



# The impact of housing displacement on the mental health of low-income parents after Hurricane Katrina



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## ABSTRACT

Previous studies in the aftermath of natural disasters have demonstrated relationships between four dimensions of displacement – geographic distance from the predisaster community, type of postdisaster housing, number of postdisaster moves, and time spent in temporary housing – and adverse psychological outcomes. However, to date no study has explored how these dimensions operate in tandem. The literature is further limited by a reliance on postdisaster data. We addressed these limitations in a study of low-income parents, predominantly non-Hispanic Black single mothers, who survived Hurricane Katrina and who completed pre and postdisaster assessments ( $N = 392$ ). Using latent profile analysis, we demonstrated three profiles of displacement experiences within the sample: (1) returned, characterized by return to a predisaster community; (2) relocated, characterized by relocation to a new community, and (3) unstably housed, characterized by long periods in temporary housing and multiple moves. Using regression analyses, we assessed the relationship between displacement profiles and three mental health outcomes (general psychological distress, posttraumatic stress, and perceived stress), controlling for predisaster characteristics and mental health indices and hurricane-related experiences. Relative to participants in the returned profile, those in the relocated profile had significantly higher general psychological distress and perceived stress, and those in the unstably housed profile had significantly higher perceived stress. Based on these results, we suggest interventions and policies that reduce postdisaster housing instability and prioritize mental health services in communities receiving evacuees.

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Hurricane Katrina, which made landfall near New Orleans, Louisiana on August 29, 2005, caused an unprecedented population displacement. The Hurricane's storm surge inundated coastal communities and caused multiple failures of the protective levees surrounding the City of New Orleans. Floodwaters covered 80% of the City's land and damaged nearly three quarters of residents' homes (Kates et al., 2006). The slow removal of storm debris impeded residents' returns; the least damaged neighborhoods were opened to re-occupancy in late September 2005, but the most devastated neighborhoods were not opened until as late as May 2006. Consequently, the City had recovered only about 50% of its pre-Hurricane population by mid-2006 (Frey et al., 2007). Residents' returns to the City were gradual and unequal by race and class (Fussell et al., 2010).

The disaster wrought by Hurricane Katrina had mental health consequences for all affected residents of the Gulf Coast, but

especially for New Orleans's residents (e.g., Abramson et al., 2008; Kessler et al., 2008; Sastry and VanLandingham, 2009). For example, a large epidemiological study found that the prevalence of anxiety-mood disorders and posttraumatic stress disorder among New Orleans's predisaster residents was higher than among those from other affected areas in Louisiana, Alabama, and Mississippi (Galea et al., 2008a, b). While stress affects mental health through multiple and interacting pathways, housing stability was found to play an important role after Hurricane Katrina (Abramson et al., 2010).

## 1. Conceptual framework

We adopt the conservation of resources (COR) theory (Hobfoll, 1989, 2001) to explain the relationship between disaster-induced displacement and stress. COR theory proposes that individuals seek to conserve resources, specifically valued objects, conditions, personal traits, and energy. Examples of these resources are, respectively, personal transportation, time for adequate sleep, feelings of wellbeing, and stamina. When resources are threatened

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or lost, individuals draw on existing resources to minimize losses. Resource loss produces stress, but stress is attenuated by successful conservation strategies and exacerbated by unsuccessful adaptations (Hobfoll, 2001). In its application to disaster research, the COR framework distinguishes the trauma of the disaster event from the loss of resources that often accompany disasters (e.g., Freedy et al., 1994; Kaniasty and Norris, 1993).

This distinction between disaster trauma and loss of resources parallels the distinction between primary and secondary disaster stressors. Primary disaster stressors, i.e., stressors experienced during the disaster and its immediate aftermath, including injuries, lack of food, water, medical care, and bereavement, are consistently associated with poorer postdisaster mental health and post-traumatic stress (e.g., Norris et al., 2002). However, the losses produced by a disaster often produce chronic or secondary stressors, e.g., property loss and damage, poor living conditions, disruptions in employment, school, healthcare access, social supports, and routines, which are associated with elevated stress and depression (e.g., Lê et al., 2013). Many of these losses occur when disaster survivors are displaced (Lock et al., 2012; Porter and Haslam, 2005). In the current study, we focus on displacement, a secondary stressor, as a predictor of postdisaster mental health. In doing so, we conceptualize displacement as multidimensional, involving temporal, geographic, mobility, and housing dimensions.

Displacement is likely to affect mental health through several pathways, none of which have been studied systematically. Displacement often disrupts the social support systems that mediate the mental health impacts of primary disaster stressors (e.g. Lê et al., 2013; Lowe et al., 2010). Further, displacement alters regular routines associated with homes, jobs, physical activity, participation in social organizations, and healthcare access (Abramson et al., 2010). It may also introduce additional stressors when housing conditions are crowded or evacuees feel socially isolated, in danger, or that they are victims of discrimination (Riad and Norris, 1996; Weems et al., 2007). These all suggest that displaced residents are likely to experience more secondary stressors than those who have returned to their homes or communities, and that displacement experiences may be associated with different levels of resource loss (Lock et al., 2012).

In a systematic review of recent studies of postdisaster displacement, eight out of ten showed elevated levels of psychological symptoms (general psychological distress, depression, and posttraumatic stress) among participants who had relocated, compared to those who returned to their predisaster communities (Uscher-Pines, 2009). Although none of these studies included survivors of Hurricane Katrina, research suggests links between relocation and mental health in this case as well. For example, using a 2007 population-based survey of southern Mississippi residents in the 23 counties affected by Hurricane Katrina, Galea et al. (2008a, b) found that an inventory of postdisaster stressors, which includes an indicator of displacement, predicted PTSD net of demographic characteristics and hurricane-related traumatic events. Sastry and VanLandingham's (2009) population-based post-Katrina study of New Orleans residents found probable mental illness was six times more likely among respondents whose homes were unlivable compared to those with livable homes, suggesting, but not explicitly demonstrating, an association between displacement and post-disaster mental health. Finally, Abramson et al. (2008) found that in their sample of residents of emergency housing or housing tracts in Louisiana and Mississippi with major damage from Hurricane Katrina, living outside of one's pre-Katrina community was associated with poorer mental health. All of these results are consistent with the expectation that displacement is associated with poor mental health, but none conclusively demonstrates this relationship.

The extant literature on the mental health impacts of displacement suffers from two additional limitations. First, it relies mostly on postdisaster data. Studies that include predisaster data show that predisaster functioning is one of the strongest predictors of postdisaster mental health (e.g., Norris et al., 2002). Lacking predisaster psychological controls, postdisaster studies are likely to overestimate the influence of displacement experiences on post-disaster psychological outcomes. Postdisaster samples might also be biased due to selective population losses (Galea et al., 2008a, b; Norris, 2006). For example, study recruitment efforts might not reach persons who have relocated far from their predisaster communities, excluding the distinct mental health effects of displacement for this group. Only three out of 24 articles reviewed by Uscher-Pines (2009) used a pre-post event longitudinal study design.

A second limitation is the focus on whether disaster survivors were displaced or not, when displacement is better conceptualized as a multi-dimensional phenomenon. At least four dimensions of displacement are shown to be associated with postdisaster mental health. First, the geographic distance of a person from their predisaster community affects mental health. A study of Hurricane Katrina evacuees, for example, found stronger associations between serious mental illness and relocation across parish lines than relocation within a parish (Hori and Schafer, 2010). Second, the type of housing to which residents relocated influences outcomes (Riad and Norris, 1996). For example, DeSalvo et al. (2007) found that after Hurricane Katrina, Tulane University employees who had stayed with friends or in a hotel during the evacuation had higher prevalence of posttraumatic stress than those who stayed with relatives, as did those who were living in a new home or a temporary trailer at the time of the survey. Third, disaster survivors who move more often experience more symptoms. For example, individuals who moved a greater number of times in the aftermath of a volcano disaster in Japan had significantly higher posttraumatic stress (Goto et al., 2006). Fourth, survivors who spend more time in interim housing experience more symptoms. In this vein, New Orleans' residents who had relocated for longer periods of time after Hurricane Katrina had higher levels of posttraumatic stress (DeSalvo et al., 2007). Although each of these dimensions is associated with poorer mental health outcomes, they have not been explored simultaneously.

To our knowledge, our study is the first to explore profiles of postdisaster displacement and their relation to mental health outcomes. Our study redresses each of these shortcomings of previous research and extends our knowledge of the effects of displacement on mental health.

## 2. Current study

We explore how displacement experiences shape postdisaster mental health through analysis of low-income parents, predominantly non-Hispanic Black single mothers, who participated in a New Orleans-based study prior to Hurricane Katrina. Approximately a year after the hurricane, over 80% of participants were located and reassessed. At the postdisaster follow-up, we collected data on four dimensions of displacement – geographic distance, housing type, number of moves, and time in interim housing. Our first aim in the data analysis was to conduct a latent profile analysis (LPA), a person-centered statistical approach, to identify displacement profiles based on these four dimensions. We expect that the four dimensions of displacement operate in tandem. For example, a participant who relocates to a different state will also be in a new home, while one who returns to her predisaster community may either be in a new home or predisaster home. Likewise, a participant who moved several times after the disaster is likely to have spent more time in interim housing than one who only moved

once. Given these interrelationships, our first hypothesis is that there are at least two profiles of displacement (returned and relocated), and possibly more, that capture differences among displacement experiences.

Our second aim was to examine the relationship between displacement profile membership and three mental health outcomes: general psychological distress, perceived stress, and post-traumatic stress. Based in COR theory, we hypothesized that participants in profiles other than the returned profile would have significantly higher levels of symptoms even after controlling for predisaster characteristics and mental health, and hurricane-related experiences, because displacement would diminish their capacity to conserve resources or prevent resource losses. Returned participants are hypothesized to have lower levels of symptoms because they were able to conserve place-based resources such as homes, businesses, jobs, social support, and access to healthcare.

### 3. Method

#### 3.1. Participants and procedure

The Resilience in Survivors of Katrina (RISK) project is a longitudinal study of low-income parents who had enrolled in three community colleges in the City of New Orleans between November 2003 and February 2005 and who experienced Hurricane Katrina. The original study examined whether performance-based scholarships affected the academic achievement, health, and wellbeing of low-income parents (Richburg–Hayes et al., 2009). Eligible students were between the ages of 18 and 34; parents of at least one dependent child under age 19; had a household income under 200 percent of the federal poverty level; and held a high school diploma or the equivalent but no college degree. Students were recruited through flyers, newspaper and radio announcements, and presentations in mandatory orientation and testing sessions for incoming freshman. Upon enrollment in the study participants provided baseline demographic, financial, and educational information.

When Hurricane Katrina made landfall, 492 participants had completed a 12-month, post-enrollment follow-up survey (Time 1), which provides predisaster measures. The phone survey was conducted by trained interviewers and participants were compensated with \$20 gift cards. After Hurricane Katrina the investigators redesigned the study to focus on disaster recovery. Between May 2006 and March 2007 – eight to 18 months after Hurricane Katrina – 402 of the 492 (81.7%) participants from Time 1 were reinterviewed. The postdisaster survey (Time 2), which was administered over the phone by trained interviewers, included the same questions as the post-enrollment follow-up survey (Time 1), as well as a module on hurricane experiences and a measure of posttraumatic stress. Participants received \$50 gift cards. Of the 402 participants who completed the Time 2 survey, 392 had lived in an area that was affected by Hurricane Katrina. These 392 Hurricane Katrina-affected participants are analyzed here. All participants provided written consent for the original study and verbal consent for the post-disaster survey. Institutional Review Boards of Harvard University, Princeton University, University of Massachusetts-Boston, and Washington State University approved the study.

Due to the recruitment criteria and the catchment area of the colleges, the study participants are mostly non-Hispanic Black women with at least one dependent child who were older than typical college students and many of whom received welfare benefits (Table 1). About a quarter lived in their parents' households and the remainder consisted of single or married household heads. We do not include education measures in our analysis since all had attained at least a high school degree or a General Educational Development certificate and none had completed college.

**Table 1**  
Descriptive data for variables included in the study (N = 392).

	M (SD)/%	Range
<i>Pre-Katrina characteristics</i>		
Age	25.56 (4.45)	18–34
Female	95.9%	–
Non-Hispanic Black	84.6%	–
Married or cohabiting	36.1%	–
Number of dependent children	1.92 (1.05)	0–7
Lived with parents	27.7%	–
Owned car	66.3%	–
Public assistance receipt	66.3%	–
<i>Pre-Katrina housing</i>		
Homeowner	13.5%	–
Renter	56.4%	–
Public housing or Section 8	14.5%	–
Lived with family or friends	15.6%	–
<i>Hurricane Katrina impacts</i>		
Evacuated before hurricane	84.7%	–
Number of hurricane-related traumas	3.17 (2.52)	0–9
<i>Housing damage</i>		
Minimal or no housing damage	15.6%	–
Moderate housing damage	39.9%	–
Enormous housing damage	44.5%	–
Days since hurricane	357.83 (74.53)	256–500
<i>Displacement characteristics</i>		
<i>Geographic Location</i>		
In pre-Katrina parish	44.5%	–
Moved to a new parish (LA)	14.9%	–
Moved to a new state	40.6%	–
<i>Type of Residence</i>		
Living in original home	23.1%	–
Living in a new home	60.2%	–
Living in temporary housing	10.4%	–
Living with family or friends	6.4%	–
Number of moves after hurricane	3.63 (1.45)	0–9
Days spent in temporary housing	130.38 (121.82)	0–644
<i>Mental health</i>		
<i>Pre-Katrina</i>		
K6 scale	5.61 (4.23)	0–24
Impact of Events Scale-Revised	–	–
Perceived stress scale	4.29 (3.31)	0–16
<i>Post-Katrina</i>		
K6 scale	6.71 (5.19)	0–24
Impact of Events Scale-Revised	33.25 (22.94)	0–88
Perceived stress scale	5.39 (3.59)	0–16

#### 3.2. Measures

##### 3.2.1. Hurricane-related experiences

We measured primary stressors related to direct experiences of Hurricane Katrina with three variables. First, a dummy-coded variable indicated whether participants had evacuated before Hurricane Katrina struck. Second, a count of nine hurricane-related stressors assessed whether participants had experienced any of the following as a result of Hurricane Katrina: 1) lacked enough drinking water, 2) lacked enough food to eat, 3) lacked necessary medicine, 4) lacked necessary medical care, 5) lacked knowledge of the safety of their children, 6) lacked knowledge of the safety of other family members, 7) a family member lacked necessary medical care, 8) felt their life was in danger, and 9) had a close friend or family member who died (Brodie et al., 2006). Third, housing damage was measured with the participant's report of the level of damage to their pre-Katrina home on a three point scale: (1) none or minimal, (2) moderate or substantial, and (3) enormous.

##### 3.2.2. Displacement experiences

Four variables measured displacement experiences. First, participants' Time 1 and Time 2 addresses were used to create three categories of geographic distance between the predisaster and postdisaster homes: 1) in the same parish within Louisiana; 2) in

different parishes within Louisiana; 3) in different states. Second, participants' current housing type was measured as: 1) a pre-Katrina residence, 2) a new home, 3) temporary housing (e.g., FEMA trailer, shelter, hotel), and 4) living with family, friends, or in some other arrangement. Third, the number of moves made between housing since Hurricane Katrina. Lastly, days spent in temporary housing. Given that displacement experiences could be confounded by the timing of assessment, we also included the number of days between Hurricane Katrina and the Time 2 assessment as a covariate.

### 3.2.3. Mental health

Our dependent variables are three measures of mental health outcomes. First, Kessler's K6 scale, a six-item screening measure of nonspecific psychological distress was used to assess pre and postdisaster psychological distress. This scale has good psychometric properties (Furukawa et al., 2003). Participants rated items (e.g., "During the past 30 days, about how often did you feel so depressed that nothing could cheer you up?") on a 5-point Likert-type scale ranging from 0 (*none of the time*) to 4 (*all the time*). Cronbach's alphas of the K6 scale were .78 and .80 for the Time 1 and Time 2, respectively.

Second, the Impact of Event Scale-Revised (IES-R), a 22-item self-report inventory of symptoms of PTSD (Zilberg et al., 1982) with good psychometric properties (e.g., Creamer et al., 2003), was used to measure PTSD symptoms as a result of hurricane experiences. It assesses distress produced by a specific traumatic event and was developed to diagnose DSM-IV posttraumatic stress disorder (PTSD) symptoms (Creamer et al., 2003). Participants rate how much they were bothered by symptoms of distress about a traumatic event during the last seven days. Responses are coded from 0 (*never*) to 4 (*extremely*) and summed to produce a score ranging from 0 to 68. Cronbach's alpha of the IES-R in the current study was .95.

Third, we measure stress perception with the Perceived Stress Scale (PSS), a widely used measure found to be valid and reliable, and which is often used in disaster studies (Cohen et al., 1983; Norris and Kaniasty, 1996). It measures the frequency of experience over the prior month of four items (e.g., "unable to control important things in your life") from 0 (*never*) to 4 (*very often*). Cronbach's alpha of internal consistency for the PSS was .73 and .75 at Time 1 and Time 2, respectively.

### 3.3. Statistical analysis

We compared participants who were reinterviewed ( $N = 402$ ) and those who were not ( $N = 90$ ) between Times 1 and 2 on all pre-Katrina sociodemographic and housing characteristics and mental health measures using independent-samples *t*-tests and chi-square tests and found no statistically significant differences. For the 392 participants who completed both Time 1 and Time 2 and were exposed to the Hurricane the overall percentage of missing data was 1.3%. To handle missing data we imputed five complete datasets with multiple imputation using Amelia II in R (Honaker et al., 2008). The results represent an average of the five separate analyses with Rubin's (1987) correction of standard error. Prior to testing our study aims, we ran descriptive statistics and a correlation matrix for all variables included in the study (available upon request).

To achieve our first aim, latent profile analysis with the four displacement variables was conducted in Mplus 7.1 (Múthen and Múthen, 1998–2012). Models with two to six classes were computed and, as there is no definitive test for determining which model best represents the data, we followed recommended practices by taking into account statistical criteria, the substantive

**Table 2**

Results of latent profile analysis of displacement characteristics ( $N = 392$ ).

Classes	BIC	Adjusted BIC	Entropy	Mean posterior probability (SD; range)
2	7773.70	7719.76	.85	.95 (.03; .92–.97)
3	7639.39	7560.07	.89	.95 (.02; .93–.96)
4	7619.58	7514.88	.88	.93 (.05; .87–.97)
5	7641.13	7511.04	.85	.89 (.04; .83–.93)
6	7657.03	7501.56	.86	.89 (.06; .79–.97)

Note. BIC = Bayesian Information Criteria.

meaning of each solution, theory, and parsimony (Berlin et al., 2014; Masyn, 2013). Statistical criteria assessed included the Bayesian Information Criteria (BIC) and adjusted BIC, information criteria-based fit statistics, with lower values indicating better fit; and entropy and average posterior probability, both measures of classification accuracy ranging from 0 to 1, with higher values indicating greater accuracy (Masyn, 2013). The Lo-Mendel-Rubin adjusted likelihood ratio test, which compares a model with  $k$  profiles to a model with  $k - 1$  profiles, was unavailable in Mplus 7.1 with the use of multiple imputations and therefore is not referenced. After the model that best represented the data was selected, descriptive statistics were computed for each profile. Additionally one-way analysis of variance (ANOVA) and chi-square tests, with post-hoc Bonferroni-corrected pairwise comparisons, were conducted to compare differences among the profiles on the four displacement variables, as well as other variables in the model (available upon request).

To achieve our second aim, we conducted hierarchical ordinary least squares regression analyses predicting the three mental health outcomes using SPSS 20.0 (IBM Corp., 2011). In the first step, predisaster characteristics, the Time 1 assessment of the outcome, hurricane-related experiences, and time since Hurricane Katrina were entered. Lacking a predisaster assessment of posttraumatic stress, we included Time 1 K6 as an index of predisaster mental health to predict Time 2 IES-R. In the second step, latent profiles were entered, and *F*-change and *R*<sup>2</sup> change were examined to determine the additional contribution of the profiles in explaining the variance in each outcome. Individual regression weights were also examined to assess the unique variance explained by each profile. If any profile reached statistical significance, profile regression weights were compared to assess whether they differed significantly from each other.

## 4. Results

### 4.1. Descriptive statistics

There was substantial variability in participants' displacement experiences (Table 1). While nearly half (44.5%) of participants remained in their pre-Katrina parish, 14.9% had relocated to a new parish within Louisiana and 40.6% had moved to another state. Less than a quarter (23.1%) were living in their pre-Katrina home, while 60.2% were living in a new home, 10.4% were living in temporary housing, and 6.4% were living with family and friends. On average, participants moved 3.63 ( $SD = 1.45$ ) times since the hurricane and had spent 130.38 ( $SD = 121.81$ ) days in temporary housing. Participants' scores on the mental health measures (K6 and PSS) increased over time.

### 4.2. Latent profile analysis

Table 2 shows the results of the latent profile analyses. The BIC was lowest for the four-class model, whereas the adjusted BIC

continued to decrease and was lowest for the six-profile model. Scree plots of the BIC and adjusted BIC, however, suggested “elbow points” at three profiles, indicating minimal gains in model fit thereafter. The highest entropy value was for the three-profile model, and highest mean posterior probabilities were for the two- and three-profile models. Based on these statistical criteria, we selected the two-, three- and four-profile solutions as candidate models, and examined descriptive statistics for each. In reviewing the two-profile models, we noted substantive differences between the profiles in the number of moves and days in temporary housing; however, they were overlapping in terms of geographic mobility and type of postdisaster housing. In contrast, the three-profile model yielded profiles that were distinct on all four displacement variables. The profiles in the three-profile model were also theoretically meaningful, representing modal experiences of 1) returning to one’s predisaster community after few moves and days in temporary housing (returned); 2) relocating to a new community after few moves and days in temporary housing (relocated); and 3) experiencing marked housing instability, characterized by many moves and a substantial amount of time in temporary housing (unstably housed). The four-profile model consisted of the same returned and unstably housed profiles, whereas the relocated profile was differentiated by geographic distance categories, but not clearly enough to justify using four profiles. We therefore selected the more parsimonious three-profile model as the best representation of the data. Note that latent profile analysis probabilistically assigns cases to profiles, so there may be very minor inconsistencies between the profile label and the descriptive statistics.

The three latent profiles reflect distinct displacement experiences, with statistically significant differences among them on each of the displacement variables (Table 3). Nearly a quarter (24.0%) of participants fit a returned profile: virtually all were living in their pre-Katrina parish and most were in their pre-Katrina home; they recorded the fewest days in interim housing and had moved the least. We labeled the second profile, relocated, which included nearly half (48.5%) of the study participants, and the third profile, unstably housed, with more than a quarter (27.6%). Most relocated participants were living in a new home and had moved to a new state; they averaged slightly more moves and slightly more time in interim housing than the returned. Unstably housed participants were spread out between different geographic locations, with a slight majority living in a new home, very few in their pre-Katrina

home, and about a fifth in temporary housing and another fifth living with family and friends. The unstably housed are distinguished by a higher average number of moves and more days in interim housing. These profiles demonstrate quite clearly that, in addition to the dichotomy of returned and displaced, there is also differentiation within displacement experiences.

#### 4.3. Regression analysis

Our next aim is to discern whether profiles are related to the three mental health outcomes (Table 4). In the first step the regression coefficients are reported for each equation with controls for pre-Katrina socio-demographic and housing characteristics, Hurricane Katrina impacts, and pre-Katrina health measures. In this homogeneous sample these models explain a modest level of variation in the dependent variables, with disaster impacts and pre-Katrina health being most significant. In step 2, the addition of displacement profiles was associated with statistically significant improvement in explained variance in the K6 scale ( $F(2, 373) = 3.15, p < .05, R^2\Delta = .01$ ), and marginally statistically significant additional variance in the PSS scale ( $F(2, 373) = 2.71, p < .10, R^2\Delta = .01$ ), *Ceteris paribus*. The addition of the displacement profiles did not predict marginally or statistically significant additional variance in the IES-R ( $F(2, 373) = .19, p > .10, R^2\Delta < .01$ ).

Significant predictors of higher K6 in step 1 were pre-Katrina evacuation ( $\beta = 1.78, p < .05$ ), more hurricane-related trauma ( $\beta = .42, p < .001$ ), and higher predisaster K6 ( $\beta = .38, p < .001$ ). In step 2, the relocated profile was a significant predictor ( $\beta = 1.71, p < .05$ ) and the unstably housed profile a marginally significant predictor ( $\beta = 1.39, p < .10$ ), each associated with higher K6 scores relative to the returned profile. The regression coefficients for the two profiles were not significantly different from each other ( $Z = .31, p > .05$ ).

Significant predictors of higher PSS scores in step 1 were age ( $\beta = .11, p < .05$ ), dependent children ( $\beta = -.39, p < .05$ ), hurricane-related trauma ( $\beta = .25, p < .01$ ), and higher predisaster PSS ( $\beta = .19, p < .001$ ). Despite step 2 being marginally significant, both the relocated and unstably housed profiles were statistically significant predictors of higher PSS scores relative to the returned profile ( $\beta = 1.09, p < .05$ , and  $\beta = 1.09, p < .05$ , respectively). The regression coefficients for the two profiles were not significantly different from each other ( $Z = .00, p > .05$ ).

**Table 3**  
Descriptive statistics for three profiles of displacement characteristics ( $N = 392$ ).

	Returned ( $n = 94$ ; 24.0%) <i>M</i> (SD)/%	Relocated ( $n = 190$ ; 48.5%) <i>M</i> (SD)/%	Unstably Housed ( $n = 108$ ; 27.6%) <i>M</i> (SD)/%	$F/\chi^2$	Pairwise comparisons
Geographic location				206.64***	
In pre-Katrina parish	97.7%	14.8%	50.4%		Returned > Relocated*** & Unstably Housed***; Unstably Housed > Relocated***
Moved to a new parish (LA)	.4%	15.1%	27.2%		Relocated > Returned***, Unstably Housed*; Unstably Housed > Returned***
Moved to a new state	1.9%	70.1%	22.4%		Relocated > Returned***, Unstably Housed***; Unstably Housed > Returned***
Type of Residence				342.05***	
Living in original home	84.5%	.8%	8.7%		Returned > Relocated***, Unstably Housed***; Unstably Housed > Relocated***
Living in a new home	1.5%	93.2%	53.1%		Relocated > Returned***, Unstably Housed***; Unstably Housed > Returned***
Living in temporary housing	4.3%	.6%	18.5%		Unstably Housed > Returned*, Relocated***
Living with family or friends	9.8%	5.4%	19.6%		Unstably Housed > Relocated***
Number of moves after hurricane	3.02 (1.15)	3.29 (1.28)	4.76 (1.36)	59.75***	Unstably Housed > Returned***, Relocated***
Days spent in temporary housing	61.65 (59.21)	71.56 (58.69)	293.67 (88.82)	425.13***	Unstably Housed > Returned***, Relocated***

\* $p < .05$ , \*\*\* $p < .001$ .

**Table 4**  
Results of ordinary least squares regression analyses predicting Time 2 mental health measures ( $N = 392$ ).

	K6 scale			Impact of events scale-Revised			Perceived stress scale		
	$\beta$ (SE)	$t$	$F\Delta$ ( $R^2\Delta$ )	$\beta$ (SE)	$t$	$F\Delta$ ( $R^2\Delta$ )	$\beta$ (SE)	$t$	$F\Delta$ ( $R^2\Delta$ )
<b>Step 1</b>			5.47*** (.19)			7.77*** (.25)			3.38*** (.13)
Constant	-.73 (2.31)	-.31		5.10 (9.85)	.52		.68 (1.66)	.41	
<i>Pre-Katrina characteristics</i>									
Age	.11 (.06)	1.78 <sup>a</sup>		.72 (2.82)	2.82**		.11 (.04)	2.46*	
Non-Hispanic Black	.03 (.76)	.05		4.56 (3.23)	1.41		-.04 (.54)	-.08	
Married or cohabiting	.27 (.55)	.49		2.53 (2.33)	1.09		-.39 (.39)	-.1	
Number of dependent children	-.47 (.27)	-1.76 <sup>a</sup>		-1.74 (1.15)	-1.52		-.39 (.19)	-2.00*	
Lived with parents	.35 (.61)	.58		-3.05 (2.59)	-1.18		.30 (.44)	.69	
Owned car	-.93 (.79)	-1.70 <sup>a</sup>		-5.36 (3.36)	-2.32*		-.36 (.39)	-.93	
Public assistance receipt	-.13 (.56)	-.23		-3.36 (2.39)	-1.41		-.28 (.40)	-.69	
<i>Pre-Katrina housing</i>									
Homeowner	-.32 (.79)	-.4		.34 (3.36)	.1		.30 (.57)	.52	
Renter	–	–		–	–		–	–	
Public housing or Section 8	.26 (.74)	.35		1.56 (3.15)	.49		-.19 (.53)	-.36	
Lived with family or friends	-.29 (.74)	-.4		-5.80 (3.14)	-1.84 <sup>a</sup>		.61 (.53)	1.15	
<i>Hurricane Katrina impacts</i>									
Evacuated before hurricane	1.78 (.72)	2.47*		.50 (3.07)	.16		.72 (.52)	1.39	
N. of hurricane-related traumas	.42 (.11)	3.86***		2.38 (.47)	5.10***		.25 (.08)	3.16**	
<i>Housing damage</i>									
Minimal or no housing damage	–	–		–	–		–	–	
Moderate housing damage	.85 (.74)	1.16		3.68 (3.13)	1.17		.81 (.53)	1.54	
Enormous housing damage	1.21 (.75)	1.62		6.70 (3.19)	2.10*		.66 (.54)	1.22	
Days since hurricane	.00 (.00)	.23		-.01 (.01)	-.62		.01 (.00)	.1	
<i>Pre-Katrina health measure</i>									
		6.42***		1.12 (.25)	4.44***		.19 (.04)	4.40***	
<b>Step 2</b>			3.15* (.01)			.19 (<.01)			2.71 <sup>a</sup> (.01)
<i>Displacement Profile</i>									
Returned	–	–		–	–		–	–	
Relocated	1.71 (.68)	2.50*		1.71 (2.93)	.58		1.09 (.49)	2.22*	
Unstably housed	1.39 (.77)	1.81 <sup>a</sup>		1.77 (3.29)	.54		1.09 (.55)	1.98*	

$p^a < .10$ ,  $*p < .05$ ,  $**p < .01$ ,  $***p < .001$ .

Significant predictors of higher IES-R in step 1 were age ( $\beta = .72$ ,  $p < .01$ ), car ownership ( $\beta = -5.36$ ,  $p < .05$ ), hurricane-related trauma ( $\beta = 2.38$ ,  $p < .001$ ), and Time 1 K6 ( $\beta = 1.12$ ,  $p < .001$ ). Neither displacement profile significantly predicted the IES-R in step 2.

## 5. Discussion

This is the first study to use a latent profile analytic approach to conceptualize displacement experiences in the aftermath of a natural disaster. Analysis of the sample of low-income parents, who were predominantly non-Hispanic Black mothers, revealed three distinct profiles of postdisaster displacement and demonstrated their relevance to postdisaster mental health. The four dimensions of displacement included in the profile analysis – geographic location, housing type, moves, and time in interim housing – have each been linked to worse postdisaster mental health (e.g., DeSalvo et al., 2007; Goto et al., 2006; Hori and Schafer, 2010). However, ours is the first study to explore them simultaneously with parsimonious measures capturing the interrelations between each dimension.

As hypothesized, we detected more than two profiles. The first, a returned profile, was characterized by return to a predisaster home or parish after relatively few moves and little time in interim housing and comprised 24.0% the sample. The second, a relocated profile, was characterized by a move to a new state and home after a similar number of moves and time in interim housing as those in the returned profile and comprised nearly half (48.5%) the sample. The third, an unstably housed profile, was comprised of participants who had moved frequently and spent lengthy periods in multiple housing arrangements and who were located various distances from their predisaster homes at the time of the survey and included 27.6% of the sample. This provides strong support for our hypothesis that displacement is not a simple dichotomy between being removed from one's home or not.

Motivated by COR theory we hypothesized that displacement profiles indicative of resource loss, i.e., those characterized by greater geographic distance from the predisaster home, living in a new home or temporary living arrangement, more moves, and more days in interim housing, would be associated with adverse mental health outcomes. We find modest support for our hypothesis. The regression analysis showed that relative to the returned profile, participants in the relocated profile had significantly higher general psychological distress and perceived stress, and those in the unstably housed profile had marginally significantly higher general psychological stress and significantly higher perceived stress. The addition of the displacement profiles to our regression model increased the explained variance by a modest but statistically significant 1%. The variance explained by displacement in prior research ranges from 0% to 5% (Acierno et al., 2007; Uscher-Pines, 2009). The relatively small value in the current study could be due to our inclusion of additional covariates that are strong predictors of postdisaster mental health (e.g., predisaster mental health, exposure to primary stressors) and the homogeneous nature of the sample, both of which limit the extent of unexplained variance.

Theoretically, our results support our contention that displacement weakens survivors' capacities to conserve resources by revealing that participants with returned profiles show lower levels of distress and perceived stress compared to those in relocated and unstably housed profiles. However, COR theory does not indicate which type of displacement would erode resources more. It is possible that the pathways to poorer mental health outcomes were qualitatively different between relocated and unstably housed profiles, although this did not produce significant differences in the level of distress and perceived stress.

We did not find an association between displacement profile membership and posttraumatic stress. Previous research provides mixed evidence for relationships between secondary stressors and

posttraumatic stress. Some research finds such a linkage (e.g., Galea et al., 2008; Goto et al., 2006) and other research shows stronger associations of secondary stressors with stress and depression rather than posttraumatic stress (e.g., Lê et al., 2013; Wickrama and Wickrama, 2008). There may be several explanations for our finding of no association. Our longitudinal design may have eliminated an artificially inflated relationship between displacement and posttraumatic stress that postdisaster studies could not. Additionally, other secondary stressors (e.g., postdisaster unemployment) could be more tightly linked to posttraumatic stress than displacement profiles. Furthermore, differences between profiles might have been diminished if returned participants experienced ongoing stressors, (e.g. reminders of the death and destruction rendered by the Hurricane), which increased their risk of posttraumatic stress relative to the other two profiles.

### 5.1. Implications

Our findings have implications for research, policy, and practice. While generally supportive of COR theory, it is still unclear which of the resources lost when disaster survivors relocate or live in unstable housing mediate psychological outcomes. One possible mediator is social support; relative to those who have returned to their predisaster homes and communities, those who have relocated or lived in unstable housing are likely to have lost contact with more members of their social support networks, increasing risk for mental health problems (e.g., Kaniasty and Norris, 2009; Lowe et al., 2010). Other potential mediators are unemployment, financial loss, and child psychopathology, each of which is more likely among the displaced and each of which has been shown to increase mental health risks (e.g., Joseph et al., 2014; Scheeringa and Zeanah, 2008). COR theory could be explored with qualitative studies exploring participants' lived experiences of displacement could provide insight into how these or other stressors associated with relocation and unstable housing lead to poor psychological outcomes.

The linkage between displacement and mental health we find in our sample of low-income, mostly non-Hispanic Black mothers underscores the importance of effective postdisaster sheltering and housing restoration policies, especially for this vulnerable group. Post-Katrina sheltering practices exposed the inadequacies of current policies for sheltering large numbers of displaced residents for prolonged periods and for repairing affordable rental property in the disaster affected community (Nigg et al., 2006; US GAO, 2010). Indeed, repeated extensions of temporary housing assistance increased anxiety and stress among those who depended on it (Lein et al., 2012). Our results demonstrate this relationship.

Finally, the results indicate the need for mental health services for relocated and unstably housed disaster survivors. Practitioners could forge connections with unstably housed survivors by connecting with disaster housing assistance programs and social service agencies working with survivors. Additionally, clinicians in communities receiving disaster survivors could avail themselves to the displaced. A greater understanding of the secondary stresses associated with resettlement and unstable housing would guide practitioners in exploring areas of stress not fully recognized in disaster-affected patients and facilitate individuals' disaster recovery.

### 5.2. Limitations

Despite the strength of the research design, there are threats to the validity of our conclusions. Measurement validity may be affected for several reasons. First, exposure to other postdisaster traumatic events and stressors was not assessed. If displacement

profiles were correlated with other postdisaster experiences, associations between profile membership and mental health outcomes could have been attenuated if measures of those experiences were included. Second, data on geographic location and type of housing were only collected for participants' housing at the time of each interview, but not for interim housing. A more detailed assessment of postdisaster housing experiences could potentially identify displacement profiles with stronger links to mental health outcomes. Third, the mental health measures used in this study were not designed to classify participants as having probable psychiatric disorders, including PTSD and major depression, and we therefore were unable to assess meaningful clinical effects. Finally, our housing measures may be affected by differential misclassification bias if those with worse mental health outcomes tend to overstate their housing difficulties.

There are also threats to the internal and external validity of our results. Our ability to establish causality may be affected by having only one wave of postdisaster data. It is plausible that, just as displacement experiences might have compromised survivors' mental health, poor mental health could have shaped displacement experiences. Research with multiple waves of postdisaster data could redress this limitation by using cross-lagged models. External validity is limited by the nature of the sample and specific disaster. The sample consisted of young, low-income, non-Hispanic Black mothers, who were attending community college prior to Hurricane Katrina, and the results might not generalize to other events or populations. Moreover, although the pre to postdisaster retention rate was over 80% and no predisaster differences were detected between those who were and were not retained, it is possible that those who did not complete the postdisaster assessment were more adversely affected by the Hurricane. Replication of the study for other disasters will refine our understanding of the effect of disaster induced displacement on mental health.

## 6. Conclusion

Our research demonstrates the utility of latent profile analysis to document patterns of postdisaster displacement across four dimensions – geographic distance, type of housing, moves, and time in interim housing. We find that, relative to study participants who had returned to their predisaster home or community, those who had relocated or were unstably housed were at increased risk of adverse mental health outcomes, controlling for predisaster mental health and disaster exposure. Further research exploring the mechanisms underlying the associations between displacement profiles and mental health outcomes is justified by our findings. Our research suggests that postdisaster housing policies that facilitate survivors' return to predisaster homes or communities, reduce postdisaster housing instability, and aid survivors' adjustments to new communities would attenuate the mental health impacts of disasters.

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