A STUDY TO DEVELOP AN OPTIMUM SYSTEM FOR COORDINATION AND CONTROL OF CASUALTY EVACUATION FOLLOWING A NATURAL DISASTER IN THE BATON ROUGE, LOUISIANA, AREA

A Problem Solving Project Report

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FOREWORD

A mock disaster was staged on April 29, 1969, to test the Baton Rouge, Louisiana, emergency disaster plan. The test, called Exercise CADA 1969 (Capital Area Disaster Alert), had twenty-three agencies participating from the Greater Baton Rouge Area. Coordination of effort for the exercise was done through an eight-man coordinating committee.

This writer was permitted to observe the exercise and to attend the critique held the same evening. The critique was attended by the participating agencies.

Practice is essential to improve a plan regardless of the limitations imposed in an artificial situation. Direct observation of this practice permitted this writer to see, firsthand, the community effort toward improving its system. Criticism under these circumstances can only be subjective, and, perhaps because of this, some criticism may not be justified. Evaluation of a community response to disaster is obviously best done after an actual disaster. Fortunately for the people of Baton Rouge, they have civic leaders who are sincerely interested in and vigorously working toward improving this aspect of medical care for their people.

I am grateful for the opportunity to have been associated with this particular health care team and with the numerous other community officials who are dedicated to public service.

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CHAPTER I

INTRODUCTION

General Information

In this country, natural and man-made disasters kill over one thousand people and injure approximately fifteen thousand more annually.[1] The yearly total of those injured from disasters is small in comparison to the annual total of injuries from other causes, such as automobile accidents. Still, the comparison belittles the impact of the single incident in which hundreds of people could be injured in a span of a very few minutes. The almost simultaneous occurrence of large numbers of casualties accompanied by the physical destruction inherent in a disaster can seriously overtax community efforts toward treatment of the injured. Normal community health resources, geared to the daily medical care requirements of the area, are suddenly faced with the problem of providing definitive medical care to a large number of people in a short period of time. The effectiveness of the medical response in a disaster situation will depend, to a major extent, upon the plans made beforehand.

Optimal use of finite medical resources in a suddenly imposed and possibly overtaxing situation will require careful pre-disaster preparation and determined post-disaster execution of the plans. This important phase of community health care planning is one in which the hospital administrator should seek a leadership position. The hospital

upon hospital services brought on by a disaster. His should be a key role in extending planned medical response to a disaster beyond the hospital emergency room door.

Conditions Which Prompted the Study

The Louisiana Capital Area Health Planning Council and the Medical Society of East Baton Rouge Parish both recognized a need to achieve a higher degree of coordinated medical response to disasters. Within the medical society, an emergency medical services committee was established. Subsequently, a subcommittee on disaster medicine was formed. The immediate objectives of the subcommittee on disaster medicine embodied planning for the handling of disaster casualties, to include those caused by atomic and civil disorders. Since the Greater Baton Rouge Area is highly industrialized (primarily petrochemical industries), plant accidents, which could produce large numbers of casualties, also fell within the scope of medical disaster planning efforts. It is the ultimate goal of the Emergency Medical Services Committee to establish an emergency medical services system capable of assisting casualties produced by a single accident or in a mass casualty incident.

Statement of the Problem

The problem is to develop the best system for the coordination and control of casualty evacuation following a natural disaster in Baton Rouge, Louisiana, area.

Objectives

The objectives of this paper are:

1. To analyze and evaluate the present system of medical response to a disaster in Baton Rouge.

2. To describe those functions which are needed to improve the present system and to apply the derived system to three alternative situations.

Criteria

The system designed must:

1. Be applicable to a multicentric disaster such as that produced by a tornado or an earthquake as well as to a disaster occurring at a single location such as a plant explosion.

2. Provide for central control and integration of all medical resources.

3. Establish and operate a medical communications network.

4. Be a coordination center between the medical operation and other emergency services.

5. Provide central dispatch of ambulances.

6. Have applicability to disasters of varying magnitude and type.

Factors Bearing on the Problem

There are 904 operating beds in four short-term acute care hospitals in the city of Baton Rouge. There are a total of 137 acute care hospital beds distributed between the two nearby towns of Denham Springs and Zachary, Louisiana. Two Civil Defense emergency package hospitals (200 beds each) are presently stored in Jackson, Louisiana,

and two more are at Carville, Louisiana.[2]

As of June 1, 1968, there were 265 physicians and 935 registered nurses in the city. There are eight wholesale medical supply agencies in the city. There are a total of 24 ambulances performing regular ambulance services within the city and its suburbs.[3]

There is no written medical disaster plan for the city of Baton Rouge.

Assumptions

For the purpose of this study, it is assumed that:

1. All hospitals in Baton Rouge will be incorporated into the existing Baton Rouge Mutual Aid radio net.
2. The Medical Society of East Baton Rouge Parish will endorse this concept and support the need for medical and paramedical personnel.
3. The Baton Rouge Mutual Aid system and other agencies will continue to provide the support necessary to furnish vehicles, equipment, communication, and supplies.
4. The capability of some medical facilities may be limited or even eliminated by direct or indirect forces producing the disasters.
5. The personnel to fill key positions will be available, will be trained (rehearsed) for their roles, and will be capable of performing effectively under the extreme stresses produced by the situation.
6. The coordination and the control of casualty evacuation will be accepted by other emergency operating agencies as a medical responsibility and that a medical plan will be derived from this system and adopted as a part of the overall community plan.

7. Those personnel selected for key roles will not normally be subordinate to those who may be assigned a lesser position in time of disaster.[4]

Definitions

Disaster is an event or a series of events in which there is extensive injury and death to persons and extensive destruction of property and in which the established social organization of the community temporarily but abruptly ceases to operate.

Disaster medicine

> ... is emergency medical services on a large scale, applied in a community following either natural or man-made catastrophe. Under the professional leadership of physicians, it should provide systematic, rapid, effective, and life-saving medical care. This is dependent upon the availability of emergency community services, trained medical and allied health personnel, supplies, and hospital facilities. Such medical care must have as its ultimate goals the saving of life and the restoration of maximum usefulness of every survivor. Disaster medicine embodies the principle of priority of medical care by the prompt establishment of a system of triage or sorting by a physician knowledgeable in the immediate diagnosis and prognosis of trauma and acute disase.[5]

The Greater Baton Rouge Area, as defined by that city's chamber of commerce, is that area around the city within a forty mile radius. This area encompasses virtually all the local industries.

A major disaster is any disaster during which the damage caused was so great that it exceeded the resource capability of the state and its political subdivisions, thus causing the governor to request federal assistance and the president to declare the area a major disaster area.[6]

Mass casualities refers to a situation during which there are so many sick and injured persons that their number exceeds the capability of medical resources in the community to provide care for all the victims.

Minor disaster is any disaster during which the damage caused was

not excessive enough to cause the governor to request federal assistance or the president to declare the area a major disaster area.[7]

Natural disaster is a disaster produced by forces other than nuclear, biological, or chemical weapons.

Research Methodology

This report will concentrate upon developing an optimal design for central medical coordination and control of the evacuation and treatment of natural disaster casualties. Field study was limited to the observation of a mock disaster exercise (CADA 1969) in which more than two-hundred high-school students were tagged with a description of their "injury." The emergency plan tested then centered around getting all the simulated patients to a medical facility for treatment.

Research of the literature was conducted to obtain essential information on the effectiveness of the disaster response to an actual disaster in other areas. Data on the existing Baton Rouge medical plan were collected by personal interviews with various city and medical leaders, and by observation of the mock disaster exercise. The data will be analyzed and those functions need to produce optimum control of casualty evacuation will be derived.

Only minimal attempts were made to gather statistical data from past disasters. Those interviewed revealed that numbers injured in past mishaps were relatively small (fifteen to thirty). Emphasis was placed upon piecing together information on how the medical community would react now to a disaster. This assumed that past mistakes in relatively minor situations have been removed from present plans.

Review of the Literature

The population on the North American Continent and, particularly, those in the contiguous United States have been spared from truly great disasters. However, huge losses of life in the tens of thousands have occurred in other countries. As recently as February 29, 1960, for example, an earthquake and tidal wave in Agodir, Morocco, took 20,000 lives.[8]

The problem posed by a disaster to the medical care elements of the community is how to be best prepared to meet the demand for medical care produced by large numbers of injured victims. Sound, well-rehearsed plans are essential to preparedness, and there is general agreement on this throughout the literature. There exists, however a gap between principle and practice.[9]

Past practice has shown that, with or without a well-developed plan, much emphasis has been placed upon speed in evacuating the injured from the disaster site to the nearest medical treatment available, usually a hospital. The usual result has been to overload the nearest hospital with patients, while other hospitals equally well-equiped stand relatively idle. This practice of uncoordinated evacuation of the injured, with overemphasis on speed, sometimes over rough roads, may have accounted for an increased morbidity in individual cases.[10]

Careful sorting of disaster victims into treatment priority categories has been hampered by this obsession to take all the victims to a hospital regardless of the extent of their injuries. This has resulted in a general absence of first-aid treatment and an inefficient use of limited medical resources.[11]

Flexibility in plans, to provide for optimal use of all scarce resources in any contingency, is a factor stressed frequently in the literature. Flexibility, however, is difficult to achieve, for different types of disasters place different kinds of demands upon community responsiveness. Plans that provide for procedures to be undertaken in foreseeable situations and include general guidance for action under unexpected situations appear to be the most effective.[12] Universally, the writer's stress preparedness, central control, coordinated effort, and adequate communications as key factors in effective disaster response.

Prevention of disaster, where possible, can pay the greatest dividends in terms of saving lives and limiting destruction in the community.[13] There are many things a community can do to prevent some disasters. One example is the passage of industrial zoning laws to keep hazards such as dangerous industrial effluent and other by-products from possible contact with residents and property. Another example is well-developed fire and safety standards for dwelling and public buildings. There are many more examples in fields such as health and sanitation standards or flood control and similar measures that are aimed specifically at protecting the community from the possible hazard of foreseeable danger.

Community disaster planning, then, must encompass more than the post-disaster period. Planning should include an examination of the pre-disaster posture of the community as well. When a hazard cannot be prevented, such as an earthquake or a tornado, then planning should provide contingencies that will minimize the loss of life and property.

Footnotes

[1]Solomon Garb and Evelyn Eng. Disaster Handbook (New York: Springer Publishing Co., Inc., 1964), p. 1.

[2]Louisiana, Office of Civil Defense Director, Emergency Communications Annex to the City of Baton Rouge and Parish of East Baton Rouge Civil Defense Emergency Operations Plan, Annex B; Emergency Communications, "Professional Medical Services" (Baton Rouge: Office of Civil Defense Directory, 1968), para 4, n.p.

[3]Ibid.

[4]John W. Raker, et al., Emergency Medical Care in Disasters, Publication No. 457 (Washington, D. C.: National Academy of Sciences, National Research Council, 1956), p. 59.

[5]Council on National Security and Committee on Disaster Medical Care, Role of the Physician in Disaster Medicine (Chicago: American Medical Association, 1965), p. 1.

[6]Louisiana, Civil Defense Agency, State of Louisiana National Disaster Relief Plan, Annex B: Natural Disaster Accounting Procedures (New Orleans: Civil Defense Agency, May 1, 1959), p. B-1.

[7]Ibid.

[8]Reader's Digest Association, 1968 Reader's Digest Almanac and Yearbook (Pleasantville, N. Y.: Reader's Digest Association, Inc., 1967), p. 570.

[9]Raker, et al., Emergency Medical Care in Disasters, p. 11.

[10]Ibid., pp. 22: Garb and Eng, Disaster Handbook, pp. 10, 59; Harold C. Lueth, "Emergency Medical, Hospital, and Nursing Care", Annals of the American Academy of Political and Social Sciences, CCCIX (January , 1957), p. 148.

[11]Raker, et al., Emergency Medical Care in Disasters, p. 23.

[12]U. S., Department of Navy, Naval Radiological Defense Laboratory, An Operational Concept of an Emergency Medical Command and Communications System, by Richard E. Shoemaker and Barry Korn (San Francisco: Serendipity Associates, 1967), p. 20.

[13]Garb and Eng, Disaster Handbook, p. 8.

CHAPTER II

DISCUSSION

General

A community can be described as an unstructured system composed of many subsystems. These subsystems interact in a prescribed manner in accordance with the norms, the culture, and the laws of the subsystems and the community. Further, these subsystems can be studied independently and analyzed and their interactions with each other can be defined, particularly with respect to a given circumstance. The fire and the police departments are examples of subsystems that are interactive. Each department has its own function, yet each frequently works with the other in providing a service to the community.

A disaster shocks this ongoing system, and extreme demands may be placed upon its elements as a result. During and immediately following a calamity, one of the first community reactions is giving medical aid to the injured survivors.

This study is directed toward designing a system whereby medical aid to the injured victims of a disaster can be provided most effectively through optimum allocation of medical resources. Discussion will exclude specific reference to wartime catastrophe which could be produced by nuclear, biological, or chemical weapons. The highly technical aspects involved in transportation and first-aid treatment of such casualties will most certainly complicate the medical effort.

However, this problem can be studied separately and specific actions incorporated into the system evolved from this study.

This chapter is organized into five major areas of discussion. First, the present method of providing disaster medical care is described in sufficient detail to provide the reader with a conception of the method. Secondly, a brief description of the deficiencies in the system will be presented. The third discussion area is devoted to describing proposals for a new organizational concept. Fourth, this concept will be developed and its functions defined. Finally, alternative methods of deploying the concept and the merits of each will be detailed.

Present System of Medical Response to a Disaster

Baton Rouge has a very well-developed Mutual Aid system. It was the first of its type developed in the United States. When it was organized in 1944, the system was originally one of mutual support among the local industries in conjunction with the Baton Rouge Fire Department. It is a pool of manpower and equipment, organized by local industries, to cope with virtually any emergency that might arise within those participating industries. In a sense, an industrial emergency aid system that is too costly for any one industry to maintain. Originally Mutual Aid was intended only to assist participating industries in a given area. There are now over 100 similar organizations throughout the United States wherever industries concentrate. The program has since expanded to assist the community as a whole and function in such emergencies as fires, explosions, gas liberation, power failure, and

forces of nature (storm, wind, and flood). Mutual Aid functions only when requested. Its membership is totally institutional and is purely voluntary. The area served consists of an area of approximately a thirty mile radius around Baton Rouge.[1]

The city fire department is the central notification point for requests for Mutual Aid. The message is then relayed to the agencies whose assistance is needed. The nature and the scope of the emergency determine the agencies to be contacted. The fire department also functions as net control for Mutual Aid radio net, which has some forty-five base stations on the same net. The radio net links all the participating industries, the Civil Defense Communications Center, the law enforcement agencies, and the two largest of the four hospitals. (Plans are underway to link the two remaining hospitals into the radio network).

The initial disaster alert system provides for a primary and a secondary notification list. Someone at or near the scene notifies by telephone or otherwise, the fire department, the city police, the sheriff, the state police, or Civil Defense. Any one of these five agents is designated the primary informant of the remaining four, and this constitutes the primary list. Medical personnel and ambulance services are on the secondary notification list of Civil Defense.[2] The Medical Exchange, a commercial answering service for physicians, is the primary contact through which Civil Defense notifies the physicians. Hospitals are notified via the Mutual Aid radio net or by a telephone call received from the city fire department as part of its secondary notification procedure. The hospitals, then, notify their respective staff members. The Medical Exchange uses both the telephone

and an electronic wireless paging system to notify the physicians using this service.

Following alert notification, the hospitals prepare to receive casualties, the ambulances proceed to the disaster site, and certain physicians and nurses, so designated in advance, proceed to the disaster site to perform triage of casualties. Medical aid, overall, is geared toward an unicentric disaster site. For example, a plant explosion, or an airplane crash in the downtown or near downtown area. The predesignated physicians and nurses organize themselves into triage teams at the site. These teams, as they are now constituted, consist of one physician and one nurse each. (Four such teams were so organized in the mock disaster.) One of the triage teams is designated to perform three major tasks: (1) ambulance dispatcher, (2) acting medical chief at the scene, and (3) performance of triage. The other three teams acted only in the performance of triage. The triage teams circulate through the disaster scene, seeking victims and categorizing them. The victims are marked by a color-coding system, the color denoting a treatment category priority.

Communication among triage teams is done by voice at the scene. Communications with the hospitals is accomplished through the police radio or through verbal contact with ambulance drivers.

Ambulance services are provided by private and public agencies. These vehicles responded well to the mock disaster but acted somewhat independently in delivering their patients to a hospital. Before the triage team responsible for ambulance dispatch was fully operational, the ambulances took patients to the nearest hospital. Even after the ambulance dispatcher was attempting to coordinate the flow of patients,

there was considerable confusion because that particular dispatch team was unrecognizable from the others. Some drivers left in exasperation for the nearest hospital. One driver, upon returning from a hospital, reported to the dispatch-controller-triage team that the hospital he just came from was full. No more patients were sent to that hospital. When the mock disaster was over, that particular hospital had received only nine patients during the exercise. The bulk of 200 patients were distributed in two of the four hospitals. A total of 30 patients were distributed among the other two. Therefore, over 170 patients were delivered to two locations.

First-aid rendered at the scene was impossible to evaluate during the exercise. Verbally, there were plans to apply first-aid measures at the scene, but all categories of patients were delivered to the hospitals anyway. The color-coding system for denoting categories of priority for treatment is being revised. In any case, the ambulance drivers were unfamiliar with the color code method used.

In addition to ambulances, Mutual Aid furnished trucks and litters from local industry resources to transport the injured. The drivers were not trained in first-aid, and there was no assistant driver who could help load the litter patients.

A very comprehensive list of resources available through Mutual Aid is maintained at the fire department.[3] This list shows the location, the name, and the telephone number of the supplier. Items ranging from heavy equipment, such as large vehicles, to rope and ladders are cross-indexed in this file. The equipment needed must be requested since it is not automatically dispatched.

and with radios netting with the Civil Defense Emergency Operations Center radios was dispatched to the scene. The intent was to use this van to assist in coordinating patient evacuation from the scene to the hospital. It was not so used, primarily due to lack of communications between the van and the dispatch team. Walking distance from the site to the van was too far (approximately 50 yards) to provide efficient use of this important piece of equipment. The chief of police assisted the triage-dispatch-control team with information on patient input status to hospitals through the use of a hand-held radio. Police officers posted as traffic controllers at hospitals were queried for that information.

An American Red Cross emergency services van was dispatched to the scene. It played no major role in the exercise even though four first-aid instructors were dispatched with the van.

Major Deficiencies

Since there is no formal or written medical plan, there is no solid organizational response. Principally, there is loose control of the medical effort. There is a need for a medical leader who has central authority over all medical resources in the community.[4]

There is a need for a clear cut organizational framework which will fit the medical plan. Other emergency services have no way of knowing which person or organizational department should be their prime point of contact. Furthermore the lack of organization prevented the equitable distribution of work, a focal point for communications needs, or even a reporting point for incoming additional resources. As noted earlier confusion existed among ambulance drivers which could have been

avoided. Also the trucks and litters furnished by local industry stood idle for a time at the site because the drivers didn't know to whom to report. There is provision for a medical element within the Civil Defense organization plan for Baton Rouge, but, as yet, this aspect has not been implemented, at least not in writing.

The present system does not provide for resupply of medical items to support emergency medical teams. If treatment is to be performed, then supplies will be consumed. The hospitals and the other ongoing facilities have pre-arranged resupply channels. Emergency treatment teams deployed to render aid are not likely to be capable of resupplying themselves.

Procurement of additional manpower to fill voids in emergency service, to establish first-aid points, to reinforce existing teams, or to provide special emergency services appeared only loosely arranged in the present system. There is no single individual appointed to accomplish this task, and it is likely that much confusion could result from an uncoordinated recruitment effort. In a chapter devoted to the convergence phenomenon, Garb and Eng described some serious problems that could result from well-intended but imprudent requests for assistance.[5] Again, the need for coordination and central control is warranted.

Expansion of the medical disaster effort may be required if secondary disasters occur, such as fires following a tornado or an earthquake, or if the time span of the disaster occurrence itself is abnormally long. Extra shifts should be available to take over during prolonged operations. No such provision is apparent in the present Baton Rouge medical response system.

Another area of concern was the lack of provision for obtaining rescue teams to extricate trapped victims. This task should be left to trained personnel. Raker points out that spontaneous efforts by uninjured survivors has been of greatest variability.[6] This is corroborated by other authors.

Central ambulance dispatch was attempted during the mock disaster exercise but with little success. Without adequate communications, central dispatching of ambulances and other emergency vehicles is virtually impossible to achieve during disaster operations.

Adequate communication in other areas was also lacking. At the minimum a hand-held electric voice amplifier (bullhorn) could have been used at the site. Contact should be maintained with agencies outside the disaster site. This was not done except through the City Police Department which needs all its resources for its own use.

The alert notification system is dependent on a plan, an organization and a communication capability. Since none of these were evident to the degree required the alert notification system was too loosely arranged, and would probably break down in an actual disaster situation.

Proposals for a New Organizational Concept

Discussion herein relates not only to specific actions needed to improve specific deficiencies but also to suggestions toward constructing an entirely new system.

Since there is no time to organize during a disaster, the medical elements of the community must organize for disaster operations ahead of time. Organization can be accomplished along lines developed by local

disaster planners or as shown in Appendix A of this report. The method of organization is not so critical. The important thing is to have a framework within which one can perform duties and within which all duties to be performed are provided for. The organizational arrangement should not stop at specifying hierarchal positions of major elements. The subelements should be examined carefully for adequacy of staffing and available resources. For example, in organizing a triage team as a subelement, one should examine staffing closely to determine if this team can perform as expected. Development of an organizational structure can and should be done concurrently with planning.

Another key consideration in organizing the medical response is to provide for a recognized and a unified point of authority. This central point of authority serves to resolve conflicts in role among elements making up the organization, prevents duplication or excessive overlapping of activity, allocates resources, and, in general, provides for overall control of the medical effort. The need for central control of the medical effort is not so apparent when disasters are limited to one area and casualties are not spread out. The requirement to coordinate is reduced and decisions regarding spreading of resources are less crucial in the limited-area disaster. The real value of central control becomes apparent when the disaster site encompasses a large area and there are several important focal points. Decisions regarding distribution of resources are more critical to successful effort and the need for coordination with other emergency services is vastly increased. Central control, however, should not be so constrictive as to preclude the delegation of authority or to restrict the use

of subcontrol centers. Subcontrol centers, with their own recognizable points of authority, subordinate to the central controller but with authority over their medical segment, are essential to maintaining a manageable span of control. The subcontrol centers also provide for coordination with other emergency services in their immediate area. A sound medical organization with provision for central control and coordinative capability has not always been manifest in past disaster responses.[7]

The tool with which coordination and control are achieved is communication. This implies communication of all types--verbal orders, runners, telephones, radios, vehicles, written instructions, and the like. Of primary interest is communicating by voice over two-way radio or telephone within a network which can supply information to those who need it in a timely manner. All medical elements should be able to communicate with each other, either through direct links or through intermediate centers. Alternate methods of linking communications are diagrammed in Appendix B.

Another important aspect of a good communications network is the alert notification procedure. The present system involves a rather loosely tied together system with no provision for ensuring the completion of all essential calls. A detailed discussion of alternative methods in an alert notification system will not be developed in this report. It is sufficient to say that any alert notification method should be iron-clad to insure that the chain of calls is not broken. Provision should also be made for reaching those who are momentarily unavailable by pre-arranging reporting-in sites and procedures for those who hear indirectly of the need for their services.

In Baton Rouge, the Parks and Recreation Department has been assigned the mission of rescue as a primary function. Certainly, coordination should be pre-arranged to be sure this valuable function is available when needed.

A volunteer organizer to form litter-bearer squads would be helpful. Emergency medical treatment teams should not be required to comb a debris-strewn area in search of casualties. This task could be better performed by a person trained in first-aid who could seek out victims, render aid on site, and call for litter bearers or rescue squad, as needed. This aid man should be equipped with means of communicating with a subcontrol element. A hand-held radio would be excellent, particularly if it could be clipped to the belt when not needed to free both hands for first-aid. Litter bearers could be recruited from uninjured survivors or converging persons seeking some way to offer their services.

Administrative services should be available to the physician while disaster medical operations are in progress. Medical resupply, manpower recruitment, implementation of expansion schedules, organization of volunteers, and ambulance dispatching are among the more important tasks that could be performed by an administrative section. In fact, none but the central medical controller and the triage or the sorting team chiefs need be physicians. By pairing physician duties to those tasks which none but the physician can perform, more physicians can be made available and their talents more efficiently and more effectively utilized. Other health care professionals should be provided to assist in accordance with their abilities. Dentists, nurses, pharmacists, and trained first-aid men should be pressed into service to the maximum

of their abilities and, in turn, provided with administrative support which can further enhance their effectiveness.

The application of sound first-aid procedures prior to patient evacuation to definitive hospital care can probably save many hours delay in treatment. For example, the patient with a broken leg delivered to a hospital without having a splint properly applied may arrive in worse condition than when initially injured. In cases where serious bleeding or airway obstruction is involved, proper first-aid procedures can save many lives. Yet, in past disasters, patients were rushed to a hospital with less than 10 per cent of them receiving any noticeable first-aid prior to evacuation. Early treatment at the scene of the disaster is very important.

Well-organized sorting teams can do much to promote and supervise the administration of first-aid during disaster operations. However, a physician who applies splints and pressure dressings during triage at a disaster site is not utilizing his talent wisely. The physician in charge of a sorting team should have a nurse as primary assistant and four or five paramedical personnel to perform the less demanding medical tasks.

Casualty sorting or triage is an important part of conserving scarce medical resources. If at all possible, only those patients who need hospital care should be sent to a hospital. This does not mean that only the worst injury cases should be evacuated. It means that not all injured patients, regardless of the extent of their injury, should be sent to a hospital. First-aid stations can be formed near the site and minimally injured persons treated there. Hospital emergency facilities are limited, and, unless patient input is regulated, the less serious

injuries can clog the smooth flow of patients and delay treatment of the more seriously injured. Maintaining adequate communication with the hospitals in the area can provide the feedback necessary to control patient input. Also the status of a hospitals ability to treat the more severely injured can be ascertained.

Communicating with hospitals during a disaster and including them in the medical alert procedure are essential. Alerting all the hospitals at the first notification of a disaster allows them to gather their personnel and their material and perpare to receive patients. During the disaster, they should be kept informed of the estimated number of injured persons who have not yet been treated and the number of patients incoming on an ambulance or an emergency transport vehicle each time a vehicle is dispatched. The hospital, in turn, should furnish the central medical controller with status information with which he can make reallocation of resource decisions.

An issue inherent in central authority is the problem of jurisdictional dispute. The state of Louisiana, in its Natural Disaster Relief Plan, has set out guidelines for agreements between American Red Cross and state and local agencies with a disaster relief function. The central medical authority in charge of disaster medical care should be assured of clear understanding of the extent of his authority in this aspect. Coordination with other key agencies such as city police, state police, and Mutual Aid is essential to obviate uncertainty about the priority of support or the extent of support available during disaster operations. In a multicentric disaster situation, the need to distribute patient workload as evenly as possible among treatment facilities is even more critical. In any type of disaster, the often-repeated mistake

of overloading one hospital, while others in the local area go virtually overlooked, should not be repeated. With an established control system, this mistake can be avoided.

By good communication, each patient-carrying emergency vehicle originating in a medical subcontrol sector or the main sector can be routed to a specific destination hospital. Private automobiles carrying injured family members or friends are hard to control, but the number of patients delivered in this manner should be relatively small. These autos, however, could cause a problem in hospital parking lots, and, if the hospital fails to maintain good traffic control around the emergency room entrance, there could be a problem in getting patients from ambulances. Appeals over the local radio station and coordination with police to establish check points and encourage rerouting of these autos to a first-aid station should be tried. In other disasters, it has been reported that personal autos have passed up an operating first-aid station in preference for a hospital.[9]

Succinctly stated these proposals point out the need for and feasibility of, an operating center which can control, communicate and coordinate patient flow during disaster operations. Ideally the operating center should control with the efficiency and speed of a military unit. The writer recognizes that the necessary regimentation and discipline to meet the ideal situation is probably impossible in a civillian community. However, the need for a certain level of discipline and efficiency is still apparent. These levels can be achieved to a high degree if all participants are fully aware of their duties and leadership is recognizable in the organization.

The Emergency Medical Operations Center

The concept of an emergency operations center is by no means new. In Baton Rouge there are already several such centers. The local Civil Defense organization has a center; the City Police and City Fire Departments each have a center which operates on a daily basis. In each case the centers can be expanded rapidly to serve the community during a disaster.

Since one of the first community reactions to a disaster is giving aid to the injured survivors, the medical community should be as well prepared as other providers of emergency services. Medical control, coordination and communication must be done from a place and by people in much the same manner as a police department. With an emergency medical operations center the requirement for a source point is satisfied. More concretely, there is now a place manned by people which can serve in a functional manner. Duties therefore must fall within functional lines or areas of responsibility.

The emergency medical operations center (EMOC) is the nucleus of the medical organization in a disaster. It can be tailored to fit the demands of a given situation providing the basic structure performs certain functions. Alternative methods of deployment will be discussed in the next section of this chapter. At that time the unique advantages or disadvantages of three alternative configurations will be presented.

The mission and essential functions derived from the proposals in the the foregoing section are presented in this section.

The mission of the EMOC is to act as central controller of all medical resources, to provide for medical treatment and means of rapid evacuation of the injured victims of a disaster, to maintain

communications with medical and other emergency services, and to coordinate medical response with all other emergency disaster services.

The essential functions of an EMOC are:

1. Control of medical resources must rest with the chief medical controller (CMC). The CMC must be influential in the allocation of medical resources if the medical plan is to respond in a timely manner. Medical resources must be employed to do the greatest good for the greatest number. Medical support is finite, therefore it is essential that control be established at the highest level attainable in the community to insure that all medical resources are available for commitment in support of the medical plan.

2. Coordination with other emergency services must be maintained in order to facilitate a smooth and a harmonious transfer of patients from the disaster site to the required level of medical care. Control and communication are closely associated with this function. All requests for additional assistance, whether from community or noncommunity sources, will be channeled through disaster operations headquarters. Coordination is necessary to effect priorities on the distribution of resources needed to support the medical effort; to provide casualty and other related information to disaster operations headquarters; and to obtain information on the available transportation routes which can be furnished to ambulance drivers. The EMOC is coordination central for all matters pertaining to medical operations.

3. Communications must be available to allow contact between EMOC and disaster control headquarters and between EMOC and hospitals and medical subcontrol centers. In each of the three designs (see Appendix B), the communications link-up is shown geographically. Additionally, communications provide contact with other disaster services with which

coordination and control are accomplished. EMOC acts as the main functionary in establishing and maintaining a medical communications network.

4. The EMOC will provide for flexibility in the execution of the medical plan in that it is responsive to the need for redistribution of medical resources. Through this control concept, expansion, reduction, or concentration of medical response can be more rapidly achieved. Special requirements imposed in special situations can be quickly and efficiently arranged. For example, changes in the situation brought on by secondary disasters may require rapid redistribution of medical effort. The CMC makes all decisions to shift medical support to meet changing requirements. Alternate plans and alternate EMOC locations are provided by the CMC.

5. When not actively engaged in emergency disaster operations, the EMOC staff will plan and recommend the implementation of measures to safeguard the health of the community following the emergency phase of the post-disaster period.

6. EMOC will assure that patient treatment does not terminate until all patients have been treated to the extent required. This may involve arranging for the evacuation of patients to facilities outside the community with special treatment skills not available in the community.

7. EMOC must provide for early collection, sorting, first-aid treatment, and evacuation of the injured. Through a well-organized system, patient and treatment must be brought together as quickly as possible in an attempt to reduce morbidity and mortality among injured disaster victims.

8. Ambulance dispatch will be controlled by the EMOC. Medical subcontrol elements or triage team communicators will request a destination medical facility from the chief ambulance dispatcher in the EMOC. The location of the ambulance or the other emergency vehicle will be stated and the patients condition should be given, if known. As a minimum, the number of patients either litter or ambulatory should be given. The ambulance dispatcher will furnish the destination for the vehicle, specify the route to be taken, and provide information on the availability of a police escort officer. Requests for additional emergency vehicles originating in subcontrol elements or triage teams will be channeled through the central ambulance dispatcher in the EMOC. Medical facility status information relative to patient care capability will be reported to the central ambulance dispatcher, who will maintain this information for the EMOC.

9. Medical supplies and resupplies will be provided by the medical supply coordinator in the EMOC. Following initial notification of the disaster, supply resources will be dispatched to the emergency treatment sites. Hospitals will maintain their ongoing supply system and will be exempt from coordinating medical supply request through the EMOC. Lists of all available suppliers in the local and surrounding areas will be maintained by this section of the EMOC. Coordination for Mutual Aid support in this area should be channeled through the EOC at disaster operations headquarters. Rescue and extrication requests will also be processed through this section when not readily available to the requestor.

10. Medical and paramedical manpower resources will be maintained by a section in the EMOC. The alert notification system to muster

personnel is prepared by this section. The individual in charge of this section, or his alternate, will be the first person in the EMOC to be notified of a disaster. His notification should come from the Civil Defense (disaster operations headquarters) as part of the Civil Defense secondary notification list. All requests for medical manpower initiated from anyone outside the EMOC should be routed through this section. Medical manpower resources must receive the approval of the CMC prior to dispatch. The hospital alert notification system will also be maintained and executed through this section.

11. EMOC will organize volunteers to support the medical effort as an optimal function to be done only if not elsewhere provided for. The chief volunteer organizer will, in coordination with EMOC medical supply, organize and equip litter teams to assit the triage teams in casualty collection. Also, litter teams will be dispatched to hospitals by the chief organizer when requested by the hospital. Blood donor requests will also be coordinated through this section. The chief volunteer organizer will select and announce volunteer collection points to provide a manpower pool and to provide a place to go for persons who wish to volunteer their services. Light rescue teams can be organized from the skilled volunteers. These teams can be dispatched to the triage teams or the subcontrol elements to assist in casualty rescue and extrication if needed or they can be reported to EOC as available for dispatch in support of its effort.

12. EMOC will provide for safeguarding the health of the community on matters not related to direct emergency medical aid applied to the injured disaster victims. The chief public health officer acts as the CMC principal staff advisor on matters related to environmental

health hazards created by the disaster, such as air and water pollution, need for mass immunization, facilities for collecting and identifying dead persons, and disposition of dead animals.

The primary duties of the chief medical controller are:

1. To assess the medical situation immediately following notification and make an estimate of the medical response required.

2. To activate the medical plan and EMOC and assume control of the medical effort.

3. To furnish emergency medical aid within the disaster area by dispatching the necessary sorting teams.

4. To insure that an alert notification system has been completed and, in particular, that all hospitals have been alerted.

5. To establish contact with disaster operations headquarters and inform them of the extent of activation of the medical response.

6. To supervise functions of the EMOC.

The administrative assistant to the chief medical controller will: (1) supervise the execution of the medical plan, (2) resolve internal coordination problems as they arise, (3) assist the chief medical controller as required, and (4) maintain a log of the actions taken during response to the disaster for purposes of review and critique of the medical plan at a later time.

The functions and the duties of the EMOC that have been described in this section should satisfy the demand for medical operations during a major disaster. Responses to disasters of a lesser magnitude need not require maximum personnel staffing of the EMOC. The chief controller, following his assessement of the situation, should specify the extent of the medical response.

Advantages and Disadvantages of the Three Proposed Casualty Evacuation Coordination and Control Systems

Three casualty evacuation coordination and control systems are diagrammed in Appendix B. Some advantages and disadvantages will be common to all. All three designs with the common functions described above satisfy the criteria established in Chapter I. An organizational staffing chart for an EMOC is shown in Appendix A. The Civil Defense EOC is diagrammed in Appendix C.

The general advantages of the concept as a whole have already been discussed in the preceding sections. The comparisons made here will be confined to the physical arrangement of the systems to provide the services required of them.

Each of the possible systems would be expensive to implement. Costs are relative to desired specifications and to compatibility with existing equipment in other emergency services. Deriving dollar cost figures is worthy of a study in itself and for this reason this writer will not attempt to estimate the dollar requirements. There are resources already available in other areas of the city. Appendix C alone reflects a large number of mobile radio units that might be made available for use in the medical effort. Certainly arrangements for their use would have to be pre-planned and coordinated. A more extensive survey done locally might reveal even more resources in the community. For example, local HAM operators or citizens band enthusiasts could add significantly to communications resource requirements.

Alternatives in communications resources are available. The decision to use locally available equipment, buy new equipment or use a mix of new and locally available equipment will markedly affect the

total cost of all three of the proposed systems.

System design No. 1

This system is intended for deployment during disaster only. In concept this system, with its required equipment and space, remains dormant except for practice sessions, maintenance periods or actual use. Its advantages are:

1. A specified communications network is provided.

2. The system is expandable within its present framework.

3. A central coordinating point is provided for ourside emergency services requesting medical aid.

4. A control center of the medical effort is specified.

5. The flow of patients from the disaster site to hospitals is controlled centrally to insure patient dispersion.

6. A central point for requests for additional services is provided.

7. The communications are maintained with the EOC at disaster operations headquarters.

8. The EMOC is the focal point for coordinating and processing requests for medical aid from outside the community.

9. The EMOC can process patient transfers to facilities outside the community.

10. A rapid response to changing situations is possible and provided.

11. A dependence upon vulnerable communications, such as telephone, is eliminated.

12. The central listings of medical resources are maintained.

13. The current medical status information is maintained centrally,

providing an information source for other agencies.

14. The records of disaster response are maintained for future review and critique.

15. The system could be made mobile.

16. The system can coordinate and regulate air as well as ground evacuation.

The disadvantages are:

1. Key personnel capable of performing required EMOC functions under the stress of disaster situations may not be available, so alternates must be provided.

2. Use of two way radio communications equipment requires extensive training to obtain high degrees of efficiency.

3. A system of this sort would not be feasible for very minor disaster situations.

4. Set-up time of the system cannot begin until the key personnel arrive and the site is selected.

5. The system may even hamper casualty evacuation if full cooperation of other services is not achieved.

6. Frequent training and rehearsal in the use of the system are required to maintain contemporaniety in high personnel turnover periods.

7. Capital financing requirements for initial equiping of the EMOC with communications gear may be high.

8. A liaison person would need to be present in the Civil Defense EOC to coordinate other services.

System design No. 2

This system is intended to be used on a daily basis to coordinate

the dispatch of ambulances and the delivery of accident victims or other emergencies on a substantially reduced scale of a disaster EMOC. See Appendix D for list of special duties.

The Safety Council of Greater Baton Rouge estimates that more than 78 persons will be killed and 5,450 will be injured in auto accidents alone in the city of Baton Rouge and in East Baton Rouge Parish during 1969. Of those injured at least 409 will suffer permanent disability. An average then of almost 15 people a day in a 365 day year are potential sources of activity for a center operating on a daily basis. Add to this the numbers of household accidents, industrial mishaps and daily emergencies to local hospitals and there emerges a sizeable workload. It is recognized that this daily workload is already being handled through other established agencies, but ideally these everyday emergencies should be handled through an EMOC.[10]

The same advantages and disadvantages of design No. 1 accrue to the disaster implementation phase of this design. Other special advantages are:

1. The system provides for the daily coordination of emergency patient evacuation to assure delivery of a patient to an adequately staffed and adequately equipped hospital emergency room.

2. The system can be used to coordinate patient transfer from medical facility to medical facility, either inside or outside the community.

3. The system provides a central point for disaster notificaton and implements medical alert notification.

4. The communications with essential agencies are maintained until EMOC is established.

5. The status information on hospital facilities and related medical services is already on hand and up to date when disaster alert is received.

6. This design provides an ongoing system that requires augmentation only during disaster operations.

Other disadvantages are:

1. This design is the most expensive of all systems to maintain. Since it would be operating daily, personnel staffing cost would be added to equipment costs. It is probably more easily financed on a regional basis or an area similar to a Standard Metropolitan Statistical Area (SMSA).

2. It would require highly skilled radio operators to function on a daily basis.

In addition to radio skills, the operator must know transportation requirements for certain types of injures, be able to furnish accurate first-aid information to police and fire departments as required, and be familiar with medical terms and types of emergency equipment. The skills requirement should be at least that of an ambulance personnel, on all shifts, so that the operator can transmit reliable information on patient condition.

System design No. 3

This system is activated only during disasters. A unique function of this sytem is to provide for a fixed, rearward EMOC located with the Civil Defense EOC and minimally staffed to provide for person-to-person coordination with other emergency services in the EOC. The forward EMOC would operate somewhat independently on all actions, except for

coordination with other emergency services and arrangement for air evacuation of patients.

Some advantages and disadvantages in this system that are not found in the other two systems are as follows: The special advantages are:

1. The system provides for personal medical liaison in the EOC.

2. The rearward EMOC can act as alternate EMOC during prolonged periods of operations where work shifts might be required.

3. The rearward EMOC can take over duties of primary EMOC almost immediately in the event primary EMOC becomes inoperative.

4. Since helicopter evacuation, if available, would most likely be part of the state police mission, rapid coordination could be accomplished with state police liaison in EOC.

The special disadvantages are:

1. Confusion might exist at the hospital radio station as to which EMOC is calling.

2. This design is slightly more expensive than system No. 1 due to some duplication of radio equipment and staff.

Summary

A disaster shocks a community and produces a crisis requiring immediate action to reduce losses of life and property.

Although the city of Baton Rouge has no written medical plan for disaster, the medical community has expended considerable effort in testing its verbal concept. A mock disaster exercise was conducted on April 29, 1969, and this writer was permitted to observe this test. From observation of this test and interviews with local civic leaders,

the present system for disaster medical care was derived and presented in the beginning of this chapter.

By comparison of actions taken in the present system with those actions recommended in the literature, a descriptive analysis of deficiencies was obtained and discussed. This anlaysis pointed out the need for a well-planned and a well-organized medical response. Central control of the medical operation was also lacking. Communications, coordination, medical resupply, manpower recruitment, expansion of medical effort, rescue, administration, and many other deficient areas were noted.

The concept of an emergency medical operations center and its common functions was presented. Those functions listed satisfy the criteria for an optimal system for coordination and control of casualty evacuation during a natural disaster. These functions were also deduced from those attributes which are needed to correct the deficiencies in the current system. The resultant EMOC with its internal organization is presented as an appendix. The concept is stated in the form of functions to be performed.

The relative advantages and disadvantages of employing the EMOC in three different communicative configurations were given. Two configurations are to be implemented during disaster only, and the third is to be an ongoing system which is simply augmented to perform the added functions necessary during a disaster. The principal advantage of a daily, operating EMOC is the speed with which it can be put into operation and the lack of lapse in emergency communications. Its principal disadvantage is the high cost of operating such a system.

System No. 1 is the least expensive of the three, but it does not

provide a ready alternate center in the event it becomes inoperable. System No. 3 provides a rearward element that functions on a limited scale within the Civil Defense EOC. This offers a ready alternate center and rapid coordination with other emergency services. Since some duplication of communications equipment is required, it is more expensive to implement than System No. 2. Even though the community may not be able to support any of the systems, they were still derived in order to furnish a basis for future medical plans and organization.

Footnotes

[1]Louisiana, Mutual Aid System of Baton Rouge, "Handbook of Procedures," September 15, 1964, p. 1 (lithographed).

[2]Louisiana Office of Civil Defense Director, Communications Section, "Local Disaster Communications Plan," Communications CADA 1969, Baton Rouge, 1969, p. 2(mimeographed).

[3]Mutual Aid System, "Handbook of Procedures," p. 9.

[4]Raker, et al., Emergency Medical Care in Disasters, p. 11.

[5]Garb and Eng, Disaster Handbook, p. 41.

[6]Raker, et al., Emergency Medical Care in Disasters, p. 18.

[7]Naval Radiological Defense Laboratory, Operational Concept of Emergency Medical Command and Communications System, p. 26.

[8]Garb and Eng, Disaster Handbook, p. 57.

[9]Raker, et al., Emergency Medical Care in Disasters, p. 24.

[10]Committee on Acute Medicine, Peter Safar, Chairman, Recommendations for Communitywide Emergency Medical Services, Resuscitation, and Intensive Care (Park Ridge, Ill.: American Society of Anesthesiologists, October, 1967), p.5.

CHAPTER III

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based upon the data collected and presented, the following conclusions are drawn:

1. The optimum system for coordination and control of casualty evacuation following a natural disaster in the Baton Rouge area is embodied in the emergency medical operations center concept.

2. System design No. 2, as depicted in Appendix B and with the functions described in Chapter II, is the best EMOC concept in spite of the higher cost.

3. No matter which concept is found to be most desirable, a written medical disaster plan is needed for the city of Baton Rouge.

Recommendations

It is recommended that further study be conducted in the following areas:

1. An alert notification system for the medical community of the city of Baton Rouge for incorporation into the medical plan.

2. A communications committee to determine the type of radio equipment that would be best suited for a medical communications network, to include all elements as depicted in the EMOC design.

3. A system for identifying all key personnel involved in the

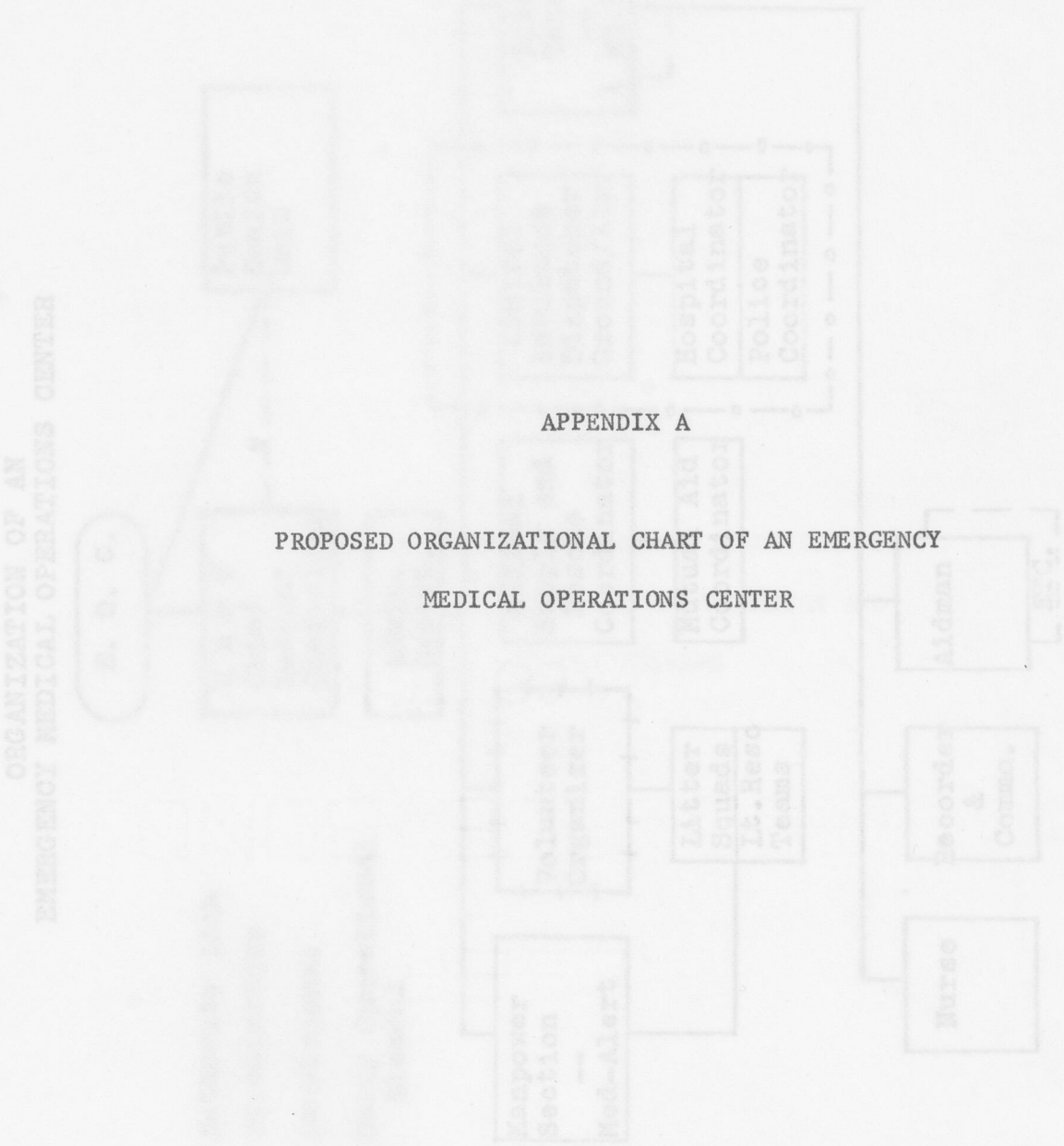
medical disaster operation to provide a ready mark of authority to other emergency workers and to provide a source of contact for augmentation resources reporting to an area.

4. A traffic control system at hospitals and other key points to prevent clogging of key traffic lanes by converging nonessential persons during a disaster.

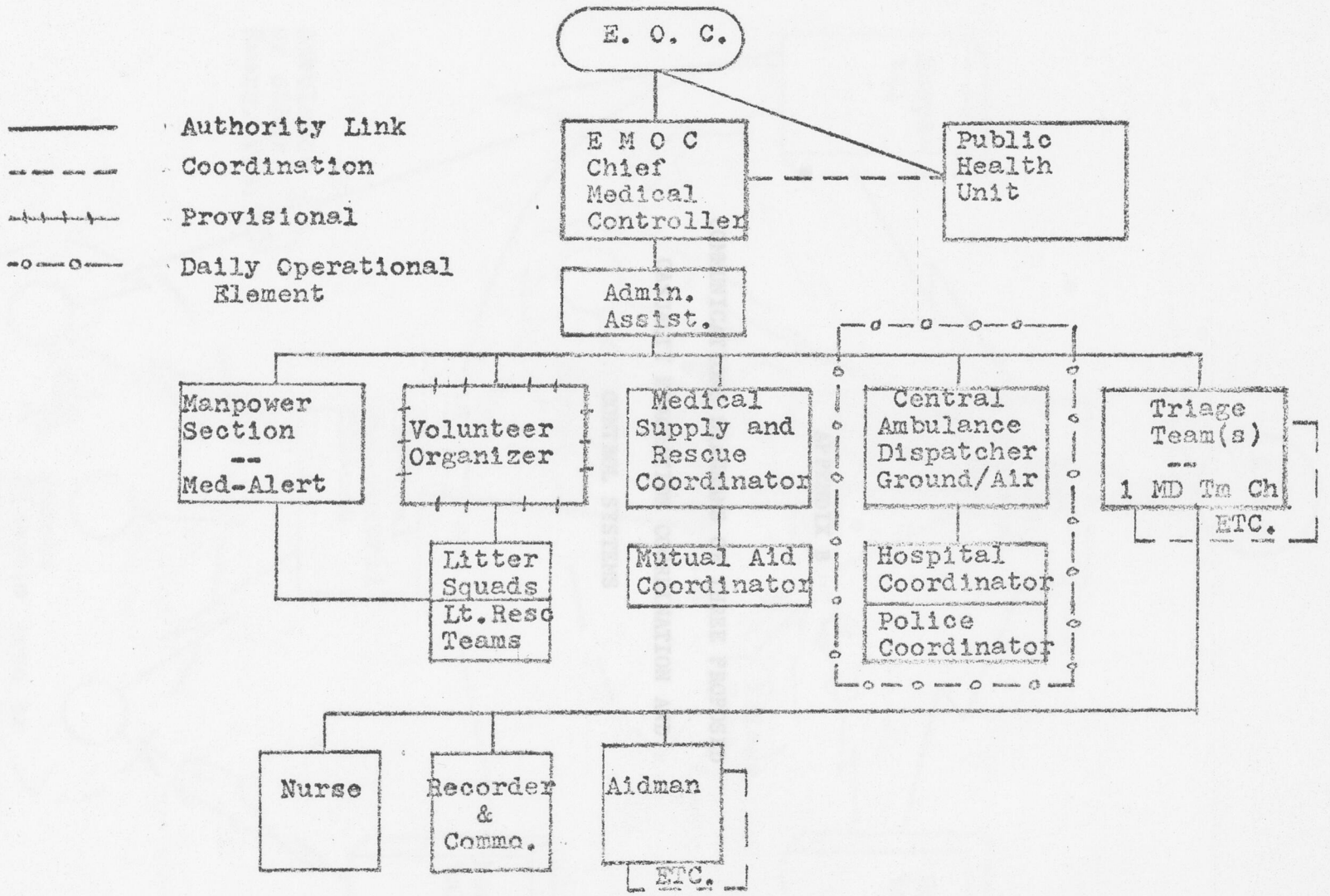
5. A system for consolidating the ambulance resources in the community into an integral unit, while still maintaining proprietary identity, to facilitate central ambulance dispatching.

APPENDIX A

PROPOSED ORGANIZATIONAL CHART OF AN EMERGENCY MEDICAL OPERATIONS CENTER



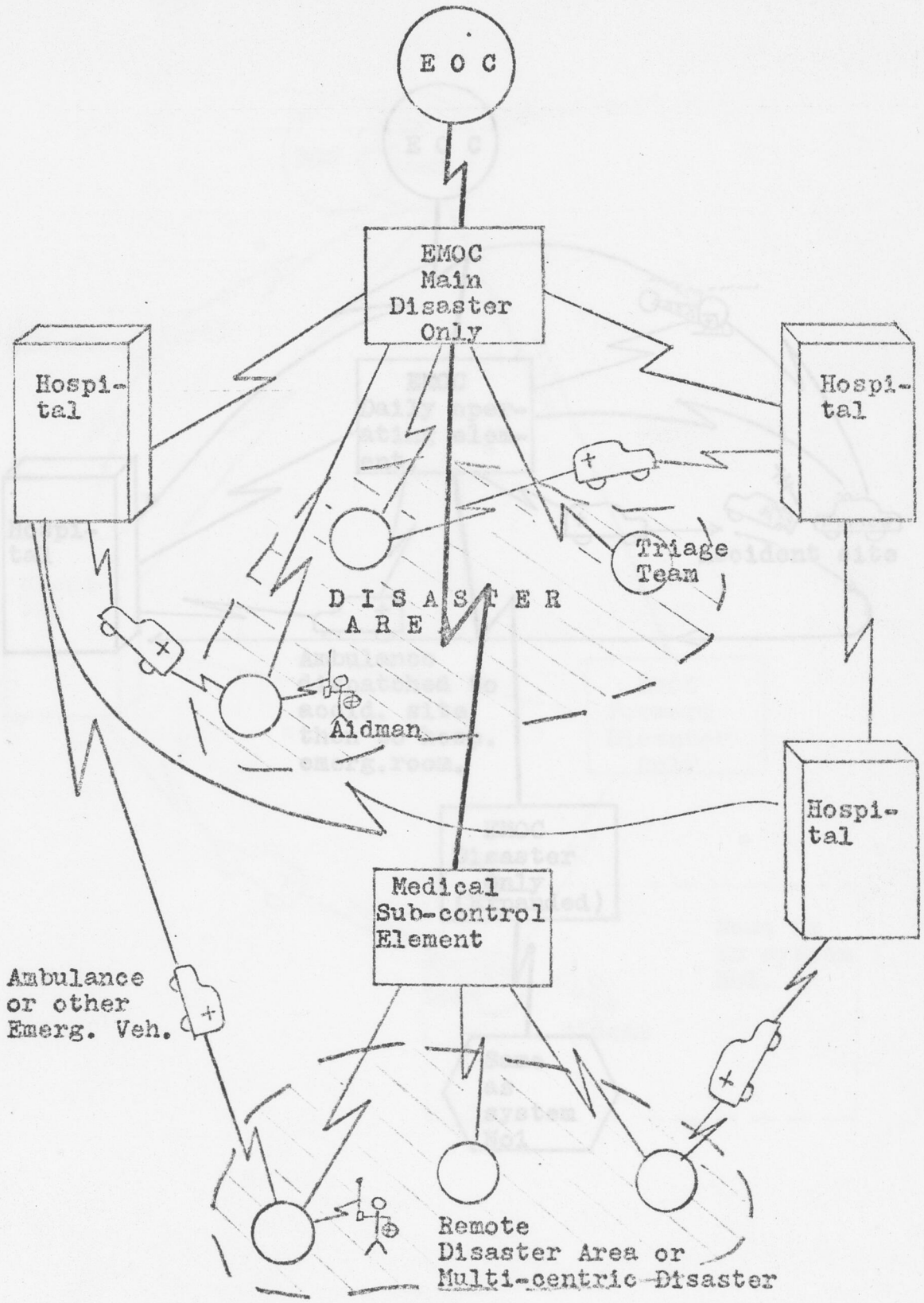
ORGANIZATION OF AN EMERGENCY MEDICAL OPERATIONS CENTER



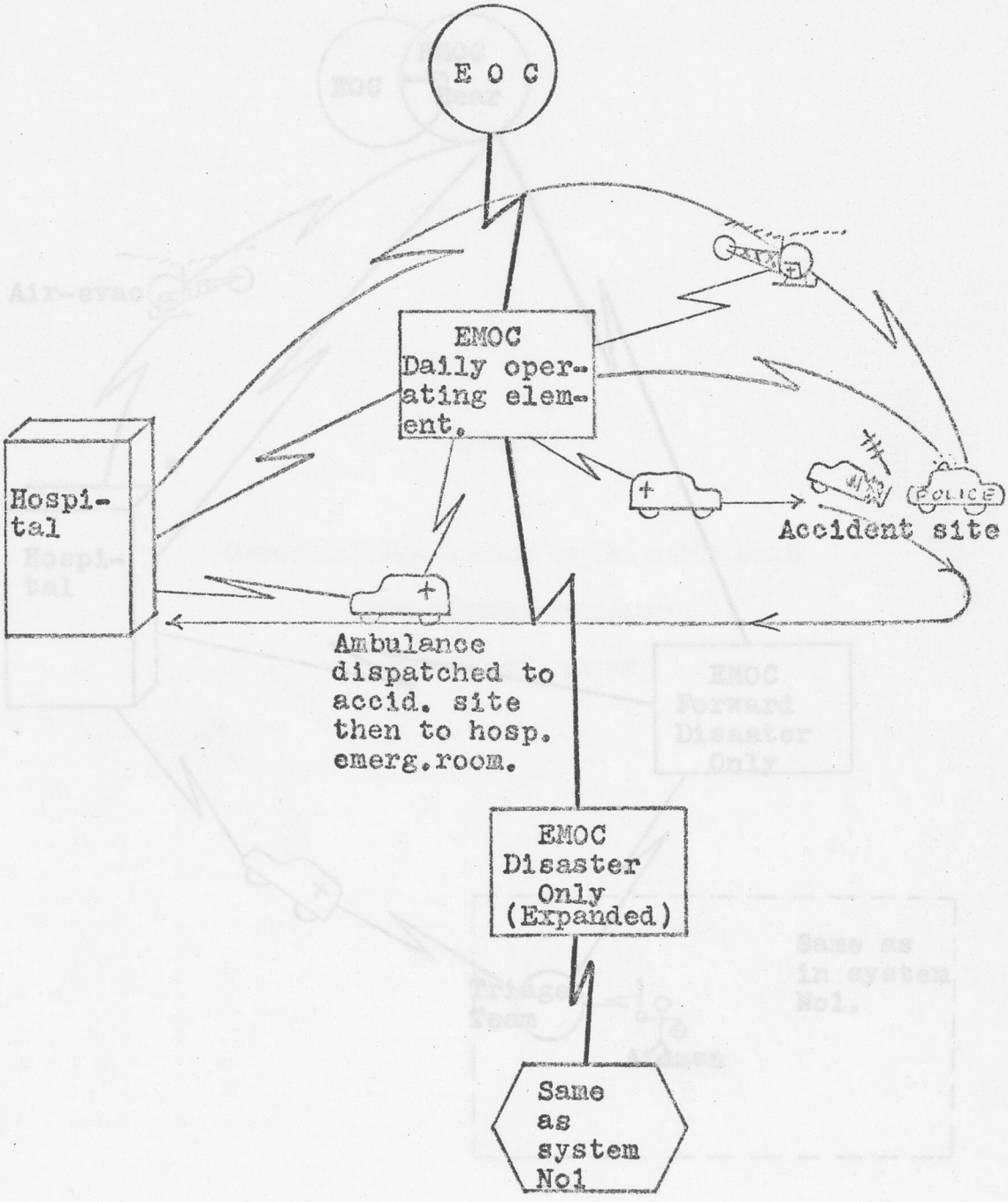
APPENDIX B

COMMUNICATIONS DIAGRAMS OF THREE PROPOSED CASUALTY EVACUATION COORDINATION AND CONTROL SYSTEMS

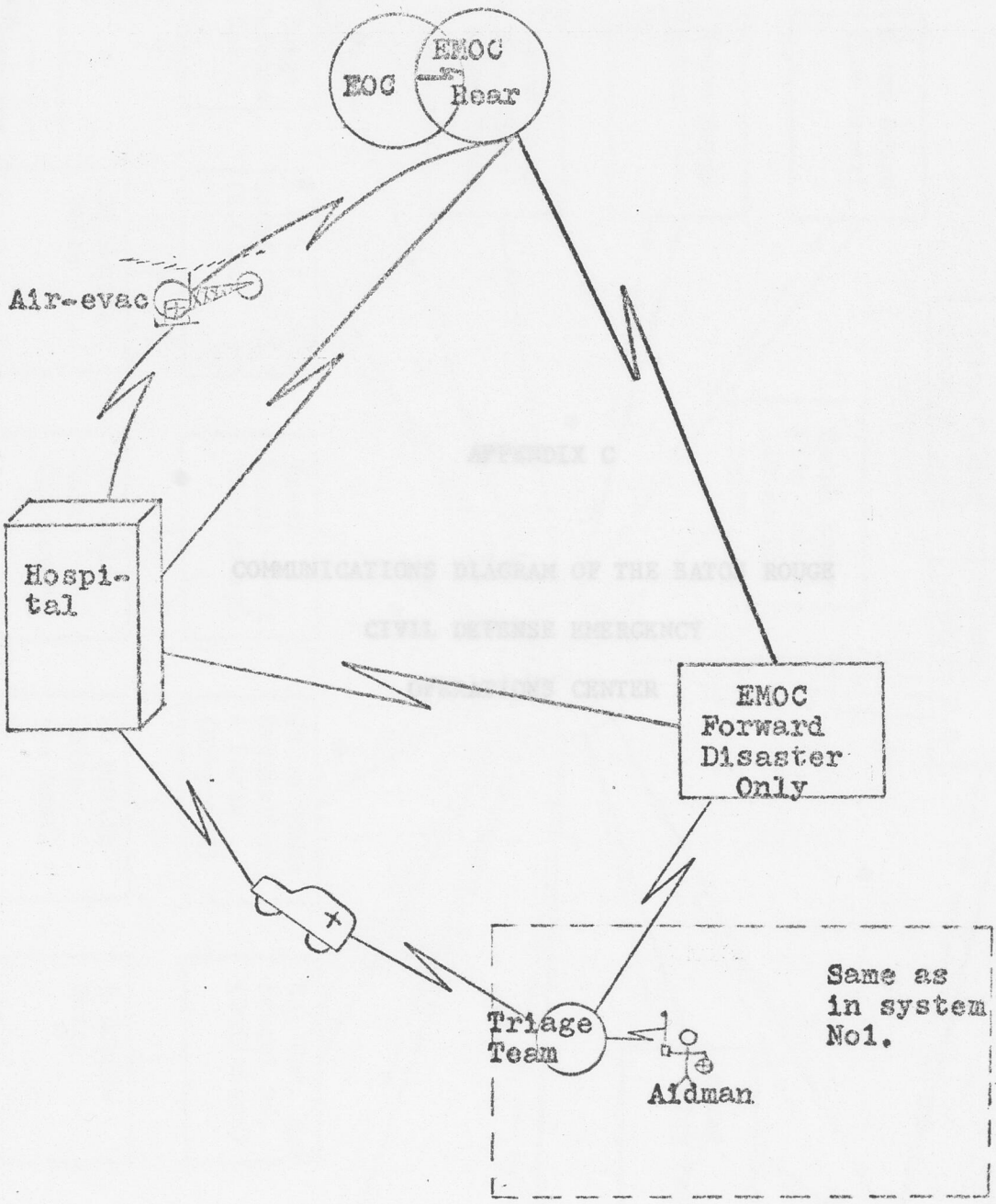
SYSTEM DESIGN NO. 1



SYSTEM DESIGN NO. 2



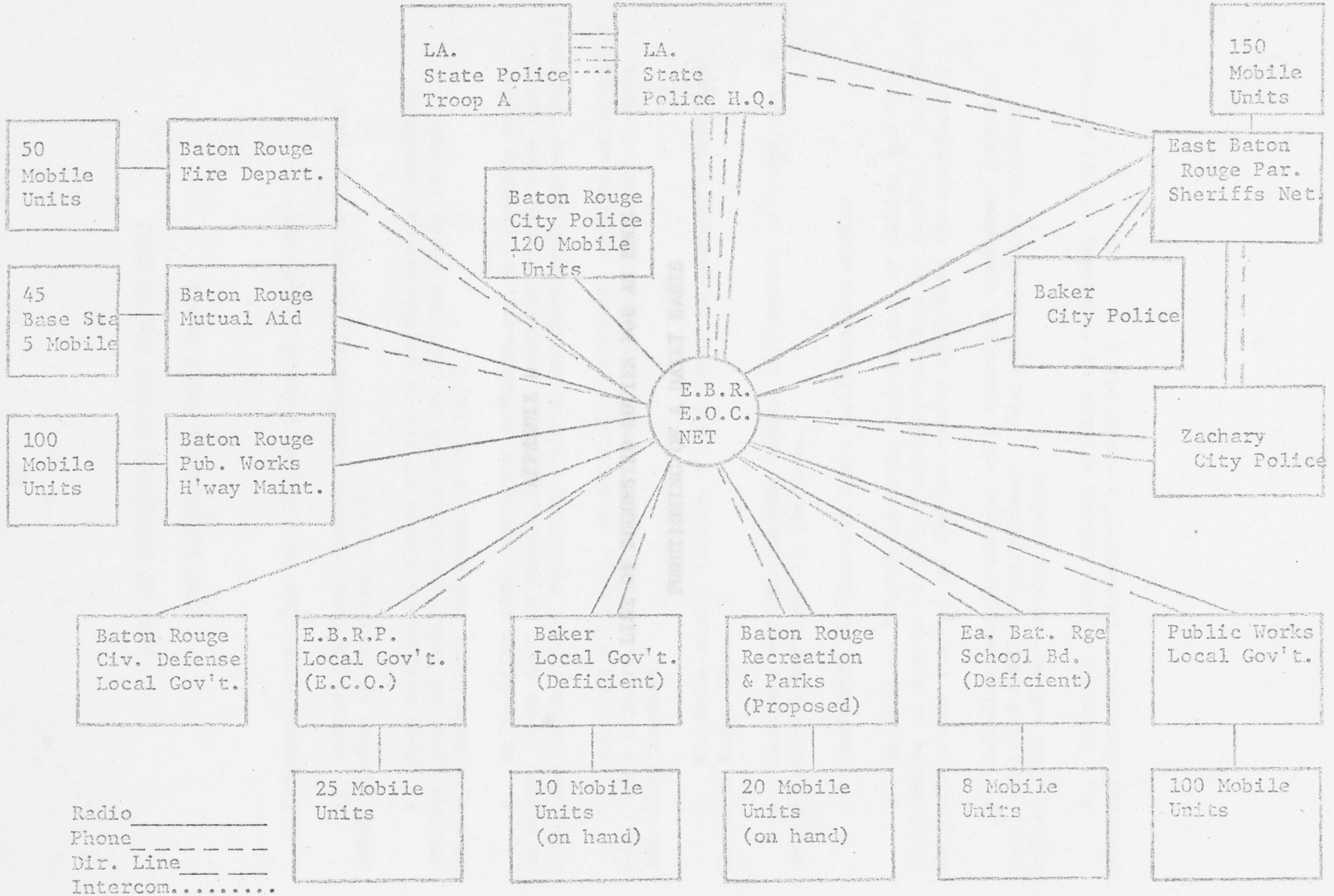
SYSTEM DESIGN NO. 3



APPENDIX C

COMMUNICATIONS DIAGRAM OF THE BATON ROUGE CIVIL DEFENSE EMERGENCY OPERATIONS CENTER

EAST BATON ROUGE, LOUISIANA- EMERGENCY OPERATIONS CENTER



APPENDIX D

LIST OF SUGGESTED DUTIES FOR AN EMOC

FUNCTIONING ON A DAILY BASIS

LIST OF SUGGESTED DUTIES FOR AN EMOC

FUNCTIONING ON A DAILY BASIS

Personnel operating the EMOC on a daily basis must:

1. Understand basic medical terminology, particularly that which relates to physical trauma.

2. Have working knowledge of and be proficient in operating various types of radio equipment such as citizens band, FM band, AM single-side band, and other as required.

3. Be familiar with transport requirements for certain types of injury cases such as spinal fractures, cardiac cases, burn casualties, and those others requiring special consideration during transport.

4. Maintain a listing of specialty treatment centers nationwide, i.e., burn centers, neurosurgical centers, poison treatment centers, and other centers.

5. Maintain source listing of all types of emergency vehicles in Baton Rouge area.

6. Maintain current patient status information on hospitals and related medical services in the area.

7. Implement the medical alert notification system.

8. Be able to furnish accurate information to police and fire departments if rescue or fire-fighting equipment is needed. (Alternate: Maintain source listing of special rescue equipment and personnel.)

9. Maintain communications with essential emergency agencies until disaster EMOC is operational. Continue ambulance dispatch within EMOC and act as net control.

10. Maintain a log, either written or recorded, of all messages sent and received. (Recorder is preferred.)

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ABSTRACT

A STUDY TO DEVELOP AN OPTIMUM SYSTEM FOR COORDINATION AND CONTROL OF CASUALTY EVACUATION FOLLOWING A NATURAL DISASTER IN THE BATON ROUGE, LOUISIANA, AREA.

A Problem Solving Project Report Submitted to the Facualty of Baylor University in Partial Fulfillment of the Requirements for the Degree of Master of Hospital Administration.

By Major Joseph F. Folding, MSC

August 1970 64 Pages

The problem was to develop an optimum system for coordination and control of casualty evacuation following a natural disaster in the Baton Rouge, Louisiana, area. Research of the problem consisted of gathering data from observation of a mock disaster exercise in addition to personal interviews with local civic authorities whose personnel would normally furnish emergency disaster services. Research of the literature was done to provide a comparison of recommended methods to actual practice. The major findings were that a written medical plan did not exist and that a concept could be developed that would form the nucleus for a written plan. The emergency medical operations center was functionally described, and it was concluded that an organizational and communications configuration could provide daily emergency medical operations support to the single traffic accident and with augmentation the same center could provide disaster medical operations support. It was recommended that, in spite of the cost, the EMOC concept be adopted and that further study be conducted in the area of alert notification, radio equipment, disaster personnel identification, and consolidation of daily ambulance dispatch.