Rapid Assessment of the Needs and Health Status in Santa Rosa and Escambia Counties, Florida, after Hurricane Ivan, September 2004

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Background: Hurricane Ivan, a Category 3 storm, devastated the Florida panhandle on September 16, 2004, causing extensive property damage and 24 deaths. The Florida Department of Health requested assistance from the Centers for Disease Control and Prevention to conduct a rapid assessment in Santa Rosa and Escambia counties to determine the health impact of the hurricane and needs of the affected population.

Methods: A questionnaire was administered 6 days after the hurricane made landfall. The survey instrument elicited information about house damage, illness/injury, and access to utilities. A modified cluster sampling method was used to select 30 clusters in each county. Seven households were interviewed in each cluster and reported weighted frequencies.

Results: Three quarters of houses in each county were damaged. Households in Santa Rosa and Escambia lacked basic utilities, including regular garbage pick-up, telephone service, and electricity. Fifty-four percent of households in Santa Rosa and 27% in Escambia reported using a generator. The most commonly self-reported health conditions were sleep disturbances in Santa Rosa (54%) and upper respiratory problems in Escambia (46%). Injuries were reported in fewer than 15% of households in each county.

Conclusion: Rapid restoration of power, telephone services, and debris pick-up remained a priority 1 week after the event. Findings demonstrated the need for (1) mental health and primary care services, (2) information about safe generator use, and (3) ways to access medical care and medications.

Hurricanes are one of the more common natural disasters and the seventh most common cause of weather-attributed deaths in the United States.[1] Hurricanes rated a category 3 or greater (on the Saffir-Simpson scale of 1 to 5) strike the United States or its territories approximately once every 1.5 years.[2] In May 2004, the U.S. National Hurricane Center predicted a 50% probability of an above-normal hurricane season.[3] In Florida during the fall of 2004, 4 hurricanes (i.e., Charley, Frances, Ivan, and

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Jeanne) made landfall during the period of August 13 to September 24. Combined, the 4 hurricanes in Florida resulted in approximately 110 deaths and $15 billion in damages and displaced nearly 7 million people.[4] Hurricane Ivan, a category 3 hurricane, was the third hurricane to make landfall in Florida and devastated Santa Rosa and Escambia counties in the northwestern Florida panhandle. On September 16, Ivan struck Florida, bearing sustained winds of 130 mph, resulting in a 10- to 15-foot storm surge, causing 24 deaths, displacing half a million people, and leaving behind billions of dollars in property damage.[5,6] The magnitude and extent of property damage and destruction caused by Ivan in Florida state are estimated to have exceeded that caused by both hurricanes Frederic (September 1979) and Opal (October 1995).[5]

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The main purpose of this survey was to assess the needs and health status of the most affected community in a post-hurricane state and to provide timely and reliable information that the Florida Department of Health could use to help response efforts and aid planning for future disasters. To accomplish these goals, we conducted a rapid needs assessment (RNA) survey in Santa Rosa and Escambia counties using a modified cluster sampling method to evaluate the public health impact of Hurricane Ivan. Cluster sampling methodology has been applied previously for RNAs after natural disasters and can be used to provide population-based estimates of the number of people who have specific needs after a disaster.[7–10]

Methods

Sample Selection

On the basis of information on hardly affected areas obtained from Florida Department of Health and local emergency response teams, Santa Rosa and Escambia counties were identified as the areas most heavily damaged by Hurricane Ivan. The storm produced high numbers of displaced people.

A probability proportional to size sampling methodology modified from the World Health Organization's Expanded Program on Immunization was used to obtain a sample of 30 clusters in each county.[11,12]

A map of the selected cluster and replacement clusters were given to the interview teams to use as guides while conducting the surveys (Figure 1). Spanish-speaking interviewers were placed on teams assigned to clusters with a large Hispanic population.

Survey Instrument

A questionnaire was developed jointly with the Florida Department of Health. Questions included in the survey were selected or modified from templates developed by the Centers for Disease Control and Prevention (CDC) and used in previous rapid need assessments.[13–17] The survey questionnaire solicited information about demographic factors, type of housing structure, extent and type of damage to the structure, access to basic utilities, access to health services, health status, and immediate needs. Referral forms were created for immediate needs pertaining to safety threats, such as live electrical wires, chemical spills, and urgent medical issues. The goal of the survey was to complete 7 households per cluster for a total of 420 household interviews in both counties.

Data Collection

The survey instruments were administered over a 3-day period, 6 days after Hurricane Ivan made landfall in Florida, starting September 21 and completing on September 24. The survey teams included staff members from Florida Disaster Community Health Assessment Teams and volunteer nursing students from Florida State and Florida A&M universities. Thirteen survey teams with 2 or 3 interviewers each were trained on September 20 and 21, 2004. The training focused on selecting households, administering

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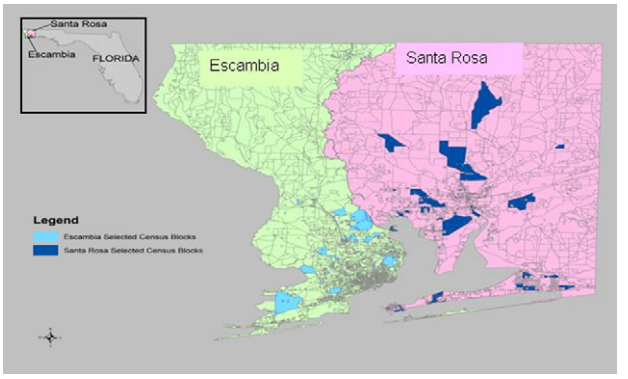

Figure 1: Map of Santa Rosa and Escambia Counties. Selected clusters for surveys, darkly shaded for Santa Rosa and lightly shaded for Escambia.

interviews, and reporting safety concerns. The teams also were briefed on safety issues for themselves, such as field communication and available logistical support during the process.

The teams began the surveys in the central area of their assigned cluster, moved in a random direction along roadways to identify the first individual housing unit, and continued to the next nearest housing unit until 7 interviews were completed within each cluster. If the team identified any immediate needs pertaining to safety threats and urgent medical issues, the interviewing team completed confidential referral forms that were faxed to the Santa Rosa Health Department and personally delivered to the Escambia County Health Department each evening.

In addition to referrals, the survey teams distributed important printed fact sheets on specific health issues, including infant feeding, dehydration, safe generator use, toll-free information numbers for general needs, prescription and health care information, and location of feeding/supply stations. The teams were instructed to keep track of nonrespondents and the reasons why interviews could not be completed.

Data Analysis

Survey findings were analyzed by using SAS 9.0 (SAS Institute, Cary, North Carolina) and SUDAAN (Product of Research Triangle Institute, North Carolina) in the analysis to account for the survey's complex sampling design and to obtain variance estimates.[18,19] Two replacement clusters were included in Santa Rosa County. The weighted frequency and number of households projected as needing specific assistance were reported.

Findings

Survey teams visited 352 houses in Santa Rosa County and 241 houses in Escambia County and obtained information from 210 households in each county, with response rates of 60% and 87%, respectively. In Santa Rosa, 2 replacement clusters (14 households) were included in the analyses because of inaccessibility of the primary selected clusters. A total of 173 households—142 from Santa Rosa and 31 from Escambia—did not respond. The main reasons for nonresponse were: no one at home (n = 165), refusals (n = 5), safety threat (n = 2), and language barrier (n = 1). The most commonly reported "greatest needs" in both counties were garbage pick-up and restoration of electricity. Other "greatest needs" reported in the survey included access to medical care, medications, home repair, and ice.

Health Care Needs

Eight percent of surveyed households in Santa Rosa and 10% in Escambia reported at least 1 person younger than 2 years. In addition, 27% of the households in Santa Rosa and 29% in Escambia reported at least 1 adult 60 years or older. Six percent of the households in Santa Rosa and in 4% in Escambia reported that a pregnant woman lived in the household.

Table 1 provides a comparison of self-reported health conditions identified in Santa Rosa and Escambia counties. In Santa Rosa County, 12% of the households self-reported that at least 1 person had sustained injuries since the hurricane, and 17% of the households reported that a member had been ill. Common findings in both counties were post-hurricane sleep disturbances, respiratory illness, gastrointestinal illness, and skin conditions or rashes.

During the investigation, 12 households were referred to the appropriate county health department for immediate needs pertaining to a safety threat or urgent medical situation. The referrals included need

Table 1. Health conditions reported 1 week after Hurricane Ivan, Santa Rosa and Escambia counties

	Santa Rosa County*				Escambia County*			
Health status	Households (%)	(95% CI†)	No. of households projected‡	(95% CI†)	Households (%)	(95% CI†)	No. of households projected‡	(95% CI)
With injuries since hurricane	12	(7–18)	6053	(3184–8922)	14	(7–21)	17772	(9014–26531)
With illnesses since hurricane	17	(10–25) (1–13)	8520	(4898–12141)	18	(10–26) (0–6)	22778	(12673–32883) (0–7743)
Sleep disturbance	7	(0–11)	8760	(1653–15867)	3	(3–17)	3756	(4231–21344)
Respiratory illness	6	(2–8)	7170	(732–13607)	10	(1–6)	12779	(1119–8023)
Gastroenteritis	5	(0–3)	6062	(2231–9892)	4	(0–6)	4571	(0–7743)
Skin rash	1		1230	(0–3642)	3		3756	
Problems obtaining medical care	11	(5–18)	5491	(2350–8631)	4	(0–10)	5538	(0–11787)
Problems obtaining medication	10	(5–16)	5129	(2228–8029)	9	(3–16)	11388	(3211–19565)

*N = 210.
†Confidence interval.
‡Estimates based on 2000 U.S. Census.

for immediate medical attention, medications, and assistance with cleanup of hazardous conditions.

Housing Types and Problems Reported

The study found that more than two thirds of households were single-family site-constructed homes in Santa Rosa and Escambia (72% and 84%, respectively) (Table 2). Twenty-four percent of the houses in Santa Rosa and 9% in Escambia were mobile homes. Five percent in Santa Rosa and 7% in Escambia were multiple-family dwellings (e.g., apartments or condominiums). At the time of the interview, three fourths of the houses in each county were damaged by the hurricane, and a small percentage of damaged homes in Santa Rosa and Escambia were uninhabitable.

In both counties, households reported wind, flood, and fallen trees as the main causes of damage to their homes and property (Table 3). The number of projected households damaged by flood and fallen trees was relatively higher in Escambia County than in Santa Rosa County.

Households in Santa Rosa County reported a number of basic disruptions (see Table 3) that included the lack of basic utilities (e.g., electricity, telephone), no regular garbage pick-up, and lack of access to fuel for vehicles or generators. Approximately half of the households with electricity in Santa Rosa and 27% in Escambia used a gasoline-powered generator. Although generators in most surveyed households in both counties were placed outdoors during use, generators in 10% of households in Escambia reportedly were used indoors or in a garage.

More than 80% of households in both counties used bottled water as their source of drinking water. This meant that a few households (<15%) were using public water systems for drinking.

Field Observations

Presence of Pests

An increase in yellow jacket wasps were observed in many neighborhoods in Escambia County. The standing water appeared to have forced the insects from ground nests. Thus, families needed information about how to trap the yellow jackets and, in some cases, were forced to keep children and pets indoors with no power and sometimes no screens on windows. This meant great discomfort because of high humidity and heat index. Potential health implications included insect stings, allergic response, and heat-related illness or injury.

Other threats included unleashed dogs that had the potential to develop packs and cause dog bite injuries.

Helping Residents to Reconnect with Community

Anecdotal reports indicated that personal interaction during the interviews gave some survey respondents a sense of reconnection to the outside. They had no radio, television, phone, or other means of receiving information and thus had felt isolated. Occupants of households contacted during the survey were cooperative (97% for Santa Rosa and 99% for Escambia), shared their concerns, and were grateful for state and federal public health response following the disaster. They also were happy to receive printed information.

Table 2. Structure type, extent, and cause of households' damage by Hurricane Ivan, Santa Rosa and Escambia counties, Florida, September 2004

	Santa Rosa County*				Escambia County*			
Variable	Households (%)	(95% CI†)	No. of households projected‡	(95% CI†)	Households (%)	(95% CI†)	No. of households projected‡	(95% CI†)
Structure type								
Mobile home	24	(19–29)	11719	(9069–14368)	9	(6–12)	10670	(7008–14332)
Single-family house	72	(65–78)	35164	(31815–38514)	84	(79–89)	104619	(98782–110455)
2–5 Family unit	5	(0–9)	2236	(138–4334)	7	(4–11)	9097	(4521–13673)
≥ 6 Family unit	–	–	–	–	0	(0–1)	262	(0–775)
Damage to home								
None or minimal	20	(13–26)	9675	(6518–12833)	30	(21–39)	37632	(26177–49088)
Damaged, but habitable	72	(65–79)	35331	(31670–38993)	65	(55–75)	80834	(68242–93425)
Damaged, uninhabitable, repairable	6	(2–11)	3079	(922–5235)	1	(0–3)	1748	(0–3575)
Damaged, uninhabitable, destroyed	2	(1–4)	1033	(316–1751)	4	(0–9)	4434	(0–10639)
Cause of damage								
Wind	97	92–100	47835	(45575–50095)	91	83–99	113613	(104122–123105)
Flood	63	51–75	31011	(25180–36842)	30	17–43	37620	(21510–53729)
Tree	55	42.5–69	27113	(20388–33839)	62	50–74	77434	(62397–92472)

*N = 210.
†Confidence interval.
‡Estimates based on 2000 U.S. Census.

Table 3. Service disruption and immediate household needs in Santa Rosa and Escambia counties after Hurricane Ivan, Florida, 2004

	Santa Rosa County*				Escambia County*			
Household utilities	Households (%)	(95% CI†)	No. of households projected‡	(95% CI†)	Households (%)	(95% CI†)	No. of households projected	(95% CI)
No running water	3	(0–6)	1511	(0–3098)	1	(0–1)	633	(0–1737)
No electricity	34	(27–42)	16832	(13018–20645)	27	(20–35)	33885	(24663–43108)
No indoor toilet	2	(0–5)	1214	(3–2425)	4	(0–9)	4998	(0–10784)
No functioning telephone	13	(7–19)	6327	(3198–9456)	16	(10–22)	20123	(12571–27675)
No regular garbage pick-up	41	(32–50)	20196	(15929–24463)	21	(14–28)	26505	(17881–35129)
No access to transportation	1	(0–3)	715	(0–1439)	3	(1–6)	3992	(572–7413)
No access to fuel	11	(5–17)	5562	(2655–8468)	13	(6–20)	16204	(7580–24828)
No money for immediate needs	12	(7–19)	6124	(3182–9066)	12	(5–19)	14818	(6397–23239)
Food and water								
Using well water	0	(0–1)	229	(0–679)	0	–	–	–
Using public water	15	(9–20)	7128	(4213–10043)	9	(5–14)	11785	(5954–17617)
Using bottled water	85	(79–91)	41762	(38847–44677)	91	(86–95)	112862	(107030–118693)
No access to 3-day food supply	5	(1–9)	2581	(658–4503)	6	(1–11)	7510	(1261–13759)

*N = 210.
†Confidence interval.
‡Estimates based on 2000 U.S. Census.

Discussion

Hurricanes affect public health by damaging public utilities such as water, power, transportation, and communication. Furthermore, an increase in the number of deaths, people suffering mental health problems, injuries or illnesses, and damage to infrastructure such as hospitals and pharmacies create imbalances in routine health service delivery.[20] Nine days after Hurricane Ivan made landfall, a survey was used to identify some of the public health problems experienced by residents in Santa Rosa and Escambia counties.

Residents Stayed in Damaged Households

A large number of homes in both counties had sustained damage but were still occupied. Despite recovery efforts that started on September 17, basic public utilities had not been restored to many residents by the time of the survey, approximately 1 week after the storm.

Despite early public health messages about safe generator use, 10% of the Escambia population using generators continued to position generators in dangerous locations.

The major need was for electricity to be restored and garbage pick-up. Because many occupied houses lacked basic utilities, this could result in substantial cause for acute illnesses as a result of improper food storage and poor environmental hygiene. In addition, ongoing power outages contributed to use of portable generators, with subsequent risk for electrocution and exposure to carbon monoxide poisoning. Despite early public health messages about safe generator use, 10% of the Escambia population using generators continued to position generators in dangerous locations.

Health-related Issues

Reported illnesses and injuries were not unusual after this hurricane. Sleep disturbance, respiratory problems, and injuries were major health concerns for the community and are consistent with previous reports of hurricane-related morbidity.[10,21] Even though the number of referrals was small, concerns for injury, acute illness, or chronic diseases were exacerbated during the recovery period.

There was a high percentage (10% in Santa Rosa and 9% in Escambia) of households that reported problems with obtaining medication. These data can be used indirectly to indicate the percentage of the households with chronic illness in these particular communities. The limited access to routine medication for chronic illness was attributed to a lack of money, fuel, and transportation. Planners need to give special consideration to the needs of chronically ill people in a post-hurricane environment and give attention to the functional capacity of hospitals and pharmacies to deliver basic health services, such as prescription refilling, in areas affected by a hurricane. The relief assistance also should be directed to address the needs of sensitive and vulnerable groups such as the elderly,

young, and pregnant women. Following the hurricane the needs of the affected population may vary from basic necessities such as food and shelter to special needs because of age or illnesses.

An assessment method that is based on predisaster population estimates give representative results following hurricanes. These techniques give accurate information for emergency management officers and public health experts who face the task of prioritizing services and directing recourses to the affected communities.

Limitations

Sampling Problems

If an originally selected cluster was inaccessible to the survey team, they were instructed to use replacement clusters. Because of road blocks, the surveyors were unable to reach and therefore describe households in primary selected clusters. Those households may have been more adversely affected by the hurricane, and by not including them, the survey probably underrepresents the effect and extent of damage caused by the hurricane.

The times selected for sampling may have affected results. If residents were staying elsewhere and only returned for short periods, the survey teams may have missed them and consequently the data may overrepresent the more seriously affected households.

Inter-rater Reliability

There may have been a lack of consistency on data collection between interviewing teams. Not all teams were available for ongoing education regarding survey methodology during the interview periods. Feedback was provided to some of the teams throughout the survey period, but not all teams were available to receive this information. This lack of consistency on data collection may affect our findings and limit the ability to do further detail analysis on some variables, such as injury.

Strengths

Despite limitations, RNAs provide a valid method to determine the immediate needs of a community after an acute event. This method has been used in many difficult disaster situations[10,13,22] and provides population-based estimates within a relatively short time frame.

The ability to integrate survey sampling methods with activities being done by the existing local community assessment teams was useful in building collaboration (e.g., training on RNA method) with local community workers and the state health department. It was especially helpful to have available a sufficient number of interviewers who were health professionals, because this allowed completion of the survey in a relatively short time. Additionally, urgent medical conditions and safety threats were identified during the survey and referred to corresponding authorities.

Data from the report was useful for multiple needs. The information was used to focus public education efforts regarding safe use of generators. Data were provided to state and local health officials to assist in decision making about deploying resources to areas affected by the hurricane.

Conclusion and Recommendations

Hurricane Ivan destroyed services that are essential to maintain the health status of community residents. A survey conducted approximately 1 week after the storm demonstrated that restoration of power and telephone and debris pick-up remained a priority. Regional planners need to identify how best to restore public utilities in the first days after a hurricane. Planners may want to evaluate which community resources are essential to a great number of residents, such as gas stations, grocery stores, or pharmacies.

The findings of this study demonstrated the need for public health education. Early distribution of information and public education about the need to develop family disaster plans before the event help to minimize the health impact of hurricanes.

After the event, individuals may be affected by stress-related problems, such as sleep disturbances, or need information about safe use of generators and ways to access medical care and medications. Postevent education will be hampered by disruptions to normal operations of radio, television, and newspapers. Alternative methods may be needed, such as holding community forums or posting information at gas and ice stations. When radio and television transmission does resume, the public can be instructed to follow daily broadcasts at specific times on specific radio frequencies. The state should consider the value of mobile clinics and conditioning of temporary shelters in future hurricane-response plans.

The RNA tools used during this survey provided information about community health status and potential health threats within 9 days after the hurricane. These findings were useful for county and state public health officers and emergency managers for immediate needs assistance.

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Key Points Table

Public safety, first responders

1. Expect to find residents staying in damaged households.
2. Lack of public utilities will affect ability to obtain and safely store medications, safely store food, and maintain personal hygiene.
3. Unsafe use of home generators increases the risk of carbon monoxide toxicity.

Emergency and primary care providers

1. Health-related concerns reported after Hurricane Ivan included sleep disturbances, respiratory illness, gastrointestinal illness, and skin conditions or rashes.
2. Victims may present with illness or injuries resulting from environmental hazards, such as insect stings or dog bites.

Public health authorities

1. Consider pre-event staging of resources to help return community's infrastructure.
2. Maintain educational campaigns regarding postdisaster needs, such as safe use of generators, sources of safe water, living without power or regular news reports, managing garbage until services can be restored.