, Very good, Good, Fair, or Poor?" These responses were dichotomized into Poor Health (self rating of fair or poor) and Good Health (self rating of excellent, very good, or good).

SRQ-20: Mental Health (Waves 1 and 2)

The SRQ-20 (World Health Organization, 1994) is a 20-item measure of mental health that can be administered via interview or self-report questionnaire. Responses are rated dichotomously (yes = 1, no = 0) and are based on one's symptoms over the past 30 days. According to the WHO SRQ-20 manual (World Health Organization, 1994), items are representative of several mental health constructs, and thus, should not be interpreted in isolation. The SRQ-20 appears reliable and valid in Vietnamese samples (Tuan, Harphan, & Huong, 2004), and high internal consistency was found in the present sample ($\alpha = .87$). Consistent with recommendations for scoring the measure (World Health Organization, 1994), we dichotomized the total scores as scores ranging from 0 to 7 as a "non-case," and scores ranging from 8 to 20 as "case." These scoring procedures have been reported in several studies conducted in developing countries (World Health Organization, 1994; Sartorius & Janca, 1996; Harpham et al., 2003).

Religious Affiliation (Wave 1)

Religious affiliation was measured dichotomously using a participants' indication whether or not they practiced any of the following religions: Buddhism, Christianity, or other religion.

Typhoon Exposure (Wave 2)

As reported in our prior research with hurricanes (Freedy, Resnick, & Kilpatrick, 1992; Freedy et al., 1994; Acierno et al., 2006), typhoon exposure variables included yes-no responses to the following questions: (a) "Did you evacuate from the place you were living because of the storm?"; (b) "Because of the typhoon damage, were you unable to live in your home?"; (c) "Whether you evacuated or not, were you injured during or after the storm?"; and, (4) "Was any member of your family injured or killed during or after the storm?"

Peri-Event Fear Rating (Wave 2)

Peri-traumatic fear predicted mental health outcomes in our prior study of hurricane effects. Thus, peri-traumatic fear was included in the present study as assessed by the question, "How afraid were you during the typhoon that you might be killed or seriously injured by the storm?" Participants rated the item on a 4-point Likert scale (Not at all, A little, Moderately, Extremely Afraid) Responses were coded dichotomously as Extreme Fear vs. No Extreme Fear.

Statistical Analyses

Two-tailed bivariate χ^2 analyses were performed to examine post-typhoon SRQ-20 caseness in relation to gender, religious affiliation, health, and typhoon exposure

Table 1

Bivariate Analyses: Total Sample (irrespective of pre-typhoon SRQ-20 caseness)

			Post Typhoon SRQ-20 Caseness			
	%	N	χ^2	OR	CI	p
Gender			5.90	1.49	1.08 - 2.05	.015
Female	30.5	136				
Male	22.8	80				
Health Status			58.72	4.43	2.97 - 6.61	.000
Poor	36.4	182				
Good	11.4	34				
Religious Affiliation			8.13	1.79	1.19 - 2.67	.004
No	29.6	180				
Yes	19.0	36				
Forced to Evacuate			32.43	2.5	1.81 - .44	.000
Yes	37.5	128				
No	19.4	88				
Extreme Fear During Typhoon			38.04	3.20	2.18 - 4.68	.000
Yes	34.4	176				
No	14.1	40				
Home Unlivable			14.93	2.02	1.41 - 2.88	.000
Yes	40.1	75				
No	24.9	119				
Injured During Typhoon			12.54	3.46	1.67 - 7.14	.000
Yes	54.8	17				
No	26.0	197				
Family Member Injured			5.99	2.44	1.17 - 5.08	.014
Yes	46.7	14				
No	26.4	202				

Note. For all logistic regressions, non-significant risk ratios are evident from confidence intervals that span the value 1; these risk ratios should be considered equal to 1: no increased or decreased risk. OR|=|odds ratio; CI|=|confidence interval.

Table 2

Logistic Regression: Total Sample (Irrespective of pre-typhoon SRQ-20 caseness)

Variable	SRQ-20 Caseness			
	OR	95%CI	W	p
Gender (female)	0.96	0.64-1.39	0.08	.776
Health Status (poor)	3.59	2.29-5.63	31.17	.000
Religious Affiliation (No)	1.47	0.93-2.35	2.78	.096
Forced to Evacuate	1.85	1.19-2.83	7.62	.006
Extreme Fear During Typhoon	2.56	1.60-4.12	15.12	.000
Home Unlivable	1.05	0.67-1.65	0.05	.830
Injured During Typhoon	2.46	1.07-5.62	4.53	.033
Family Member Injured	2.08	0.89-4.83	2.83	.093

Table 3

Bivariate Analyses: Subsample (Restricted to Pre-typhoon SRQ-20 Non-caseness)

	%	N	χ^2	OR	CI	p
			Post Typhoon SRQ-20 Caseness			
Gender			0.15	1.34	0.89 - 2.02	.093
Female	16.3	47				
Male	20.7	71				
Health Status			29.95	3.5	2.20 - 5.61	.000
Poor	26.3	92				
Good	9.2	26				
Religious Affiliation			8.97	2.31	1.32 - 4.07	.003
No	21.3	102				
Yes	10.5	16				
Forced to Evacuate			19.16	2.44	1.63 - 3.68	.000
Yes	27.1	68				
No	13.2	50				
Extreme Fear During Typhoon			27.38	3.68	2.21 - 6.14	.000
Yes	25.1	98				
No	8.3	20				
Home Unlivable			7.62	1.89	1.20 - 2.97	.006
Yes	29.1	39				
No	17.9	69				
Injured During Typhoon			7.21	3.36	1.32 - 8.55	.007
Yes	42.1	8				
No	17.8	108				
Family Member Injured			8.62	3.29	1.42 - 7.63	.003
Yes	41.7	10				
No	17.8	108				

variables. Next, all variables that reached a cutoff of $p < .05$ in bivariate analyses were examined in logistic regression analyses to determine their relative risk for post-typhoon SRQ-20 caseness. An identical statistical procedure was repeated with the subsample of those participants who did not meet pre-typhoon SRQ-20 caseness criteria. Hence, the second set of univariate and multivariate analyses were focused on identifying predictors of new caseness in previously non-case individuals, and took advantage of the longitudinal, pre- and post-typhoon nature of the research design.

Results

Sample

Of the 797 participants for whom both pre- and post-typhoon data were available, the mean age was 41.6 years (SD = 16.5 years; range = 18 to 96). Considering marital status, 18.4% were single, 69.6% were married, 2.7% were separated or divorced, and 9.2% were widowed. Considering employment status, 3.1% were unemployed,

14.8% were retired, 5% were students, 8.8% worked in the home with their families, and the remainder were engaged in undefined work. SRQ-20 pre-typhoon caseness was 20.7% ($N = 165$); SRQ20 post-typhoon caseness was 27.1% ($N = 216$) ($\chi^2 = 109.83$, p < .001). The proportion of participants who were "positive" for each of the risk factors is given in Table 1.

Analyses with the Total Sample

Table 1 also shows the odds ratios and results of χ^2 analyses in terms of risk for post-typhoon SRQ-20 caseness for the total sample. Each risk factor, including female gender, low religiosity, forced evacuation, extreme fear during the typhoon, damage rendering one's residence uninhabitable, and injury to oneself or one's family member was associated with increased likelihood of post-typhoon caseness, indicating general similarities between US and Vietnamese populations. However, as presented in Table 2, only the subset of variables related to poor health status, forced evacuation, extreme peri-event fear, and experienced injury significantly predicted negative emotional outcome in the final model logistic regressions

Table 4

Logistic Regression: Risk Factors for Post-typhoon SRQ-20 Caseness Subsample (Restricted to Pre-typhoon SRQ-20 Non-caseness)

Variable	SRQ-20 Caseness			
	OR	95%CI	W	p
Health Status (poor)	2.98	1.77-5.00	16.90	.000
Religious Affiliation (No)	2.11	1.11-3.98	5.27	.022
Forced to Evacuate	1.56	0.90-2.70	2.57	.109
Extreme Fear During Typhoon	2.79	1.52-5.13	10.90	.001
Home Unlivable	1.11	0.62-1.97	0.12	.728
Injured During Typhoon	2.25	0.77-6.62	2.18	.140
Family Member Injured	2.54	0.98-6.62	0.09	.765

in which unique variance accounted for the outcome variables was isolated. Negative health status was the most powerful predictor.

Analyses Restricted to Individuals Classified as Wave 1 SRQ-20 Non-Case

As mentioned, analyses were repeated with the subset of participants for whom pre-typhoon SRQ-20 caseness was not evident to isolate risk factors for developing negative mental health outcomes in previously mentally healthy individuals. Univariate analyses restricted to this subsample were similar to those for the total sample with the one exception that gender was no longer predictive of negative outcome (Table 3). However, final model logistic regression indicated a different pattern of risk for new case status (Table 4). Specifically, the likelihood of becoming symptomatic following the typhoon in individuals who were not previously symptomatic was associated with poor health status, lack of religious affiliation, and extreme fear during the typhoon.

Discussion

This study represents the first pre-post-disaster study with an epidemiological sample, and results indicate a significant increase in probable mental health caseness following the event. The longitudinal nature of data collection permitted identification of risk relationships wherein temporal (but not causal) inferences could be made. Thus, while a longitudinal design cannot fully support causal inferences with respect to risk factor identification, it can establish an important criterion of causality and causal contribution (for outcomes with multiple causes) in that the risk factor is here verified as *preceding* the outcome variable of study.

The present study was among the two existing epidemiological surveys of mental health in the Vietnamese population (Freedy, Resnick, & Kilpatrick, 1992; Thanh, Tran, Jiang, Leenaars, & Wasserman, 2006),

and would not have been possible without the direction and cooperation of the Da Nang Ministry of Health and cooperating NGOs. Many study findings bore a striking similarity to those of recently completed US investigations with hurricane victims (Green & Solomon, 1995; Acierno et al., 2007). Specifically, risk of mental health problem caseness, as measured by the SRQ-20, was associated with pre-typhoon reports of poor health status, forced evacuation, and peri-typhoon experience of extreme fear, as well as post-typhoon personal injury. In addition, lack of religious affiliation and having a family member who was injured during the storm approached statistical significance as negative risk factors. Interestingly, gender was not predictive of post-storm negative psychological outcome when effects of other variables were considered, and was not at all predictive of negative outcome among the sample of affected Vietnamese who did not evince SRQ-20 caseness before the storm. Gender was also not predictive in the findings of Tang (2007) investigating the psychological sequelae of the 2004 South East Asian Tsunami in 265 adult Thai survivors. This finding is in contrast to previous reviews (see Norris et al., 2002a, 2002b), and may indicate an important cultural difference in disaster responding between Eastern and Western peoples. Thus, with the exception of the findings for gender, observations were largely consistent with research on Western populations, particularly the noted correlations between poor health and injury and negative emotional states (Ren, Skinner, Lee, & Kazis, 1999; Acierno et al., 2006).

Religious affiliation was not studied in the Florida Hurricanes survey on which the present post-typhoon survey was based, and is an interesting risk/protective factor that has been identified as potentially important in previous research (Dervic, Grunebaum, Burke, Mann, & Oquendo, 2006). However, Acierno et al. (2006) did identify social support as a protective factor, and the social nature of most religious affiliations may indicate there is some common overlap between these variables. The nature of "spirituality" is a concept somewhat difficult to operationally define, but is rather universally identifiable.

It is interesting that of all the initially predictive variables, only three remained so, and religious affiliation was among them.

In the overall sample and in the sub-sample of individuals who did not evince pre-storm SRQ-20 caseness, the two most consistent and strongest predictors of probable mental health problems were poor self-reported health and extreme fear during the typhoon itself. This matches well with US samples, and with survey studies of mental health outcomes secondary to stressors other than disasters (Zoellner, Goodwin, & Foa, 2000; Galea et al., 2002; Acierno et al., 2007).

Of, perhaps, greater interest is the diversion of risk factors when the overall sample and the subsample of non-prestorm SRQ-20 caseness are compared. For the former group, typhoon-related consequences (i.e., forced evacuation, injury due to storm) appear to be more important in predicting negative psychological outcomes than for the latter. These risk factors are qualitatively different from the others studied in that they require a repertoire of active coping skills and behavioral responses to react to new situations produced by personal injury and residential displacement. Individuals with prior mental health problems, who are already more likely to find themselves in an environment of reduced personal and social resources (Hobfoll, 1989; Freedy, Shaw, Jarrell, & Masters, 1992), appear to be less able to bring sufficient coping resources to bear in dealing with additional stressors related to the effects of disaster. By contrast, those without pre-typhoon mental health problems were generally unaffected by the consequences of the hurricanes *per se*. Instead, comorbid health problems, extreme fear, and lack of religious affiliation, which may be a proxy for low social support, were predictive of risk. Taken together, findings across these two groups of participants indicate that it may not be storm exposure factors, *per se*, that predict negative mental health outcomes, but rather, the interaction of pre-exposure mental health status and storm exposure consequences.

Conclusion

This study is important in that it represents the first pre-post disaster study conducted with an epidemiological sample, and its findings clearly establish increased mental health problems post-event. However, the study was not without its limitations, not the least of which is that its original design was not that of either a disaster study, or a longitudinal study. As such, extensive pre-typhoon risk factors for negative mental health were not assessed, and direct comparison of results from the Vietnamese population and US populations are not completely possible. On a related note, although consistent with previous literature on disasters, several study variables were limited to single item predictors, limiting the reliability of constructs. Moreover, an additional class of interviewers (medical doctors) was added to the Wave 2 data collection effort. Although no differences were noted between interviewer types on SRQ-20 scores and other mental health outcome variables (reported elsewhere), the possibility remains that some interviewer effects were present, leading to confounded results. Finally, all data were exclusively self-reported, with no behavioral, biological risk, or outcome variables assessed. However, as this is the first pre-disaster post-disaster epidemiological study to have ever been conducted with mental health outcomes, we feel its value overcomes these limitations. Future efforts, including potential follow-up interviews, will provide very important long-term data that speak to the course of mental health problems precipitated by disaster.

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