CHAPTER FOUR

CONCEPTUAL FRAMEWORK AND METHODOLOGY

This chapter includes a conceptual presentation of how disasters and disaster health care affect health, a discussion of the major research questions, and an outline of the methodology used in this study. First, however, it is necessary to define several of the major terms and concepts used throughout this work.

Effectiveness. Effectiveness is generally thought of as the ability to obtain a desired goal or state. A chief requisite in effectiveness studies, then, is a statement of goals or objectives against which the actual performance can be evaluated. This requisite has been a prime difficulty in health care evaluations for three reasons. First, it is difficult to define health care goals, due to the multifaceted nature of the concept of health. Second, it is difficult to obtain reliable and valid measures of this broad concept. Finally, health care institutions may vary considerably with respect to their goals and objectives (i.e., financial return, behavior and/or belief modification, etc.), thus creating a difficulty that becomes even more acute when looking at a collection of domestic and foreign disaster health care teams which may represent quite different normative backgrounds.

James Lewis[1] suggests in a non-medical context that disaster researchers and planners should attempt to observe disasters from the viewpoint of "insiders," those people affected by the disaster, thereby recognizing the impacts of disasters in more human terms. He argues that this approach should result in disaster research and planning which is more directly applicable to the affected populations, rather than based on the perhaps more esoteric values of outsiders. From my own experience in the field, I suggest that if we used this "human needs" approach to discern the goals of disaster health care, we could logically conclude that the affected population would want disaster health care efforts to be directed at negating the health effects of the disaster. That is, the health care should attempt to restore victims to their pre-disaster health status and prevent disaster-caused health sequelae that may occur in a delayed fashion. It is this broad goal against which disaster health care effectiveness will be measured.

Health. Health is a broad, abstract concept which is almost universally ill-defined at the abstract level, but which entails many narrowly defined concrete functions (i.e., glucose metabolism, peristalsis, DNA replication, etc.). An unconscious mixing of the abstract and concrete levels of the concept "health" frequently leads to confusion and misunderstanding. At the abstract level, health has been traditionally defined as an absence of disease, or complete physical,

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[1] James Lewis. Lynn H. Stephens and Stephen Green, eds., "The Vulnerable State: An Alternative View," Disaster Assistance: Appraisal, Reform and New Approaches (New York: New York University Press [UNA-USA], 1979) pp. 104-129.

mental and social well-being[2] -- which definition merely substitutes the word "well-being" for the word "health." The WHO definition not only fails to define the meaning of "health," but it also gives the impression that health can be seen as an absolute state, rather than an amalgamation of relative properties which constantly fluctuate.

Parsons[3] and other sociologists have given us a somewhat more useful direction to follow in the concept of "functional health." This approach defines health as the ability to carry out socially determined roles without physical, mental or social handicap. The importance of this approach is two-fold: (1) it gives purpose to health in defining it as a functional prerequisite to life's activities, and (2) it recognizes fluctuation and variation. Society's demands of the physical, mental, and social functions of a two-year old, for example, are quite different from its demands of a twenty-two year old or a ninety-two year old. Additionally, the definition recognizes that social demands (and therefore, concepts of health) vary considerably from society to society, thereby making the definition amenable to social differentiation.

A problem with the functionalist definition of health, and one which is even more serious with the previously mentioned WHO approach, is that it is very difficult to operationalize the concept of functional health in measurable form. The traditional measures of morbidity and

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[2] World Health Organization. Constitution, New York, 1946.

[3] T. Parsons. The Social System (Glencoe, Illinois: Free Press, 1951).

mortality are not useful to the concept since they do not directly address function. A number of scholars have been working on a methodology for defining and measuring health in terms of functional abilities.[4,5] These approaches, however, if at all practical, can only be used for very small groups of people who can be studied intensively where cultural norms are both well-known and understood. This is, of course, very expensive and impractical for the measurement of population health status or the health status of any large group.

In this study, a combination of functionalist and non-functionalist approaches to measurement is used. I use traditional morbidity statistics collected by the health ministry and by survey technique, in conjunction with the surveyed population's assessment of its own health status.

Health Outcome. Health outcome, or more specifically, improved health outcome is generally conceptualized as the desired product of health care. Within this conceptual approach, health outcome is defined as the health status of a person who has received health care of some kind, measured after the care (or some portion of it) has concluded. The post-care health status is assumed to be the product of the health

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[4] Marilyn Bergner, Ruth A. Bobbitt, William E. Pollard, Diane P. Martin, Betty S. Gilson. "The Sickness Impact Profile: Validation of a Health Status Indicator," Medical Care, January, 1976, pp. 57-67.

[5] Donald L. Patrick, J.W. Bush, Milton M. Chen. "Toward an Operational Definition of Health," Journal of Health and Social Behavior, March 14, 1973.

care. Donabedian,[6] Starfield,[7] Martini, et al,[8] and others have called this assumption into question, accurately pointing out all of the other variables which coincide with health care to determine a patient's health outcome. Nevertheless, we will define health outcome as a patient's post-treatment health status, which has an assumed, but unknown causal relationship with health care.

Health Team. A team is an organized group of people who work for a common goal. The concept of a team fits well for many disaster health care groups who come from outside of the disaster zone; they are organized and have plans for providing disaster health care. Some local health care practitioners may not fit the definition quite as well, having banded together to provide care to victims only after the disaster occurred and lacking any formal organization. Such groups will nonetheless be included under the rubric "team" in this study, both because these individuals do, indeed, work toward a common goal, and because their familiarity with the region may enable them to respond to unexpected contingencies more quickly than a previously organized team from outside the region. Individuals with health care skills who provide aid without any operational ties to an organized disaster health

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6 Avedis Donabedian. A Guide to Medical Care Administration Volume 2: Medical Care Appraisal -- Quality and Utilization (Washington, D.C.: The American Public Health Association, 1969).

7 Barbara Starfield. "Measurement of Outcome: A Proposed Scheme," Milbank Memorial Fund Quarterly, Health and Society, Winter 1974.

8 Carlos J.M. Martini, G.J. Boris Allan, Jan Davison, E. Maurice Backett. "Health Indexes Sensitive to Medical Care Variation," International Journal of Health Services, Vol. 7, No. 2, 1977, pp. 293-309.

group are not investigated in this study, due to the impossibility of gathering data on them. Because the existence of such individuals is sometimes claimed to be more of a hindrance than a help,[9] the actual performance of such individuals should be examined in the future.

Case Mix. Case mix is the mixture of different kinds of health problems seen by a health care provider or team. Case mix can be examined in terms of breadth, the scope of different kinds of case types, and depth, the degree of seriousness or complication of the cases seen.

Goodness of Fit. The goodness of fit is the degree to which a program or service's design and content are appropriate to meet the specific needs of the situation to which the program is being applied. While this concept may not be easy to operationalize in some fields of endeavor, in the health field it is relatively simple to judge whether the mix of procedures, medicines or personnel applied to a given situation is appropriate to meet the needs. This is due to the high degree of specialization in medicine and the lack of cross-over of therapy types.

Before beginning discussion on the research questions around which this study is built, we need to consider a conceptualization of the major variables and their relationships in the long causal chain between a community's (or individual's) pre-disaster health status, the

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[9] Claude de Ville de Goyet, E. del Cid, A. Romero, E. Jeannee, M. Lechat. "Earthquake in Guatemala: Epidemiologic Evaluation of the Relief Effort," Bulletin of the Pan American Health Organization, Vol. 10, No. 2, 1976.

intervention of the disaster agent, post-disaster health care, and the final health outcome. This discussion is based on the model diagrammed in Figure 4-1, and will follow in the same sequence in which the boxes are numbered.

(1) The physical environment affects all that takes place within it. In disasters, it determines what types of natural disaster agents pose a threat. Hurricanes, for example, are usually not a viable threat to places far inland. The environment can also affect the force of the disaster agent's impact. Heavy stands of trees can, for example, reduce the speed and force of ground winds, avalanches or floods, or they may enable a small brush fire to convert into a major conflagaration.

The physical environment also affects the normal, or pre-disaster, health status of the population. It does this indirectly, by influencing population characteristics and community organization, and directly, in ways too numerous to discuss here. While the normal physical environment does not exert a direct influence on the final patient health outcome after a disaster, it does achieve indirect influence through many causal paths.

(2) Population characteristics are extremely important to the health planner and researcher in determining vulnerability to disaster. Many characteristics must be considered, including the highly important pre-disaster health status, which is discussed in section 4.

The population density may affect both health status and vulnerability. High density increases the chance of endemic contagious disease and may, in poor areas, decrease the chance of adequate sanitation. High density also increases the sheer number of people

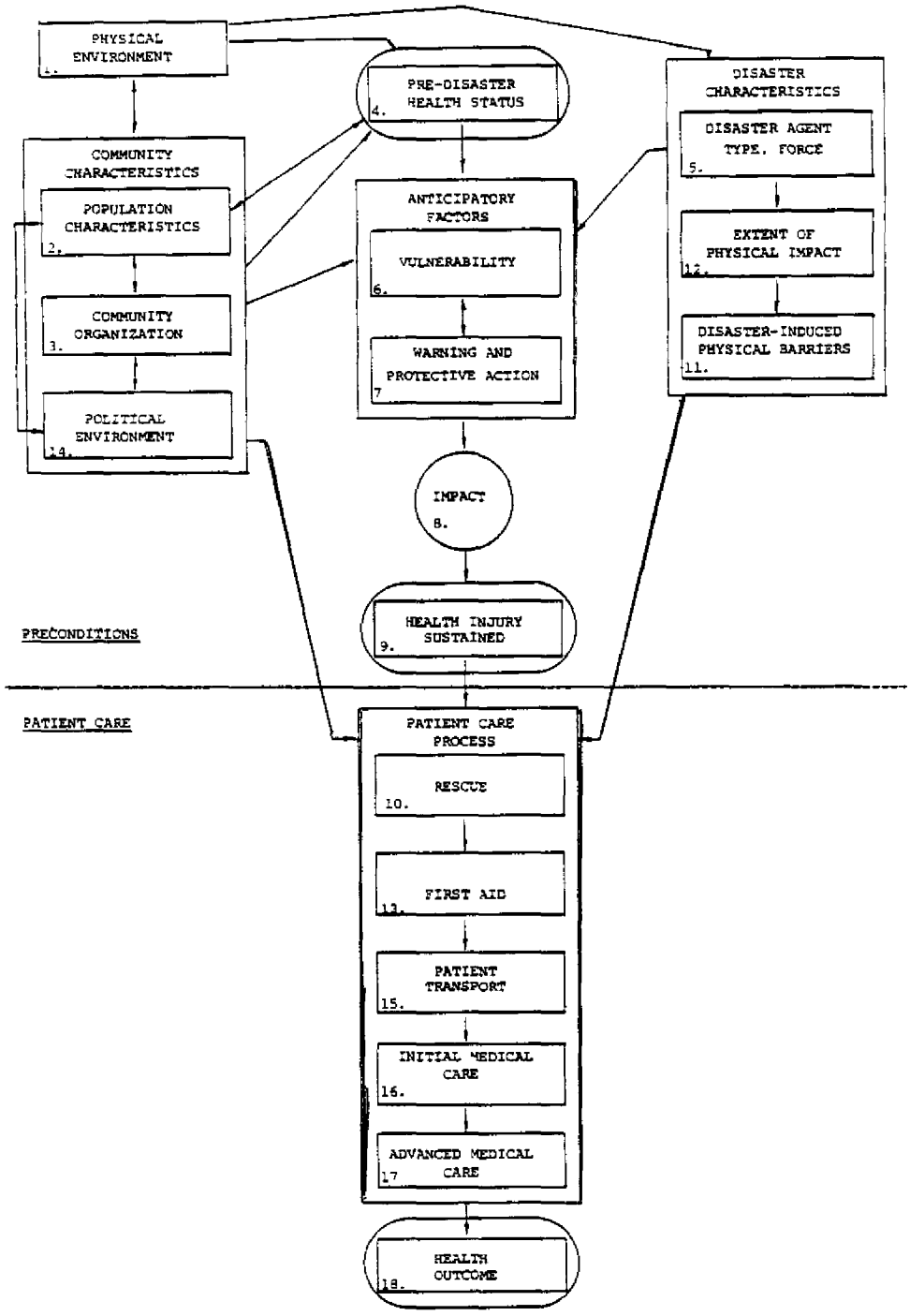

Figure 4-1 Variables and Relationships Leading to Disaster Health Care Outcome

vulnerable to damage in a natural disaster. The 1964 Alaskan earthquake, for example, surely would have had more serious casualties if the same quake had hit densely populated Southern California.

Age distribution may prove a valuable indicator of vulnerability in trauma-producing disasters. Recent studies show that the young (ages 2-9) and the elderly (above 60) have a much higher morbidity and mortality rate in traumatic disasters than do infants and young - and middle-aged adults.[10] The implication is clear: populations with a high proportion of young or elderly might expect to suffer more fatalities in a disaster than would a more evenly-distributed population. The same studies show that females suffer considerably higher disaster morbidity and mortality than males. Exceptionally high or low injury rates might be at least partially traced to an unusual male-female ratio.

Housing and sanitation are included under general population characteristics. Vulnerability indicators might include the type of structures, kind and availability of fresh water supply, and the kind and availability of sanitary facilities. The type of structures indicates vulnerability in some kinds of disasters, such as earthquakes.

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[10] Roger I. Glass, Juan J. Urrutia, Simon Sibony, Harry Smith, Bertha García, Luis Rizzo. "Earthquake Injuries Related to Housing in a Guatemalan Village, Science, 197, August 12, 1977.

Knowledge of housing types may help explain exceptionally high morbidity or mortality rates. Knowledge of the availability and type of sanitary facilities may help explain difficulty in controlling water-borne diseases after disease occurrence, and may help pinpoint disease causes during the emergency period. In general, the more complicated and "modern" a sanitation system is, the more prone it seems to sustain damage in a natural disaster.

Another important population characteristic is the population's means of livelihood and use of land. For example, a community that lives in a self-sufficient fashion and has inhabitants who, because of their normal labors, are practiced in the skills of construction and food production, may find the process of post-disaster recovery easier than a community which is more dependent on the labor of others. Communities whose main sources of economic activity are dependent on the availability of electricity, may find that post-disaster recovery relies on technologies and bureaucracies over which they have no control. Land use will not only affect the immediate supply of food, but may also influence the community's physical vulnerability to disaster damage through the effects of such things as deforestation and flood plain use.

Additionally, the population may have particular cultural beliefs or customs that impact survival chances. These might range, for example, from the Pakistani villager's fatalistic approach to life "Allah wills it," to the Mormon practice of keeping one year's supply of food in store.

(3) Community organization, like population characteristics, may be influenced by the physical environment. It may also be influenced by

political problems within and outside of the community. For purposes of this model, we will be concerned only with community organization as it affects disaster health care outcome.

Much in the same way that individuals adjust to their physical environment, so also does community organization. If the threat of natural disaster is constant, as happens in a typhoon-plagued coastal area, community organization is likely to exhibit some response to the recurring danger. Typhoon contingency plans may exist with a stated chain of command. Such organization may directly affect a community's disaster-related vulnerability, post-impact rescue, and first aid operations. However regional political problems such as hegemony competition or civil strife, may render standing community organization ineffective.

Community organization may also affect the population's pre-disaster health status through the organization of water supply, sanitation, food distribution, housing and health care. A fine example of the inclusion of this type of information in the analysis of a disaster relief program can be found in Disaster in Bangladesh by Chen, et al.[11]

(4) The pre-disaster health status is the actual starting point in this conceptual model. It is not only the starting point in terms of any pre-post comparison, but it also determines much of the population's stamina and vulnerability to health damage.

Perhaps the best indicator of the population's resilience

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[11] Lincoln Chen, ed. Disaster in Bangladesh (New York: Oxford University Press, 1973).

against infections and its ability to withstand a sudden break in normal water and food distribution systems, is its nutritional status. Adequately nourished people can normally easily survive a several-week interruption in food delivery. A break in food delivery can cause a chronically malnourished person to succumb to disease and dehydration. In Chapter Three we saw that the nutritional status of most Dominicans is precarious.

It is also important to examine other health problems that are endemic in the community. Most important are the prevalence rates of such diseases as malaria, dengue, tuberculosis, cholera, typhoid fever, and other debilitating diseases that may lower resistance to other invasive agents, or which may themselves be spread by disaster-caused environmental changes. The examination of endemic health problems will not only give a starting point for disease-specific pre-post comparisons, but it can also indicate which endemic health problems have the highest potential for post-disaster conversion to epidemic status.

(5) The type of disaster agent and force with which it hits the community may be at least partially determined by the immediate physical environment, as already noted. The disaster agents in the case of this study are two hurricanes which hit the Dominican Republic within six days of each other. The study communities are situated on the coast, or close to it, and were in the pathway of the eye of both storms.

(6) Vulnerability is weakness or likelihood of incurring injury or damage when faced with a given phenomenon. In disasters, vulnerability is agent-specific. Adobe walls, for example, which are very prone to collapse in earthquakes, may in fact be protective in wind storms.

Vulnerability can be analyzed in terms of zones, which differ from community to community in accordance with such things as land forms, land use, type and placement of structures, and community organization. When dealing with agent-specific vulnerability, at least a logical causal relationship must be established between the agent type and the particular community variables that may impact the chance of damage or injury.

(7) Warning and protective action must take place after the threat of disaster is recognized, but prior to its occurrence. The threat may be imminent, such as in a flash flood, or distant and unpredictable, as evidenced in a known earthquake zone or flood plain. Such action might consist of anti-seismic housing construction or a flood diversion project. In this way, an area's vulnerability to a particular disaster agent determines the type of protective action, while the protective action taken helps determine the area's vulnerability to that disaster agent. Protective action taken in the face of imminent disaster generally assumes the form of attempting to remove oneself from a position of vulnerability, or at least lessen the effect of inescapable damage.

(9) The health injury sustained by the disaster-affected population is the degree to which the disaster agent directly or indirectly damages the health of the population. The more obvious and immediate form, traumatic injury, can be examined both in terms of breadth (types) and severity (emergent, acute, non-acute), the latter probably being the more important measure. The health injury may also take the form of increased infectious disease or malnutrition, both of which should be

measured using normal methodologies. Because it may take some time for these effects to develop fully, the definitive estimation of the health injury sustained by a given population should not be made too hastily. The type and extent of health injuries, be they disease or trauma, determine much of what follows in rescue, first aid, transport, and definitive care -- not to mention eventual health outcome.

(10) Rescue is designed to remove victims from a position of entrapment or further danger, in an effort to prevent further harm and so that the process of helping disaster victims recover from their injuries or diseases can commence. The type of rescue done depends on the following four variables: (1) the community organization in its provision for manpower, equipment and structure; (2) the type and extent of disaster-induced physical barriers (box 11); (3) the types and extent of health injuries sustained; and (4) the imminency of further danger.

The community may already have rescue units organized, or may have a recognized authority structure that can provide immediate organization of a rescue effort. On the other hand, a lack of formal organization or authority may lead to spontaneous, unorganized rescue efforts, which are more likely to produce further injury to the disaster victim than are organized rescue efforts.

(11, 12) The extent of physical impact is the physical damage the disaster agent does to the community. This includes the disaster-induced physical barriers to the relief effort, which might take the form of the destruction of roads or bridges, or the interposition of fire or rubble, preventing access to victims. Physical impact also includes the destruction of available housing, medical facilities, food

stocks, communications facilities, etc.

Besides physical impact, another basic determinant of rescue work is the type of health injuries victims sustain. For example, people crushed under fallen debris will need a different rescue approach than do people surrounded by fire and suffering smoke inhalation. Concomitantly, the type of health injury and the imminence of further danger will determine the speed necessary in the rescue process. (13) First aid and rescue are closely related, both temporally and in that they share many of the same constraints and problems. First aid, in fact shares the same determinant variables as rescue, i.e. physical impact and type of injury. These variables are shown to affect first aid through rescue in Figure 4-1. First aid, however, also has some problems and constraints not generally faced by those who are responsible for rescue alone.

First aid is the initial examination of a victim's health condition, preliminary diagnosis of problems, and stabilization of those problems before transport to definitive medical treatment. In some cases, first aid may consist of quick life-saving actions, such as cardio-pulmonary cerebral resuscitation or hemorrhage control. In addition, it is usually the responsibility of first aid providers to triage the patients to the correct definitive care facility according to the type and severity of injuries incurred by the patient.

Although rescue and first aid should ideally take place concomatantly, as often happens in economically wealthier nations, it is not always possible in developing nations where resources for first aid training may be less available. Because first aid provision requires

more training than do basic extrication techniques, first aid groups in a developing nation are more likely to come from outside of the primary impact zone. Indeed, they may come from outside of the national boundaries. Because first aid groups and their equipment are more likely to come from outside the impact zone, they are also more likely to face problems caused by political rivalry or corruption (box 14 in Figure 4-1). Such problems may be considerable, including such extremes as denial of entry permission and confiscation of supplies.

(15) The transport of patients is ideally a part of the rescue and first aid process, but this, too, is not always the case in developing countries. A patient's condition may be sensitive to the way transport is performed. Careless technique may aggravate injuries, or excess delay may deprive the patient of timely lifesaving medical techniques.

(16) Initial (or "field") medical care is the first definitive medical care provided to the injured or ill disaster victim. This initial medical care is basically differentiated from advanced care (box 17) in the level of technology available to handle severe cases. Initial care teams will be able to handle the majority of medical complaints, but will not have the equipment or specialists available to handle problems normally considered the domain of "secondary" or tertiary" care in the United States. The latter domain will more closely fit the duties and abilities of advanced care teams. In fact, the distinction between "initial" and "advanced" medical care in the disaster may be an artificial conceptualization which is only pertinent in relatively resource-rich circumstances. In many developing countries, disaster health care will be supplied by whomever is able to reach the affected

area, and a referral service for complicated cases may not be possible.

The condition of disaster victims arriving for initial care is the product of all the variables represented in boxes 1 through 15 in Figure 4-1. The objective of initial care is no less than to mend the disaster victims' multifarious health problems and prevent others from occurring, thus creating the conceptualized dependent variable -- health outcome. In fact, even more than in the practice of normal clinical medicine, in the disaster situation the "health outcome" cannot be seen as a direct or perfect product of the health care provided. There are too many variables that are uncontrollable by the health care team. Nonetheless, a relationship is conceived to exist between the health care provided (both curative and preventive) and the eventual post-disaster health status of the affected individual or community, although the strength of this relationship is unknown.

Given the above conceptual discussion of what happens to determine health outcome in a natural disaster, we need to discuss the major research questions in this examination of the empirical experience in the Dominican Republic in 1979.

RESEARCH QUESTION ONE: WHAT WERE THE HEALTH EFFECTS OF THE HURRICANES?

The hurricanes that hit the Dominican Republic killed over two thousand people and left a large but unknown amount of injuries. Floodwaters overran fresh water supply systems as well as sewer systems and latrines, thereby mixing the two sources of water. Floods and high winds carried away food supplies both in the field and in storage. People were forced to crowd together into standing-room-only shelters

where they sought refuge from the vagaries of the storms. In the meantime, they breathed on each other, coughed and sneezed on each other, and exposed each other to unusually high concentrations of urine and fecal matter.

The combination of the above occurrences had great potential for damaging the public's health. In order to provide reasonably effective health care following similar situations in the future, we need to know what happened to the health of disaster victims in the Dominican Republic. We need to know roughly how many of the people were injured, and what kinds of injuries they suffered. How severe were the injuries? For purposes of future injury prevention, we need to know what caused the injuries, what the people were doing and where they were at the time they were injured.

With the forced crowding, overrun sanitary systems and foodstock depletion, it is possible that a major long-term health effect of the disaster would be in the form of increased infectious disease and malnutrition. Because of a lack of data, the effect of the disaster on malnutrition is not directly addressed in this study. To examine whether the hurricanes affected the public health through an increase in infectious disease it is necessary to examine pre- and post-disaster incidence rates. We also need to interview community members to obtain their reports on the post-disaster health experience in order to understand conditions which are not among the reportable diseases and to strive for that "insider's" point of view stressed by James Lewis.[12]

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[12] James Lewis, op. cit.

Since the infectious disease sequelae of the disaster may take some time to develop, our examination of them should cover both short- and long-term effects.

RESEARCH QUESTION TWO: HOW WELL WERE THE MEDICAL AND PUBLIC HEALTH NEEDS ADDRESSED?

Once we have an indicator of what happened to the population's health following Hurricanes David and Frederick, we can make some judgement about the adequacy of the health relief effort. This will follow in two manners: by examining how well the health care provided for the treatment of traumatic injuries and the cure or prevention of infectious disease, and by examining the goodness of fit between the health relief operation and the demonstrated needs. This evaluation of the post-disaster health care is a necessary step in the attempt to learn how such health relief can be improved.

RESEARCH QUESTION THREE: WHAT WERE THE MAJOR PROBLEMS IN THE RELIEF EFFORT, AND WHAT LESSONS CAN WE LEARN FROM THEM?

The major problem addressed in the Taylor and Cuny quote in Chapter One is that disaster relief providers rarely share their "lessons learned" with other providers. Because of this, we continue to repeat the same mistakes. This chapter provides a mechanism by which to collect, analyze, and share the lessons learned by disaster relief providers and recipients in the Dominican Republic.

RESEARCH QUESTION FOUR: WHAT ROLE DID THE POPULATION PLAY IN DETERMINING ITS OWN HEALTH OUTCOME?

The conceptual model presented earlier in this chapter clearly

shows that disaster health care is not the sole variable responsible for the eventual post-disaster health outcome. The community itself plays a role in its own health outcome, and this has not in the past been seriously studied. Chapter Six is an examination of the population's attitudes toward the disaster and its sequelae, the protective actions the people took, and what protective actions they would take should another hurricane occur. It examines compliance with official appeals to boil water before its consumption, and willingness to work together as a community to restore shelter and food. The chapter also presents an outline of the physical/psychological symptoms felt by survey respondents during the actual passing of the hurricanes, and takes a look at the communities' self-assessment of well-being prior to, immediately following, and two years after the disaster. The information presented in this chapter should prove valuable to providers of disaster health care and general relief in small rural communities and should stimulate further research into the field of disaster --- community --- relief interactions.

METHODOLOGY

As previously mentioned, the data for this study come from several sources: government statistics, two population surveys, and interviews with agency administrators and community leaders. The data collection methodology is discussed here by data source.

The government statistics are from previously unanalyzed[13] data

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[13] These data are previously unanalyzed, with the exception of work by this author. See: Bissell, RA: "Delayed-Impact Infectious Disease After a Natural Disaster" in The Journal of Emergency Medicine, Vol. 1, No. 1, 1983.

collected by the Ministry of Public Health. The data are based on diagnostic reports filed by mandate on all patients seen in the government-run hospitals and clinics. As such, these data represent continuous under-reporting, in that government run medical services probably see little more than fifty percent of national illness episodes, as mentioned in Chapter Three. These incidence or diagnostic reports are taken in the field by the health care practitioners, usually fifth year medical students doing their "pasantía" (field clinicals), or recent medical graduates. The author spent some time in field clinics observing the diagnostic and recording processes in an effort to evaluate both the reliability and validity of the recorded data. Diagnoses were almost always made based on presenting complaints and a cursory physical exam, usually with no laboratory confirmation available. The validity was judged to be of mediocre but consistent quality. Health care practitioners faithfully sent all diagnoses to the ministry where personnel of the statistics division compiled reports on a monthly basis. It was not possible to ascertain how the bureaucratic processing of the data may have affected their reliability. Everyone consulted, both inside and outside of the Ministry of Public Health, agreed that the data reliability has remained constant over the last six or seven years, and that any deviation during the hurricane period would have been a worsening of the normal under-reporting, due to the breakdown of transportation and communications systems. The data presented here were taken directly from the monthly report forms in the ministry's statistics office, in Spring, 1981.

I wanted to study a limited number of diseases that in the past

have been thought to be sensitive to changes caused by disasters. The diseases I chose were malaria, typhoid and paratyphoid fevers, hepatitis, gastroenteritis, and measles (rubeola). The data for typhus, tuberculosis, influenza, and the venereal diseases proved too incomplete to be useful, and cholera is not an important disease in the Dominican Republic. I decided to study these diseases in five contiguous provinces which form a straight line in a west northwesterly direction away from Hurricane David's initial point of landfall. From east to west, the bulk of the population of each succeeding province is consecutively further away from the wind effects of the storm. This was done in an attempt to separate wind effects from flood effects of the storms, and is described more thoroughly in the next chapter. I chose both the diseases and the provinces to be studied before collecting and reviewing the data. The diseases were examined and graphed over the five-year period of 1976 through 1980. The five months immediately following the disaster, September 1979 through January 1980, were statistically compared with the morbidity experience of the remaining fifty-five months of the study period. To test the significance of any observed increases, I drew a line three standard deviations away from the fifty-five month mean. The three standard deviation level assures statistical significance at the 0.001 level or better. This method of significance testing was chosen in order to be on the "safe" side of any doubt about the data reliability. The major weakness of this method is that it cannot be used for diseases which are in a long-term upswing, or which fluctuate wildly on a cyclical basis.

The population surveys were done two years apart, the first in

September 1979, two weeks after Hurricane Frederick, the second in September 1981. All three communities surveyed are within a fifteen kilometer radius, and were struck by the eye of both storms. The first survey was carried out by Drs. Amiro Pérez Mera,[14] Julio Cross Beras,[15] and John Belcher,[16] who had, by good fortune, preselected the communities for an intensive health survey prior to the hurricanes. The random sample, which was chosen prior to the storms but adhered to afterwards, was chosen by the block method. At the time of the hurricanes, the survey instrument was altered to be more disaster-relevant. The questionnaire was administered orally by surveyors employed by the INTEC Medical School in Santo Domingo and the National Statistics Office. A total of 220 families were interviewed in the three communities: sixty in Juan Baron; seventy in Palenque; and ninety in Yaguate.

The second survey, two years later, was designed by this author, with assistance from Drs. Amiro Pérez Mera, Julio Cross Beras and Oscar Rivera Rivera.[17] It was designed as a follow-up to the first survey, the data of which had been computerized but never analyzed or used. The second survey used the same sample as the first, but suffered some losses due to family relocation and death. "Lost" families were not replaced. A total of 188 families were interviewed in the second

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[14] National Statistics Office; presently Minister of Public Health

[15] National Statistics Office

[16] University of Georgia, Athens

[17] Health officer, USAID, Santo Domingo

survey: fifty-four in Juan Barón; forty-nine in Palenque; and eighty-five in Yaguate. Both Juan Barón and Yaguate retained ninety percent or better of the original participants, while Palenque dropped to seventy percent, bringing the average retention for the three communities to 85.5 percent. The second survey instrument was divided in two parts: the first repeating those questions asked of the family units two years earlier, and the second being a detailed health questionnaire for individual family members. The second survey, then, in addition to having 188 family interviews, also had 931 individual health assessments. The entire survey was administered orally as was done in 1979. This was necessary in a country of such low literacy. A survey team trained by the Dominican Red Cross and led personally by the national Red Cross Coordinator for Disaster Relief, Demetrio Castillo, performed the interviewing. The author was present and directed the interviewing in each community.

The data were thoroughly checked before being entered onto computer tape. Only one case of data falsification was found, in Yaguate, and these data were expunged before being entered or analyzed, and the interviewer was fired.[18] The data were coded and processed at the National Statistics Office, where a permanent record remains. Without being able to assign a numerical value, these data were judged to be "clean" and as valid and reliable as possible for survey research in a developing country with a low research budget. Further data analysis and statistical work continued using the computer facilities at the

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[18] The forty-nine families interviewed in Palenque is the number left after the falsified data were expunged.

University of Colorado School of Medicine.

It must be mentioned that, although the communities surveyed were all hit by the eye of the two storms, they were by no means "exciting" examples. If anything, they were unusual in that they suffered very little mortality compared to many surrounding communities. In the next chapter we will see that the health experiences reported by these communities were supported by the provincial-level data.

I conducted the agency interviews in person with the agency administrator or that person most directly responsible for the agency's disaster response during the hurricane period. Interviews were done in the native language of the interviewee. A list of questions was sent out a week before the interview was conducted. These interviews were done with several Dominican government agencies, the USAID, and various national and international voluntary relief organizations. In a few cases, where an interview proved impossible, information was gathered via letter and through the use of agency publications.

I interviewed two groups of community leaders at the three sites: health promoters and elected or volunteer leaders of the community. The health promoters are mostly women in their twenties and thirties who have received government-sponsored training to act as health educators, facilitators, first aid respondents, and health record-keepers in their communities. Each health promoter has responsibility for around eighty families. I selected the community leaders for interview with the help of the health promoters. There was very little debate about who was a community leader in these small communities. In fact, in every instance, all of the selected

interviewees belonged to some kind of community leadership committee, such as the Committee for Reconstruction in Juan Barón. The health promoters were interviewed in detail about the health experience of the community. I questioned the community leaders about the psychological reactions to the hurricanes, the actions the communities took, and the aid they received. They were also asked for their perceptions of mistakes that were made and improvements that could be made in future actions aimed at prevention and relief.

Keeping in mind the previously discussed role that epidemiology plays in the overall goals of this work, we now move on to the next chapter's discussion of the epidemiologic findings.