THE INFLUENCE OF PLANNING ON EMERGENCY MEDICAL SERVICES IN DISASTERS

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The increasing attention directed toward emergency medical services (EMS) in the medical and health planning communities has encouraged a growth in concern for the special demands placed on EMS in mass casualty situations. Brief case studies, most common to the increasing body of professional literature on disaster EMS planning, raise issues of onsite care, coordination, and communication technologies, among many others. (Reynolds and Wright, 1976) The varied positions on these issues, revealed in the literature and in plans themselves, reflect a seldom explicit debate between two alternative conceptions of disaster planning.

On the one hand, planners seem to view mass casualty demands on EMS delivery as simply an expansion of "normal" everyday demands. EMS in mass casualty situations is seen as being like everyday EMS, only more so; that is, the increase in demands is viewed as a quantitative one. Conceived in this way, the principal problem becomes expansion of resources to meet these demands--hospital space, medical supplies, EMS vehicles. The new advances in sophisticated radio technology links between EMS-related organizations are relied upon to accomplish and coordinate such expansion.

However, on the other hand, one planning organization has warned, "Do not think giving away pieces of equipment guarantees coordinated performance on the part of your EMS providers." (Arkansas Health Systems Foundation, 1975: 14) In this view, the coordinated allocation of scarce resources is only one of the interorganizational problems that distinguishes disaster EMS from everyday EMS, both quantitatively and qualitatively and demands distinctive strategies.

Though seldom admitted explicitly, this qualitative difference in disaster EMS demands is operationally acknowledged in almost all mass casualty EMS plans. The designation of a site coordinator, special communication technologies, and inclusion of organizations that are not everyday EMS groups, are among the strategies that acknowledge the mass casualty-everyday EMS distinction.

Each plan and each disaster response strikes some balance between these two conceptions of disaster EMS demands. The ideal balance would take into account the unique characteristics of disasters, while also reflecting what Quarantelli has termed the "carryover principle" of planning: "that which prevailed prior to a disaster is likely to prevail after a disaster." (Quarantelli, 1976: 10)

Disaster EMS strategies can be evaluated in terms of the effectiveness of their particular tradeoffs between these conflicting constraints. This paper will make a start toward such an evaluation in a preliminary review of data on organizational responses to 19 disasters in 16 communities. After detailing the methodology of the study, brief observations on the context of planning will be offered. Selected dimensions of planning and responses, including the organizations involved, on-site care, search and rescue, transportation and casualty allocation, will then be examined.
METHODOLOGY

This study is part of a Disaster Research Center (DRC) research project on the delivery of emergency medical services in mass casualty situations in the United States. During this project, DRC field teams conducted field research in selected communities where mass casualty incidents producing more than 30 casualties was reported. The supplementary research conducted on selected baseline cities and on planned events expected to produce mass casualties is not considered in this study. The data collected included interviews with personnel in EMS-related organizations, medical disaster plans and critiques, and other related documents.

From May, 1975 through February, 1977 DRC examined 21 mass casualty incidents in 18 communities. This preliminary report considers 19 of those events in 16 communities; two flood responses were set aside because of the distinctive longer-term EMS demands made by that particular kind of disaster agent. The remaining natural and technological disaster agents displayed a wide range of characteristics, such as speed of onset, duration of impact and size of impact area. Casualty counts varied from 28 to 398; hospital admissions, one measure of severity of injury, ranged from eight to 61. The communities impacted, however, were not so widely representative. Disaster agents impacted only two communities in the 25,000 to 500,000 population class. A clustering by variables such as population size, disaster planning, and disaster agent type was also very evident.

The class of communities with populations over 500,000 contributed six of the seven communities with disaster plans. All of the communities in that larger population range and all of the seven communities with disaster EMS plans experienced focalized disasters—agents, such as transportation crashes or explosions, with an impact limited to one or several distinguishable sites. On the other hand, smaller communities rarely had formal interorganizational EMS disaster plans. These communities without plans had about an equal chance of experiencing a focalized or a diffuse disaster agent—a diffuse disaster agent here meaning an agent with a wide and unfocused impact, such as a tornado or noxious gas. The concurrence of these factors, and the impossibility of holding disaster stimulus constant, are among the factors that necessarily limit this analysis to tentative conclusions.

PLANNING CONTEXT

Of the 16 communities studied, seven had a formal interorganizational plan for disaster EMS. All six communities with populations over 500,000 had such a plan. In addition to city size, dollar interest in EMS seemed to be related to the existence of an overall EMS plan for mass casualty events. Seven of the communities with disaster plans possessed an elaborate radio or dedicated telephone line technology, connecting at least the major hospitals, the ambulance dispatch, and one safety force (police or fire). The dollar interest and interorganization contact implied in such a system was not confined to cities with plans, however; half of the communities with this kind of technology did not have an interorganizational EMS disaster plan.
PARTICIPATING ORGANIZATIONS

The organizations most commonly associated with normal delivery of EMS are hospitals and ambulance companies. Also important to EMS delivery are police and fire departments. Branches of these safety forces are, in many cities, the chief providers of ambulance services. (Burner, 1970) In all cities, police officers are usually the first responders to casualty-producing incidents. (Task Force on Ambulance Services, 1967) These organizational actors were all included in the disaster plans studied here as well, with the safety forces of ten given a much more direct role than that assumed by them in everyday EMS delivery.

Organizations not usually associated with normal EMS delivery were also included in some disaster plans and responses, with varying results. Organizations with formal or informal ties to the EMS system were more likely to respond. Thus, Civil Defense attended none of the three disasters in one large city, even though its participation was specified in the plan, but was part of the response in two small towns where it participated in EMS personnel training. Organizations were more likely to respond effectively where immediate response was not essential; quick activation of a procedure and arrival at a distant scene can be logistically impossible when this is not an everyday demand. In one plan, Red Cross vehicles were to report to the disaster site and major hospitals for communication use. Once, a vehicle arrived at the site in time to be useful; but in a second case, the vehicle was denied access to the site by a policeman unfamiliar with the vehicle; in a third incident, the vehicles arrived too late. In another community, the Red Cross had a comparatively longer period of time to establish a first aid station and temporary shelter some distance from the site and did so successfully.

ON-SITE MEDICAL CARE

On-site care in most everyday EMS incidents is accomplished by ambulance attendants with various levels of training. Doctors are generally in contact only by radio in a very few special vehicles, if at all. Any sort of triage procedure is rarely observed.

While a large number of disaster victims received little or no on-site stabilization due to transportation and coordination problems, plans generally seemed to assume that ambulance attendants would see most victims. Four of the plans also assigned doctors a role in care on the site, a role only rarely filled. In several other disasters first aid stations emerged as another medical care option. A triage procedure was part of every plan examined here but was seldom an integral part of the actual response.

PHYSICIAN CARE

Physician care at the site is one of the few issues debated in the disaster planning literature. (Holloway, 1971; Rutherford, 1973) Supporters feel that triage decisions require a medical professional. Detractors ask where such doctors are to come from, since the hospitals closest to the disaster site are those most likely to need their full staff and since speedy arrival is essential to effective response. The record of responses
studied here supports the detractors. Three communities, experiencing five disasters, planned automatic dispatch of a physician team to the disaster site. In two incidents the medical teams were never sent; in two incidents the teams were turned away from the site or arrived too late. In the fifth disaster the doctor played an effective part in the response. However, in this instance the town (and hence the travel time) was small, the disaster a slowly emerging one (carbon monoxide in a factory), and the doctor the holder of two county medical posts and the title of plant physician. A fourth community plan assigned a doctor to the ambulance dispatcher’s radio during disaster for medical advice; the doctor responded quickly and was available but later suggested that his services were unnecessary.

SITE TREATMENT

Site treatment and release areas, or first aid stations, were not included in any of the plans studied here. Theoretically, such an area could serve as an alternative to hospital treatment for the large number of "walking wounded," whose numbers too often result in crowded conditions in hospitals, and drain hospital energies from the seriously wounded. (Golec and Gurney, 1977) Establishment of such a site would have to be responsive to casualty numbers and types and would rely upon some triaging procedure to allow it time to be set up and to direct patients toward it. Fear of liability, both by site personnel and by any corporations implicated in a disaster, further encourages the conservative strategy of providing hospital treatment for victims.

In only two of the 19 incidents studied here did an alternative to the hospital treatment site emerge. The establishment of the Red Cross shelter in one such incident was described in the Organizations section just previous to this one. In another disaster, a tornado, EMT initiative created a first aid station that treated and released 20 to 40 casualties, about half the reported number.

Triage of casualties is included in all the plans but rarely occurs to any great extent due to the lack of coordination at the site and lack of control over casualty transportation. In substituting speed for coordination, triage decisions are simply moved to the more professional and familiar sphere of the hospital, already taxed by treatment demands.

SEARCH AND RESCUE

No plan studied here designated procedures or coordinators for search and rescue in diffuse disasters. This reflects the unspoken bias observable in the plans toward the focalized disasters most common to the large cities dominating planning—a bias suggested in the literature. (Holloway, 1971) Nonetheless, the issue deserves some attention, at least in smaller cities as they too begin disaster EMS planning. Search and rescue is a directed operation very different from the usual responsive orientation of safety and EMS organizations. Usually involving the fire department, safety officials, ambulances and volunteers, it is most often uncoordinated despite many communication technologies available.
TRANSPORTATION

Normally, the bulk of EMS transportation is accomplished by use of private vehicles, though professional ambulances handle many of the most severe emergencies. The disaster EMS plans considered here, however, seem to assume that it is possible for all transportation to be done by professionals or vehicles directed by professionals at the site. As long as 1) alternate transportation (safety forces, private vehicles, walking) is available, 2) site coordinators arrive late or cannot control the entire site, or 3) a disaster has diffuse impact and cannot be coordinated by a single organization, casualty allocation will not be controlled by plans assuming EMS control.

In eight out of the 19 disasters studied, a majority of the victims were transported by EMS vehicles or their designates. (Table 1) Seven of these were focalized disaster agents. In five disaster incidents, four of them diffuse, the majority of the victims were transported either by their own efforts or by private vehicles. This is the pattern expected; those disasters with casualty distribution most closely resembling that of everyday (diffuse) EMS display transportation modes most like those of everyday EMS operations.

Looking at the table another way, however, it becomes evident that only four of the eight focalized incidents in "plan communities" showed a large degree of transport by EMS vehicles, while all three focalized incidents in the communities without plans had EMS transportation dominant. Examination of the four anomalous incidents shows that one was produced by late arrival of coordination at a site within walking distance of a hospital; most casualties could walk and simply transported themselves. The remaining three incidents occurred in cities in which the safety forces customarily transport less serious EMS victims, and in which planned coordination by the fire department was supplemented or supplanted by police coordination. A potential for controlled transportation was not realized here because of carryover of everyday practices, high organizational autonomy, and late arrival of the assigned coordinators.

CASUALTY ALLOCATION

In normal EMS delivery, casualty allocation decisions are made either by the dispatcher or the driver, generally by some established rule (closest hospital, usual hospital, correct category of hospital). Other factors being equal, ambulance attendants' familiarity with hospital personnel also can influence such decisions. (Golec and Gurney, 1977) Though 12 of the 19 communities studied here have radio systems that would facilitate communication with the hospital, there was no evident that this was common operating procedure for everyday EMS. Only rarely outside the mass casualty situation is there a need for on-site coordination.

In disaster EMS situations, casualty allocation patterns almost invariably appeared to be the result of the common sense rule of "closest
hospital." This was, in part, a result of the failure of EMS to control transportation, as detailed above. Yet this pattern was also affected by the site coordinators established by the plan, the use of technology to feed back information, and the role of the ambulance dispatcher.

COORDINATION

All of the EMS mass casualty plans studied recognize the distinctive demands of the disaster situation in specifying an on-site coordinator to allocate casualties, supervise triage, and coordinate interorganizational efforts. (Table 2) Ideally, the choice of on-site coordinator should consider:

1) usual first responder
2) usual EMS provider
3) interorganizational education and recognition

In most cases, the choice of a medical figure for this role fails on all three counts. The reasons that it proved effective in one of the two communities where it was planned have already been elaborated in the section on on-site care.

The responses which were best informed by the plans and reported most efficient in allocation of those casualties handled were those designating an ambulance personnel as site coordinator. However, in two of these three cases, this coordination was established relatively late with the arrival of the coordinator, leaving the bulk of casualties to unsupervised allocation.

The "first arrival" problem is further illustrated in the response to five disasters where the fire department was the designated coordinating organization. In the three of these instances, the police, who arrived first at the site, partially or totally usurped the role of the fire department in casualty allocation.

Turning to the unplanned responses, coordination by ambulance personnel once more proved effective in casualty allocation. In the instances of fire department coordination, one completely superseded the usual EMS notification system, causing confusion and possible overload of one hospital; in the other incident with such coordination, ambulances were dispatched from the site to their usual hospitals, achieving an equitable patient distribution primarily because of the distribution of patients across two sites. The coordinating role of ambulance dispatch increased in these unplanned responses largely because of the diffuse nature of many of the disasters there, rendering a single site coordinator ineffective.

COMMUNICATION TECHNOLOGY

The mere presence of technologies permitting communication did not create information flow through official channels in these responses. As noted in Golec and Gurney (1977), even hospitals with such technologies
were most often notified of the disaster informally or by the arrival of the first casualties. Feedback of information on hospital or site status was not regularly offered. In several instances, however, communication technology facilitated a message to site or dispatch that a given hospital could not take any more patients or needed certain supplies.

The presence of a plan seemed to encourage effective use of existing technology in only two instances in which a site coordinator communicated by radio with a dispatcher coordinating other resources with those at the site. Several plans and several spontaneous responses attempted to establish new communication systems with such strategies as dispatch of police vehicles or Red Cross vehicles to hospitals and site or the site presence of safety vehicles with multiple communication possibilities. Even when these resources not usual to the EMS system arrived in a timely fashion, they were not generally used to give ongoing feedback; rather, when they were used, it was usually to report hospital overload or for other problem messages.

GENERALIZATIONS AND SUGGESTIONS

In evaluating the balance between the everyday EMS operations and special disaster operations, several questions must be asked.

1. How is this part of disaster demand different from normal EMS demand?
2. Can this demand be satisfied by some adaptation of normal EMS operations?
3. If not, what strategy takes advantage of the largest number of everyday EMS operations or organizations?

Where distinctive disaster operations are instituted, semiannual drills, critiques, and organizational education will help assure their effective implementation.

Organizations. Disaster plans studied here showed that plans should include all safety and EMS organizations explicitly, since all may be expected to respond. Inclusion of other organizations should take into account the importance of response time, since few organizations can respond with the speed of EMS organizations; thus, it may not be practical to plan to use other organizations for communication technologies or immediate on-site demands.

On-Site Care. The disaster cases examined here suggest that it is often difficult for doctors to arrive at a site in time for their services to be used effectively. Since extensive triage is so seldom done at the disaster site, the casualties are usually removed before physicians can arrive. The rise in paramedic training for ambulance technicians reduces the need for such professional services.

While an emphasis on site treatment and release would seem optimal, it will not become possible until an emphasis on overall coordination, rather than on speed, dominates the disaster site. At that point the issue of
medical liability will have to be balanced against the advantages of that strategy. Similarly, the occurrence and the quality of triage depends on better site coordination.

Search and Rescue. In planning for smaller cities, establishment of responsibilities for search and rescue in every section of the city or the existence of a coordinator and process to assign such responsibility at the time would seem optimal.

Transportation. If on-site coordination occurred more quickly and embraced more organizations, some of the problems in transportation control could be avoided. However, all transportation cannot be expected to be controlled. One solution would be to improve hospital to site communication, such that hospitals could alert coordinators to overload possibilities caused by such a transport pattern. Another solution would be to automatically dispatch all controlled transportation to more distant hospitals.

Casualty Allocation. Ambulance personnel seemed to make good coordinators here, both in experience and in recognition by others, but their response time often brought them to the site after the arrival of safety forces, leaving them little to coordinate. Golec and Gurney's treatment of needs assessment (1977) suggests a two stage solution to the problem: a special fire department stabilization team followed by an ambulance coordinator to the site.

Of equal importance with the choice of a site coordinator, however, is the need to educate all other EMS responders that they are not the coordinators; in this way, first response by another EMS-related organization will not prevent the plan from being put into operation.

CONCLUSION

This paper began with a brief discussion of two approaches to planning for disaster-related EMS delivery: the first type of planning philosophy stresses the need for increasing and expanding EMS resources to meet what is viewed primarily as a quantitative change in the demand for EMS, triggered by the disaster agent; the second approach to planning advocates the use of distinctive strategies by EMS systems which must adapt to qualitative, as well as quantitative, differences in demand.

With the notion in mind that actual instances of disaster planning and response seem to be influenced by both conceptions in varying degrees, patterns of disaster planning and response on the part of EMS-related organizations in 19 disaster events studied by the Disaster Research Center were analyzed and discussed. Attention was paid to the planning context in which the disasters occurred, and different aspects of the actual EMS response to the disaster--organizations that participated, on-site care and treatment, search and rescue, emergency transportation and casualty allocation, and communications--were discussed in terms of the extent to which they were affected by formal and informal preplanning.
In general, two major areas of contrast were highlighted: contrasts between the everyday EMS response and EMS response in disasters; and contrasts between what is planned formally and what actually occurs in mass emergencies. In the latter category, for example, it was noted that, while some community disaster plans specify that there shall be medical coordination by a physician at the disaster site, this usually has not occurred in disasters in such communities and may not be practical to recommend.

This and other similar findings served as the basis for a set of suggestions designed to encourage EMS planners and operations personnel to inquire further about the extent to which everyday and disaster EMS are similar and the degree to which they are distinct. Several specific recommendations were advanced, all of which stress the need for a practical, comprehensive, inter-organizational approach to the planning and delivery of disaster-related EMS.
### TABLE 1. TRANSPORTATION AGENT FOR MAJORITY OF CASUALTIES

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### TABLE 2. COORDINATING AGENT FOR SOME PORTION OF CASUALTIES

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