

Quick Response Report #101 REPEAT RESPONSE TO HURRICANE EVACUATION ORDERS

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[Return to Hazards Center Home Page](#)

[Return to Quick Response Paper Index](#)

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REPEAT RESPONSE TO HURRICANE EVACUATION

ORDERS

Introduction

Hurricane Hugo (1989) remains a vivid memory in the minds of residents of South Carolina. When a hurricane threatens the East Coast of the U.S., comparisons with Hugo are inevitable. Not mentioned by name are the hurricanes that appeared to threaten the seaboard, perhaps prompting protective action, but making landfall elsewhere. In the 1996 hurricane season, two of these hurricane events, Bertha and Fran, prompted evacuation orders to be issued along the North and South Carolina coasts. In both instances, the edge of the hurricane nicked the northern coast of South Carolina - each making landfall just over the border in North Carolina.

These two events offer a unique opportunity to study the impact of repeated "false alarms" - evacuations ordered based on expectations of hurricane landfall that ultimately proved to be wrong. The influence and credibility of forecasters and local officials, important factors in the evacuation response, could be affected by this recent history of repeated "misses," "near-misses," and "hits." The impact of false alarms on future evacuations is a widespread source of speculation and concern in the emergency management community, but very little research has directly studied the implications of these unnecessary evacuations (Baker, 1991). Using these two hurricane events as case studies, this study employed short, face-to-face surveys to examine three specific questions:

- 1 Were there differences in evacuation responses of residents for hurricanes Bertha and Fran?
- 2 Was there an action or specific piece of information that convinced people to evacuate and did this vary between the two hurricane events?
- 3 What was the major source of "reliable" information influencing the decisions to evacuate and did this differ in the two hurricane events?

Survey Methodology

Three communities were selected to assess the behavior of residents in order to identify a range of experiences during the initial threat from hurricanes Bertha and Fran. All are distributed along coastal Carolina (from south to north). The communities include Hilton Head and Myrtle Beach, South Carolina, and Wilmington, North Carolina. Although the entire South Carolina coast was evacuated for each hurricane, the actual risk was for the northern part of the coastline in Horry County (Myrtle Beach region). Wilmington experienced the impacts of both hurricanes. The surveys involved face-to-face interviews with respondents at the entry to major stores (grocery and discount) in each community. This design was selected in order to focus on the residential populations of these heavily touristed communities. The survey included both open-ended and closed questions and required from five to ten minutes to administer. Less than two weeks after Hurricane Fran, survey teams were in the field in South Carolina (September 13-15, 1996). Because of the extent of damage, we were unable to get into the Wilmington area for interviewing until two weeks after that (September 28). We used a screening question to target residents and those who were in the area for both hurricanes. This approach yielded a total of 526 responses for a total response rate of 75%, which included 323 completed surveys - a completed survey response rate of 45%.

Table 1: Survey Responses

Wilmington	TOTAL	Hilton Head	Myrtle Beach Area
		SC	SC
NC			
Survey Date	9/13 - 9/14/96	9/14 - 9/15/96	
9/28/96	9/13-9/28/96		
Total Surveys			

Not in area	32	177
4 213		
Completed	128	143
52 323		
Refusals	79	76
24 179		
Total Contacts	238	396
80 714		
Response Rate (%)	67.2	80.8
70.0 74.9		
Complete Survey		
Response Rate (%)	53.7	36.1
65.0 45.2		

1996 Hurricane Season in the Carolinas

Hurricane Bertha made landfall at Wrightsville Beach, NC as a Category 1 hurricane on July 12, 1996 at 4:45 p.m. with hurricane force winds of 105 mph (FEMA 1996). Tropical force winds extended 230 miles outward from the center. Damage in North Carolina included power outages, downed trees and power lines. There was considerable beach erosion in Carolina and Wrightsville beaches and some structural damage to property in Kure Beach and Surf City. In South Carolina, damage was minimal. Evacuation orders were issued by the governor of South Carolina and by counties' boards of commissioners in North Carolina. On July 18, 1996, a federal disaster declaration was issued for seven North Carolina counties based on storm, wind, and flood damage associated with Bertha (Lawrence, 1996).

On September 5, 1996, Hurricane Fran made landfall over Cape Fear just south of Wilmington, NC as a weak Category 3 storm (Mayfield, 1997). Fran's maximum sustained winds were 115 mph with a reported storm surge of 12-15 feet. Tropical force winds extended 290 miles seaward of the storm's center and up to 100 miles inland. The primary damage was in North Carolina with wind and storm surge damage ranging from Corncrake Inlet in the south to New River inlet in the

north. The hardest hit barrier island communities included Carolina Beach, Wrightsville Beach, Topsail Beach, and North Topsail Beach. Inland, flooding from the already swollen rivers and saturated ground was extensive throughout the state.

In South Carolina, damage from Hurricane Fran was limited to downed trees, some flooding in low-lying areas, power outages, and some roof damage. A federal disaster declaration was issued on September 6 for North Carolina and Virginia. The federal disaster declaration for the four northeastern-most counties in South Carolina followed on September 30.

Survey Results

The tally of responses to the entire survey are provided in [Appendix 1](#). For this report, we will focus on our three primary research questions.

Differences in Evacuation Responses

For Hurricane Bertha, 37% of our respondents evacuated and this percentage increased to 55% for Hurricane Fran (Question 2). There were considerable differences between the three communities. The highest evacuation rates (both events) were in Hilton Head, the community furthest from landfall, while the lowest rates were in Wilmington, the area that sustained the greatest impact of the two storms (Table 2). This can be partially explained by the island location of Hilton Head (compared to the mainland locations of Wilmington and Myrtle Beach). Moreover, there is only one evacuation route from Hilton Head to the mainland.

Table 2: Evacuation Rates

Location	# Evacuated prior to Total Interviews	# Evacuated prior to Bertha (% of	# Evacuated prior to Fran (% of
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	community sample)	community sample)
Hilton Head, SC 128	64 (50%)	83 (65%)
Myrtle Beach, SC 143	48 (34%)	76 (53%)
Wilmington, NC 52	6 (12%)	17 (33%)
Total 323	118 (37%)	176 (55%)

Despite the difference in the storms, there was considerable consistency in individuals' choices. Of the 323 respondents, 43% did not evacuate for either hurricane, 34% evacuated for both, and 21% left in Fran but not in Bertha. The remaining 3% (9 individuals) left for Bertha, but remained for Fran. There were no differences in evacuation behavior attributable to the sociodemographic characteristics of respondents. Further, 75% of the respondents had previously experienced a hurricane (Question 23).

For the majority of residents, the timing of the evacuation advisories were just about right - not too early nor too late (Question 16). However, nearly 20% of respondents felt the evacuation orders for Bertha were premature while 15% believed that to be the case for Fran. Again there was considerable difference between the three communities with 35% and 18% of the Hilton Head residents suggesting that the evacuation orders came too early for Bertha and Fran respectively. In Myrtle Beach and Wilmington, only between 4 and 13% of the respondents felt that the warnings were issued too early.

Triggering Event Or Information

We asked respondents in an open-ended format what convinced them to leave the areas for each storm (Question 7). The first response was coded as a 1, the second a 2, and so forth. Unlike previous evacuation studies, we found no dominant response; rather, residents gave multiple reasons for their decisions to evacuate (Table 3). In Hurricane Bertha,

for example the advice from the media (the Weather Channel, local media, NWS) and the Governor's evacuation order were the most frequent responses. These were also listed in the same order for Fran, but the severity of the storm and the probability of a "hit" were also significant prompts in the resident's risk calculation.

Table 3: What Convinced You to Leave the Area? (first reason given)

First Reason Given		Bertha	Fran	
Bertha	Fran	% of those	% of those	% of
total	% of total	who	who	% of
survey	survey	evacuated	evacuated	
population	population	(n=118)	(n=176)	
(n=323)	(n=323)			
Governor's order/advice		24.6	22.2	
8.9	12.0			
Local officials/local				
emergency responders		11.0	5.7	
4.0	3.1			
Weather Channel/ National				
Weather Service/local news		25.4	25.0	
9.3	13.6			
actions/advice from friends				
or family		6.7	7.9	
2.5	4.3			
Severity of storm/probability				
of "hit"		9.3	16.5	
3.4	9.0			
Other		24.6	23.9	
9.0	13.0			
Did not evacuate		NA	NA	
62.8	44.9			

What is interesting to note as well is the decline in the reliance on government officials from Bertha to Fran. This is partially explained by the frustrations of the Hilton Head residents over traffic jams and other difficulties with emergency operations encountered during the Bertha evacuation two months earlier. In fact, 47% of respondents reported problems in trying to leave the area for Bertha and more than half of the evacuees reported likewise for Fran (53%) (Question 6). Yet, the majority of residents felt the warnings and evacuation process was handled extremely well (32% in Bertha, 49.4% in Fran) (Question 14). Reasons for non-evacuation centered on the perception of safety of the housing unit and/or location relative to the danger (Table 4). Non-evacuees also mentioned the probability of landfall and information from the Weather Channel as reasons given for staying.

Table 4: Major Reasons Given for Non-Evacuation

Reason (%)	# Respondents
	n=182
Severity of storm/probability of a "hit"	37 (30)
Weather Channel	15 (8)
Perception of safety of home/location	43 (24)
Job requirements	12 (7)
Other (contains no category greater than 4%)	61 (34)

Information Reliability

As noted earlier, the primary prompts for the evacuation decision were governor's orders and media reports of the approaching storms.

However, when asked about the reliability of the information they received, very few of our respondents evaluated the governor's orders as the most reliable (Table 5). There was no change in perceived reliability of the governor's orders between the two storms. The most reliable source of information was the media (25% for Bertha, 31% for Fran) followed by specific references to The Weather Channel (7% for Bertha and 11% for Fran). Although respondents may have heard the governor's orders in the media broadcasts, that was only a portion of the information they received from that source. There were no significant differences among our three sites.

Table 5: Reliable Sources of Information

	Bertha % responses n=323	Fran % responses n=323
Governor's order	2.8	2.8
Media - TOTAL	39.4	52.5
<i>Media subtotals</i>		
Media - general	25.2	31.3
Media - local	3.4	5.0
Media - Weather Channel	6.8	10.9
Media - radio	4.0	5.3
Actions of friends/neighbors	0.9	1.6
Personal experience	1.2	1.6
Other	1.2	1.9
Not Applicable	54.3	39.7

For those who evacuated for Fran and not Bertha (67 respondents), the most reliable sources of information mirrored the overall results. In descending importance these were the media 42%, the Weather Channel (18%), the radio (13%), local media (6%), and the actions of

family/friends and personal experience (13%). Media sources were more widely used in this group of evacuees.

The broader response of listening to the media, coupled with specific references over and over again to the Weather Channel suggests a greater independence in evacuation decision making. The Weather Channel became an independent source of information and confirmation of the storm's direction and severity. Several respondents also reported logging onto the Internet to get information; however, local emergency managers reported receiving phone calls asking for assistance in interpreting the statistics that residents found on the web.

The seeming difference between reliable sources of information and factors that convinced people to evacuate are important. Our respondents found media (of all kinds) an important source of information for hurricane characteristics, although in many cases it was orders from the governor and other considerations that convinced them to leave.

If Another Hurricane Approached

The impact of unnecessary evacuations on the way information was considered in decision making was also investigated by asking, "If another hurricane approached the coast, would you evacuate? and why?" While hypothetical questions can pose difficulties, in the context of this discussion asking how people would make that decision in the future was based in reflection on recent past decisions. While a past situation does not account for all of the factors that may play a role in the future, this grounding in experience makes the question more accessible. The majority of respondents (47%) gave a qualified answer - evacuation would depend on certain factors. Another 31% responded with an unqualified "yes" and 22% with an unqualified "no." Most respondents' answers to this hypothetical question were consistent with their responses to hurricanes Bertha and Fran. These consistencies are also reflected in significant differences among communities in residents' predicted future evacuation behavior.

Of the 98 people who said simply "yes," the clear majority, 55%, explained their concerns over personal and family safety in general

terms such as "I'm afraid," "better safe than sorry," or "be crazy not to [evacuate]." Others gave specific reasons, including past experience with hurricanes, living in a mobile home, and living near the water. The experience of "false alarms" did not seem to sway their perception of the risk. For 73% of this group, the plan to evacuate was consistent with their past evacuations for both Bertha and Fran.

Among the 70 who responded "no" were the few respondents (n=7 or 2% of the total population) who indicated that they would not evacuate because the last few forecast hurricanes did not hit. Comments included, "Government leaders cried wolf too often" and "the last few didn't hit." The largest group, however, were those who believed their home was a safe place or at least safer than anywhere else (n=24 or about 7% of the total population). These respondents explained that their homes were sturdy, located on hills, or that they felt safer in their brick homes than out on the road. The second largest group were those whose job required that they stay (n=9 or about 3% of the total population). Most other responses, such as concern about being able to return to home, were shared by only a few individuals. The majority of these respondents (80%) did not evacuate for either Bertha or Fran.

The indirect effects of these "unnecessary evacuations" might be expected to be more apparent in the responses of the group (n=152 or 47% of the total population) that replied their actions would "depend" on the situation. The deciding factors that respondents gave in response to this question differed substantially from the factors that "convinced them to evacuate" for Bertha and Fran. While the actions of public officials are often reported as the most influential factors determining evacuation rates, these responses coupled with the reliance on the news sources including the National Weather Service, the Weather Channel, and the Internet for information on the hurricane suggest that individuals are relying on a variety of information sources to make personal risk evaluations.

The largest group within this subset, 16%, replied that their evacuation depended on the severity of the storm, but gave no indication of magnitude. Twelve percent responded that they would evacuate for storms classified as Category 4+. Others responded it would depend on a

variety of storm conditions, such as path, probability of a hit, and potential for flooding. In total, the number of respondents planning to rely on evaluation of storm characteristics totaled 73%. In reporting the factors determining their willingness to evacuate, 10% of the group answered that their evacuation would depend on an order from the governor.

Within the total survey group, the advice of public officials, which convinced approximately 13% of respondents to leave for Fran, is accorded only a minor role in future decision making. While 4.6% of the total population would listen for the governor's order, there is no mention of actions by other officials (either in this group or among the "yes" respondents discussed earlier). While this factor did not decline in importance between Bertha and Fran, neither was it accorded a significant place among criteria for future events.

Conclusion

The influence of "unnecessary evacuations" for Bertha played only a small role in evacuation decisions about hurricane Fran. Evacuation rates increased in Myrtle Beach and Hilton Head for the stronger hurricane Fran, despite "false alarms" for Bertha only two months earlier. Following on the experience of "unnecessary evacuations" for both Fran and Bertha, South Carolina residents anticipated little change in their future evacuation activities. The "unnecessary evacuations" did not result in any dramatic shifts in the factors that convinced people to leave or the sources of information they found reliable. Rather, in contrast to some earlier work, the reported role of officials' advisories and mandatory orders was limited as people considered a wide variety of factors in their responses.

Personal assessment of the storm characteristics and its risks played a larger role. Individuals considered the quality of home construction and location, family safety and needs, data on storm tracks, strength and probabilities, relying on the media, and the Weather Channel in

particular, to a larger degree than previously reported. Individual decisions about evacuation in these events was quite consistent. Those who evacuated for one storm and not the other (mostly for Fran and not Bertha) did so largely on the basis of storm characteristics as warnings were nearly identical. Differences in evacuation rates among communities were not accounted for by differences in level of risk, demographics, or community hurricane history. These differences suggest the need for greater investigation of community disaster culture and perceived relationships (or personal/professional relevance of other groups' concerns) among residents, authorities at different levels of government, and hurricane experts.

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Appendix 1

Date: _____
Location: _____
ID: _____

My name is _____ and I'm from the
 Geography
 Department at University of South Carolina in Columbia.
 We're
 undertaking a study of evacuation responses from residents
 in this
 area for both Hurricane Bertha and Hurricane Fran. Would
 you mind if
 I ask you a few questions?

1. Were you in the area when Hurricane Bertha or Hurricane
 Fran began
 to threaten the South Carolina coast?

	Yes(%)	No(%)
Bertha	92	8
Fran	98.5	1.5

If NO, then terminate the interview and thank respondent
 for his/her
 time. If YES, then continue.

2. Did you leave your home to go someplace safer

	Yes(%)	No(%)
before Hurricane Bertha hit?	36.5	63.5
before Hurricane Fran hit?	54.5	45.5

If YES, then continue. If NO, then go to Question
 #12.

3. Where did you go? (Check the category that is the
 closest to
 respondents answer. Be sure to ask question for each
 hurricane)

	Bertha (%)	Fran (%)
public shelter	1	2
motel/hotel	16	26

friend/relative	12	21
other (specify)	3	4
not applicable	63	46

4. Where (city or town, county) was that located?

Bertha _____ not summarized _____

Fran _____ not summarized _____

5. How long did it take you to get there? (hours to nearest 1/2 hour)

Bertha -- average 3.2 hours

Fran -- average 3.0 hours

6. Did you experience any problems in trying to leave the area?

	Yes(%)	No(%)
Bertha	47	53
Fran	19	81

If yes, what were they? _____ not summarized _____

7. What convinced you to leave the area prior to landfall for

Hurricane Bertha? For Hurricane Fran? (Ask as an open-ended question, place a 1 in the column for first reason, number 2 for second reason, and number 3 for third).

First Reason Given
(% of total respondents; N=323)

Bertha Fran
order from the Governor

7.7	11.1
advice from the Governor	
1.2	0.9
order/advice from local public officials	
3.4	1.9
order/advice from local/state police or firemen	
0.6	1.2
advice from the National Weather Service	
3.1	5.6
advice from the media (Weather Channel, local news)	
6.2	8.0
advice/actions from friends/relatives	
2.5	4.3
the severity of the storm	
1.9	5.6
the probability of the storm hitting this area	
1.5	3.4
other (list)	
9	13
not applicable	
62.8	44.9

Second Reason Given
(% of total respondents; N=323)

Bertha	Fran
order from the Governor	
2.5	3.1
advice from the Governor	
0.3	1.2
order/advice from local public officials	
0.6	0.6
order/advice from local/state police or firemen	
1.5	1.9
advice from the National Weather Service	
0.9	2.8
advice from the media (Weather Channel, local news)	
3.1	4.0
advice/actions from friends/relatives	
0	0.9
the severity of the storm	
4.0	6.5
the probability of the storm hitting this area	
0.3	1.5

other (list)
4.6 7.4
not applicable or not answered
82.0 70

Third Reason Given
(% of total respondents; N=323)

Bertha Fran
order from the Governor
0.3 0.6
advice from the Governor
0.3 0.3
order/advice from local public officials
0 0
order/advice from local/state police or firemen
0 0.6
advice from the National Weather Service
0.3 0.6
advice from the media (Weather Channel, local news)
0.6 1.2
advice/actions from friends/relatives
1.6 1.9
the severity of the storm
0.3 0.6
the probability of the storm hitting this area
0.6 0.6
other (list)
2.8 5.0
not applicable or not answered
93.2 88.5

Bertha _____

Fran _____

7a. If there was a difference in responses between Bertha and Fran, ask respondent to explain. Record answer below.

8. What was the most reliable source of information that led to your decision to leave? Check the one that applies. (Interviewers - please follow the exact wording)

	% responses	
	Bertha	Fran
Governor's order	2.8	2.8
Media - general	25.2	31.3
Media - local	3.4	5.0
Media - Weather Channel	6.8	10.9
Media - radio	4.0	5.3
Actions of friends/neighbors	0.9	1.6
Personal experience	1.2	1.6
other	1.2	1.9
not applicable	54.3	39.7

Bertha _____

Fran _____

8a. If there was a difference in responses between Bertha and Fran, ask respondent to explain. Record answer below.

9. What day/time did you leave the area? Use 24 hour clock and date/day

Bertha - not summarized
 Fran - not summarized

10. When did you return home (day/time)? Use 24 hour clock and date/day

Bertha - not summarized

Fran - not summarized

11. In this area, where was the formal evacuation zone for

Hurricane Bertha? not summarized Don't know _____

Hurricane Fran? not summarized Don't know _____

12. What made you decide not to go anyplace else (or not evacuate)?

13. If another hurricane approached the South Carolina coast, would you decide to leave the area and why?
(Be sure to ask this as one question; Check Yes or No and fill in why)

	% responses
Yes	30.7
No	21.6
Depends	47.6

Why

Any additional comments here

14. How well do you feel the warning and evacuation process was handled?
Check the category that applies.

	Bertha %	Fran %
extremely well	32.4	49.4
well	29.9	34.0

not very well	17.0	5.5
don't know	5.2	4.9
no answer	14.5	9.6

Any additional comments here

15. Do you feel you received enough information to make a good decision to evacuate or stay?

	% response
Yes	91.3
No	4.6
No Answer	4.0

Any additional comments here

16. Do you feel you were told to evacuate . . .

	yes (%)	no (%)	no answer (%)
Bertha - too early	19.7	57.1	22.5
Bertha - too late	5.5	71.3	22.5
Fran - too early	14.5	68.5	16.4
Fran - too late	2.5	81.2	16.4

We have just a few background questions we'd like to ask.

17. How many people live in your household?

	adults (%)	children (%)
0	0	70.0
1	16.1	12.4
2	67.8	10.8
3+	15.8	6.8

18. Is there anyone in your household with special needs?
(Prompt: For instance, needing regular medical care)

respondents

	(%)
yes	12.1
no	87.9

19. How many vehicles do you have?

# of cars	0	1	2	3	4+
% of respondents	2.5	31.7	46.6	13.7	5.5

20. How long have you lived here?

Length of residence	% of respondents
Less than 1 yr	7.1
1-2	9.7
2-5	15.9
5-10	19.5
10-15	12.2
15-20	15.5
20+	9.3

21. Do you own or rent?

	% of respondents
own	77
rent	23

22. Is your home a fixed structure, a mobile home, or an RV?

	% of respondents
fixed structure	84.5
mobile home	15.5

23. Have you experienced a hurricane before?

	% of respondents
yes	74.9
no	25.1

24. Would you be willing to participate in a follow-up study?

233 (72%) people responded yes

If yes, get name, address and phone number.

Name _____
Address _____
Phone Number _____

Thank you very much for your time.

Interviewers, please record the following information after respondent leaves.

Demographics

Race	% respondents
Anglo-American	90.6
African- American	8.2
Other	1.3

Sex	% respondents
Female	46
Male	54

Approximate Age	% respondents
18-45	43.4
46-64	27.4
65 or older	29.2

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