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The Impact of Hurricane Katrina on the Prevalence of Health Impairments and Disability among the Pre-Katrina Adult Population of New Orleans

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Abstract

This paper uses data for pre-Katrina New Orleans residents from the American Community Survey for periods before and after Hurricane Katrina, to examine the effects of the hurricane on the prevalence of health impairments and disability, as well as disparities in these outcomes by demographic and social factors. The aim of the paper is to assess the health effects of a major natural disaster that resulted in large-scale population displacement and migration.

Introduction

Hurricane Katrina struck New Orleans, Louisiana, on the morning of August 29, 2005. It was a natural disaster with enormous effects directly tied to the environment and operating through migration and residential displacement. The hurricane and flooding, as well as the subsequent displacement and resettlement, had an obvious toll on the health and well-being of the city's population. Yet, six years later, there remain important gaps in knowledge about the effects of Katrina on the health of the New Orleans population and, in particular, on disparities in health by demographic and social characteristics.

A number of studies have examined the effects of Katrina on mental health outcomes, such as depression, serious mental illness, suicidality, and post-traumatic stress disorder (see, for example, Galea et al., 2007; Kessler et al., 2006; Kessler et al., 2008; Paxson et al., 2009; Norris,

VanLandingham, and Vu, 2009; Sastry and VanLandingham, 2009; Sastry, 2011). There have, however, been almost no studies that have assessed the toll of Katrina on other health outcomes such as health impairments and disability.

This paper addresses this gap in the literature and, furthermore, provides an illustrative example of using an important new data source—the American Community Survey—to study the causal effects on health and well-being of natural disasters and migration or displacement in the United States. Specifically, we use marginal structural models (Robins et al. 2000)—a technique related to propensity score reweighting—to examine the well-being of the pre-Katrina New Orleans population in the year after the hurricane, compared to a matched population from the prior year. Our results provide information about which population groups from the city suffered the worst health effects in the aftermath of the hurricane.

Data and Methods

We use the restricted data from the American Community Survey (ACS) to examine the impact of Hurricane Katrina on the prevalence of health impairments and disability among adults who lived in New Orleans just prior to Katrina. The specific outcomes we examine are individual-level reports of: (1) blindness, deafness, or severe vision or hearing impairment; (2) a condition that substantially limits physical activities; (3) learning, remembering, or concentrating; (4) dressing, bathing, or getting around inside the home; (5) going outside the home alone to shop or visit a doctor's office; (6) working at a job or business and (7) any of the preceding six health conditions.

Our empirical strategy involves constructing two samples describing this same population, one collected during the twenty months prior to Katrina and one collected during the

first year following Katrina. To ensure the comparability of the two samples, we first apply a propensity-score reweighting procedure to the post-Katrina sample. This ensures that the post-Katrina sample represents the same underlying population even if some groups were systematically under-represented in the unadjusted sample. We then estimate a series of linear probability models that measure the change in the prevalence of several health impairments from before Katrina to after. We examine the extent to which the impacts varied across demographic subgroups by estimating models with varying levels of covariate interactions.

We construct the two samples to be compared using information on the date of each individual's ACS interview, each individual's county of residence at that time, and each individual's county of residence on year prior to the interview. We include individuals in the pre-Katrina sample whose interviews occurred between January 1, 2004 and August 28, 2005 and who lived in Orleans Parish at the time of the ACS interview. We include individuals in the post-Katrina sample whose interviews occurred between November 1, 2005 and August 29, 2006 and who lived in Orleans Parish one year prior to the ACS interview (regardless of the residence location at the time of the interview). This procedure ensures that the post-Katrina sample includes both evacuees and those who were able to return to New Orleans more quickly. Finally, we include only individuals who were at least 25 years old on December 31, 2005.

The propensity score reweighting procedure involves two steps. Define the "propensity score" $\rho(x) \equiv P(t = post\_Katrina \mid x_i = x)$ to be the probability that an observation with characteristics $X = x$ drawn at random from a pooled sample of both pre- and post-Katrina observations comes from the post-Katrina sample. To obtain and estimate of the propensity scores across individual observations, we estimate a logistic regression of a dummy indicator that an observation came from the post-Katrina sample on a vector of demographic variables X

among a pooled sample that contains both pre- and post-Katrina observations, weighting by the Census-produced ACS sampling weights. For each ACS observation *i*, we then compute an estimated propensity score $\hat{\rho}(x_i)$ by applying the logistic CDF to the estimated regression evaluated at x_i. In all substantive analysis, we weight each post-Katrina observation by the product of the ACS sampling weight and the propensity score weight,

$$w = \left(\frac{1-\hat{\rho}(x_i)}{\hat{\rho}(x_i)} \right) \left(\frac{\hat{\rho}}{1-\hat{\rho}} \right), \tag{1}$$

where $\hat{\rho}$ is the unconditional (on *x*) probability that an observation comes from the post-Katrina sample. This approach ensures the comparability of the two samples under the assumption that there are no unobserved effects that both influence the probability of being included in the post-Katrina sample and are correlated with outcomes of interest.

Next, we investigate how the prevalence of health impairments and disability changed following Hurricane Katrina. Let Y_i be a dummy outcome variable. To examine how the prevalence of an outcome changed from before Katrina to after, we estimate linear probability models of the form,

$$Y_i = \beta_0 X_i + \beta_1 X_i \times Post_i + \varepsilon_i, \tag{2}$$

where X is a vector of dummy demographic variables and $Post$ is an indicator that an observation comes from the post-Katrina sample. The parameter β_0 describes the prevalence of the outcome prior to Katrina across demographic groups and β_1 describes the changes in the outcome's prevalence following Hurricane Katrina. To investigate the change in the outcome's prevalence for the whole population, we define *X* to be a constant. We also investigate the change outcomes for particular groups by allowing *X* to be a series of indicators for particular

subgroups. For instance, we estimate models where *X* contains indicators for black and non-black, models where *X* contains indicators for male and female, models where *X* contains indicators for various age groups, and finally models in which *X* defines all three-way interactions for these age-race-sex groups.

Preliminary Results

We present a preliminary set of tables with this extended abstract which show that there are statistically and substantively significant effects of Hurricane Katrina on a number of health outcomes. Furthermore, there are important differences by age, sex, and, race in the estimated effects of the hurricane on health outcomes. Particularly significant are the major deleterious effects on health status in the year after Hurricane Katrina for young blacks—especially young black females.

Analysis Plan

Our plan for completing this paper is to finalize the regression model results and write up the results. We expect the preliminary results described in this abstract to remain virtually unchanged in the final set of model results.

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Table 1. Pre-Katrina Levels and Post-Katrina Changes by Race, Sex, and Age in Health Status

Group	Blindness, deafness, or severe vision or hearing impairment		A condition that substantially limits physical activities		Learning, remembering, or concentrating	
	Pre-Katrina prevalence	Post-Katrina change	Pre-Katrina prevalence	Post-Katrina change	Pre-Katrina prevalence	Post-Katrina change
All	0.055	0.005	0.141	0.022**	0.058	0.027***
	[0.005]	[0.008]	[0.008]	[0.012]	[0.005]	[0.009]
Age						
25–39	0.015	0.003	0.018	0.045***	0.030	0.015*
	[0.004]	[0.008]	[0.004]	[0.012]	[0.007]	[0.011]
40–64	0.028	0.025***	0.122	0.022*	0.041	0.032***
	[0.004]	[0.009]	[0.010]	[0.016]	[0.005]	[0.011]
65+	0.198	–0.044*	0.400	–0.017	0.150	0.034
	[0.022]	[0.030]	[0.025]	[0.036]	[0.021]	[0.031]
Race						
Black	0.054	0.013	0.163	0.022*	0.067	0.025**
	[0.007]	[0.011]	[0.011]	[0.017]	[0.008]	[0.012]
Non-black	0.056	–0.006	0.104	0.023*	0.042	0.032***
	[0.008]	[0.010]	[0.009]	[0.015]	[0.007]	[0.013]
Sex						
Male	0.048	0.024**	0.138	0.006	0.061	0.009
	[0.006]	[0.011]	[0.011]	[0.016]	[0.008]	[0.012]
Female	0.060	–0.009	0.144	0.035**	0.055	0.042***
	[0.007]	[0.010]	[0.010]	[0.016]	[0.007]	[0.012]
	Race-by-sex-by-age					
Black male by age						
25–39	0.011	0.024*	0.015	0.056***	0.070	–0.037*
	[0.006]	[0.019]	[0.006]	[0.023]	[0.024]	[0.028]
40–64	0.034	0.066***	0.191	–0.019	0.054	0.025
	[0.009]	[0.022]	[0.026]	[0.036]	[0.012]	[0.023]
65+	0.169	0.004	0.433	–0.098	0.183	–0.031
	[0.037]	[0.067]	[0.053]	[0.077]	[0.040]	[0.055]
Black female by age						
25–39	0.018	0.002	0.025	0.057**	0.009	0.060***
	[0.007]	[0.013]	[0.008]	[0.026]	[0.004]	[0.019]
40–64	0.031	0.016	0.109	0.074***	0.042	0.058***
	[0.007]	[0.014]	[0.013]	[0.026]	[0.008]	[0.018]
65+	0.217	–0.093**	0.522	–0.017	0.193	–0.011
	[0.046]	[0.055]	[0.044]	[0.067]	[0.046]	[0.059]
Non-black male by age						
25–39	–	–	0.013	0.034*	–	–
	–	–	[0.008]	[0.024]	–	–
40–64	0.017	0.007	0.083	0.004	0.032	0.008
	[0.007]	[0.011]	[0.015]	[0.023]	[0.011]	[0.017]
65+	0.211	–0.049	0.254	0.027	0.118	0.023
	[0.041]	[0.053]	[0.041]	[0.061]	[0.032]	[0.048]
Non-black female by age						
25–39	0.014	–0.014*	0.013	0.016	0.043	–0.028*
	[0.009]	[0.009]	[0.007]	[0.017]	[0.016]	[0.018]
40–64	0.021	–0.002	0.081	–0.009	0.028	0.011
	[0.009]	[0.012]	[0.018]	[0.024]	[0.013]	[0.017]
65+	0.186	–0.021	0.309	0.070	0.086	0.162***
	[0.034]	[0.049]	[0.039]	[0.061]	[0.023]	[0.059]

Note: Robust standard errors in parentheses; *p<.10; **p<.05; ***p<.01; cells marked with a "–" have been suppressed because the underlying population was smaller than the Census disclosure avoidance threshold.

Table 2. Pre-Katrina Levels and Post-Katrina Changes by Race, Sex, and Age in Health Status

Group	Dressing, bathing, or getting around inside the home		Going outside the home alone to shop or visit a doctor's office		Working at a job or business	
	Pre-Katrina prevalence	Post-Katrina change	Pre-Katrina prevalence	Post-Katrina change	Pre-Katrina prevalence	Post-Katrina change
All	0.049	0.003	0.078	0.007	0.147	–0.003
	[0.004]	[0.007]	[0.006]	[0.009]	[0.009]	[0.013]
Age						
25–39	0.011	0.001	0.014	0.017**	0.033	0.031***
	[0.003]	[0.006]	[0.004]	[0.009]	[0.007]	[0.013]
40–64	0.035	0.010	0.053	0.001	0.12	0.001
	[0.005]	[0.010]	[0.007]	[0.010]	[0.010]	[0.015]
65+	0.152	–0.012	0.256	0.009	0.410	–0.069**
	[0.017]	[0.024]	[0.023]	[0.034]	[0.025]	[0.037]
Race						
Black	0.055	0.005	0.087	0.002	0.168	–0.015
	[0.006]	[0.010]	[0.008]	[0.012]	[0.012]	[0.017]
Non-black	0.040	0.001	0.064	0.016	0.110	0.020
	[0.006]	[0.009]	[0.009]	[0.014]	[0.011]	[0.017]
Sex						
Male	0.043	–0.000	0.065	0.004	0.147	–0.003
	[0.006]	[0.009]	[0.008]	[0.011]	[0.013]	[0.018]
Female	0.054	0.006	0.088	0.011	0.146	–0.002
	[0.006]	[0.010]	[0.009]	[0.013]	[0.011]	[0.015]
	Race-by-sex-by-age					
Black male by age						
25–39	0.013	–0.005	0.025	0.006	0.062	0.025
	[0.007]	[0.009]	[0.011]	[0.018]	[0.023]	[0.034]
40–64	0.048	0.011	0.083	–0.025	0.208	–0.027
	[0.013]	[0.022]	[0.019]	[0.023]	[0.027]	[0.038]
65+	0.151	–0.035	0.215	–0.030	0.407	–0.127**
	[0.039]	[0.051]	[0.044]	[0.063]	[0.054]	[0.077]
Black female by age						
25–39	0.013	0.007	0.011	0.042***	0.026	0.049**
	[0.006]	[0.013]	[0.006]	[0.018]	[0.008]	[0.021]
40–64	0.033	0.028**	0.043	0.026*	0.099	0.025
	[0.007]	[0.016]	[0.008]	[0.017]	[0.013]	[0.022]
65+	0.203	–0.031	0.353	–0.025	0.522	–0.163***
	[0.033]	[0.048]	[0.047]	[0.065]	[0.044]	[0.064]
Non-black male by age						
25–39	0.005	0.001	–	–	0.011	0.036**
	[0.005]	[0.007]	–	–	[0.006]	[0.017]
40–64	0.032	–0.02**	0.043	–0.012	0.084	–0.009
	[0.009]	[0.011]	[0.011]	[0.016]	[0.016]	[0.024]
65+	0.076	0.039	0.094	0.132***	0.229	0.080
	[0.027]	[0.041]	[0.029]	[0.053]	[0.040]	[0.063]
Non-black female by age						
25–39	0.010	–0.004	–	–	0.029	–0.003
	[0.009]	[0.010]	–	–	[0.014]	[0.017]
40–64	0.024	–0.002	0.035	–0.003	0.064	0.009
	[0.009]	[0.014]	[0.011]	[0.016]	[0.016]	[0.023]
65+	0.138	0.010	0.269	0.025	0.387	0.012
	[0.030]	[0.045]	[0.040]	[0.068]	[0.040]	[0.066]

Note: Robust standard errors in parentheses; *p<.10; **p<.05; ***p<.01; cells marked with a "–" have been suppressed because the underlying population was smaller than the Census disclosure avoidance threshold.

Table 3. Pre-Katrina Levels and Post-Katrina Changes by Race, Sex, and Age in Health Status

	Any of the six health conditions	
Group	Pre-Katrina prevalence	Post-Katrina change
All	0.206	0.040***
	[0.010]	[0.015]
Age		
25–39	0.058	0.064***
	[0.009]	[0.018]
40–64	0.168	0.051***
	[0.012]	[0.019]
65+	0.559	–0.033
	[0.024]	[0.037]
Race		
Black	0.225	0.048**
	[0.014]	[0.021]
Non-black	0.174	0.028*
	[0.014]	[0.020]
Sex		
Male	0.204	0.031*
	[0.014]	[0.021]
Female	0.207	0.047***
	[0.012]	[0.018]
	Race-by-sex-by-age	
Black male by age		
25–39	0.091	0.053*
	[0.025]	[0.041]
40–64	0.255	0.023
	[0.028]	[0.042]
65+	0.549	–0.065
	[0.055]	[0.084]
Black female by age		
25–39	0.046	0.115***
	[0.011]	[0.032]
40–64	0.151	0.109***
	[0.016]	[0.030]
65+	0.654	–0.085*
	[0.039]	[0.063]
Non-black male by age		
25–39	0.032	0.055**
	[0.016]	[0.030]
40–64	0.118	0.012
	[0.018]	[0.028]
65+	0.419	0.063
	[0.047]	[0.071]
Non-black female by age		
25–39	0.059	–0.013
	[0.018]	[0.025]
40–64	0.115	0.009
	[0.020]	[0.029]
65+	0.535	0.015
	[0.043]	[0.066]

Note: Robust standard errors in parentheses;
*p<.10; **p<.05; ***p<.01.