ORIGINAL RESEARCH

Does Preparedness Matter? The Influence of Household Preparedness on Disaster Outcomes During Superstorm Sandy

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ABSTRACT

Objectives: This study empirically examines preparedness with a kit, medication, and a disaster plan on disaster outcomes including perceived recovery, property damage, and use of medical or mental health services.

Methods: Using a cross-sectional, retrospective study design, 1114 households in New York City were interviewed 21-34 months following Super Storm Sandy. Bivariate associations were examined and logistic regression models fit to predict the odds of disaster outcomes given the level of preparedness.

Results: Respondents with an evacuation plan were more likely to report not being recovered (odds ratio [OR] = 2.4; 95% confidence interval [CI]: 1.5-3.8), property damage (OR =1.4; 95% CI: 1.1-1.9), and use of medical services (OR = 2.3; 95% CI: 1.1-4.5). Respondents reporting a supply of prescription medication were more likely to report using mental health (OR = 3.5; 95% CI: 1.2-9.8) and medical services (OR = 2.3; 95% CI: 1.1-4.8)

Conclusions: Having a kit, plan, and medication did not reduce risk of adverse outcomes in Superstorm Sandy in this sample. Disaster managers should consider the lack of evidence for preparedness when making public education and resource allocation decisions. Additional research is needed to identify preparedness measures that lead to better outcomes for more efficient and effective response and recovery.

Key Words: emergency preparedness, Super Storm Sandy, disasters, health services

Disaster preparedness is defined as the act of "enhancing the ability of social units to respond when a disaster occurs."[1] For households, this means being ready to take protective action when a disaster is imminent or being able to obtain or mobilize the necessary resources to respond to and recover from a disaster.[1] How preparedness is measured at the household level varies greatly. There is no definition of preparedness widely accepted among researchers or practitioners.[2] There are several inventories and checklists, and scholars have replicated the use of some preparedness measures, but there is no standardized validated tool widely used in research studies.[1,2] A literature review published in 2012 found that 8 of 36 preparedness studies conducted between 1993 and 2010 developed new instruments to measure preparedness and the remaining studies replicated scales or tools from past research without providing information on development of the measure.[2] Agencies and organizations, including the American Red Cross (ARC) and the Federal Emergency Management Agency (FEMA), recommend that households have a basic set of preparedness supplies, a plan, and a supply of prescription medication. Messages are disseminated to households through commercials, pamphlets, billboards, and online.[3,4]

Despite preparedness campaign efforts in the United States by FEMA and the ARC, research shows that most people are not prepared for a disaster.[5-7] However, when evaluating socioeconomic, demographic, and health variables, differences exist among these studies regarding who is more or less likely to be prepared.[8-12] Americans also tend to overstate their preparedness.[7,11] The American Preparedness Project 2015 report on the perceptions of the American public and preparedness of American households found that 50% of households report being prepared with a kit and plan. However, when households were asked for specific information about the kit contents and plans, only 35% of households reported adequate preparedness. Household preparedness has increased since 2003 (23% prepared) by 12%. When asked about confidence in the government to respond to a disaster, 40% of Americans report they are not confident. Furthermore, 51% of Americans report that they believe a first responder will arrive within an hour of a disaster to provide assistance.[7]

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Disaster researchers have identified many predictors of preparedness, including prior disaster experience,[1,13-15] age,[15] income,[1,15] internal locus of control, perceived threat, current distress,[15] school age children in the household, being female, and integration in community life.[1] Researchers have found that certain groups are more likely to be prepared with supplies, including African Americans, Latinos, households with children, households with members born outside of the United States,[16] and households with past disaster experience.[17,18] Certain groups have also been found to be more likely to prepare with a plan, including those who are married or partnered, living in the Western United States,[7] with past disaster experience,[7,17] and with past evacuation experience.[17]

Researchers have documented that preparedness plan and supply recommendations are not based on empirical evidence. Uscher-Pines and colleagues argued in a 2012 article discussing the assumptions underlying household disaster preparedness in the United States that "the role individual Americans are being asked to play (in household preparedness) is largely based on conventional wisdom." They provide evidence that preparedness messages are based on unverified assumptions and the content of recommended kits is largely based on expert panel guidance rather than empirical evidence.[8] Furthermore, research on whether having a disaster kit results in a reduced need for aid, better health outcomes, less property damage, or increased disaster resilience is lacking.[2,19] Additionally, there has been little research on preparedness and few to no replication of the studies on preparedness that have been conducted. This gap in research limits the ability to generalize findings.[1,2] Furthermore, research has focused primarily on planning and buying behavior rather than what was used or perceived as useful for individuals coping with disaster.[8]

This study aims to contribute to an empirical evidence base for preparedness by examining the relationship between disaster preparedness, having a kit and a plan, and disaster outcomes including property damage, medical or mental health impacts, and perceived recovery in a sample of households impacted by Super Storm Sandy in New York City (NYC) from October 22 to 29, 2012.[20] We hypothesize that simply having a set of supplies is not associated with better disaster outcomes but that having a plan, due to the process involved in developing a plan, is associated with better outcomes.

METHODS

Sample

A total of 2086 households in NYC's 5 boroughs were randomly sampled and contacted by phone (75% landline and 25% cell phone) to complete an interviewer administered computer assisted telephone interview (CATI).[21] Interviewers received 10 hours of training, and each phone number in the sample received 10 call attempts at varied times of day and days of the week. Landlines in flood inundation zones were oversampled using FEMA flooding maps. A response rate of 5.6% was computed following the standard American Association for Public Opinion Research (AAPOR) methodology.[22] Phone survey research has experienced declining response rates due to a number of factors, such as changing norms in phone use from making calls to text and Internet based communication, increased phone solicitation and the use of caller identification.[23,24] In 2017, Gallup reported an average response rate of 7%, down from 28% in 1997.[24] Studies of response rates and bias consistently show that low response rates are not a reliable indicator of bias.[24,25] Expected sample proportions were calculated using the US Census Factfinder tool for 2014.[26] Consistent with recent studies of disaster recovery,[27] females and those with higher education were overrepresented in the sample. Those identifying as white were overrepresented but, curiously, so too were those identifying as American Indian/Alaska Native and Hawaiian/Pacific Islander, although the absolute numbers for these latter groups were small. Expected and observed values for those identifying as African American were nearly identical (Table 1).

Respondents who reported during study screening that they lived in NYC during Super Storm Sandy (October 22-29, 2012) were interviewed 21-34 months after the storm about disaster preparedness, warning and evacuation, impacts, and physical and mental health.[20] The interview was administered in English and Spanish. The study survey was developed as part of a larger research center effort to measure and understand community resilience.[28] The survey specifically aimed to measure household or individual level constructs that aligned with a community level model of resilience. This model was developed based on 18 domains of community functioning.[29] Where validated measures of concepts exist, they were utilized. Pilot testing of the survey was completed prior to CATI programming, and then the CATI survey was piloted before training interviewers. The measures utilized in the present analysis are elaborated on in the measures section to follow. Study protocols were reviewed and approved by the Institutional Review Boards at the University of Delaware and NYC Department of Health and Mental Hygiene. Complete data were obtained from 1114 households on preparedness and disaster impacts and are included in this analysis.

Measures

Disaster outcomes assessed include housing and property damage, use of medical or mental health services, and perceived recovery. Preparedness exposure measures include disaster supplies (food, water, flashlight, radio), a plan, and a supply of prescription medication, which is taken from the Behavioral Risk Factor Surveillance System (BRFSS) general preparedness module and measures a standard set of supplies commonly recommended by FEMA and the ARC.[3,4]

Housing and property damage was assessed by asking respondents to indicate with a yes (1) or no (0) response to the

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TABLE 1

Sandy Sample and NYC Population Demographic Characteristics

		Sandy Sample (%)	US NYC Census (2014%)	
Gender	Male	43	47.6	
	Female	57	52.4	
Race	White	50.2	43.6	
	African American	24.6	24.7	
	Asian	5.1	13.2	
	American Indian and Alaska Native	0.9	0.4	
	Native Hawaiian and other Pacific	0.5	0	
	Two or more races	2.9	3.2	
	Other	15.8	14.7	
Education	Elementary school only	1.7	10.3	
	Some high school, didn't finish	5	9.6	
	Completed high school	17.3	24.4	
	Some college but didn't finish	13.3	14.4	
	2 year college degree A.A./A.S.	9	6.3	
	4 year college degree B.A./B.S	26.2	20.7	
	Graduate or professional degree	27.5	14.3	
Income	Less than $20,000	12.4	10.3	Less than $10,000
	$20 to $35,999	10	6.2	$10 to $14,999
	$36 to $45,999	6.2	10.6	$15 to $24,999
	$46 to $60,999	9	9	$25 to $34,999
	$61 to $75,999	7.3	11.6	$35 to $49,999
	$76 to $100,999	11	15.5	$50 to $74,999
	$101 to $150,999	9.9	11	$75 to $99,999
	$151 to $250,000	6.1	12.6	$100 to $149,999
	More than $250,000	3.7	5.7	$150 to $199,999
			7.4	$200 or more
Income (recoded)	$0 to $35,999	29.5	36.1	
	$36 to $75,999	29.8	27.1	
	$76,000 to $150,999	27.6	23.6	
	$151,000 - > more than $250,000	13	13.1	
Housing Tenure	Owner-occupied	43.9	31.9	
	Renter-occupied	56.1	68.1	
Age	Under 5 years		6.5	
	5 to 9		5.7	
	10 to 14		5.6	
	15 to 19	1.7	6	
	20 to 24	6.9	7.7	
	25 to 29	6.5	9.1	
	30 to 34	7.6	8.3	
	35 to 39	8.6	7.1	
	40 to 44	6.8	6.9	
	45 to 49	8.6	6.7	
	50 to 54	8.9	6.6	
	55 to 59	10.6	6	
	60 to 64	11.5	5.3	
	65 to 69	8.8	3.9	
	70 to 74	5.3	2.9	
	75 to 79	3.1	2.2	
	80 to 84	2	1.7	
	85 and over	2.9	1.8	

question, "Did Sandy affect your house or property in any way?". We selected this question to capture the range of housing and property damage impacts reported by respondents including damage to foundation (9.3; $n = 59$), roof (36.4%; $n = 111$), plumbing (25.3%; $n = 77$), electrical (51.8%; $n = 158$), personal property (30.8%; $n = 94$), porch, patio, or balcony (26.9%; $n = 82$), vehicle (19.3%; $n = 59$), or home was unlivable (20.5%; $n = 63$). Physical health impacts of Sandy were

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assessed by asking respondents, "Did you or any member of your household require medical treatment for Hurricane Sandy related injuries?". Mental health impacts of Sandy were assessed by asking respondents, "Did you or any member of your household get counseling because of feelings caused by Hurricane Sandy?". Mental and physical health impacts were dichotomously coded 1 (yes) or 0 (no). Perceived recovery was assessed by asking respondents, "In general terms, how much has your household recovered from Sandy?". Respondents indicated completely, almost, somewhat, or not at all recovered. Respondents that indicated completely or almost recovered were categorized as "recovered" and respondents that indicated somewhat or not at all were categorized as "not recovered".

Preparedness was assessed by asking respondents if they made an evacuation plan before Sandy, had 3 days of drinking water per person, a supply of nonperishable foods, a flashlight and batteries, a battery-operated radio, and an extra supply of prescription medication. A summary measure of preparedness supplies was computed. Respondents with food, water, a flashlight, and radio were categorized as prepared with supplies. Respondents with less than all 4 supplies were categorized as unprepared with supplies. An evacuation plan (yes, no) and supply of prescription medication (yes, no) were examined as separate exposures as not everyone requires prescription medication and creating a plan is the only preparedness measure taken for the explicit purpose of disaster preparedness and it requires multiple household members to participate in its development.

Demographic variables examined in this analysis include income (< $20,000, $20-35,999, $36-45,000, $46-60,000, $61-75,999, $76-100,999, $101-150,999, $151-250,999, >$250 K), education (elementary school only, some high school, completed high school, some college, associate's degree, bachelor's degree, some graduate work, master's or professional degree, Advanced graduate work or PhD, other/do not know/refused), sex (male, female, do not know/refused), and race (White, African American, Asian, American Indian/Alaska Native, Native Hawaiian/Pacific Islander, multiple races, do not know/refused). Due to small counts of respondents in the latter race categories, race was recoded as White, African American, and other race.

Data Analysis

A chi-square analysis was performed to examine the bivariate association between individual characteristics, preparedness, and disaster outcomes. A logistic regression model was fit to examine the likelihood of positive disaster outcomes given reported preparedness with a kit, plan, and medication. The models were adjusted for individual characteristics including sex, race, income, and education level where those factors were independently associated with the outcome. Change in the coefficient of the logistic regression model was examined and adjusted odds ratios (AOR) and 95% confidence intervals (CI) are reported. Statistical analyses were conducted in Stata 13.[30] A power analysis indicates that we need a sample of 223 respondents that are prepared and 446 respondents that are not prepared to observe a medium effect size. In the present analysis, 510 respondents have all 4 preparedness supplies and 604 respondents do not have the full range of supplies.[31]

RESULTS

The mean age of respondents was 50 years old, and over half of the sample reported female sex (57%; $n = 635$). More than half of respondents were college graduates with a bachelor's degree or higher education (52.4%; $n = 584$) and nearly half reported white race (48%; $n = 534$) and a quarter reported African American race (24.7%; $n = 275$). Approximately 40% of the sample reported greater than $60,000 income (41.5%; $n = 462$) (Table 2).

The initial examination of Super Storm Sandy outcomes indicated that over a quarter of the sample of 1114 respondents had their housing or property affected by the storm (27.4%; $n = 305$) and few respondents reported accessing mental health (3.1%; $n = 35$) or medical services (1.6%; $n = 18$). Less than 10% (8.2%; $n = 91$) of the sample reported not being recovered 2 years after Sandy. Respondents reported a high level of preparedness with disaster supplies before Sandy, including food (84.5%; $n = 941$), water (74.7%; $n = 832$), and a flashlight (93.6%; $n = 1043$). More than half the sample also reported having a battery powered radio (62.1%; $n = 692$). However, less than half of the sample reported having all 4 preparedness supplies (45.8%; $n = 510$). Many fewer respondents reported having an evacuation plan (25.3%; $n = 282$) or an extra supply of medication (43.3%; $n = 482$) (Table 2).

We fit 4 models, 1 for each disaster outcome: perceived recovery, housing and property damage, use of medical services, and use of mental health services. First, we examined the outcome perceived recovery. Over 90% of the sample reported being almost or completely recovered, and 8.2% ($n = 91$) reported being somewhat or not at all recovered (Table 2). When examining for demographic differences, age ($\chi^2 = 12.8$; $P < 0.05$), income ($\chi^2 = 19.4$; $P < 0.05$), education ($\chi^2 = 28.2$; $P < 0.01$), and race ($\chi^2 = 38.0$; $P < 0.001$) were each independently associated with perceived recovery (Table 3). A bivariate analysis of differences in perceived recovery by our outcome preparedness measures showed that having an evacuation plan ($\chi^2 = 20.5$; $P < 0.001$) was statistically significant (Table 3). There was no statistically significant relationship between perceived recovery and having preparedness supplies or having a supply of prescription medication. A logistic model including statistically significant demographic characteristics and preparedness measures demonstrates that those respondents having an evacuation plan (AOR = 2.4; 95% CI: 1.5-3.8) and being African

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TABLE 2

Sample Characteristics (n = 1114)

Demographics	Frequency	Percent
Education		
Elementary school only	18	1.6
Some high school	55	4.9
Completed high school	185	16.6
Some college	138	12.4
Associates degree	94	8.4
Bachelor's degree	280	25.1
Some graduate work	27	2.4
Masters or professional degree	224	20.1
Advanced graduate work or PhD	53	4.8
Other, don't know, refused	40	3.6
Race/ethnicity		
White	534	47.9
African American/Black	275	24.7
Asian	54	4.9
American Indian and Alaska Native	10	0.9
Native Hawaiian/Pacific Islander	7	0.6
Identifies as two or more race/ethnicities	31	2.8
Other, don't know, refused	203	18.2
Sex		
Male	477	42.8
Female	635	57.0
Don't know, refused	2	0.2
Income		
< $20,000	141	12.7
$20-35,999	123	11.0
$36-45,999	70	6.3
$46-60,999	106	9.5
$61-75,999	87	7.8
$76-100,999	132	11.9
$101-150,999	120	10.8
$151-250,999	76	6.8
Over $250,000	47	4.2
Don't know, refused	212	13.5
Preparedness		
Supply of non-perishable food	941	84.5
3 days of drinking water per person	832	74.7
Battery powered radio	692	62.1
Flashlight	1043	93.6
All four preparedness supplies	510	45.8
Evacuation plan	282	25.3
Extra supply of prescription medication	482	43.3
Disaster outcomes		
Housing/property impacted	305	27.4
Used mental health services	35	3.1
Used medical services	18	1.6
Perceived not recovered	91	8.2

American (AOR = 2.9; 95% CI: 1.6-5.1) are more likely to report poor recovery outcomes ($P < 0.001$; Table 4).

Next, we examined the disaster outcome of housing or property damage. Nearly 30% of respondents ($n = 305$; 27.4%) reported housing or property damage (Table 2). Bivariate analysis of differences in the demographic characteristics for households reporting property damage and those who did not report property damage, showed age ($\chi^2 = 9.7$; $P < 0.05$) was statistically significant. When examining differences in preparedness by reported property damage, having an evacuation plan was statistically significant ($\chi^2 = 6.0$; $P < 0.05$; Table 3). Statistically significant characteristics were examined in a logistic regression model. Households that reported having an evacuation plan were 1.4 times more likely to report property damage (AOR = 1.4; 95% CI: 1.0-1.9; $P < 0.05$; Table 4).

The third model examines mental health service use; about 3% of the sample (3.1%; $n = 35$) reported utilizing mental health services following Sandy. NY State BRFSS 2012-2013 reports that 10.1% of adults in NYC report poor mental health 14 days or more in the past month.[32] When examining the bivariate associations between mental health services after Sandy by demographic characteristics of the sample and preparedness, age ($\chi^2 = 11.3$; $P < 0.05$), having a supply of medication ($\chi^2 = 7.4$; $P < 0.01$), and an evacuation plan ($\chi^2 = 8.0$; $P < 0.01$) were independently associated with use of mental health services after Sandy (Table 3). Households reporting having a supply of medication were 2.3 times more likely (AOR = 2.3; 95% CI: 1.1-4.8) to report using mental health services. Households reported having an evacuation plan before Sandy were greater than 2 times more likely (AOR = 2.3; 95% CI: 1.1-4.5) to report using mental health services after Sandy (Table 4).

Finally, only 18 respondents in the sample (1.6%; Table 2) reported utilization of medical services following Super Storm Sandy. There was no statistically significant difference in use of medical services after Sandy observed for any of the demographic characteristics within this sample. Bivariate examination of preparedness measures demonstrates that having a supply of medication is associated with use of medical services after Sandy ($\chi^2 = 6.3$; $P < 0.05$; Table 3). Households reporting having a supply of medication were almost 3.5 times more likely to report needing medical services following Sandy than households without a supply of medication (AOR = 3.5; 95% CI: 1.2-9.8; Table 4).

DISCUSSION

Overall, roughly half of study respondents ($n = 1114$) reported preparedness with all 4 supplies (45.8%), having a battery powered radio (62.1%), and a supply of medication (43.3%). Far fewer respondents reported an evacuation plan (25.3%). When examining preparedness as a predictor of negative disaster outcomes, we observed that an evacuation plan played the most significant role. Having an evacuation plan was a risk factor for poor perceived recovery as well as for housing and property damage and using medical services following Sandy. Having a supply of medication was a risk factor for using mental health and medical services. We also observed that greater income ($101-150,000) and greater education

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TABLE 3

Bivariate Associations Between Sample Preparedness and Demographic Characteristics and Disaster Outcomes

	Perceived not recovered n (%)	House or property affected n (%)	Used mental health services n (%)	Used medical services n (%)
Evacuation plan	41 (15.2)***	93 (33.0)*	16 (5.7)**	6 (2.1)^
Meds	43 (9.4)	143 (29.7)	23 (4.8)**	13 (2.7)*
Water supply	62 (7.7)	222 (26.7)	30 (3.6)	12 (1.4)^
Food supply	71 (7.9)	253 (26.9)	29 (3.1)	14 (1.5)^
Radio	61 (9.2)	202 (29.2)	23 (3.3)^*	15 (2.2)
Flashlight	86 (8.6)	291 (27.9)	29 (2.8)	18 (1.7)^
Summary measure of preparedness supplies	42 (8.6)	144 (28.2)	29 (3.5)	8 (1.6)

*$P < 0.05$;
** $P < 0.01$;
*** $P < 0.001$.
^ Fisher's exact test.

TABLE 4

Odds of a Negative Disaster Outcome [OR (95% CI)]

	Perceived not recovered***	House or property affected*	Used mental health services*	Used medical services**
MODEL 1				
Evacuation plan	2.4 (1.5-3.8)			
Medication supply				
Income	1.0 (1.0-1.0)			
Age	0.9 (0.7-1.1)			
Race (White)				
African American/Black	2.9 (1.6-5.1)			
Other	1.6 (0.8-2.9)			
Education (< HS)				
High school graduate	0.5 (0.2-1.1)			
Some college	0.3 (0.1-0.7)			
College graduate	0.3 (0.1-0.5)			
Graduate studies	0.4 (0.2-0.8)			
other	0.3 (0.1-1.2)			
MODEL 2				
Evacuation plan		1.4 (1.1-1.9)		
Age		1.0 (0.9-1.1)		
MODEL 3				
Medication supply			3.5 (1.2-9.8)	
MODEL 4				
Evacuation plan				2.3 (1.1-4.5)
Medication supply				2.3 (1.1-4.8)
Age				1.0 (0.4-1.4)

*$P < 0.05$;
** $P < 0.01$;
*** $P < 0.001$.

(some college or college graduate) were protective against poor recovery while African American race was a risk factor.

Certain findings are perhaps counterintuitive, or at least not what policy-makers and disaster planners desire. For example, respondents with a plan experienced more severe effects. Obviously, this does not tell us that a plan is meaningless, but it is possible that people who planned saw themselves (correctly) as more vulnerable to hazard effects. Similarly, having medicine on hand signals awareness of a medical condition that would point to the need for postdisaster services.

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The findings point to some impediments to preparedness, but also indicate some significant challenges to public officials and others who are interested in people's abilities to protect their safety. First, many aspects of people's lives intervene in their capacity to take protective measures, including limited access to transportation or financial resources. Second, targeting these dimensions is often the role of different agencies and increasingly in networked systems of service delivery. And third, it may well be that aspects of education and awareness must be ratcheted to prominence. A key finding was the lack of association of preparedness supplies with any disaster outcome. One important point is that our findings, of course, are biased toward those who survived. A look at the causes and distribution of fatalities suggests possible different emphases on aspects of preparedness, which are described next.

According to the Centers for Disease Control and Prevention,[33] and a detailed discussion in the New York Times[34] that looked at the NYC region, most fatalities in Super Storm Sandy were from drowning (some 38%). Falling trees accounted for another 19%, and falls (often down stairs in the dark) 11%. Carbon monoxide poisoning, vehicular accidents, assorted injuries, fire, hypothermia, medical com plications or failure of electric-powered medical appliances, electrocutions, and 1 unidentified cause were the remainder of causes of death. For this reason, it may be that emphasis should be not on having equipment, but on more conceptual tasks such as interpreting hazard information and relating it to the local environment: proximity to water, trees, and power lines. Evacuating would have spared all of the drowning victims, and perhaps several of the others, such as those who died from carbon monoxide poisoning, hypothermia, and fires. A flashlight may have spared those who died in falls. It is difficult to assess the deaths from trees, because several of those were well inland. Two of the drownings occurred when they failed to evacuate, reportedly for fear of looting.[35]

Potential interventions remain perplexing because no messaging or risk communication has been found to be consistently effective across all places. Of course, our data are drawn from an advanced urban area in an event that did not destroy the bulk of the city and surroundings. In such a situation, other kinds of preparedness might be needed. Similarly, the roster of dangers might be different in rural areas, where isolation may increase some burdens. And of course, preparedness and disaster-related sensemaking[36] will look entirely different in places with intersecting chronic hazards or conflict.

Preparedness should be seen as a contextual activity that comprises the natural, technical, and social system. Just as hazard is generated from the interplay of those systems,[37] the various phases of disaster management must reflect these relationships. Comprehensive preparedness from the household perspective might thus be conceptualized as an awareness of social systems (eg, network of help), technical systems (eg, condition of, or hazards threatening, a house or apartment), and natural systems (eg, prevalence of local hazards, such as trees or street flooding, which also connects with the surrounding technical systems of urban infrastructure). For the most part, household preparedness at this level appears to be rare or nonexistent.

Preparedness cannot be converted to a roster of supplies, but has to be a part of the ways of knowing, converted into the folkways of a place, whether the place is less developed or rural, suburban, or urban. While some observers have noted that urbanization has detached people from an awareness of ecological systems,[38] that detachment has not been compensated by an awareness of the engineered systems in towns and cities, or by the complexities of transitional systems such as the wildland-urban interface.

It is beyond the scope of this study to outline the necessary programs that would need to be in place, but a period of education and activism leading to social change, along the lines of those seen in earlier years with regard to environmental conservation, forest fires, and household fire would appear to be warranted. These had several things in common, such as an emotional dramatic arc (eg, Smokey the Bear,[39] *Silent Spring*[40]) paired with actual things that could be done, such as proper care with fire, control of pesticides, smoke detectors, and household fire planning. A larger feature of awareness must therefore be environmental awareness, part of the local knowledge and sensemaking. This larger conceptual preparedness will require a period of education and social change, perhaps akin to the shift in environmental values that began in the 1960s with the "ecology" movement. There, stewardship of resources and care for environmental amenities became virtues, yielding actual change. Preparedness, too, must be a virtue, not a list. Achieving such social change remains a large and difficult task.

Future research focused on building an evidence base for preparedness can examine the role of a supply kit and plan on more immediate disaster experience such as the utilization of response services, including shelters or use of emergency services. Additional analyses of this sample are planned to examine if supplies beyond food, water, a flashlight, and radio were used and what supplies respondents wish they had when reflecting back on their disaster experience. This analysis will take an important step toward understanding what supplies might be useful for hurricane preparedness. Examining the utility of preparedness with a kit and plan in other hazard contexts would also enhance our understanding of preparedness.

Examining the utility of preparedness in disaster events is an important first step in working toward evidence-based disaster preparedness. Just as important as these empirical studies is developing a more comprehensive theory-driven model of household preparedness that builds on the wealth of disaster scholarship on social, technical, and natural systems.

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This study has some limitations to note when considering study findings. The present study is a retrospective, observational, analytic, cross-sectional study. Data collection on this sample was designed to examine disaster resilience. Taking into account research participant time and the range of issues asked about in the survey, only a limited number of questions focused on preparedness. Using a broad survey of disaster resilience, while limiting the depth on any 1 issue, provides an opportunity to examine preparedness on a variety of outcomes and to continue to explore preparedness in a wide range of areas as new lines of inquiry develop. Much of social science research utilizes survey data collection as this is an effective and efficient method for collecting data on a range of topics for descriptive and explanatory studies. Survey research, however, carries limitations, including the challenge of obtaining sufficient and nonbiased response rates, recall bias, and interviewer bias.[41] Study protocols were developed based on the Dillman protocol to reduce bias, including a re-contact protocol of 10 calls to cell phones and land-lines, detailed interviewer training, and the use of a CATI system to ensure reliability and validity of the data collected.[42]

CONCLUSIONS

Agency and organizational efforts focus on disseminating messages about preparedness kits annually, including FEMA, the ARC, and the American Public Health Association.[3,4,43,44] In the absence of evidence linking a kit and a plan to improved disaster outcomes, preparedness efforts and public health funding and energy may be better-spent encouraging households in completing a household level vulnerability assessment and then providing the support to prepare appropriately for the risks present. This might include national messages calling on households to self-assess and directing residents to local risk information sources. At the local level, trusted risk communicators (or messengers) need to raise awareness about local hazards and specific preparedness measures relevant to the context.

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