Katrina-related Health Impacts on Vietnamese New Orleanians: A Longitudinal Analysis

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Abstract: A wide range of self-reported and objective health measures collected for a Vietnamese immigrant sample living in the greater New Orleans area just weeks before Hurricane Katrina struck possess extraordinary potential as baseline measures for investigating how immigrants fare after such disasters. We assess the short term (1 year) effects of a natural disaster upon the health of a recent immigrant population by comparing pre-event and post-event physical and mental health assessments for working age (20-49) Vietnamese-American New Orleanians. Individuals in our sample underwent a 90 minute health assessment during June and July 2005 (n=125); and the majority of these same individuals have been located and re-assessed during August and September of 2006 (current n=82). Our working sample is these 82 individuals for whom we now have both pre and post-event physical and mental health measures. This sample size will increase as interviews continue over the next several weeks.

INTRODUCTION

We know little about how refugees and other types of immigrants respond to the shock of subsequent displacement and other disruptions following a disaster in their destination country. The after-effects of Hurricane Katrina are likely to affect Vietnamese-American New Orleanians in ways that are quite distinct from the impacts on the majority and long-term resident population groups, i.e., African-Americans and whites.

Comprehensive health data collected for a Vietnamese immigrant sample living in the greater New Orleans area just weeks before Hurricane Katrina struck possess extraordinary potential as baseline measures for investigating how immigrants fare after such disasters. We assess the short term (1 year) effect of the natural disaster upon the health of recent immigrant population by comparing pre-event and post-event physical and metal health assessments for working age (20-49) Vietnamese American New Orleanians. Our participants underwent a 90 minute health assessment during June and July 2005 (n=125); about two thirds of them (n=82) were located and re-assessed during August and September 2006.

BACKGROUND

On August 29, 2005, Hurricane Katrina struck the coastal areas of Louisiana, Mississippi, Alabama, and Florida, resulting in over 1000 deaths in Louisiana alone. Hundreds of thousands of homes and businesses were destroyed, and even larger numbers of families have been displaced. Media attention has been especially intense on the devastation of the city's lower ninth ward, which suffered heavy damage near one of

the major levee breaks. But little attention has focused on a substantial population of recent Vietnamese immigrants living in metropolitan New Orleans, many of whom live in this same heavily-damaged lower-ninth ward.

This population of Vietnamese-Americans has settled in New Orleans during the past thirty years after fleeing and seeking refuge from an earlier disaster, the turmoil of war and government collapse in South Vietnam during the 1970's. Vietnamese-Americans total around 1.2 million (U.S. Census Bureau 2002), among whom approximately 12,000 live in New Orleans area pre-Katrina (U.S. Census Bureau 2000). The levee failures occurring just after Hurricane Katrina's landfall flooded a major Vietnamese enclave in eastern New Orleans, resulting in the evacuation and dislocation of this entire immigrant community.

A major theme within the disaster-research literature is that some populations are much more affected than others (Bolin 1982; Solomon *et al.* 1987; Norris *et al.* 2002a; 2005; Norris and Alegria 2005). Despite this consensus, a weakness of this literature is its almost exclusive focus on the welfare of the most mainstream populations, with an occasional special focus on the poor. Work underway on the effects of Katrina in the greater metropolitan New Orleans area maintains this trend by focusing on the majority African-American and white populations living there (Logan 2006; Abramson *et al.* 2006; Hurricane Katrina Community Advisory Group 2006). This study helps expand this literature by focusing on the short-term physical and mental health consequences of Hurricane Katrina upon an important immigrant group, Vietnamese New Orleanians.

The relatively little attention given to Vietnamese-Americans affected by this disaster constitutes a serious gap in the research, since the 7,000 Vietnamese New Orleanians

made up well over two-thirds of all the Asians in the city and had settled in highly visible concentrations, most notably in the New Orleans East neighborhood along Bayou Sauvage mentioned above (U.S. Census Bureau 2000). Moreover, the Vietnamese constituted the largest single national-origin group of immigrants in New Orleans, making up 22% of all the foreign born people in the city (U.S. Census Bureau 2000).

Potential impacts of Katrina on Vietnamese-American New Orleanians

Zhou and Bankston (1994; 1998) and Bankston and Zhou (1997) have studied adaptation and assimilation processes among Vietnamese-Americans extensively, in fact, in the same immigrant community that we plan to study in the current proposal. They find that Vietnamese-Americans typically arrived poor, and live in marginal urban areas. Some eventually move to more desirable areas once they accumulate enough capital. These two authors credit the close-knit character of the community with the general success of most second generation Vietnamese American children in avoiding many of the urban perils that plague their similarly disadvantaged neighbors.

But Vietnamese-New Orleanians face special difficulties that may exacerbate the effects of this second cataclysm to occur in their recent history. Massey and Denton (1992) using 1980 census data confirm the Vietnamese to be the most segregated among all Asian immigrant groups in the United States. According to the U.S. Census Bureau (2000), 93% of the Vietnamese speak Vietnamese at home; 65% do not speak English very well; and 44% are classified as linguistically isolated. Asian immigrants are considered by many to be a model minority in many respects, health outcomes among them. Among adults age 25 and older, Frisbie *et al.* (2001) find that while Asian

immigrants in general have better health outcomes than the U.S. born, this advantage declines with duration of U.S. residence, and did not hold for those from Vietnam, who had worse outcomes than either the other Asian immigrants or native-born U.S. whites.

Health care utilization among Vietnamese-Americans is reported to be low (Strand and Jones 1983), in part due to difficulties in communicating with providers (D'avanzo 1992). A disjuncture between traditional and western belief systems – especially with regard to mental illness - is another possible barrier to accessing health care in this new environment that is also understudied (but sees Jenkins *et al.* 1996). Levels of stress and strategies for dealing with it may play central roles in the health and everyday lives of working-age adult Vietnamese immigrants, but these topics have not been extensively investigated. Very high pressures to succeed from the family and community (Zhou and Bankston 1998), trauma related to the war and their subsequent exodus, and a vast cultural gulf between the sending and receiving countries may lead to higher baseline levels of stress among this working-age adult immigrant population with respect to more long term U.S. natives.

There are several possible reasons for this apparent increased risk of negative outcomes among immigrants generally and among the Vietnamese in particular. First, immigrants often live in more marginal areas of the city (Blaikie *et al.* 1994); certainly true in the case of the enclave studied here, which is on the far edge of land recently reclaimed from the swamp surrounding New Orleans. Second, although social mobility among Vietnamese-Americans has received much attention, the fact that many of them – especially in this enclave in eastern New Orleans – still occupy fairly vulnerable and low-wage positions of social status will make these losses quite acute (Wisner 1998). Third,

being non-native speakers of English, access to information and services for self-protection and recovery will be less available (or attractive) to them than to other groups (Wisner 1998). Only about half of Southeast Asian immigrants have job-based health insurance compared to almost three-quarters of whites; 27% of Southeast Asian immigrants have no health insurance at all, compared with 13% of whites and 23% of blacks without insurance (Smedley *et al.* 2002). Some hypothesize barriers to such information and services include language and isolation (Strand and Jones 1983; D'avanzo 1992).

Fourth, some of the social characteristics that contribute to the adaptation of the Vietnamese under normal circumstances may also become sources of stress. Living in an ethnic neighborhood may provide important social-psychological support (Zhou and Bankston 1998), but sudden displacement from that neighborhood, with its cultural symbols and settled interpersonal networks, may for that very reason suddenly remove critical sources of comfort and adjustment. Even Vietnamese who had moved out of the ethnic neighborhood to other parts of the New Orleans area generally retain strong ties to the neighborhood and saw it as a symbolic center of ethnic identity. While members of all ethnic groups suffered from temporary or permanent loss of their homes, the damage to the Vietnamese community may have removed both a place for maintaining ties to co-ethnics and a physical representation of the traditions and values of the homeland.

Other socioeconomic and cultural features of this group may mitigate some post-Katrina impacts, relative to other groups. First, is a strong sense of ethnic identity; and strong family, social, and economic ties to other Vietnamese living outside of the affected area. As news of Katrina's devastation spread, Vietnamese-Americans across the country

contributed to relief work via NGOs and religious organizations (*The Houston Chronicle* August 31, 2005; *The Los Angeles Times* May 15, 2006). Second, the experience of Vietnamese-American families with the horrific experiences related to the war and collapse of South Vietnam during the 1970s may make this group more resilient to the effects of Katrina than it otherwise would have been. Such a potential advantage of being previously experienced with similar types of stressors is referred to as the "inoculation hypothesis" (Norris and Murrell 1988).

Alternatively, such previous experience could exacerbate unresolved and lingering psychological wounds from that earlier period, especially among older members of this population, who would be most likely to have experienced them. Previous research on non-Vietnamese samples has linked repeated experience with traumatic events to worse psychological outcomes compared with a single (or a small amount of) experience (Breslau *et al.* 1999; McCauley *et al.* 1997; Sutker *et al.* 2002).

In addition to systematic differences among Vietnamese, blacks, and whites regarding the impact of Katrina, we are also keenly interested in the distributions of outcomes among Vietnamese-Americans. This community is by no means homogeneous. While many remained in their original community in the heavily flooded lower ninth ward, other families had migrated to the more affluent west bank. Similarly, the degree of segregation and linguistic isolation also varies substantially among communities, families, and even individuals, as do degrees of ethnic identification and connection to the ethnic community. Fortunately, we have good pre-event information on these key measures of affluence and acculturation, and so will be able to capture these important sources of within-group variation on our outcomes of interest.

METHODOLOGY

Sampling

Households including Vietnamese-American working-age adults living in the greater New Orleans area were identified using a recently-updated (during May 2005) register of Vietnamese families that is maintained by the principal Catholic Church and principal NGO in the area. This register includes both Catholic and non-Catholic Vietnamese families, and lists household members by name. The total number of households in the register is 866. We selected a representative sample of all households on the list that appeared to contain at least one eligible respondent, i.e., someone who was between the ages of 25-49; was born in Vietnam; arrived in the U.S. between 1980 and 1990; and was also between the ages of 15-30 when they arrived. These original criteria, while quite restrictive, were chosen because the main objective of the original research was to examine the impact of international migration upon the health of Vietnamese immigrants who had lived substantial portions of their lives both in Vietnam and in the U.S.

Households thought to include an eligible respondent were contacted by our NGO counterparts and asked to participate. For those who agreed, an appointment was arranged. Upon arrival at the household thought to have an eligible respondent (the original registers had a list of residents, with their ages), the interviewer followed a procedure to first list and then randomly select an eligible respondent. The entire set of questions and measurements took about 60 – 90 minutes to complete. Of 490 households that appeared from the register to potentially include an eligible respondent, we

successfully completed 125 interviews. In total, we had 46 refusals, yielding a response rate of 73%.

In spite of substantial obstacles posed by the situation in post-Katrina New Orleans, we have located and successfully re-interviewed 82 of our original 125 respondents from 2005 during August and September 2006. We had only one refusal.

Measures

Key features of health to be evaluated in the health assessment are included in Table 1, and include standardized overall self-assessments of health; standardized measures of psychological well-being; and physical measures. Our hypothesized relationships between these health outcomes and our predictor variables are discussed below, in the sub-section *Conceptual framework and hypotheses.*

Numerous questionnaire items/modules to be collected are taken from preexisting instruments for three reasons. First, validity and reliability of the standardized instruments are already assessed. Second, the use of standardized items will facilitate comparisons between the data collected for the proposed study and preexisting (or subsequent) surveys of other immigrant and native groups affected by Katrina. Third, we have baseline data based upon these standard measures already collected from just before the storm with which to compare our subsequent measures for our sample.

The health assessment begins by confirming and updating previously collected key background characteristics of the respondent. Acculturation and assimilation were previously assessed using the standard scale developed by Anderson and colleagues (1993). Self-assessed health was measured and will be reassessed with the Short Form 36

(SF-36), developed by RAND corporation and JE Ware (Ware and Sherbourne 1992). This instrument is highly regarded (McDowell and Newell 1996) and widely used. It has also been used with success with other Vietnamese populations by the PI and his colleagues (VanLandingham 2006). The SF-36 includes assessments of physical functioning, role limitations due to physical health problems, bodily pain, social functioning, general mental health, role limitations due to emotional problems, vitality, energy, fatigue, and general health perceptions. A major advantage of this instrument with regard to Hurricane Katrina is that another major study based at Columbia University (Abramson *et al.* 2006) is employing the SF-12 as a major instrument. This will allow for extremely useful comparisons between the Vietnamese Americans in the proposed studies and the majority black and white populations that are the focus for the Columbia sample.

The two dimensions of psychological well-being included in the SF 36 (general mental health and role limitations due to emotional problems) were supplemented at baseline by a depression scale developed by Kinzie *et al.* (1982) for the Vietnamese, and the Affect Balance Scale (ABS), which has recently been specifically adapted for the Vietnamese (Devins *et al.* 1997); both of these instruments were re-administered at T_1. The measure of social functioning in the SF 36 was supplemented at baseline by the inclusion of the Social Relationship Scale (SRS - McFarlane *et al.* 1981). Given the anticipated importance of social networks as a predictor of Katrina-related health problems, these instruments will be further supplemented by the Louisville Social Support and Social Embeddedness Scale in subsequent rounds. We also ask detailed questions post-Katrina about sources and types of actual support received.

Four physical measures were taken at baseline and will be included in our subsequent rounds: blood pressure, waist-hip ratio, body mass index (BMI), and lung capacity. Blood pressure is well regarded as a biomarker for chronic stress in populations (it may reflect other factors for particular individuals), as is the waist hip ratio among some observers (Kelly *et al.* 1997). BMI is a standard marker for malnutrition and obesity. Lung capacity will measure exposure and declining lung function due to mold, dust, and other forms of air-pollution in the post-Katrina physical environment; as well as possible effects due to increased smoking post-Katrina.

Our lifestyle module administered at baseline asks several questions about smoking and drinking, and will be included in all three subsequent rounds of the survey, as will our modules assessing access to care and occupational injury. These latter two modules were supplemented in round T_1 by additional questions about post-Katrina injuries and access to care. Other new modules, i.e., not included in the baseline measures, include an assessment of PTSD and a set of questions related to Katrina-related economic losses and assistance. We administered the CIDI version of the PTSD assessment instrument. This particular version is highly regarded and has been widely used in national assessments, such as the National Latino and Asian American Study, which included Vietnamese Americans (Alegria *et al.* 2004). These national data will provide extremely valuable benchmarks with which to compare our post-Katrina assessments for our Vietnamese-American sample.

Official translations were used where they were available, i.e., for the SF-36; the Vietnamese Depression Scale, and the Affect Balance Scale. All other instruments were translated into Vietnamese by professional translators during the summer of 2003, and

then pre-tested in Ho Chi Minh City, Vietnam, before our first round of data collection for the original (R03) study on immigrant health. Numerous minor revisions were made after the pretests and during our interviewing training exercises during the summer of 2003. Our interviewers reported no translation problems during the subsequent fieldwork. For the U.S. sample that serves as our baseline for the work proposed here, all of our interviewers are bilingual and all of our instruments are available in both English and in Vietnamese, so we are able to interview our respondents in the language of their choosing. For the 2005 baseline survey, 38% chose to answer in English; and 62% chose to answer in Vietnamese.

Conceptual framework

The conceptual framework for the study is outlined in the figure below. Working from left to right, the underlying model proposes that various dimensions of health status for this population will be adversely affected by events related to Hurricane Katrina and its aftermath. We hypothesize that these Katrina-related impacts on health will be mediated through two classes of more proximate determinants: changes in the physical environment experienced by the migrants; and changes in the social environment. Regarding the former, air, water, and soil contamination have been problematic in the New Orleans area since the flood, and so those who have remained here will have exposure to a host of pathogens and other harmful substances compared with what they faced at baseline. Also, the strain in living in sub-standard temporary housing after the storm, and various types of injury and strain associated with clean-up are also adversely affect our physical health outcomes. These stressors should be particularly acute for those

experiencing both the stress of temporary and cramped housing plus relatively high loss of assets.

Mental strains resulting from social disruptions are also anticipated. The emotional stresses associated with unemployment are anticipated to adversely affect our various mental health outcomes. While we anticipate that Vietnamese households are more likely to remain together than households of other minority evacuees, where this does occur, such dislocation of members of the same household to different locations is likely to negatively affect mental health and well-being of individual members, as household members may end up in various locations because of work or schooling opportunities. Of course, such adverse events sometimes present opportunities, such as better schools and jobs and less crime in some of the areas the evacuees relocated to compare to their communities of origin. To recognize such possibilities, we have emphasized this proximate determinant less heavily, as indicated by a lighter shading of the upward pointing arrow for this determinant.

The set of moderating influences in the circle at the bottom of the drawing is a schematic recognition that the set of features specified within will determine in part the degree to which the proximate determinants described in the box just above will affect our health outcomes. Obviously, whether the individual lives in New Orleans or elsewhere after the event will affect in turn whether he can be affected by the environmental contaminants found there. Less obvious, perhaps, is that the degree to which individuals and families have access to capital and the degree to which they are able to navigate the U.S. government's bureaucratic agencies, e.g., FEMA, will also

moderate these effects. Finally, we anticipate that various aspects of Vietnamese culture may serve to dampen the effects of Katrina on this population vis-à-vis other groups.

RESULTS

This section reports and summarizes our preliminary analyses for a sub-set of our key outcome measures described above. Table 2 describes the basic characteristic of the study population. Those participating in both pre and post Katrina studies (n=82) have mean age of 42.43 (by 2005), just 0.5 year older than the average age of the total original pre-Katrina cohort (n= 125). This indicates that the selection of the post Katrina sample is remarkably representative from the original cohort. Among 82 those participating in both rounds and among the original125 participating in 2005, 66% are female, 34% are males. One of our 82 retained respondents apparently married during the year post-Katrina; and there are more unmarried in our total original sample compared to those we retained – we lost more single individuals than ever-married ones. We also appear to have lost between waves more original respondents in the lowest education category compared to the highest education category. Slight changes in the distribution of occupational categories are also apparent in Table 2, but several key difference between the far right and far left columns (e.g., in business ownership) is likely due to business losses due to flooding. Immigrants have 10 years of average education completed (25.6%: 0-6 years; 13.4% 7-9 years; and 61% above 10 years).

Table 3 compares average pre- and post Katrina SF-36 health dimension scores. These are scored in such a way that larger scores indicate better health outcomes, and are scaled 0-100 for easy interpretation; the statistical test is a repeated-measures test of

difference between means. That the 2005 average scores for the entire initial cohort (n=125) and for those who were eventually re-interviewed in 2006 (n=82) are nearly identical provides confidence that the missing 43 respondents in 2006 will not bias the 2005 and 2006 comparisons. Also, these average scores show remarkable consistency in that all 8 dimensions show a decline in 2006 compared to 2005. These declines are statistically significant for 5 of the 8 scales (RP, BP, GH, VT, RE), and borderline for one more (PF).

Bivariate contrasts in Table 4 show that the pattern of change between waves on our key outcomes vary significantly and consistently with age and occupation, but not with the other background variables. The scores are significant lower among respondents aged 40-49 for physical functioning, bodily pain, and general mental health; and are of borderline significance for general health and vitality. The unemployed (pre-Katrina) and low-skilled workers fare worse than the other categories on the dimensions of social functioning, and bodily pain; similar patterns are of borderline significance for vitality and mental health dimensions.

Table 5 describes the multivariate regression models on SF-36 pre- and post-Katrina difference scores controlling for SES. Age is one again significantly associated with the difference scores in all health dimensions ($p<.05$). Older people have less difference scores than younger people. Occupation is also found to be associated with the difference score. Unemployed people have less differences on pre- and post Katrina scores on physical functioning, role limitation due to physical health problems, bodily pain, and vitality. People who have professional job also have less difference on pre- and post Katrina score on role limitation due to physical health problems.

Table 5 presents a preliminary multivariate analysis of our key SF-36 health dimensions, using the difference between the 2006 and 2005 scores as our outcome. Older age a remarkably consistent predictor for poorer outcomes in 2006 (post-disaster) relative to 2005. Age is statistically significant or of borderline significant for all 8 dimensions. Being single (never-married) is associated with quite large coefficients for several of these outcomes (suggesting a penalty for being single) and is significantly associated decline in mental health between waves. The pattern of results suggest similar penalties for being unemployed (pre-Katrina); unemployment status in 2005 is significantly associated with a decline in bodily pain. Overall, these models explain an impressive amount of variance in the differences between scores.

Our preliminary multivariate analysis of depression scores in 2006 show similar penalties for age and unemployed status in 2005 (Table 6).

DICUSSION

Our collection of a wide range of standard measures of physical and mental health for a sample of Vietnamese New Orleanians just before Hurricane Katrina struck in late August 2005 presents a rare opportunity to examine the short, medium, and longer-term effects of a major disaster upon the health of a population-based sample of working-age immigrants. Our initial follow-up wave during the fall of 2006 led to the successful re-recruitment and re-interview of 82 of our original 125 respondents from the summer of 2005. Our initial tabulations indicate that the 42 respondents whom we have yet to locate do not differ systematically on key background and outcome variables compared to the 82 we retained.

Preliminary analyses demonstrate that Hurricane Katrina had measurable negative impacts upon the health of this community on a wide range of standard measures of physical and mental health. Statistically significant declines were found for role limitations due to physical health problems; bodily pain; role limitations due to emotional problems; vitality, energy, fatigue; and general health perceptions. A decline in physical functioning was of borderline significance. Those in the age group 40-49, who likely bear most of the burden of worry and care for these families, suffered a greater decline than did younger adults age 20-39 on several of our key outcomes; and those who were unemployed pre-Katrina also appear to have fared worse than those who were employed.

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Tables and figure for Katrina PAA paper

Figure: Conceptual framework

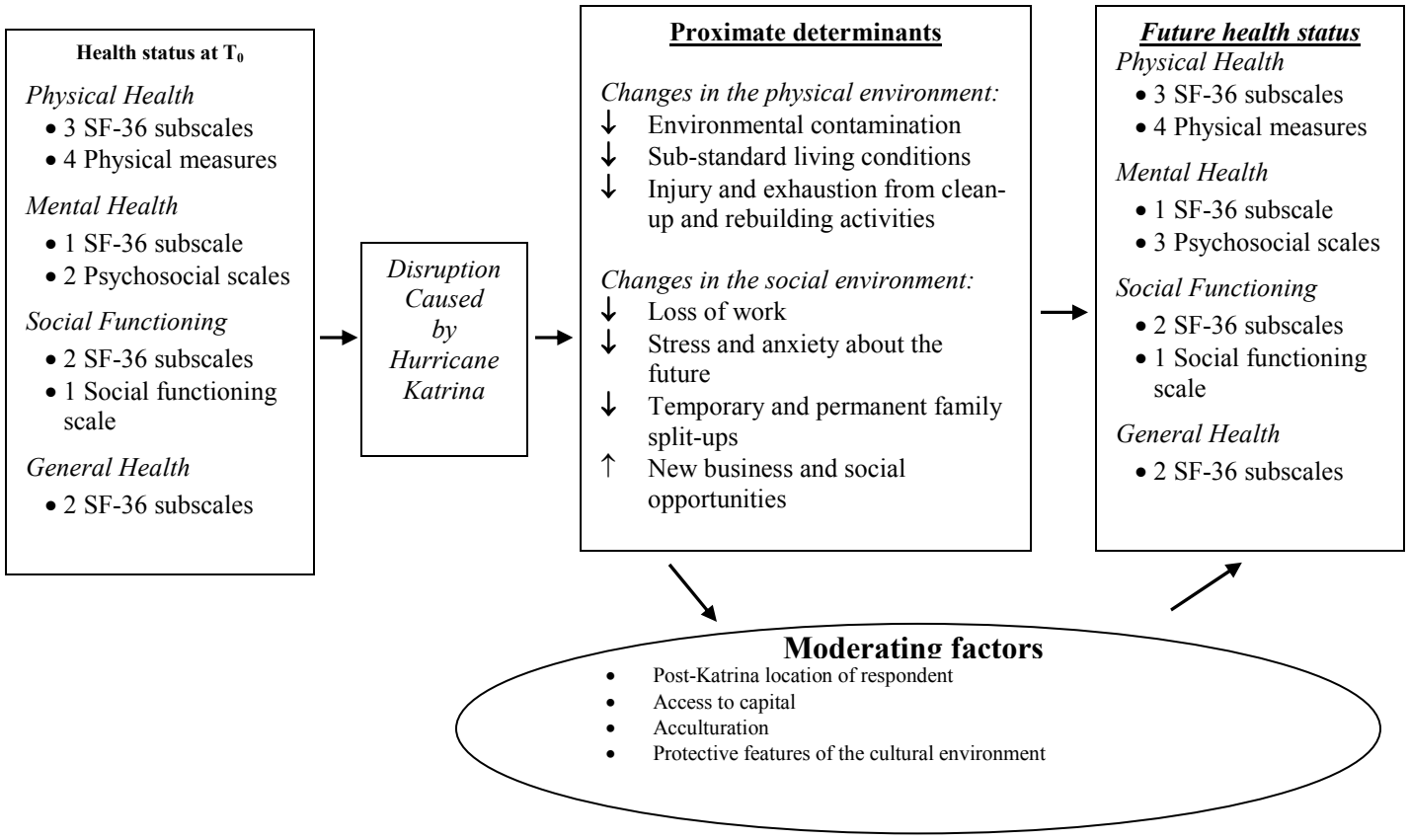

Table 1: Measures

Instrument, module, or measurement	**T_0** summer 05	**T_1** fall '06
Household schedule; background module	X	X*
SF-36 – 8 health sub-scales	X	X
Vietnamese depression scale	X	X
Vietnamese affect balance scale	X	X
Occupational injuries module	X	X
Access to care module	X	X
Body mass index	X	X
Waist-hip ratio	X	X
Blood pressure	X	X
Lung capacity (peak flow)	X	X
Lifestyle module (smoking, alcohol, etc)	X	X
Acculturation module	X	X
Social Relations Scale	X	X
Post-Katrina family living situation		X
PTSD instrument (CIDI)		X
Louisville Social Support and Social Embeddedness Scale		X
Post-Katrina injuries sub-module		X
Post-Katrina asset losses sub-module		X
Post-Katrina assistance; and sources		X
Post-Katrina access to care sub-module		X

Table 2: Demographic characteristic of study participants

Items	***Post-Katrina (n=82)***	***Pre-Katrina (n=82)***	***Pre-Katrina (n=128)***
	Percentage/(n)	**Percentage/ (n)**	**Percentage/ (n)**
Age			
Mean	43.91 (82)	42.43	41.95
Median	45.00	43	42
Range	(28-52)	(28-52)	(28-52)
Sex			
Male	34.1% (28)	34.1% (28)	34.4% (44)
Female	65.9% (54)	65.9% (54)	65.6% (84)
Marital status			
Never married	6.1% (5)	7.3% (6)	14.1% (18)
Married living with spouse	86.6% (71)	85.4% (70)	76.6% (98)
Separated, divorced, widowed	7.3% (6)	7.3% (6)	9.4% (12)
Education			
0-6 years	25.6% (21)	26.8% (22)	32% (41)
7-9 years	13.4% (11)	14.6% (12)	13.3% (17)
10 years or above	61.0% (50)	58.5% (48)	54.7% (70)
Occupation			
Agriculture, unskilled, service	24.4 (20)	21.0% (17)	17.3% (22)
Clerical, factory, skilled, sales	30.5% (25)	32.1% (26)	26.8% (34)
Professional,	14.6% (12)	12.3% (10)	11.8% (15)
Entrepreneur	8.5% (7)	17.1/ (14)	21.3%/ (27)
Unemployed, other	22.0% (19)	17.1/ (14)	22.8%/ (29)
Property			
Mean	6.57	7.04	6.97
Std	0.14	0.03	0.06

Table 3: Comparing pre- and post-Katrina health dimensions from the SF-36

Health scale	*Post -Katrina (n=82)*	*Pre-Katrina (n=82)*	*Immigrants (n=127)*	*US population (n=2474)*
#1. ^PF	80.49	86.60	86.94	84.15
	(α=92.58%)	(α=92.9%)	(α=92.35%)	
2. RP**	73.78	87.80	87.60	80.96
	(α= 95.71%)	(α= 88.49%)	(α= 87.39%)	
3. BP*	69.14	76.38	77.12	75.15
	(α= 90.08%)	(α= 76.46%)	(α= 68.44%)	
4. GH***	51.62	66.83	66.42	71.95
	(α= 62.04%)	(α= 73.79%)	(α= 67.48%)	
5. VT***	54.51	61.91	61.34	60.86
	(α= 54.60%)	(α= 38.40%)	(α= 36.41%)	
6. SF	77.59	82.62	82.64	83.28
	(α= 66.55%)	(α= 44.08%)	(α= 33.70%)	
7. RE***	74.58	92.50	91.60	81.26
	(α= 65.10%)	(α= 82.92%)	(α= 83.40%)	
8. MH	67.95	69.90	69.20	74.74
	(α= 63.75%)	(α= 56.60%)	(α= 48.53%)	

Larger scores indicate better health outcomes.
PF = Physical functioning, RP = Role limitations due to physical health problems
BP = Bodily pain, GH = General health perceptions,
VT = Vitality, energy, and fatigue, SF = Social functioning,
RE = Role limitations due to emotional problems, MH = General mental health
# Scores for General US population is from SF-36 Health Survey Manual and Interpretation Guide (Ware et al. 1993)

Table 4: Bivariate relationship between demographic characteristics and SF 36 subscales pre-Katrina and post-Katrina difference scores (N=82)

Variables	*Diff-PF*	*Diff-RP*	*Diff-BP*	*Diff-GH*
Age				
25-39	7.65*	2.94	6.82*	-7.58^
40-49	-9.77	-18.46	-10.91	-17.20
Sex				
Male	0.89	-12.50	-6.86	-10.11
Female	-9.81	-14.81	-7.43	-17.85
Education				
0-6 years	-10.71	-13.10	-10.05	-20.81
7-9 years	-8.18	-20.45	-18.00	-22.64
10 years or above	-4.06	-13.00	-3.68	-11.22
Occupation				
Agriculture; unskilled; service	-3.18	-4.55	-7.82*	-19.09
Clerical; factory; skilled; sales	-2.92	-7.00	3.72	-9.88
Professional and entrepreneur	0.26	-21.05	-0.47	-13.74
Unemployed and others	-14.63	-19.44	-21.89	-19.59
Marital status				
Never-married	13.75	15.00	-10.00	-15.40
Currently married	-7.64	-17.25	-6.68	-16.25
Divorced or widowed	-3.33	0	-11.50	-2.67

Notes: ^ significant at the $p < 0.1$ level. * significant at the $p < 0.05$ level. ** significant at the $p < 0.01$ level. *** significant at the $p < 0.001$ level.

Table 4: Cont. (N=82)

Variables	*Diff-VT*	*Diff-SF*	*Diff-RE*	*Diff-MH*
Age				
25-39	1.88^	5.88	-5.88	7.53*
40-49	-9.69	-7.88	-21.16	-4.43
Sex				
Male	-3.21	-6.25	-23.46	1.29
Female	-9.62	-4.40	-15.09	-3.63
Education				
0-6 years	-7.86	-10.12	-17.46	-6.10
7-9 years	-17.73	-19.32	-3.33	-4.36
10 years or above	-4.90	0.25	-21.09	0.32
Occupation				
Agriculture; unskilled; service	-5.00^	-11.36*	-12.12	-4.72^
Clerical; factory; skilled; sales	-0.20	8.50	-4.00	7.04
Professional and entrepreneur	-6.84	-2.63	-21.05	-5.89
Unemployed and others	-15.77	-16.67	-32.00	-6.37
Marital status				
Never-married	-11.25	2.50	0	-3.20
Currently married	-7.89	-5.28	-17.87	-1.97
Divorced or widowed	0.83	-8.33	-33.33	-0.67

Notes: ^ Significant at the $p < 0.1$ level. * Significant at the $p < 0.05$ level. ** Significant at the $p < 0.01$ level. *** Significant at the $p < 0.001$ level.

Table 5: Multivariate regression model on SF-36 health dimension pre-Katrina and post-Katrina difference scores

Predictors	*SF-36 Health outcomes Mental Health*							
	Diff-PF		**Diff-RP**		**Diff-BP**		**Diff-GH**	
	Beta	**p**	**Beta**	**p**	**Beta**	**p**	**Beta**	**p**
Age	-1.98**	0.007	-2.90*	0.023	-1.88**	0.01	-0.92^	0.08
Sex								
Female (reference)								
Male	-10.31	0.15	-1.11	0.93	-4.13	0.56	-9.08^	0.078
Education	-0.35	0.60	-2.30^	0.54	-1.24^	0.067	-0.92^	0.06
Marital status								
Separated, formerly married as (reference)								
Never married	-5.17	0.68	-26.03	0.24	-4.28	0.73	-10.93	0.23
Married and living with spouse	-4.65	0.66	-7.09	0.70	8.93	0.40	-1.58	0.84
Occupation								
Agricultural, unskilled, service (Reference)								
Clerical, factory	-2.42	0.83	-13.48	0.48	5.41	0.62	7.96	0.32
Professional, entrepreneur	-4.41	0.71	-36.72^	0.08	-4.62	0.69	-1.70	0.84
Unemployed and other	-18.04^	0.10	-32.44^	0.09	-21.45*	0.05	-6.34	0.42
Constant	103.16	0.004	167.48 **	0.007	88.98**	0.01	42.14^	0.09
R^2	0.19		0.15		0.23		0.17	

Notes: ^ significant at the p < 0.1 level. * significant at the p < 0.05 level. ** significant at the p < 0.01 level. *** significant at the p < 0.001 level.

Table 5: (continued)

Predictors	*SF-36 Health Outcomes Dimension*							
	Diff-VT		**Diff-SF**		**Diff-RE**		**Diff-MH**	
	Beta	**p**	**Beta**	**p**	**Beta**	**p**	**Beta**	**p**
Age	-1.37*	0.011	-1.66*	0.04	-2.15^	0.077	-1.12*	0.021
Sex								
Female (reference)								
Male	-7.67	0.13	-1.42	0.86	5.42	0.65	-7.83^	0.098
Education	0.049	0.92	-0.82	0.28	-0.72	0.53	-0.34	0.45
Marital status								
Separated, formerly married as (reference)								
Never married	-10.32	0.25	-20.38	0.15	-8.08	0.70	-19.47*	0.022
Married and living with spouse	-0.50	0.95	2.77	0.82	2.95	0.87	6.63	0.35
Occupation								
Agricultural, unskilled, service (Reference)								
Clerical, factory, skilled, sale	3.76	0.63	14.91	0.22	-0.24	0.99	11.01	0.13
Professional, entrepreneur	-6.81	0.41	-1.18	0.93	-19.81	0.31	-7.12	0.36
Unemployed and other	-13.81^	0.073	-12.73	0.29	-28.45	0.12	-5.09	0.48
Constant	64.75 *	0.012	75.58^	0.051	91.07	0.117	51.16 *	0.027
R^2	0.22		0.18		0.11		0.23	

Notes: ^ significant at the $p < 0.1$ level. * significant at the $p < 0.05$ level. ** significant at the $p < 0.01$ level. *** significant at the $p < 0.001$ level.

Table 6: Multivariate regression model on depression (N=73)

	Depression	
Predictors	**Unstd beta**	**P**
Age	0.29***	0.004
Sex		
Female (reference)		
Male	-0.36	0.71
Marital status		
Separated, formerly married (reference)		
Never married	1.01	0.57
Married and living with spouse	-0.11	0.94
Occupation		
Agriculture, unskilled, service (RF)		
Clerical, factory, skilled, sales	-1.66	0.19
Professional, entrepreneur	0.31	0.64
Unemployed, other	3.13*	0.03
Pre-Katrina depression score	-0.04	0.63
Constant	-8.12^	0.07
R^2	0.31	

Notes: Vietnamese depression scale: (Range: 3-28), higher score indicates higher depression level.
^ Significant at P<0.1; *Significant at p <0.05; **Significant at p <0.01; ***Significant at p <0.001.