

Natural Hazard Research

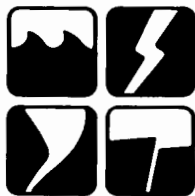
HURRICANE HUGO'S IMPACT
ON THE VIRGIN ISLANDS

by

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This document was prepared by the author while serving as Assistant Commissioner of Health, U.S. Virgin Islands. However, the views expressed here reflect her own thoughts - not the official position of either the U.S. Virgin Islands Department of Health or her present contract employer, Hess Oil Refinery of the Virgin Islands.

PREFACE

This paper is one of a series on research in progress in the field of human adjustments to natural hazards. The Natural Hazards Working Paper Series is intended to aid the rapid distribution of research findings and information. Publication in the series is open to all hazards researchers and does not preclude more formal publication. Indeed, reader response to a publication in this series can be used to improve papers for submission to journal or book publishers.

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SUMMARY

In order to develop an accurate picture of the effects of Hurricane Hugo on the U.S. Virgin Islands, a research team from the Virgin Islands Department of Health conducted two surveys of the island population – one, soon after the event; another, a year later. Although other issues were addressed, both assessments focused on aspects of the storm affecting the health of island residents. Beyond assessing the more immediate impacts of the hurricane, the researchers developed a demographic profile of the population before and after Hugo in order to ascertain possible long-term effects and impacts on the psychological and social environment.

This paper presents the results of those two studies. The extensive data (offered in both narrative and graphic form) provide many guideposts for the mitigation of future disasters in the Caribbean.

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INTRODUCTION

The curtain has at last risen on the 1990's. In the 80's the U.S. Virgin Islands underwent a dramatic about-face in physical beauty and health delivery. Destruction took place in only a moment of that decade, but construction will require a tremendous struggle well into the 21st century. True construction will be possible only through desperate efforts based on a solid foundation and untiring dedication. The backbone of the health delivery system was fractured and pulverized. The arms and legs were dislocated. The psyche sustained tremendous emotional stress resulting in depression. There were headlines such as "Anarchy in St. Croix," (New York Post, September 21, 1989); "Winds of Chaos," (Time, October 2, 1989); "Farrelly: Hugo Left \$935M in Damages," "Prayer Battles Hurricanes," (V.I. Daily News, October 25, 1989); "Lifeline Facilities Had No Generators," (V.I. Daily News, October 28, 1989); and "1989: Hugo Makes It a Year to Remember," (V.I. Daily News, December 31, 1989-January 1, 1990).

The above paragraph is from an initial survey undertaken by the U.S. Virgin Islands Department of Health - The Hurricane Hugo Health Assessment (Christian, 1990).

Many people reported on Hurricane Hugo. Newspapers, victims, television stations, calypsonians, local officials, and U.S. federal officials told their story, and all of these focused on the looting and domestic violence that prompted President Bush to send U.S. troops to American soil for the first time in 20 years to quell riots.

People also talked about the total disruption of power. There was no electricity for months in the Virgin Islands, and there was little hope to have it restored well before 1990.

People also spoke about the total failure of communication between St. Croix and the outside world for over 24 hours. All emergency radio communication was damaged, and the local Virgin Islands Telephone Company, VITELCO, was not able to restore communications until well into 1990.

People also reported the destruction of over 95% of the homes in the Virgin Islands, with St. Croix having all homes affected in some way.

There was also talk about the governor's lack of responsiveness and the lack of preparedness on the part of the Virgin Islands Territorial Emergency Management Agency (VITEMA).

Finally, there was talk about the damage to government buildings and schools and the loss of the tourist industry. But were any or all of these stories the real story?

In undertaking an assessment of the effects of Hugo, the research team from the Virgin Islands Department of Health attempted to develop a thorough and accurate account and analysis. We did not just want to tell another story. We wanted to present the unbiased facts based on descriptions by the affected population, the people of the U.S. Virgin Islands.

This population-based survey of a natural disaster area, the first in the history of the United States, was the Hurricane Hugo Health Assessment (Christian, 1990) cited above. To supplement the findings of this report, a follow-up study was conducted one year later. Although other impacts were addressed, both assessments focused on the health status of island residents. For example, the only hospital on St. Croix was destroyed, and the only hospital on St. Thomas was badly damaged. Consequently, one question addressed the affect of the loss of these institutions on acute illnesses. Similarly, with five out of seven ambulatory care sites severely affected, we attempted to discover where the poor would receive health care with these services disrupted. According to J.F. McCarthy, 50% of the Virgin Islands population is below the poverty level (McCarthy, 1989). We were particularly concerned about these persons.

PURPOSE OF THE STUDY

Our focus was not on the short-term effects of or immediate response to Hurricane Hugo. Rather, we wanted to determine a demographic profile of the population before and after Hugo, as well as assess the quantity and quality of damage based on type of housing construction. We wanted to get beneath the surface and

discover the possible long-term effects, the trauma to the psychological and social environment, and the scars that would remain among the population of the U.S. Virgin Islands. Specifically, the questions addressed were:

- How were the demographic characteristics (age, sex, race, ethnicity, and island of residence and birth) of the population affected by the hurricane?
- What displacement effects were apparent?
- How were income and education related to home ownership, insurance coverage, and damage by the hurricane?
- What types of temporary homes would the people accept in case of another disaster?
- What was the primary source of drinking water?
- What source(s) of drinking water was responsible for most cases of diarrhea?
- What type of physical injuries occurred and was there a change in treatment or outcome?
- Should it be recommended that glass windows be taped prior to a hurricane?
- Did a significant number of individuals suffer from diarrhea because of lack of food storage?
- Were utilities available and/or restored on one island more quickly than on another, and if so, why?

Other questions were:

- What was the effect of the disaster on the mental health of the population?
- What were the psychosocial effects of the hurricane on the population?
- Would the population, based on this stress, show significant depression or indications of future depression?
- Since the quality of health is very much affected by the quality of water, the food supply, and shelter, how would disruption or change in these vital items affect the population?

- Does the population condone taking "without permission" any of the items that were reported as looted?
- What is the population's rating of government agency response following the disaster?

To answer these questions, a systematic study of a sample of Virgin Islands households was conducted at two different times. Eighty percent of the data were collected within six weeks with each survey. Due to our initial inability to contact some of those selected for interview, the entire data collection for each study period lasted approximately 12 weeks. Because the sample was nonreplacing, every effort was made to contact those selected. These studies were done with technical assistance from the Centers for Disease Control in Atlanta, Georgia.

Because the second survey was a follow-up and continuation of the first, this report duplicates much of the narrative from the Hurricane Hugo Health Assessment that was presented to the Secretary of Health of the U.S. Department of Health and Human Services in July 1990.

LITERATURE REVIEW

The Virgin Islands has a long history of dealing with hurricanes and disaster. Caribbean Indians thought hurricanes were evil spirits. Judson (1989) reports that Alexander Hamilton's eloquent descriptions of a 1772 hurricane on the island of St. Croix inspired the island planters to send him to college in New York. Larsen (1950) and Dookhan (1974) report that the capital of the U.S. Virgin Islands, which was defined by where the governor lived, changed after an 1867 destructive hurricane that "surpassed anything in magnitude and destructiveness recorded in history" (Dookhan, 1974, p. 220). That storm was followed one month later by a disastrous earthquake and tidal wave, felt most severely in Frederiksted, St. Croix.

Hurricane Hugo, with winds of 170-220 mph, has been labeled the worst hurricane in the history of the Caribbean. It scoured

the Virgin Islands, leaving not a single tree, bush, or blade of grass untouched on St. Croix. After the storm, the island was a chocolate brown desert depleted of all of its lush colors. Its structures looked as though they had been bombed. Roofs were blown away, windows were shattered, and walls were sucked out.

Although hurricane winds do much damage, wind is not the biggest killer in a hurricane. Most victims die from drowning. The flooding that accompanies a hurricane, for the most part, does not come from intense rain but from storm surge. The U.S. National Weather Service estimates that storm surge causes nine of every ten hurricane associated fatalities. Yet, Hugo, despite its fury and tremendous physical damage, took only two lives in the U.S. Virgin Islands - one from drowning and one from trauma suffered from a falling roof.

DEFINITIONS

For this study, the following definitions were used:

- 1) WAPA: the Water and Power Authority - the electricity company that serves the U.S. Virgin Islands.
- 2) Household or family: the group of people who lived at a home associated with a WAPA meter identification during the entire week before Hurricane Hugo. Household members include related people, unrelated people, roomers, and live-in servants. People who considered the residence their home (even though they were not at home at the time of the interview) were considered family members. People who lived elsewhere, such as students living away from the home, or persons living at the same address but in a separate apartment, were not included.
- 3) Current resident: any individual who: a) lived in the home associated with a meter identification in the entire week before Hurricane Hugo, and b) was, at the time of the assessments, living at a given address.
- 4) CDC: U.S. Centers for Disease Control in Atlanta, Georgia.

METHOD

Survey Design

To derive data that would be geographically representative of the populations on each of the three U.S. Virgin Islands (St. Croix, St. Thomas, and St. John), a sampling frame was used that yielded a virtually complete list of households on each island. From this list, a systematic sample was drawn, producing sets of households that were proportional to the number of households on each island.

Sampling Procedure

The sampling frame that was used in these assessments was unique and scientifically ideal. While most surveys use incomplete population lists for sampling frames or must "map" the geographic districts of interest, we used a list of all water and electricity consumers on the islands. This list was provided by WAPA and, according to an estimate, covered at least 98% of the islands' population on the day before the hurricane. The sample sizes derived for our surveys were based on standard statistical practice (assuming a level of significance of 0.05 and a confidence interval of 90%). Although we were clearly interested in collecting a variety of public health data, we based our sample size estimate on the proportion of persons with depressive symptoms in the population. Knowing that 17% of the general population are depressed at any one time, we assumed that this would double to 34% in the Virgin Islands in the wake of Hurricane Hugo. Based on the total number of households in the Virgin Islands, we thus initially estimated that 384 households were needed for our sample. However, because we were interested in making many comparisons, while controlling for the possibility of statistical confounding, we roughly doubled our required sample size. Our 2% sample of the population thus allowed for multiple comparisons and stratifications in the data analysis.

To obtain this 2%, we first ordered our sampling frame by island of residence. Within each island-specific block of house-

holds, we sorted our households according to geographic districts (i.e., routes traveled by WAPA professionals to obtain billing information). The total number of households on this "double-sorted" list was 35,746. Two percent of these amounted to 715 households for interview. Thus, by sampling every 49th household from this sampling frame, we were able to draw a sample that was geographically representative and proportional to the number of households on each island.

This method yielded 347 households for St. Croix, 354 households for St. Thomas, and 26 households on St. John - 727 households for all three islands potentially to be surveyed. However, it was clear to us that the small numbers for St. John would not allow us to make any statistically significant statements about that island. Therefore, we decided to oversample St. John and used as our potential sample 193 households, resulting in a sampling of 14% of the St. John population.

One year later, we resampled the same households, separating responses of those that participated the first time from those that did not. This separation permitted a longitudinal cohort study of the the same individuals at two points in time - directly after the disaster and one year later (see Table 1).

TABLE 1
ACTUAL COHORT SAMPLE SIZE

	Households	
	<u>1989-1990</u>	<u>1990-1991</u>
St. Croix (1 in 49 households)	282	267
St. Thomas (1 in 49 households)	307	272
St. John (1 in 49 households)	14	15
Oversample		
St. John (1 in 7 households)	112	90
Total household sample size	715	644
<hr/>		
Total persons in sample	2174	

In addition, utilizing the same listing of electric company customers, we sampled individuals we were unable to interview in the first survey, although they had been selected to be interviewed. An additional 74 contacts were made among the three islands; these were analyzed separately from the cohorts.

RESPONDENT SELECTION AND INTERVIEW

The listing of electric company customers was chosen as a means of determining true pre-Hugo households. This method assured that more than 98% of households were represented, since in previous studies it had been estimated that greater than 98% used electricity.

From a random starting point, households were systematically selected by meter identification number from a computerized list of customers obtained from WAPA. Each number was recorded on the interview along with the corresponding name and address. If the name appearing on the interview was different from that appearing on the WAPA list, interviewers verified that this was the household selected by checking the meter number on the electric bill or on the meter. This assured that a well that was hooked up to a separate meter was not selected instead of an individual's home.

While our sample frame was unique in its almost complete coverage of the population to which we wanted to generalize, our 2% sample was of households and not individuals. Therefore, it was necessary to select an individual within each household to target for interview. Because we were interested in collecting data on all household members, we chose to interview the female in the household who knew most about the family members. Our choice not only provided us with a more consistent quality of information than would have been provided by family members chosen at random; it also allowed us to solicit personal information and expect a uniform degree of disclosure. In most cases, the women we interviewed would know more than any other household member about the family as a whole - especially about young chil-

dren (particularly desirable knowledge, since there were questions related to children's activities and school and a depression scale related to the behavior of young children). In addition, other questions relating to the Center for Epidemiologic Studies Depression (CES-D) Scale, and other emotional, attitudinal, and relational questions were asked. As more women were interviewed, the validity of the analysis increased. If the female in the household could not be interviewed (because she was absent, had left the island because of the hurricane, or was unwilling or unable to be interviewed), the male was interviewed.

After obtaining verbal consent, a closed-ended, in-person interview was conducted lasting approximately 40 minutes. While most interviews took place in sampled homes, telephone interviews were conducted when necessary (e.g., if the household had been vacated after the hurricane). At the end of the interview, the person interviewed was given the opportunity to seek health advice and was referred to a health clinic when appropriate.

Safeguards Against Measurement Error

Several safeguards were taken to ensure a representative sample of the Virgin Islands population:

- 1) Households that were sampled were not replaced by nonsampled households. If family members had moved to another residence, they were traced and interviewed, regardless of their present location.
- 2) WAPA customer numbers were verified on a sample of household power meters to ensure correct survey inclusion.
- 3) There were no households listed more than one time in the sampling frame. Therefore, all households had the same probability of selection.

As a result of our nearly complete sampling frame, subsequent systematic sample of households, and rigorous commitment to this survey method, the results obtained from this study allow generalizations about the entire Virgin Islands population. In

addition, the follow-up, which resampled the same households, allowed us to do a longitudinal cohort study of the population.

DATA COLLECTION

Representative data from the assessments are presented in graphs included in the Appendix on page 39. These findings are further discussed in the "Results" section below.

Type of Analysis¹

The data were analyzed using the statistical package, "Epi Info," version 5.0 and version 5.1. Epi Info is a series of microcomputer programs for handling epidemiologic data in questionnaire format and also for organizing study designs and results. It combines the features most used by epidemiologists in statistical programs such as SAS or SPSS and database programs like dBASE into a single uncopyrighted program.

Instrumentation

The survey instruments were devised with the help of the CDC and input from the staff of the Division of Prevention, Health Promotion and Protection (PHPP) of the U.S. Virgin Islands Department of Health. Pilot testing was done on all three islands. After the pilot study, the 1989-1990 questionnaire was revised from 113 to 93 questions and the 1990 follow-up questionnaire was revised to 74 questions.

The Hurricane Hugo health assessments were devised not only to answer some very important questions for the health department but also to address concerns of other agencies. The initial assessment instrument was divided into several areas: demographics, response to alert, home characteristics, construction characteristics, health, and utilities. Health was subdivided into morbidity, mortality, and mental health status. The follow-up assessment instrument included all of the major categories of the

¹ Technical assistance during the data analysis was provided by Robert Linkins and Robert Fagan, epidemiologists at the CDC.

initial assessment but added questions concerning injuries, a rating of public agencies, and questions about the public's attitude toward "taking items without permission."

Data Collection

As discussed earlier, data collection in both surveys took approximately 12 weeks – November 1989 through January 1990 for the initial survey, and August 1990 through October 1990 for the follow-up. Again, the samples were nonreplacing; therefore, every effort was made to reach households. Hard-to-reach households were visited at different times of the day and week. In some cases neighbors were contacted first in order to reach the selected households. In cases where a family had left the island, an effort was made to obtain a current telephone number.

Plot maps from the Department of Public Works and the Recorder of Deeds were consulted in order to locate hard-to-find households. After the "easy-to-find households" were completed, WAPA's chief meter reader was consulted regarding directions for the other houses and situations where the meter number selected was different from the house at that address.

RESULTS

The results are presented in narrative form supplemented by the graphs included in the Appendix on page 39.² Since the follow-up questionnaire omitted some of the questions on the initial questionnaire and added some new ones, some of the results reflect only one point in time; this is noted when it occurs.

Table 2 shows the disposition of the interviews. The completion rate in both assessments was very high – 84% in the initial study, 89.6% in the follow-up. Our combined refusal rate was less than 2% for the two surveys.

² Not all of the data are presented here or in the Appendix. For a complete set of findings and/or a copy of the survey instruments, contact the author.

TABLE 2
DISPOSITION OF INTERVIEWS
HURRICANE HUGO HEALTH ASSESSMENTS

	<u>1989-1990</u>	<u>1990-1991</u>
Completed	84.0%	89.6%
Refused	1.0	4.0
Off-island for Hugo	5.0	2.0
Vacant during Hugo	5.0	0.8
House Destroyed/NC	4.0	4.0
Not a residence	1.0	0.4

Age

Among the households studied, 10-19 year olds were most prevalent (21.5%), followed by 0-9 (18.1%), 40-49 (16.5%), 30-39 (13.2%), 20-29 (12.2%), 50-59 (8.3%), 60-69 (5.9%), 70-79 (2.9%), and 80+ year olds (1.3%).

Sex

Females comprised 53% of the study population and males 47%. Again, actual respondents were primarily women (75.5%).

Race and Ethnicity

Blacks comprised 79.5% of the population in the first survey and 81.2% in the second survey, averaging 80.4% of the population; whites, 16.8% and 14.5%, averaging 15.7%; Hispanics, 18.0% and 16.4%, averaging 17.2%, with 68.8% indicating they were black and 15.1% indicating they were white. These data were consistent with previous surveys.

Notably, 13.1% stated they were "Other" but did not identify themselves as Asian, 1.5% of the Hispanics did not know their race, and 1.0% refused to answer. Clearly, it is increasingly difficult for individuals to define race versus ethnicity and to recognize the former as a genetic factor and the latter as a cultural or linguistic trait.

Of the Crucian residents, 81.6% were black, 13.6% were

white. Of the St. Thomians, 80.4% were black and 16.4% were white. Of St. Johnians, 71.2% were black and 28.8% were white, but with a 9% shift in the racial composition from white to black after the storm. In the first study, 66.1% of the St. John population was black and 30.4% white. After the storm, the black population increased to 75.6%, and the white population decreased to 21.1%, showing an apparent exodus of whites from St. John.

There are clear differences in the Hispanic population by island. Of the residents on St. Croix, 21.6% are Hispanic. On St. Thomas, 13.4% are Hispanic, but on St. John, only 2.4% are Hispanic. Of all the Hispanics in the territory, 66.4% live on St. Croix, 41.6% live on St. Thomas, and 2.2% live on St. John. On St. Croix an analysis of the black and white population by ethnicity reveals that of the 81.6% that are black, 17.6% are black Hispanic, 82.0% are black non-Hispanic. Of the 13.6% that are white, 24.7% are white Hispanic and 74.0% are white non-Hispanic. On St. Thomas, of the 80.4% that are black, 11.9% are black Hispanic; 88.1% are black non-Hispanic. Of the 16.4% that are white, 12.2% are white Hispanic; 87.8% are white non-Hispanic. On St. John, 2.9% of blacks are Hispanic; 97.1% are non-Hispanic; 100% of whites are non-Hispanic.

Island of Residence

Of the respondents, 52.6% were from St. Thomas, 46.7% from St. Croix, and 1.6% from St. John. As stated earlier, St. John was oversampled and analyzed separately from St. Thomas and St. Croix. However, the slight shifts in island population reflected in this study remain interesting. Both St. Thomas and St. John have grown, perhaps as a direct result of the storm.

Place of Birth

A significant finding is the continuing increasing percentage of the population born outside the Virgin Islands; 43.7% of those studied were born on other Caribbean islands. Of the remainder, 15.6% were born in St. Croix, 15.8% in St. Thomas, 14.5% in the U.S., 5.6% in Puerto Rico, 0.9% in St. John, and the

remaining 3.9% were born elsewhere.

The proportion of whites born on St. Thomas (12.1%) was three times that born on St. Croix (3.3%). The majority of respondents born on other Caribbean islands were black (97.2%) versus white (1.4%), while those from the U.S. were three times more likely to be white (64.7%) than black (33.5%). Of all the whites in the territory, the majority (59.3%) were born in the U.S. Of all the blacks, the majority (52.9%) were born on other Caribbean islands.

More respondents born on St. Thomas stayed on St. Thomas to live (94.0%) than did respondents on St. Croix (81.7%). Of the people born on St. John, 80% lived on St. Thomas. Of the respondents born in Puerto Rico, 70.8% lived on St. Croix. Of respondents born on other Caribbean islands, 49.3% lived on St. Thomas, 49.7% lived on St. Croix, and 1.0% lived on St. John. Of respondents born in the U.S., 53.9% lived on St. Thomas and 40.1% on St. Croix. This subpopulation is even more significant on St. John; over 6.0% of all Virgin Islands residents born in the U.S. live on St. John, although St. John represents only 1.8% of the total population.

Displacement by Island

As the storm approached, 8.1% of St. Thomas residents, compared to only 2.1% of St. Croix and 1.7% of St. John residents, left their island because of Hugo. After the storm, an additional 1.3% of St. Thomas residents left, for a total displacement by Hugo of the St. Thomas population of 9.4%. On St. Croix there was a dramatic exodus of an additional 24.1%, for a total of 26.2% of the population leaving the island as a result of Hugo.

One year later, 24.7% of the St. Croix population had left and 39.4% of those had not returned – a total of 9.7% of the population. On St. Thomas, 8.5% of the population had left and 60.9% of those never returned – 5.1% of the population. On St. John, 1.7% left before the storm and an additional 2.6% for a total of

4.3%. One year later, an additional 1.3% had left. Thus, a total of 5.6% of St. Johnians left the island and 40% did not return - 2.2% of the total population.

The 1990 U.S. Virgin Islands census reported a decline of the total population, but with St. Croix having more residents than St. Thomas (St. Croix - 50,139; St. Thomas - 48,166; St John - 3,505). Our data clearly show that the significant displacement on St. Croix was short-lived, although approximately twice as many residents have still not returned to St. Croix compared to St. Thomas or St. John. One might speculate that either there was an undercount on St. Thomas (the opinion of many officials including the governor) or that the storm negated the tremendous growth of St. Croix since the 1980 census.

Another significant effect of Hugo was the apparent exodus of school-age children, especially those nearing graduation. Six percent of the total school population - 3.3% of the family members on St. Thomas and 0.9% of the family members on St. John - went to school off-island because of Hugo. For St. Croix, 9.2% of the school population exited.

One year later, the exodus had increased. Approximately 13.1% of St. Croix students had left, and 92.1% of those had not returned, for a total student displacement of 12.1%. On St. Thomas, 3.9% had left and 98.9% had not returned for a total displacement of 3.8%. On St. John, 3.4% left and none had returned. These findings are significant and might suggest serious psychosocial consequences for these adolescents.

Income

There were significant shifts in income distribution as a result of the storm. In the first analysis, 23.0% of the population earned less than \$10,000 - the largest single income group. They were followed by the 17.0% who earned \$10-15,000; 11.6% who earned \$16-20,000; and, at the opposite extreme, 10.3% who earned more than \$50,000. One year later, the largest group was those who earned \$16-20,000 (33.4%). Those earning less than \$10,000

had decreased to 17.3%, and all other income brackets had decreased as well, except the \$36-50,000 group in which there was a slight increase from 7.7% to 10.5% and the \$10-15,000 group which experienced no change.

However, it is important to note the shift in income by race. In the original study, 23.8% of whites versus 7.3% of blacks earned over \$50,000, while 13.9% of whites versus 25.1% of blacks earned less than \$10,000. Hispanics paralleled blacks; 23.6% earned less than \$10,000, and 7.5% earned more than \$50,000.

In the follow-up one year later, there was a clear shift in income among all races, with a statistically significant, larger portion earning \$16-20,000 in all cases. At the same time, the proportion of whites earning more than \$50,000 dropped significantly to 7.4%. Further analysis shows that the latter shift in income was due to whites leaving the island. One year after the storm, among persons earning more than \$50,000, 46.2% of whites had left versus only 7.4% of blacks.

Of those who made more than \$50,000, 74.0% had insurance versus 32.5% among those who earned less than \$10,000.00.

It is interesting to note that of those respondents who earned \$10,000 or less, 51.4% used public water as their source for drinking water, versus 2.7% of those who earned over \$50,000.

When looking at the relationship between education and income level, although the number of technically trained individuals was small, it is interesting to see the drastic changes in their income following the storm. These findings show the commonly perceived increase in earning capacity of technically trained persons post-Hugo.

Of those earning over \$50,000, 40.3% were born in the U.S.; 24.2% in other Caribbean islands; 16.1% on St. Croix; and 9.7% on St. Thomas. Of respondents born in Puerto Rico, 31.3% earned less than \$10,000. Of St. Croix-born respondents, 18.1% earned less than \$10,000, versus 13.0% of St. Thomas-born respondents.

St. Croix residents are poorer than St. Thomas residents. The former represent 59.0% of those who earn less than \$10,000 and 40% of those earning greater than \$50,000. The latter represent 36.3% of those earning than \$10,000 and 60% of those earning more than \$50,000.

There was three times more depression among those earning less than \$10,000 (23.9%) compared to those earning greater than \$50,000 (8.0%).

In addition, right after the storm, of those who earned less than \$10,000, 1.4% had great difficulty gaining access to health care; 9.4% had some difficulty; 62.3% had no difficulty; and 26.1% did not need care. Of those who earned \$20-30,000 - the usual gray zone for receipt of health care services - none had great difficulty; 11.8% had some difficulty; 46.1% had no difficulty; and 48.1% did not use the services. Of those who earned greater than \$50,000, none had great difficulty; 6.5% had some difficulty; and 46.8% had no difficulty. One year later, access had improved; among those earning less than \$10,000, none had great difficulty or some difficulty, and 99% had no difficulty. Of those earning \$20-40,000, 100% had no difficulty. Of those earning greater than \$50,000, none had great difficulty; 18.4% had some difficulty; and 81.6% had no difficulty. These figures speak well for the structure of the health delivery system in the U.S. Virgin Islands, where over 99% of the population had contact with health care, and the most needy were well served.

Education

Almost 40% of the population did not graduate from high school, and only 20.9% had a college education or postgraduate training. Proportionally, approximately two and a half times more whites (37%) had a college education and postgraduate training compared to blacks (14.2%).

St. Thomas has a more educated population than St. Croix. On St. Croix 46.5% of the population had less than a high school education, versus 39.8% on St. Thomas. Both islands are about

equal in respondents with a college education or higher: 15.3% for St. Croix and 16.0% for St. Thomas. Both islands reported a critically low number of technically trained respondents - 1.9% for St. Croix and 0.4% for St. Thomas - suggesting that the need for outside assistance in rebuilding was real and not just driven by opportunity for capital gains in the construction industry.

Response to Alert

Radio was the overwhelming means of alerting the public to the impending storm; 81.0% of respondents first became aware of the storm through a radio alert. The next most significant means were television (8.3%), and word of mouth (6.0%). Among all respondents, 82.0% remained at home during the storm.

Of the 18.1% that evacuated, 68.5% did so because of the perception of danger; 3.7% because they were asked to do so by the authorities; 2% because of both a request by authorities and danger; and 20.4% because of other reasons.

Of the respondents who did not evacuate, 66.3% felt their home was safe; 9.5% felt no real danger; and 7.5% simply stated they had sized up the situation and decided to stay home. Of those who stayed, 47.4% took refuge last in the bedroom; 17.4% in the living/dining room; and 7.7% in the bathroom.

Home Ownership

There were striking differences in the amount of damage to homes when measured by home ownership and by island. However, there was a consistent decrease in percentage of damage when comparing homes owned to homes rented to government-owned homes (see Table 3).

On St. Croix, 80.9% of owned homes were damaged versus 51.9% for St. Thomas/St. John. On St. Croix, 37% of government-owned homes were damaged versus 22.2% on St. Thomas/St. John. The relative risk of sustaining damage to a home was less than half (46% for St. Croix and 43% for St. Thomas/St. John), if a person lived in public housing.

TABLE 3
 HURRICANE DAMAGE TO WALLS OR ROOF FOLLOWING HURRICANE HUGO
 U.S. VIRGIN ISLANDS

	<u>Damaged*</u>		
	<u>Pop</u>	<u>No</u>	<u>Rate</u>
Home Ownership			
own home	343	225	63.6%
rent home	187	92	49.2
government owns home	63	13	28.6
housesitting	7	6	85.7
Home Insurance			
no	166	93	56.0
yes	294	183	62.2
Type of Home			
single family home	393	253	63.7
mobile home	19	13	68.4
duplex	14	7	50.0
apartment	169	59	34.9
Water Source in Home			
public	37	11	29.7
cistern	403	241	59.8
well	7	5	71.4
bottled	149	83	55.7
Wall Construction of Home**			
poured concrete	59	29	49.2
wood frame, wood siding	56	41	73.2
wood frame, metal siding	17	11	64.7
metal building	6	4	66.7
metal frame, wood siding	8	7	66.7
concrete block	385	216	56.1
brick or stone	9	7	77.8
Roof Construction of Home**			
concrete	113	31	27.3
wood frame, shingle	5	3	60.0
wood frame, tile	3	3	100.0
wood frame, Hypolen	55	30	54.6
wood frame, gal. screwed	143	84	56.7
wood frame, gal. nailed	178	143	80.3
wood frame, gal. unknown	22	12	54.6
wood frame, tar paper	4	1	25.0
metal frame, gal.	22	9	40.9

*at least "some" damage incurred by walls or roof

**damage was to either walls or roof or both

Among those who owned their homes, 41.9% applied to the Federal Emergency Management Agency (FEMA) for aid, but the highest percentage of applications came from respondents who lived in government-owned housing (64.1%).

Homes Insured

Of all dwellings, 48.8% were insured, 28.6% were not; the response for 12.0% was "not applicable" because they were owned by the government or the respondent was house sitting. An additional 10.1% of the respondents did not know their home insurance status. Among whites, 61.5% were insured versus 46.2% of blacks.

Damage was greater for the insured (62.2%) than uninsured (56%) (see Table 3). On St. Croix, 79.8% of the insured versus 63.2% of the uninsured had damage; on St. Thomas/St. John, 51.1% versus 46.5%. Did respondents with more solidly built homes feel that insurance was not needed? Were they just risk takers? Or were they just lucky?

Interestingly, 28.9% of those without insurance did not request funds from FEMA. Did they have no damage or were they put off by the process? Indeed, many anecdotes circulated about owners concerned over "people getting in their business," the confidentiality of the application process, and the repayment process. Some felt the application was so complicated that they gave up in the process of filling it out. Others were put off by the large volume of paperwork required. Still others were alienated by the attitude of the employees of FEMA.

Also of interest, 42.7% of those with insurance applied to FEMA. Were they underinsured or part of the unfortunate group whose insurance companies were in default in making payments? Several major insurers of Virgin Islands residents issued checks that bounced, declared bankruptcy, or simply stalled without ever paying claims. Alarming, of those who applied, only 59% received assistance, while only 75% of those with no insurance received assistance. Moreover, only 7% of those without insurance

received Small Business Administration (SBA) assistance, and only 11.2% of all the population received SBA assistance, despite the huge sums that were reported spent in the territory.

Status of Housing/Potential for Return to Previous Home

The follow-up survey showed that 89.2% of respondents were living in the same house that they occupied before Hugo. Conversely, of those displaced on all three islands, only 23.7% reported they intended to return to the home that they lived in the week before Hugo.

Type of Housing

Before Hugo, 65.2% of respondents lived in single family dwellings; 28.1% in an apartment/condominium/dormitory; 3.3% in mobile homes; 2.4% in duplexes; and 0.2% on boats.

Damage by Type of Housing

In the Virgin Islands, mobile homes sustained the most damage (68.4%) and apartments the least (34.9%) (Table 3).

Walls

In comparing wall construction, metal frame with wood siding had the highest risk of damage (1.78 times that of poured concrete). On St. Croix, 100% of homes with metal frames and wood siding were damaged (Table 3). Additional results (not shown here) demonstrated clear differences in the relative risk of damage by island.

One year later, of the population that had reconstructed walls, 53.6% had reconstructed with concrete blocks; 19.6% with poured concrete; 19.6% with wood frame and wood sidings; and only 1.8% with metal buildings. Apparently, much of the population took heed and reconstructed with the lessons from Hugo in mind. However, the small percentage that lived in mobile homes and that had sustained considerable damage typically returned to the same type of home.

Roof

In comparing damage by type of roof, on all three islands the highest damage consistently was to wood frame, tile roofs (100%) followed by wood frame, galvanized nailed roofs (Table 3).

One year later, those who had reconstructed their roofs still used wood frame, galvanized construction, whether screwed (26.7%) or nailed (24.8%), more than any other type of roof construction. Only 8.6% of new construction used concrete.

Windows

Taped windows sustained more damage (46.7%) than those not taped (27.9%) (Table 4) - a pattern that was consistent on all three islands and at all levels of damage. Clearly, taping windows was not helpful and resulted in an increased risk of damage.

Preference for Temporary Housing

The first question asked about temporary housing was "If it were available would you apply?" The responses changed significantly over time. Right after the storm, only 37.1% said yes, while one year later, this response almost doubled to 62.9%. The change probably was due to the difficulty victims had in getting help to reconstruct quickly and effectively. Many people remained in their damaged homes while they were under repair and found that such living conditions were a tremendous challenge. Apparently, on reflection many would have chosen temporary housing.

Respondents were asked what type of temporary housing would be acceptable if another hurricane struck tomorrow and destroyed their home. They were given eight choices and asked to respond affirmatively to each choice that was acceptable. Trailers were added as an option in the follow-up analysis. The choices and responses are shown in Table 5.

Only a small portion of the population initially found any of the temporary housing that was available after Hurricane Hugo acceptable. However, their understanding and acceptance of prefab housing and trailers grew over the year, probably because of positive experience with prefab modular structures such as a

prefab modular hospital that was erected, modular units installed at a high school, and other such dwellings that were used successfully after the storm.

TABLE 4
HURRICANE DAMAGE TO WALLS, ROOF, OR WINDOWS
FOLLOWING HURRICANE HUGO
U.S. VIRGIN ISLANDS

	<u>Pop</u>	<u>Damaged</u>	
		<u>No</u>	<u>Rate</u>
Wall Construction of Home*			
poured concrete	59	4	6.8
wood frame, wood siding	56	21	37.5
wood frame, metal siding	17	5	29.4
metal building	6	3	50.0
metal frame, wood siding	8	5	62.5
concrete block	385	36	9.4
brick or stone	9	3	33.3
Roof Construction of Home**			
concrete	113	27	23.9
wood frame, shingle	5	3	60.0
wood frame, tile	3	3	100.0
wood frame, Hypolen	55	27	49.1
wood frame, gal. screwed	143	83	58.0
wood frame, gal. nailed	178	139	78.1
wood frame, gal. unknown	22	12	54.6
wood frame, tar paper	4	1	25.0
metal frame, gal.	22	9	40.9
Windows***			
wood louvers	204	73	35.8
metal louvers	414	192	46.4
glass louvers			
taped	75	35	46.7
untaped	111	31	27.9

*numbers shown indicate homes with damaged walls

**numbers shown indicate homes with damaged roofs

***numbers shown indicate homes with damaged windows (by specific type)

TABLE 5
CHOICE OF TEMPORARY HOUSING FOLLOWING HURRICANE HUGO
U.S. VIRGIN ISLANDS

<u>Order of preference</u>	<u>1989-1990</u>	<u>1990-1991</u>
1. Immediate repair of the roof organized by the federal government	69.2%	66.1%
2. A prefab home withstanding 170 mph winds	63.4	78.9
3. Immediate repair of the roof organized by the local government	55.9	61.7
4. Local government control and assignment of vacant housing	50.6	56.3
5. A shelter	35.9	45.5
6. A prefab home withstanding 70 mph winds	32.4	45.3
7. A tent	27.0	31.4
8. A wooden building such as a shed	25.1	32.7
9. A trailer	n/a	54.7

Health Effects

Mortality

There were no statistically significant changes in the number of persons who died following Hugo. By the time of the second survey, 1.1% of the population had died - 0.7% right after Hugo and a cumulative 1.1% one year hence. Although this survey question did ask cause of death, it did not ask if the deaths were a direct or indirect result of Hugo. We simply wanted to know if there were any significant differences due to the storm. None were found.

Psychosocial Effects

We expected changes in the emotional state of the respondents, and a significant portion of the survey was dedicated to discovering these effects. This report focuses on four of the

many questions, of which three looked at activities of adults and one looked at activities of children.

Immediately after the storm, 13.5% of respondents felt their relationship with their spouse or partner got better; 6.3% felt it got worse; and 55.7% felt it did not change. The other 24.5% did not think the question applied to them or did not know. One year later, the responses were even more positive with 21.3% stating that the relationship was better.

Although newspapers reported excessive violent behavior among the population, only 8.2% reported more anger, 1.2% reported less anger, and 28.3% reported the same amount of anger as a month before the storm. Over 60% of the population reported the question of anger was not applicable in that there was no violent behavior. Of those who were more angry, 51.0% were on St. Croix, 40.8% were on St. Thomas, and 8.2% were on St. John. These proportions differ from the population distributions of the islands and show a higher incidence of anger in St. Croix and St. John.

An interesting finding was the response to a question regarding emotional closeness of the respondents to friends/family. The majority (51.6%) felt closer than the month before Hugo; 43.8% felt no difference; and 4.0% felt farther apart. One year later, 40.4% felt closer, and a larger percentage (57.0%) saw no difference. Consistent with the other negative psychosocial effects, fewer than 2.5% felt farther apart than the year before. We analyzed these figures to see if they reflected the feelings of individuals who had left the territory but found no significant difference between those who left and those who stayed.

We found very little change in the behavior of children with respect to sleep difficulties, nightmares, bladder control (bed-wetting), speech problems, excessive clinging, energy level, or sibling fighting.

Depression Index

On the standard (CES-D) depression index, immediately after the storm 34.3% of St. Croix respondents showed depression versus

25% of those on St. John and 20.9% on St. Thomas. The standard norm of depression in a population is 17%. However, on re-analysis, when we deleted those who did not know, who answered not applicable, or refused, we found less depression. Thus, right after the storm, 22% of St. Croix, 13% of St. Thomas, and 16.7% of St. John respondents reported being depressed. One year later, the same sample showed 13.3% for St. Croix, 8.6% for St. Thomas, and 5.6% for St. John. These results clearly show a higher rate of depression (double the standard percentage) on St. Croix, the island most affected by the storm. However, the results also generally show a population with a strong, healthy psyche.

Health Status

Source of Drinking Water and Its Effects on Health

Among all respondents, 67.1% used cistern/rainwater before the storm; 24.8%, bottled water; 6.2%, public water; 1.2%, well water; and 0.8%, some other source. Most public water consumption occurred among children less than 18 years old, probably because of the use of public water fountains in the schools.

Among whites, 74.3% used cistern water, versus 65.1% of blacks. Among blacks, 7.7% used public water, while no whites did so. Of blacks, 25.3% used bottled water, compared to 20.8% of whites. These responses were consistent for St. Thomas and St. Croix. However, St. Johnians only used cistern water (75%) and bottled water (25%).

The source of drinking water after the storm changed dramatically. Use of bottled (store bought) water increased to 54.2%, while 32.9% of respondents used cisterns, and 5.7% used buffalo (army water trailer/trucks). As it turned out, this change was detrimental, for we found that 60.9% of those who developed diarrhea used bottled water versus 25.3% of those who used rain water. We postulate that the respondents assumed that the bottled water was clean (but that cistern water was not), and we believe that our public service announcements on the use of

cistern water ~~after~~ the storm were heard and translated into action. The respondents chlorinated their cisterns and boiled their water, resulting in a decrease in coliform bacteria in the water and thus less diarrhea. The respondents who used bottled water, on the other hand, assumed that the water was safe and did not boil it or take any other precautions, resulting in the ingestion of coliform bacteria and consequent diarrhea.

In April 1990, both the St. Croix Avis and the V.I. Daily News reported on water contamination and the analyses of water samples by the Environmental Protection Agency and by the Caribbean Research Institute. The institute found contamination of bottled water from the major distributor of bottled water in the territory, reinforcing our findings.

One year later, the population reverted to its pre-Hugo sources of drinking water.

Physical Injury

The survey showed that those who lost roofs incurred more injury on St. Croix but not on St. Thomas and St. John. Although injury was higher for those who lost some or all of their glass windows, the majority of those who had all windows lost did not have injury.

In all, 6.3% of the population had injury from Hugo. Of the injuries, those to feet and toes were most prevalent at 3.2%, followed by spine and back (1.3%), and legs and hip (1.3%). These injuries included broken bones, cuts requiring stitches, cuts or abrasions without stitches, concussion, bruises, punctures, foreign bodies, and other miscellaneous injuries with no significant difference or predominance. The most common type of accident was striking against a stationary object in the home. Most individuals recovered completely (48.6%) or partially (31.4%).

Of those injured, 8.2% received a tetanus shot. Of those who stepped on a nail or were badly cut and had not had a tetanus shot within the previous 10 years, only 25% received a new shot. Of those who had had a tetanus shot within 10 years, 59.5% re-

ceived another shot. Clearly the immunization policy of the U.S. Virgin Islands Department of Health is not being followed.

Personal Habits

Access to Health Care

In the 1989 survey, the majority (85%) of the population indicated no problem obtaining medical care after the storm; 77.9% reported no difficulty in the follow-up survey. Only 2.7% had serious problems with access to medical care right after, compared to 10.7% one year later. The relationship between access and income was discussed earlier, and we indicated that all income groups reported few problems with access. However, it appears there are more problems with access now. Perhaps the population's expectations and needs have changed.

Payment for Health Care

The assessments revealed that 55% of respondents did not need medical care. Of respondents needing medical care, 44.1% paid for their total care; 14.3% used Virgin Islands government insurance; and 11.5% received free service. Surprisingly, only 8.4% used a medical assistance (Medicaid) card, and 8% used Medicare. One year later, only 9.7% had not needed medical assistance. Of those who used health care in the year following Hugo, 33.5% stated they fully paid themselves; 24.8% used Virgin Islands government insurance; 14.4%, Medicare; 10.6%, other third party payment; 8.5%, free care; and 7.9%, Medicaid. These last two figures are surprising, since the Medicaid eligible population is 33% of the total population. At the same time, the findings on free care vary considerably from reports of hospitals, where officials say that nearly 50% of care is free because of nonpayment. The question in our assessments asked how respondents paid for care. Is the difference a hospital billing/management problem, a bias against those who cannot afford or cannot pay for off-shore hospital care, or is it an unwillingness of the population to accurately report how they paid for care?

Smoking and Drinking

The data did not show any significant difference in smoking or drinking among the population before and after the storm.

UtilitiesElectricity

By the conclusion of the first assessment, 83.4% of the Virgin Islands had electricity. On St. Croix, 69.5% of the respondents had WAPA power, and 14.9% were using generators. On St. Thomas, 95.4% had WAPA power, and 1.3% had generators. On St. John, 98.3% had WAPA power, and 1.7% had generators.

One year later, the disparity still existed with 100% of St. Thomas and St. John having power, compared to 83.1% of St. Croix. Also of note is the length of time WAPA took to restore power (Table 6).

TABLE 6
LENGTH OF TIME BEFORE POWER RESTORED
COMPARISON AMONG ISLANDS

<u>Island</u>	<u>Weeks</u>								
	0	4	8	12	16	20	26	32	54
	<u>Percentage of Respondents with Electricity</u>								
St. Croix	0	11.9	24.2	57.2	78.0	88.9	93.4	95.6	96.4
St. Thomas	2.2	37.9	72.4	92.7	95.7	97.2	98.6	99.7	100
St. John	0	60.1	86.8	100					

The Crucian population was very vocal through their senators and the media about the disparity in services that were available to the St. Thomas population versus the Crucian population. These data support that perception of disparity.

Telephone

In the first survey, 35.9% of the Virgin Islands population had telephone service; 3.4% on St. Croix, 14.0% on St. Thomas and

6.7% on St. John never lost service. There ~~was~~ **wide** disparity among the islands. Of St. Johnians, 81.1% had telephone service, versus 60.3% of St. Thomians and 7.8% of Crucians. This may reflect the amount of damage by islands, the ~~responsiveness~~ of repair crews on each island, and/or the timing of the survey. St. Thomas was surveyed two weeks later than St. Croix. One year later, 84.8% of the population had telephone service. As with electrical service, the difference in restoration of service by island was significant (Table 7).

TABLE 7
LENGTH OF TIME BEFORE TELEPHONE SERVICE RESTORED
COMPARISON AMONG ISLANDS

Island	<u>Weeks</u>								
	0	4	8	12	16	20	26	32	54
	<u>Percentage of Respondents with Telephone Service</u>								
St. Croix	4	7.1	13.7	20.8	31.6	46.6	58.6	74.5	84.4
St. Thomas	14.5	43.8	59.5	73.9	82.7	87.2	93.1	96.5	96.5
St. John	2.2	46.7	86.8	100					

Attitude and Behavior

Attitude Toward

"Taking Things Without Permission"

Boyd (1991) reports that over half of the sampled population of both St. Thomas and St. Croix believed that it was reasonable to take food in the aftermath of the major disaster, whereas only 10% thought it reasonable to take nonessential items like gold, jewelry, or perfume. In our survey, we asked:

After the storm, some people in the V.I. took various items without permission. Do you think it reasonable that people took any of the following: FOOD, CLOTHING, BUILDING MATERIALS & TOOLS, FURNITURE & APPLIANCES, GOLD, JEWELRY, AND PERFUME?

Did any of your neighbors take items without permission?
 We do not want to know who did

The results for the aggregate U.S. Virgin Islands showed that 46.9% felt it was permissible to take food; 24%, clothes; 13.7%, building materials; 4.3% furniture and appliances; but only 1.8%, gold, jewelry, and perfume. For the island of St. Croix, more than 50% felt that it was all right for individuals to take food, compared to 31% on St. Thomas, and 33.3% on St. John.

There were also significant differences in responses to the question concerning knowledge about neighbors taking things without permission; 16.9% of the St. Croix population were aware of such activity, whereas on St. Thomas, 3.7%, and on St. John, 3.3%. In all, less than 10% of the general sample knew people who took things without permission.

Rating of Government Agencies

Table 8 shows the rating of agencies by the population before and after Hugo. It is clear from the findings that the ratings of most of the agencies improved after Hugo. Notably, less than 10% of the population rated the services of the hospital to be very good, yet 38.1% rated it good. Health fares better in that 45.8% of the population rated the services as good. In comparison, nationally, 38% of a sample of mainland U.S. residents rated the U.S. health care system (i.e. the health system on the mainland) excellent or good (Employee Benefit Research Institute, 1991), suggesting that the Virgin Islands population is not as displeased with health services as is usually reported in the media.

TABLE 8
 RATING OF GOVERNMENT AGENCIES FOLLOWING HURRICANE HUGO
 U.S. VIRGIN ISLANDS

	<u>Very Good to Excellent</u>		<u>Good</u>	
	Pre-Hugo	Post-Hugo	Pre-Hugo	Post-Hugo
National Guard	12.8	15.3	52.3	52.5
VITELCO	12.1	13.2	49.5	49.8
Human Services	12.1	12.3	50.9	54.0
WAPA	11.7	16.2	51.4	55.6
Health	10.5	10.1	47.1	45.8
Education	9.2	9.2	44.4	45.8
Hospital	8.3	8.1	39.4	38.1
Public Works	8.1	9.6	39.5	43.5
Police	7.6	8.8	40.6	43.3
Consumer Services	7.0	8.1	37.0	37.5
Labor	6.9	7.2	37.7	40.8
The Legal System/Courts	6.0	6.9	37.0	39.4
Housing	5.1	5.8	32.1	35.4

DISCUSSION

Policy Issues

If they are to be productive, these unique Hurricane Hugo health assessments must be used by the agencies that respond to emergencies (either by managing them, providing services during and after them, or by aiding recovery and restoration) to develop effective policies. Taking into account the enormous destruction Hurricane Hugo caused in the Virgin Islands, the results presented here must be carefully studied and acted upon to ensure a proactive rather than reactive response to future emergencies. These assessments highlighted the enormous social problems that can face the Virgin Islands following a disaster - problems that can be exacerbated by the socioeconomic and educational differences between whites and blacks. With the native-born population now a minority, politicians who use the tactic of disenfranchising the immigrant with statements about "we born here" will find

themselves with a decreasing constituency.

The Hurricane Hugo health assessment follow-up confirmed that a portion of the population had permanently left the islands, supporting the very small population growth found by the 1990 census. However, the finding in that census that the St. Croix population is now the majority is curious when one considers that the largest exodus of persons in the territory was from St. Croix.

The lack of technically trained individuals in the Virgin Islands must be taken as a mandate by the Department of Education and the Board of Education. Mandatory classes in technical fields might be a start for reversing and eventually eliminating this deficit. Because people learn by experience and because economic reward in technical occupations is increasing, exposure in secondary schools to technical trades should result in many of our youth choosing these occupations and thus helping their community.

Many secondary students left school as a result of Hugo (more so on St. Croix than St. Thomas). Some schools lost so many students that certain classes were discontinued and teachers were asked to restructure their classes. With the decrease in the student population came a concomitant decrease in the number of teachers, as they too left the islands. This loss of close friends and role models must be traumatic for both students and parents. In planning for future disasters, it is critical to look at potential impacts on the school system - not only on physical plants, but on the people and structure that make up the institutions. Some preparations must be made to secure these vital resources.

The lessons for the insurance industry are major. No one would have anticipated the results discovered in these assessments. The disparity between the insured and the uninsured affects not only the health industry but also the housing industry. The limited assistance to home owners provided by SBA and

FEMA is alarming considering the vast sums of money reportedly spent in the territory. Clearly, one basic need - shelter - is not secure or insured if a disaster hits, and policy makers must seriously examine this issue.

The stability of the society is dependent on the population feeling assured that they will have shelter, that they will be able to sleep protected from the elements, and that in a disaster safe shelter will be available. This was not the case following Hugo, as demonstrated by these assessments.

Impact of Health Activities/Implementation of Findings

The analyses of injuries documented the limited physical injury experienced by the Virgin Islands population due to Hurricane Hugo. However, of serious concern was the finding that recommendations for tetanus immunizations were not followed. Whether the cause was adults being reluctant to obtain immunizations or medical professionals not following policies, the Virgin Islands Department of Health has to educate the public more vigorously regarding adult immunizations and monitor the sources of medical care for compliance with schedules and procedures.

The Hurricane Hugo health assessments did show that informing the public via public service announcements can be effective, as the results concerning drinking water clearly demonstrated. Indeed, taking into account the history of past disasters, and specifically hurricanes, the Virgin Islands Department of Health should probably be complimented because there were no epidemics. The assessments reconfirmed the value of an active health education program assisted by cooperative newspapers and radio and television stations.

Recovery from a natural disaster takes up to 18 months or more. The process varies from individual to individual and can involve recovery from actual physical injury, restoration of damaged property, or overcoming the stress of unemployment, monetary loss, and temporary separation from loved ones. All these consequences take an emotional toll on the population. For

1990, the St. Thomas Carnival Committee used the theme, "Stress Free Recovery for 1990." But as the Mighty Boo, the youngest Calypsonian for the 1990 Carnival Calypso tent sang,

I believe the Carnival Committee make a mistake
There will be recovery for 1990
But not stress free.

Our data support the Mighty Boo's position, but they also show that collectively the islands have a very healthy psyche. The population is no more depressed than the average for the rest of the U.S. The children are emotionally stable and healthy.

Attitudes and Behavior Regarding "Looting"

The Hurricane Hugo health assessments documented the attitude and behavior of the population concerning "taking items without permission." Clearly, an overwhelming majority felt that it was wrong to take luxury items, furniture and appliances, and building materials. But this attitude was not as strong regarding the taking of basic essentials such as food and clothing.

Rating of Services

Frankly, we were surprised at the favorable rating given most agencies, particularly that for health and hospital services. Although the media often report total dissatisfaction with medical services, in these assessments we found that almost one-half of the population rated the services of the Department of Health as good; a lower percentage (38.1%) rated Hospitals as good.

CONCLUSION

The problems demonstrated by this disaster cannot be solved unless there are drastic changes in the perspective of all Virgin Islands decision makers.

Health, and the institutions established to insure it, cannot be taken for granted. The system can be improved. For example, all of the elements of the information revolution - satellite communication networks, personal computers, computer networks, and facsimile machines - can now all be incorporated

into the effort to protect health.

Unlimited opportunities can blossom from the understanding that we are all one, when faced with a natural disaster such as Hugo. We must use our age of intelligence and technology to secure for ourselves a health delivery system that can respond to the needs of all.

In the U.S. Virgin Islands, it is very evident that natural disasters are part and parcel of the Caribbean. In this regard, Caribbean people must work collectively to solve or at least minimize the aftereffects of natural disasters. Health care providers, in particular, are mindful of the long-term impacts of these disasters. We can rebuild a roof in two months, but it can take much longer to repair the emotional scars due to a roof falling on a loved one.

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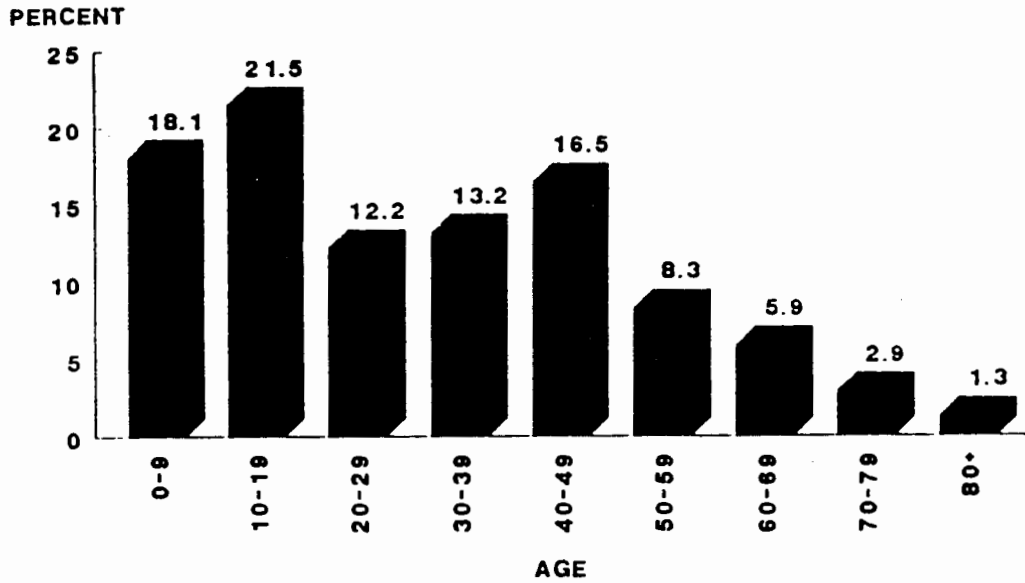
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AGE

U.S. VIRGIN ISLANDS

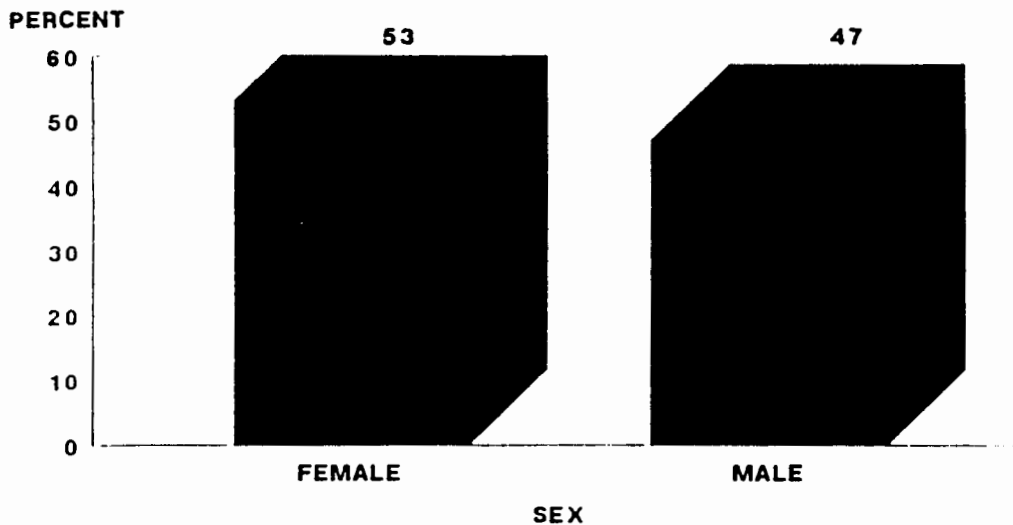
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



SEX

U.S. VIRGIN ISLANDS

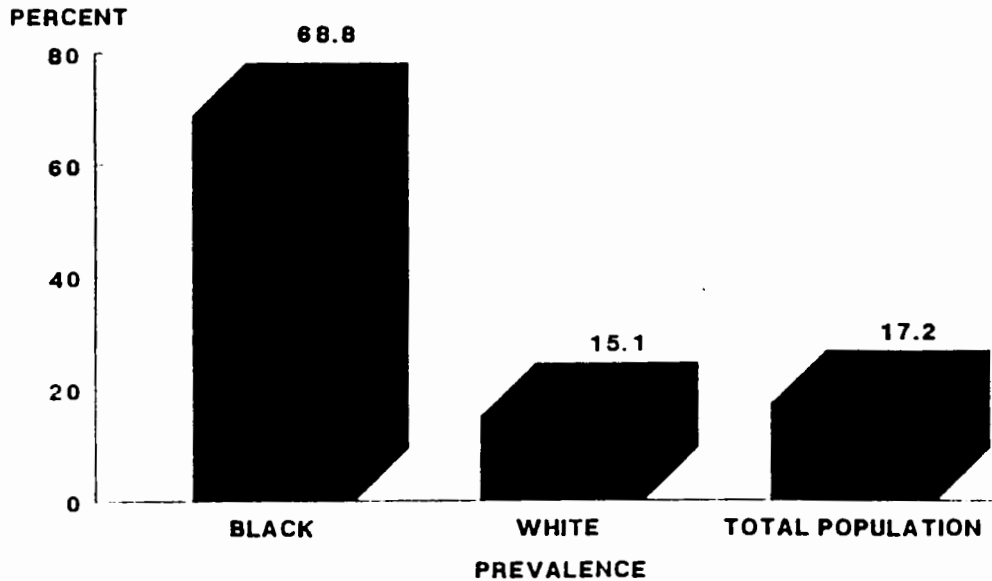
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



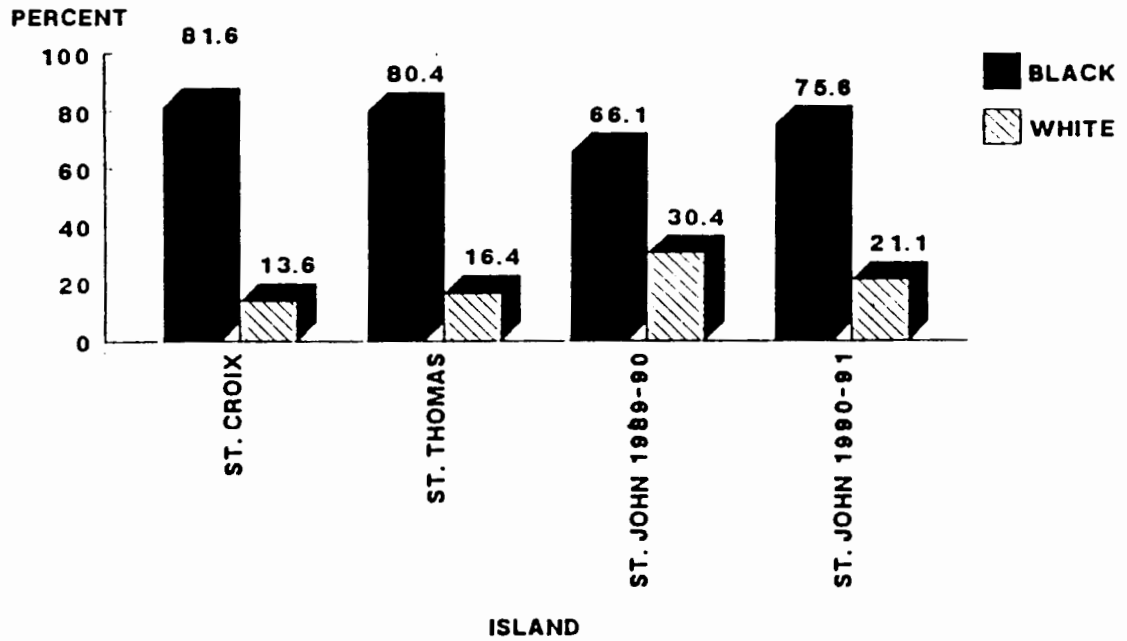
RACE U.S. VIRGIN ISLANDS HURRICANE HUGO HEALTH ASSESSMENTS 1989-91

BLACK		
PERCENT BY YEAR	1989-90	79.5
	1990-91	81.2
	AVERAGE	80.3
WHITE		
	1989-90	16.8
	1990-91	14.6
	AVERAGE	15.8
OTHER		
	1989-90	2.9
	1990-91	3.9
	AVERAGE	3.3
REFUSED/DON'T KNOW		
	1989-90	0.8
	1990-91	0.2
	AVERAGE	0.2

RACE OF HISPANICS U.S. VIRGIN ISLANDS HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



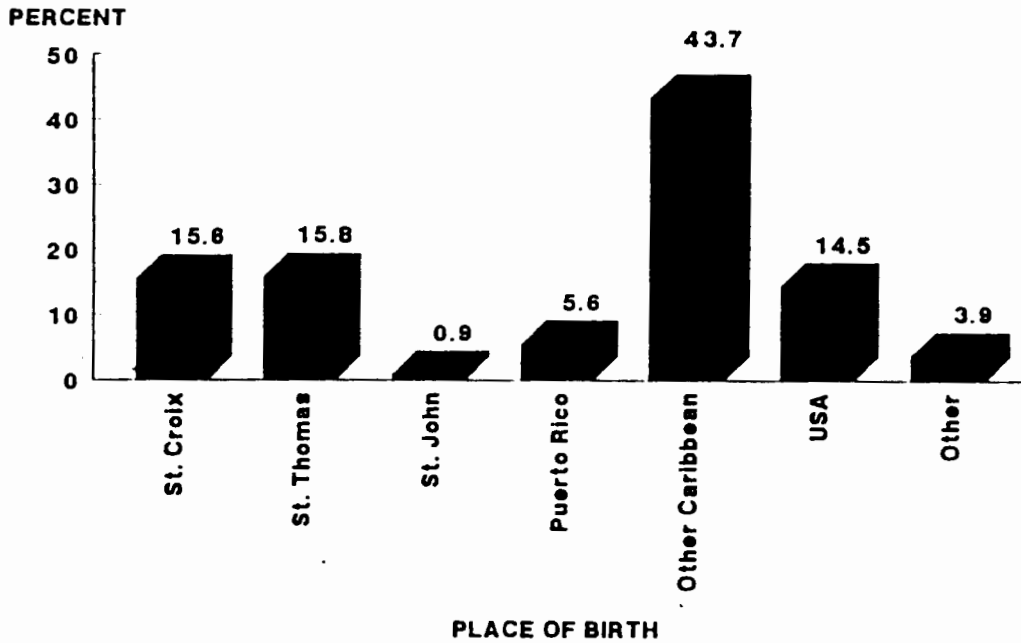
RACE BY ISLAND U.S. VIRGIN ISLANDS HURRICANE HUGO HEALTH ASSESSMENTS 1989-90



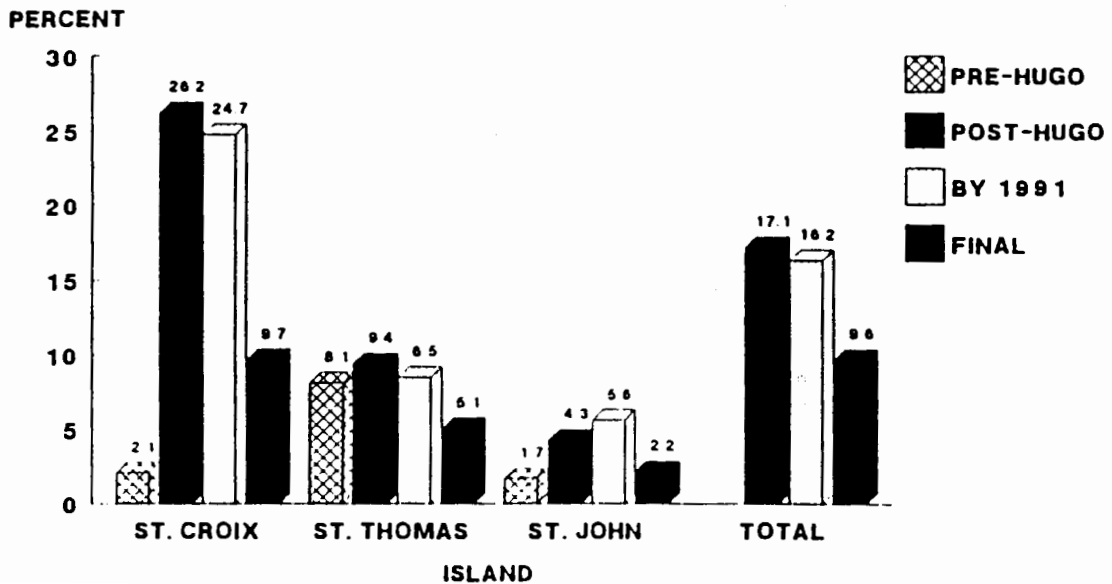
HISPANICS BY ISLAND U.S. VIRGIN ISLANDS HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



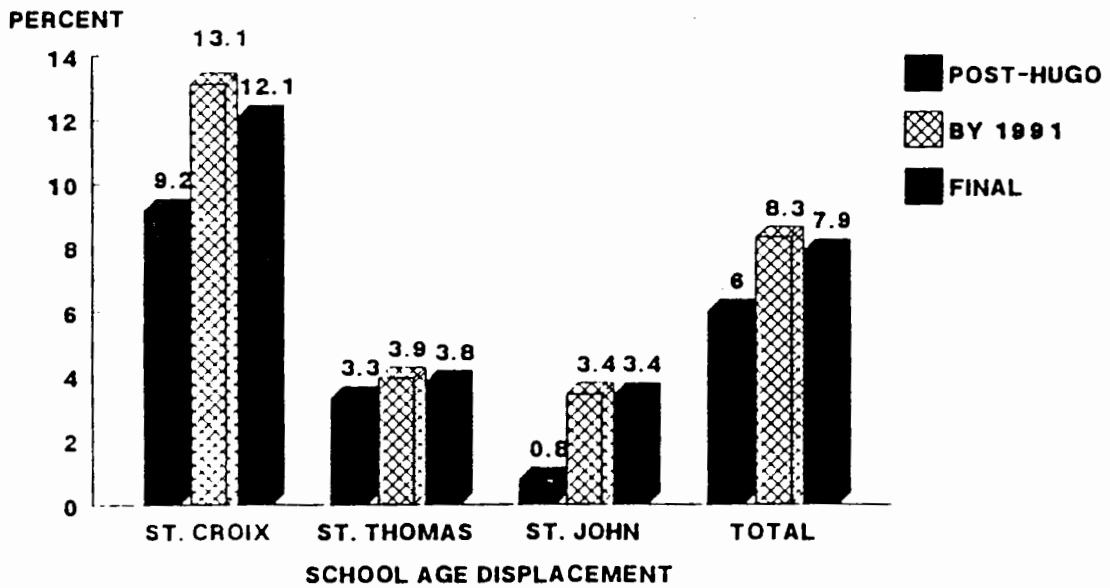
**PLACE OF BIRTH
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HURRICANE HUGO HEALTH ASSESSMENTS 1989-91**



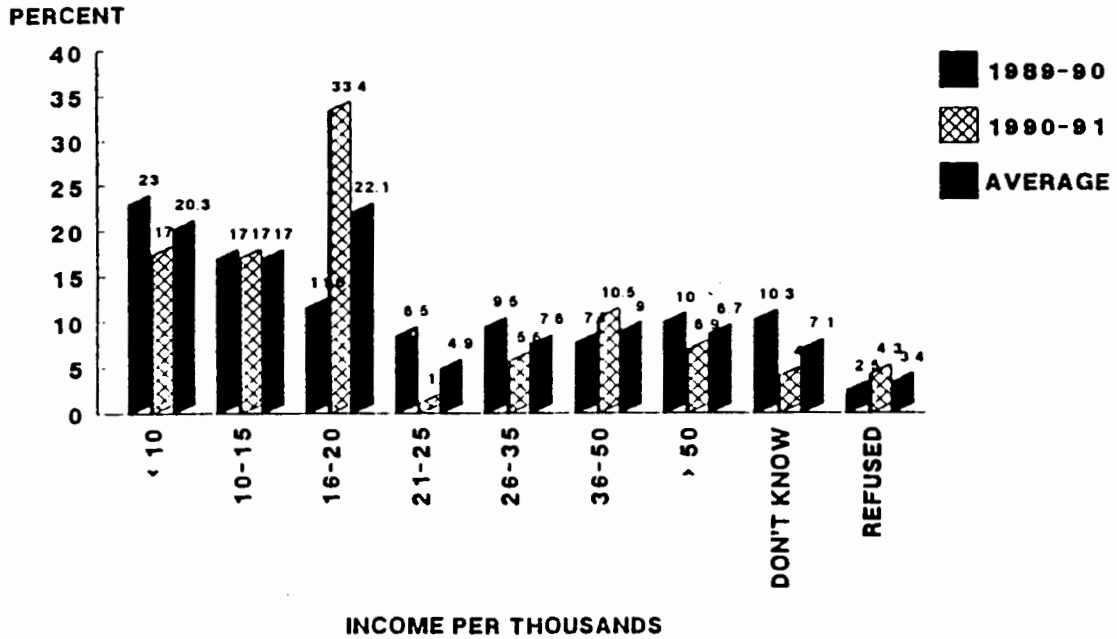
**DISPLACEMENT
U.S. VIRGIN ISLANDS
HURRICANE HUGO HEALTH ASSESSMENTS 1989-90**



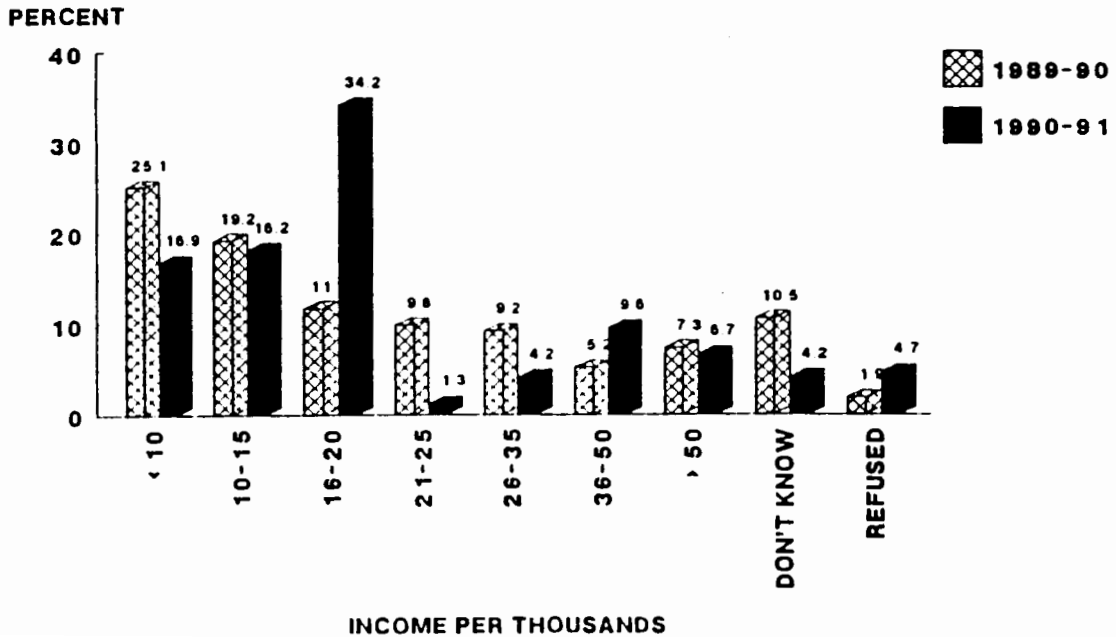
**SCHOOL AGE DISPLACEMENT
U.S. VIRGIN ISLANDS
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91**



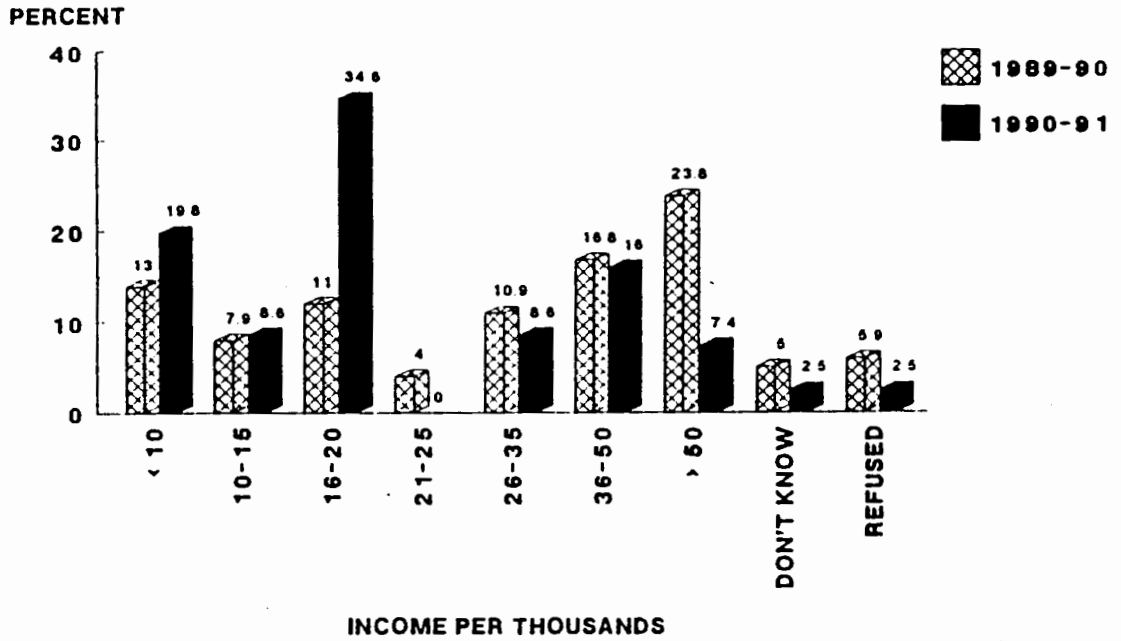
INCOME OF RESPONDENTS U.S. VIRGIN ISLANDS HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



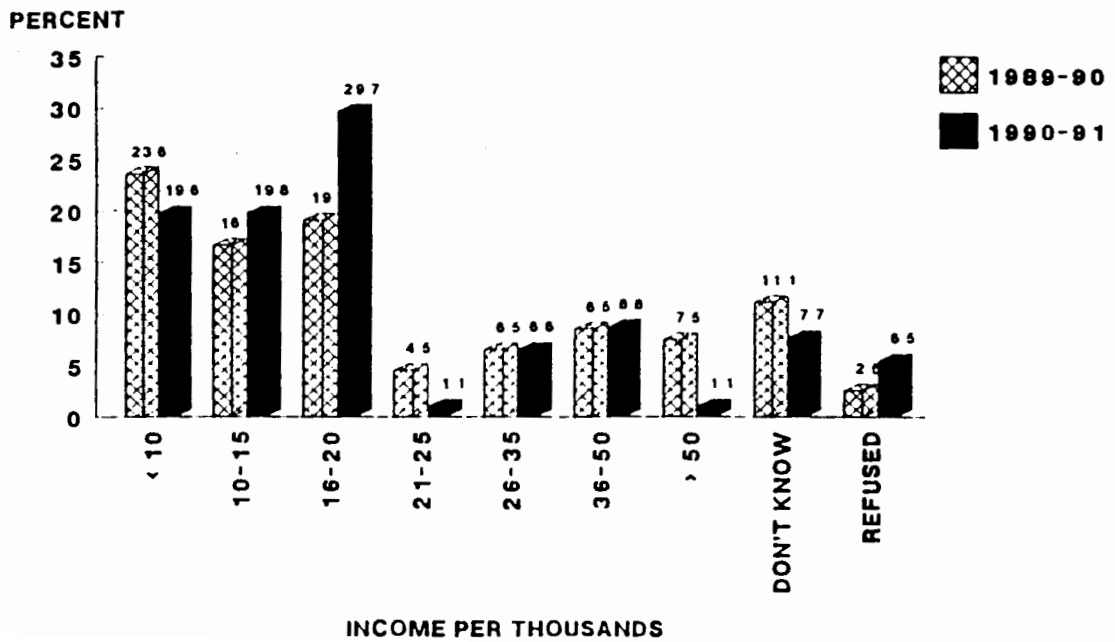
INCOME OF BLACK RESPONDENTS U.S. VIRGIN ISLANDS HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



**INCOME OF WHITE RESPONDENTS
U.S. VIRGIN ISLANDS
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91**

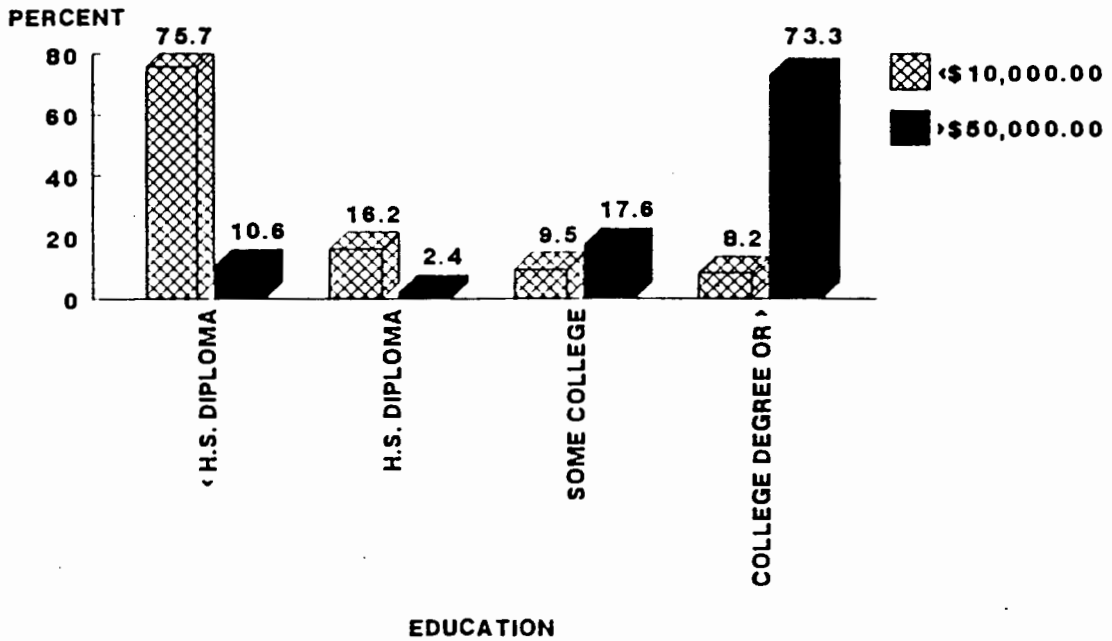


**INCOME OF HISPANIC RESPONDENTS
U.S. VIRGIN ISLANDS
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91**



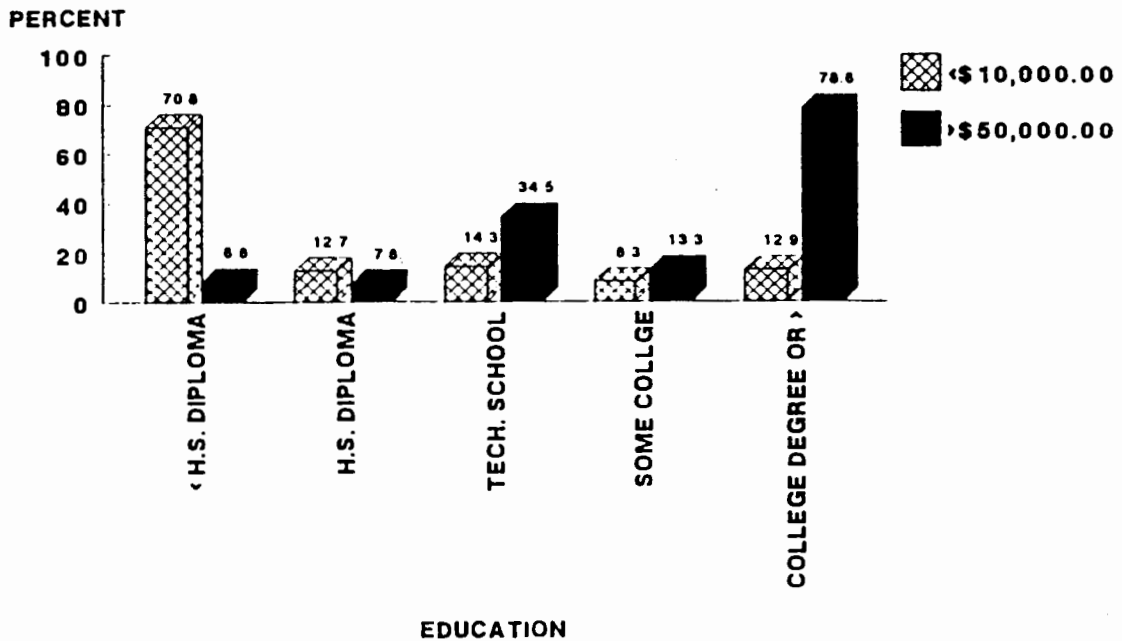
EDUCATION VERSUS INCOME - 1989-90
U.S. VIRGIN ISLANDS

HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



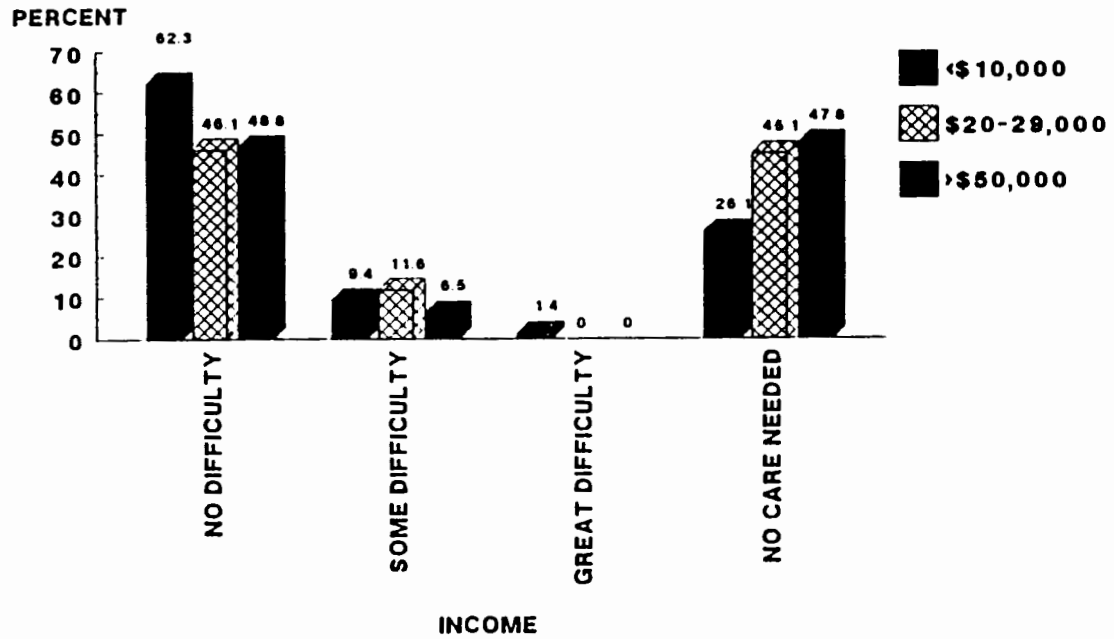
EDUCATION VERSUS INCOME - 1990-91
U.S. VIRGIN ISLANDS

HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



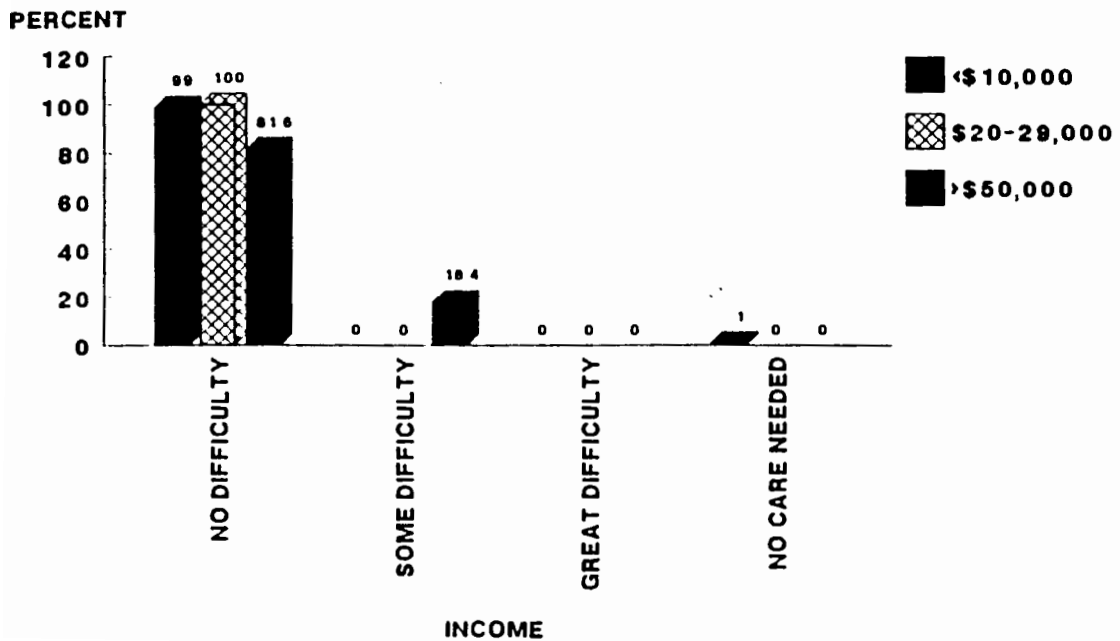
ACCESS TO HEALTH CARE VERSUS INCOME - 1989-90
U.S. VIRGIN ISLANDS

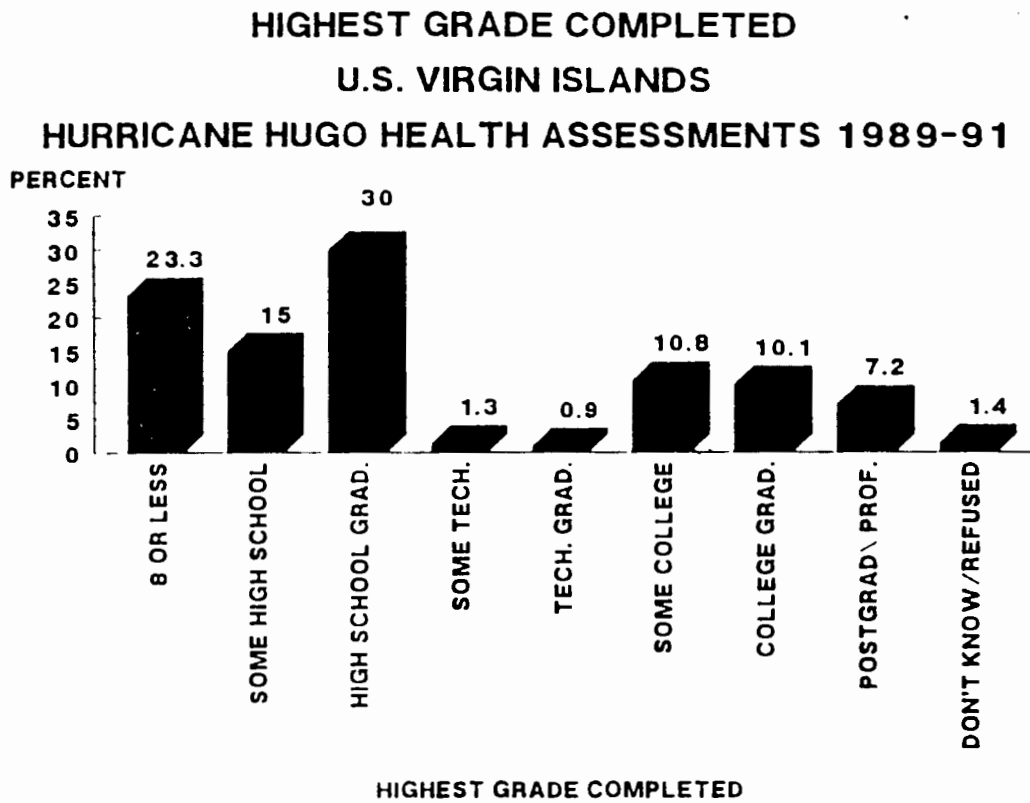
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



ACCESS TO HEALTH CARE VERSUS INCOME - 1990-91
U.S. VIRGIN ISLANDS

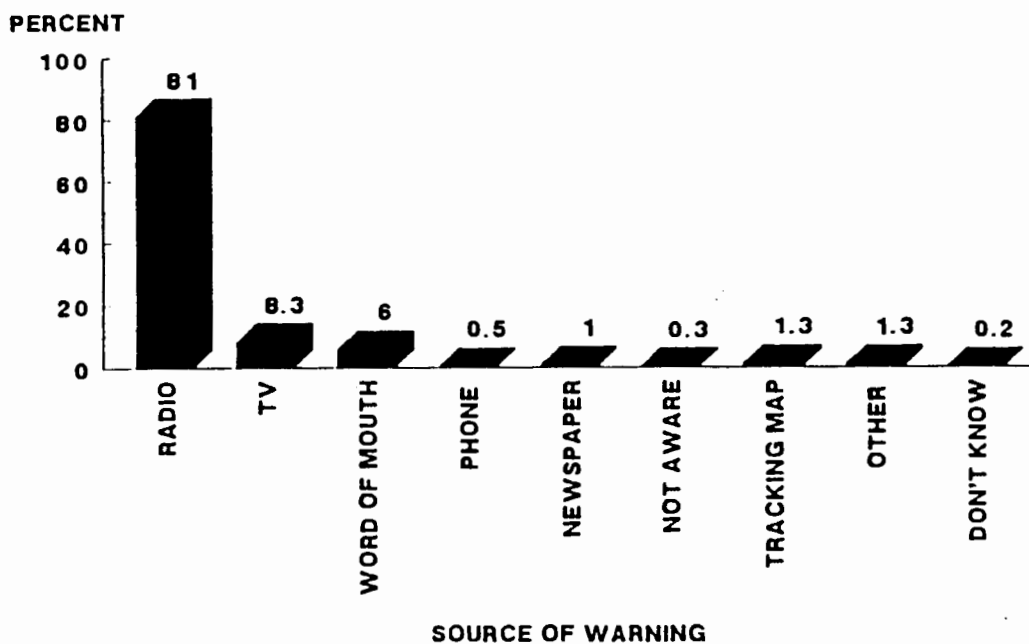
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91





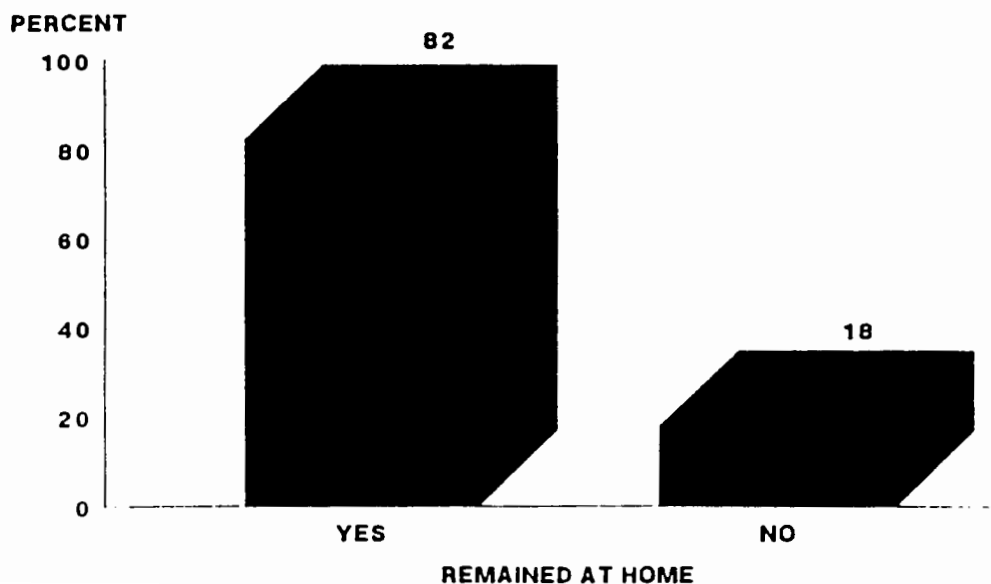
**SOURCE OF FIRST WARNING OF THE APPROACH OF HUGO
U.S. VIRGIN ISLANDS**

HURRICANE HUGO HEALTH ASSESSMENTS 1989-91

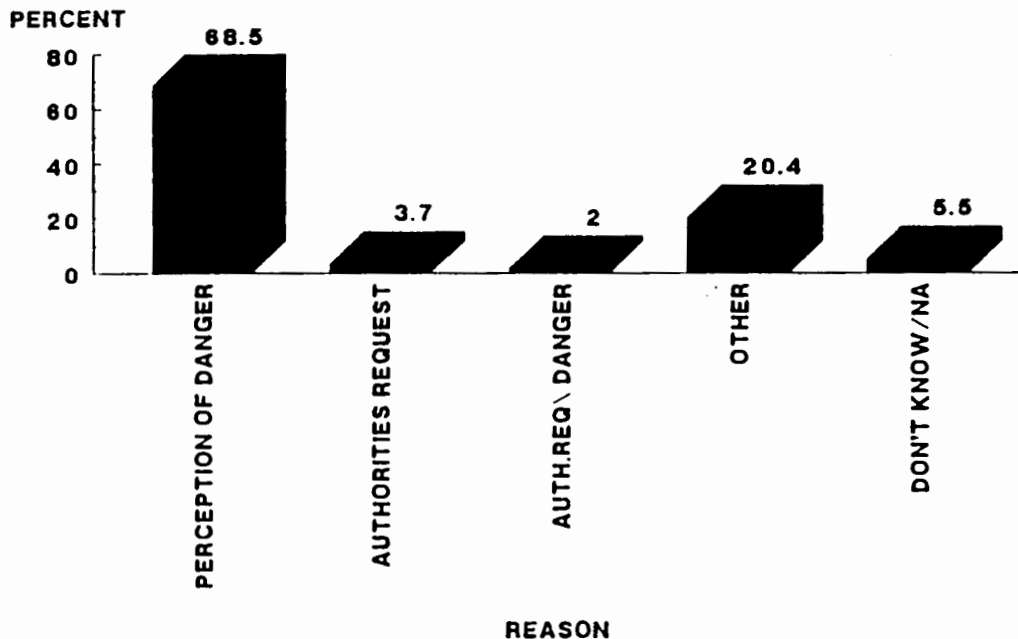


**REMAINED AT HOME DURING ALL OF HUGO
U.S. VIRGIN ISLANDS**

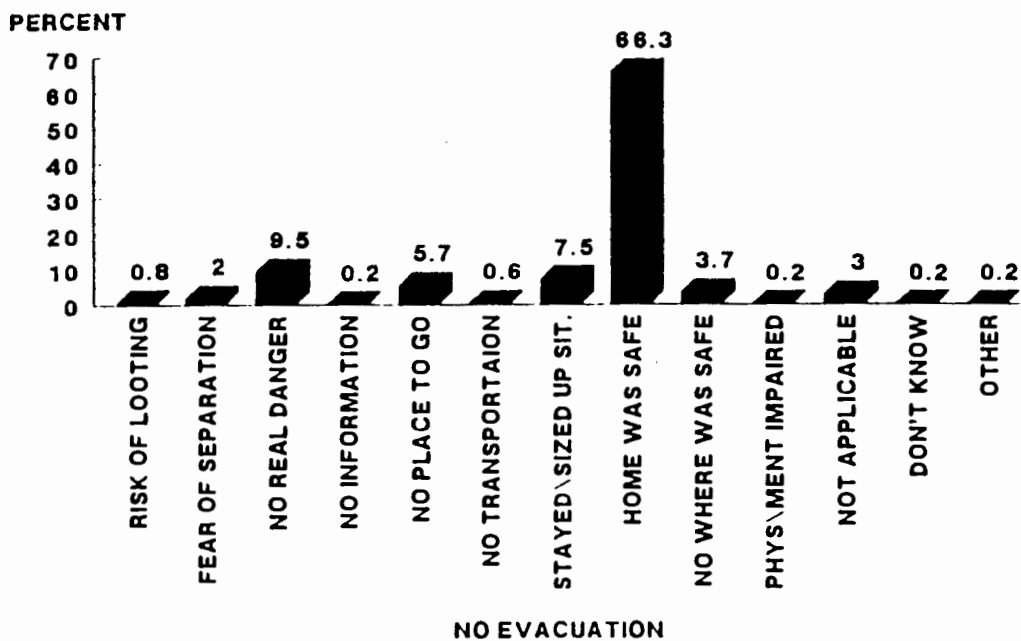
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



**REASON FOR EVACUATION OF HOME
U.S. VIRGIN ISLANDS
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91**

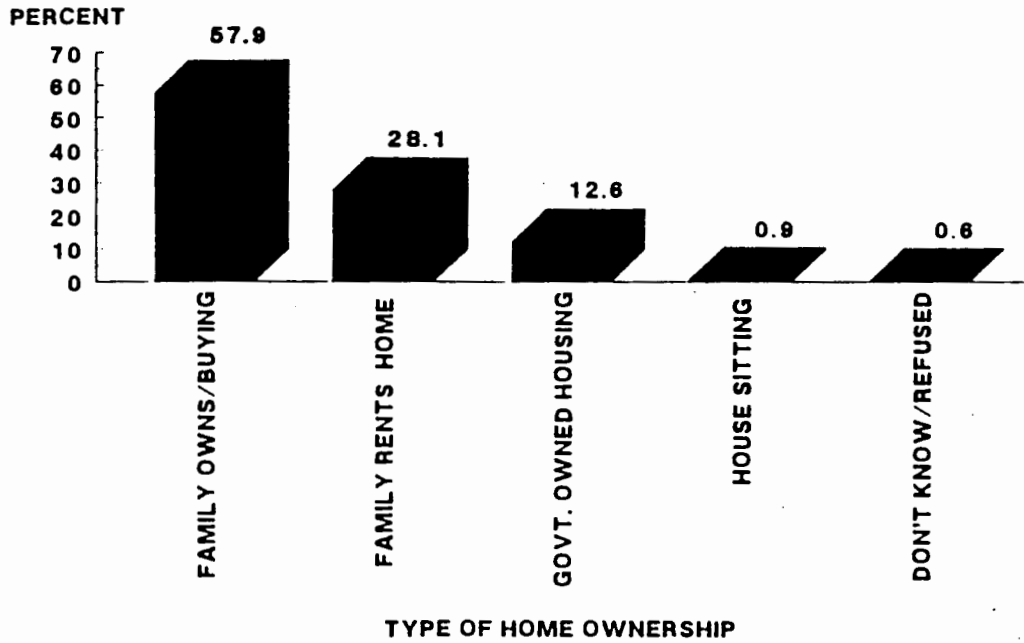


**REASON FOR NO EVACUATION
U.S. VIRGIN ISLANDS
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91**



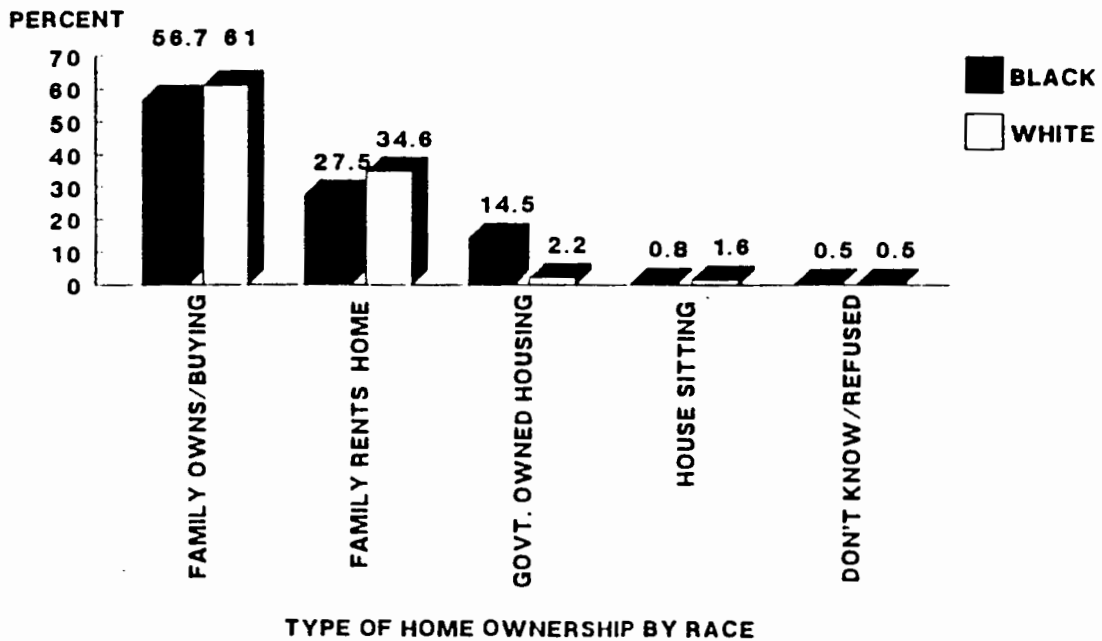
STATUS OF HOME OWNERSHIP U.S. VIRGIN ISLANDS

HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



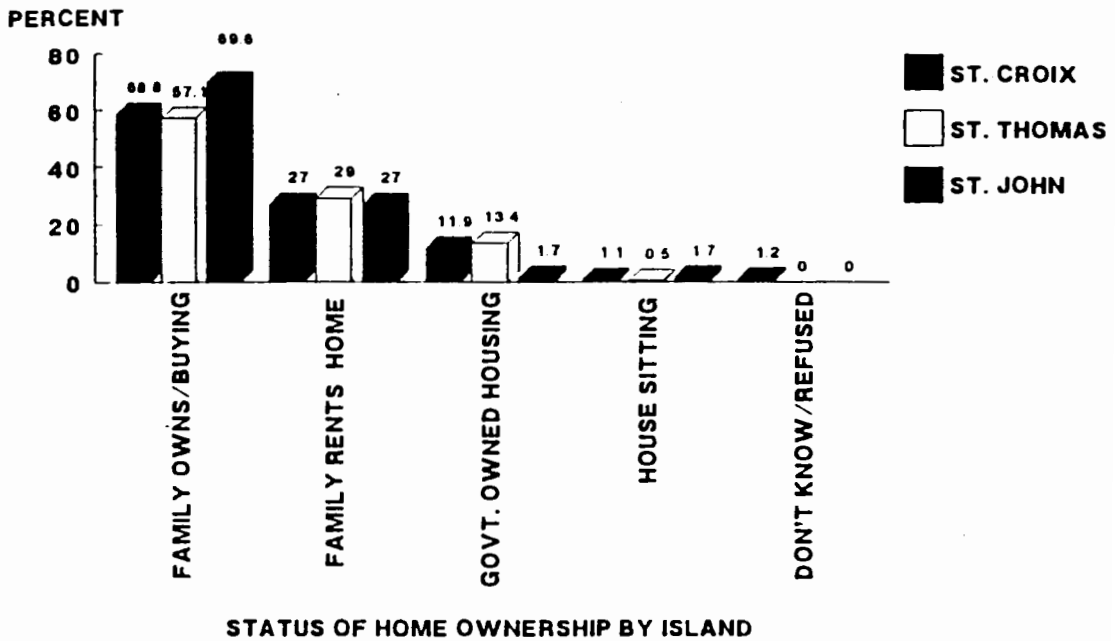
STATUS OF HOME OWNERSHIP BY RACE U.S. VIRGIN ISLANDS

HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



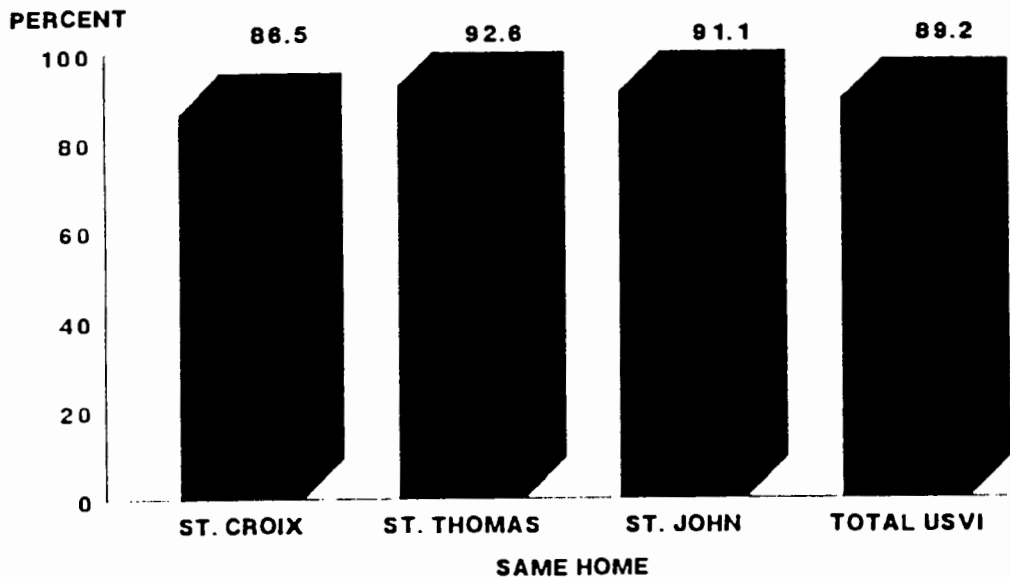
**STATUS OF HOME OWNERSHIP BY ISLAND
U.S. VIRGIN ISLANDS**

HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



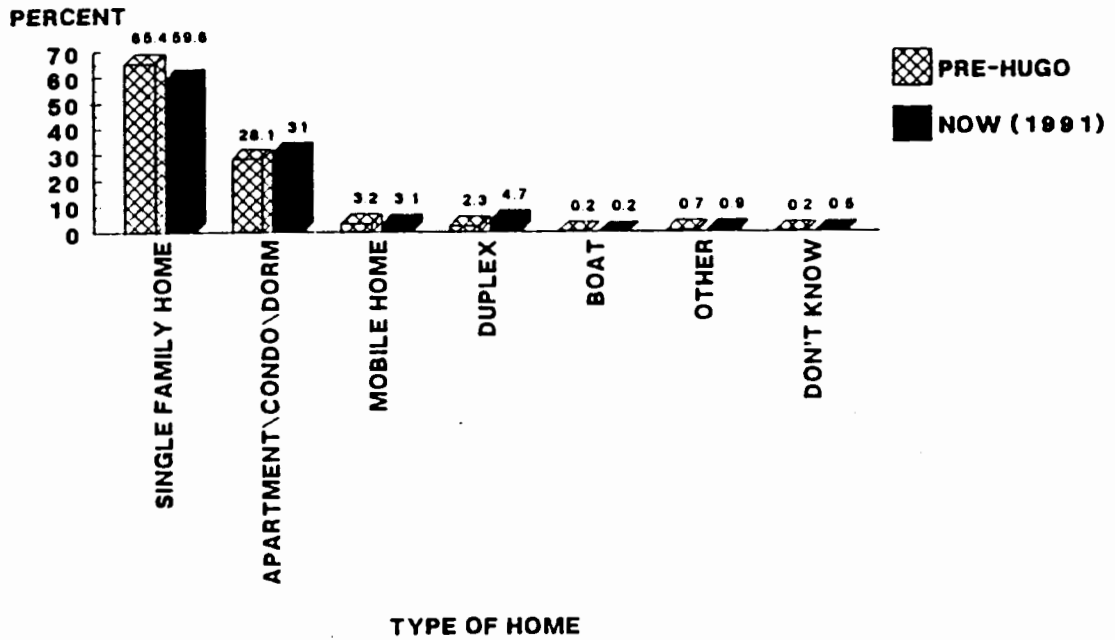
**SAME HOME AS BEFORE HUGO
U.S. VIRGIN ISLANDS**

HURRICANE HUGO HEALTH ASSESSMENTS 1989-91

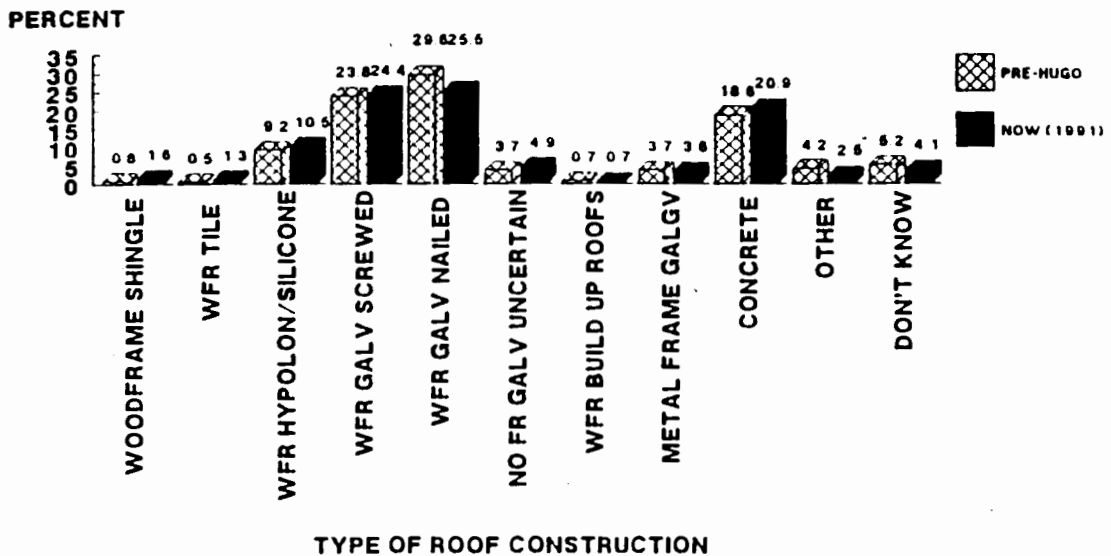


NB OF THE 10.6% WHO WERE DISPLACED, ONLY 23% OF THOSE PLAN TO MOVE BACK TO SAME HOME

TYPE OF HOUSING U.S. VIRGIN ISLANDS HURRICANE HUGO HEALTH ASSESSMENTS 1989-91

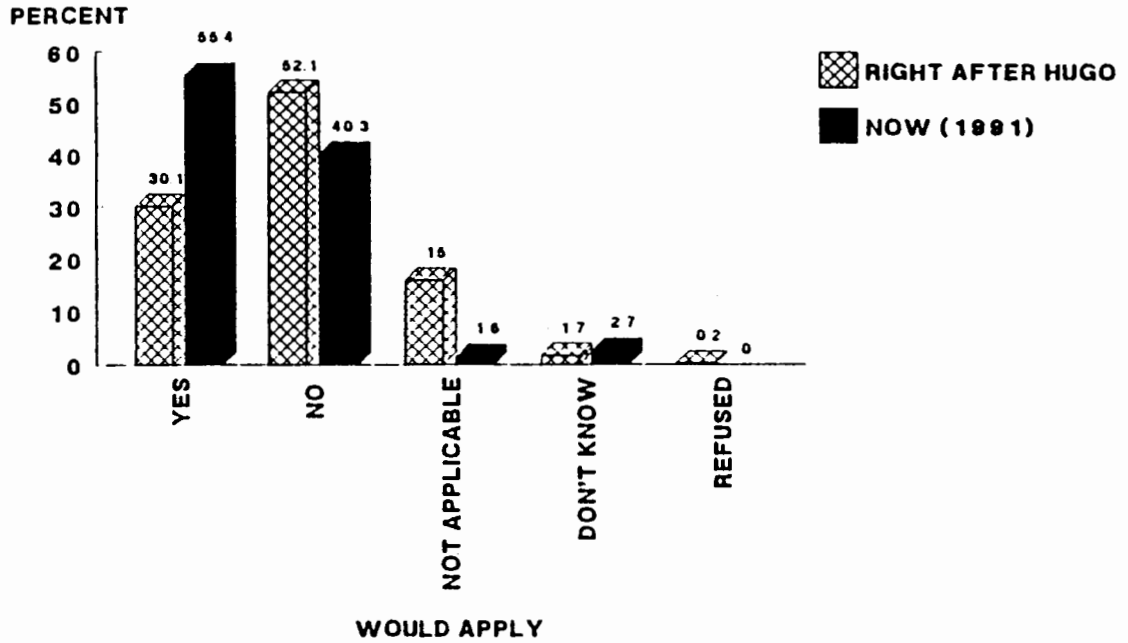


TYPE OF ROOF CONSTRUCTION U.S. VIRGIN ISLANDS HURRICANE HUGO HEALTH ASSESSMENTS 1989-91

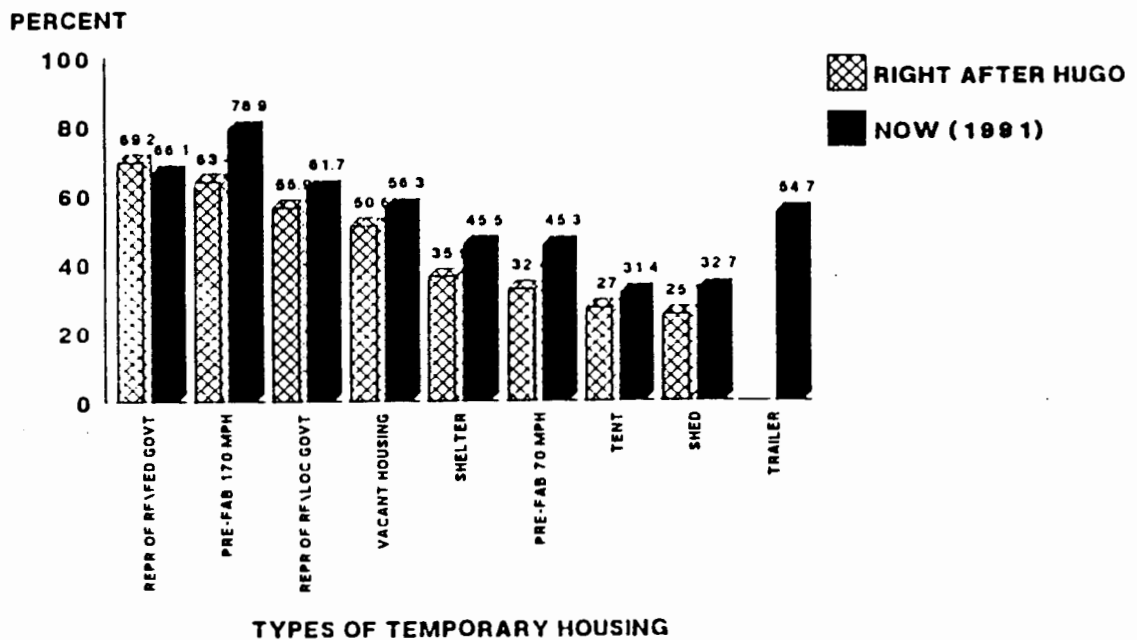


OF THE 19% WHO RECONSTRUCTED THEIR ROOFS,
GALVANIZE SCREWED(26.7%) OR NAILED(24.8%) WAS
PREFERRED OVER CONCRETE(18.6%)

**APPLY FOR TEMPORARY HOUSING IF AVAILABLE
U.S. VIRGIN ISLANDS
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91**



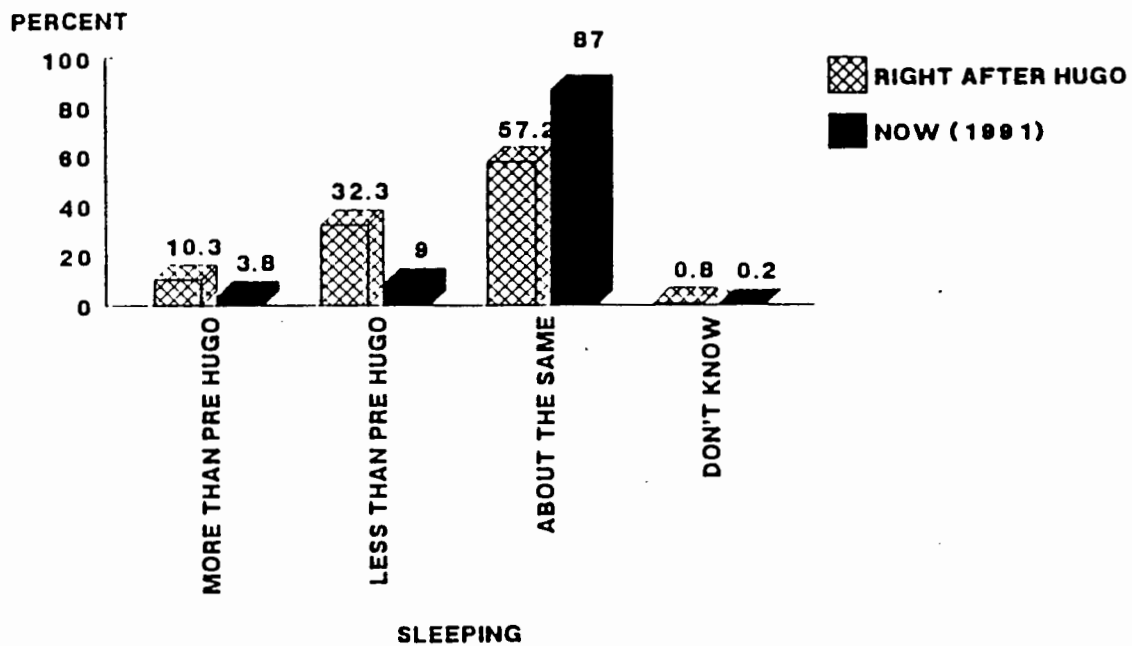
**TYPE OF TEMPORARY HOUSING WOULD ACCEPT
U.S. VIRGIN ISLANDS
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91**



SLEEPING PATTERNS POST-HUGO

U.S. VIRGIN ISLANDS

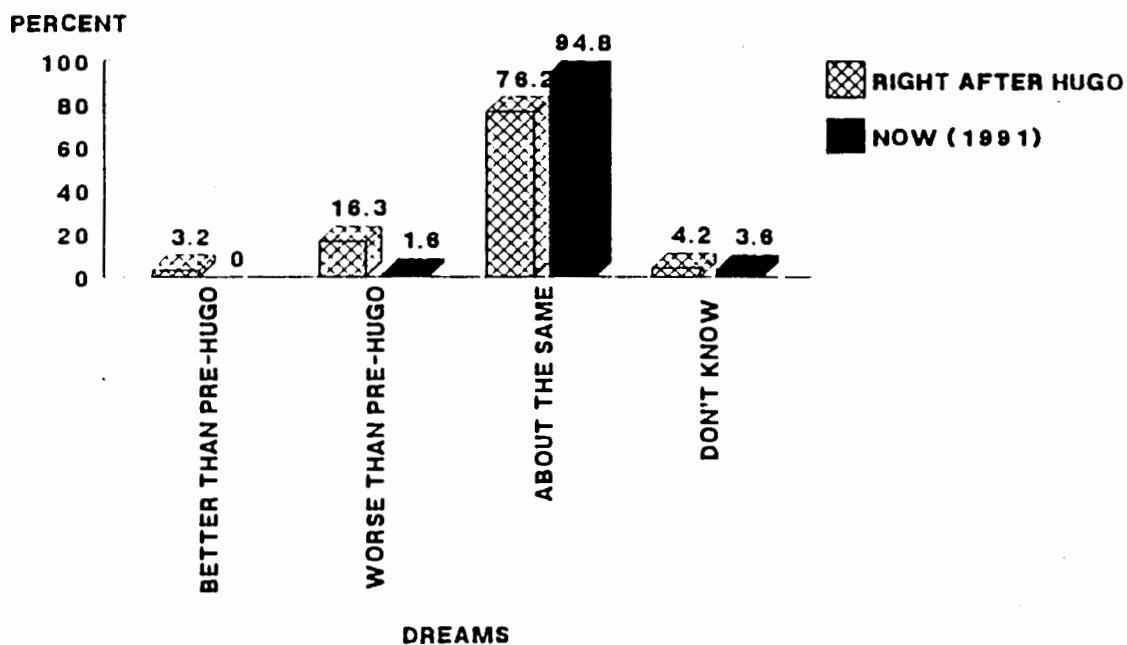
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



STATUS OF DREAMS

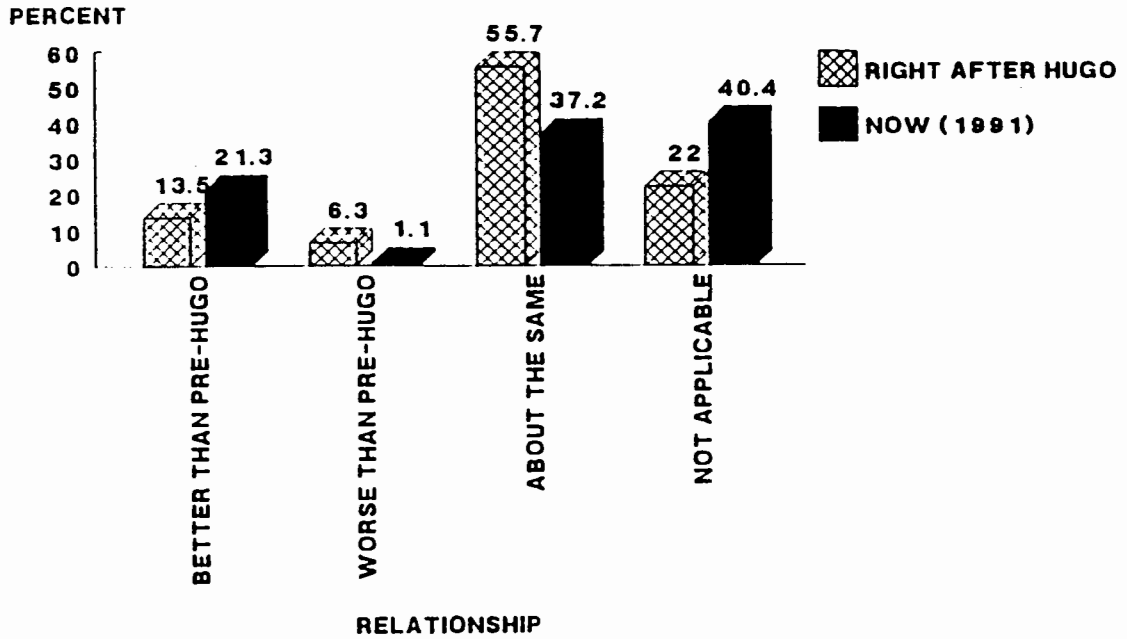
U.S. VIRGIN ISLANDS

HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



**STATUS OF RELATIONSHIP WITH SPOUSE/PARTNER
U.S. VIRGIN ISLANDS**

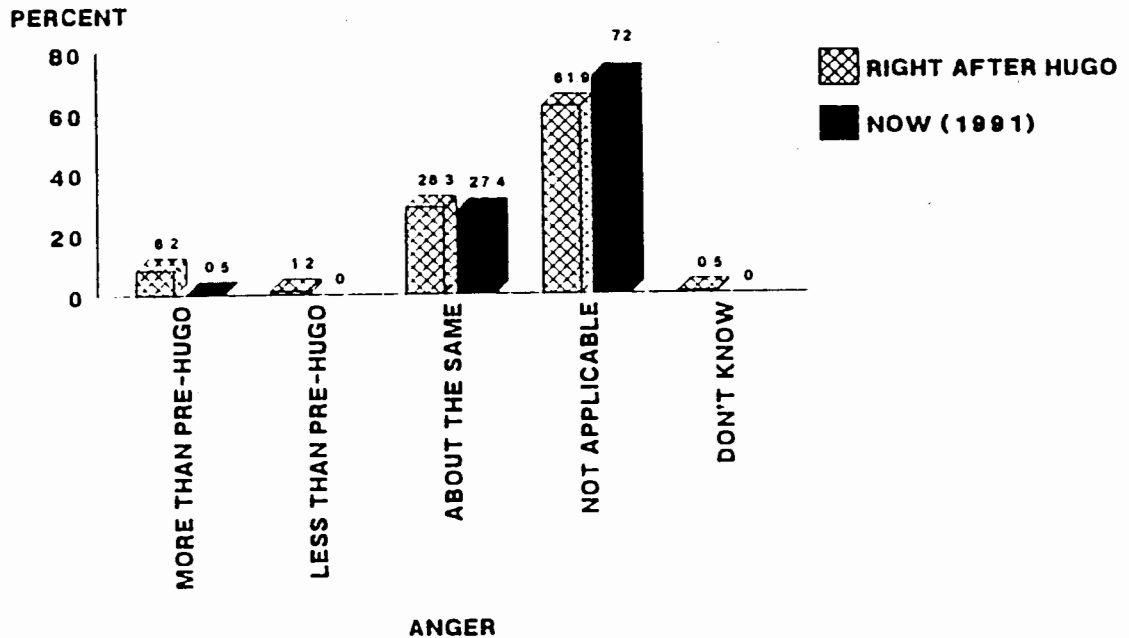
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



ANGRY BEHAVIOR

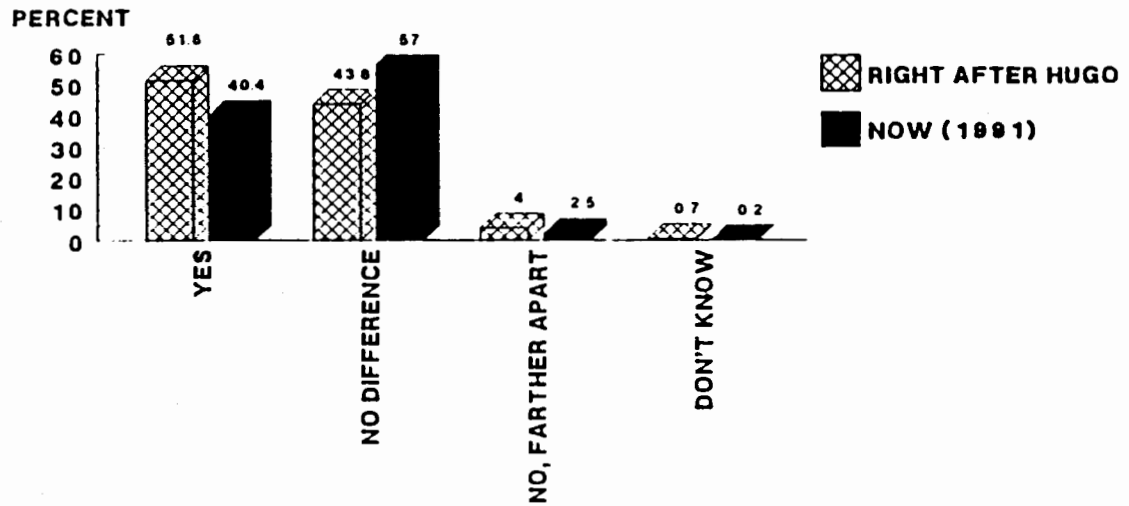
U.S. VIRGIN ISLANDS

HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



**EMOTIONALLY CLOSER TO FAMILY/FRIENDS
U.S. VIRGIN ISLANDS**

HURRICANE HUGO HEALTH ASSESSMENTS 1989-91

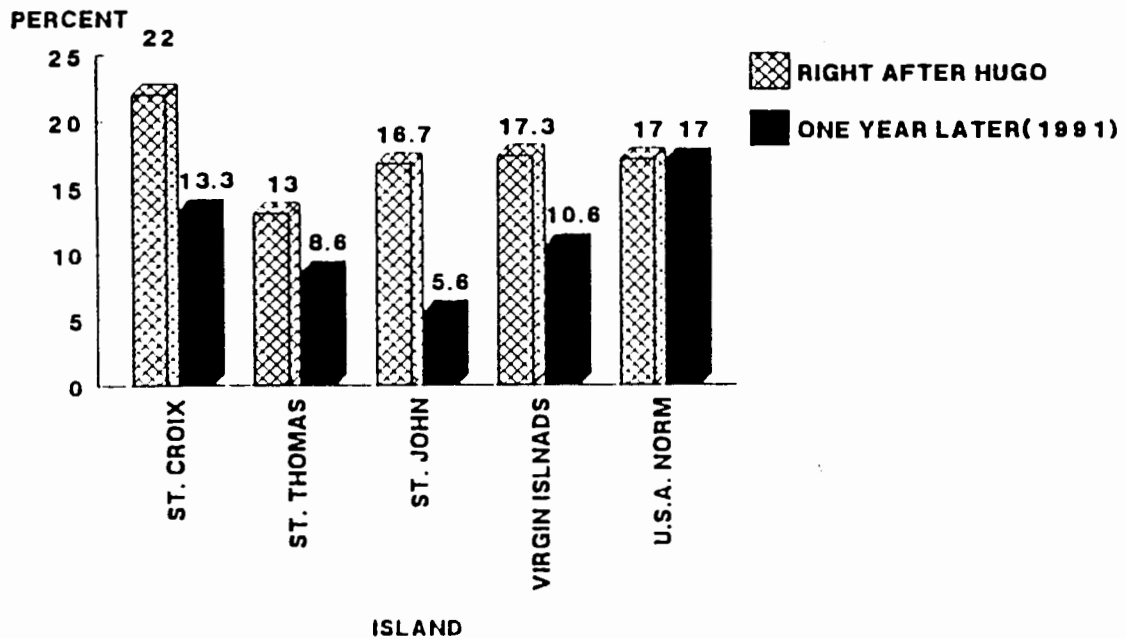


EMOTIONALLY CLOSER

NO SIGNIFICANT DIFFERENCE IN RESPONSE TO FEELING CLOSER TO FAMILY/FRIENDS IN THOSE WHO LEFT (47.5%) THAN THOSE WHO STAYED (47.2%)

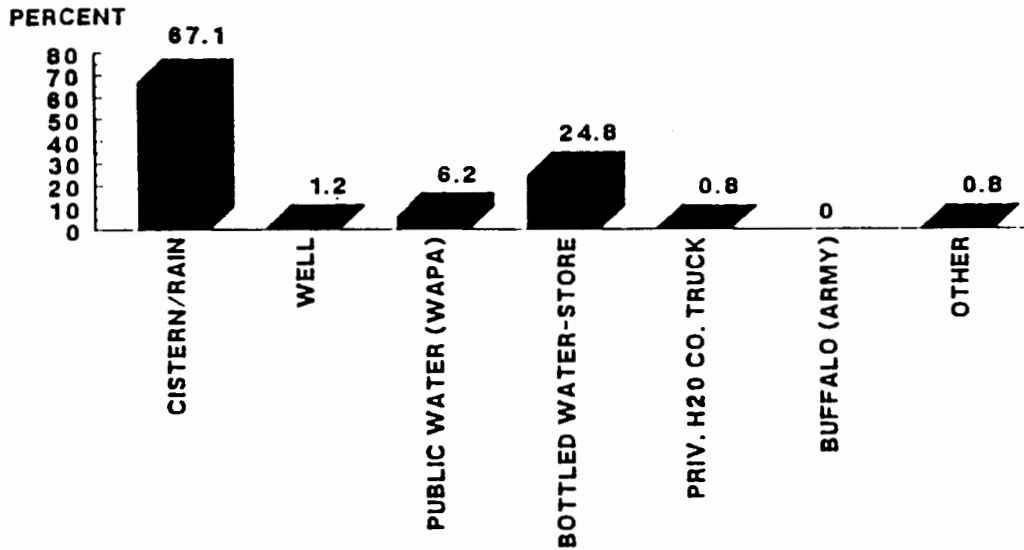
**DEPRESSION INDEX
U.S. VIRGIN ISLANDS**

HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



**PRIMARY SOURCE OF DRINKING WATER PRE-HUGO
U.S. VIRGIN ISLANDS**

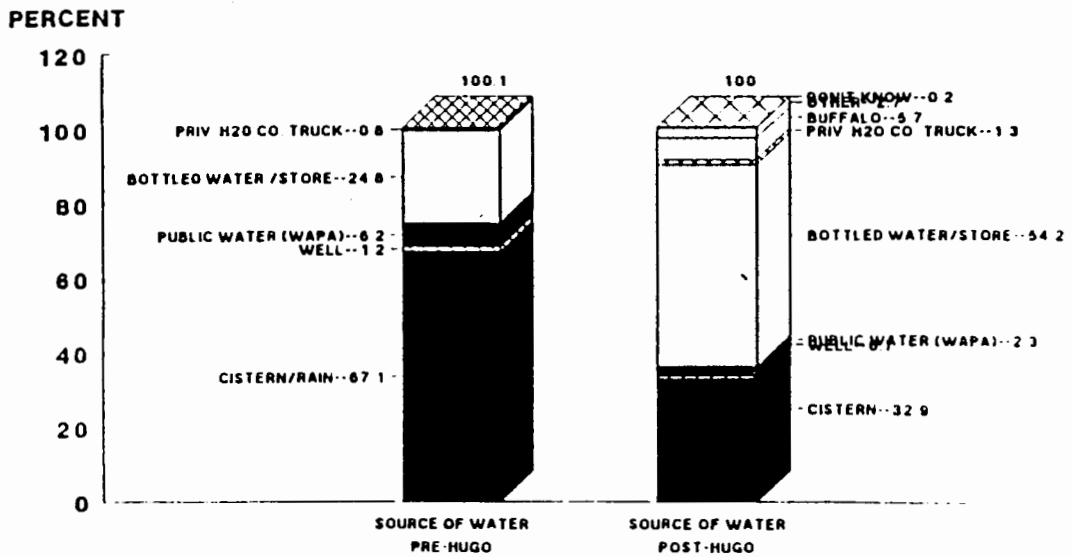
HURRICANE HUGO HEALTH ASSESSMENTS, 1989-91



PRIMARY SOURCE OF DRINKING WATER PREHUGO

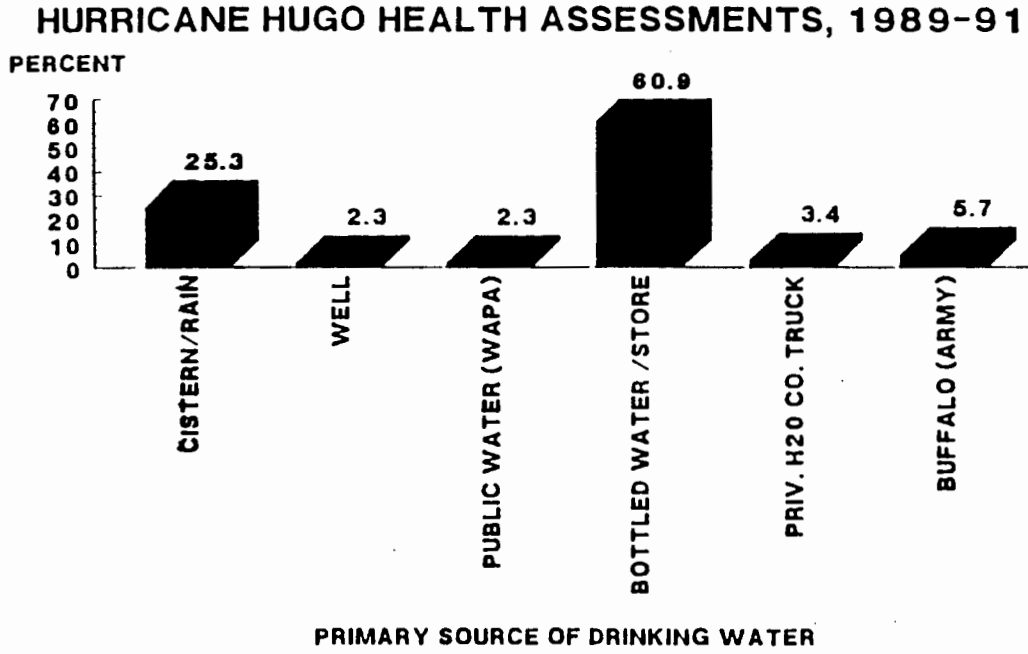
**SOURCE OF DRINKING WATER
U.S. VIRGIN ISLANDS**

HURRICANE HUGO HEALTH ASSESSMENTS 1989-91

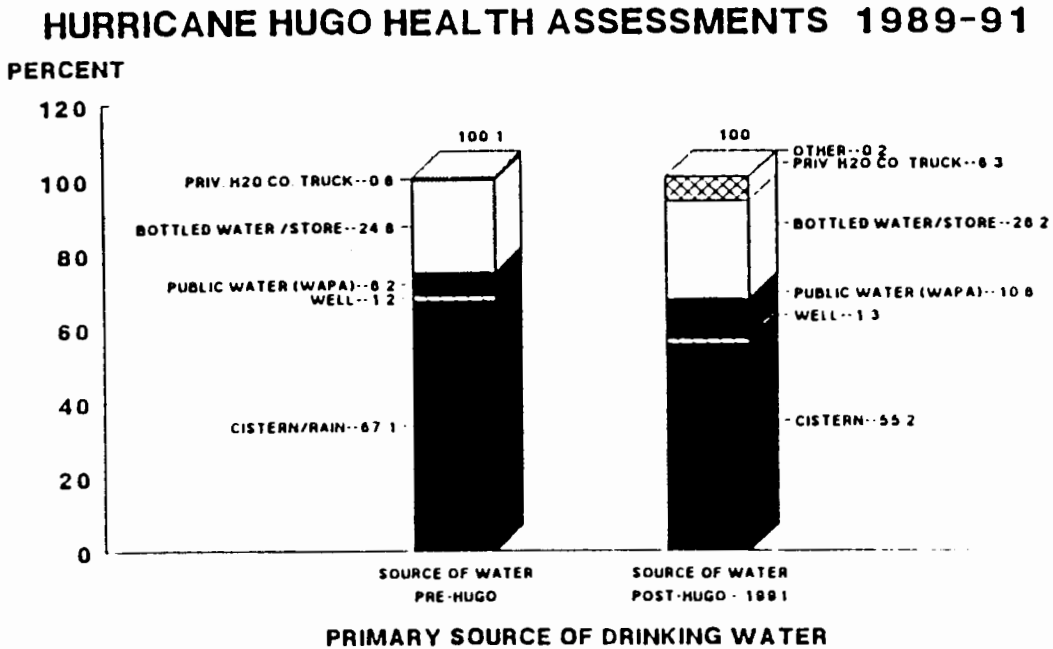


PRIMARY SOURCE OF DRINKING WATER

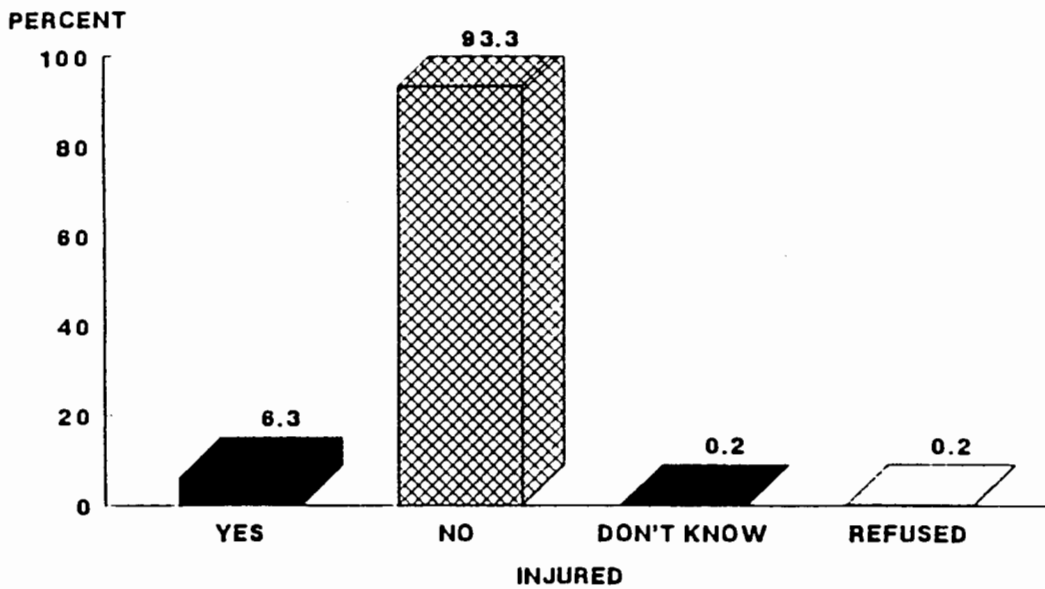
**DIARRHEA POST-HUGO BY SOURCE OF DRINKING WATER
U.S. VIRGIN ISLANDS**



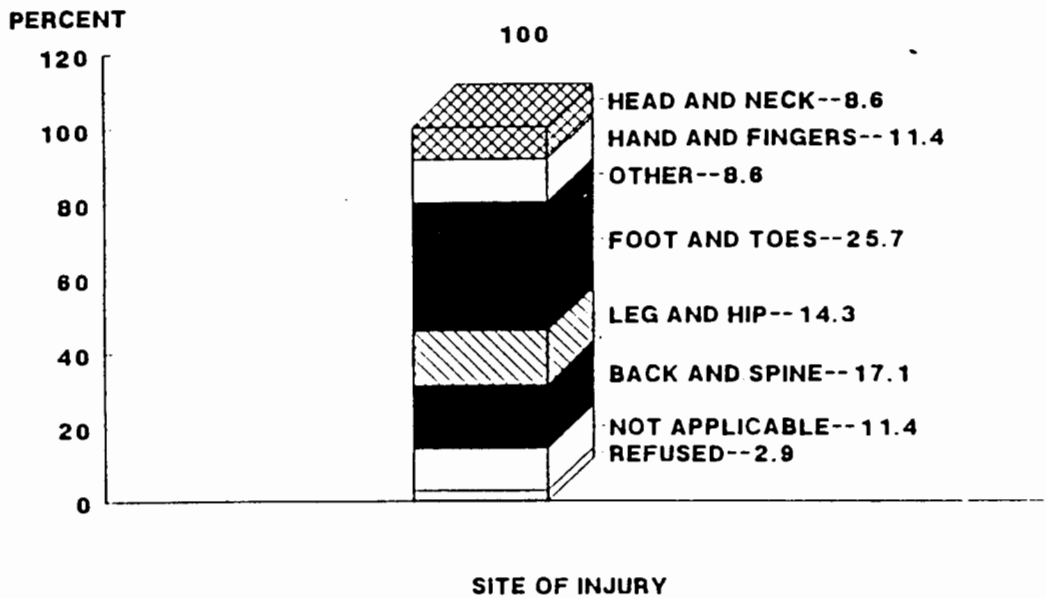
**SOURCE OF DRINKING WATER
U.S. VIRGIN ISLANDS**



INJURED
U.S. VIRGIN ISLANDS
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91

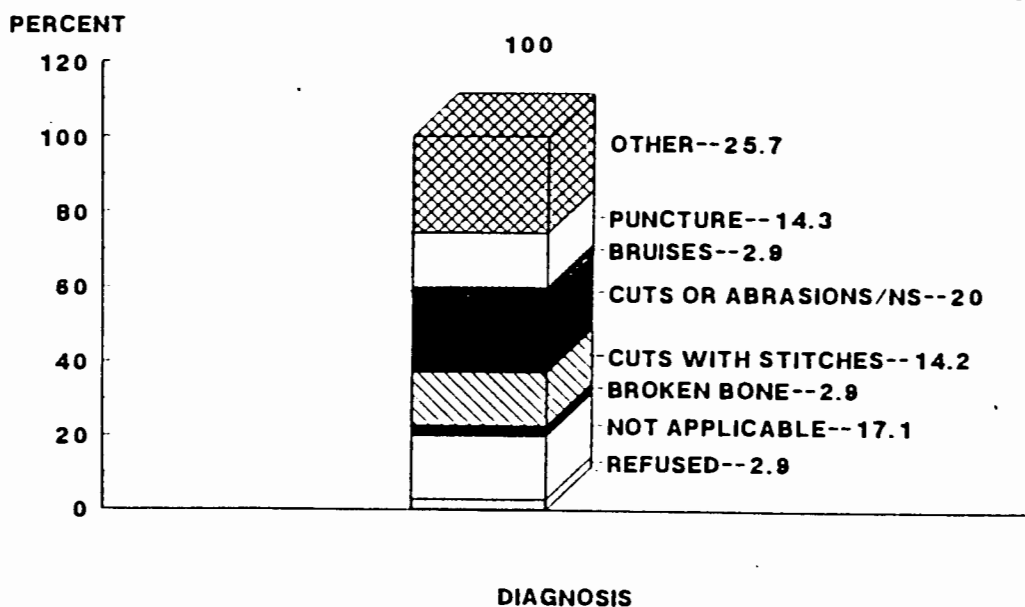


INJURY BY PART OF BODY
U.S. VIRGIN ISLANDS
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



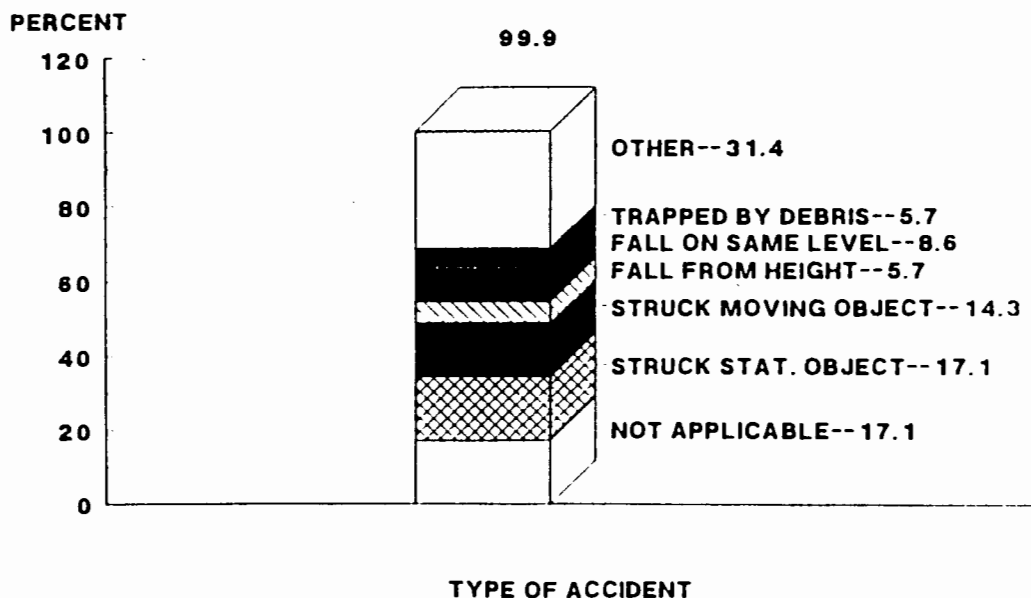
DIAGNOSIS OF INJURY U.S. VIRGIN ISLANDS

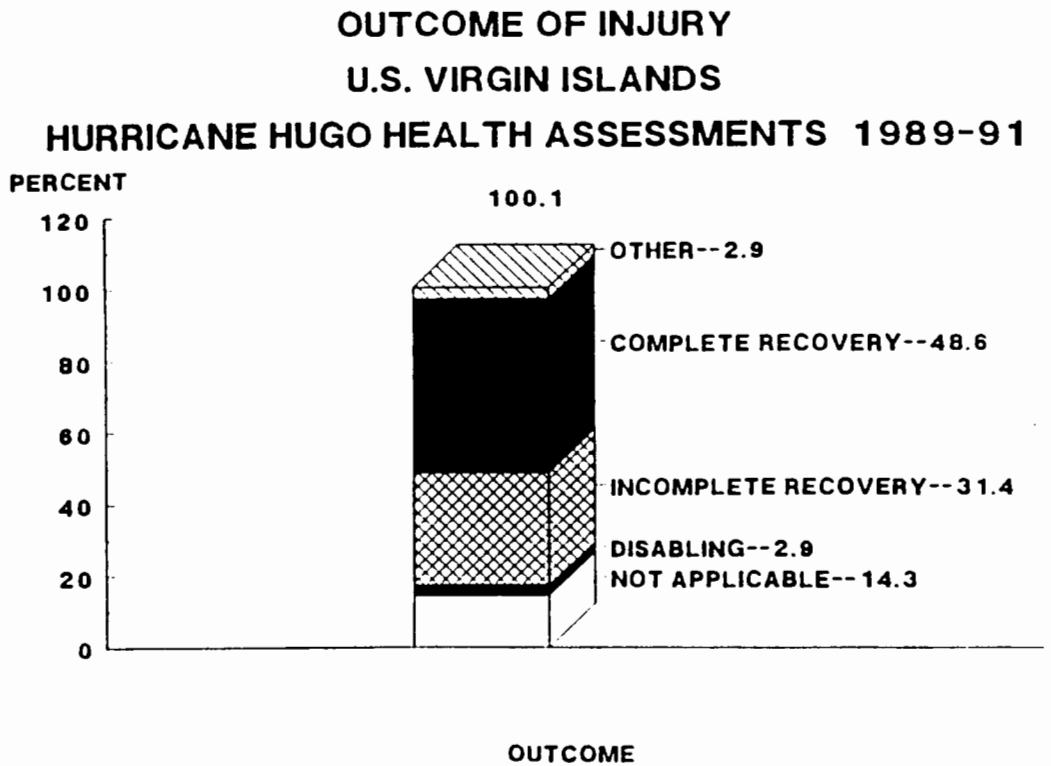
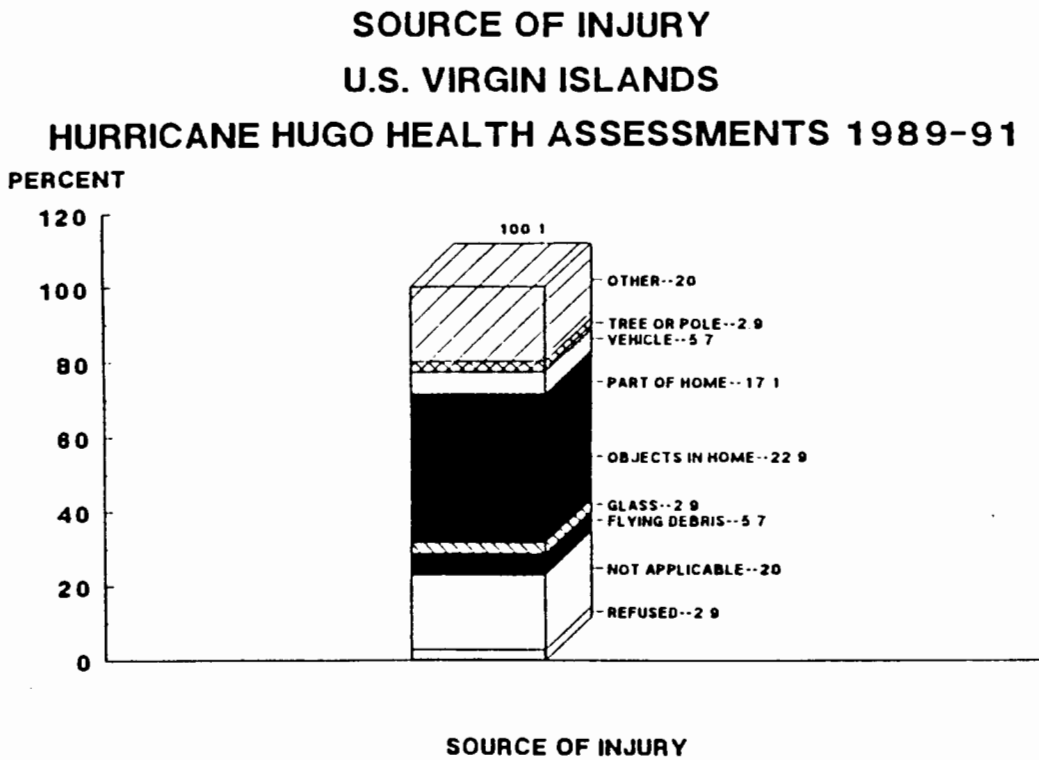
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



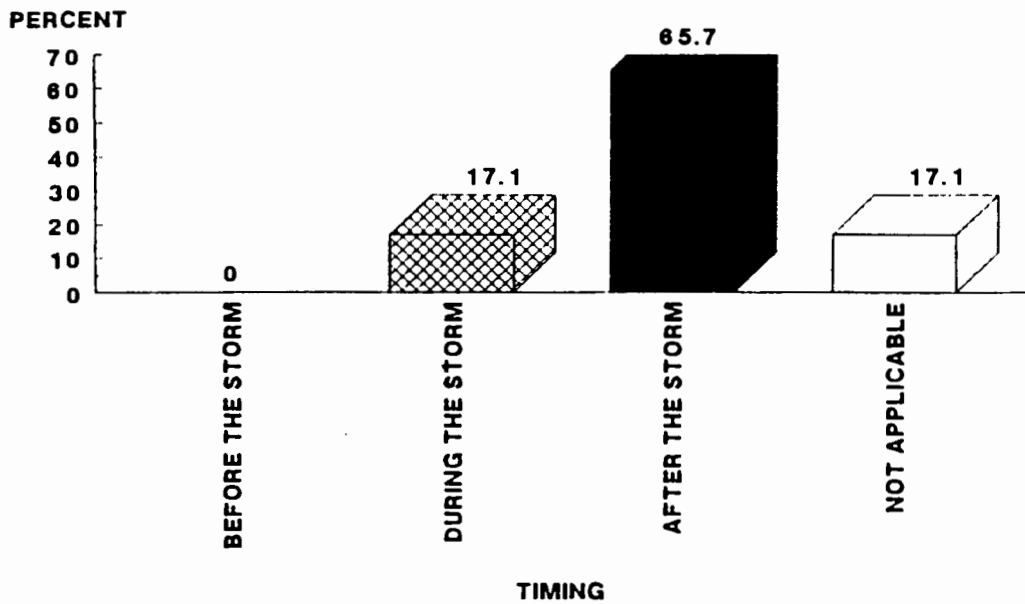
TYPE OF ACCIDENT U.S. VIRGIN ISLANDS

HURRICANE HUGO HEALTH ASSESSMENTS 1989-91

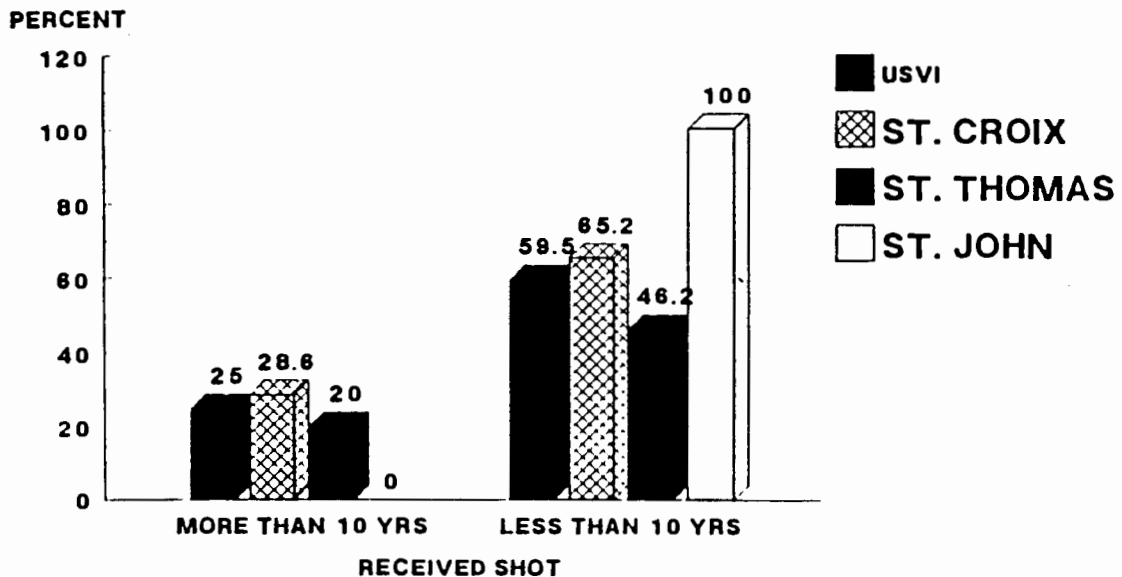




**TIMING OF INJURY
U.S. VIRGIN ISLANDS
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91**



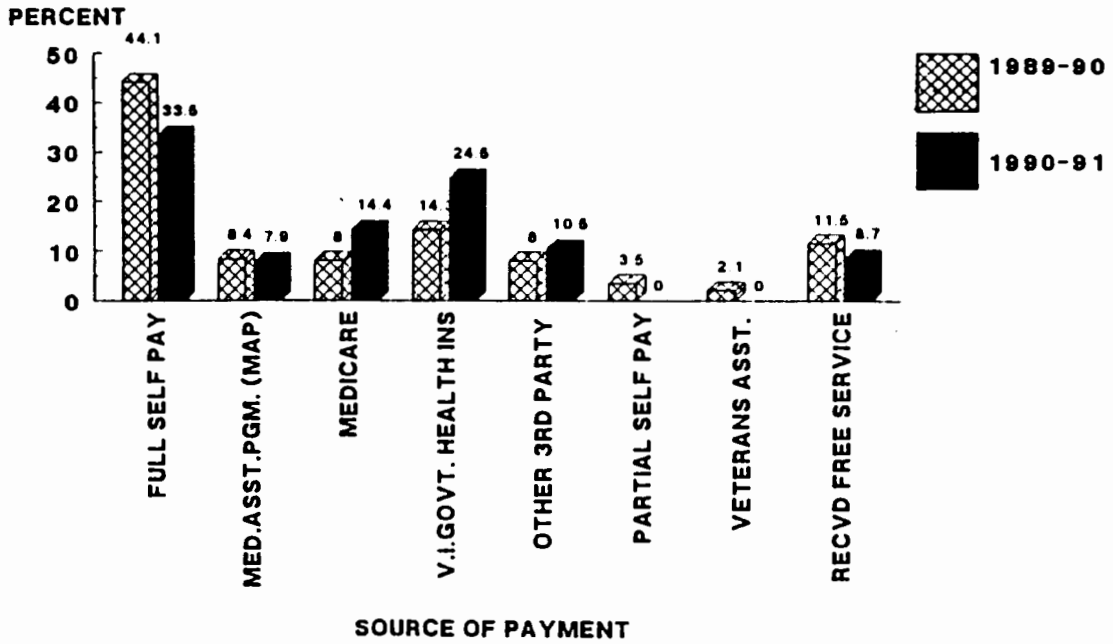
**INJURED WHO RECEIVED TETANUS SHOT PER LAST SHOT
U.S. VIRGIN ISLANDS
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91**



NB THE CDC GUIDELINES REQUIRE A TETANUS SHOT EVERY TEN YEARS

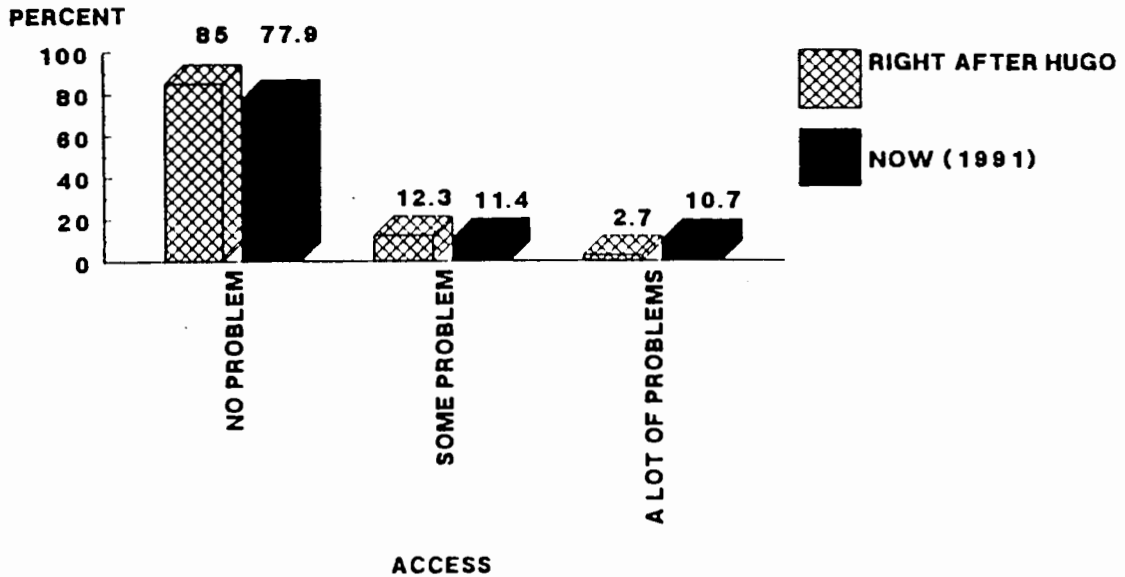
**PAYMENT FOR MEDICAL CARE POST-HUGO
U.S. VIRGIN ISLANDS**

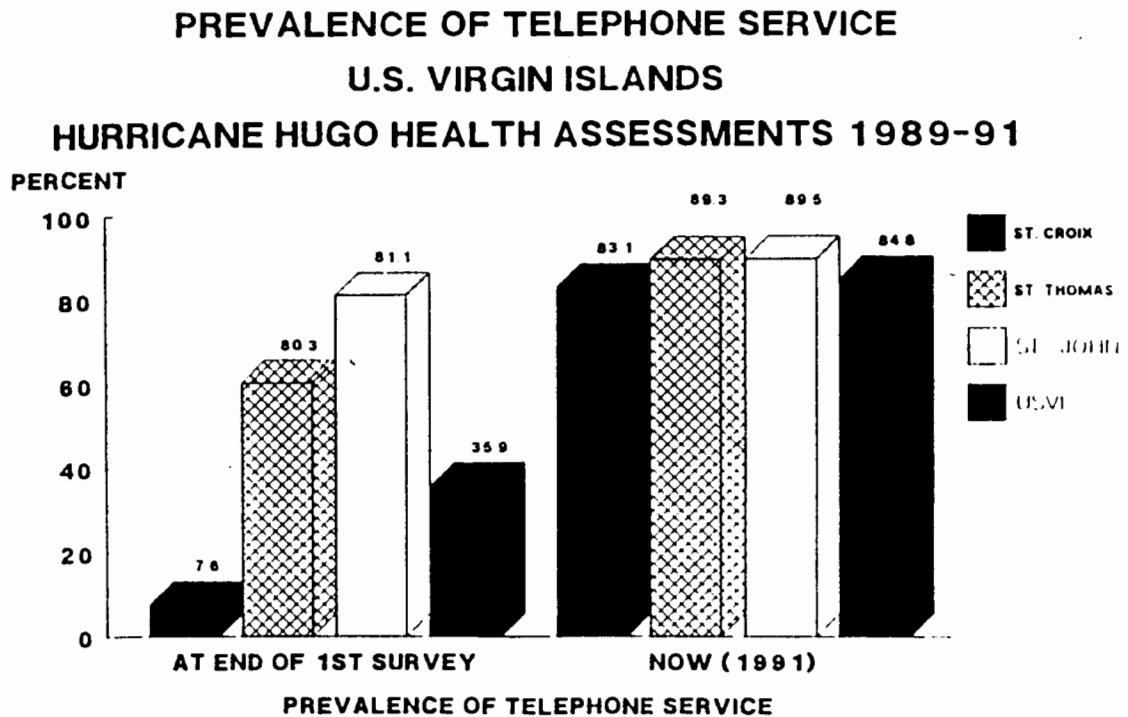
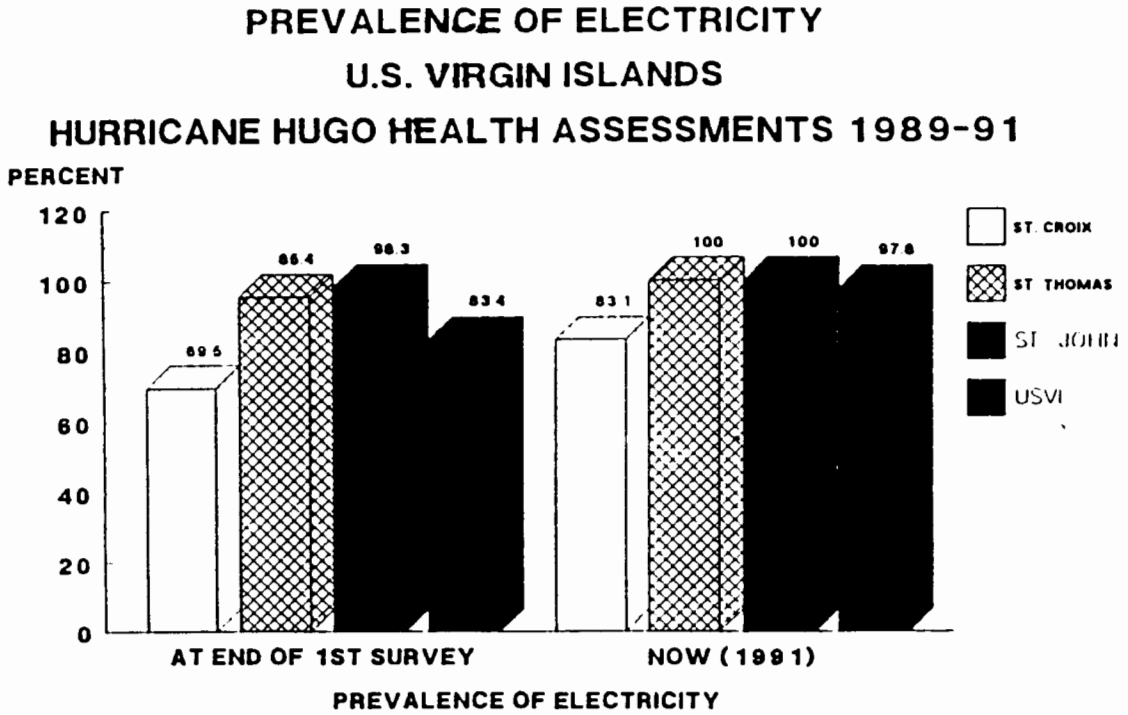
HURRICANE HUGO HEALTH ASSESSMENTS - 1989-91



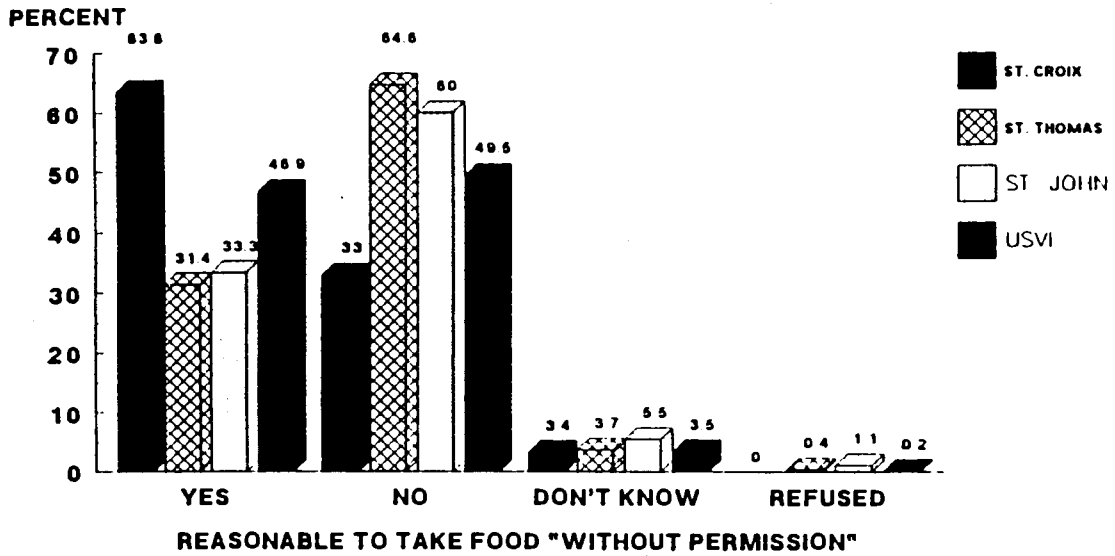
**ACCESS TO HEALTH CARE
U.S. VIRGIN ISLANDS**

HURRICANE HUGO HEALTH ASSESSMENTS 1989-91

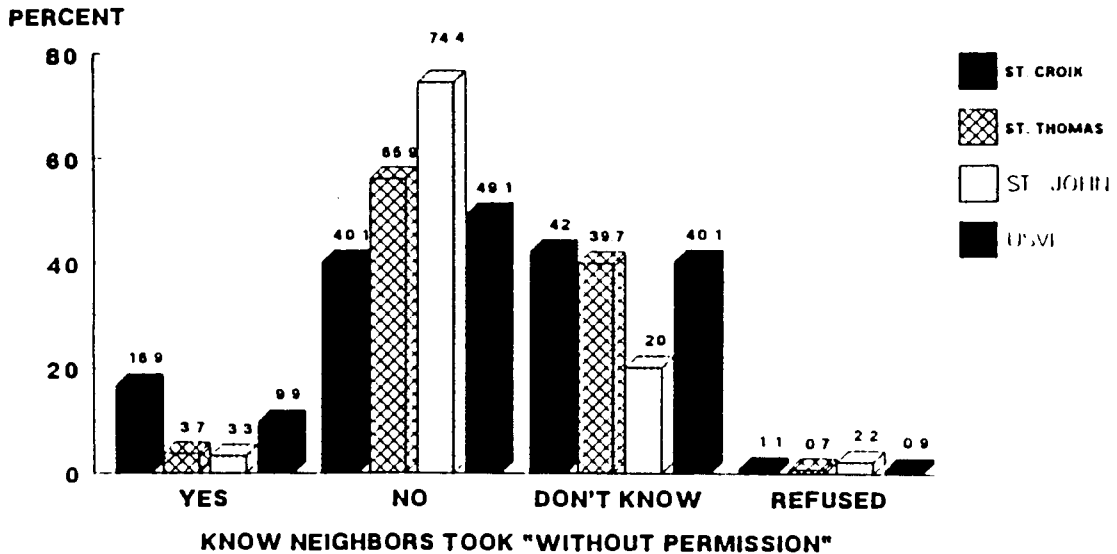




REASONABLE TO TAKE FOOD "WITHOUT PERMISSION"
U.S. VIRGIN ISLANDS
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



KNOW NEIGHBORS TOOK "WITHOUT PERMISSION"
U.S. VIRGIN ISLANDS
HURRICANE HUGO HEALTH ASSESSMENTS 1989-91



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