

The social vulnerability of the American population is not evenly distributed among social groups or between places. Some regions may be more susceptible to the impacts of hazards than other places based on the characteristics of the people residing within them. As we saw with Hurricane Katrina, when coupled with residences in high-risk areas such as the hurricane coasts, differential vulnerabilities can lead to catastrophic results. The geographic discrepancies in social vulnerability also necessitate different mitigation, post-response, and recovery actions. Given temporal and spatial changes in social vulnerability in the future, a one-size-fits-all approach to preparedness, response, recovery, and mitigation may be the least effective in reducing vulnerability or improving local resilience to hazards.

Keywords: social vulnerability; spatial inequities; race; class

Moral Hazard, Social Catastrophe: The Changing Face of Vulnerability along the Hurricane Coasts

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(Crossett et al. 2004). This growth is most visible along the nation's hurricane coasts—stretching from Cape Cod to Miami along the Atlantic Ocean and from Brownsville, Texas, to the Florida Keys along the Gulf of Mexico. In addition to the sheer increases in the number of people, the character of coastal residents has changed as well. Instead of seasonal populations, coastal counties now have significant year-round residents—many of them elderly retirees or service industry workers who keep the tourist industry afloat. Coastal residents are more racially and ethnically diverse than in past decades. The expansion of low-wage jobs primarily in the service sector has partially fueled this diversity. Despite our collective prosperity as a nation today, the disparity in incomes between the richest and poorest Americans widens every year. This wealth gap is especially evident in coastal counties, where the rich live right along the shore, and the income gradient decreases with distance away from the water's edge. This disparity in wealth is a significant social problem at the local and regional level. It is also a spatial problem for coastal communities with geographic mismatches between employment opportunities and where workers can find affordable housing that is also built to current code standards.

The American dream of owning a single detached house is beyond the reach of nearly half of the nation's households. Instead, many people turn to manufactured housing or mobile homes to achieve the dream of purchasing their own affordable home. This is especially true among coastal counties in the Gulf and the southeastern United States. Unfortunately, these types of structures are highly vulnerable to severe storms and high winds and actually may increase the risk of damage, along with injury and possibly death, to the people who live in them in hazard-prone areas.

Social Vulnerability Defined

Social vulnerability is the product of social inequalities. It is defined as the susceptibility of social groups to the impacts of hazards, as well as their resiliency, or ability to adequately recover from them. This susceptibility is not only a function of the demographic characteristics of the population (age, gender, wealth, etc.), but also more complex constructs such as health care provision, social capital, and access to lifelines (e.g., emergency response personnel, goods, services) (Cutter 1996; Cutter, Mitchell, and Scott 2000; Cutter, Boruff, and Shirley 2003).

The origins of social vulnerability can be seen in the quality of life and livability studies in the social and behavioral sciences during the 1950s and 1960s. This research attempted to understand the characteristics of places that make them either suitable or less suitable places to reside. The decade of the 1960s and the early 1970s saw a spike in interest by the federal government in the identification of social well-being and progress indicators (U.S. Department of Health, Education, and Welfare 1969; U.S. Office of Management and Budget [OMB] 1973). During this time, research into the social characteristics of people and places began to take shape as a viable and useful way to understand how people might cope with sickness, social problems, and environmental inequities (Maloney 1973; Smith 1973;

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Berry 1977). It is this type of research (a combination of demography, sociology, geography, and natural science) that has spawned the current trend in hazard-related vulnerability science (Cutter 2003).

Whereas the physical vulnerability can be easily identified using data from past events, the social aspects of hazard vulnerability are a bit more complicated given their temporal and spatial variability.

The built environment also plays a role in social vulnerability, especially the nature and age of the housing stock as noted above (Heinz Center 2002). More generalized characteristics of the built environment such as urbanization, economic vitality, and development help define the livability and quality of life of the community (Pacione 1990, 2003), which in turn influences hazard susceptibility, response, and resilience in the aftermath of a disaster. For example, the preevent trajectory of a community's economic vitality and quality of life almost always continues postevent. If a community were stressed economically and losing population prior to disaster, this trajectory would continue long after the disaster recovery and reconstruction was finished. Disasters magnify the existing social and economic trends in places; they do not fundamentally change them (Kates 1977). So, if we are to make progress in reducing vulnerability, we need to move recovery beyond the status quo to a more sustainable and socially just future.

Hurricane Katrina and the Aftermath

Hurricane Katrina was a wake-up call for the American public. A major hurricane striking New Orleans or nearby was bound to happen and, in fact, was one of the oft-discussed worst-case scenarios by hazards researchers and emergency managers. The ill-fated "Hurricane Pam" training exercise sponsored by FEMA, the series of articles in the *Times-Picayune* in 2002, and provocative essays by researchers (Laska 2004) all highlighted the impending social catastrophe, yet few governmental officials listened or, more important, took action.

The lack of action during the preparedness phase defines an emergency management system that is not functioning at its highest level. When the storm began bearing down along the Gulf Coast, the emergency management system became

overwhelmed and simply collapsed, creating the social catastrophe that we saw in New Orleans. While preparedness (including evacuation) was reasonable in some areas along the hurricane's path (Mississippi and Alabama coasts), it was abysmal in other places (the city of New Orleans). Those with resources left in advance of the approaching hurricane; those without (largely the poor, African American, elderly, or residents without private cars) remained, trapped in the rising floodwaters.

Most of our experience with hurricane preparedness, response, and recovery is within a suburban context, not an urban central city. Suburban areas have lower population and housing densities, and the primary mode of transportation is the private automobile. Evacuations from suburban communities are relatively straightforward (albeit traffic congestion is the big problem), with most residents providing their own transportation and seeking shelter out of state or inland with family or friends. Generally, only a small percentage of "special needs" populations require additional assistance in moving out of harm's way—the infirm or some mobility-limited elderly. The evacuations from coastal Mississippi and Alabama reflected more of this suburban experience and went relatively smoothly compared to New Orleans.

Urban places, whether well networked and solidly built or poorly constructed and socially challenging, create new and complex emergency management challenges. Typical large-city problems such as segregation; neighborhood decline; socioeconomic deprivation; and inequities in health, well-being, and health care accessibility have now become central issues for many emergency managers across the nation, necessitating more focus on improving the resilience of the community and its residents—enhancing skills and other attributes known to minimize loss in the first place or to strengthen the capacity to recover.

Many inner-city residents do not have the wealth of their suburban counterparts, do not own a private automobile, and rely almost exclusively on public transportation. In the city of New Orleans, for example, more than fifty-one thousand people or 27 percent of the adult population did not own a car, prompting these residents to seek shelter wherever they could. While not often considered "special needs" by emergency managers and planners, the inner-city poor of New Orleans became the human face of Katrina.

Moral hazards, according to economists, are when insurance changes the behavior of the person being insured. For example, the availability of flood insurance in high-risk, flood-prone areas encourages individuals to build there, despite the known risks. If the insurance was not available and the individual households had to absorb all the losses themselves, they might choose to reside elsewhere, where their investments were more protected. Looking at it differently, the failure of the nation's social safety net despite emergency preparations also created a different moral hazard. With the dysfunctional relief operation, the nation gasped at the sight of people being plucked off of rooftops; the lack of basic food, water, and sanitation at the Superdome and Convention Center; and the general anarchy that befell the city. How could this be America? This socially vulnerable population was exploited even more during the response phase when intergovernmental friction and bureaucratic ineptitude at the local, state, and federal levels delayed relief sup-

plies for up to a week. The preexisting social vulnerabilities gave rise to the social catastrophe; the moral hazard occurred with our collective inability to adequately respond. What good is a federal response plan when it clearly does not work and does not alleviate the suffering of the most vulnerable within our society? What does it say about the adequacy of preparedness when we know so little about the most disadvantaged within the communities—those that require additional assistance to get out of harm's way? How can we mitigate now so that a Katrina-like situation does not occur in the future? How do we know which places are more socially vulnerable than others and where mitigation interventions would be the most beneficial?

Social Vulnerability Metrics and Methods

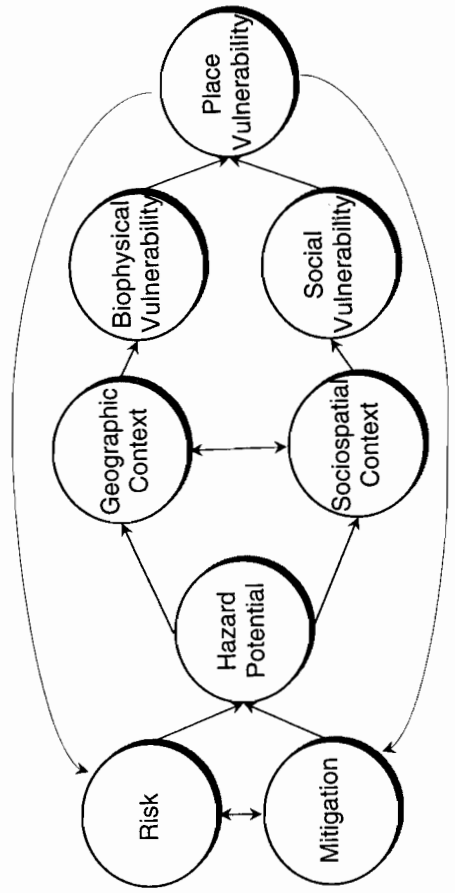
The development of a social vulnerability metric for U.S. counties has allowed the science of vulnerability to move forward in understanding not only spatial differences in social vulnerability between counties from 1960 to 2000 but has also permitted the temporal analysis of this idea of decreased resiliency within a single county or other political unit. This measure over time is important for understanding the broad impact of disaster mitigation in the United States as well as more localized changes in social vulnerability that are caused by different factors at different spatial and temporal scales.

The theory behind this index of social vulnerability is based in the Hazards of Place Model (Figure 1), which conceptualizes the inputs to social vulnerability within the broader hazards paradigm. Place vulnerability is made up of two main components: those factors of the environment that lead to increased potential for hazardous events to occur, or physical vulnerability (e.g., Do you live in a hurricane area, or near a chemical or nuclear facility?); and those characteristics of the people and places that make them less able to cope with and rebound from disaster events. Whereas the physical vulnerability can be easily identified using data from past events, the social aspects of hazard vulnerability are a bit more complicated given their temporal and spatial variability. How to capture complexity into a single metric or indicator of vulnerability has been difficult.

The Social Vulnerability Index (SoVI)

The SoVI as described by Cutter, Boruff, and Shirley (2003) uses a subset of forty-two socioeconomic, demographic, and built environment variables to capture the level of resilience to hazard events for U.S. counties. This subset of variables was chosen because it encapsulates all of the factors and characteristics found in past research on disaster vulnerability. This set of variables was simplified from a much larger group of census variables culled for each decade from 1960 to 2000. The application of a factor analytical approach to these decadal sets of variables provided a smaller set of independent factors that account for a majority of the overall variance within the data. These component parts can then be appraised and

FIGURE 1
THE CONCEPTUAL FRAMEWORK FOR UNDERSTANDING THE
VULNERABILITY OF PLACES



SOURCE: Based on Cutter (1996).

assigned a general socioeconomic or demographic title based on which factors loaded highest on each component.

There is remarkable consistency (and robustness) in this overall indicator of social vulnerability. Specifically, the SoVI had a total of eleven to twelve components and explained 74 to 78 percent of the total variation among counties for the five decades. The most consistent single indicator for all decades was socioeconomic status, development density, population age, race/ethnicity, and gender account for nearly half of the variation in social vulnerability among counties for all U.S. counties.

When applied to the hurricane-ravaged coastal counties/parishes of Louisiana, Mississippi, and Alabama, the SoVI helps us understand dissimilarities in the ability to adequately respond to and rebound from this disaster, both spatially and temporally. Of particular interest is the differential vulnerability of specific counties/parishes compared to the others impacted by this storm. This is no more evident than the disparities between Orleans Parish and the other parishes and counties hardest impacted by the flooding and storm surge inundation following Hurricane Katrina. As seen in Table 2, in 2000 Orleans Parish had the highest social vulnerability score of all Katrina-impacted coastal parishes or counties. This was not always the case. In 1960, both Jefferson and St. Bernard Parishes had higher SoVI scores than Orleans. However, all the Katrina-affected parishes and counties had lower overall social vulnerability scores in 2000 than they did in 1960, with one exception: Orleans Parish. The higher social vulnerability score in 2000 compared to 1960

TABLE 1
CONSISTENCY IN THE SOCIAL VULNERABILITY INDEX (SOVI), 1960-2000

	1960	1970	1980	1990	2000
Percentage variance explained	75.8	74.2	77.5	77.9	78.1
Number of factors	11	12	12	12	11
Most important component (percentage variance explained)	Socio-economic status (17.8)	Socio-economic status (16.1)	Socio-economic status (13.8)	Socio-economic status (13.3)	Socio-economic status (14.7)

TABLE 2
SOCIAL VULNERABILITY SCORES OF COASTAL COUNTIES AFFECTED BY HURRICANE KATRINA

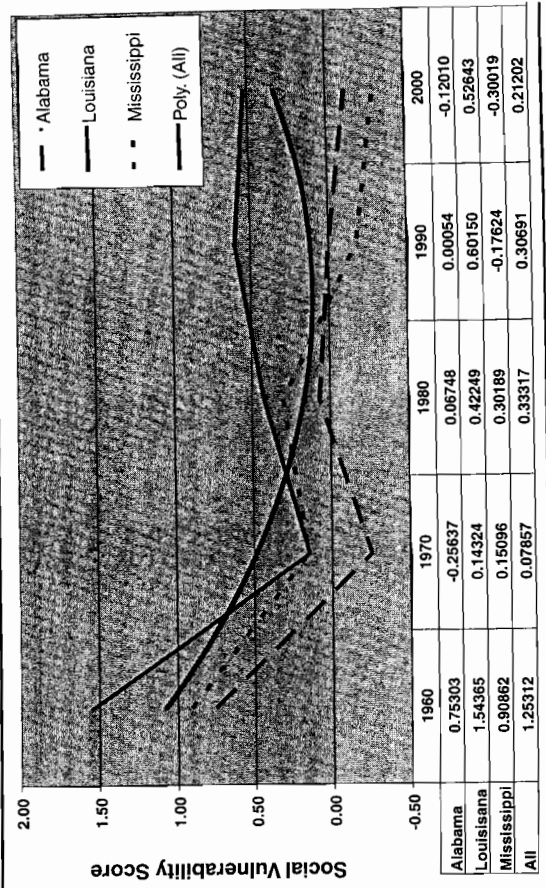
County/Parish	State	SoVI 2000 ^a	Primary Contributing Factors
Baldwin County	AL	-0.69659	Rural agriculture, debt/revenue ratio
Mobile County	AL	0.45640	Race/gendered employment, gender
Jefferson Parish	LA	0.26792	Race/gendered employment, debt/revenue
Lafourche Parish	LA	-0.30376	Debt/revenue ratio, infrastructure employment
Orleans Parish	LA	1.98826	Race/gendered employment, race
Plaquemines Parish	LA	0.96718	Infrastructure employment, rural agriculture
St. Bernard Parish	LA	1.04649	Debt/revenue ratio, infrastructure employment
St. Tammany Parish	LA	-0.54963	Rural agriculture, socioeconomic status
Terrebonne Parish	LA	0.26856	Age, infrastructure employment
Hancock County	MS	-0.82442	Rural agriculture, race
Harrison County	MS	0.16426	Race/gendered employment, gender
Jackson County	MS	-0.24041	Debt/revenue ratio, rural agriculture

a. Standardized scores on Social Vulnerability Index (SoVI) with a mean of 0 and a standard deviation of 1. Positive values indicate higher social vulnerability, while negative values depict lower levels of social vulnerability.

suggests an increase in social vulnerability over time, unlike the other counties in the affected region. This indicates that not only do the persons living in Orleans Parish generally have less ability to cope with major natural disasters than their counterparts in the other parishes, but they also have less ability to rebound from catastrophe than they did in 1960.

What are the primary determinants of the social vulnerability in these counties/parishes? The dominant driving forces behind the social vulnerability of these counties/parishes are race, gender, and class. In addition, two measures of economic vitality were important—rural agriculture and debt/revenue ratio. The dependence on a single-sector economic base such as agricultural provides some vulnerability since there is no alternative source of employment for the community if that sector sustains long-term damage. Similarly, the ratio of local debt to revenue

FIGURE 2
SOCIAL VULNERABILITY OF KATRINA-IMPACTED COASTAL STATES, 1960-2000



is also indicative of vulnerability, especially if the debt-to-revenue ratio is high. In Orleans Parish, the primary factors driving social vulnerability are race, class, and gender (Table 2). This is also true for Jefferson Parish, Mobile County, and Harrison County.

Scaling up to the state level, the social vulnerability scores for these three states are similar (Figure 2). Although all three states have seen decreases in social vulnerability since 1960, Louisiana still has an overall higher social vulnerability score when compared to the two other Katrina-impacted coastal states—Alabama and Mississippi. Interestingly, the trend in social vulnerability has been decreasing over time, but in 2000 it took an upward turn.

The SoVI provides a single metric for intrastate and interstate comparisons. It also provides a fundamental grasp of the underlying dimensions that contribute to vulnerability. It is both the aggregate (SoVI score) and disaggregate (individual SoVI components) knowledge that will allow emergency managers, planners, and individuals to help shape the future of hazard mitigation in an attempt to decrease vulnerability and increase the future resilience of these places.

Coastal erosion vulnerability:

The intersection of physical and social indicators

Another way to use the SoVI is to combine it with some physical indicator such as flood potential, storm surge inundation, or coastal erosion. In a pioneering study,

TABLE 3
HURRICANE KATRINA-AFFECTED COASTAL COUNTIES AND THEIR
OVERALL COASTAL VULNERABILITY

County/Parish	Overall Place Vulnerability	Coastal Erosion Index	Social Vulnerability Index
Baldwin County	-0.94	-0.42	-0.52
Mobile County	0.37	0.57	-0.20
Jefferson Parish	0.04	1.15	-1.10
Lafourche Parish	1.09	1.37	-0.28
Orleans Parish	1.38	0.72	0.66
Plaquemines Parish	3.00	2.49	0.51
St. Bernard Parish	1.31	1.76	-0.45
St. Tammany Parish	-0.21	0.17	-0.38
Terrebonne Parish	2.37	2.16	0.21
Hancock County	0.60	0.98	-0.37
Harrison County	1.39	1.55	-0.17
Jackson County	0.46	1.25	-0.78

SOURCE: Based on Boruff, Emrich, and Cutter (2005).

Boruff, Emrich, and Cutter (2005) combined a coastal erosion index developed by the U.S. Geological Survey with a variant of SoVI—a recalculation of social vulnerability derived by comparing the variability in social vulnerability among coastal counties ($N = 213$), not all counties in the U.S. ($N = 3,141$). Looking at all U.S. coastal counties (with the exception of the Great Lakes, Alaska, and Hawaii), the results suggest a highly differentiated pattern of coastal erosion vulnerability along the nation's coastlines. In the Gulf Coast region, for example, the coastal erosion vulnerability is a product of social characteristics, not physical attributes such as mean wave height, rate of sea level rise, and so on. On the other hand, the coastal erosion vulnerability for the Atlantic and Pacific Coast counties was most influenced by physical characteristics.

Two parishes in Louisiana—Plaquemines and Terrebonne—rank in the top ten for the most vulnerable coastal erosion counties in the entire United States. In examining just those counties affected by Hurricane Katrina, physical attributes had more significance than social indicators in determining the overall coastal erosion vulnerability score (Table 3), especially in Plaquemines and Terrebonne. However, in Orleans Parish, social vulnerability and physical attributes had roughly the same impact on the overall coastal erosion vulnerability score.

These are just two illustrations of the spatial dimensions of social vulnerability and the utility of the vulnerability metric known as the Social Vulnerability Index, or SoVI. Simply understanding the characteristics of people and places that lead to increased vulnerability is not enough to curb the escalating losses from natural disasters. What is needed is knowledge about who the most socially vulnerable people are within a population and where those less resilient reside. If we have a spatial understanding of the differences in social vulnerability, policies, procedures, and disaster management protocols can be put into place before an event

occurs to minimize the impact of disaster events, thus saving lives and reducing property losses, rather than afterward. It highlights the need for proactive rather than reactive approaches to vulnerability reduction.

Enhancing Resiliency

The stretch of coastline impacted by Hurricane Katrina's storm surge measured more than two hundred continuous miles, from southeast Louisiana, through Mississippi and Alabama, to the Florida panhandle. Although many of the million-dollar houses along this coastline were nearly or completely destroyed from this surge, it has the impact further west and north from the storm surge area that exemplifies the differences in social vulnerability in this disaster. For example, three miles inland from the Grand Strand in Mississippi, people are still trying to live in condemned houses while their more affluent counterparts on the beach have not returned to live in some of the homes that perhaps were only minimally damaged during the hurricane. The people living in the condemned housing have little to fall back on including federal disaster relief, while the beachfront owners have taken a three-month "forced" vacation while the power is restored to their homes and the roads are cleared and repaired. The same could be seen in New Orleans. Those without access to vehicles, proper shelter, food, clothing, and the like paid the price after the storm moved through, while those more affluent were able to evacuate long before impacts were being felt from Hurricane Katrina. Three months after Hurricane Katrina and the failures of the levees in New Orleans, residents in the 9th Ward district were finally allowed into the area to retrieve what was left of their belongings. The more affluent parts of the city (and not surprisingly those less affected by flooding) have had power and water restored for months—a measurable outcome based on the relative social vulnerability of the residents. This scene is played out all along the Gulf Coast in places like Waveland, Pass Christian, and Diamondhead, Mississippi; and in Bayou LaBatre, Coden, and Dauphin Island, Alabama. There will be differential patterns in the recovery of these places.

The SoVI represents an operational protocol for empirically determining social vulnerability. As a single metric, the SoVI is quite robust and consistent over time. It provides a useful tool for comparing one county to another, either within a state or between states. As an overall index with several component parts, the SoVI provides an understanding of the dynamics that factor into the computation of social vulnerability—which factors contribute more, which ones less. The relative importance of each indicator provides the pathway for vulnerability reduction and improvements in the resilience of communities. As such, SoVI presents a tool that will enable planners and developers, city governments, and individuals to make more informed decisions surrounding many aspects of hazard mitigation, preparation, and recovery.

For policy purposes, decreases in overall social vulnerability can be achieved locally by focusing mitigation and planning on the most important component for

each community, rather than implementing broad-brush approaches that might miss the more intricate place-based differences in social vulnerability that are present at different localities. For example, a shift from manufactured housing to wood-frame single-unit detached housing built on pilings may be more costly in the short run as the Gulf Coast region rebuilds, yet this type of housing construction may be more sustainable in the longer term. It is not a coincidence that many of the structures that withstood the storm surge and the levee break were some of the older, more historic buildings in the region. The remnants of Hurricane Katrina will be felt for decades along the Gulf Coast. The recovery and reconstruction needs to proceed, but a "one-size-fits-all" strategy is not going to work and may, in fact, exacerbate the preexisting social vulnerabilities found in the region. Greater care and consideration must be taken to derive a socially just recovery and reconstruction of the Gulf Coast.

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Hurricane Katrina created an unprecedented need for sheltering and temporary housing across a four-state area along the Gulf Coast. This article reviews the disaster literature with respect to sheltering and temporary housing and contrasts how these needs actually developed with respect to both the preimpact and postimpact evacuation situations. The article also investigates the ways that intergovernmental planning failed to anticipate the need for shelter/housing solutions or to implement effective measures to put those plans into operation.

Keywords: hurricane; flooding; evacuation; intergovernmental planning; sheltering; temporary housing

Hurricane Katrina and the Flooding of New Orleans: Emergent Issues in Sheltering and Temporary Housing

By
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Hurricane Katrina resulted in the largest relocation of citizens within the United States since the Dust Bowl of the 1930s. However, the Dust Bowl migration of 300,000 to 400,000 people from the southern plains states to California took place over several years, in comparison to an estimated 1.2 million people who left their homes and communities within hours or days before Hurricane Katrina's landfall along the Gulf Coast on August 29, 2005 (Gregory 1989). Due to the subsequent flooding of New Orleans, the 100,000 to 120,000 residents who remained in the city were rapidly transformed into a second wave of evacuees, greatly intensifying the need for shelter and housing.

This article assesses the adequateness of governmental efforts to provide shelter and housing for thousands of evacuees displaced by Hurricane Katrina. Although this process is ongoing, the data used in this analysis primarily reflect actions taken during the warning and early response periods.¹ Because the largest group of evacuees were from the New Orleans area and because they constituted the largest number of those in "official" shelters (i.e., those facilities that were preidentified and/or run by the Ameri-