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Disaster vulnerability and evacuation readiness: coastal mobile home residents in Florida

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Abstract This article examines disaster preparedness in a highly vulnerable population, mobile home park residents in hurricane-prone areas. The vulnerabilities of this population mandate evacuation as the only viable disaster response strategy, but this does not always happen. In order to explore evacuation decision making, interviews were conducted with 75 mobile home park residents in Ruskin, Florida. Descriptive results build on a conceptualization of physical, structural, socio-economic, and "residual" disaster vulnerability; the latter is defined as a combination of experiences, perceptions, and preparations that inhibit the willingness and abilities of respondents to protect themselves. While residents generally prepared for disasters, evacuation plans were troubling. Barriers to evacuation based on measured vulnerabilities remained unclear, and analysis of responses failed to explain respondents' varying evacuation preparations. Future research needs to address differential evacuation behaviors among mobile home park residents. We further conclude that disaster preparation and education need to address the special risks of this and other vulnerable populations better.

Keywords Evacuation · Disaster vulnerability · Perception · Mobile homes · Florida

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1 Introduction

While disaster vulnerability can be defined in various ways, it is usually determined through the combination of physical forces that comprise the natural environment and socio-economic and political processes of the human environment (Wisner et al. 2004). A high-risk physical environment, when combined with certain socio-demographic and economic traits, can exacerbate vulnerability. In this context, mobile home residents located in high-risk coastal areas are distinctly vulnerable populations because of the limited protection afforded by their dwellings and their socio-economic status. Research has shown, for instance, that age, gender, household size, education, income, health, pet ownership, and structural conditions of homes all influence disaster outcomes (e.g., Bolin and Stanford 1991; Cutter and Finch 2008; Enarson and Scanlon 1999).

Conditions resulting in high vulnerability, then, generally should lead to evacuation as the only viable short-term strategy in responding to an imminent disaster. Despite this, not all threatened groups evacuate during times of impending disasters, regardless of their rating on vulnerability indices. Therefore, what appears to be a good strategy for one group might be an irresponsible course of action for another. As a result, it is argued that a "one size fits all" approach to disaster preparation and education fails to take into account dramatically differential levels of vulnerability. The question to be addressed, then, is what particular conditions influence evacuation readiness and behaviors in highly vulnerable populations?

This article examines disaster vulnerability and evacuation readiness in one highly vulnerable population: residents of mobile home parks in high-risk hurricane areas.[1] The goal of the research was to identify barriers to evacuation by assessing the impacts of vulnerability conditions on evacuation readiness.

2 Background literature

Disasters are characterized as intersections of geophysical events with vulnerable populations, as the result of natural and social processes that continually unfold over time (Hoffman and Oliver-Smith 2002). Research on vulnerability, therefore, has evolved into a comprehensive discipline that investigates not only geophysical processes but also social, economic, and political forces (Tobin and Montz 1997; Wisner et al. 2004). A frequently utilized framework to understand disaster vulnerability is the "Pressure and Release" Model (PAR) developed by Wisner et al. (2004). This model describes the social and geophysical pressures that build from endemic root causes, social problems (such as poverty, lack of power, or poor community health), unsafe living conditions, and hazardous geographic locations, and describes the intersection of these factors with a natural environment that ultimately results in a disaster (Wisner et al. 2004, p. 51). In this respect, residents of mobile home parks located in hurricane-prone coastal regions throughout the southeastern United States are by definition highly vulnerable populations living in unsafe geographic areas and homes, and are therefore at a high risk to be affected by natural disasters.

Vulnerability, whether at a community or individual level, is thus comprised of a number of environmental/physical, social, economic, and political factors. Social vulnerability in

[1] In accordance with the United States Census Bureau and to reflect residents' preferences, we use the term "mobile home" to refer to the variety of housing that is not built on site, ranging from "manufactured homes" (the preferred term by the manufactured housing industry) to "trailers."

particular groups, for instance, results from structural factors such as socio-economic status, ethnicity, and age, which may compromise the ability to prepare for and to recover from disasters (Cutter and Finch 2008). The literature on socio-economic vulnerability is extensive, and researchers have addressed many variables that may affect disaster response capabilities. The outcomes of such work, however, are not always clear, as some traits have contradictory influences. Age, for example, is often associated with increased vulnerability, since the elderly are often less wealthy and unable to undertake vigorous remedial activity. Yet not all elderly are poor, and many can respond favorably to the onset of disaster. Attempts to develop comprehensive and reliable indices of social vulnerability have also met with mixed success (Chakraborty et al. 2005; Cutter et al. 2003; Cutter and Finch 2008). Nevertheless, when disasters do strike, they have a way of revealing and reasserting the underlying social structures of a society (Oliver-Smith and Hoffman 2002, p. 9), just as hurricanes Katrina and Rita exposed the racism and class disparities that still imbrue the United States (Elliot and Pais 2006). Since differential vulnerability to hazards is, partially, the result of social structural factors, it follows that vulnerability is not accidental but rather is firmly entrenched in everyday life (Hewitt 1983).

In this perspective, effective mitigation strategies must begin before a hazard becomes a disaster (Morrow 1999; Tobin et al. 2005, p. 11), and such strategies must include explicit recognition of differential physical, social, and economic vulnerabilities. Spatially based studies have also shown that social vulnerability is becoming more widespread (Montz et al. 2005; Thomalla et al. 2006) and has even increased in some areas in recent years (Chakraborty et al. 2005; Cutter and Finch 2008; Wu et al. 2002). These widening disparities are further evidence that a single disaster plan, at the level of a county for instance, may be incomplete and not suited to protect everyone.

There is considerable variation in how individuals and communities perceive and interact with the physical environment, specifically with respect to future hazards. As Riad and Norris (1998) point out, people must perceive a problem and believe that action, in this case evacuation, will be beneficial. Perception and action are, in part, shaped by previous disaster experiences (Arlikatty et al. 2006; Siegel et al. 2003) as well as by physical and geographic factors such as location and proximity to the hazard (Brody et al. 2008; Tobin et al. 2006). As a result, leaders in coastal areas, especially those with heterogeneous populations, may need to develop formal emergency plans for local areas (Cutter and Finch 2008; Morrow 1999).

Furthermore, vulnerability is closely associated with dwelling characteristics, features that are especially pertinent to mobile homes. Mobile homes are particularly susceptible to damage from high winds and are generally less resilient in disasters than standard housing (Bolin and Stanford 1991; Chakraborty et al. 2005; Cutter et al. 2000; Heinz Center 2000). These structures, therefore, warrant special attention. In the United States, approximately 19.5 million people live in 8.8 million mobile homes (American Community Survey 2007). Mobile homes and residents can be found in every state and every region of the country, yet they are most concentrated in the Sunbelt. In 2006, 888,000, or fully 10%, of the nation's mobile homes were located in Florida. In the same year, approximately 1.8 million Florida residents, roughly one in ten, lived in mobile homes. Within Florida, mobile homes and mobile home communities are disproportionally concentrated on the west (Gulf) coast, where the research for this article was conducted.

Research on disaster preparation and evacuation has produced interesting findings. Forecasting, warning, and response systems provide alerts of impending problems with the goal being to precipitate remedial action to save lives and property (Tobin and Raulerson 2007). This approach has reduced death and injuries, although economic disruption

remains common (Sorensen 2000). Yet weaknesses abound, as demonstrated by Hurricane Katrina, which exposed the difficulties of facilitating effective responses (Hartman and Squires 2006). A major failing in research, however, has been how to ensure that warning information will be taken seriously and responded to in a timely manner (Dash and Gladwin 2007; Gruntfest and Carsell 2000; Gruntfest and Handmer 2001). Little attention has been given to understanding how people both comprehend and respond to warning messages; it is, after all, response that provides the legitimacy to the strategy (Gruntfest and Handmer 2001).

Making the decision to evacuate one's home is dependent on many factors. Riad and Norris (1998, p. 3) stated that successful evacuation "requires the involvement of both the community (issuing orders, providing marked exit routes) and the individual (decision making)." Paton (2003) and Paton and Johnston (2001) examined health education literature in their studies of resilience and stressed the need to integrate mitigation strategies with community development planning. Family relationships can be both supportive in disaster conditions, by promoting effective action, and also disruptive, having negative effects on preparedness leading to families sitting out the storm together and stockpiling food (Kirschenbaum 2004). Other studies have highlighted the disadvantages faced by some minority groups and, by extension, the advantages of others in disasters (Elliot and Pais 2006), as well as the negative impacts of more contextual factors in evacuation, such as when families are separated (Haney et al. 2007), or the confusion that sometimes results from repeated evacuation orders (Dow and Cutter 1998). Generally, though, levels of evacuation readiness among coastal United States residents are alarmingly low (Baker 1991; Blendon et al. 2008).

Based on the literature, three main questions were raised with respect to the disaster vulnerability and evacuation readiness of coastal residents of mobile home parks:

(i) To what extent are mobile home park residents prepared for hurricanes?
(ii) What prior arrangements have mobile home park residents made for evacuation?
(iii) How do mobile home park residents perceive their own risk and vulnerabilities?

3 Methods and data

3.1 Research area

Ruskin is a town of approximately 8,000 residents (US Census 2000) located on the Little Manatee River in the southwest section of Hillsborough County on Florida's West Coast. The community was founded in 1906 by a Chicago lawyer as a socialist, cooperative community and named after the English philosopher John Ruskin. The town remained primarily agricultural until the onset of expansive suburban growth beginning in the 1980s, based on the area's vicinity to the urban centers of Tampa and St. Petersburg. This rapid development has increased the area's vulnerability to future disasters in a variety of ways. Many of the new developments, for example, are located on or near water and therefore within high-risk hurricane or even tropical storm surge areas.

With over 500 sites, Hillsborough leads all other Florida counties in the total number of mobile home parks. According to the data provided by the Florida Department of Health, in summer 2007, Ruskin was home to a cluster of 39 registered mobile home parks that accommodated approximately 1,900 homes. Approximately 25% of all Ruskin residents (US Census 2000) live in mobile homes, either in parks or in single-sited homes. The total

number of mobile home residents, however, fluctuates greatly throughout the year due to the large numbers of "snowbirds" (northern residents who spend cold months in Florida) and "sunbirds" (Florida residents who go north during hot summer months) who reside in this area (Smith and House 2006). While Ruskin does have an above-average portion of Hispanic residents (approximately 33%), most mobile home parks, especially those in waterfront locations, are inhabited by white homeowners, the majority of whom are elderly.

3.2 Research strategy

A questionnaire survey was conducted with mobile home park residents between June and September 2007 by a team of faculty, graduate, and undergraduate students. Park owners and managers were contacted, and permission for the study was obtained prior to contacting any participants. A brief pilot study was undertaken to test questions and to assess the utility of the overall conceptual approach. Final questionnaires were administered inside or outside the homes of participants, and on a few occasions in other areas of the parks, such as at the clubhouse or by the swimming pool. Originally, a random sample of every third home was planned, but due to low summer occupancy rates, this strategy did not work and a mixed sample was implemented, consisting of all willing participants in some parks and a convenience (social network based) sample in others. Upon completion of the survey, all participating households received a $5 gift card to a local grocery store as a token of gratitude, as well as an American Red Cross brochure titled "Disaster Preparedness for Seniors by Seniors."

3.3 Research sites and interviews

Face to face interviews were conducted with members of 75 households residing in seven Ruskin mobile home parks that ranged in size from 32 to 159 homes (Table 1). We attempted to contact the managers and/or owners of all mobile home parks that appeared to be senior communities within the city limits of Ruskin and that were located within approximately a half mile from water. We included all communities to which we gained access within the available time frame. While conducting research, we discovered that one of our sites, Paradise Mobile Court, had recently begun to accept residents of all ages, including families. All other research sites were age-restricted or "senior" parks open to

Table 1 Research sites in Ruskin, Florida

Park name	Total homes	Occupied homes[a] (% of total homes)	Interviewed households (% of occupied homes)	Rejections (rate)
Paradise Mobile Court	114	71 (62.3)	24 (33.8)	8 (25.0)
Hawaiian Isles Mobile Home Estates	135	41 (30.3)	18 (43.9)	1 (5.2)
Neptune Mobile Village	159	68 (42.8)	16 (23.5)	32 (66.7)
Riverbreeze Estates	115	10 (8.7)	8 (80.0)	0 (–)
Riverside Mobile Home Park	51	7 (13.7)	4 (57.1)	3 (42.9)
Yost Adult Retirement Park	63	8 (12.7)	4 (50.0)	0 (–)
Harts Mobile Home Park	32	2 (6.3)	1 (50.0)	1 (50.0)

[a] The number of homes occupied during the summer was received from managers or estimated by researchers based on visual clues indicating occupancy

persons 55 years of age and older. Ruskin research sites were therefore selected based on three criteria: a large share of senior residents, proximity to water, and ease of access.

Despite some uncertainty regarding the exact number of occupied homes, we estimated that roughly 70% of mobile home residents in these parks are seasonal and do not reside there during the summer months. The participation rate of the estimated total summer population was 36%. The remaining 64% comprise rejections, people who could not be reached, and people who were not contacted due to the sampling procedures used in several parks. Overall, 60% of all attempted interviews were granted. It appears that variations in the rejection rate were due, in part, to differences in the appearance, age, and interaction style of individual interviewers. We noticed, for example, that female interviewers were less often rejected than males. By design, our sample is biased toward over-representing seniors. Due to our recruitment strategies, we likely over-represent residents who are active members of neighborhood social networks, yet it is very difficult to determine what influence, if any, this characteristic has on our findings. Overall, our sample consists of a representative share of adults and seniors who live year-round in waterfront Ruskin mobile home communities. The study population is indicative of a much larger number of Gulf Coast Floridians residing in mobile home parks.

3.4 Variables

The study population experiences high risk and vulnerability to natural hazards because of its coastal location, risk exposure, and intervening socio-economic factors. Consequently, four measures of vulnerability were incorporated into the study: physical environment, structure or dwelling, socio-economic, and residual. Physical vulnerability was examined through an assessment of the potential for hurricane landfall in the area. Structural or dwelling vulnerability was determined by age of homes, degree of physical reinforcement of homes, and existence of insurance coverage. Socio-economic vulnerability was assessed through a series of commonly utilized variables including age of respondent (by design), disability, gender, income, education, and pet ownership. The final measure, residual vulnerability, was determined through previous disaster experience without suffering losses, perceptions of one's physical risk and personal preparedness, and actual preparations taken to shelter in place. Lastly, an indication of evacuation readiness was established through questions focusing on residents' willingness to follow evacuation orders and their actual plans for evacuation.

4 Results: dimensions of vulnerability in Ruskin mobile home population

4.1 Physical vulnerability

Ruskin is located in a high-risk area. The landfall probabilities in Hillsborough County in any given year are approximately 40% for a tropical storm and 18% for a hurricane of any category (United States Landfalling Hurricane Probability Project 2008). The area has not officially experienced hurricane-force winds since 1921, yet there have been numerous near misses in recent years, particularly in 2004. Furthermore, Ruskin is one of the most vulnerable areas of Hillsborough County to storm-induced flooding (Allman 2006). The storm surge map indicates that parts of Ruskin, including one entire and two partial research sites, are subject to flooding during a tropical storm, while all research sites, as

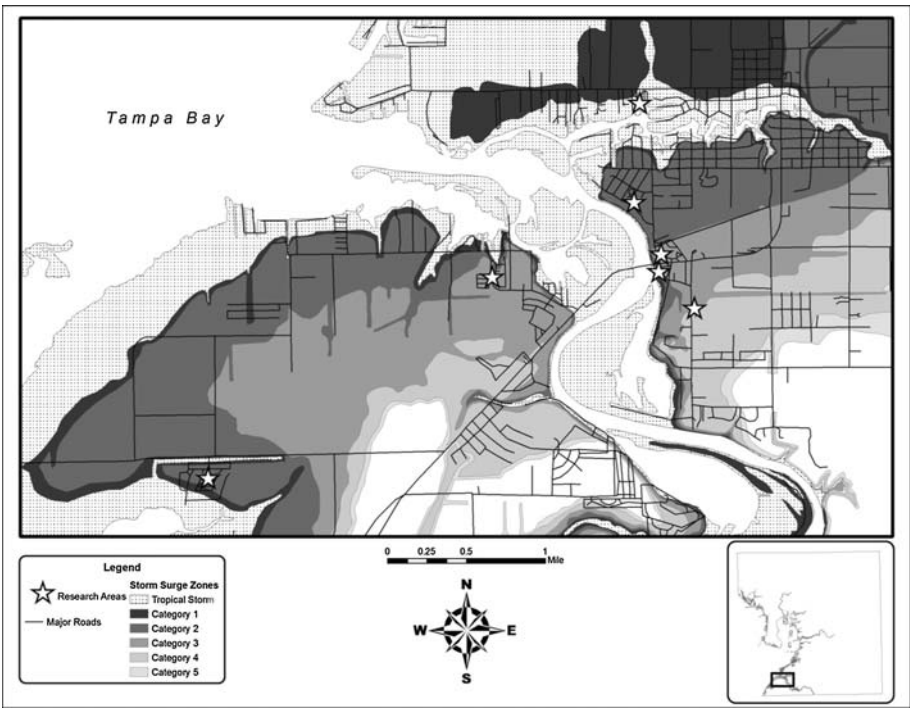

Fig. 1 Research sites and storm surge zones in Ruskin, Florida

well as much of Ruskin's downtown, are predicted to be completely inundated in a category two or higher hurricane (Fig. 1).[2]

New development has encroached on mangrove forests, wetlands, and upland hammocks that otherwise provide a natural barrier to storms. The pace of road improvement in and around Ruskin, however, does not match that of other development, which will further compromise hurricane evacuation. Indeed, transportation will likely be a major issue during any hazard requiring extensive evacuation. Based on the results of simulations in 2006 and 2007, a Senior Planner of Hillsborough County's Hazard Mitigation Program suggested in a personal conversation that, "we know that Ruskin is going to get wrecked, if [a hurricane] takes the right angle." Mobile home residents receive mandatory evacuation orders in the event of a category one hurricane or higher and are likely to receive a mandatory, or at least voluntary, evacuation order in the event of a tropical storm.

4.2 Structural vulnerability

Beyond the mere fact of living in a mobile home, the actual condition of dwellings inhabited by the target population is an additional source of vulnerability (Table 2). The vast majority, 90%, of homes inhabited by respondents were built before stricter safety codes were implemented for mobile homes in 1994 in the aftermath of Hurricane Andrew

[2] The research site markers on the map are placed at the center of the parks. Many parks fall into two or even three flood zones which creates additional disparate vulnerability within parks.

Table 2 Structural vulnerability

Variable	Indicator	Frequency	Percent
Age of homes	Built before 1994	64	90.1
	Built before 1976	40	42.3
Reinforcement	Do not have hurricane shutters	64	85.3
	Do not have hurricane windows	71	94.7
	Did not inspect tie downs	43	57.3
Insurance	No home insurance	45	60.0
	No wind insurance	55	73.3
	No flood insurance	66	88.0
	Do not have home inventory	55	73.3

(Simmons and Sutter 2008). More rigorous building codes appear to have been successful, with damages due to wind reduced somewhat in newer structures (Montz and Tobin 2005; Simmons and Sutter 2008). However, in the study parks, 42% were manufactured before any building safety codes were implemented for mobile homes in 1976. According to Reinhold (2008), an engineer, pre-1976 homes are like "raw eggs" and are virtually impossible to reinforce. Field observations revealed that many of the mobile home parks in Ruskin are in disrepair. Furthermore, the safety of homes also greatly depends on the physical condition of the surrounding built environment. Given that all homes of respondents were located in densely sited communities that included many older mobile homes, even new homes built to the latest codes cannot be considered safe due to the likelihood of wind-borne debris from disintegrating surrounding structures.

Only one in seven residents reported installing hurricane shutters and only one in 20 residents reported installing hurricane-proof windows. Moreover, more than half reported that they had not inspected the tie-down straps of their homes within the last year. Most concerning, however, is that 60% of respondents did not have any sort of home insurance (or did not know for sure whether or not they did). This high rate of non-insured homes may be explained by the fact that, following the active 2004 and 2005 hurricane seasons, insurance companies have been increasingly hesitant to cover mobile homes, resulting in either much higher premium rates for mobile home owners or a lack of availability of insurance altogether. Close to three quarters of our informants believed that they were not insured against wind damage and only one in eight residents, 12%, had some form of flood insurance, despite the fact that all homes are located in a storm surge zone. Roughly one in four respondents had made a home inventory listing their personal valuables and possessions, which is crucial for the claiming of compensations. Again, these are self reports; the actual incidence of noninsured households (and other variables) in the population might be even lower due to response bias.

4.3 Social and economic vulnerability

A series of commonly used variables was used to assess social and economic vulnerability among respondents, including age, disability, gender, household income, education, and pet ownership (Table 3). Over three quarters of respondents was over 50 years of age, and approximately one-third was over 70 at the time of the interview. The average age of the park population, 63 years, is 28 years higher than the average age of Ruskin residents in 2000. The sample included a higher percentage of women than men (59% vs. 41%), which likely reflects the higher number of women among seniors. Although this research did not

Table 3 Social and economic vulnerability

Variable	Indicator	Frequency	Percent
Age of respondent	Over 50 years	57	77.0
	Over 70 years	25	33.8
Gender	Female	44	58.7
Disability	Person with disability in household	28	37.3
Household income	Under $20,000 per year	29	40.3
	Under $10,000 per year	13	18.1
Education	Highest degree high school or less	53	70.7
Pets	Household with pet(s)	38	50.7
	Multiple pets	17	22.7

focus on differential vulnerability by gender, this point is important because women have been found to be more vulnerable to disasters in previous research (e.g., Always et al. 1998; Enarson and Scanlon 1999).

Approximately 45% of respondents reported that a person with a disability lived in their household. This is higher than the Ruskin average (28%) and over twice the U.S. average (roughly 20%). Many of these disabilities were severe and would require advance registration with a special needs shelter in case of a hurricane-related evacuation. In addition, observations during interviews suggest that the self-reported disabilities of participants might be on the low side.

With respect to economic conditions, results show that 40% of respondents had annual household incomes of less than $20,000 and 18% had income levels below $10,000; these households were at or below the official poverty threshold for households of all sizes. The most frequently reported income range was between $20,000 and $29,999 (28%), a range that includes the average income of Ruskin households ($28,200), but a figure that is much lower than the U.S. average household income of $42,000. Considering the increasing cost of living in the area, it is safe to say that two-fifths of the survey respondents live in dire economic circumstances, which places them in a high-risk category (e.g., Elliot and Pais 2006).

Similarly, the formal education achievement of respondents was low; 70% listed high school or less as the highest level achieved, which compares with 46% for the U.S. average education among people over 25 years of age. Lastly, the incidence of pet ownership in the study population was somewhat below to the U.S. national average, with over 50% of households in our sample having pets.[3] Dogs were the most common, followed by cats. Note, however, that almost half of all the pet owners, close to 23% of the total population, have multiple pets, which can seriously complicate hurricane evacuation and sheltering.

4.4 Residual vulnerability

Residual vulnerability, in the context of this study, comprised those additional factors, including disaster experiences, perceptions, and preparations, beyond physical and social structural conditions that might possibly increase (or decrease) disaster vulnerability

[3] According to the 2007/2008 APPA National Pet Owners Survey, 63% of U.S. households own a pet, which equates to 71.1 million homes. Thirty-four percent of US households have at least one cat, while 39% have at least one dog (APPA 2008).

Table 4 Residual vulnerability

Variable	Indicator	Frequency	Percent
Experience	Past hurricane	54	72.0
	Past evacuation	30	47.6
	Suffered hurricane losses	23	34.3
Perception of risk	Home not in surge/flood area, or don't know	26	34.7
	Does not know shelter in Ruskin	33	44.0
	Well, or very well, prepared for hurricane	53	70.7
	Not really, or not at all, concerned about hurricane	17	22.6
Preparations	Have stored water	49	65.3
	Have stored food	54	72.0

(Table 4). This concept was measured through hurricane experience without suffering losses; reported perceptions of physical risk, preparedness, and resources; and actual preparations made to "shelter in place" (as opposed to evacuating).

Seventy-two percent of study participants had previously experienced a hurricane, which indicates a high level of familiarity with this hazard and almost half, 48%, had evacuated during the last event. While one-third of respondents suffered losses, one in five suffered a severe loss such as losing the roof or entire home.

By design, all surveyed households were located in an evacuation zone, yet this basic fact was unknown to many informants. Nearly 35% of respondents were unaware that their homes were located in a flood or evacuation zone. Forty-four percent of respondents did not know whether or not a hurricane shelter existed in their town or where any shelter was located. Seventy percent reported that they were currently well, or very well, prepared for a hurricane, and nearly 23% were not really, or not all, concerned about a hurricane coming to their area during the 2007 storm season.

Despite the widespread lack of knowledge and improper risk evaluations, many interviewees had made some preparations in anticipation of a hurricane. Most common were preparations for sheltering in place, indicating that a large number of residents expected to stay at home during a hazardous event and were not planning to leave at the first sign of an impending hurricane or tropical storm. Almost three in four reportedly had stockpiled food and over 65% had stored water. Individuals had purchased generators and batteries, flashlights and radios, coolers and ice makers, sand bags and fire extinguishers, and had collected books, magazines, and crafts in case they were stuck in their homes for longer periods of time without electricity and other comforts.

5 Evacuation readiness and barriers in Ruskin mobile home population

We measured evacuation readiness through reported willingness to follow evacuation orders and through specific plans made for evacuation (Table 5). Eighty-three percent of respondents stated that they were conducive to following mandatory evacuation orders, and only 17% of respondents were opposed to such action. Reasons cited for not planning to evacuate include multiple pets and the determination to "tough it out," either entirely or up to a certain storm strength (such as a category three or four hurricane, or winds above

Table 5 Evacuation Readiness

Variable	Indicator	Frequency	Percent
Evacuation readiness	Will not evacuate, or do not know	13	17.3
Evacuation place	Uncertain or unsafe evacuation destination	19	25.3
Evacuation planning	Have not made any personal plans or preparations	24	32.0
	Have not made arrangements for pets (of all pet owners)	12	31.6

130 mph). Using personal judgment and waiting until the last minute to decide to evacuate can exacerbate difficulties with preparations and with the evacuation itself.

While reported evacuation potential is high among participants, the reality may be less reassuring especially when looking closely at the anticipated evacuation locations. In addition to the 17% who were not planning on leaving, 25% reported evacuation preparations that need to be classified as more or less volatile.[4] Aside from family, friends, shelters, churches, and work settings, which are considered realistic and reliable destinations for evacuation, approximately 25% of interviewees mentioned a range of highly uncertain and potentially unsafe places, such as hotels/motels, mobile home park clubhouse, car, campground, or "do not know yet." This means that over two in five respondents did not have reliable and safe plans for a possible evacuation, indicating the likelihood that hundreds of households in the larger Ruskin area living in highly vulnerable locations and homes likely will not be protected during a major event.

Furthermore, one in three respondents admitted that they had not made specific plans or preparations of any sort. This is roughly complementary with the 70% of respondents mentioned above who felt that they were very well or well prepared. Lastly, it was found that only two in three pet owners had made arrangements for their pets during a hurricane, indicating that about one in six respondents overall could be stranded in a hurricane due to their pets.

6 Discussion

This study provided satisfactory answers to our initial research questions: to what extent are mobile home park residents prepared for hurricanes? What prior arrangements have mobile home park residents made for evacuation? How do mobile home park residents perceive their own risk and vulnerabilities? However, as many studies do, it also raised a number of more specific questions regarding evacuation readiness in such a highly vulnerable population. The findings on physical vulnerability demonstrate quite clearly the high-risk potential for park residents in Ruskin. All the parks will be flooded in the event of a category two hurricane or larger that has any significant storm surge. In addition, wind damage to mobile homes is expected to be extensive in any storm event. When these findings are combined with structural conditions and socio-economic traits, the situation for Ruskin during the next strong storm is challenging. The vast majority of mobile homes were constructed before new building codes were enacted and hence are susceptible to severe damage, if not outright destruction, in high winds. The effectiveness of attempts to

[4] Schmidlin et al. (2009) discuss the "dubious" quality of evacuation destinations of mobile home residents following a tornado warning.

mitigate events by using shutters, window protection, and tie downs is questionable. These data are based on self reports by participants who may not have an accurate technical understanding of what "hurricane shutters," "hurricane proof windows" and "tie downs" really are; thus, the actual number of underprepared residents might be even more alarming than those reported here. The very low rate of insurance among homeowners for either wind damage or flooding was also a cause for serious concern.

In sum, the entire study population falls into two major vulnerability categories: location in a flood/evacuation zone and residency in an older mobile home. Indeed, the risk exposure of residents is exacerbated by the advanced age of their homes, the lack of physical reinforcement of homes, and the overwhelming absence of insurance coverage. Overall, therefore, it means that in the event of a hurricane, and maybe even in a tropical storm, the majority of respondents are likely to suffer serious damage or even the complete loss of their homes without the possibility of receiving compensation through insurance payments. Furthermore, if these data reflect characteristics of the larger Ruskin mobile home population, it means that potentially over 1,000 such households do not have insurance coverage and therefore would be acutely threatened in the event of a tropical storm, much less a stronger hurricane. Our research has shown that mobile home park residents are underprepared for storm threats and lack adequate evacuation planning. Further research needs to address the clearly nuanced reasons for differential evacuation behaviors among mobile home park residents. Perhaps disaster education needs to address the special risks of this and other vulnerable populations.

While evidence regarding the heightened vulnerability of all above-average age groups is inconclusive (Cutter et al. 2003), it is safe to assume that it does increase with age after a certain point, and that—on average—people in their seventies and eighties are less resilient because physically they are less capable of responding than people in their fifties and sixties. Therefore, the large elderly population living in mobile home parks in Ruskin would suggest that particular attention should be given to this population. Pets also complicate the picture. Hillsborough County has an extremely limited capacity in this regard with only two pet-friendly shelters, none of which is in or near Ruskin. Several individuals explicitly noted that they were not able to evacuate because of their many pets.

In sum, it appears that, overall, the target population experiences considerable social vulnerability. However, it is also important to emphasize that the research population possesses a number of social resources and strengths. For example, respondents generally have good access to transportation (car ownership per household is above 90%), have a higher than average degree of homeownership (88%), and have a small household size (the average household size is 1.72; only three participating households had more than two members).

In addition, participants are overwhelmingly white (over 97%); yet it should be stressed that it is unclear what role this might play in disaster preparation. Being of non-white ethnicity is frequently considered an added vulnerability in disaster studies (at least in the United States, e.g., Haney et al. 2007), but this is not always the case. In his Israeli study, Kirschenbaum (2004) found that neither ethnicity nor education play a significant role in disaster preparation. Further, many respondents seemed to participate actively in neighborhood social networks. The large number of retirees among our respondents suggests that they are not as acutely threatened by job loss as others in case of a disaster. Finally, the fact that many respondents receive social security and other state support means that they are already in the system, which might lessen complications and delays in receiving disaster assistance. However, due to the absence of any reliable composite index of social vulnerability and our inconclusive evidence, it is impossible to weigh objectively the

strengths and weaknesses. Overall, though, the above conclusion that our study population experiences increased, meaning higher than average, social vulnerability to disasters mainly due to their economic, educational, and pet-related disadvantages seems justified.

Assessing our results regarding residual vulnerability, the high rate of prior hurricane experience may also have conflicting outcomes when it comes to evacuation. Close to 40% of all respondents had experienced a hurricane without suffering harm, which could generate a false sense of security and subsequently have negative effects on future preparedness and evacuation planning. In addition, there was a poor perception of risk as measured by respondents' awareness of flood or evacuation zones. Arlikatty et al. (2006) for instance, suggest that previous hurricane experience actually decreases disaster resilience instead of increasing it. In their study, the generally low ability of people to locate their risk area correctly was even diminished by previous hurricane experience. Keep in mind that evacuation is mandatory (even though it is rarely enforced) for mobile home residents regardless of their exact evacuation zone in the event of any category hurricane, and that evacuation is often recommended in a tropical storm.

Another probable limiting factor in evacuation practices is the misperception regarding shelter awareness: 44% of respondents did not know whether a hurricane shelter existed in their town or where one was located. In fact, many of our respondents thanked us for letting them know that there is, indeed, a shelter that opens for higher intensity storms in their vicinity. Considering these findings, a heightened "false sense of security" is suggested by the fact that over 70% of participants reported that they were currently well, or very well, prepared for a hurricane, and almost one in four participants, 23%, were not really, or not all, concerned about a hurricane coming to their area at the beginning of the 2007 storm season. Residents might feel well or very well prepared, yet our study revealed findings that actually indicate the contrary.

Respondents' plans for storm mitigation were likely to limit overall effectiveness. Some of the items accumulated for survival and convenience at home were not suitable elsewhere and most were not easily transported. Those who suggested staying in place were also unprepared or misguided given the structural weakness of most dwellings. However, it is quite positive to see that less than one in five respondents, 17%, was opposed to, or uncertain about, following a mandatory evacuation order. Thus, the percentage of people who stated that they were willing to evacuate, 83%, is considerably higher than the percentage that is reported for general coastal populations (about two thirds, according to Blendon et al. 2008). This latter group, however, includes dwellers of traditional homes and apartments. It is possible, too, that social desirability bias (Dijkstra et al. 2001; Nederhof 1985), where respondents give answers perceived to be more favorable in order to present themselves in a better light, and which is one of the most common sources of bias in surveys, may have caused residents to respond that they were better prepared or more willing to evacuate than is actually the case. In sum, while the vast majority of respondents were not adverse to evacuating, upon closer investigation, a much smaller percentage had made realistic and safe preparations to leave their homes.

7 Conclusions

While the research produced clear results regarding the hurricane vulnerability and evacuation readiness among coastal mobile home residents, statistical analyses failed to establish significant causal relationships between these groups of variables. Of course, research was directed at one particular group, seniors in mobile home parks, to explore

their vulnerabilities, but this may have limited the variation in disaster preparedness decision making. Nevertheless, this interesting result, or rather lack of significance, can be understood in a variety of ways.

1. The possibility exists that evacuation readiness is not patterned according to the measured physical, social, and residual vulnerabilities yet must be explained by other variables, for instance psychological or entirely situational factors. However, given the socially constructed characteristics of most human behaviors, we consider this to be very unlikely.
2. A second possible—and more technical—explanation for the lack of statistical findings is the limited size of the sample. Specifically, the small cell sizes of the dependent variables measuring evacuation readiness did not accommodate more subtle statistical measures that might have produced valuable insights. Increasing the overall sample size is a simple way toward possibly producing more significant results.
3. Technical limitations may also harbor other lessons to improve future research. The survey contained mostly categorical and qualitative variables, which limited the range and detail of possible statistical tests. Future surveys should allow for the construction of more continuous, numerical measures that will be amenable to multivariate analyses (e.g., MANOVA, principle components analysis, and discriminant function analysis) that might be better suited to explain variations within and among groups.
4. The lack of statistical findings could indicate that the existing scholarly understanding of vulnerabilities and evacuation behaviors is limited and insufficiently conceptualized when applied to populations that are already highly vulnerable. In other words, we might not have considered the kinds of independent measures and variables, and not asked the types of questions, effectively to isolate those factors that function as barriers to evacuation readiness and behaviors which are crucial for the targeted population. The remedy is to build critically on existing successes and to refine research questions and measures as precisely as possible in the future.

Irrespective of its analytic outcomes, the descriptive results of our study clearly underscore the need for specific preparedness planning and education among mobile-home residents. Given the high vulnerabilities of mobile-home residents, and especially those within this group who are elderly, disabled, poor, and so forth, the first response of such people should be to evacuate to a safe location every time a hurricane, or even a tropical storm, threatens to hit. Yet, our results show that this ideal outcome is far from happening.

Aside from a few leaflets explaining and assisting with building reinforcement, neither FEMA nor the American Red Cross currently offer brochures that realistically and specifically address the physical, social, and residual vulnerabilities of mobile home residents who are exposed to hurricanes in the southeastern United States. Likewise, local governments and agencies lack specific plans to deal with the onslaught of mobile home residents in need of assistance before, during, and after extreme weather events. Many areas and regions are at a complete loss of staging an adequate response to a major hurricane, as the—comparatively speaking—limited and benign tropical events of the 2004 and 2005 season occurring on United States territory managed to reveal.

As a result of this lack of readily available information and assistance, many especially vulnerable residents rely upon information that targets the broader public and therefore primarily addresses the needs of more common types of residents, such as owners of suburban site-built homes. Common sense admonitions to buy or to assemble a "hurricane readiness" kit, for example, are largely superfluous for mobile home residents given that they should always evacuate. In fact, the constant repetition of such messages might

produce a false sense of security and an increased desire to "shelter in place" which is likely to be a dangerous response. That is, policymakers must be made aware that in many cases, county-wide evacuation plans or other preparations may not meet the needs of many residents, and especially not of those who are most vulnerable.

Aside from very few exceptions, mobile home park owners and managers fail to assist residents in times of need. While many senior mobile home communities develop vibrant social networks among residents that offer positive resources in times of disaster (Kusenbach and Taylor 2009), other parks suffer from a high degree of disorganization and internal segregation that is caused or exacerbated by predatory policies, negligent owners, and stigmatizing public stereotypes of "trailer" living. Lastly, mobile home residents themselves are, at least partially, to blame for their lack of knowledge and care regarding personal risks and vulnerabilities. Whether intentional or not, many mobile home residents exhibit a lack of responsibility for their own protection and for the safety of others (including pets) in their households. Overall, then, a need is present for better education and improved planning at all levels of accountability, from the individual mobile home resident, to the private sector, to local, state, and federal agencies who work to ensure the safety of citizens (Chen et al. 2006; Lindell and Prater 2007). We believe that scholarly research can and should provide valuable direction and insight to better fill this need.

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