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Physical and Mental Health Status of Hurricane Katrina Evacuees in Houston in 2005 and 2006

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Abstract: **Objectives.** Hurricane Katrina necessitated the evacuation of over 200,000 individuals into Houston. This study compared characteristics of three samples of evacuees with those of the U.S. population and examined how evacuees' experiences have changed over time. **Methods.** Sub-populations of evacuees in Houston were surveyed immediately following the hurricane, two months afterwards, and one year later. Demographic characteristics, socioeconomic status, physical and mental health status, and access to care of the most disadvantaged evacuees in Houston were analyzed. **Results.** Predominantly, evacuees surveyed were Black, low-income, unemployed, and facing challenges accessing health care. Twenty-eight percent felt their health was worse than it was before Katrina. Almost 60% of evacuees reported nervousness, restlessness, worthlessness, hopelessness, and spells of terror or panic at least a few times a week. **Conclusions.** The evacuees displaced by the storm experienced loss of full-time employment, income, and deteriorating health, as well as struggles accessing necessary physical and mental health care.

Key words: Hurricane Katrina, evacuees, mental health, hurricane-related stressors, disasters.

Hurricane Katrina struck the Gulf Coast of the United States on August 29, 2005, and caused one of the largest natural disasters in U.S. history. The hurricane and resulting flooding from levee breaches prompted rapid displacement of people from the metropolitan New Orleans area. Over 200,000 evacuees are estimated to have fled to the Houston area,¹ and over 150,000 remained in Houston almost one year later.² High prevalence of anxiety-mood disorders, particularly acute stress disorder, and posttraumatic stress disorder, have been documented in many of the Katrina evacuees in Houston^{3,4} and other destinations,⁵ and in those who returned to the Gulf Coast.⁶

Separation from family and relocation increase the risk for mental health problems following a disaster.³ Previous research has found that evacuees from natural disasters who did not return to their communities within one year fared worse in terms of

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mental health than those who never evacuated and those who evacuated and returned.³ Vulnerable individuals have been shown to be particularly prone to stress following a disaster, with vulnerability encompassing prior distress, social class, gender, and social isolation deepening socially structured inequalities already in place.⁷

One of the strongest relationships in psychiatric epidemiological research is the negative association between socioeconomic status and psychological distress.⁷ Thus, it is reasonable to expect that the overwhelmingly poor and disadvantaged evacuees who remained in the Houston area after the hurricane, separated from family and social support, might disproportionately suffer from post-disaster stresses. The existing literature on Hurricane Katrina evacuees has not assessed the changes over time in evacuees' physical and mental health problems, major challenges faced, or issues with access to care. We examine descriptive statistics from three separate waves of surveys administered at different points in time to different groups of the most disadvantaged Katrina evacuees in the Houston area (specifically, those who did not have resources to evacuate in advance of the hurricane). We then compare their characteristics with data from the Medical Expenditure Panel Survey (MEPS) to get an overview of how evacuees' socioeconomic status, physical and mental health, health insurance coverage, and access to care differ from those of the general U.S. population.

Methods

Data. Three waves of survey data were collected from Katrina evacuees in the Houston area. The target population for the study was people who remained in New Orleans during the hurricane and were subsequently evacuated to Houston. The following description is adapted from a report written by the principal investigator who gathered the data.⁸ All three waves of the cross-sectional surveys utilized a non-random convenience sample of evacuees.

The first wave was administered from September 10 through September 19, 2005. This wave of the survey was conducted in large shelters with 150 or more evacuees, such as the George R. Brown convention center and the Reliant Center complex. Many of these evacuees had been housed in at least one place before arriving at the large shelter; their responses cannot be generalized to evacuees who were sheltered exclusively in individuals' homes, hotels, or other locations.

Individuals were approached and asked if they were willing to participate in a research study. All three waves of the study involved both participation in experiments about cooperation, for which participants earned between \$10 and \$75, and completion of a survey, for which they earned \$10 more. Efforts were made to achieve a quota of males and females. Initially, the evacuees, emotionally and physically exhausted and living in close quarters, hesitated to participate. After the first groups were surveyed, word spread among evacuees that the survey was for research purposes only, and additional recruitment of respondents was easier. All questionnaires were self-administered. Approximately 8% of the respondents were unable to read, and in those cases a research assistant read the items and recorded the responses.

The second wave of data was gathered from October 21 through November 5, 2005 and surveys were conducted in motels and apartment complexes. The large shelters

had long since closed their doors and evacuees were dispersed across the city. A list of hotels housing evacuees was obtained, and areas with the largest concentration of evacuees were targeted. Fliers noting the times and location of the study were posted in the hotels. The bulk of the surveys were completed next to the swimming pool, with small groups admitted to complete the survey while the others waited nearby. As evacuees moved out of motels during the study period, surveying was moved to apartment complexes.

Wave 3 took place from July 11 to July 21, 2006 in apartment complexes. Facilities were set up within the apartment complexes, and participants were recruited by someone with extensive experience working with Katrina evacuees. Surveys were administered in common rooms within complexes, as well as in individuals' apartments and church meeting rooms. It is important to note that the populations surveyed in each wave are likely to differ due to the departure of those who were able to return home or find more permanent housing. This statistical bias is not controlled for in the descriptive statistics.

Despite efforts to ensure that both genders and all ages 18 and over were represented, there was a dearth of respondents age 65 and older. This is similar to the experience of another large survey of Katrina evacuees.⁹ Wave 1 had five respondents 65 and older (1.5%), wave 2 had six (1.6%) and wave 3 had 25 (6.9%). In order to make valid national comparisons, we removed adults 65 and over from our analysis. This results in sample sizes of 347 nonelderly adults in wave 1, 371 in wave 2 (after also dropping a respondent who reported an age of 12) and 337 in wave 3. In recognition of the fact that leaving home, friends, and family after the hurricane was traumatic, the surveys used wording that encouraged evacuees to refuse to answer any question at any time. Thus, there are missing responses in the data, with some questions having up to 10% non-response rates.

National comparisons are made using data from the 2004 Medical Expenditure Panel Survey (MEPS).¹⁰ The MEPS is a national probability survey designed to be representative of the U.S. civilian non-institutionalized population. We focus on the nonelderly, ages 18 to 64 for comparison with the Katrina evacuee data.

Comparisons with national data allow us to evaluate similarities and differences among the general U.S. population age 18 to 64, the U.S. southern poor population, and the surveyed Katrina evacuees. We defined the southern poor as those individuals in the South with household incomes of less than 125% of the Federal Poverty Level (FPL), since this cutoff most closely resembled the incomes reported by the evacuees. The MEPS designation for the South contains 17 states, including Louisiana, Mississippi, and Texas. All descriptive statistics were calculated using Stata 10.0.¹¹

Results

Demographic comparisons between U.S. population and Katrina evacuees. Although it is not possible to calculate statistically significant differences across these survey responses due to the differences in sampling strategy and sample size of the evacuee surveys, the comparisons give an idea of how the evacuees differ from the general U.S. population. The overwhelming majority of evacuees reported their race as Black

(96.4%), as seen in Table 1 (which reports wave 3 data). More evacuees have some college education (23%) than the general U.S. population (17.2%) or the southern poor (12.8%), but rates of college graduation are comparable between the Katrina evacuees (11.5%) and the southern poor (9.6%). The Katrina population is slightly younger than the comparison groups. The marital status of evacuees differs dramatically from that of the other populations. The majority of evacuees surveyed have never been married (57.8%), while 28.6% of the U.S. population and 37.6% of the southern poor have never been married.

Table 1.

**DEMOGRAPHIC AND HEALTH CHARACTERISTICS OF
KATRINA EVACUEES COMPARED TO THE U.S. NONELDERLY
AND SOUTHERN POOR POPULATIONS**

N=337	Katrina evacuees ^a (%)	Southern poor ^{b,c} (%)	U.S. population (%)
<i>Gender</i>			
Female	55.2	57.0	51.0
<i>Race/ethnicity</i>			
White	0.0	50.7	68.4
Black	96.4	26.5	12.0
Indian/Eskimo	1.5	1.1	0.9
Asian	1.5	1.2	4.8
Hispanic	0.6	20.6	13.9
<i>Education</i>			
No high school education	5.8	11.0	4.6
Some high school	25.5	25.9	10.5
High school graduate	34.2	40.0	33.4
Some college	23.0	12.8	17.2
College graduate	11.5	9.6	33.8
<i>Age (mean)</i>			
	36.4	37.0	39.9
<i>Marital status</i>			
Married	16.0	34.9	55.9
Single	57.8	37.6	28.6
Divorced/separated	13.9	22.9	13.3
Widowed	2.1	4.2	1.9
Unmarried living w/partner	10.2	NA	NA
<i>Health insurance^d</i>			
Private insurance	19.9	17.3	67.1
Uninsured	30.7	56.0	22.5
Medicare	13.3	7.1	2.4
Medicaid/SCHIP	30.4	17.8	5.9
Military	1.8	0.8	1.8
Other government	3.6	1.0	0.4

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Table 1. (continued)

N=337	Katrina evacuees ^a (%)	Southern poor ^{b,c} (%)	U.S. population (%)
<i>Health status</i>			
Excellent	19.9	19.6	29.2
Very good	21.5	20.8	32.6
Good	32.6	32.0	26.0
Fair	19.3	18.2	8.8
Poor	6.6	9.2	3.3
<i>Presence of health conditions</i>			
High blood pressure	26.9	21.8	19.1
Asthma	16.5	10.7	9.6
Arthritis	18.7	19.5	15.8
Diabetes	8.7	8.1	5.4
Heart disease	7.4	8.2	6.4
Stroke	4.2	2.9	1.3
Allergies	29.5	NA	NA

^aData from Wave 3 surveys administered July 11–26, 2006.

^bResidents of the South with income less than 125 percent of Federal Poverty Level.

^cData for Southern poor and U.S. population are from 2004 (MEPS).

^dFor evacuees, insurance status before Katrina.

MEPS = Medical Expenditure Panel Survey

NA = indicates the question was not asked in the MEPS survey

Far more of the general U.S. population has private insurance than the southern poor or Katrina evacuees. One in five evacuees said they had private insurance coverage before the hurricane. Relatively high percentages of the evacuees report Medicare (13.3%) or Medicaid (30.4%) coverage. Thirty percent of evacuees said they were uninsured before Katrina, higher than the national proportion (22.5%), but lower than the proportion of poor respondents of the South who are uninsured (56%).

Health status. The health status of the evacuees is similar to that of the southern poor. Forty-one percent of evacuees are in excellent or very good health, compared with 61.8% of the U.S. population and 40.4% of the southern poor. Evacuee reports of chronic conditions are similar to those of the other populations. However, slightly greater proportions of evacuees report high blood pressure (26.9%) and asthma (16.5%). Almost one-third of evacuees report suffering from allergies.

Evacuee health and access to care. Immediate effects of the hurricane on evacuees' health and well-being, as well as access to care in the months after the hurricane, are highlighted in Table 2, which reports on responses from Waves 2 and 3. Illness and injury imposed by the hurricane included cuts (11.6%), skin rashes (23.4%), nausea (19.7%) and sprains or broken bones (4.3%). Almost 10% experienced the worsening of an existing medical condition, and 6.5% indicated the hurricane brought on depression, anxiety, or headaches.

Table 2.**EFFECTS OF HURRICANE KATRINA ON EVACUEES' HEALTH, ACCESS TO CARE, INCOME AND EMPLOYMENT, WAVES 2 AND 3^a**

Variable	%	N
<i>Did you suffer from illness or injury due to Katrina?^b</i>		
Cut	11.6	43
Skin rash	23.4	87
Nausea	19.7	73
Sprain/broken bone	4.3	16
Worsening existing medical condition	9.7	36
Depression/anxiety/headaches	6.5	24
<i>How many times have you seen a doctor or nurse since Katrina?^b</i>		
0	38.5	143
1	25.0	93
2	19.9	74
3	7.3	27
4+	9.1	34
<i>How many times have you been to the doctor or nurse since January 1, 2006?^c</i>		
0	26.7	90
1	22.6	76
2	11.0	37
3	9.5	32
4+	21.1	71
<i>Where have you received medical care since Katrina?^b</i>		
Temporary shelter for evacuees	38.5	143
Doctor's office	10.5	39
Emergency room	15.9	59
Clinic/other health center	13.7	51
<i>During or since Katrina, was anyone in the family unable to get medical help they felt necessary?^b</i>		
See a doctor	32.8	122
Medical tests	11.0	41
Medical treatments	12.6	47
Prescription medicines	29.1	108
<i>Health compared to before Katrina^b</i>		
Worse	28.3	105
About same	53.3	194
Better	17.5	65
<i>Health compared to before Katrina^c</i>		
Worse	27.6	98
About same	54.9	163
Better	12.2	70

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Table 2. (continued)

Variable	%	N
<i>Before the hurricane how were you employed?^a</i>		
Working full time	58.2	196
Working part time	11.3	38
Retired	3.9	13
Student	6.8	23
Homemaker	4.5	15
Unemployed	13.9	47
<i>Have you found employment since you arrived in Houston?^a</i>		
Yes, full time job	11.9	40
Yes, part time job	11.0	37
Yes, but I have stopped working	6.5	22
No	68.2	230
<i>Income (household, before tax, in year before Katrina)^c</i>		
<\$15,000	41.5	140
\$15,000–\$25,000	30.9	104
\$25,000–\$50,000	16.6	56
\$50,000–\$75,000	4.7	16
\$75,000+	2.4	8
<i>Income (household, before tax, now)^c</i>		
<\$15,000	71.5	241
\$15,000–\$25,000	15.4	52
\$25,000–\$50,000	5.0	17
\$50,000–\$75,000	1.5	5
\$75,000+	1.8	6

^aPercentages do not sum to 100 due to missing responses.
^bResponses from Wave 2 survey (October 21–November 5, 2005).
^cResponses from Wave 3 survey (July 11–21, 2006).

In wave 2, conducted two months after the hurricane, 38.5% of evacuees indicated they had not seen a doctor or nurse since Katrina. The remainder reported they had at least one visit, with 10 being the maximum number of visits recorded. Close to 40% said they had received medical attention at a temporary shelter for evacuees, and some were treated at a doctor's office (10.5%) or a clinic (13.7%). Nearly 16% reported they had sought care at an emergency department. In wave 3, 26.7% reported that they had not had any visits to the doctor or nurse since January 1, 2006, indicating evacuees surveyed in this wave experienced better access to care. However, having made a visit varied greatly by insurance status. Almost 40% of the uninsured reported no visit to the doctor or nurse, while only 13% of those reporting private insurance, 25% of those with Medicare, and 15% of the Medicaid population reported not having made a visit.

Significant access difficulties were indicated in the two-month period following

Katrina. One-third of evacuees reported they or someone in their family was unable to see a doctor when they felt it was necessary. Obtaining prescription medications was an obstacle for three out of ten respondents. Problems accessing necessary medical tests (11%) or treatments (12.6%) were also reported.

Changes pre- and post-Katrina. Katrina affected self-reported health, income, and employment status of evacuees. When asked in wave 3 to compare their current health status with their health status the day before Katrina, 27.6% reported it to be worse. Fifty-five percent felt their health status remained the same, while 12.2% felt their health had improved (the wave 2 respondents answered similarly when they were asked the before and after question). Employment and income are socioeconomic characteristics closely tied to well-being. Both of those factors were affected by the post-Katrina upheaval. The majority of evacuees reported in wave 3 that they were employed before the hurricane, with 58.2% working full-time, 11.3% working part-time, and 13.9% unemployed. Those same respondents indicated that, almost one year after the hurricane, 68.2% had not found employment since arriving in Houston. Another 6.5% had found a job in Houston but were no longer working. Almost 12% reported securing a full-time job, and 11% had a part-time job.

It is well known that most New Orleans residents before the hurricane were not wealthy.¹² Furthermore, New Orleans residents who evacuated to shelters were overwhelmingly from low-income households. This predominantly low-income population suffered an additional financial hit as a result of the hurricane. Approximately 41% of evacuees in wave 3 reported household income of less than \$15,000 in the year before Katrina, almost one-third had incomes between \$15,000 and \$25,000, and 7.1% had incomes greater than \$50,000. Seventy-one percent of those evacuees reported that nearly a year after the hurricane their income was less than \$15,000, 15.4% reported incomes between \$15,000 and \$25,000, and 3.3% reported incomes greater than \$50,000.

Mental health. Table 3 compares the mental health status of Katrina evacuees with that of the U.S. population. Perhaps surprisingly, evacuees were less likely than the southern poor (39.3%) to report suffering from anxiety and/or depression. Almost 19% of evacuees reported anxiety/depression in wave 2, whereas 25.8% of the evacuees surveyed in wave 3 suffered these conditions.

Four measures from the Kessler K-6 screening scale of mood-anxiety disorders were asked of the evacuees. The results can be compared with responses from the MEPS estimates of the U.S. population to get a general idea of the reported prevalence of these disorders. The K-6 measures include feeling *nervous, restless, hopeless, and worthless*. The K-6 scale is useful in identifying potentially serious mental health problems.¹³ Evacuees are more likely to report feeling nervous *some, most, or all of the time* (52.6% in wave 2 and 48.7% in wave 3) than the U.S. (20.5%) and southern poor (32.9%) populations. Evacuees were much more likely than the U.S. population and southern poor to report feeling restless, with 53% of evacuees in wave 2 reporting restlessness. Almost 44% of evacuees surveyed in wave 3 reported feeling restless. Although this cohort was less likely than the previously surveyed evacuees to report restlessness, it constitutes a much larger share of the wave 3 surveyed evacuees than the 22% of the U.S. population and the 34.9% of southern poor respondents who report feeling restless according to MEPS.

Table 3.**MENTAL HEALTH STATUS OF EVACUEES
COMPARED WITH THE U.S. POPULATION^{a,b,c,d}**

Variable	Wave 2 n=371 %	Wave 3^e n=337 %	Southern poor^f %	U.S. population %
<i>Anxiety/depression</i>				
Yes	18.9	25.8	39.3	24.0
No	81.1	62.3	59.5	75.5
<i>Nervous</i>				
Yes	52.6	48.7	32.9	20.5
No	32.9	45.7	66.0	78.1
Don't Know	4.9			
<i>Restless</i>				
Yes	53.1	43.9	34.9	22.2
No	32.9	49.3	63.7	76.3
Don't Know	5.9			
<i>Worthless</i>				
Frequently	15.9	14.8	4.1	1.0
Sometimes	29.9	30.0	31.0	18.4
Never	41.8	52.8	63.3	79.1
Don't Know	6.5			
<i>Hopeless</i>				
Frequently	24.5	23.7	3.6	1.0
Sometimes	39.6	35.6	40.4	26.2
Never	25.1	34.7	54.8	72.4
Don't Know	4.3			
<i>Scared</i>				
Yes	38.8	32.0		
No	41.8	59.6		
Don't Know	5.4			
<i>Fearful</i>				
Yes	42.0	40.7		
No	37.7	47.5		
Don't Know	5.7			
<i>Tensed</i>				
Yes	52.3	56.7		
No	30.5	38.3		
Don't Know	6.5			
<i>Suicide</i>				
Frequently	5.7	3.6		
Sometimes	12.9	15.7		
Never	70.4	77.4		
Don't Know	5.4			

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Table 3. (continued)

Variable	Wave 2 n=371	Wave 3 ^e n=337	Southern poor ^f	U.S. population
	%	%	%	%
<i>Lonely</i>				
Frequently	27.2	28.5		
Sometimes	43.4	46.6		
Never	19.7	23.4		
Don't Know	3.0			
<i>Blue</i>				
Frequently	19.9	22.3		
Sometimes	42.0	45.7		
Never	22.9	24.3		
Don't Know	6.5			
<i>Difficulty making decisions</i>				
Frequently	25.9	18.4		
Sometimes	42.3	55.5		
Never	23.2	24.6		
Don't Know	2.2			
<i>Spells of terror or panic</i>				
Yes	27.8			
No	47.2			
Don't Know	7.5			
<i>Are you having these reactions at least a few times a week?</i>				
Yes	56.9			
No	27.5			
Don't Know	7.5			
Not Applicable	6.5			
<i>Have you discussed these reactions with a doctor, nurse, etc?</i>				
Yes	15.4			
No	74.7			
Not Applicable	7.8			

^aMedical Expenditure Panel Survey (MEPS), 2004. Rockville, MD: Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services.

^bYes includes some, most or all of the time responses. No includes little or none of the time. Frequently = all of the time; sometimes = a little, some, or most of the time; never = none of the time.

^cThe reference time period varies: for MEPS response it is in the last 4 weeks, for Wave 2 since Katrina for Wave 3 since January 1, 2006.

^dPercentages do not sum to 100 due to missing responses.

^eDon't know was not an option in Wave 3 of the survey.

^fData for Southern poor and US population are from 2004 (MEPS).

Feelings of worthlessness or hopelessness are strong indications of mental health status, particularly depression,¹⁴ and evacuees are far more likely than the southern poor or general U.S. population to report frequently experiencing these emotions. Less than 1% of the U.S. population reports frequently feeling worthless or hopeless, whereas 15.9% of evacuees in wave 2 frequently felt worthless and 24.5% frequently felt hopeless. There was little difference in reports across waves, with 14.8% frequently feeling worthless and 23.7% frequently feeling hopeless in wave 3. Although these results cannot be compared directly due to differences in sampling, the differences do provide some insight into the circumstances faced by the evacuees.

The remaining mental health questions are not paired with results from a national dataset; instead, they focus on evacuee responses within waves over time. In wave 2 [October 21–November 5, 2005], evacuees were asked to compare their current situation with their situation just prior to Katrina, a period of two or three months. Wave 3 [July 11–July 21, 2006] respondents reported on their status since January 1, 2006, a longer time period that stretched over more than six months. The only notable evident improvements between evacuees surveyed in wave 2 and wave 3 include reports of being distressed or bothered by feelings of being *scared* and reporting *difficulty making decisions*; in fact, these might not be improvements but instead merely differences between the evacuees surveyed in those waves. Thirty-nine percent of evacuees in wave 2 and 32% in wave 3 felt scared, and 25.9% in wave 2 compared with 18.4% in wave 3 said they frequently had difficulty making decisions.

About the same percentages across the two waves reported feeling *fearful*, *tensed*, *frequently lonely*, and *frequently blue*. Forty-two percent of evacuees felt fearful in wave 2, 52.3% reported feeling tensed or keyed up, 27.2% were frequently lonely, and 20% were frequently blue. Six percent of evacuees in wave 2 were distressed by feelings of suicide, whereas 3.7% reported these feelings in wave 3. In wave 2, 27.8% of evacuees reported having experienced spells of terror or panic. Almost 57% of evacuees in wave 2 said they have any of the above mental health-related reactions at least a few times a week. Only 15.4% of these respondents reported discussing their feelings of fear, tension, suicide, depression, anxiety, and other emotions with a doctor or nurse.

Evacuees were asked their view of prospects for staying in Houston (Table 4). In wave 1, 48.7% of evacuees reported they were *very likely* or *somewhat likely* to stay in Houston. Already, only one-third felt it was *very likely* they would return to their community. Six weeks later in Wave 2, 55.3% reported they were *very likely* or *somewhat likely* to stay. By wave 3, 68.2% of evacuees (who had already remained in the Houston area for almost a year) indicated it was *very likely* or *somewhat likely* they would remain in the Houston area. It is important to note that the final wave did not include the *don't know* option that was included in earlier waves. In earlier waves, fewer evacuees reported a great likelihood of remaining in the area, but they also reported uncertainty about the place to which they would relocate. Wave 3 results suggest that after one year, evacuees thought it was unlikely they would be leaving Houston.

Table 4.**TRENDS IN DECISION TO REMAIN IN HOUSTON^a**

	Wave 1 n=347	Wave 2 n=371	Wave 3 n=337
<i>How likely is it you will permanently stay in Houston(%)?</i>			
Likely	48.7	55.3	68.2
Unlikely	15.0	16.2	30.3
Don't Know	31.1	26.7	NA

^aPercentages do not sum to 100 due to missing responses; *don't know* was not a choice in wave 3. NA = not applicable

Discussion

The evacuee surveys were designed to follow the experiences of individuals who did not have resources readily available to evacuate New Orleans in anticipation of Katrina. They are intended to reflect the circumstances of the most disadvantaged evacuees, rather than all evacuees. The evacuees surveyed were much more likely to be Black, low-income, and single than the general U.S. population. In many demographic respects, they resemble the southern poor generally. We find that the hurricane exacted a great toll on evacuees, particularly affecting employment and income. U.S. Census Bureau data reveal a similar finding: the larger evacuee population displaced by the storm has a high unemployment rate, low incomes, and limited housing.¹⁵ Three out of ten in our study report their health status was worse after the hurricane, and many report difficulties getting access to care. Evacuees were less likely than the general population to report suffering from anxiety or depression as such. However their responses to K-6 scale measures reflect a disproportionately high likelihood of potential mild/moderate and even serious mental illness. Their responses also indicate that—despite almost 60% of evacuees reporting feelings such as fear, tension, suicide, depression, anxiety and spells of terror or panic at least a few times a week—they are not discussing their feelings with trained medical professionals.

Those evacuees remaining in Houston have little to go back to in New Orleans and may never return. The scale of devastation in the poorest neighborhoods of New Orleans has most likely resulted in a permanent demographic change.² The increased likelihood of remaining in Houston may be driven in part by the selection effect of evacuees who were not able to return home; the longer they remained, the greater the likelihood that evacuees would stay in the area. More than 200,000 initially evacuated to the Houston area; many with resources seized early opportunities to return to New Orleans. The resulting socio-demographic changes in both New Orleans and Houston are likely the largest experienced in the U.S. in the past century.² Houston data indicate that 83,300

evacuees were occupying government-financed apartments in January 2006.¹⁶ Roughly one-fourth of this group ended up in high-crime neighborhoods, adding to an already stressful relocation. Researchers coordinating data efforts for the data in our study estimate the surveyed population is representative of about 40,000 evacuees, likely the most vulnerable and disadvantaged of all those fleeing Katrina.

The picture for the evacuees remaining in the Houston area is bleak. Many depend on government assistance (ironically considering the inadequacy of the government's initial response to the storm).¹⁷ Houston's health care system was already overwhelmed before the hurricane struck. The initial impact of evacuees on Houston's emergency departments in the days after the storm was modest,¹⁸ but there have been no reports on larger effects on Houston's health care system. Almost one-third of Houston residents are uninsured, and the capacity of the safety net system is limited and meets less than one-third of the demand for its services.¹⁹ Mental health facilities are at capacity, and Katrina heightened the need for mental health services for Houston residents as well as for the evacuees (W. Schnapp, personal communication).

Limitations. There are a number of limitations to our study. Given the nature of the sampling design, the survey results are not intended to reflect the characteristics of all evacuees. Rather, they are representative of a subset predominantly made up of Black, low-income, disadvantaged, long-time New Orleans residents who were forced to shelters of last resort before they drove or were bused to Houston. The strategies for identifying and recruiting subjects are not standardized and result in a variable sampling framework. Statistically significant differences across waves cannot be calculated as the denominator of eligible subjects in each wave likely differs. Thus, temporal analysis is restricted to before and after responses by evacuees within each wave of the surveys rather than across the waves. Inferences across waves over time about improvements or worsening of evacuees' characteristics are not possible, as the evacuee population changes over time.

Due to there being very few respondents over age 65, the elderly were dropped from our analysis. The non-random sample-selection approach implemented here and the random approach within a convenience sample implemented in Brodie et al. suggest that there was no best method of ensuring the elderly were represented in the surveys.⁹ Considering the elderly made the majority (55%) of the clinic visits at the shelters,²⁰ future surveys following disasters should ensure their needs are evaluated.

It is important to note that the wording of the surveys administered to evacuees differs from the wording of the comparable questions in MEPS. For example, in wave 2 evacuees were asked to report on circumstances *since Katrina*, in wave 3 the time frame was *since January 1, 2006*, and in the MEPS the time frame is *in the last four weeks*. Responses available in MEPS were not always the same as those in the survey. The questions and possible responses in each wave of the survey sometimes differed. *Don't know* was a choice in wave 2 that was not included on wave 3 surveys.

Conclusions

Not only did Katrina evacuees to Houston endure a natural disaster, they endured an inadequate government response to it and its aftermath. The chaos that ensued imme-

diately after Katrina and the slow emergency response could have exacted a higher mental health toll on some individuals.^{21,22} It is clear that many evacuees remaining in the Houston area are poor and in need of health care services, with the uninsured bearing the brunt of lack of access to care. The situation is unlikely to improve. Evacuees are affected in many ways that we will never completely disentangle. For example, in a 2007 survey analyzing a convenience sample of the homeless in Houston, 6% of the homeless surveyed reported they were Hurricane Katrina or Hurricane Rita evacuees (D. Buck, personal communication). It is important to address the health care needs and access issues in this population in the short run. In the long run, efforts should be undertaken to improve both education and employment for the evacuees. Public health professionals must take a leadership role so that the natural disaster does not balloon into a force that further deepens social disparities, particularly in health.²³

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Notes

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