Disaster Study Number 6

Emergency Medical Care in Disasters

A Summary of Recorded Experience

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Committee on Disaster Studies

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COMMITTEE ON DISASTER STUDIES

The Committee on Disaster Studies is a committee of the Division of Anthropology and Psychology, National Academy of Sciences—National Research Council. It was established as the result of a request made of the Academy—Research Council by the Surgeons General of the Army, the Navy, and the Air Force, that it "conduct a survey and study in the fields of scientific research and development applicable to problems which might result from disasters caused by enemy action."

The function of the Committee is to aid in developing a field of scientific research on the human aspects of disaster. The Committee maintains a clearinghouse on disaster research, publishes a roster of scientific personnel in the field of disaster research, and issues periodically a Newsletter. It makes modest grants to encourage research in disaster studies, advises with responsible officials on problems of human behavior in disaster, and from time to time issues reports on the results of disaster research.

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Disaster Study Number 6
Committee on Disaster Studies
Division of Anthropology & Psychology

EMERGENCY MEDICAL CARE IN DISASTERS, A SUMMARY OF RECORDED EXPERIENCE

A SPECIAL REPORT
prepared for
THE COMMITTEE ON DISASTER STUDIES

by

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PREFACE

This is the first special report within the series of Disaster Study Reports. The special reports are being prepared by the Committee on Disaster Studies to summarize, analyze and publish the findings of a wide variety of disaster studies which have been conducted during recent years.

A community disaster is an event which destroys and disrupts. It has its impact not only on the individuals and families which are its victims, but also on the organized community from which these victims must receive help. The persons, agencies and institutions which serve the welfare and safety of the community are called upon to carry on an abnormally high load at the same time that communications, transportation and other processes on which they normally depend are disrupted. This is not more true of any service than of the medical services, especially in sudden, violent disasters.

When a tornado strikes a town, for example, literally hundreds of people may be injured in a matter of a few minutes. The hospitals and the medical and paramedical personnel are suddenly faced with the problem of mobilizing their resources and of treating these victims effectively, under circumstances which are far different from those of normal practice.

This does not mean that order cannot be established, effective emergency procedures followed, and sound judgments made. These things can be done, as illustrations cited in this report will show. It does mean that medical and paramedical personnel and institutions must understand the abnormalities of the disaster situation and that they should think about and plan and practice for this situation before it occurs.

The authors summarize these circumstances, analyze the problems they create for medical practice, and recommend practical solutions to some of these problems.

The issuance of this report does not imply endorsement of each opinion or factual statement by every member of the Committee on Disaster Studies or by the Committee's sponsoring agencies. We do firmly believe that this thoughtful analysis, based upon a wide variety of empirical data, deserves the serious attention of

all persons who might be called upon to help meet the emergency medical needs of a disaster-stricken community. These persons include not only medical and hospital personnel, but also other community leaders and officials. As this report points out, adequate emergency medical care is a total community responsibility.

Carlyle F. Jacobsen
Chairman
Committee on Disaster Studies

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I. INTRODUCTION

A. Background

The Committee on Disaster Studies of the Division of Anthropology and Psychology of the National Academy of Sciences-National Research Council has been in existence since December, 1951. The Committee has sponsored a number of studies of disasters in order to gather information about the behavior of humans in these extreme situations. Certain information on the medical care given casualties under disaster conditions has been amassed during the course of these general fact-gathering studies. Further data on medical care of disaster casualties has been secured by special study teams detailed to investigate this problem more systematically. The information thus obtained has been sufficiently provocative that it has seemed a worthwhile endeavor to seek out and consolidate the recorded data on emergency medical care in disasters.

B. Purpose

It is hoped that this effort will produce better understanding of the magnitude of the problems of medical care in disaster and that planning for medical care in future disasters will improve by lessons learned from past experiences.

C. Scope

The information available for study is not complete but an attempt has been made to summarize the pertinent publications. Sources include reports of studies carried out under auspices of the Committee on Disaster Studies, publications by physicians and interested participants involved in past disasters, studies made by the National Opinion Research Center, and material obtained from recorded interviews made by various groups in different disasters.

D. Method

Material pertinent to medical care is presented in its chron-

ological relation to the disaster and the events which follow. The progress of the injured toward their treatment, during treatment, and following treatment is described along with the problems encountered. Information pertinent to certain aspects of medical care is lacking in many recordings of disaster events so that the material is gleaned from many sources.

II. SOME GENERAL CHARACTERISTICS OF DISASTERS

A. The time-space model of disaster

In the largest sense, disasters are events in which an existing sociocultural system is disrupted by the impact of extraneous forces. The measure of the seriousness of the disaster is not the physical magnitude of the external force, but the magnitude and duration of the disruption it produces, directly and indirectly. In most grave disasters the whole community is implicated in the event; hence, the system of medical care in the community is almost inevitably disrupted. Thus the problems of medical care are often not merely problems of ministering to a disaster-struck population, but are also problems of repair, maintenance, and readjustment of the existing system of medical care.

Although each individual disaster is unique in detail, certain general properties may be recognized as common to most disasters. Researchers in the field have developed "models" of the time sequence and space involvement of the typical disaster event. These models are useful in providing a vocabulary and a frame of reference. The following stages have been suggested in the time "model" of disaster:

STAGE	FUNCTION
1. Steady State	The pre-disaster situation. Aspects of this situation relevant to what happens later are: kinship; economic, political, and religious systems; class and cast; demographic factors; topography and climate.
2. Warning	The possibility or probability of impact in the relatively remote future is indicated to the target population.
3. Threat	The probability or certainty of specific and local personal danger in the near future is indicated.

4. Impact	The extraneous force strikes. Destruction accomplished directly by this agent is called primary impact. Derivative destruction, after the working of the impact agent itself, is called secondary impact, and may continue for a long period. The laceration produced by flying debris in an explosion would be primary impact; the development of shock an hour later during a trip to a hospital would be secondary impact.
5. Isolation	The time between the cessation of impact and the arrival of aid from outside the impact area. During this period the victims of primary impact take inventory of their situation and attempt to help themselves. Outside the impact area inventory is also being taken and aid is being mobilized and dispatched.
6. Rescue	Aid from outside arrives. Extrication and evacuation of casualties and others, application of some first aid, and the control of secondary impact agents such as "hot" wires, traffic jams, spreading fires, etc., is carried on.
7. Rehabilitation	Problems of long-term medical care, reconstruction, food, clothing, finances.
8. Irreversible Change	A new equilibrium or steady state is re-established in the community after a few days, weeks, months, or even years. Generally the disaster leaves a legacy of some irreversible changes, although the efforts of rescue and rehabilitation workers have usually been to

restore the old steady state in most respects.[1]

In addition to the time schema outlined above, a spatial pattern is discernible in most disasters, with the area of involvement consisting of five zones, roughly conceptualized (and with due regard to the huge variability in the actual shape) as concentric circles about a core of "total impact:"

ZONE	FUNCTION
1. Total Impact	Area in which the impact agent works out its full capability for destruction.
2. Fringe Impact	Area in which impact agent does damage that is minor relative to what occurred in the area of total impact.
3. Filter Area	Virtually undamaged zone, from which the first rescuers and sightseers enter the impact area, and through which, in opposite directions, evacuees and rescue workers must pass. Serious traffic congestion often occurs here.
4. Organized Community Aid	The entire community, first, selectively by special institutions, and later, the whole population, is involved in the disaster, both by suffering secondary-impact inconveniences, and by performing rescue and rehabilitation roles.

1. The time model is based on John W. Powell, Jeannette Rayner, and Jacob E. Finesinger, "Responses to Disaster in American Cultural Groups," in Symposium on Stress (Washington, D. C.: U. S. Government Printing Office, 1953), pp. 174-193, with minor modifications suggested in Anthony F. C. Wallace, Tornado in Worcester: An Exploratory Study of Individual and Community Behavior in an Extreme Situation (National Academy of Sciences-National Research Council, Committee on Disaster Studies Disaster Study No. 3 [Washington, D. C., 1956]).

5. Organized Regional Aid	Outside the area of community involvement, selective involvement of various institutions (e.g., military, Red Cross, materials suppliers, etc.) radiates outward, and may bring into the disaster rehabilitation process personnel, supplies, and money from the entire nation and perhaps from foreign nations.[2]

It is manifest that there is great variability from one disaster to another in the duration and overlapping of the functional time phases and in the shape and extent of the space zones. Furthermore, the events occurring in a time phase or in a given space category show considerable qualitative variation from one disaster to another. It is important to note, however, that these times and phases can usually be distinguished, and planning should take them into account. In particular, it should be noted that while there is always an impact area, it is not always possible to predict where it will be. Probable flood areas can be calculated in advance with a considerable degree of certainty; epidemic areas can be predicted more roughly from a knowledge of the distribution of housing and sanitary conditions; but the ground-zero point of an atomic warhead, or the path of a tornado, cannot be determined in advance. Thus all disasters cannot be planned for in the same way.

B. The psychological climate of disaster

Under the stress of disaster conditions there exists a psychological climate different from that prevailing during normal conditions. In general, the behavior of persons under extreme stress is apt to be less efficient than usual even in the performance of simple or routine tasks. It may be extremely inefficient to the point of appearing pathological or quasi-pathological. The common denominator of this deterioration of behavior is its regressive quality: there is reversion to previously learned and less complex ways of doing tasks and of establishing the relations of the individual to his environment. The nature and depth of this "regression"

2. See Wallace, op. cit. (1), for an amplification of these concepts and a more systematic analysis of the integration of the space-time phases.

is variable, depending both on the person's own constitution and history and on the situation in which he is placed.

Among the injured and the less severely injured persons in the impact area, particularly the area of total impact, a phenomenon conveniently labeled "the disaster syndrome" is seen. It may affect almost everyone in the area for at least a brief period of time. In a fraction of these persons (perhaps one third in disasters of the explosive type) it persists long enough for observers from outside to note when they enter the impact area if the isolation period has been as long as fifteen minutes. (These estimates are based on observations made at Worcester, Massachusetts, after the tornado disaster.) The disaster syndrome is characterized by the following stages:

1. "Shock Stage"	Victim is unable to make more than minimal efforts at extrication and first aid for self and immediate relatives or friends; is described as apathetic, stunned, dazed; is unable to estimate the extent or degree of destruction; rarely leaves area or summons aid; may "putter about" doing inconsequential tasks or "wander aimlessly;" may be unaware of seriousness of own wound; has "flat" affect.
2. Suggestible Stage	As help arrives, victims become able to do minimal and routine tasks under direction; extreme concern develops over welfare of others, and reassurance of welfare of community is sought; there is lingering minimization of own losses or injuries; marked gratitude is expressed for minor services and favors.
3. Euphoric State	In some victims a sort of euphoria develops after the immediate crisis is past. There is intense altruism and willingness to work for community welfare; rescue and rehabilitation workers are praised; old grudges may be forgotten; and a strong esprit-de-corps may produce a kind of neighborhood revival.

4.	Ambivalent State	As the euphoria wears off, complaints against rescue and relief agencies develop; mass care organizations are criticized; personal financial and domestic problems come into focus.

This syndrome may require several days or even weeks to evolve. It is most clearly recognized in its early phase. Seldom does it require measures more intensive than reassurance and information; but the syndrome is important to physicians because of its influence on the response of casualties to efforts to treat them. The injured are docile and relatively insensitive to pain; they cannot care for themselves adequately, and they may minimize injuries. Their docility may mask temporary inability to deal realistically with the situation.

A very different but equally significant emotional reaction occurs in persons concerned with rescue, medical care and rehabilitation. The "counter-disaster syndrome" is characterized mainly by an over-eagerness to be of service. Blood donors insist on the "right to give blood;" volunteer workers insist on their right to help in the care of the injured; ambulance drivers drive too fast. In Worcester, the only true clinical psychoses reported to have been "caused" by the disaster were noted in persons from outside the impact area who felt guilty over the inadequacy of their own services. Physicians and hospital personnel and other members of the community outside the impact area often feel themselves under great pressure to function rapidly and effectively. Performance under stress is apt to be regressive (in less profound a sense, perhaps, than in the disaster syndrome), and to express itself by lapses to earlier patterns of response. Physicians may revert to inappropriate methods of treatment (e.g., primary suture for severely contaminated lacerations), may ignore available methods of therapy which require more skill (e.g., fail to administer plasma or available whole blood). Administrators are apt to haggle unduly over the "ownership of the disaster" and regard unemotional out-of-town representatives of national agencies like the Red Cross as competitors rather than colleagues. Rigidity of administrative procedure (such as refusal to admit negroes to partially occupied white wards) may result in failure to utilize facilities already in short supply.

Recommendations for the prevention of these difficulties will be deferred until a later section; but it may be pointed out here that the best prophylaxis against this sort of stress-induced breakdown in relief personnel may be brought about by the actions of a

centralized medical administration. One of the principal functions of a central medical authority would be the immediate reduction of anxiety-to-be-of-service by mobilization of personnel to assigned disaster roles and by the communication to the individual relief worker the feeling that he is doing a valuable and appreciated job.

C. The intrusion of non-medical variables into the medical system

The facilities for medical care in any American community constitute a semi-independent social system, with most of the equipment and personnel geographically limited to hospitals and private offices in a few parts of urban and suburban areas, rather than spread widely through urban, suburban, and rural areas. Under steady state conditions the system functions at a rate governed by the normal incidence of medical disorders and by the attitudes of the population toward them. Supply and personnel mobilization and recruitment are likewise geared to "normal" occasions. Furthermore, American medical professional personnel function with relatively high autonomy so that there is often lack of clear communication and authority channels between the medical profession and the rest of the community. Within the profession, there exists rather rigid specialization in role and prestige.

The problems of emergency mass medical care are those of absorption of quantities of patients intruded into the medical system at a rate beyond its normal operating capacity. During this process limitations of adaptability of the system are disclosed. Furthermore, when the medical system obtains the assistance of non-medical agencies for relieving the burden on its facilities in matters of transport, communications, supply, public information, etc., mal-coordination may develop.

The detailed integration of medical and non-medical institutions under disaster conditions should be made a major part of medical disaster plans. Even if integration cannot be accomplished, the nature of the problems presented by inadequate integration can be recognized in advance and some internal provision can be made for coping with them.

III. A CONSIDERATION OF PRE-DISASTER PLANNING

A. Central Control

In the various disaster situations on which there is available information it has seldom been possible to discern evidence that a highly organized plan for centralized control of the management of medical problems was developed. It is true that in Great Britain and Germany during World War II the repeated air attacks led to a rather well worked out centralized control plan which was accepted in operation because the need for such planning was clearly demonstrated by the early experience with the raids. In this country no such highly organized plan has been developed during the single disaster events thus far encountered. There is little planning which would establish centralized control of the flow of casualties in a large area in any future disaster in the U. S. There is an agreement between the Red Cross and the Federal Civil Defense Agency which appears to be understood at the national level, but is not so well clarified at the local level. By the terms of this agreement the primary responsibility for the provision of emergency medical care in a disaster rests on the local doctors, hospitals, and health authorities, who are in turn organized under the Civil Defense plans. To the Red Cross is assigned the responsibility for relief and welfare activity connected with disaster management. In a number of disasters there has been noted some misunderstanding of the relative roles of the organizations between local chapters of Red Cross and local Civil Defense authorities.

Pre-disaster planning in this country relies in general on local agencies. Important among these agencies are the police and fire departments of the areas, the local hospital staffs, and various national and local social welfare agencies active in the region. Explicitly in most of the plans volunteer activity is expected.

Disaster plans in the several United States disaster situations on which information is available were found to have been at various levels of development. Actually, while a number of regions have developed plans for the medical care of disaster casualties on a regional basis, such a well developed regional plan has never been tested by an actual disaster in the U. S. A number of hospitals, however, which have encountered actual disaster conditions had previously developed highly organized disaster plans. Among those hospitals with organized disaster plans tested in this fashion

were the Perth Amboy General Hospital,[3] the Massachusetts General Hospital during the Cocoanut Grove disaster,[4] and the Air Force base hospital in the Warner Robins Tornado.[5] Many other hospitals were either lacking in disaster plans or had less highly developed plans prior to encountering a disaster.

In general, in the U. S., it is a vaguely formulated premise in civilian planning that any disaster which becomes too large to be handled easily by the local system will involve the use of military forces and possibly of medical personnel and equipment.

> "You have already mentioned the Army or the armed services, and armed forces . . . Col., Will you be so kind as to tell us under what circumstances this help can be secured and what we have to do to secure it?"[6]

There is formalized agreement about these planning details particularly on the part of the military.

> "The Robins Air Force Base conducts domestic emergency operations under the operational control of the Commander, 14th Air Force, in accordance with par. 5b(17), AFR 23-2. The protection of life and property and the maintenance of law and order within territorial

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3. Anthony W. Eckert and David T. Riddell, "When Disaster Struck We Were Prepared," Hospitals, XXIV (September 1950), 60, and Anthony W. Eckert and David T. Riddell, "Disaster Preparation A Prayer or a Plan?" Hospitals, XXV (April 1951), 41.

4. Nathaniel W. Faxon, "The Problems of the Hospital Administration," Annals of Surgery, CXVII, No. 6 (June 1943), 803-808.

5. Lewis M. Killian and Jeannette F. Rayner, Assessment of Disaster Operations Following the Warner Robins Tornado (Unpublished report, National Academy of Sciences-National Research Council, Committee on Disaster Studies, August 20, 1953), p. 15.

6. Waco Tornado (Brief from meeting held in Waco, Texas, August 14, 1953).

> jurisdiction of any State is primarily the responsibility of the State and local authorities. Intervention with Federal Troops will take place only after State and local authorities have utilized all their own forces and are unable to control the situation, or when the situation is beyond the capabilities of the State or local authorities, or when the State or local authorities will not take appropriate action."
>
> "The Commanders, 3rd and 4th Armies will assist civil authorities in the control of domestic emergencies, either in the event of imminent necessity or on order of the President."[7]

Conversely, it appears that most military establishments regard the nearby civilian personnel and supplies as available, if necessary, for use in a major disaster. There appears to be little formalized agreement about this latter understanding.

7. Domestic Emergency Plan (Georgia: Robins Air Force Base, 1954), p. 1.

IV. THE MEDICAL PROBLEM OF DISASTER

Most of the available data has come from recent experience with disasters within continental United States. These disasters have been of moderate to great magnitude in physical damage to persons and property. There has been variation in duration of warning and of impact but most of these disasters have been of the brief warning explosive type precipitating a sudden problem of mass casualties.

The problems created by disasters of even greater magnitude or different type may not be entirely comparable to those described here.

A. Notification

Before the actual impact of the disaster, during the period of generalized warning, many methods of widely varying efficiency have been used for alerting the general populace of the impending danger. It is obvious that the type of threat, its duration, and the nature of the warning system have great importance for the state of the alertness of the populace, and that this in turn has importance for the problem of medical care of the injured.

It may be said that in past experience only rarely have the warning systems now in common use functioned to alert the majority of the civilian populace to imminent sudden danger. In certain instances officials have been notified with accurate or sometimes incomplete data, but, in general, no successful general alarms have been possible. On an individual basis people who have suffered sudden catastrophic events may have become aware of the impending danger either by previous experience with similar episodes or by intuition; but these isolated instances are mostly without bearing on the problem of transmission of the warning to the general populace.

After the sudden impact of a disaster, notification of responsible officials has usually been haphazard. It appears that a common pattern of events was that considerable time elapsed before full understanding of the magnitude of the disaster problem was reached by responsible officials.

> "The Mayor of Waco is a volunteer, his paid job is managing a football stadium. He left

> his office around 6:00 on T-day, 'feeling that something was wrong'. Finding equipment already at work on the R. T. Dennis Building, his first thought was 'protection'. He sought the police chief and highway patrol captain. The captain of State Highway Patrol said no one had tried to call him; he had accidently been near the impact area, had gone back to his office and, guessing at the need, called Austin, Texas for aid. It was midnight before he could make contact with the Mayor or Chief of Police."[8]

The general pattern of notification of hospitals has also been haphazard; and it appears that the time between the notification of the hospital and the time that the first patient arrived at the hospital was roughly proportional to the geographic distance of the hospital from the zone of impact of the disaster. The hospitals most closely located to disaster areas often were warned of the event only by the appearance of the ambulatory injured. Hospitals more remotely located have had periods of alerting as long as one half to three-quarters of an hour before the first patients arrived.[9]

> "Our hospital is located in the northwest edge of town and was not at all damaged. In fact, we did not know a cyclone had hit the main part of town until after the patients started arriving."[10]

> "The Warner-Robins area is 18 miles from Macon, Georgia . . . The Superintendent of

8. John W. Powell, An Introduction to the Natural History of Disaster (Unpublished report, Baltimore: Psychiatric Institute of the University of Maryland, June 30, 1954), pp. 63-64.

9. T. G. Blocker and Virginia Blocker, "The Texas City Disaster: A Survey of 3,000 Casualties," American Journal of Surgery, LXXVIII, No. 5 (November 1949), 767.

10. Julian Pace, Superintendent of Hillcrest Hospital, Waco, Texas (Unpublished report to the National Academy of Sciences-National Research Council, Committee on Disaster Studies, n.d.).

> the Macon Hospital, had just gotten home from work when notified by Col. C., of the base hospital, of the emergency . . . It was fully an hour before any patients arrived from Warner-Robins. During this time the hospital was able to organize for the expected large influx of injured."[11]

> "Many of the hospitals were unaware of the catastrophe until the arrival of their first ambulatory casualties. At 5:25 p.m. an injured man arrived without warning at Hospital #7 in Worcester. Hospital #13 and #15 in suburban communities were also informed by the arrival of casualties . . . About 5:20 Hospital #6 in Worcester was informed by telephone call from the Worcester City Police that lightning had struck the 'Home Farm' (Brookside Home for the Aged) and that a few casualties were coming; the first of the injured had told the surgeon in charge of the accident ward to prepare for hundreds of casualties. Hospital #5 in Worcester received about a half-hour notice before their first casualties arrived at 6:30."[12]

> "In Galveston, a doctor witnessed the explosion from his office window and immediately alerted all the hospitals in the city to prepare to handle a large number of casualties."[13]

Notification of the public of the event of a disaster occurs locally when nearby people observe the actual events in the impact

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11. Killian and Rayner, op. cit. (5), pp. 2, 8-9.

12. Henry J. Bakst, Robert L. Berg, Fred D. Foster, and John W. Raker, The Worcester County Tornado - A Medical Study of the Disaster (Unpublished report, National Academy of Sciences-National Research Council, Committee on Disaster Studies, January 17, 1955), p. 12.

13. Leonard Logan, Lewis M. Killian, and Wyatt Marrs, A Study of the Effect of Catastrophe on Social Disorganization (Chevy Chase, Maryland: Operations Research Office, July 22, 1952), p. 38.

zone. Usually knowledge of the event spreads from recognition of the immediate local problem to a more complete realization of the general problem involved. (It also occurs by imperfect dissemination of information brought about by official sources.) There is often great delay in the spread of complete information.

The manner of notification of the medical personnel responsible for the eventual care of the disaster casualties has usually been comparable to that by which the public learns of the disaster, but in certain isolated instances notification of the key personnel has been accomplished by the action of the responsible hospital officials. Not infrequently hospital administrators have arranged to notify key medical persons on a spontaneous basis even if there has been no previously organized disaster plan.

> "No organized system for notifying and recalling personnel had been set up except at Hospital #4 and Hospital #6. At these two institutions the Superintendent called several men who had previously been selected as key persons in the event of disaster."[14]

B. Extrication, First Aid, and Field Triage

After the impact of a sudden catastrophic disaster a recognizable pattern of events has been observed repeatedly. The uninjured survivors have extricated themselves from the debris and looked about them first with a focus on their own immediate problems and then on the problems of their immediate families. The efficiencies of the activities carried out by uninjured survivors have been of greatest variability. Some are totally ineffectual and their activities may take forms incongruous with the needs of the situation. Others have been more able to assist relatives to carry out a pattern of organized activity, and to widen their focus of attention as they become convinced that their own immediate problems were controlled.

> "A psychiatrist at Worcester State Hospital was in his car during impact. After caring for himself and his family, he went into the Great Brook Valley and other areas to give

14. Bakst and Others, op. cit. (12), p. 45.

first aid. His description of the isolation period in one of the worst parts of the total impact area is the best single account in my files, of the quality of the behavior and emotion during the isolation period . . . 'I said, I'm a doctor. I'll help her, go and get some blankets. So he did . . . and as I was searching around in a fairly aimless way for something to deal with the wound someway with, he came back with the blankets . . . He was going through some papers (my fantasy is that he was humming while going through these papers; I don't think he actually was, but he was very much unconcerned) and then it started to rain . . . As I would encounter people who were not hurt, I would say, 'Help me move some of these wounded people out,' and they couldn't. I would talk to them and explain what I had in mind, and they seemed to react and respond in a normal way, and then just stand there or wander away, and nod their heads and not do anything."[15]

"The typical pattern of first establishing the whereabouts and condition of kin before doing anything else, is apparent: 'In a few minutes the thing was all over. I thought about my mother-in-law that was all alone, so I jumped in a car and went out to see about her. When I got over there, she was all upset and crying and I brought her back here to be with my wife. Then all the neighbors began to come in here, because it was about the only house that had a roof left on it. So I got them all in, told them to be as comfortable as they could, and I went downtown to see what I could do there to help."[16]

"Most of the survivors in the main path of the tornado were dazed. It took a number of minutes

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15. Wallace, op. cit. (1), pp. 77-79.
16. Eli S. Marks, Charles E. Fritz, and Others, Human Reactions in Disaster Situations (Unpublished report, National Opinion Research Center, Report No. 52, June 1954), I, 156.

> for them to realize the seriousness of the damage. Each was appalled by the magnitude of destruction and numbed by the realization of his own personal losses. Each made what efforts he could to extricate himself from the ruins of the damaged buildings. Most survivors then looked for other members of their families who had been nearby when the storm struck. Those able to do so attempted to extricate injured people from the rubble. They fell to work on the nearest problem that presented itself."[17]

The major work of extrication of injured from the debris and the initial steps to get the injured to medical treatment have been functions carried out chiefly by volunteers who entered the impact zone from the fringe areas about it, and from the uninjured areas at further distances. Volunteers streamed in almost at once. They came from an increasing radius in space as time passed. The earliest volunteers were alerted by their own perception of the needs near to them. Later volunteers came because of notification received by unofficial and official sources in areas more remote from the damage.

The extrication and transportation of the injured has been carried out by intense individual effort which was at first largely disorganized. Later, partial organization characterized by activity of teams of volunteers developed. All these efforts were marked by improvisation in the mechanical means of extrication and transportation of the victims.

> "When the tornado passed, neighbors and volunteers in the area immediately began rescue operations and casualties were rushed off to Hurley Hospital for the most part in all kinds of conveyances--station wagons, private cars, trucks, etc. ambulances and hearses were pressed into service immediately and dispatched by the police."[18]

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17. Bakst and Others, op. cit. (12), p. 13.

18. Irving Rosow, A Comparative Study of Human Relations and Communications in Disaster (Unpublished report, National Academy of Sciences-National Research Council, Committee on Disaster Studies), p. 50.

"This friend of mine that was killed--we dug down to him and he had a big two-by-four across his back and the brick was piled three feet high on top of it. When we got down to this big timber, one fellow hollered to get a saw. Course, everybody just stood there, so I got up and ran down the street trying to find someone I knew to borrow a saw from. I met a man down there that I thought would have one, and I asked him and he said yes, there was one over here on the back of his garage. He would never find it he was so nervous. He could never find it. So I went out and found the saw. When I got back, that man that run the service station come with a big hydraulic jack and raised the timber with the jack."[19]

In at least one instance there is some question of increased damage to entrapped victims which may have been brought about by amateur efforts at extrication.

"In my opinion, many died who might have lived had there been an effective rescue and evacuation team. In fact as I saw the early evacuation efforts, it is miraculous that more did not die. I saw many school boys as well as grown men, chopping and sawing at beams which held up whole sections of roof and tons of bricks, in ignorant and feeble rescue attempts."[20]

Authority in the form of police and fire officers and other officials has sometimes been present without assuming control of the work going on.

A feeling of urgency has pervaded the attitudes of the workers and victims alike.

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19. Marks, Fritz and Others, op. cit. (16), p. 157.

20. Joseph Hertel, The Waco Disaster (Unpublished report, National Academy of Sciences-National Research Council, Committee on Disaster Studies).

> "Both the typically simple family-oriented and the complex other-oriented rescue activity described and illustrated above were undertaken almost exclusively by local residents, with almost no assistance from individuals from non-impact areas. The non-impact population, of course, only learned of the tornado later that night; they had some distance to cover to get to the stricken areas; and they had to come over debris-littered on--and, in some cases, actually blocking--roads. The stricken population itself had little choice except to undertake the immediate rescue work. With the realization that the buried persons would die if not quickly extricated, the impact population quickly began rescue activity."[21]

There is evidence pointing to the need to establish the whereabouts of kin and to bring them to a place of safety, especially on the part of family and neighbors. Since the early rescue efforts have been undertaken by local ego-involved people, either individually or in small groups, this urgency seems to be a result of identification with the victims. Ambulatory injured have maneuvered their way out of the rubble to the nearest available hospital. Even rescue workers who are not personally involved have been disturbed by the magnitude of the task and the horrors of the situation and have attempted to move all the victims out of the disaster area as soon as possible. The time in which the injured have actually been removed from the disaster zones is quite strikingly short. For example, in the Worcester Tornado all the injured apparently were removed from the zone of impact within two to two and a half hours after the tornado passed. Similar short times of evacuation have been observed in other instances.

> "It is estimated by some observers that at least three-fourths of the surviving victims were out of the stricken area two hours after the tornado passed."[22]

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21. Marks, Fritz and Others, op. cit. (16), p. 158.

22. Rosow, op. cit. (18), p. 50.

The end result of hurried attempts at evacuation has been a general absence of first aid to disaster victims. With a few notable exceptions, the experience of the hospitals receiving disaster victims has been that less than 10 percent showed any evidence of first aid measures when they arrived.

> "The number of casualties given first aid cannot be determined. The number apparently varied in the damaged area under discussion, but in general, it was probably less than 10 percent of the total casualties. The basis for this estimate is the observations of the medical personnel who worked in the receiving wards of the various hospitals."[23]

> "First aid was almost exclusively given in the hospital or medical centers. Only 13 percent of the impact respondents gave or received first aid, while in the stricken area themselves. This 13 percent, furthermore, includes 4 percent of the respondents who reported treating themselves. While the proportion of individuals who were involved in first aid was probably low, it is possible that our data underestimate such activity. It may be that people who received treatment in hospitals, or medical centers later that night, failed to report the emergency first aid they obtained in the impact area itself."[24]

Fractures have been transported largely unsplintered; hemorrhage has been controlled when the blood pressure fell or by crude measures such as stuffing lacerations with pieces of clothing. The use of tourniquets has rarely been observed.

Attempts to set up first aid stations within the impact zone have been made in almost all the major disasters studied. During the period of time in which the injured were being evacuated, these first aid stations have been largely by-passed both by the ambulatory victims and by the volunteers providing transportation

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23. Bakst and Others, op. cit. (12), p. 14.

24. Marks, Fritz and Others, op. cit. (16), p. 167.

for the more seriously injured. Sometimes the avoidance of the first aid stations has resulted from lack of knowledge of their presence; but, even when the station has been known to be present, the tendency of the victims and the volunteer ambulance drivers has been to go to the nearest hospital.

> "Some physicians functioning in the disaster area attempted to set up first aid stations so that casualties could be brought to them. One such station was established in a drug store on Burncoat Street in Worcester. These doctors report that most vehicles carrying casualties passed them by."[25]

> "From the beginning, casualties that were brought in to Hurley Hospital for medical aid were unscreened; rescue workers seemed more interested in getting the more seriously injured victims into the first available transportation."[26]

Many first aid stations have been manned by non-professional people during the earlier hours of the disaster.

> "I was blown from the sidewalk clean inside a cafe, but there wasn't a scratch on me. I went outside and it was an awful sight. There were people running all over the street, cut up, some screaming. About that time one of the firemen--one who wasn't killed--came by me and said 'For God's sake, where can we get some first aid supplies?' He and I ran across the street to that drug store. It was a wreck, the front all blown in. I said to the owner, 'Where can we get some medical supplies?' He said, 'There they are on the floor--take what you want!' We picked up all we could carry and ran down to a vacant lot and set up an aid station. Other aid stations were set up in this manner."[27]

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25. Bakst and Others, op. cit. (12), p. 15.
26. Rosow, op. cit. (18), p. 51.
27. Logan, Killian, and Marrs, op. cit. (13), p. 36.

Later first aid stations have been used to a small degree in the care of construction and repair workers, military personnel and the like.

It is at this early stage in the conduct of medical care after a disaster that unusual leaders have emerged and taken control or partial control of the situation for varying periods of time. Sometimes these people have not been adequately qualified to handle these situations.

A good example is to be found in the Waco tornado disaster. During the first day after the impact of the tornado, a young woman-volunteer took charge of a first aid station in downtown Waco and gave aid to a number of people. She requisitioned drugs and freely distributed sedatives including barbiturates. (Most of the injured for whom she cared were not actually victims of the tornado itself.) Later events and further investigation indicated that this girl was completely untrained in medical activities; she was a car-hop and part-time prostitute from the outskirts of the city who had responded to the disaster situation in this unusual fashion.

> "The first man, apparently, to enter the area, reach for a telephone, and begin summoning people and issuing orders to the end of setting up an aid station and canteen in the heart of the stricken area, was a chiropracter. . . . One of the first persons reported helping in the National Guard Armory aid station was a young woman in a white coat and an operating room headress, who called up a drug store and requisitioned drug supplies, and freely administered sedation, including barbiturates, seconal and codeine . . . It turned out that this girl was a car-hop and part-time prostitute from the edge of town."[28]

Another example from the same disaster was that of a chiropracter who was not accepted in normal times in the professional activities of the local medical group. This man occupied himself with setting

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28. John Walker Powell, Preliminary Observations: Waco, Texas, Tornado of May, 1953 (Unpublished report, National Academy of Sciences-National Research Council, Committee on Disaster Studies).

up first aid stations during the early period after the tornado, and was intensely active in this endeavor. The effectiveness of these first aid stations is questionable, and another authority closed some of them as rapidly as they were organized.

> "This man opened three canteen-aid stations in the storm area on his own initiative. A Red Cross physician said 'On Wednesday, I had to go around and close all three of his aid stations, since there was no medical personnel at any of them."[29]

In the Arkansas tornado an orthopedic surgeon, who was also a controversial figure among the medical profession in normal times, organized his entire operating team and brought it into the area. He carried out surgical procedures for the first day after the tornado. His activities would appear to have been rather effective, but nonetheless, he was criticized by the members of the medical profession of the area.

In the disasters studied there has been very little evidence of any efforts to establish sorting of the injured at any point before they reached the hospitals. The dead, the seriously injured, and the slightly injured were transported indescriminately except that the ambulatory, who were usually less severely injured, often took it upon themselves to reach the nearest hospital under their own power.

> "Then there were the dead. During this early period rescue workers generally disregarded the dead in removing the injured, but many of the injured were 'dead on arrival.' In the critical situation it was not always easy to distinguish the living from the dead. A classic story is that of the rescue worker who stopped to feel a man's pulse and concluded that he was dead. Only then did he notice that the man had no head. Under such conditions, it is not surprising that corpses began to arrive at the aid stations as soon as did the injured."[30]

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29. Ibid., p. 13.

30. Logan, Killian, and Marrs, op. cit. (13), p. 44.

C. Transportation and Traffic Control

Just as the means for moving injured out of the rubble have been largely improvised, so the ambulance vehicles used to transport them from the fringe area to the hospitals have also been improvised. Police cars, ambulances, fire trucks, private cars, delivery trucks, and a host of other vehicles were pressed into service or eagerly offered by their drivers.

The need for speed has apparently been impressed on the volunteers and injured alike. In certain instances this obsession with the need for speed may have caused injury to the victims transported. It has been reported that in the Worcester tornado some of the more seriously injured were transported over rough roads at high rates of speed after it had become possible to route the traffic rapidly across the city to one of the more distant hospitals. It has been suggested that the roughness of this ride may have contributed to the appearance of wound shock in some of the injured.

> "The drivers were obsessed with the notion that great speed made for greater liklihood of recovery. Few casualties were reported in shock at the time they were placed in vehicles, whereas many were in shock upon arrival at the hospital."[31]

In the other disasters on which data is available no similar episode appears to have taken place. This does not mean, however, that it did not occur, since these other disaster studies had not been oriented as specifically toward medical care as the Worcester study, hence data that might have revealed the presence of wound shock was not obtained.

Control of traffic has been a development of the rescue period and has been attained only several hours after the impact of a sudden disaster. This has been true in spite of the active work of volunteers who stationed themselves at most of the street corners very promptly. Sightseers and volunteer vehicles converged on the impact zone. They produced clogging of the roads and became effective barriers which for rather long periods of time,

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31. Bakst and Others, op. cit. (12), p. 59.

slowed the flow of traffic.

> "The two most troublesome problems, as far as the hospital was concerned consisted of the spectators, who jammed the ambulance driveway, and heavy traffic which lengthened the time necessary to bring the injured to the hospital."[32]

In none of the disasters studied has any traffic control authority achieved success in designating the hospital to which the emergency ambulances were to be directed. The hospital nearest the disaster impact zone was the immediate goal. As soon as this hospital was flooded so that it became physically impossible to admit patients or even drive vehicles there, the traffic was diverted to the next nearest hospital, and so on in a progressive wave-like flow from the nearer hospitals to the more distant hospitals. The general pattern has been that the nearest hospitals are overwhelmed and the hospitals more remote from the disaster zone receive fewer casualties than their reasonable share.

Exceptions to this general pattern have been reported. When a hospital occupies a position of distinction in the community it may be that all victims and volunteers think of it first. Such an instance occurred in Flint where the flow of casualties was directed immediately to a more widely known, large, downtown hospital while a relatively less well known hospital nearer the impact zone was almost completely by-passed.

> "Despite the directions to cars and ambulances and the improvisation of the three medical stations, most people ignored these and, with sirens wailing and horns blaring, sped their loads to Holland . . . The failure to channel the stream of victims testifies to the formidable power of salient institutions. The well-worn paths of familiarity provided goals and directed behavior under stress, when these goals were not blocked."[33]

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32. Killian and Rayner, op. cit. (5), p. 10.

33. Irving Rosow, Public Authorities in Two Tornadoes (In process of publication, National Academy of Sciences-National Research Council, Committee on Disaster Studies), p. 190.

The problem of controlling the flow of casualties to hospitals so that a reasonable distribution of patient load can be attained is a very difficult one. Experience in the Mediterranean theatre during World War II indicated that it is possible to achieve this aim when there is a relatively fixed military front and a military organization has complete control of all traffic facilities and hospitals. Under these circumstances it is possible to work out a formula for the distribution of casualties to the hospital based on the estimated time which will elapse before a given casualty at a given advance point can reach the effective surgery he requires. The army experience has been that a high degree of organization was required to carry this plan out effectively; that constant information exchange between a central point and the hospital was necessary; and that even then, there were occasionally difficulties in the operation of the system.[34, 35, 36] It is not amazing that control over casualty flow to hospitals has never been attained after a sudden disaster in a civilian setting where administrative control and information exchanges have not been developed.

In most of the disasters studied there has been no successful evacuation of the ambulatory injured or of the slightly injured to accessible medical care outside the immediate region of the disaster and its fringe area. The tendency has been for the ambulatory injured to be treated at the hospitals nearest the impact zone, and in some instances there has been resistance to the suggestion that these less seriously injured people should be transferred to another hospital or actually evacuated elsewhere. There have been some exceptions to this general experience. In the case of the Worcester disaster, the neurosurgical team accomplished well-organized sorting of the injured patients at the hospital nearest the impact zone and evacuation of these injured patients to the hospitals better equipped for their care at more remote points.

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34. Edward D. Churchill, "Panic in Disaster," Annals of Surgery, CXXXVIII, No. 6 (December 1953), 22-23.

35. Joseph Rich, "Surgical Lag," Military Review, XXVI, No. 7 (October 1946), 47-52.

36. F. B. Berry, "Medical Organization of Combat Zones and Base Sections and Critical Areas of Civil Defense," in Symposium on Treatment of Trauma in the Armed Forces (Washington, D. C.: Walter Reed Army Hospital, Army Medical Services Graduate School, 1952).

> "However, two neurosurgeons in Worcester decided on their own initiative that one of them should function at Hospital #4 and the other at Hospital #6. The casualties collecting at Hospital #7 were reviewed by the neurosurgeon assigned to Hospital #4 before he went to his post. He selected patients with head injury to be transferred to Hospital #6, provided them with tags indicating the diagnosis, and arranged to have them transported in volunteer vehicles. Later that night word went from Hospital #6 to Hospital #4 that additional neurosurgical casualties could be cared for at Hospital #6. Most of the neurosurgical patients from the disaster area eventually were cared for at Hospital #6 or at Hospital #4."[37]

In the tornado in Arkansas the small clinic in Searcy became overcrowded very early and after some time the seriously injured were successfully evacuated to the city of Little Rock for further care, the slightly injured to a temporarily established hospital in a college dormitory.

> "We tried to sort the casualties into those that had minor injuries which would not require anything to speak of and sent those either to Harding College or to the National Guard Armory. Also another group of patients who were so badly injured--brain injuries and the like, that we could not very well handle here--that is, depressed fractures in the skull and that sort of thing. And severe fractures of all types, we sent those on to Little Rock. The remainder of the injuries that we could handle, we kept here."[38]

This was a development which came rather by necessity than by actual planning. In the instance of a tornado near Macon, some of the injured and particularly those with neurosurgical problems were

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37. Bakst and Others, op. cit. (12), p. 23.

38. Head of Rogers Hospital, Searcy, Arkansas (Unpublished interview, University of Maryland Disaster Studies), p. 3.

evacuated to the Macon General Hospital or to an even larger, more remote hospital.

> "Two patients were evacuated to other hospitals because their injuries could not be dealt with at the Base Hospital or at the Macon Hospital."[39]

This plan appears to have developed spontaneously during the disaster itself. In Waco some of the colored injured were evacuated to the Air Force base hospital but this evacuation appears to have been initiated by the refusal of some of the civilian hospitals to admit more than a certain number of colored patients.

> "The Base Hospital admitted approximately 80 patients and were prepared to care for 150 patients. All those cared for were colored patients, since the space allotted to the colored people in the Waco hospitals was limited."[40]

Traffic control in the grounds and the immediate environs of the hospitals themselves has been an extremely vexing problem in most of the disasters studied. The major reason for this difficulty with control of traffic has been the great overloading of the physical facilities of the roads and parking areas by the uncontrolled flow of traffic from the disaster impact zone to the nearest available hospitals. In certain instances the overloading of physical facilities was intensified by unforseen limitations in the physical planning of the delivery areas. For example, at the Worcester Memorial Hospital a narrow inlet in an encircling wall produced a bottleneck which was impossible to overcome, and the arrangement for the flow of traffic to the receiving area was such that only one car at a time could be driven into this area. Failure to provide another point of egress from the parking area in the vicinity of the receiving room made it necessary for the

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39. Killian and Rayner, op. cit. (5), p. 9.

40. Jeannette F. Rayner, "The Role of the Military in the Waco Tornado Disaster," in Studies of Military Assistance in Civilian Disasters: England and the United States (Unpublished report, National Academy of Sciences-National Research Council, Committee on Disaster Studies, August 1953), p. 16.

traffic to return by the same route by which it had entered.

> "At Hospital #4 the main entrance is wide enough to accomodate only one car at a time. This entrance quickly proved to be a bottleneck, and it was necessary to station official and volunteer policemen to control traffic. A second bottleneck was soon in evidence at the ambulance entrance because the ambulances and private vehicles, after discharging casualties, had to turn around in a blind end and return by the same route along which they had entered, thus bucking the oncoming traffic."[41]

D. Medical Care of Casualties

1. Hospital Phase - The reported experience in civilian and military disasters which is available for study has indicated that the vast majority of the injured received first aid and treatment at a hospital. The patients with minor injuries were dismissed and those with more severe problems were admitted for further treatment. Apparently only rarely has an injury of any magnitude found treatment at home or in the office of a family physician. The medical care of disaster casualties has been the medical care offered by hospitals under these conditions.

> "Several tornado victims with major fractures were treated outside of hospitals by persons with some medical training and were kept somewhere near the disaster area. One woman whose daughter is a trained nurse, suffered a simple fracture of the femur. This nurse splintered the fracture and put her mother to bed in a friend's home. The family physician was not called until the next day. At that time the fracture appeared to be in excellent position, and the woman continued to receive treatment at home."[42]

2. Admission and Triage - Since the state of preparedness of the many hospitals with disaster experience has been variable,

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41. Bakst and Others, op. cit. (12), p. 19.

42. Ibid., p. 30.

the control which has been established over the processes of admission of the injured to the hospital has been quite variable also. In general, those hospitals which have had a longer period of warning have been able to establish organizational control over admission of injured patients somewhat better than those for whom no adequate warning has been possible. In general, also, those hospitals which have reached a more highly developed stage of pre-disaster planning have been successful in establishing better control over the admission of the injured.

At the point of sorting or triage, control over the admissions and sorting of the injured has been possible when certain key posts were manned. When a responsible experienced individual has been placed at this admission and triage point, the flow of the injured toward their proper treatment was facilitated. It has also been possible for this person, and others acting on his information, to assess "the pattern of injury" particular to this disaster and thereby to lay plans for the better care of the types of injury anticipated. An excellent example of the successful functioning of a triage system in a hospital with a highly developed pre-disaster plan was the experience of the Massachusetts General Hospital during the care of the casualties from the Coaconut Grove disaster.[43] In Worcester partial control of the flow of casualties was obtained at one hospital when one key person arrived at the emergency ward and functioned according to a previously laid plan.

> "At Hospital #4 a staff member who had been appointed triage officer at the time of World War II was alerted by the administrator of the hospital and came to perform this function. So long as he was working at one of the entry points, the flow of casualties was kept in some semblance of order. Several times when there was a lull in the casualty flow he left his post to do other tasks, and disorganization of the triage system became immediately apparent when more casualties arrived."[44]

A successful experience has been also reported by a Perth Amboy Hospital in meeting disaster induced responsibility.[45]

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43. Faxon, op. cit. (4), pp. 803-806.
44. Bakst and Others, op. cit. (12), p. 20.
45. Eckert and Riddell, op. cit. (3), XXIV, 60-64.

At or near the point of admission records can be started and identification brought about by a system of tagging. Successful accomplishments of this goal appears to be absolutely dependent on arrangements made before the disaster has actually occurred. Apparently no hospital has successfully improvised a spur of the moment record or tagging system. Records of minor injuries are usually totally lacking. Lacking such a system, there has been resultant confusion, duplication of effort, failure of identification of injured, and sometimes lack of information about essential elements in the medical therapy initiated in the admission area.

3. Therapy - Successful control over therapy given to disaster casualties has also appeared to be dependent on the level of planning attained by the hospital before disaster struck. In the absence of planning, personnel with special skills may be misused or actually wasted. At one hospital in Worcester a highly trained surgical specialist occupied a large part of his time during the early hours after the disaster serving as a stretcher bearer. In a number of disasters personnel were used in the exercise of skills which they had long since forgotten, or had, at least, not used in many years. Surgical procedures have been carried out by medical people with no surgical experience, or by those whose experience was gained many years ago, but who had not practiced surgery since.

Under these conditions of confusion, methods of therapy found by experience to be best for injuries of the type encountered in disasters have sometimes been discarded. Even in experienced personnel, the pressure of work appears to engender an atmosphere of hasty judgment in the exercise of technical skills. There appears to be a tendency to regress in judgment under these conditions of psychological stress. For example, the stress of the disaster situation forced the abandonment of sterile surgical technique in at least three instances which can be documented.

> "The conditions under which the operations were done varied from one hospital to another. At Hospital #13 it is reported that attempts at asepsis were discarded early because of inadequate stocks of sterile supplies and sterile water. Tap water was used for cleansing the wounds, and instruments were passed from hand to hand and from case to case. Any

available suture material was used."[46]

In these instances a more leisurely completion of the task at hand was perfectly consistent with the facilities available and the maintenance of the usual sterile surgical techniques. In the two tornadoes in which medical care has been best studied, the accepted surgical technique of complete debridement with preparation of the wound for delayed closure was seldom used. Certain surgeons of great experience and a wartime medical background did use this technique in a few isolated cases.

> "There were mistakes made. Some major wounds should not have been closed."[47]

Most of the hospitals which have been hard pressed by the flow of injured from disasters have actually performed no more than the number of major operations of a normal working day; but the operations were carried out at an accelerated rate working continuously from the time of impact of the disaster. The implication is that such a limited load of major surgical operations could be handled in the hospitals normally available for the care of major disaster casualties in a reasonably leisurely fashion, with competent personnel, and with due regard for the usual therapeutic criteria. In a number of isolated instances, carefully planned team activities have made it possible for a large volume of major operations to be carried out under these circumstances without violation of the usual surgical principles governing therapy.

> "Most of the deaths in the tornado victims were associated with head injuries. Most of the major operative procedures required in the early hours of the disaster were neurosurgical. The two neurosurgeons previously cited operated on a total of fourteen patients with severe head injuries within the first twenty-four hours. Of these fourteen, at least nine had compound fractures with depression of the skull bones requiring removal of fragments and release of pressure; the remainder had acute subdural or extradural

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46. Bakst and Others, op. cit. (12), p. 27.

47. George J. Curry, "The Flint Tornado," Bulletin of the American College of Surgeons, XXXIX, No. 3 (May-June 1954), 125-126.

> hematomas. The general procedure followed was that established by standard practice in neurosurgery, namely, exploration of the area of expected fracture, removal of depressed fragments, release of enclosed clots, and closure of the scalp. It is reported that there was such extensive contamination of bone fragments in these patients that it was felt wiser not to replace the bone fragments but to leave a defect in the bony skull, which might be treated at a subsequent operation if necessary. Both neurosurgeons operated under rigid aseptic precautions, at leisure, and with considerable care directed toward adequate debridement."[48]

General experience in hospital medical care of disaster casualties has been that antibiotics and tetanus prophylaxis have been given to almost every injured person.

Blood sufficient for the needs of the injured has been available without great difficulty. Perhaps there has been a tendency to use less blood, plasma, and plasma volume expanders under confused conditions than normally would be used for similar patients treated under less stressful conditions.

> "It is interesting to note that in several hospitals the point of view was expressed that whole blood should be given sparingly to injured persons and that most traumatic cases require only small amounts of blood replacement. In several instances patients with severe trauma were moved or operated upon at a time when the blood pressure had stabilized at a low normal level, the pulse was rapid, and little or no shock therapy had been given. Death occurred in at least one patient who was operated upon while in this state (a patient with a traumatic amputation)."[49]

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48. Bakst and Others, op. cit. (12), pp. 25-26.

49. Ibid., p. 25.

The medical profession appears still to be relatively unfamiliar with plasma volume expanders and few have been used in disasters. It may be that the necessity of crossmatching and the need for attention to the details of intravenous administration have discouraged the use of blood and fluids. The experience of those who managed the intravenous therapy of victims of the Cocoanut Grove disaster indicates that fluids and colloid can be administered in large volume if the medical personnel are well organized.[50]

X-ray examinations have been done under disaster conditions with two general philosophies prevailing. Quite commonly x-rays have been done with urgency and in large volume as soon as possible after the arrival of the injured persons at the hospital. In certain instances, because of the confusion in associating the patient with the film, proper interpretations were delayed. The experience of several hospitals has indicated an attitude on the part of the injured and their relatives which encourages this practice. The public appears to expect to have an x-ray done quite soon after the injury has occurred, even after a disaster. A few hospitals have deliberately delayed most x-rays for twelve to twenty-four hours after the injury, either because of pre-planning or because of the physical limitations of the x-ray facilities. There is little evidence that any great harm was done by this delay.

A variable but sometimes important part of the therapy of the injured has been the problem of psychiatric care. In general the reports have been of docility and even apathy on the part of the moderately and seriously injured.[51] Psychiatrists who have experienced the emotional problems of the injured under these disaster conditions reported that the problem of control of the injured themselves was relatively unimportant in the early hours. Occasionally some injured person appeared to need reassurrance and information about himself and his relatives in order to reduce fear.

Disaster may create psychological trauma or exacerbate existing neurotic conflicts immediately or slowly, and some cases may eventually require a course of psychiatric aid; but the hours during which emergency medical care is going on present so many realistic stresses that the reduction of these by medical care, the provision

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50. Faxon, op. cit. (4), p. 805 and Lamar Soutter, "A Note on the Blood Bank," Annals of Surgery, CXVII, No. 6 (June 1943), 929.
51. Wallace, op. cit. (15), pp. 81-87.

of nonpunative leadership, the supplying of information, and some reasurrance are probably the most effective psychiatric first aid and prophylactic measures that can be taken.

For injured persons, for relatives seeking missing persons, for evacuees, and for children, the problems of psychiatric first aid become more acute, although in the first few hours after a disaster there have been relatively few problems which formal psychiatric intervention can resolve. Information, reasurrance, and direction tend to reduce anxiety. As time passes the need for psychiatric care in the sense of therapy may in a few cases become greater.

> "The surgeon in charge of the organization of emergency teams at the hospital on behalf of the Red Cross reported to Dr. L. that, as of four or five days after the tornado, scores were returning to the hospitals with ailments which this surgeon felt were emotionally based, and traceable to the stresses connected with the tornado."[52]

In children, careful planning for professional psychiatric help may be required to aid in readjustment to personal injury or personal loss.

> "Eight of the children studied had been personally injured. Seven were injured severely, according to our criteria, the eighth having suffered only a cut finger. The seven severely injured were disturbed, accounting for one-eighth of all the disturbed children. The relationship between injury and disturbance was found to hold statistically with this small sample."[53]

Some observers have recorded that separation of children from their parents in evacuation programs produced considerable emotional disturbance, and it may be suggested that members of family or other social units be kept together whenever possible.

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52. Powell, op. cit. (28), p. 24.

53. Stewart Perry, Earle Silber, and Donald Bloch, Children in Disaster (In process of publication, National Academy of Sciences-National Research Council, Committee on Disaster Studies Disaster Study No. 5), p. 59.

"About a hundred girls and a hundred boys six years of age and older were transferred to camps. Within forty-eight hours camp counselors with a good deal of experience were encountering numerous disciplinary problems and were forced to seek psychiatric guidance in respect to their management.

"The experience at a housing project in Worcester was quite different. Social agencies provided recreational activities for fifty children from this housing project in the disaster area. Twenty-five mothers of the children participated in group discussions three times a week for three weeks. Thus the children were in daily contact with their parents. At first the discussion groups concentrated on topics related to windstorms, but as time passed interest in the tornado waned and other more mundane problems assumed increasing importance. No remarkable emotional problems developed in the parents or children of this group."[54]

4. Medical Care Provided Outside the Hospital - Although most of the medical care of disaster casualties has been furnished by hospitals, under certain unusual circumstances medical care may have to be provided outside the hospital. Disasters occurring on ships or under other circumstances of isolation may create special problems which must be handled by the facilities immediately available. Occasionally physical limitations of the area immediately around the impact zone have required the improvisation of temporary facilities. A good example is the use of a college near Judsonia, Arkansas, for the care of some injured.

"Dean S. volunteered the use of one of their dormitories . . . We also called the National Guard Commander here and got him to open the armory. I sent two nurses, I believe, to the armory and two to this barracks at Harding College, and gave them enough morphine and (anti) tetanus, dressings and that sort of

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54. Bakst and Others, op. cit. (12), p. 32.

thing to open up emergency hospitals in those two places until more adequate means could be devised. Later doctors came in from Beaver Springs, Batesville and Little Rock and all over the place and staffed those two places."[55]

In general, however, the tendency has been for doctors and patients alike to go to the hospitals after disaster has struck. Only rarely are private doctors called or visited in the early hours after a disaster even by persons of wealth. Disaster equalizes the needs and deeds of its victims.

5. Public Health Measures - In flood disasters the danger of water-borne infection caused by contamination of water supplies has stimulated mass typhoid immunization in several instances. Some confusion has been reported when hospitals were confronted with large numbers of persons demanding immunization advised by local health authorities without prior arrangement with the hospitals.[56]

6. Results - In at least one instance it is possible that increased loss of life may have resulted from wound shock induced by inept and rough handling and transportation from the impact zone to the distant hospitals. (See reference #31.) This is a factor difficult to document for many of the disasters reported.

In one instance, it is also possible that increased loss of life may have resulted from inadequate replacement of blood and fluid losses caused by the trauma of disaster. (See reference #49.) Documentation of this observation is also very difficult.

It appears possible that increased loss of life and morbidity may have occurred from the employment of modes of therapy of less than optimum desirability. The occurrence of clostridial infection threatening to life has been reasonably low, although it is reported to have been high in one disaster.[57] The probable reason for this

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55. Head of Rogers Hospital, op. cit. (38), p. 2.

56. A. A. Rivin, "Hospitals in the Flood Crisis," Hospitals, XXIX, No. 10 (October 1955), 72.

57. 7 cases gas-forming infection, Texas City. Blocker and Blocker, op. cit. (9), p. 769. 4 cases gas-forming infection, Worcester. Bakst and Others, op. cit. (12), p. 33. 34 cases gas-forming infection, Flint. Curry, loc. cit. (47).

encouraging lack of serious clostridial infection has been the universal employment of antibiotics.

> "Most wound complications were those of infection. All wounds which developed hematomas became infected. Wound infections were first noted at about 48 hours. At 60 hours the first clinical case of gas gangrene was discovered. Until 96 hours all wounds were examined every five or six hours and smears and cultures obtained. Those wounds in which gas gangrene was suspected clinically or those with evidence of Clostridium perfrignes verified by culture, were treated as gas gangrene. There were 34 such cases in the total 57 wound infections . . . All wound revisions healed and the last patient was discharged from Hurley Hospital in October."[58]

There appears to be reasonably good documentation for the observation that injuries treated under these circumstances have been complicated by a wound infection rate higher than that normally to be expected with similar injuries treated under more optimum conditions. There is some difference of opinion expressed.[59] Death from invasive sepsis appears to have been rare.

In rare instances, it is possible that loss of life or morbidity may have occurred because of lack of personnel with special skills.

There are some instances in which the results of the medical care provided can be shown to be quite gratifying. For example, there has been no proven instance of tetanus reported in the disasters thus far studied. This must be related to the universal use of some form of tetanus prophylaxis. It has already been pointed out that death from invasive sepsis has apparently been quite rare, and this result must be attributed to the almost

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58. Curry, loc. cit. (47).

59. Donald Hight, James T. Blodgett, Edmund J. Croce, Elwood O. Horne, John W. McKoan, and Charles S. Whelan, "Medical Aspects of the Worcester Tornado Disaster," New England Journal of Medicine, CCLIV, No. 6 (February 9, 1956), 267-271.

universal use of antibiotics in the injured.

Finally, certain medical teams operating with coolness, precision, and careful planning have shown by the successful results of their therapy that the care of disaster injured can be attended by excellent results when time can be taken for exercise of careful thought and judgment.[60]

E. Problems of Medical Care Administration

1. Community Organization - In the recorded experience of communities suffering limited disasters of sudden onset, coordination and integration of services and facilities has seldom been well developed in advance. After the impact of disaster in four tornado-struck communities, there was "highly independent action by separate officials or agencies, considerable duplication of effort, virtually no consultation of the appropriate groups, and severe aggravation of operating problems."[61] Only one of the disasters studied occurred where there actually was an existing plan for medical care of the disaster casualties. This tornado disaster involved an Air Force base and the adjacent town. In this instance, the Air Force base had a "domestic emergency plan." The town had no plan. The Air Force base quickly put into effect its emergency plan. Cooperation between Air Force base and town, and the availability of a ready plan where medical authority had been pre-established, made for quick and efficient care.[62]

In the absence of well-integrated organization within the community, conflicts have arisen among agencies and an atmosphere of competition for "ownership of disaster" has developed.

2. Financial Arrangements - When disaster strikes, the hospital administration does not question people regarding ability to pay for the cost of care. Care has been rendered on the basis of need, and no reckoning of cost has been made until later.

In industrial areas perhaps 40 - 60 percent of the gainfully employed may be protected by some form of insurance. Hospitals may be reimbursed by utilization of the funds provided by this insurance coverage. In most of the disasters studied, a large

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60. Blocker and Blocker, op. cit. (9), p. 771.
61. Rosow, op. cit. (33), p. 183.
62. Killian and Rayner, op. cit. (5), pp. 4-5.

proportion of the cost of the emergency care has been defrayed by the Red Cross.

In at least four major disasters, independent temporary committees were established by local or state action. These committees received donations and distributed relief funds. A part of this money has been used for defraying hospital costs. Money for this purpose was distributed through existing relief agencies for the most part. These improvised arrangements tended to create conflicts between the temporary agencies and the National Red Cross.

3. Hospital Administrative Problems in Disaster - It must be repeated that experience reported in the disasters studied indicates that the state of organization for disaster has varied widely from one hospital to another in our country. This appears to be as true for the problems connected with administration of a disaster within a hospital as it is for the purely professional technical organization.

a) Traffic Control - In many disasters spontaneous evolution of control over the traffic within the hospital's rooms and corridors has been difficult to attain; but previous experience with patients or previous planning with trial runs utilizing simulated patients has helped in attaining control of traffic.[63] When no previous plans for control of traffic have been developed, an uncontrolled flood of volunteers and a rapidly expanding flow of traffic between the key points in the hospital has seriously handicapped the smoothness of the entire operation.

> "As one approached the door (of Memorial Hospital) the street, walks and grounds were swarming with crowds of people, many attracted by the sirens, who came to watch the injured being unloaded. Others came to volunteer their services, and still others desperately attempted to locate members of their family. Inside, one was met with a wave of humid heat, noise and confusion. Casualties were lying on the floor, desks and stretchers. Whole swarms of people were moving about; some working; some with looks of desperation stepping over bodies, peering under blankets, looking for loved ones.

63. Eckert, A. W. and Riddell, D. op. cit. (3), pp. 60-64.

> In one room, used as an office and workroom for hospital volunteers, was a variety of casualties. One woman with a broken arm and dislocated hip appeared to stare through one eyeball glazed as if hit by a sandblast. One woman was dead, several had minor lacerations. In a corner an obese man lay on his back with a head and chest injury, vomiting and aspirating gastric contents. Many had needles in their arms attached to intravenous solutions, with large swellings of fluid in the subcutaneous tissues. I describe these details simply to give a picture of the confusion that existed as the physicians began to arrive on the scene."[64]
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> "Volunteers with no professional training, but an ardent desire to help, were a problem. They were a source of interference and distraction and a professionally trained person whose time could have been better used was needed to direct their activity. They had a greater nuisance value than should have been tolerated during the emergency."[65]

b) Communication - Communication between any given hospital and other hospitals or other agencies is a grave problem in time of great stress. Central control of telephone traffic has only rarely been established.[66] Telephone switchboards have often been heavily overloaded with incoming calls for information, and they have rapidly fallen behind the volume of traffic so that important administrative messages were difficult to get through. Even the use of telephones independent of the switchboard has been of limited value although in several instances occasional important messages got through by by-passing the switchboard operator by means of remote independent telephones. In many of the major disasters there has been recourse to mobile radio units brought in, sometimes

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64. George R. Dunlop, "The Worcester Tornado," Bulletin of the American College of Surgeons, XXXIX, No. 3 (May-June 1954), 127-128.

65. Killian and Rayner, op. cit. (5), p. 7.

66. George M. Smith, John J. Bourke and Stanley B. Weld, "Hartford Circus Fire Disaster," Connecticut State Medical Journal, VIII, No. 8 (August 1944), 507-512.

from considerable distances, and used as the means of communication with outside agencies and other hospitals. In several disasters this type of communication was useful for several days after impact. Experience has also shown that there is a limit to the volume of traffic which can be carried by such a radio circuit in a given length of time. Considerable monitoring of messages to be transmitted may be required in order for this system to reach maximum effectiveness.

Within the hospital important administrative decisions concerning the apportioning of hospital space, traffic control, personnel policy, etc. have sometimes not been made or not disseminated because of inadequate information on the part of the persons in authority or because of failure of communication. Decisions made by authorities in the hospital may fail to be implemented by personnel carrying out therapy in part because of communication failure. Few hospitals seem to have evolved spontaneously a system of intramural communications using loud speakers or runners to the degree that rapid flow of information and decision has been possible.

c) Personnel - It has already been pointed out that the alerting of responsible persons who must carry out therapy or make administrative decisions has not always been systematic. Certainly notification cannot be expected to be systematic in the early minutes after a sudden disaster. Even later there has been considerable lack of system in the methods used for alerting responsible persons. This appears, however, to be of relatively minor importance because most of the physicians seem to have come to the hospitals acting in response to notification made to the general population. Only relatively few were alerted to come to the hospital by some official call.

Seldom have formal policy decisions about the therapeutic measures to be carried out, the distribution of personnel, and the responsibility for given tasks been made by the administrative personnel in control.

> "But in general, the whole thing was entirely on an individual basis, that is, everybody found himself a spot one way or the other and helped. And there was no, at least, in the early part of the thing, there was no organization whatsoever, there couldn't be, . . . we

> just worked along. I sent two nurses down to the National Guard Armory; sent two more to Harding College, they were on their own hook when they got there to do what had to be done . . . It was just a matter of everybody jumping in and doing what could be done."[67]

Rather, these things have been evolved by spontaneous local individual control. In many instances designation of the person or persons who were to have authority over the activity of the hospital during the disaster period has been difficult. Under these circumstances authority conflicts or failures may arise.

There appears to be a tendency for individuals involved in disasters to regress toward previously learned skills, and in some instances physicians who bear administrative responsibility have abandoned the actual making of policy and have reverted to more detailed professional activities on an individual basis.

> "The Red Cross Medical Section included a special committee whose function was to provide hospital-agency liaison to help the hospital and coordinate medical activities. The committee was composed of one doctor from the staff of each hospital plus some Red Cross representatives. Each hospital doctor was supposed to keep the Red Cross members informed of the picture of activities, developing problems, and needs at his hospital. The Red Cross in turn was supposed to furnish the hospital with the help which was needed. Actually, when the disaster hit, this plan simply evaporated. The doctors functioned in the emergency as doctors who treated casualties rather than as liaison or communication officers who kept the Red Cross informed of the local picture. Here, their primary role commitments were clearly technical - professional

67. Head of Rogers Hospital, op. cit. (38), pp. 13-14.

rather than organizational - administrative."[68]

d) Work Space - The experience with evacuation of patients previously in the hospital to provide bed space for disaster victims has been quite variable. In certain instances hospitals have apparently successfully evacuated 30 to 50 percent of the patients in the hospital before the disaster. Either by plan or by lack of plan certain other hospitals have not evacuated any patients. Some hospitals report that they have been handicapped by a lack of space because of failure to evacuate the previously full areas. There has been wide variety in the persons who have accepted the administrative responsibility for making decisions to evacuate and for sorting the patients who are to be evacuated. Most hospitals have appeared to lack a pre-arranged policy to cover this problem.

It appears that allocation of space for emergency care has been done best by those hospitals in which some previously planned maneuver for this eventuality has been practiced or at least discussed. In those hospitals lacking previous planning many incongruities of space utilization and location have developed. In certain instances it has become necessary to transport casualties from the receiving point to a remote part of the hospital in order that therapy could be given for traumatic shock. This long trip was made necessary by the utilization of areas nearer the receiving point for purposes less closely allied to emergency care.

Operating Work Space - It has been pointed out already that most of the disasters have been of a magnitude no greater than to require maximum effort in the hospital operating rooms involved of about one normal day's work of major surgery. The Administrative problem has been that this work has been condensed into a few hours and that a vast load of minor surgical work was added at the same time. A common solution has been to set aside a special area for minor surgery and to reserve the regular operating rooms for major surgery.

> "The regularly used operating suites in most of the hospitals were functioning at maximum speed during the night of the disaster. They were utilized for the care of major surgical emergencies and were adequate to handle the

68. Rosow, op. cit. (33), p. 148.

> volume of major operations. In general, the minor surgical problems were handled in less elaborate operating rooms or in temporary establishments serving as minor operating rooms."[69]

e) Drugs and Supplies

(1) Blood - Experience with a variety of disasters has shown that in most of the United States there is available adequate amounts of blood and plasma through sources associated with the Red Cross blood program and other blood programs. Little effort is required to reach these sources. Indeed, in many instances the mere knowledge that a disaster has occurred has been enough to stimulate the blood storage center to send blood and plasma to the disaster region.

It has also been the general experience that volunteers have responded overwhelmingly in an effort to donate blood. This great flow of donors has been increased sometimes by official or unofficial public requests for blood donors. The attitude of the general public has seemed to be, "In this emergency in which I as an individual was not hurt I can give blood." In certain disasters, efforts of individual donors to give blood were blocked by circumstances, and a wave of public resentment was experienced.

> "It is important to note that despite the fact that all radio and telephone communications were out, within one hour after the disaster occurred, people were lined up outside the Blood Center waiting to give their blood because they knew it would be needed."[70]

In a number of the best documented disasters efforts to draw blood during the period immediately after the impact have produced much waste in personnel time and even in the actual blood drawn.

> "Several aspects of this problem are noteworthy. First, the Red Cross administration which is alert to the problem of blood and prompt in its collection knew that stocks were adequate and could be quickly replenished.

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69. Bakst and Others, op. cit. (12), p. 49.
70. Hertel, op. cit. (20), p. 14.

> Although it had blood sent in from the Linwood and Dover Chapters, the Fenton Red Cross did not try to organize a blood collection. Secondly, the Red Cross volunteer and the mayor probably did not know that the whole blood as it is collected cannot be used until it is first processed. Therefore, it could have no immediate value in the critical early hours. The entire incident was severely disruptive, aggravating congestion and creating new problems for the staff in an already complex situation."[71]

> ". . . A line began to form outside the Red Cross blood bank and forced it to open and accept blood even though both hospitals and the Air Force base has a six months' supply on hand, and the new blood had to be simply stockpiled as plasma or for gammaglobulin."[72]

(2) Other Supplies - Experience has shown that most civilian hospitals have stocked adequate drugs, linens, and most other general supplies necessary for use in a sudden disaster of limited proportion. There have been a few exceptions to this general rule.

> "At Hospital #13 facilities and supplies were obviously inadequate for the tremendous load of casualties accepted. Sterile supplies were immediately exhausted and nonsterile supplies were used in the operating room. Instruments went from hand to hand and from one operative procedure to the next without resterilization."[73]

In limited disasters when shortages of supplies have occurred, total replenishment has usually been obtained without trouble. A fairly common experience of hospitals has been that drug house representatives and other suppliers appeared spontaneously offering

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71. Rosow, op. cit. (33), p. 197.
72. Powell, op. cit. (28), p. 18.
73. Bakst and Others, op. cit. (12), p. 53.

assistance and supplies at the time of a disaster.[74]

f) Elevators and Power Supply - In a sudden disaster failure of municipal power in those hospitals in which no stand-by arrangement is available has been a crippling and not infrequent occurrence.[75,76] This complication occurred in at least five hospitals during the New England floods of August, 1955.[77]

Elevators when uncontrolled by operators or on automatic control have sometimes created an additional traffic problem. The general experience has been that elevators were best serviced during disaster operations by the use of an operator in each individual elevator. A number of hospitals have experienced difficulties in transportation of beds and stretchers in elevators when the limitations of the size of the elevator had not been appreciated until disaster struck.

g) Administration of x-ray diagnostic work has already been discussed in the considerations of the professional handling of the therapy of disaster victims.

h) Morgue - In a number of major disasters in which many have been killed, the local facilities for the handling of the dead have been taxed. Apparently, the facilities for handling of dead in most communities in the U. S. are not adequate for handling large volumes of dead if a disaster strikes. Very few communities or regions have developed well integrated plans for disposal of the dead when local morgue facilities are overwhelmed. In certain disasters conflicts have arisen among authorities and civilian undertakers when the latter have been pressed into service to care for the unexpected number of dead. In at least one disaster it was felt necessary to carry out embalming procedures on many bodies without specific authority from relatives by working local undertakers on an emergency basis.

> "At Hospital #6 the morgue is designed to care for twelve bodies; it received thirty-nine on

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74. "Hospitals Hard Hit by Floods," Modern Hospital, LXXXV, No. 4 (October 1955), 49.
75. Marks, Fritz, and Others, op. cit. (16), p. 226.
76. Bakst and Others, op. cit. (12), p. 52.
77. Rivin, loc. cit. (56).

> the first night of the disaster. Its refrigeration facilities proved inadequate. About 1:00 a.m. the hospital Superintendent obtained permission from Civil Defense authorities to begin mass embalming of the bodies in the morgue. Undertakers were contacted by the Medical Examiner, and embalming was completed by the next morning."[78]

Hospitals have recognized great difficulties in the administrative handling of the dead and the problems connected with them. Responsibility for disposal of the personal effects of the dead has taxed the facilities of the receiving hospitals; and the problem of identification of the dead has often been solved by opening to the public the area in which the dead are placed in order that searching relatives might inspect each body. Some confusion has been created by this approach to the problem. In other instances a rigid system of exclusion of the public has been tried. Under these circumstances relatives were allowed to enter the morgue area in the company of a hospital representative in order to search for the suspected dead relatives.

The emotional impact of the recognition of death or of the search for a loved one among the dead has been great. Relatives forced to go through this ordeal have sometimes required psychiatric care.

i) Records - Analysis of records kept under the stress situation of a disaster has seldom been possible.

> "The survey team inspected a sampling of the permanent records of tornado casualties at each hospital. These records are sketchy. Many do not indicate the time the patient entered the hospital. . . . In general, the first medical note does not appear in the record until several hours after admission. However, most of the records contain some timed medical note entered before midnight, except at hospital #7, where the large number of casualties had created a major problem.

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78. Bakst and Others, op. cit. (12), p. 53.

> "Even the later notes are inaccurate in many instances. The administration of antitetanus prophylaxis and of drugs, the performance of surgical procedures, and notes depicting the progress of the patients were often omitted. These limitations make the hospital records a sterile source of information concerning the medical care of the tornado casualties."[79]

From available information it seems fair to say that adequate record keeping can be accomplished under these circumstances only when a high grade of pre-planned organization has been set up within the hospital. One effective system has been to start the record as the patient entered the hospital by means of pre-planned tagging. Information has been entered on this tag by personnel at the triage point and the tag has travelled with the patient throughout his hospital therapy. When the patient was ready to leave the triage point, some one person or team of persons was appointed responsible for his care and the maintenance of records of his therapy and progress.[80]

In limited disasters there appears to have been a lag period before records were begun unless a careful pre-planned tagging system has been set up. Often significant records were lacking until a stocktaking occurred in the entire administrative arrangement of the hospital; in certain disasters this has taken place twelve to twenty-four hours after the first innundation of the hospital with casualties.

> "As often happens in emergencies, so much had to be done in a short time that detailed records were not kept on the patients. Those that were seriously injured were identified, their name, address and any medication or treatment which had been given to them was listed on a tag, and the tag tied to the patient. Detailed records were obtained from hospitalized patients later."[81]

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79. Ibid., p. 30.
80. Faxon, op. cit. (4), p. 805 and Henry K. Beecher, "Resuscitation and Sedation of Patients with Burns Which Include The Airway: Some Problems of Immediate Therapy," Annals of Surgery, CXVII, No. 6 (June 1943), 831.
81. Killian and Rayner, op. cit. (5), p. 9.

j) Food - Within the hospital there has been relatively little difficulty in providing food for the increased number of patients, the workers, and the volunteers in the disasters of short duration. Most hospitals have had adequate stocks of food on hand for a brief period, and experience has been that outside agencies responded generously to help solve this problem. Often regular vendors of food to the hospital have volunteered unsolicited donations. Occasionally the large numbers of outside personnel and ambulatory injured have been numerous enough to require special arrangements for their feeding. Disasters of longer duration like the floods of August 1955 created a more serious problem in supply of food and water. Contaminated water supplies made many hospitals unable to use municipal water--outside sources brought in water by tank car in one instance. Cooked meals could not be prepared in the hospital kitchens--some hospitals used cold preserved foods, but one hospital was provided cooked meals by arrangement with a restaurant outside the flooded area.[82,83]

F. Public Relations

Experience has shown that one of the major problems confronting the hospital administrator in the period of turmoil associated with a disaster has been the problem of handling the relations of the hospital with the public. Many hospitals appear to have given relatively little thought to this problem until it was thrust upon them by a sudden disaster. Many unexpected and difficult situations have arisen, and the experience of different hospital administrators has varied. The public relations problem has had four major subdivisions:

1. The transmission of information to the public by press releases, by radio announcements, etc., has been difficult because of the urgent requests for information by relatives, by other individuals, and by agencies. The communications system has been greatly overtaxed, and the telephone switchboards have become so swamped that they could not function effectively for business calls or for information calls. A number of solutions have been attempted, most of them arranged extemporaneously, but in a few hospitals

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82. Rivin, loc. cit. (56).

83. Susan S. Jenkins, "'Black Friday' Brings a Flood of Problems and Some New Thoughts on Disaster Planning to Hospitals in the Kansas City Area," Modern Hospital, LXXVII, No. 3 (September 1951), 92.

there has been deliberate planning for handling the needs of the public information. It appears that this need has been met most effectively when the hospital set up a separate information agency somewhat apart from the telephone service so that all requests for information were referred to this separate agency and not handled by the telephone operators. The personnel in this information area included not only secretarial help for sorting and compiling data, but also professional workers who evaluated data and helped influence the statements which were made to the public. Examples of hospitals in which this arrangement has been successfully set up are the Memorial in Worcester, Massachusetts and Massachusetts General in Boston, during the Cocoanut Grove Fire.

The press has required special handling because of insistence that the administrator or some other high-ranking individual speak to them personally. Photographers have occasionally been difficult to control, in that pictures undesirable for release to the general public have been taken without permission. Most administrators have felt that special arrangements had to be made to take care of the press, and some have excluded the press and photographers from the hospital for some hours after a disaster.

2. The identification of the dead and of the injured has been discussed above. The problem created by the needs of relatives to identify victims of the disaster has had great impact upon the relation of the hospital with the public in general.

3. Volunteers and crowds who came to help or to observe have often been large in numbers and have created a serious problem of control. Release of volunteers, of observers, or of would-be blood donors into the working areas of the hospital has created congestion and confusion and has hampered the professional operations. The emotional reaction of some volunteers or of some observers has occasionally been such as to require special care for these people.

The handling of volunteers in general has been a difficult problem. It has been observed by a number of administrators that volunteers could rarely be fitted into the jobs for which they were specially skilled because no very successful screening could be accomplished. Occasionally trained non-medical volunteers--for example, those volunteers previously trained to take blood--have failed to function satisfactorily under the stress situation of disaster. There have been outstanding exceptions to these

general statements. In Waco a volunteer neurosurgeon apparently served in his professional capacity. In Worcester a volunteer plastic surgeon functioned in his professional capacity; and at another hospital in Worcester, a volunteer commercial photographer functioned for the better part of two days developing x-ray films in the dark room where he apparently went on his own volition without direction.

4. Community Reaction - The long-term relation of the hospital to its community has sometimes been influenced by the handling of public relations problem during and after the acute care of the disaster victims. The possibility of evacuating slightly injured victims from the hospital or out of an entire area to a more remote region has been unfavorably received by the public in at least one disaster.

> "One woman who was not injured, but whose mother was and did not want her mother transferred to Little Rock and made rather strenuous objections to it."[84]

In at least one other disaster there has been professional opposition to the suggestion that an overtaxed hospital should permit the evacuation of some recently arrived casualties to a more remote hospital. Those hospitals which must rely on voluntary donations felt a very keen sense of responsibility to the community and, therefore, felt sharply the possible public resentment which might arise if an evacuation policy was carried out.

> "Neither the doctors nor the hospitals were ready to accept, as a normal feature, the transference of patients suffering from certain types of illness or injuries . . . But often there was opposition; sensible and soundly argued in some instances, irrational and incoherent in others. Not un-naturally, many doctors were loathe to part with their patients; they regarded the transfer of patients to special centers as an indirect reflection upon themselves and their competence . . . Hospitals, particularly those relying on voluntary donations feared that their good will might suffer

84. Head Rogers Hospital, op. cit. (38), p. 4.

if they admitted that some of their patients could get more skilled attention elsewhere."[85]

85. Richard M. Titmuss, Problems of Social Policy ("History of the Second World War: United Kingdom Civil Series") (London: His Majesty's Stationery Office and Longman, Green and Co., 1950), pp. 475-476.

V. ANALYSIS AND RECOMMENDATION

A. Central Authority

A central authority in charge of medical management of the disaster, as well as other problems related to the disaster, is a need frequently experienced in the available studies of civilian disasters.[86, 87, 88] It should be arranged in advance. This authority could be centered in several key persons and their designated replacements. Among those whose normal assignment would be to this central group are the regional head of Civil Defense, the head of the police function in the area, and the ranking public official in the medical field in the area. In order to obviate some of the uncertainty which exists in the public mind as to whether or not Civil Defense authorities are to operate in civilian disaster as well as military disaster, it might to reasonable to change the title of the Civil Defense to Disaster Control Agency.

Radio communications should be provided for this central authority at a point convenient for the management of the entire area. Auxiliary communication centers should be designated and radio facilities provided so that destruction of the main radio transmitters would not destroy the effectiveness of the system. The surviving representatives of the central authority would repair to a functioning auxiliary communication center if the main transmitters were silenced.

It would be desirable to avoid jurisdictional disputes between agencies in future disasters. An agreement reached between the Federal Civil Defense Administration (Disaster Control Agency) and the American National Red Cross assigns to the former the primary responsibility for rescue, evacuation and first aid, and to the latter the responsibility for relief and welfare activities, when disasters occur. This agreement should be more clearly understood by local representatives of the two agencies. If a change in the assignment of the major responsibility for direction and control of disaster management becomes necessary before the work is completed,

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86. Bakst and Others, op. cit. (12), p. 67.
87. Rivin, loc. cit. (56).
88. Eckert and Riddell, op. cit. (3), XXV, 41.

some well defined method of determining the point of shift of responsibility should be established.

It would be desirable to have general agreement in advance about the principles which would govern the distribution of relief money and the arrangements to be made for reimbursement of hospitals for the care rendered disaster victims. Such an agreement might be worked out by the national agencies involved in the management of disasters; it might reduce the confusion and misunderstanding which may follow local attempts to meet these problems as they suddenly appear.

It seems clear that the responsibility for integrating the medical activities of the entire area should be entrusted to the central authority, and that the authority of this group should clearly be superior to the authority of other officials or agencies of any local city or town. The right of the central authority to issue orders so as to utilize hospital facilities and personnel for the best interest of all in the disaster area must be unquestioned. This should be arranged in advance by mutual agreement, and it would require considerable education both of the public and of medical personnel. Practice drills would be essential for the smooth operation of the plan. In an actual disaster each hospital would keep the central authority informed of its current patient load relative to its resources. The central authority would then direct the evacuation personnel in the disaster zone and at traffic control points to guide the vehicles bearing the injured to the hospitals best able currently to care for them. Evacuation of casualties with minor injuries to hospitals in areas remote from the disaster should be accepted as a principle to be applied at the discretion of the central authority.[89]

Plans for the future handling of civilian disaster or of military disaster in civilian surroundings should take into account the mental and emotional reactions of large masses of people afflicted by sudden catastrophe. Such plans must assume that people will perform accustomed routine tasks better than tasks which require initiative and imaginative improvisation or which would remove them from familiar work patterns and put them into unfamiliar roles on a volunteer basis. It seems clear that such

89. Principles of Disaster Planning for Hospitals (Chicago: American Hospital Association, 1956).

plans should be centered around a small group of key personnel chosen for their proven ability to react with calm under stress. In normal times such key personnel should not be in positions subservient to officials whom they would be expected to direct in time of disaster.

Inevitably the sudden impact of catastrophe creates confusion in the populace and, on rare occasions, even panic.[90] In order that control over the entire situation be established without delay and maintained without disorder, a strong and efficient central authority seems absolutely essential. This authority should be exercised by persons whose stature and judgment command respect and unquestioning obedience.

The personality and ability of the heads of the agencies which are to take responsibility for disaster management are of maximum importance to the success of the effort. If the authority of a central agency is not made clear, its directives may be ignored in time of stress; if the organizational ability of its head is not unusually high, confusion will exist and no plan can be executed in orderly fashion.

Planning for the future would most likely be effective if it utilized existing facilities and agencies already in existence and available at the time of the disaster. The agencies should be those accustomed to operate in emergency conditions and able to command respect by virtue of accustomed authority. During the initial phase in dealing with the disaster, authority should rest in an organization which operates on a twenty-four hour schedule.

Communications can be provided with certainty only by radio, and the most available sources are police cruiser cars and other public vehicles with "three-way" radio. In cities where taxicabs have radio contact with a dispatcher, their mobile transmitters could be used as auxiliary means of communication. Volunteer amateur radio operators with their sets, and the operators of radio equipment provided by telephone companies and other commercial enterprises, could be woven into the same communications pattern.

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90. National Academy of Sciences-National Research Council, Committee on Disaster Studies, The Problem of Panic ("U.S. Federal Civil Defense Administration Civil Defense Technical Bulletin TB-19-2") (Washington, D. C.: U.S. Government Printing Office, June 1955).

In this communications network the key points are to be provided with mobile transmitters in cruiser cars. Other cruiser cars are to enter the disaster area itself; indeed, they can be expected to be among the first vehicles to reach the injured. Each hospital could be provided reliable facilities for communications by stationing a mobile transmitter within easy reach.

Plans should be made in advance and rendezvous points designated at scattered locations within an area so that available physicians could be picked up by cruiser cars or taxis and taken into the disaster zone to effect triage of casualties before their evacuation. Other physicians would be expected to report to the rendezvous points to form a pool from which individuals could be assigned to special tasks. Perhaps some could be stationed at traffic control points to screen the casualties in the vehicles and help direct their disposal.

Trained volunteer first aid teams could be part of such provisional planning. These teams would be expected to work with the physicians in the disaster area and to center their activities around the police cruiser cars, since the latter would be their source of communication and possibly of emergency first aid supplies.

In time of disaster it is a natural function of police personnel to control traffic and set up road blocks. Medical control of the evacuation and field triage of casualties could be tied closely to this activity of the police. It would seem more reasonable to rely upon the police for this function than to expect even intensive efforts at education of the public to become effective.

The clearing of roads and the execution of measures to insure against fire, explosion, and electrical contacts would be carried out by regular personnel of departments of public works and utilities when alerted by the police.

In transporting the injured, volunteer vehicles might be required. These should not be units with radio facilities, which are more desperately needed for other purposes, and the drivers should be emphatically instructed to drive carefully and slowly to a designated hospital best prepared to receive current casualties.

Under conditions of emotional tension created by disaster some measure of conflict among individuals and among agencies is to be expected. General reactions and expressions of sentiment by

the public may not always be in keeping with logical reasoning. An agency or an individual with authority may be resented even though the functions assumed by that agency or individual are vital and are efficiently discharged. Experience suggests that the public responds more favorably to authority vested in local persons with whom it is familiar than to authority vested in persons who are regarded as outsiders, even though the latter may be performing vital tasks with distinction.

B. Hospital Disaster Plans

Hospitals should develop adequate disaster plans. A disaster plan should be woven around a few key positions important to the successful performance of the professional and the administrative functions of the hospital when handling an unusual volume of casualties. It is important that available personnel be trained to fill key posts on short notice, and that performance of the functions of no one of these positions should await the arrival of any one person. If positions are temporarily filled by junior personnel in an actual emergency, senior members of the staff can relieve the juniors as soon as possible.

For the successful operation of a hospital disaster plan there are several essentials:

1. There must be provision for control of traffic at the entrances to the hospital grounds, in the unloading area, at the entrances to buildings, and within the hospital, with exclusion of vehicles and personnel not authorized to be in those areas immediately concerned with the unloading and triage of casualties.

2. There must be reliable means of radio communication with central authorities and with other hospitals. Within the hospital there must be dependable methods of communication between essential points; telephones, intercommunication speaker systems, and runners may all be needed.

3. Competent experienced surgical personnel should be in charge at the triage point and available for immediate special assignment.

4. A tagging system should be established in order to attach certain important information to each casualty soon after admission. This information should include the patient's name, address, time of arrival, the tentative diagnosis, and the time and nature of

therapy. As soon as possible, an adequate permanent record should be started for each patient.

5. Assignment of personnel not involved directly in the central planning and operation of the hospital organization should be carried out through a central controlling point. As such persons are assigned to tasks, they should be given limited, specific responsibility and be expected to stay with that task until relieved or otherwise assigned.

6. General obedience to policy in the management of medical care as set down by key hospital personnel should be unquestioning under disaster conditions. To attain this level of obedience would require considerable indoctrination of the medical staffs of most hospitals. Under disaster conditions the treatment of the injured would be based on the general principles that elective surgical therapy should be postponed, that adequate measures to combat shock should be instituted, and that contaminated wounds should be handled by debridement and preparation for delayed closure. This plan of management is endorsed in the belief that it furnishes the greatest safety and most successful outcome in spite of some contrary opinion.[91] Its wisdom seems supported by majority experience.

> "It must be emphasized that primary closure of large heavily contaminated lacerations, no matter how tempting, is ill-advised and potentially a dangerous procedure."[92]

> "Despite a decade of preaching the gospel of the no-primary-suture management of contaminated wounds under combat or disaster conditions, the lesson has not been taken to heart by the profession at large. Here is an educational challenge . . ."[93]

7. There should be plans for the evacuation of patients already in the hospital at the time disaster strikes so that space will be available for casualties. Evacuation should be timed so as to minimize interference with the care of incoming casualties.

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91. Hight and Others, loc. cit. (59).
92. Blocker and Blocker, op. cit. (9), p. 771.
93. Churchill, loc. cit. (34).

8. An adequate stock of supplies should always be on hand in the hospital, and sources of supplementary supplies should be readily available. Careful plans for replenishing supplies in case of need should be made, and co-ordination of these plans with those of other hospitals in the area should be considered.

9. The physical facilities of the hospital must be equipped and staffed for operation under disaster conditions. Auxiliary sources of power are essential. Elevator service must be reliable and should be controlled by operators. The best available area for care of the dead should be designated in advance; refrigeration is desirable.

10. Information should be made available to the public through official representatives of the hospital; an information center with its own means of outside communication seems to be the best agency to carry out this function. It should not be located at the telephone switchboard. It should have ready access to important sources of information; yet it should be removed from the main channels of patient flow. These criteria may be realized best by a system of duplicate tagging at the triage point; one record to be sent to the information center, the other to go with the patient.

11. Crowds of donors, relatives, and volunteers should be handled so that they are prevented from interfering with the activities of the hospital. Such persons might be directed to report to a remote area of the hospital, there to await news and assignments.

Bleeding of donors should be done at a site far from the areas in which patients are placed, and no blood should be drawn if this activity cannot be carried out effectively without hampering other functions of the hospital, or if facilities for handling and storing blood are inadequate.

Relatives seeking to view the unidentified dead and injured could be permitted access to the patients and to the morgue in the company of a representative of the hospital.

12. The disaster plan and its key personnel must be sufficiently flexible to make it possible for the hospital organization to handle a wide variety of injuries under a wide variety of circumstances. The possibility of partial damage to the hospital

itself must be anticipated.

C. Military Control

It is recognized that a disaster of cataclysmic proportions might cause the failure of any plan for disaster management which is based upon active voluntary co-operation of nonmilitary agencies. It might then be necessary for martial law to be imposed and military control to be exercised over some or all civilian hospitals and disaster relief agencies. However, even in such extreme circumstances, civilian agencies would have to assume responsibility for medical care and relief activities during the first few hours after the impact of disaster. They would still be expected to function as normally as possible during the period of military control.

D. Mobile Units

It is also conceivable that a disaster of great magnitude might render all local agencies and installations inoperative. It would then become necessary to move military medical administrative personnel and entire hospital units into the damaged region from the periphery. Such arrangements might be associated with military control of the disaster area, but civilian mobile units might be required to supplement military units. These mobile units present their own problems in practical application.[94]

94. Stanley W. Olson, James R. Schofield, John M. Howard, and T. B. Shearer, Mobile Medical Support for Civil Defense, "The Field Trial," Pt. I (Unpublished report, Houston: Harris County Medical Society).

VI. SUMMARY

The available data which describes the experience obtained in providing emergency medical care in natural disasters has been summarized, and certain proposals for solutions to some of the medical problems presented by disaster have been made. It must be emphasized that most of the important medical information has been obtained from experience with disasters of limited extent, relatively few casualties, brief impact and little disruption of hospital facilities.

Extrapolation from the data provided by these disasters to the conditions which may prevail in a disaster ten times or one hundred times greater in magnitude may be dangerous or impossible; hence caution must be used in applying the lessons learned in these lesser disasters to plans for the management of the medical aspects of possible greater disasters. However, this approach to planning for the future utilizes the only information past experience provides, and it should at least make possible improvement in management of the limited natural disasters which must be anticipated.

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