Chapter 3
Behavioral Analysis – Public Response in Floyd
(Prepared by Hazards Management Group)

The narrative below is provided by Hazards Management Group (HMG) for the post Floyd evacuation assessment and focuses on describing the evacuation behavior of permanent residents in Florida, Georgia, South Carolina, and North Carolina.

Method

During the months following hurricane Floyd, nearly 7,000 members of the public were interviewed to document and explain their response in Floyd and to help anticipate their behavior in future evacuations like Floyd. The sample was divided into 11 clusters of counties from Dade County, Florida through North Carolina's Outer Banks, designed to conform to hurricane planning regions used by the respective states:

1. Eastern North Carolina – the Outer Banks and counties along Albemarle and Pamlico Sounds
2. Southeastern North Carolina – from the South Carolina border to the Outer Banks, including Wilimington
3. Northern South Carolina – including the Myrtle Beach "Grand Strand" area
4. Central South Carolina – including Charleston and vicinity
5. Southern South Carolina – including the Beaufort area
6. Northern Georgia – including Savannah
7. Southern Georgia – including Brunswick and Camden County
8. Northeast Florida – including Jacksonville and St. Augustine
9. East-Central Florida – including Daytona Beach and Melbourne
10. Treasure Coast Florida – including Palm Beach and Fort Pierce
11. Southeast Florida – Dade and Broward Counties

Each of the eleven areas were stratified into four risk areas. The following is a listing of the four risk areas and the number of interviews conducted in each risk area:

1. Areas which would flood due to storm surge in category 1 hurricanes, in which 200 telephone interviews were conducted
2. Areas which would flood due to storm surge in stronger hurricanes, in which 200 telephone interviews were conducted
3. Areas of coastal counties which would not flood from storm surge in any hurricane, in which 100 telephone interviews were conducted
4. Non-coastal counties bordering the coastal counties, in which 100 telephone interviews were conducted.

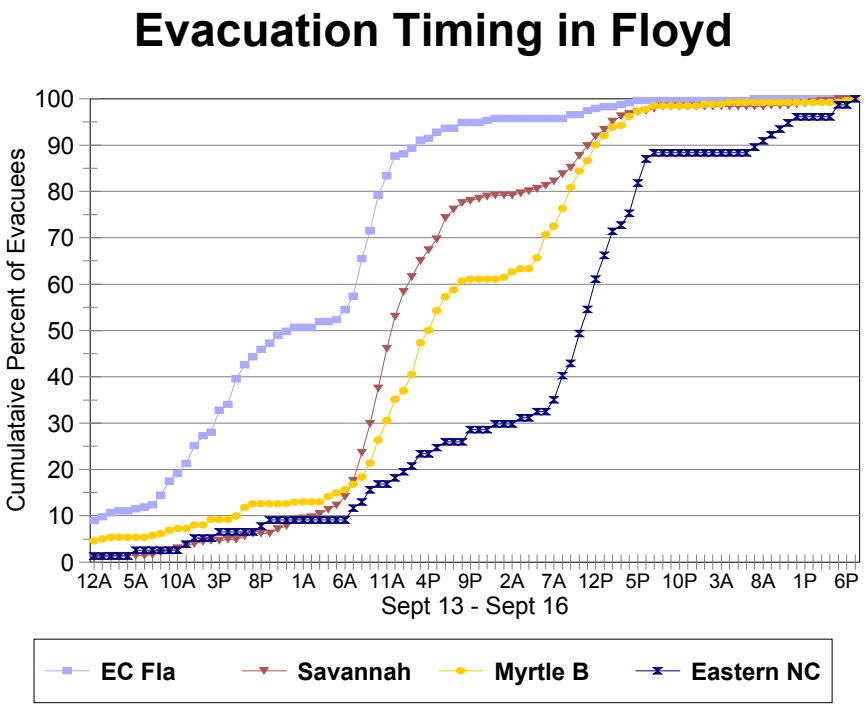
In southeast Florida, 200 interviews were conducted in the non-surge portion of the coastal counties rather than including non-coastal counties. In southern Georgia, virtually the entire coastal counties are subject to storm surge inundation in strong hurricanes, so there was no identification of non-surge portions of those counties. In eastern North Carolina the Outer Banks were treated in the design and analysis like the category 1 risk area of other locations, and areas along the sounds subject to surge inundation were treated as "other surge" areas for comparison with the other locations.

A generic version of the questionnaire used in the survey is included as an appendix to this report. Separate detailed reports were prepared for each of the 11 areas, and can be found in the documentation of the Southeast United States Hurricane Evacuation Study entitled *Technical Memorandum 1 Behavioral Analysis*. For conciseness, sample sizes are not reported in the figures cited in this summary document. Readers should keep in mind that statistics reported here are based on samples derived from larger populations. For more information about sample sizes employed for each question in each location and each risk zone, please refer to the individual area reports.

Evacuation Timing

Figure 1 is a sample of the "cumulative response curves" derived for each of the 11 areas. The vertical axis indicates the percentage of total evacuees from a location who had departed their homes by various times. The four curves show the progression of the evacuation commencing earlier to the south and gradually moving northward as the forecast track of the storm and warning areas moved northward. The curves are typical of "two-day" response curves – i.e., evacuations which take place over a period longer than 24 hours. The evacuation begins early on the first day, levels off at evening of the first day, then resumes the following day. Little evacuation began prior to evacuation notices being issued by officials.

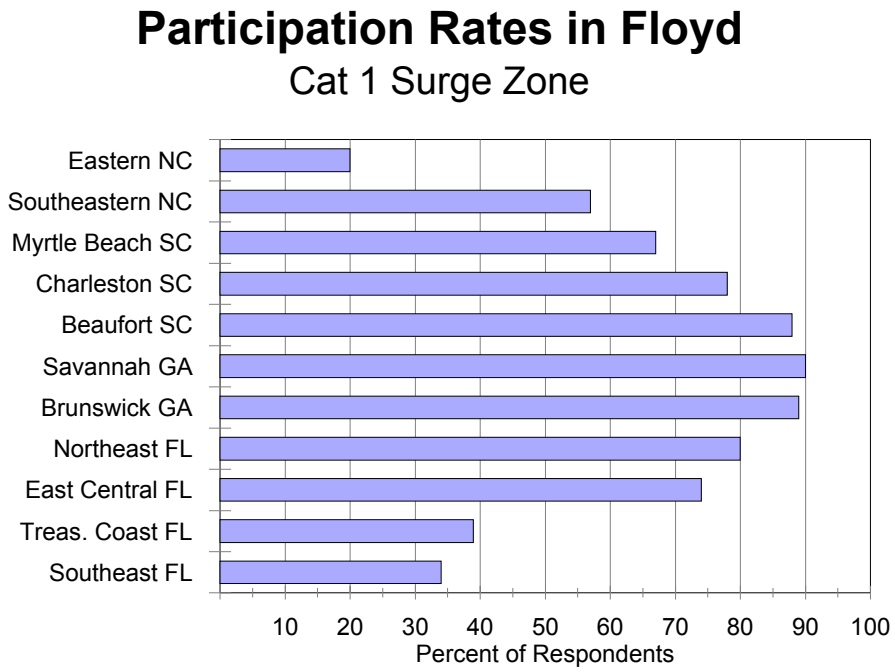
Figure 1



Evacuation Participation Rates

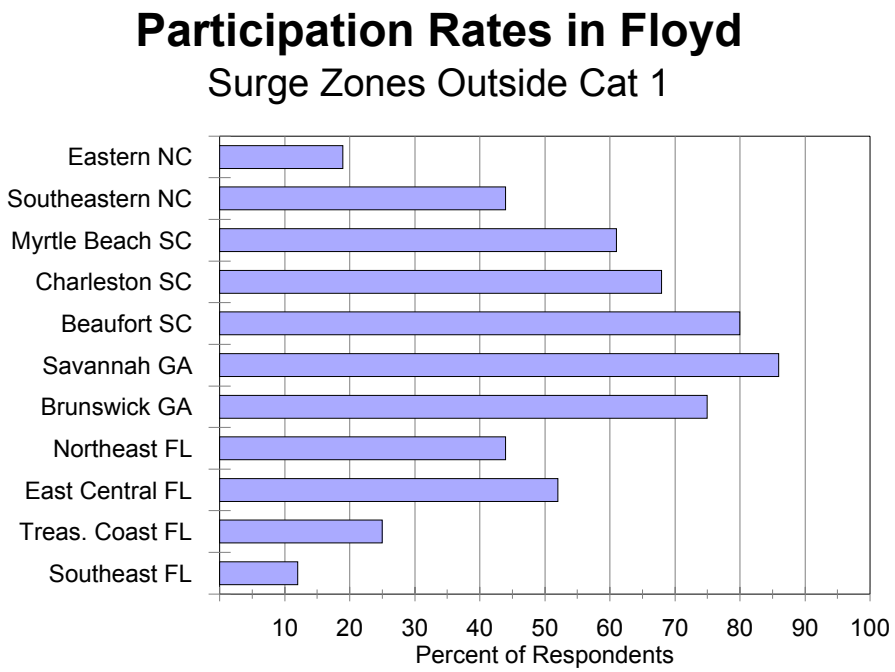
There was considerable variation in evacuation rates among the 11 survey areas (Figure's 2-5). Evacuation (i.e., leaving one's home to go someplace safer) was highest in Georgia and southern South Carolina. In the category 1 zone up to 90% left from the Savannah area, and numbers were almost as high around Brunswick and Beaufort. Rates dropped off gradually both north and south, with major dropoffs for the Treasure Coast and southeast Florida and eastern North Carolina areas.

Figure 2



Evacuation was also high in Georgia and in the Beaufort, SC area for people living in areas subject to surge inundation in storms stronger than category 1, with 75% to 85% leaving from those areas. Again, the dropoff was gradual in both directions, with more significant decreases at the ends of the study area. In Florida only category 1 surge areas were ordered to evacuate. In Georgia and southern South Carolina entire coastal counties were told to evacuate.

Figure 3



In the Charleston, Beaufort, and Savannah areas evacuation from non-surge zones was unusually high. In all three areas all or most of the counties were told to evacuate. Even away from those locations between 20% and 40% of the non-surge residents left in most survey areas. These "shadow" evacuees contributed to the number of people on evacuation routes.

Evacuation in adjacent non-coastal counties was surprisingly high, averaging approximately 25%. In the Charleston vicinity almost half the residents in adjacent non-coastal counties evacuated their homes.

Figure 4

Participation Rates in Floyd

Coastal Non-Surge Zone

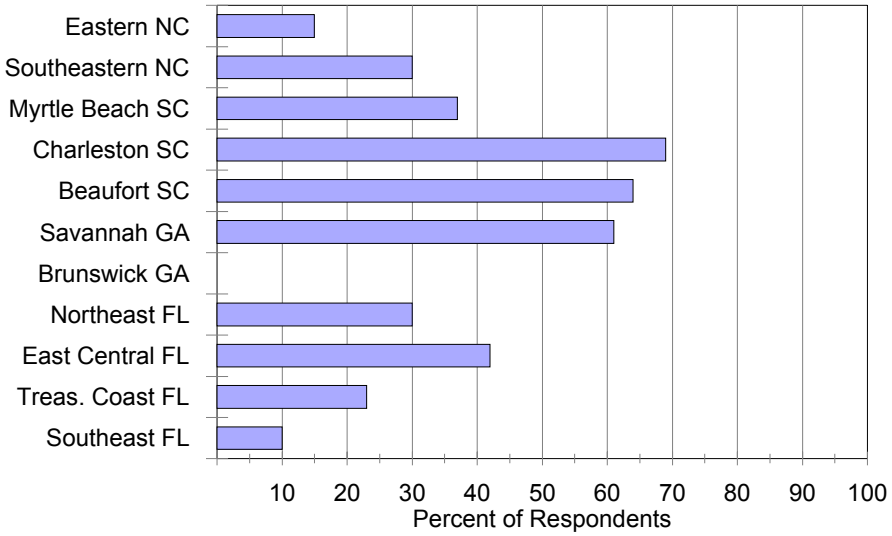
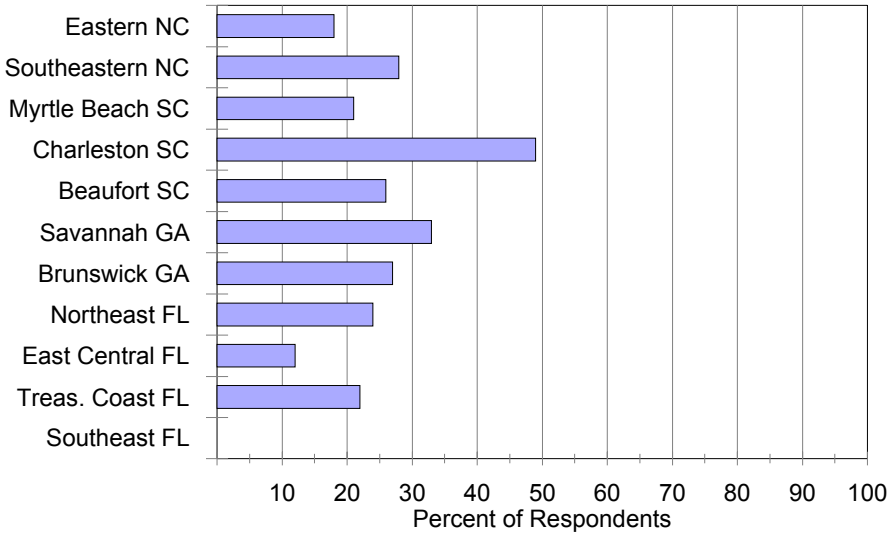


Figure 5

Participation Rates in Floyd

Adjacent Non-coastal Counties

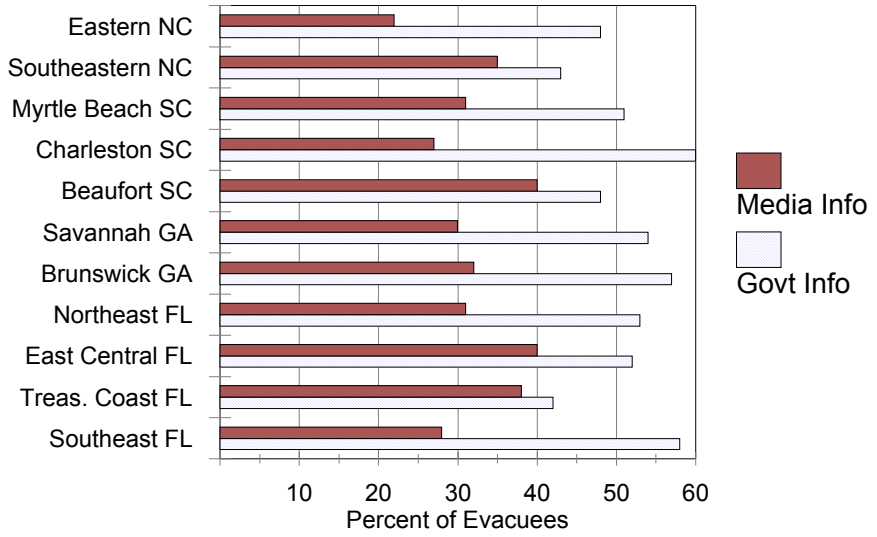


Respondents who evacuated were asked why they left, and most said they left because of a combination of reasons such as evacuation notices from public officials, storm severity, and recommendations from friends, family, and the media. To sort out the effects of official information heard via the media and other kinds of information heard through the media, evacuees were asked which was the main influence on their decision to evacuate. For most people, information coming from public officials (or which they perceived to be coming from officials) had the greater effect (Figure 6).

Figure 6

Main Reason for Evacuating

Avg. All Zones



Except in the two southernmost Florida locations, most people living in category 1 surge areas said they heard officials call for their evacuation (Figure 7). The highest percentage was only 80%, however, in Charleston. In surge areas beyond the category 1 risk area, only in Georgia and South Carolina did most people hear evacuation notices from officials (Figure 8).

Heard Officials Say Evacuate

Cat 1 Surge Zone

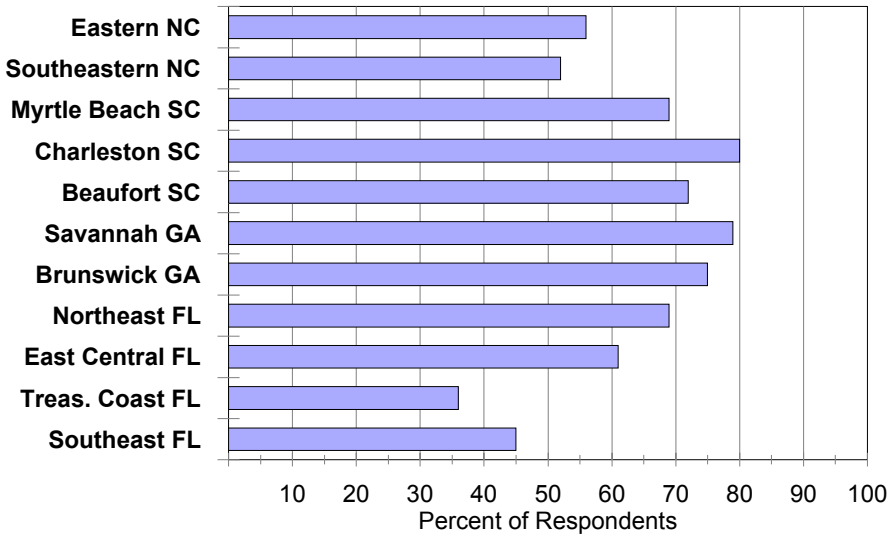
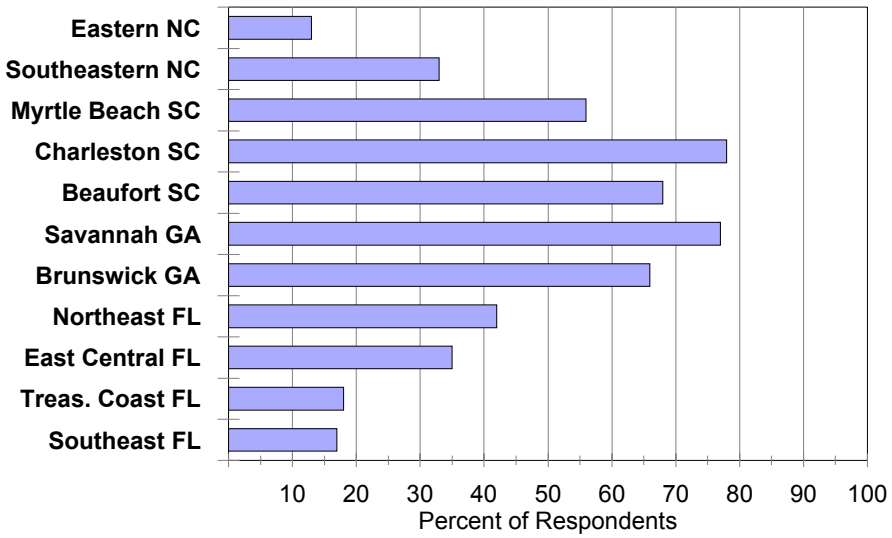


Figure 8

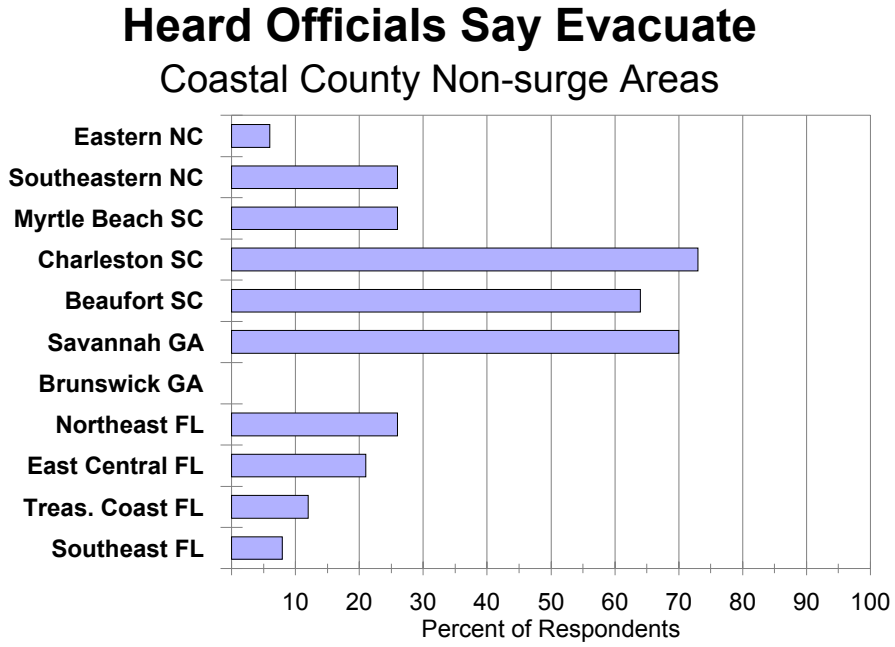
Heard Officials Say Evacuate

Surge Areas Outside Cat 1



Some residents living in non-surge areas also believed they heard officials say that they should evacuate (Figure's 9-10). In Georgia and parts of South Carolina more than 60% of the non-surge residents of coastal counties said they heard official evacuation notices which applied to them, and that was probably correct for most. In other states, and in non-coastal counties, that was probably not correct, except for people living in mobile homes.

Figure 9



Hearing, or believing one heard, evacuation notices from public officials had a significant impact on whether residents evacuated (Figure 11). Within each of the four risk areas, people who said they heard mandatory evacuation orders from officials were most likely to evacuate, followed by those who said they heard officials recommend that they should leave, followed by people who said they didn't hear from officials that they should leave. It is extremely important for officials to reach those for whom evacuation notices are intended and to avoid confusing those for whom they are not intended.

Figure 10

Heard Officials Say Evacuate

Adjacent Non-coastal Counties

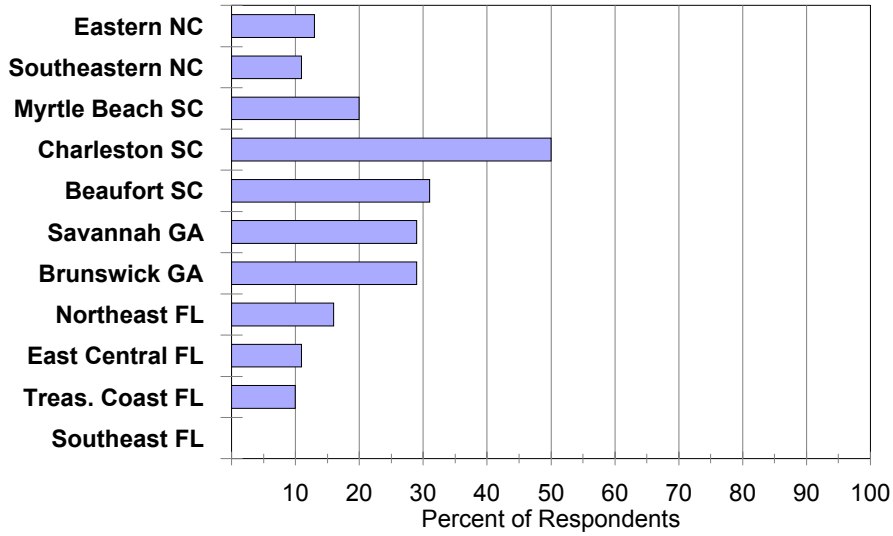
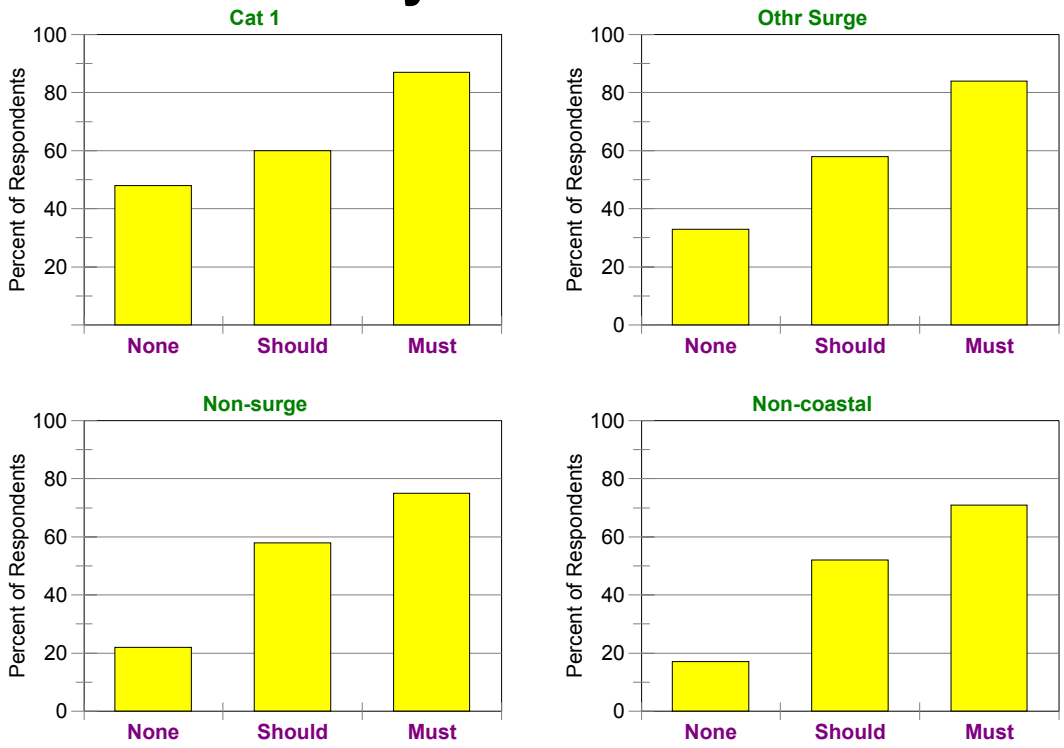


Figure 11

Evacuation by Official Notice Heard



One reason there was substantial evacuation from areas not targeted by officials is that many residents of non-surge areas perceive themselves to be vulnerable in major hurricanes (Figure's 12-13). When asked whether their homes would be safe in a 125 MPH hurricane, 20% to 40% of the people living in coastal county non-surge areas believe their homes would be unsafe from storm surge and waves, and 25% to 60% believe their homes would be unsafe, considering both wind and water. Even in adjacent non-coastal counties 15% to 35% believe their homes would experience dangerous flooding from storm surge or waves, and 40% to nearly 60% believe their homes would be unsafe, considering both wind and water. Although some of the areas might experience inland flooding from heavy rainfall, and some people live in mobile homes or substandard construction, most are probably overestimating their vulnerability.

The importance of the perception is depicted in Figure 14. People who believe their homes are unsafe are much more likely than others in their same risk area to evacuate. In most locations people who believe their homes are unsafe are about twice as likely as others to leave. This is a good thing when applied to people who really need to evacuate, but it can contribute to overcrowding on evacuation routes and in shelters when applied to people who could stay home and be safe.

There are various ways to reach the public with evacuation and vulnerability information during a hurricane threat, but local television and The Weather Channel are the most-relied upon sources of information in most locations (Figure 15). Eventually the Internet and online computer services will gain increased importance, but currently less than 10% of coastal residents say they rely heavily on those sources for hurricane information during a threat.

Perceived Unsafe in 125 MPH Hurricane

Coastal County Non-surge Areas

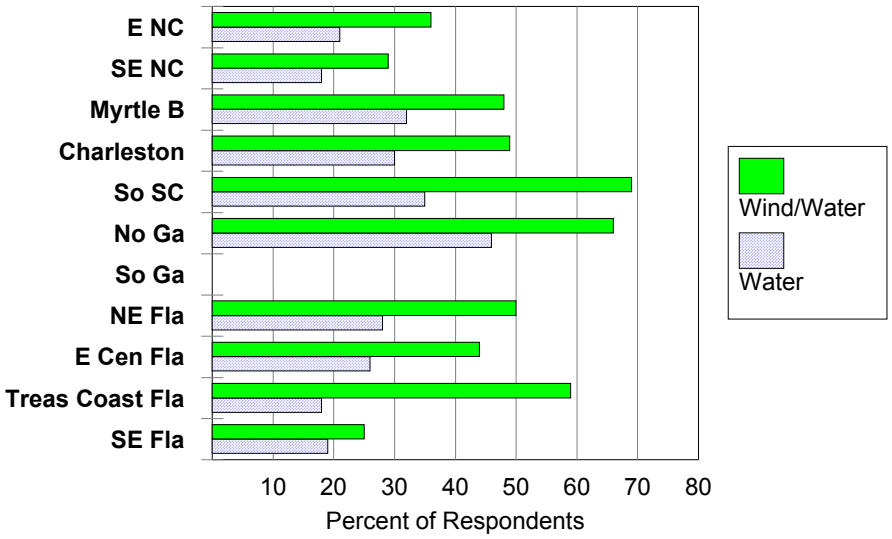


Figure 13

Perceived Unsafe in 125 MPH Hurricane

Adjacent Non-coastal Counties

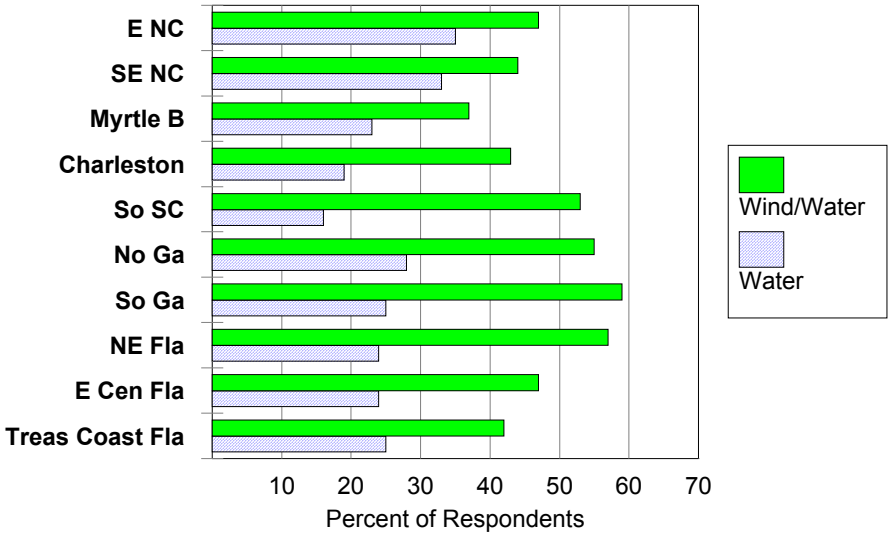


Figure 14

Evacuation by Perceived Safety in 125 MPH Hurricane

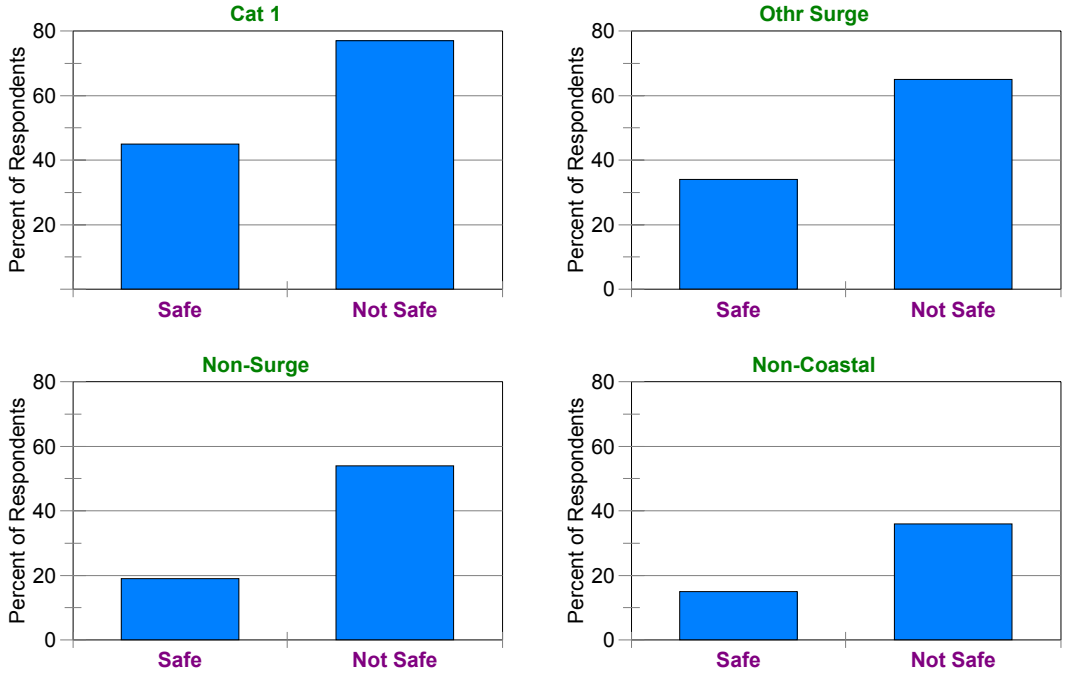
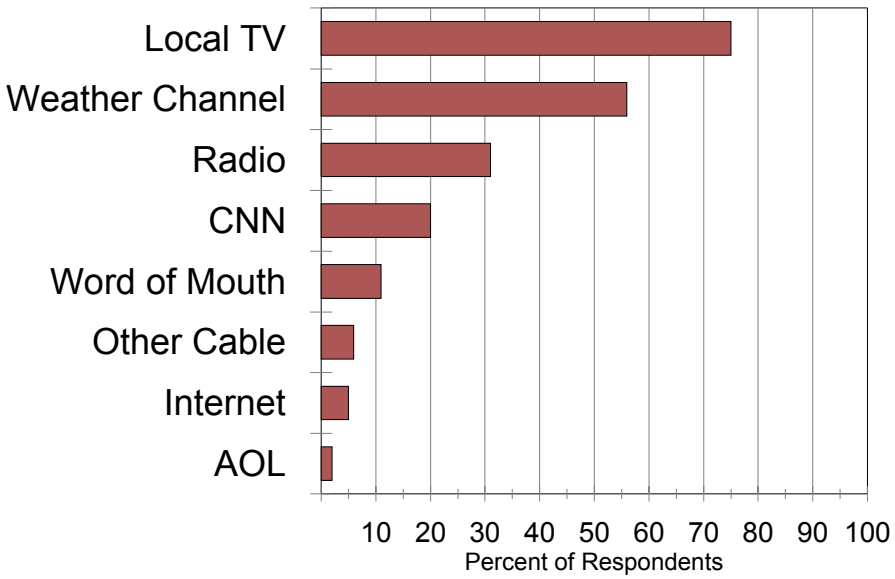


Figure 15

Relied on Sources a Great Deal



Evacuation Destinations

As indicated earlier, evacuation refers to leaving one's home to go someplace else. The new place can be across town or in a different state. Evacuation congestion is made worse when large numbers of evacuees leave the local area rather than simply going to safe locations within their own community.

In Floyd, an unusual percentage of evacuees went to destinations outside their own county (Figure's 16-19). Among evacuees from category 1 and larger surge zones, as many as 98% left their own county, and in eight of the eleven study locations more than 70% did so. These percentages are unusually high, but even in non-surge areas more than half the evacuees went out-of-county in eight of the ten non-surge locations (there was no sample of non-surge residents in the south Georgia area). In adjacent non-coastal counties more than half the evacuees went out of county from half the survey sites.

Evacuees who went to locations outside their own county were asked why they did so. In some places the answer was obvious. Georgia and some South Carolina locations evacuated entire coastal counties, so there were no places to go within those counties and still comply with evacuation notices. Moreover, in those locations residents appear to appreciate the vulnerability of their counties. In many locations, public shelters are not operated in coastal counties or even in the next tier of counties inland.

Respondents gave three predominant explanations for going out of county: 1) that was the location of friends or relatives with whom they could stay, 2) the storm was strong enough so they wanted to get far away from it, and 3) they had to go as far as they did to find vacant lodging.

Respondents were asked whether their decision to go out of county was mainly influenced by information they were hearing from public officials via the media, other information from the media, or information from friends and relatives. Influences varied among locations, but in

most places information from public officials had a greater influence than other messages heard through the media or from friends and relatives.

Figure 16

Evacuees Going Out of County

Cat 1 Surge Zone

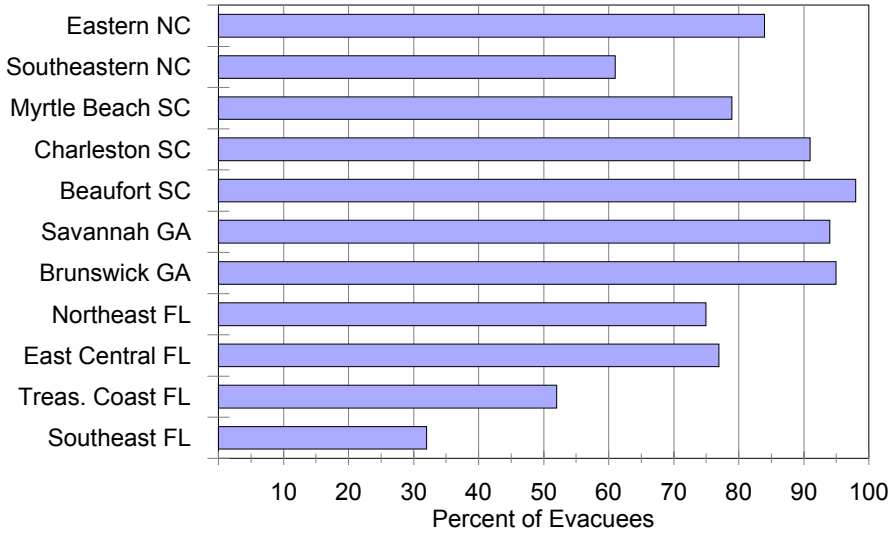


Figure 17

Evacuees Going Out of County

Surge Zones Outside Cat 1

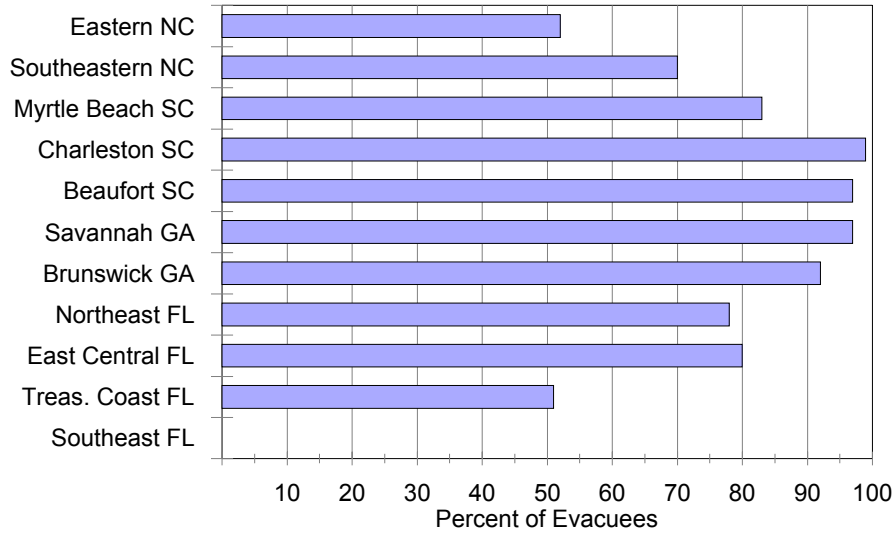


Figure 18

Evacuees Going Out of County

Coastal Non-surge Zone

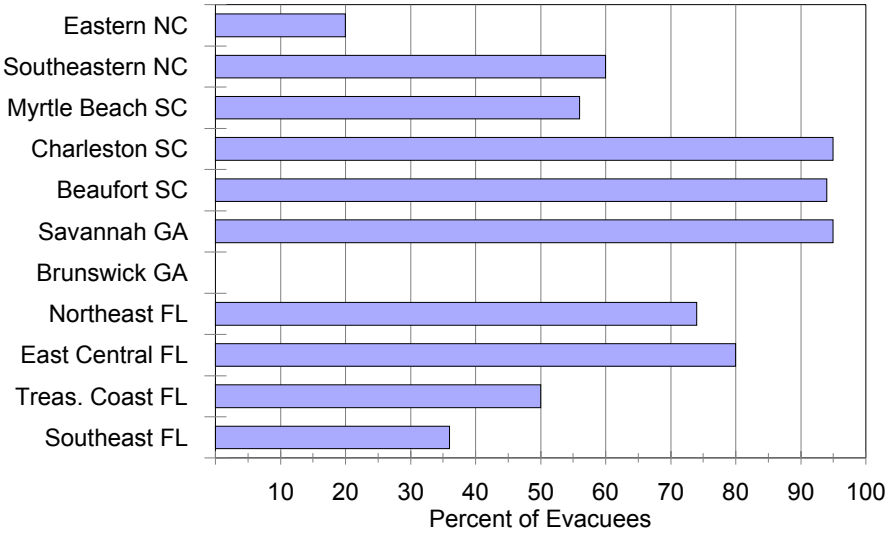
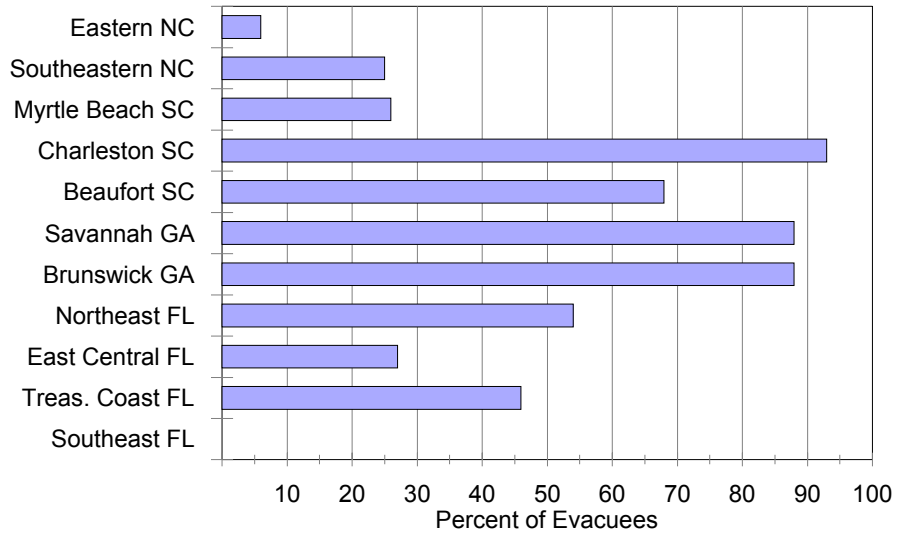


Figure 19

Evacuees Going Out of County

Adjacent Non-coastal Counties



Between 85% and 90% of the evacuees said they reached their original destinations. Of those who changed plans roughly equal numbers went farther from home and closer to home than planned. Those going farther mainly did so looking for vacant lodging. Those who went less far did so mainly because of fatigue.

Few evacuees from other states went to Florida, which is understandable, given the track of the storm (Figure 20). Georgia, however, received visitors from both Florida and South Carolina (Figure 21). Thirty percent of the Northeast Florida evacuees went to destinations in Georgia, and 40% of those leaving Beaufort, SC went into Georgia. Few people from out of state went to South Carolina, and most evacuees from South Carolina went out of state (Figure 22). North Carolina received 14% of the Beaufort evacuees, 25% of those leaving Charleston, and 33% of those from Myrtle Beach (Figure 23).

Figure 20

Out of County Evacuees to Florida

Avg. All Zones

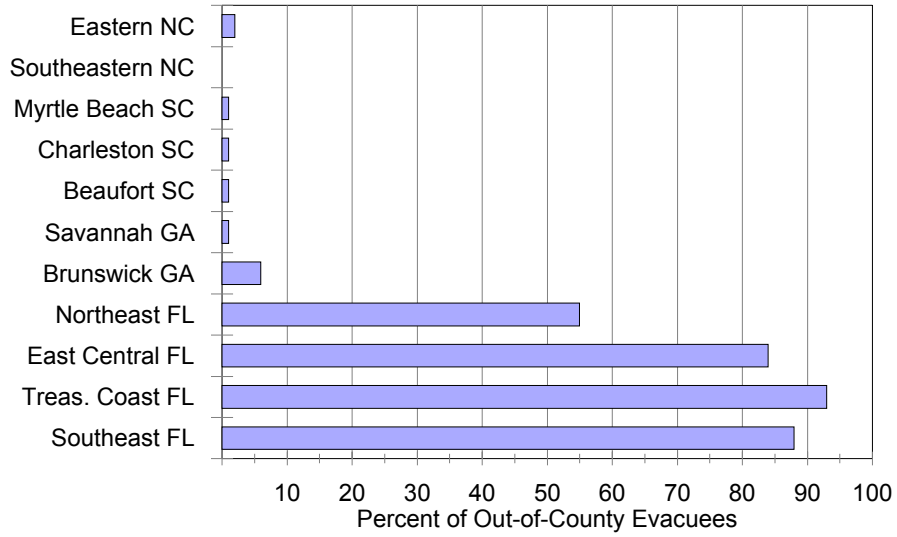


Figure 21

Out of County Evacuees to Georgia

Avg. All Zones

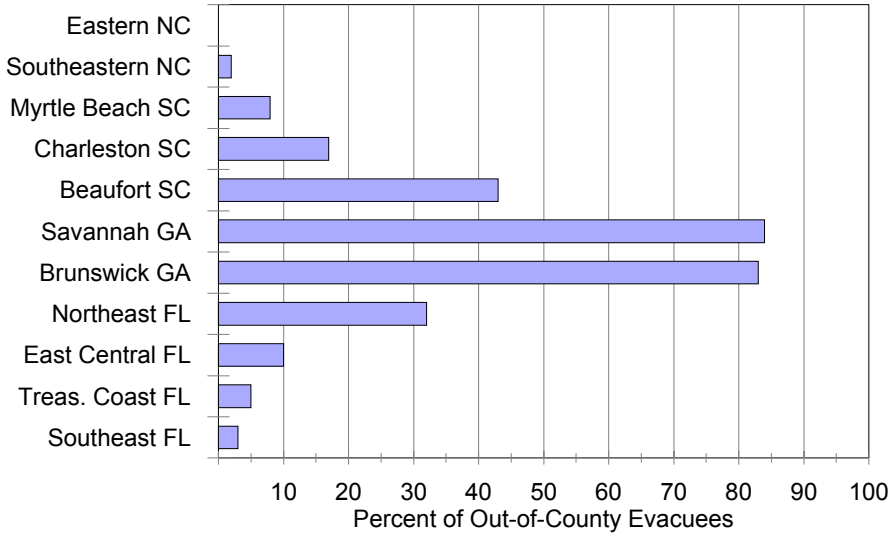


Figure 22

Out of County Evacuees to So. Carolina

Avg. All Zones

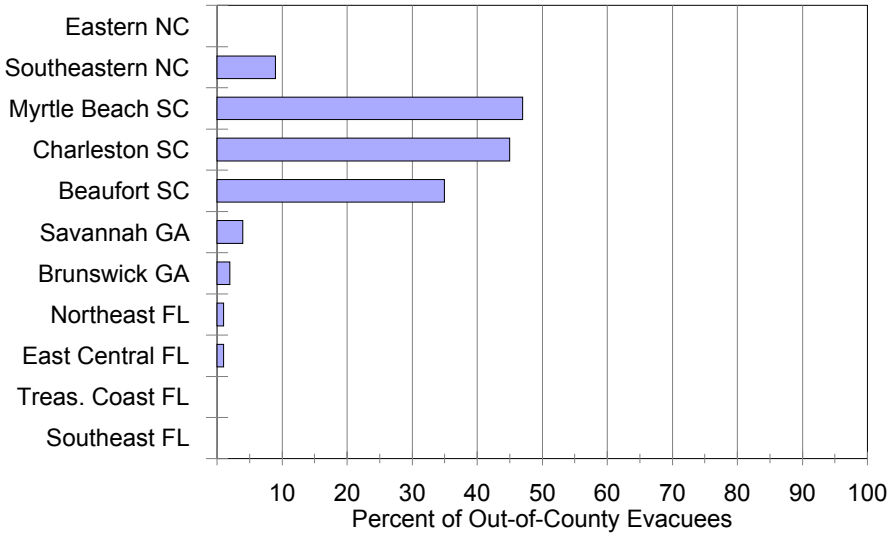
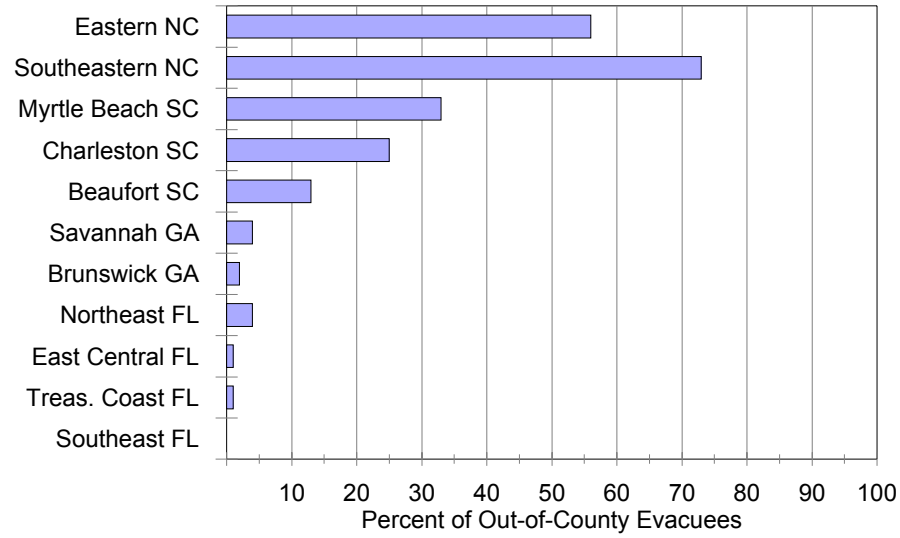


Figure 23

Out of County Evacuees to No. Carolina

Avg. All Zones



The majority of evacuees went to the homes of friends and relatives, which is common in most evacuations (Figure 24). Between 20% and 30% in most locations went to hotels and motels (Figure 25), and fewer than 10% (closer to 5% in most locations) went to public shelters (Figure 26). The remainder went to a variety of places such as their place of work, second homes, and churches.

Approximately 40% of the evacuees said they heard announcements concerning the availability of shelters or refuges after they left home, but fewer than 10% of those who heard took advantage of the offers.

Figure 24

Evacuees Going to Friends/Relatives

Avg. All Zones

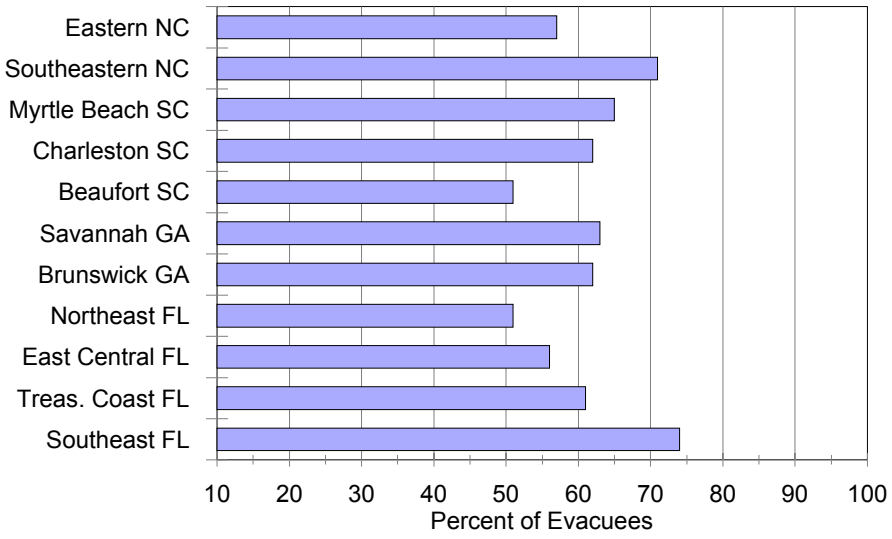


Fig 25

Evacuees Going to Hotels/Motels

Avg. All Zones

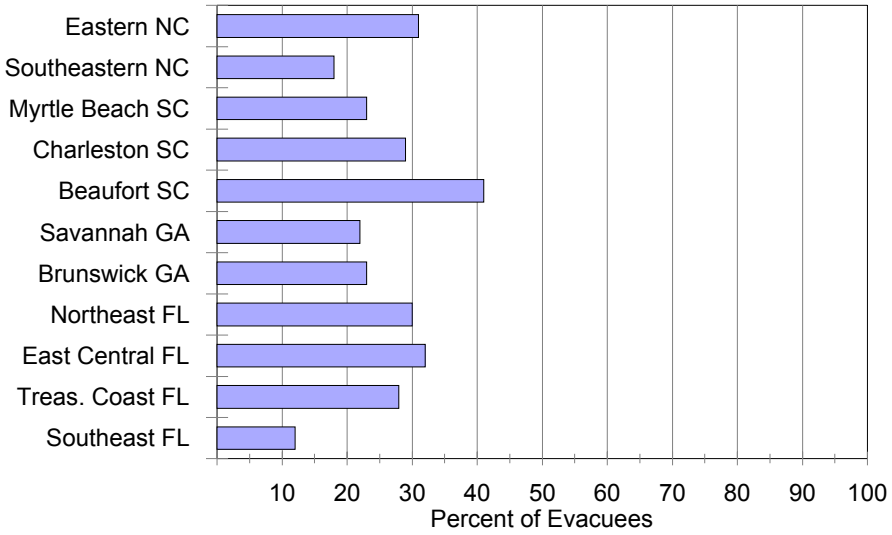
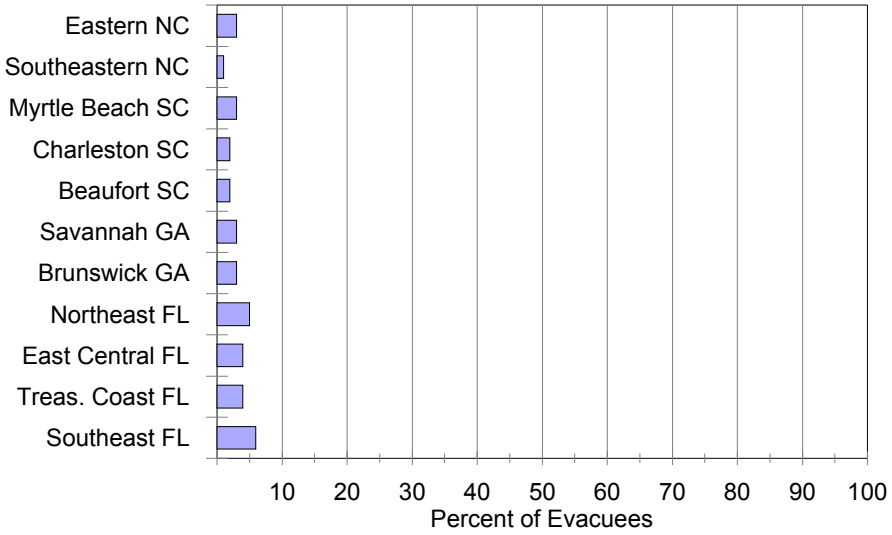


Figure 26

Evacuees Going to Public Shelters

Avg. All Zones



Transportation

Of all the vehicles available to evacuating households, between 65% and 75% were used in Floyd (Figure 27). The statistic is typical of most evacuations.

Evacuees in Charleston had the longest average travel times -- almost nine hours (Figure 28). Beaufort and the two Georgia sites also had average travel times exceeding six hours. Respondents were also asked how long they had expected the evacuation to take, and not surprisingly, expectations were shorter than reality (Figure 29). In Charleston more than half of the evacuees said the evacuation took more than five hours longer than they expected, and in Beaufort and the Georgia locations almost half gave that response.

When asked the reasons for traffic delays, most respondents blamed the large volume of traffic and too many people leaving at the same time. In most locations fewer than 30% attributed the delays to poor management. The exception was Charleston, where over 40% gave that explanation. Some people mentioned the need to reverse lane evacuation routes.

Evacuees were asked whether they would be willing to delay their departure in an evacuation to let people in areas of greater risk leave first, in order to avoid congestion. Between 80% and 90% said they would (Figure 30). Whether quite so many actually would cooperate in that manner, the responses do demonstrate a significant receptivity to the argument if officials are able to make it with conviction.

Figure 27

Percent of Available Vehicles Used

Avg. All Zones

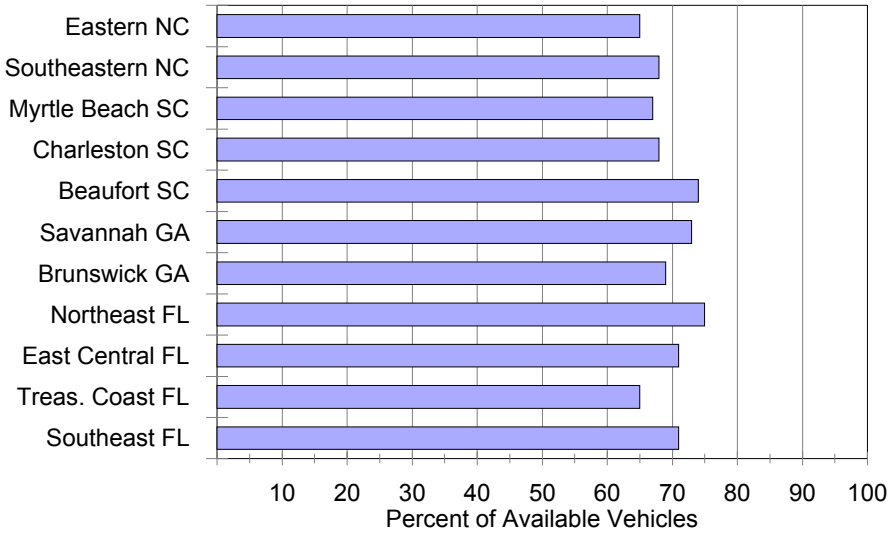


Fig 28

Mean Hrs to Reach Destination

Avg. All Zones

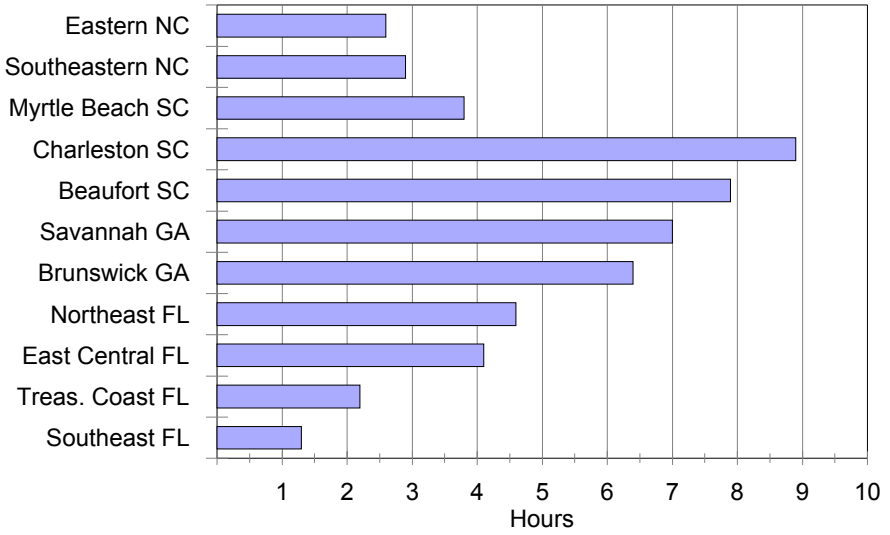


Figure 29

Taking > 5 Hrs More than Expected

Avg. All Zones

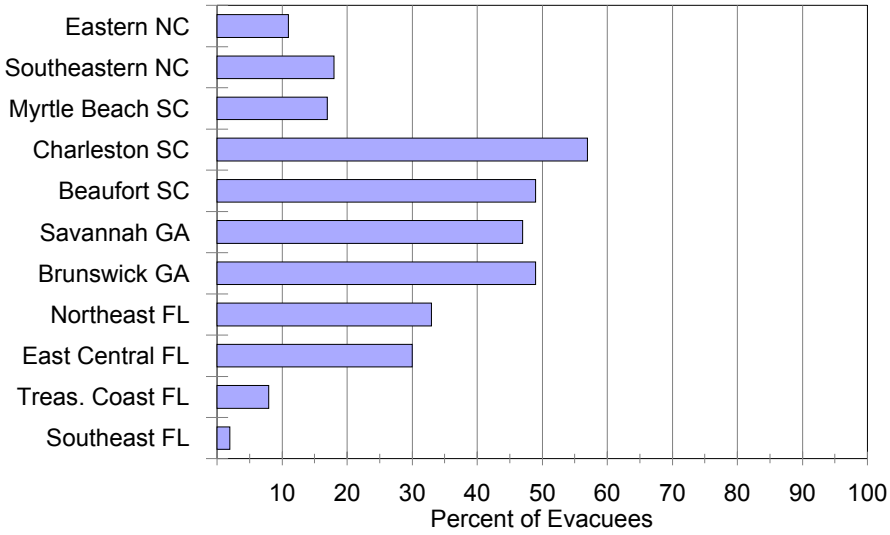
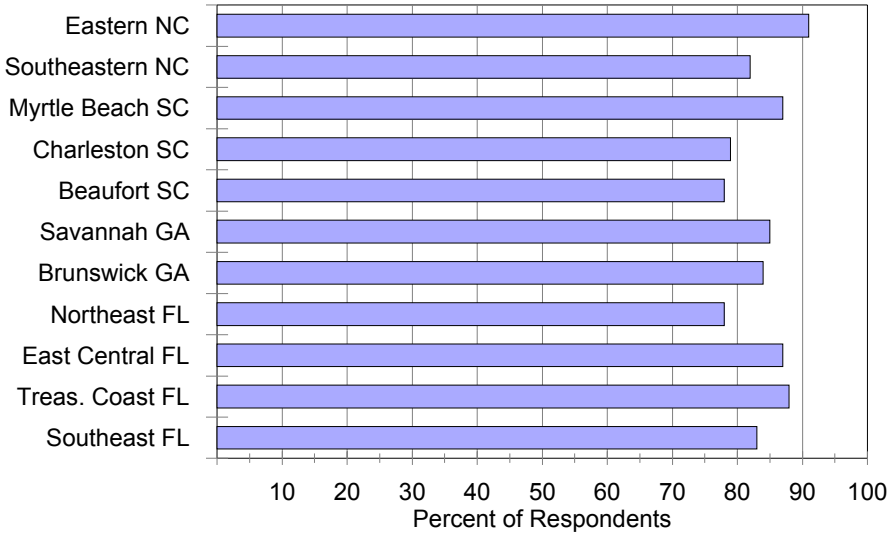


Figure 30

Would Delay Leaving If Urged

Avg. All Zones



Between 35% and 60% of the evacuees said they used interstate highways for a substantial portion of their evacuation (Figure 31). Those respondents were asked whether they would use interstates again in the future or use secondary roads. In the area from Jacksonville, FL through Charleston, SC (where evacuation times were longest), most said they would use secondary roads, a combination of secondary and interstate, or that it would depend on circumstances. North and south of those locations (where travel times were shortest) a majority said they would use interstates in the future.

Between 70% and 90% of the respondents said they were familiar with the road systems in the areas through which they were evacuating (Figure 32). This implies that evacuees would be able to take advantage of information about alternative routes if they received the information. In Floyd between 20% and 55% of the evacuees said they heard announcements about evacuation route problems before leaving home (Figure 33). Of those hearing the announcements, approximately 30% changed their plans concerning routes to use in the evacuation. In most survey locations a majority of evacuees said they heard announcements once they left home about evacuation route problems (Figure 34). About 25% said they changed their route choices while underway as a result.

Evacuees appear to be receptive to route announcements, as evidenced by their behavior in Floyd and also in response to a hypothetical posed in the survey. Respondents were asked whether they would be willing to use a route other than the one they had planned to use if urged to do so be officials in order to avoid congestion, even if the alternative route took them out of their way. More than 70% said they would (Figure 35). The main point is not whether exactly that many would actually comply with such a recommendation but that so many are at least inclined to consider it favorably.

Figure 31
Use of Interstates in Evacuation

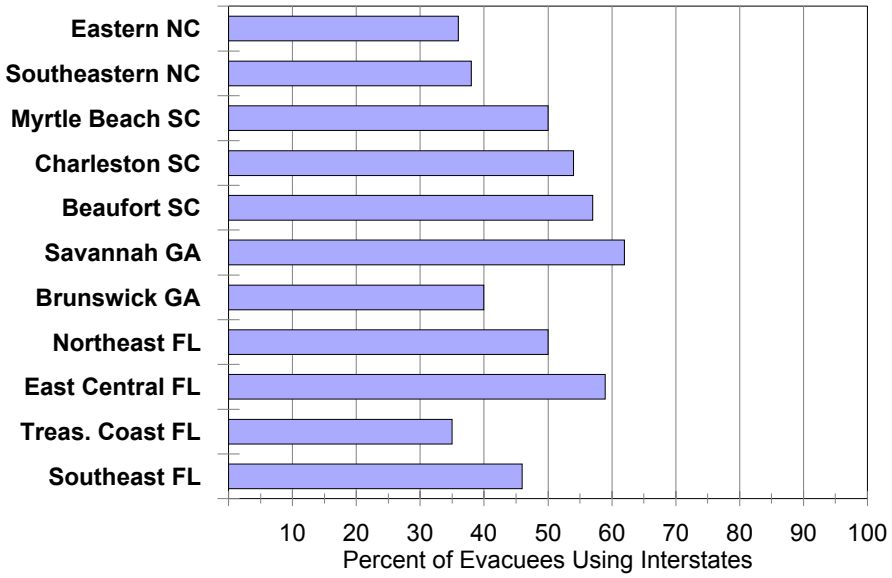


Figure 32
Familiar with Roads

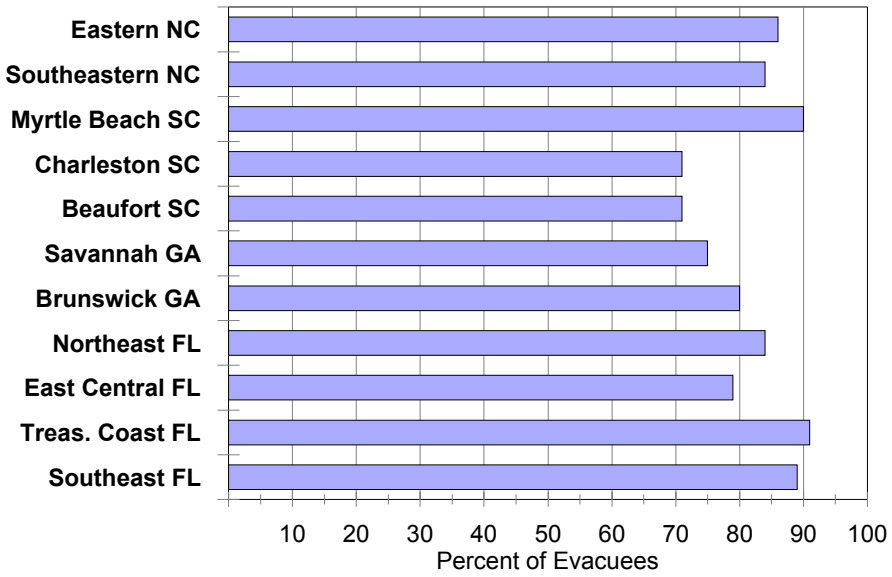


Figure 33

Heard Road Info Before Leaving Home

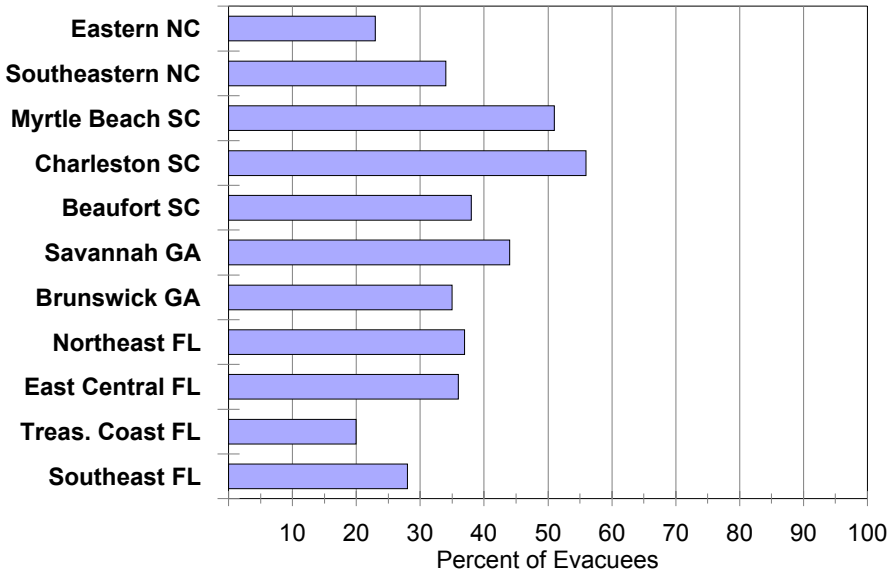


Figure 34

Heard Road Info After Leaving Home

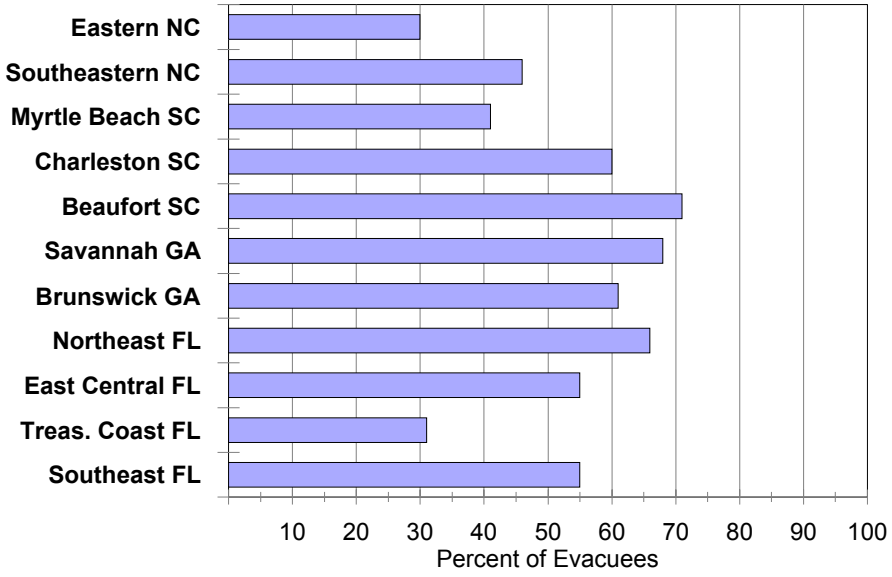
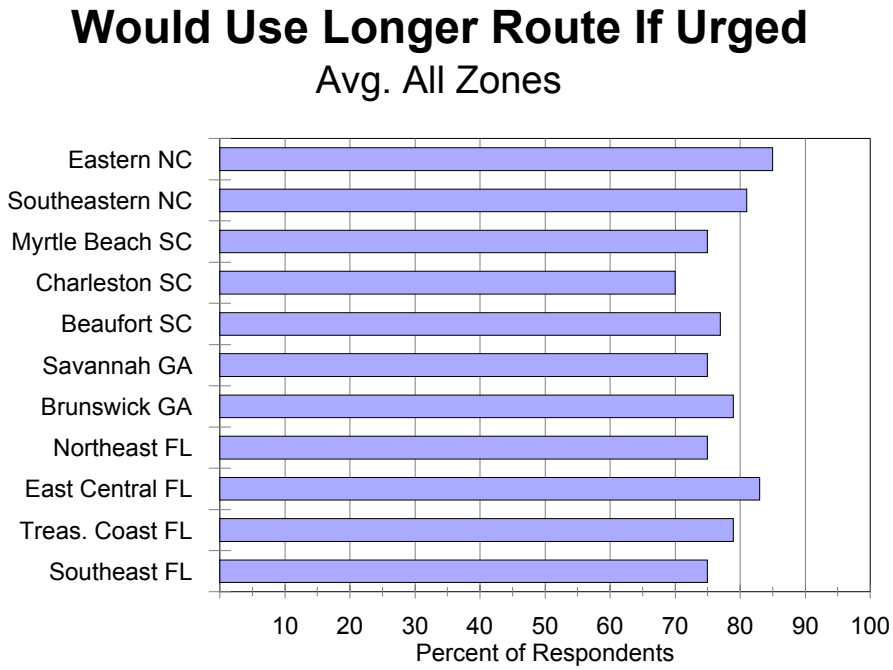


Figure 35



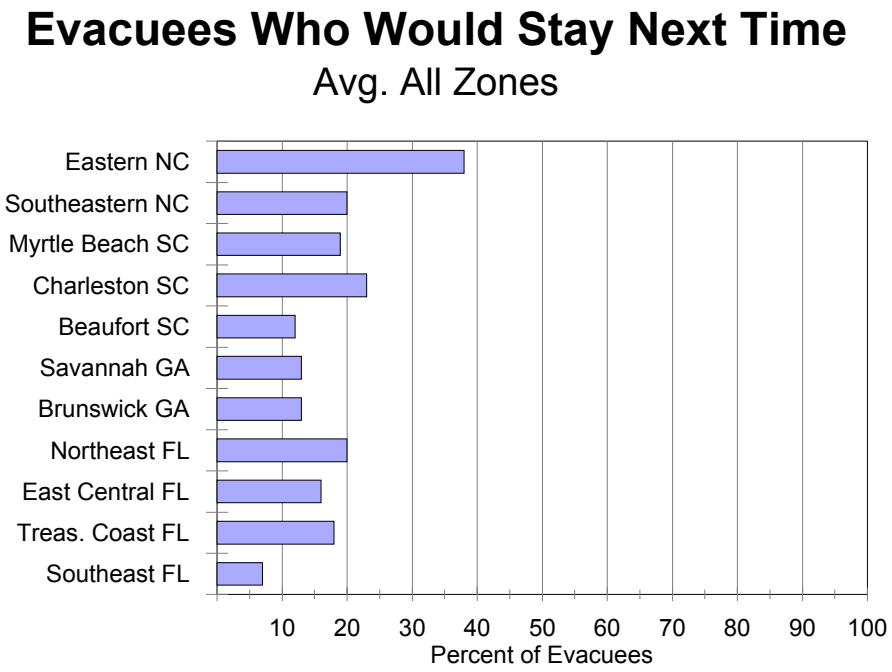
Next Time

One question asked following Floyd was whether the unpleasant experiences during the evacuation would deter people from leaving in future hurricane threats. Certainly many evacuees had bad experiences, but when asked to describe the sorts of difficulties they endured, most respondents, even in Charleston, reported none, other than aggravation. The most common complaint was a lack of restroom facilities, followed by food and water. It is important for public safety officials to recognize the fact that the people who complain about events by contacting agencies, writing newspapers, and so forth don't constitute a random sample of the public.

When asked what they would do differently if faced with a similar hurricane threat in the future, fewer than 20% of the evacuees in most locations said they would not do so again (Figure 36). Some of these respondents didn't need to evacuate in Floyd, so their inclination to stay in the future is not a negative, and most of those who do need to go can be convinced

to do so in an actual threat. The most common response when asked what they would do differently was to leave earlier next time.

Figure 36



Recommendations:

1. Continue to use post storm assessments as the primary tool for providing behavioral data to the HES process.

2. Run scenarios with higher out-of-county evacuee percentages for strong storm clearance time calculations.

3. Capitalize on the behavioral finding by HMG that the public is willing to try phased evacuations and alternative highway routes if instructed by government officials.

4. Hold meetings to discuss ways in which the public's response/behavior can be changed through media messages so that highway congestion can be lessened.