

Social costs of displacement in Louisiana after Hurricanes Katrina and Rita

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Abstract Hundreds of thousands of Louisiana citizens were displaced from their homes as a result of Hurricanes Katrina and Rita. Of those displaced within Louisiana some relocated to other parishes, some to other residences within the same parish, and others were able to return to their pre-storm residence. This article draws upon data gathered by the 2006 Louisiana Health and Population Survey to examine the social costs of displacement across 18 Louisiana parishes approximately 1 year after the hurricanes. Specifically, we examine how displacement affected housing, economic, and health outcomes for individuals and families. Further, we compare the implications of two types of displacement (1) internal displacement—within-parish relocation versus (2) external displacement—relocation across parish lines. We found that the displaced had lower odds of owning their homes, living in detached housing, and retaining access to primary health care facilities. The displaced were also more likely to be unemployed and exhibit symptoms consistent with severe mental illness. The externally displaced suffered income declines. These trends are critically important for understanding both the short- and long-term ramifications of displacement after disaster. Our findings have implications for theories, policy makers, and planners considering the larger social costs of disaster and large-scale displacement.

Keywords Displacement · Disaster · Migration · Hurricane Katrina · Hurricane Rita · Environment · Natural hazards · Natural disaster · Social impacts · Homeownership · Income

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Introduction

One of the more critical factors affecting recovery from disaster is displacement. On balance, past research suggests that individuals and families who are forced from their pre-disaster places of residence are more likely to lose jobs and income, and are more prone to experiencing health problems during the recovery period (see Norris et al. 2002 for an overview of the literature). We define these challenges as the social costs of displacement.

We build upon previous research by assessing the extent to which displacement has implications for housing, employment, income, and health. This article examines these social costs of displacement by making use of a unique data set to compare two groups of Louisiana residents (displaced versus non-displaced) 1 year after the catastrophic hurricanes. The 2006 Louisiana Health and Population Survey (LHPS) (Louisiana Department of Health and Hospitals and Louisiana Recovery Authority 2006), conducted from June to December 2006 and covering 18 parishes (counties) directly and indirectly affected by either Hurricane Katrina or Rita (or both) enabled demographers to provide accurate estimates of displacement by differentiating among three groups of 2006 southern Louisiana residents: (1) non-displaced, those still living in pre-hurricane places of residence; (2) internally displaced, those still living in pre-hurricane parishes, but forced to move to a new residence; and (3) externally displaced, those still living in the southern Louisiana region who had relocated from other parishes after the storms (Hori et al. 2009). Altogether, these three groups make up the population, which remain after the devastating storms of 2005—the people who constitute a large part of the population associated with recovery in these regions. Our findings have implications for theories concerning the effects of disasters, for policy makers considering the larger social costs of disaster and large-scale displacement, and for planners interested in providing both short- and long-term assistance to areas in which a large proportion of the population is displaced.

Before presenting our findings, we first summarize the displacement dynamics in the wake of Hurricanes Katrina and Rita, and provide a conceptual framework, rooted in previous disaster studies, to guide our analysis of the social costs of displacement.

Population movement after the 2005 hurricanes

In 2005, Hurricanes Katrina and Rita forced hundreds of thousands of Gulf coast residents to temporarily or permanently relocate to other states, to other locations within the state, or to other residences within the same community in which they lived before the catastrophic storms. Researchers have begun to catalog the dynamics of this displacement (e.g., Hori et al. 2009; Plyer and Bonaguro 2007; Swanson et al. 2007). These demographic trends are critically important for understanding both short- and long-term ramifications for areas devastated by disasters. Short-term demographic trends affect efforts to provide temporary housing (Quarantelli 1982, 1995), and health care services (Norris et al. 2002). Over

the longer term, “[demographic] estimates are used for many types of decision-making, from distribution of state revenue-sharing dollars to choosing the location for fast food restaurants” (Smith 1996, p. 459).

Researchers confront several challenges in tracking displaced populations after disasters, including (1) lack of available data (Hori et al. 2009; Smith 1996); (2) technical difficulties of collecting data under extreme and dynamic circumstances in the wake of a disaster; (3) accurate assessment of the scale of disaster since the potential destination for the displaced is unlimited so that tracking all movements is nearly impossible; and (4) the cost of data collection. As a consequence, few studies have explored the social costs of displacement through explicit comparisons between displaced and non-displaced populations in and surrounding areas devastated by disasters.

The extent, quality, pace, and overall length of the recovery process, however, depend not only on rebuilding damaged physical infrastructure, but also on gaining a better understanding of, and addressing, the social costs related to being displaced or to living in areas where large numbers of residents have been displaced from their former homes, family, friends, and daily routines. Despite these challenging realities, demographers have successfully developed reliable methods to estimate post-disaster population shifts. Smith (1996) and Smith and McCarty (1996) introduced the scientific approach of population estimates and tracking the displaced after Hurricane Andrew in 1992. There were several demographic studies conducted after Hurricanes Katrina and Rita in 2005. Shortly after the storms, a “rapid community needs assessment survey” (McNeil et al. 2006) and a “rapid population estimate survey” (Stone et al. 2007) were conducted in Hancock County, Mississippi and the City of New Orleans, respectively. Another study estimated population and housing damage in the most damaged areas in Mississippi (Swanson et al. 2007).

According to Census estimates (2006), Louisiana lost approximately 208,000 residents between 2005 and 2006. This represents 4.8% of the total state population. This population loss was primarily from the most devastated parts of Louisiana, including the New Orleans metropolitan area, the most populous part of the state. The parishes directly hit by the hurricanes experienced vast changes in their population. In contrast, other parishes experienced population increases, due to both disaster-related displacement and longer-term migration trends. According to the Census, however, the population increases in any particular parish were modest (i.e., less than 10% increase) suggesting that displaced populations in the region were distributed somewhat evenly. In sum, net population figures produced by Census suggest that Hurricanes Katrina and Rita caused substantial population loss in four severely damaged parishes—Orleans, Plaquemines, St. Bernard, and Cameron—but minimal population change in other regions or the state as a whole.

Meanwhile, Hori et al. (2009) documented that the actual number of people displaced by Hurricanes Katrina and Rita was much more than the number indicated by the net change in population. They estimated the out-migration and in-migration separately for the more severely devastated parishes in southern Louisiana. They also captured the people who were displaced within their pre-storm parish due to storms, which is not typically possible to estimate. Their results indicated that the

actual displaced population was much greater than suggested by Census estimates; net population figures underestimated the scale of displacement. For example, Census estimates for Jefferson Parish indicated a 4% population decline (22,000). In contrast, the authors' analyses estimated that 195,000 individuals in Jefferson Parish were displaced after 2005 hurricanes as follows: 85,000 by out-migration, 63,000 by in-migration, and 47,000 by intra-parish movement (Hori et al. 2009).

These findings are critical for policy makers and service providers, since those displaced face many challenges by displacement, such as losing resources and connection to community, regardless of the direction or distance they moved. Although this study was cross sectional and could not measure the pace of repopulation and recovery, the results clearly showed that total population movement after a massive disaster could be more than the initial estimates based on net population change.

The effects of displacement on individuals and families

Erikson's (1976) seminal study of the Buffalo Creek Flood vividly portrayed the sense of hopelessness, shock, and trauma that characterizes "disaster syndrome" resulting from a general perception that a community and a way of life have been demolished. Subsequently, a large body of literature in the "disaster mental health" tradition has concluded that psychological effects of disasters are multifaceted and can persist for years (Norris et al. 2002). While acknowledging in general pervasive effects of disasters on individuals, more detailed analysis has found substantive individual and group level differentiation in post-disaster recovery (Halpern and Tramontin 2007, p. 101).

Housing and living situation

The first challenge facing those displaced by Hurricanes Katrina and Rita involved finding temporary, semi-permanent, or permanent housing. These challenges were more pronounced for those still living in the most devastated parishes of Orleans, Plaquemines, St. Bernard, and Cameron, due to the sheer devastation to available housing stock. Those displaced to surrounding parishes may have been relegated to in less-than-ideal situations, such as FEMA trailer parks, hotel rooms, separated from family, or doubled up with relatives or friends. These are but a few of the complex constellation of housing and living situations in which Louisiana residents found themselves following Hurricanes Katrina and Rita. Many of the displaced remained in temporary housing and living arrangements for years after the event, due both to the enormous scale of the damage to housing caused by Katrina and to the relatively slow pace of recovery funding distribution (Gall and Cutter 2007; Horne 2006).

Previous disaster studies directed at both the household and community levels have pointed to the critical importance of re-establishing housing (Peacock et al. 2006). In situations where large numbers of people cannot return to their pre-disaster residence, a complex process unfolds in which evacuated individuals and

families first seek emergency shelters, then temporary housing, and finally permanent housing or semi-permanent housing (Quarantelli 1982, 1995).¹ The sheer scale of Hurricane Katrina may cause scholars to reconsider the adequacy of Quarantelli's housing classification system as it appears that up to 40% of the pre-storm housing stock was devastated beyond the capacity to repair. Moreover, concomitant hindrances to rebuilding such as coastal degradation and sky-rocketing insurance costs cast doubt as to whether some areas will ever be able to rebuild enough housing to re-establish their pre-storm populations (Picou and Marshall 2007). Previous disaster housing research points to several aspects of disasters and the recovery process that work to reinforce or exacerbate existing inequalities: (1) Federal assistance programs favor homeowners over renters (Peacock and Girard 1997; Peacock et al. 2006); (2) urban centers with high proportions of renters are particularly vulnerable to increased poverty in the wake of disasters (Comerio 1998); (3) rents tend to increase after disasters and many available rentals are taken by higher income households temporarily displaced from their pre-storm homes (Bolin and Stanford 1998); and (4) minority ethnic and racial groups tend to be overrepresented in low-income groups and, therefore, have the most difficult time with housing recovery in the wake of a disaster (Comerio 1998; Peacock et al. 2006). Therefore, in studying post-disaster situations, it is important to distinguish between the effects of displacement on housing and the effects of class and race on housing.

Income and employment

A second key challenge that some individuals face after a disaster is finding employment or otherwise maintaining the income necessary to support themselves. In the aggregate, economists have noted that hurricanes and other disasters can cause tremendous damage to an area's economy without causing major changes in employment rates and per capita income (Guimaraes et al. 1993). This happens because post-disaster reconstructions often provide employment and income-earning opportunities in the short term, making up for losses in standard economic activity. An economic analysis of Hurricane Hugo demonstrated that the major impact was not in the aggregated per capita income or employment, but rather in the sectoral composition of jobs and income—with substantial increases in construction and retail trade counterbalanced by declines in other sectors of the economy (Guimaraes et al. 1993). Importantly, however, these income and employment benefits often fail to make up for the loss of wealth (Guimaraes et al. 1993). Further, the sheer scale of Hurricane Katrina makes this disaster unique in that it remains unclear whether full recovery will ever occur; in any case, the recovery process is projected to last well over 10 years (Brunsma et al. 2007).

One study examining post-Hurricane Katrina employment found that displaced persons had lower odds of employment recovery, operationalized as having a job or having a job that was “just as good” as the job held before Katrina, a year after the

¹ Of course, this is a gross oversimplification of the process, the main point being that housing options shift from in the immediate, short-term, and longer-term period of recovery (Quarantelli 1995).

storms (Zottarelli 2008). This study also found that low income blacks living in New Orleans have uniquely low odds of employment recovery. Although the focus of Zottarelli's study was on the intersection of race and place, the findings clearly indicate a strong negative impact of displacement (even after controlling for race and place of pre-storm residence).

Our findings below may be seen as a replication of this analysis using a different data set. Zottarelli (2008) used data from a two-stage Gallup survey conducted first in September/October 2005 with a follow-up in August 2006. Zottarelli's study differs from this research in that it includes only hurricane survivors (identified through their application for assistance through the Red Cross), whereas our study includes estimates of all residents living in an 18 parish region in Louisiana, irrespective of whether they ever sought disaster assistance.

Health

A third challenge many hurricane survivors face relates to health care. The extensive literature on the health implications of disaster points to three primary concerns: (1) accessing care, (2) maintaining health insurance, and (3) coping with anxiety, depression, and other mental health disorders (see Norris et al. 2002 for a comprehensive review).

Major hurricanes and other disasters cause major disruptions to existing health care systems, and this was certainly the case following Hurricanes Katrina and Rita. Federal funding for post-disaster health care delivery may have helped to alleviate some of the challenges of providing care to survivors, but the availability of post-disaster care is, at least, partially dependent upon the viability of the services and systems of delivery that existed before the disaster (Axelrod et al. 1994). All those who remain in the most devastated regions may face challenges accessing care. If one's primary care practitioner's office has been shut down, then it makes little difference whether that particular person was or was not displaced from their home. Still, those who are displaced, especially those who relocated far from their previous community, may have more difficult challenges accessing care in their new or temporary residence. General practitioners may be not be accepting new patients; it may be difficult to have medical histories transferred; it may be more difficult and time consuming to find transportation to access care. These are just a few of the many and complex challenges of accessing health care for displaced persons.

Decades of disaster mental health literature have consistently demonstrated a strong relationship between forced and voluntary movement, and psychiatric symptoms among survivors of disasters (Norris et al. 2002). A recent study demonstrated that psychological problems can persist for more than 2 years after a disaster, and that relocated victims were twice as likely as non-relocated victims to experience psychiatric symptoms operationalized as medically unexplained physical symptoms (MUPS) (Yzermans et al. 2005). Studies completed since Katrina and Rita have demonstrated broad mental health consequences of these catastrophic hurricanes (Singelmann and Schafer forthcoming; Kessler et al. 2006). Other studies have shown extremely elevated levels of depressive symptoms among residents of FEMA parks in Louisiana (Singelmann and Schafer forthcoming).

In sum, the literature clearly suggests that major disasters may have employment, income, housing, and health implications for all victims, and that these challenges may persist for years. Equally clear are findings that the challenges may be particularly acute for displaced victims. We, next, turn to our analysis of the implications of displacement in southern Louisiana.

Methods

Data and sample

We used data from the 2006 LHPS conducted from June through December 2006 in 18 parishes affected by Hurricanes Katrina and Rita in southern Louisiana² (see Fig. 1 for the locations of these parishes).

The 2006 LHPS was administered under the technical assistance of the U.S. Census Bureau and U.S. Centers of Disease Control and Prevention (CDC)/Agency for Toxic Substances and Disease Registry (ATSDR) as requested by the Louisiana Department of Health and Hospitals (LaDHH) and Louisiana Recovery Authority (LRA). The survey was designed to provide accurate population estimates and collect demographic and health information for 18 parishes of southern Louisiana approximately 1 year after the 2005 hurricane season. The 2006 LHPS is a cross-sectional, household survey using a two-stage cluster sampling technique that achieved an 82.8% response rate.³ The standard census sampling technique based upon census blocks was modified using locally available data (i.e., the number of FEMA trailer parks and local judgments about the habitability of housing units). The full data set contained responses from 5,556 households representing 15,003 individuals.

The strength of the 2006 LHPS for our analysis of displacement lies in its ability to distinguish between internally and externally displaced populations by asking three questions. The survey had 25 questions in total; some questions were asked only for the first 5 people in the household, and some were asked only regarding people over a certain age. Displacement questions were asked for the first 5 people in the household of all ages. The three questions are following:

1. Is this the same house this person lived in before the 2005 hurricanes (before August 29th 2005)?
2. If NO, what was this person's zip code before the 2005 hurricanes (before August 29th 2005)? (if person does not know his/her former zip code, specify the city, parish/county, state or country he/she moved from.)
3. What was/were the reason(s) for this person's change in residence after the 2005 hurricanes? (Mark ALL that apply)—Moved because a person in

² Our analysis utilized the 2006 LHPS—Controlled Weights (Louisiana Department Health and Hospitals and Louisiana Recovery Authority 2006). The 18 surveyed parishes are: Ascension, Calcasieu, Cameron, East Baton Rouge, Iberia, Jefferson, Lafourche, Livingston, Orleans, Plaquemines, St. Bernard, St. Charles, St. Helena, St. Tammany, Tangipahoa, Terrebonne, Vermilion, and Washington.

³ Figure calculated by LHPS researchers and reported in Hori et al. (2009).



Fig. 1 Map of 18 surveyed parishes in Southern Louisiana

household lost job due to hurricane, Former house was damaged, Moved to Louisiana/this parish for job opportunities, and Other reason (specify).

From these questions, we determined (1) the number of the displaced by counting the respondents who answered ‘no’ to the first question, (2) the pre-hurricane parish of residence by using geographic information given to the second question, and (3) the number of the displaced by counting the respondents who chose “former house was damaged” and/or “lost job due to hurricane” for the reason they changed residence.

We then classified our sample into three categories: (1) non-displaced—those who stayed at their pre-storm residence, (2) internally displaced—those who were displaced due to storm and moved within their pre-storm parish, and (3) externally displaced—those who were displaced due to storm and moved outside their pre-storm parish. We excluded respondents who moved to different residence for non-storm related reasons from our analysis, since this category included rescue/recovery workers. We also excluded respondents younger than 16 years old. After excluding non-storm related migrants and population under 16 years old, the sample size consisted of 4,970 households and 10,347 individuals.

The shortcoming of the 2006 LHPS lies in that fact that, as a rapid response survey, it was limited in scope. In addition to including only 25 questions, the survey did not gather sufficient information on the pre-storm housing, employment, and health situations to support detailed analysis. Ideally, we would have liked to know whether former homeowners still owned their homes, received insurance settlements, or were eligible for public recovery payments. Similarly, it would have been helpful to have more information on pre-storm health situations of respondents to focus attention more specifically on whether those who needed primary care access were receiving it. Despite these limitations, the 2006 LHPS does allow us to

take a first step in comparing the relative social costs of internal versus external displacement.

Dependent variables

The 2006 LHPS included questions about the entire household and the individuals within the household. The first person in the household (Person 1) was asked to fill out the form and answer questions for all the members in the household. Person 1, as defined in the questionnaire of the 2006 LHPS, is supposed to be “the person living and staying here, and in whose name this house or apartment is owned or rented” (2006 Louisiana Health and Population Survey 2006). In cases where no such person was available, any adult living or staying in the residence could be Person 1. Therefore, Person 1 is an adult member of the household and most likely the head of household or his/her spouse (although not necessarily).

As per the discussion above, our dependent variables are outcomes related to housing, economic status, and health. All outcomes of interest are treated as dichotomous variables except for one, the number of residents in household. For this dependent variable, ordinary least squares (OLS) regression is conducted. This survey did not obtain detailed, pre-storm data on housing, economic, and health—except for one health outcome, access to health care, described below.

Housing outcomes

Home ownership The respondents were asked whether they owned or rented the residence in which they currently resided. We coded an owner as 1 and a renter as 0.

Number of residents in household The respondents provided the number of people living or staying in the housing unit.

Detached housing The respondents were asked to choose the type of housing unit: “One-family house detached from any other house,” “One-family attached to one or more houses,” “Building with 2 apartments,” “Building with 3–4 apartments,” “Building with 5–9 apartments,” “Building with 10–19 apartments,” “Building with 20–49 apartments,” “Building with 50 or more apartments,” “FEMA or other temporary trailer on private property,” “FEMA or other temporary trailer on commercial property,” “A mobile home,” and “Boat, RV, van, etc.” For the purposes of this article, we treat the “One-family house detached from any other house” as an ideal housing situation and code it as a 1, and all other non-ideal type of housing units as 0. We recognize that this treatment may not fully capture the diversity of housing options or preferences.

Economic outcomes

Unemployment The current employment status was asked for population 16 years and older, and there were eight response categories for the question. We recoded

“Employed for wages” and “Self-employed” as employed, “Out of work for more than 1 year” and “Out of work less than 1 year” as unemployed, “A Homemaker/Caregiver,” “A Student,” “Retired,” and “Unable to work” as not in labor force. The unemployed is coded as 1 while the employed is coded as 0, and those who are not in labor force were not included in the analysis.

Decline in income Respondents were asked to estimate (1) their total household income in the past month and (2) their total household monthly income in a typical month before the hurricanes. Respondents were then asked to choose whether their household income change based on their estimates of monthly incomes. They chose among three possible categories: same, more, and less. Those whose most recent monthly household income estimate was less than the estimated pre-storm monthly income were coded 1, while those with the same or higher recent monthly income estimates were coded 0.

Health outcomes

Access to primary care services The respondents were asked to indicate the place to get health care usually, both before the 2005 hurricanes and currently. Response categories were: “Doesn’t get care anywhere,” “Clinic or health center,” “Doctor’s office or HMO,” “Hospital emergency room,” “Hospital outpatient department,” “Some other place,” “Doesn’t go to one place most often.” We coded “Clinic or health center” and “Doctor’s office or HMO” as 1, and all others as 0.

Uninsured The respondents were presented with a list of different health insurance plans and asked to check all that apply.⁴ Those who checked at least one health insurance or coverage type were coded as 0. Those who reported no insurance were coded as 1. In addition, we included those with only a limited, single-service health plan as uninsured (coded 1) because these plans do not provide broad-based health care coverage.

Serious mental illness Six questions using 1–5 point scale were asked about how often the respondent (Person 1 only) felt during the past 30 days. Each response was reverse-coded and summed as the score of symptoms consistent with serious mental illness. Then, the summed score was dummy coded based on whether or not the respondent’s score was higher than 13. The use of this scale is based on a methodological study designed to evaluate several screening scales for measuring serious mental illness. It is a truncated version of the World Health Organization (WHO) Composite International Diagnostic Interview Short Form (CIDI-SF) scale (Kessler et al. 1998), the K10/K6 scale of nonspecific psychological distress (Furukawa et al. 2003), and the WHO Disability Assessment Schedule (WHO-DAS) (Rehm et al. 1999). Those who had a score higher than 13 were considered to have

⁴ The types of health insurance are: Private health insurance, Medicare, Medi-Gap, Medicaid, Louisiana Children’s Health Insurance Program, State-sponsored health plan, Military health care, Indian Health Service, and Other government program. The respondents were asked to choose all that applied.

symptoms consistent with serious mental illness and coded as 1, while those whose score were lower than 13 were coded as 0.⁵

Independent variable

The independent variable is displacement status. First, we simply compare the outcomes of displaced versus non-displaced respondents. Then, we compare non-displacement to two types of displacement, internal (within-parish of pre-storm residence) and external (relocation to another parish in southern Louisiana). For our three-group comparison, the non-displaced is the reference category. Since the survey asked for pre-storm residence (using either zip code or name of place), the pre-storm residences of those displaced from other parishes included areas outside the 18-parish survey region (e.g., Mississippi, Texas, or other parishes in Louisiana or out of state).

Control variables

The control variables used in the analysis are respondent's gender (1 for male and 0 for female), age (in years), race (1 for black and 0 for all others),⁶ household income, education (in years),⁷ and current employment status (employed, unemployed, and not in labor force). The income question was asked at household level, and the respondents provided either monthly or annual income. When the respondents provided monthly income, household income was multiplied by 12 to derive annual income. Also, income was divided by 1,000 when used for regression analysis to adjust the skewness of the distribution. For current employment status, employed is a reference category.

Statistical approach

Estimates of the effects of displacement status on the outcomes of our interest are based on a logit model which takes the following form:

⁵ Six questions related to serious mental illness were: During the PAST 30 DAYS, how often did you feel (1) ...nervous? (2) ...hopeless? (3) ...restless or fidgety? (4) ...so sad or depressed that nothing could cheer you up? (5) ...that everything was an effort? and (6) ...down on yourself, no good, or worthless? The response categories were: (1) All of the time, (2) Most of the time, (3) Some of the time, (4) A little of the time, and (5) None of the time.

⁶ The respondents were asked to indicate what the person considers himself/herself to be and choose all that applied from the following categories: White, Black/African American, Asian, American Indian/Alaska Native, and Native Hawaiian/Other Pacific Islander.

⁷ Respondents were asked to report their educational attainment, and answers were coded in categories ("No schooling completed," "Less than high school," "High school graduates/GED," "Some college or associates," "Bachelor's degree," and "Some or completed graduate/professional"). The variables were recoded so that a certain number in years was assigned to each category (for example, 12 for "High school graduates/GED").

$$\log\left(\frac{pi}{1-pi}\right) = \alpha + \beta_k X_{ik}$$

where α is a constant, X_{ik} is the vector of independent variables, and β_k denotes the effect of a unit change in X_k on the log odds of outcome 1. Since we test the effects of displacement status on several different kinds of outcomes, the unit for each analysis varies based on the dependent variable used. For the outcomes related to housing situation, household income, and serious mental illness, the responses of Person 1 are used as predictors, and the responses of the individuals older than 16 are used for all other outcomes. We employed appropriate weights to account for the complex sampling design used by the LHPS and report significance levels associated with robust standard errors.

Comparison of characteristics among three displacement status

In order to understand the differences or similarities of characteristics among people of the different displacement statuses, we examined the descriptive statistics of our sample. We assumed that displaced individuals are more vulnerable than non-displaced individuals, and we theorize that displaced individuals are more likely to lose resources such as jobs or access to health care services. We also assume that the externally displaced had more disadvantages than those internally displaced because they moved away from their pre-storm communities and the resources attached to those communities.

Table 1 presents the percentage distribution of demographic, housing, and health characteristics. The initial comparison simply contrasts the displaced to non-displaced. The left-side column presents descriptive statistics for the entire sample. The middle-two columns compare displaced and non-displaced populations on both dependent and control variables. The two right-side columns further subdivide the displaced population into two groups: (1) internally displaced and (2) externally displaced, to see whether there is any difference in the characteristics between them and whether the different types of displacement are related to differences in outcomes.

First, the displaced population represents approximately 15% of the individuals in the 18 parishes, and the proportion is almost even between those internally displaced and externally displaced. Note that if we had not identified those who were internally displaced, we would have identified far fewer displaced individuals.

Table 1 indicates demographic differences between the non-displaced and the displaced populations. The displaced population was a slightly younger, although this discrepancy is attributable mainly to those internally displaced, which is the youngest population (mean age = 31.2) among the three groups. The racial composition is also different between the displaced and the non-displaced; the displaced had smaller proportions of white and higher proportions of blacks, irrespective of whether displacement was internal or external. The displaced and non-displaced populations' aggregated educational attainment was similar, with the non-displaced having slightly smaller percentages with a high school diploma

Table 1 Descriptive statistics of individuals and households in the 2006 LHPS data

Variables	Total	Non-displaced	Displaced	Internally displaced	Externally displaced
Individuals (%)	100	84.7	15.3	7.4 ^a	7.3 ^a
Number of respondents (all ages)	13,008	11,054	1,954	1,177	667
Households (%)	100	86.0	14.0	6.9 ^a	6.6 ^a
Number of households	4,994	4,287	707	431	238
Mean age	37.7	38.4	34.1*	31.2	37.2 [#]
Percent white	67.9	71.2	49.2*	49.5	46.9
Percent black	28.4	25.1	46.7*	47.8	47.3
Percent other	3.7	3.7	4.1	2.8	5.8 [#]
Percent high school graduate (age 25+)	35.6	35.3	37.3	37.8	37.9
Percent bachelor's degree (age 25+)	15.4	15.8	13.0*	12.1	14.2
1. Housing outcomes					
Home ownership					
Percent own house	75.3	80.7	41.1*	41.3	41.0
Percent rent house	24.7	19.3	58.9*	58.7	59.0
Mean number of residents	2.7	2.7	2.9	2.8	2.9
Housing type					
Percent house/apt.	88.1	90.0	76.4*	72.6	80.1 [#]
Percent trailer/mobile home	11.9	10.0	23.6*	27.4	19.9 [#]
2. Economic outcomes					
Individual employment (age 16+)					
Percent employed	56.2	56.9	51.9*	55.4	48.1 [#]
Percent unemployed	5.1	3.8	12.3*	9.8	14.9 [#]
Percent not in labor force	38.7	39.3	35.8*	34.7	36.9
Household income					
Percent no income	3.5	2.9	6.8*	5.9	7.8
Median household income	36,000	36,000	30,000*	27,000	30,000
Percent decline in income since Hurricanes	21.6	18.4	41.5*	28.2	56.5 [#]
3. Health outcomes					
Access to primary care					
Percent before hurricanes	85.8	87.4	77.3*	80.9	73.8 [#]
Percent after hurricanes	82.3	85.1	66.4*	74.0	60.4 [#]
Health insurance					
Percent uninsured	15.7	14.3	24.0*	19.1	28.3 [#]
Percent serious mental illness	8.9	7.5	17.7*	20.1	15.7

* Difference between non-displaced and displaced is significant at $p < .05$ level

Difference between internally displaced and externally displaced is significant at $p < .05$ level

^a There were some respondents who answered they were displaced but did not provide the information of their pre-storm residence. Therefore, those cases ($n = 110$ for individuals and $n = 38$ for households) are missing and not included after subdividing the displaced population

(35.3% compared to 37.3%) and slightly larger percentages with a Bachelor's degree (15.8% compared to 13%).⁸

Bivariate housing comparisons by displacement status are instructive and substantive. Whereas 80.7% of the non-displaced were homeowners, only 41.1% of the displaced owned their home. Further, only 10% of the non-displaced lived in trailers or mobile homes, whereas nearly 23.6% of the displaced had these accommodations. The externally displaced may have had rather more substantial living arrangement, such as renting a house or apartment, since they had to stay in the post-storm residence for a while. We speculate that this may be because the internally displaced were more likely to live in trailer or mobile home, which is more likely to be temporary housing, to stay closer to or in the same location of their pre-storm residence, although our data cannot track the address of their former residence. The number of persons per household, meanwhile, does not show much difference among three groups, despite our expectation that the displaced may have more people in the household.

The comparison of economic characteristics by displacement status indicates that the externally displaced faced more difficulties than non-displaced or internally displaced. Consistent with expectations and with Zotarelli's (2008) findings, the externally displaced had higher proportions of unemployment at about 15%, compared to 10% for internally displaced and 4% for non-displaced, respectively. The externally displaced also had the highest proportions of decline in household income, as more than half of those displaced from other parish saw their household income declined during the past month compared to the year before, in contrast to only 28% of the internally displaced and only 18% of the non-displaced. On the other hand, the internally displaced had a lower median household income than the externally displaced, \$27,000 vs. \$30,000.

Finally, the health-related characteristics of sample also indicate that the displaced are more vulnerable than the non-displaced. Only 14% of the non-displaced lacked health insurance, compared to 24% of the displaced (and 28% of the externally displaced). Similarly, only 7.5% of the non-displaced reported symptoms consistent with serious mental illness, compared to 17.7% of the displaced. Finally, 85% of the non-displaced sought health care through their primary care physician, an HMO, or a primary care clinic after the hurricanes, and all but 2.3% reported seeking care in similar ways before the hurricanes. In contrast, smaller proportions of the displaced populations accessed primary health care before the hurricanes (77%), and the hurricanes caused a 10% decline in access to primary health care services among the displaced. The decline in access to primary care health services was even larger for the externally displaced, from about 74% to 60%, respectively, before and after the storms: a 14% drop. To some extent, the displacement cost even for those who stayed close to their pre-storm residence (they witnessed a 7% decline in the proportion with access to primary care, from 81 to 74%, probably due to long-term closures of medical facilities in the wake of the hurricanes, especially in and around New Orleans).

⁸ Percentages with high school diploma and Bachelor's degree include only respondents aged 25 and older.

Next, we use regression techniques to determine whether the bivariate findings described above hold when we control for socio-demographic characteristics of the respondents.

Regression results

We present our results separately in Tables 2, 3, and 4 for housing, economic, and health outcomes, respectively. Within these broad areas, we employ two models for each dependent variable: Model A regresses the dependent variable on the bivariate displacement measure and controls; and Model B regresses the dependent variable on the three-part displacement variable (where non-displaced is the base category opposed to internal and external displacement).

Housing

Our analysis begins with examination of the effects of displacement on housing outcomes (Table 2). We estimate the odds using logit model for dichotomous outcomes, and we use OLS regression for the count variable, number of residents in housing unit. When all the other variables are held constant, displacement decreases the odds of owning home by 77% and living in detached housing by 60%,

Table 2 Logistic regression estimates for the effects of displacement on housing outcomes

Displacement	Housing outcomes					
	Home ownership (1)		Detached housing (2)		Number of residents (3)	
	A	B	A	B	A	B
Status						
Displaced	0.229***		0.399***		-0.033	
Internally displaced		0.293***		0.397**		-0.079
Externally displaced		0.169***		0.439**		0.040
Age	1.032***	1.033***	1.027***	1.027***	-0.033***	-0.033***
Male	1.332	1.357	1.127	1.135	-0.170	-0.168
Black	0.408***	0.413***	0.748	0.758	0.211	0.203
Household income	1.017**	1.017**	1.022***	1.022***	0.008***	0.008***
Education	1.004	1.004	1.054	1.054	-0.057**	-0.056*
Unemployed	1.187	1.182	1.139	1.134	0.239	0.237
Not in labor force	1.097	1.110	1.363	1.372	0.253*	0.247*
Log pseudo-likelihood	-1407.071	-1389.382	-1573.035	-1556.355	n.a.	n.a.
Pseudo R^2	0.174	0.176	0.133	0.135	0.165	0.166
N	3070	3049	2978	2958	3084	3067

For logistic regressions, the odds are presented. For OLS regression (Model 3), the unstandardized coefficients and R^2 are presented

* $p < .05$, ** $p < .01$, *** $p < .001$, significance levels calculated using robust standard errors (not reported)

Table 3 Logistic regression estimates for the effects of displacement on economic outcomes

Displacement	Economic outcomes			
	Unemployment (1)		Decline in income (2)	
	A	B	A	B
Displaced	2.593***		2.273***	
Internally displaced		2.111**		1.211
Externally displaced		3.434**		4.072***
Age	0.997	0.993	0.990*	0.990*
Male	0.511**	0.508**	0.938	0.92
Black	1.343	1.319	1.442*	1.412*
Household income	0.983*	0.983*	n.a.	n.a.
Education	0.759***	0.758***	0.943*	0.941*
Unemployed	n.a.	n.a.	9.187***	9.565***
Not in labor force	n.a.	n.a.	1.155	1.141
Log pseudo-likelihood	-866.280	-857.857	-1776.443	-1741.951
Pseudo R^2	0.140	0.142	0.097	0.107
N	3840	3808	3734	3706

* $p < .05$, ** $p < .01$, *** $p < .001$, significance levels calculated using robust standard errors (not reported)

Table 4 Logistic regression estimates for the effects of displacement on health outcomes

Displacement	Health outcomes					
	Access to primary care (1)		Uninsured (2)		Serious mental illness (3)	
	A	B	A	B	A	B
Displaced	0.243***		0.908		2.240**	
Internally displaced		0.423**		0.720		1.988*
Externally displaced		0.168***		0.977		2.839*
Age	1.014**	1.014**	0.966***	0.966***	0.993	0.992
Male	0.857	0.895	1.122	1.107	0.710	0.701
Black	0.879	0.868	0.913	0.889	1.293	1.288
Household income	1.004	1.003	0.969***	0.969***	0.975***	0.975***
Education	0.961	0.964	0.863***	0.860***	1.004	1.006
Unemployed	0.303**	0.283**	3.027***	3.105***	2.507*	2.501*
Not in labor force	0.794	0.788	0.457***	0.463***	1.214	1.223
Pre-storm access to primary care	195.633***	198.179***	n.a.	n.a.	n.a.	n.a.
Log pseudo-likelihood	-1325.325	-1299.375	-2255.079	-2223.086	-843.555	-838.596
Pseudo R^2	0.536	0.540	0.198	0.199	0.111	0.113
N	6044	6004	6160	6116	3084	3063

* $p < .05$, ** $p < .01$, *** $p < .001$, significance levels calculated using robust standard errors (not reported)

respectively (Models 1A and 2A). Both internally and externally displaced persons have reduced odds of home ownership and living in detached housing (Models 1B and 2B). Displacement was not significantly related to the household size (Models 3A and 3B).

Taken together, the findings from Table 2 provide further evidence of the social costs of displacement in relation to housing and living. We advise caution when interpreting the relationship between displacement and lack of homeownership 1 year after the hurricane. Since we do not know which respondents owned homes before the hurricanes, we cannot rule out the possibility that this is a spurious relationship, especially since renting was more common in some of the most devastated areas such as New Orleans. Further, homeowners may have been more motivated than renters to return to their original place of residence, while renters' ability to return would depend largely on the efforts of their pre-storm landlords.⁹ Still, homeownership is an important component of American life contributing to family stability and access to economic resources. If displacement reduces odds both of home ownership and living in a single family home, then it may be the case that some of the displaced were living in what Quarantelli (1995) terms "temporary housing." If many residents are living in temporary housing situations, then there are implications for communities, schools, industry, and health institutions in southern Louisiana. We expected that the externally displaced would have more options than the internally displaced for housing, because the externally displaced were more broadly scattered across the 18-parish region, while the internally displaced were more concentrated in the parishes most damaged by the hurricanes. However, the results showed that both forms of displacement had similar negative effects on housing. The finding concerning household size is also interesting; displacement does not appear to increase the odds of overcrowding within households.

Family economic situation

Table 3 presents the findings for the regression of employment and income loss on displacement and control variables. Displacement increases the odds of unemployment by 160%, and external displacement increases these odds by a whopping 240%, even after controlling for all the other factors (Model 1A and Model 1B). The odds of realizing a decline in household income after the hurricanes were also dramatically increased by displacement, by almost 130% (Model 2A). However, the real challenge to maintaining income was felt by those who were externally displaced, as external displacement increased the odds of reporting a decline in household income by 300%, while there was no significant difference between the non-displaced and internally displaced in reporting a decline in income. The fact that the internally displaced did not have significantly different odds of maintaining incomes in comparison with the non-displaced, and, yet, they did have increased

⁹ Residents, both homeowners and renters, who were temporarily displaced but able to return to their pre-storm residences before the surveys were *not* counted as displaced. Many residents, however, were unable to rebuild and return within that one-year time frame.

odds of being unemployed, suggests that they might have been better able to draw upon community financial resources in the year after the hurricanes.

The findings in Table 3 provide further evidence of the financial hardships of displacement after disasters. While aggregate employment and household incomes may not decline after disasters (Guimaraes et al. 1993), the capacity of individuals or groups of individuals to recover economically may vary dramatically. After Katrina and Rita, displaced persons had a more difficult time maintaining employment, irrespective of whether or not they were internally or externally displaced. Our findings lend further support to Zotarelli's (2008) contention that both place and race play an important role in economic recovery. We think that the particular issues related to displacement, irrespective of race or place of origin, need more systematic consideration. If aggregated employment and incomes are maintained, then why is it that displaced residents have such low odds of capitalizing on the economic opportunities during the period of reconstruction and recovery? Perhaps, the findings in the next section provide a partial explanation.

Health outcomes

We present our results for health implications of displacement in Table 4. After controlling for other variables, displacement reduces the odds of access to a primary care facility, but increases the odds of reporting symptoms of serious mental illness, while it does not significantly affect the odds of having health insurance (Models 1A, 3A, and 2A, respectively). The reduced odds of access to primary health care and the increased odds of reporting of symptoms of serious mental illness occur among both the internally and externally displaced, but the negatives for external displacement are far greater (Models 1B and 3B). We added an additional control for pre-storm access to primary care, which greatly increased the pseudo R-square measure. Still, the negative effects of displacement remain strong.

We would like to make four comments with respect to the results in Table 4. First, without downplaying the significance of research demonstrating the widespread health challenges facing all disaster survivors, our findings clearly show additional health-related costs associated with displacement. Second, our finding that displacement does not affect insurance is instructive, suggesting that health challenges go beyond insurance coverage. Third, we cannot overstate the importance of our findings connecting displacement to serious mental illness. The disaster mental health literature described by Norris et al. (2002) clearly indicates that the psychological consequences of disasters relate as much or more to the period of recovery than to the trauma caused by the event itself. Further, public health systems have made considerable strides toward providing mental health services to survivors. Fourth, since we were able to control for access to primary health care services before the storms, the results of models 1A and 1B increase confidence that the effects of displacement are not spurious. We urge theorists and practitioners to take a more comprehensive look at the broad-based implications of displacement, both internal and external, for survivors of major hurricanes such as Katrina and Rita.

Subgroup comparisons

As our data set does not allow us to control for pre-storm conditions, we attempt to determine whether the effects of displacement hold across various subsamples of the 18 parish sample. Our objective is to ascertain whether the effects of displacement are more severe for certain populations than others. We divided the sample, therefore, along four distinct dimensions: (a) Race—white versus nonwhite; (b) location—Katrina damaged, Rita damaged, and less damaged¹⁰; (c) labor force participation—in versus out of labor force; and (d) income level—low income versus not low income.¹¹ For these analyses, we focused on the overall effects of displacement without discerning between the internally and the externally displaced. Although all the relevant controls were included in each analysis, we report in Table 5 only on the effect of the displacement variable.

The results show that some effects of displacement hold across various subsamples, while other effects vary. In particular, an interaction between location and displacement was revealed for a number of outcomes (as depicted by bold-faced symbols).

The effects on housing situations of respondent were similar across all but one subgroup. Specifically, displacement did not affect the odds of living in a detached house in Rita-damaged parishes. The effects of displacement on economic circumstances were consistent across racial, income, and labor force participation subgroups, but varied significantly by location. Specifically, in both Rita- and Katrina-damaged parishes, displacement did not significantly increase the odds of unemployment or income loss. In order to interpret these findings, it may be instructive to know that majority of displaced in damaged parishes were internally displaced (75% of Katrina households and 82% of Rita households), while in less-damaged parishes the majority (65%) were externally displaced. Hence, the finding that displacement did not affect economic outcomes in more-damaged areas is consistent with the expectation that all the residents, whether displaced or not, are affected economically in the damaged areas (Erikson 1976; Guimaraes et al. 1993). The fact that we still see significant economic differences between the displaced and the non-displaced in less-damaged areas should spur additional research on how the interaction of displacement and location affect economic outcomes.

With respect to health outcomes, Table 5 shows that displacement has no effect on insurance and a consistent negative effect on access to primary care across all subgroups. There are, however, several subgroup differences with respect to serious mental illness. For whites, those living in damaged parishes, and those in the labor force, displacement did not increase the odds of reporting symptoms consistent with serious mental illness. There was no difference in the significance of the effect of displacement across income level. Again, the results further emphasize the need to consider the locational aspects of displacement. Moreover, with respect to mental

¹⁰ Katrina-damaged = Jefferson, Orleans, Plaquemines, St. Bernard, and St. Tammany. Rita-damaged = Calcasieu, Cameron, and Vermillion. The remaining parishes are less damaged. We note that all 18 parishes suffered damage, and some suffered from both hurricanes. These groupings reflect, imperfectly, the extent of damage.

¹¹ Low income = the bottom quartile of the household income, approximately \$19,200 or less.

Table 5 Comparison of effects of displacement by race, location, labor force participation, and income level

Outcome	Full sample	Subgroup comparisons								
		Race		Location (of damage)			Labor force participation		Income level	
		White	Nonwhite	Katrina	Rita	Neither	In	Out	Low	Not Low
Housing										
Home ownership	–	–	–	–	–	–	–	–	–	–
Detached housing	–	–	–	–	O	–	–	–	–	–
Number of residents	O	O	O	O	O	O	O	O	O	O
Economic										
Unemployment	+	+	+	O	O	+	n.a.	n.a.	+	+
Decline in income	+	+	+	O	O	+	+	+	+	+
Health										
Uninsured	O	O	O	O	O	O	O	O	O	O
Access to primary care	–	–	–	–	–	–	–	–	–	–
Serious mental illness	+	O	+	O	O	+	O	+	+	+

Bold symbols indicate that the effect is different for subgroup from that for full sample
 Control variables were included in the regression analyses
 +, Positive effect or odds of effect increased, $p < .05$
 –, Negative effect or odds of effect decreased, $p < .05$
 O, No effect, $p > .05$

health outcomes, issues of race and labor force participation can also interact with displacement to either exacerbate or help alleviate some of the suffering commonly experienced by disaster victims.

The results of Table 5 support the two key arguments of this article: (1) that displacement leads to wide-ranging social costs and (2) that those costs may vary depending on locational factors. While the previous section compared internal versus external displacement, this section revealed distinct, but similar, differences according to whether or not the displaced were living in areas that were heavily damaged by the two devastating hurricanes.

Discussion

We used a unique data set to describe the extent of displacement, both internal and external, in southern Louisiana during the year following Hurricanes Katrina and Rita. We then examined the social costs of displacement to individuals and households by focusing on three broad areas: *housing, economics, and health*. Our

results indicate a negative association between displacement and many of these aspects of people's lives, causing them to lose important resources, and reducing quality of life. Displacement was negatively associated with owning homes, living in preferred detached housing, maintaining pre-storm incomes, and retaining access to primary health care facilities. Displacement was positively associated with unemployment and severe mental illness. We found only minor distinctions in the outcomes as related to internally versus externally displacement (e.g., external displacement was associated with income decline). In general, however, both kinds of displacement had negative implications for maintaining quality of life after the hurricanes.

One limitation in the analysis of this study is that the causal relationship between the displacement and outcome is not identifiable since the 2006 Louisiana Health and Population Survey did not gather adequate information necessary to conduct pre-storm, post-storm analysis on most housing, economic, and health outcomes of interest. The only pre-storm information gathered related to access to health care. This limitation means, therefore, that the displaced may not have had those resources even before the storms, or the outcomes may not have been caused by displacement. In other words, people were forced to evacuate because of where they lived, but many areas that suffered the most destruction were lower-income areas. In the absence of more pre-storm controls, our findings can only suggest an independent, negative association between displacement and dependent variables related to housing, economics, and health.

Also, in larger parishes some internally displaced may have moved considerable distances from their pre-storm residences. Unfortunately, sample sizes were too small for accurate population estimates at the zip-code or neighborhood level. On the positive side, even longer distance, within-parish displacement may have provided for the displaced the access to the same or similar school and health services as provided for those who might have had crossed the parish border.

An important strength of our analysis lies in our ability to separate the internally displaced from the externally displaced residents of post-storm Louisiana. We should reiterate, here, that the externally displaced were current residents who were displaced due to storm and moved from another parish (either other surveyed parishes, other parishes in Louisiana (not surveyed), or out of state). We found differences in odds of outcomes even between different displacement statuses, which tell us that the displaced people may have experienced differently depending on how far they were displaced from their pre-storm residence. In general, the social costs of displacement were the highest for the externally displaced, but there were a few exceptions to this rule.

Taken as a whole, the results of these analyses underscore the importance of timely demographic data in the wake of major hurricanes (Hori et al. 2009; Smith 1996). Demographers must go beyond traditional use of Census data to estimate net population changes by county from the year prior to the year after a disaster. This approach vastly understates the amount of displacement, and consequently, may lead to erroneous assumptions about the needs of the population residing in and around devastated areas. The rapid population survey design utilized by the 2006 LHPS was critical for understanding the true extent of displacement, and for starting

to assess all the social costs associated with these high levels of displacement—as much as one out of eight citizens having been displaced. This article makes a strong contribution in this regard.

Although it may not be possible to prevent some disasters, during the recovery phase, policy makers, planners, public health officials, and community organization can take steps to mitigate the large social costs associated with displacement. Indeed, work of this nature regularly occurs after major disasters, and this was too the case after Hurricanes Katrina and Rita. However, policy makers, planners, and workers can ultimately do a better job with recovery with a more comprehensive understanding of the extent and social costs of large-scale displacement.

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