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EMS DELIVERY IN DISASTERS:
PRELIMINARY FINDINGS

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Introduction

The Disaster Research Center (DRC), founded in 1963 at the Ohio State University, has been concerned throughout its history with conducting sociological research studies on the response of groups and organizations to community-wide emergencies, especially natural disasters. Well over three hundred field studies have been conducted by DRC personnel in the United States and other countries. In addition to studying organizational behavior during and after disasters, DRC has been interested in learning about organizational planning for community-wide emergencies. The research has also attempted to assess both the short-term and the long-term consequences of natural disasters for various aspects of community life.

Earlier DRC research focused upon a variety of emergency organizations, including fire and police departments, local civil defense organizations, and the Red Cross. While hospitals and other emergency medical service (EMS) deliverers were always looked at in DRC studies (e.g., see Drabek, 1968), it was not until approximately seven years ago that DRC began giving these kinds of organizations major emphasis in its research. Since that time, several works, concerned primarily with hospital responses in disasters, originated from DRC (Quarantelli: 1970; Stallings: 1970; Taylor: 1974; and Blanshan: 1975).

In the early 1970's DRC also began a thorough survey of the medical area literature on EMS in disasters and mass-casualty situations. Professional journals such as Emergency Medicine, Journal of the American College of Surgeons, Hospital Management, American Journal of Nursing, as well as a number of books, were included in this literature survey. The analysis of the literature revealed that the bulk of the published work on EMS disaster planning and response consists of single-case studies, descriptive in nature. Many of the writings on disaster EMS are concerned with the response of single hospitals or hospital specialties; others are concerned with specific medical or administrative problems faced by hospitals and other EMS deliverers in disasters. DRC was led to conclude that, while there is an impressive and growing literature on general EMS topics, research of a systematic, comparative nature on the functioning of hospitals, other EMS organizations, or EMS systems in disasters and other mass casualty situations had never been attempted.

At about the same time, a number of pilot studies were conducted by DRC in hospitals of approximately fifteen U.S. communities. These studies attempted to gain information on the structure and functioning of hospitals--especially hospital emergency departments--under both normal and disaster conditions. Later studies in this pilot phase, conducted in the wake of the devastating 1974 tornadoes, were quite detailed and comprehensive.

These earlier efforts served as a basis for current DRC research which for the past two years has been concerned with undertaking a systematic and comparative study of the delivery of EMS in large-scale, relatively sudden mass-casualty-producing situations in the U.S. During this time, in addition to gathering baseline data in a number of U.S. cities, DRC has conducted

field studies of twenty-seven mass emergencies in twenty-two communities, spanning fourteen states, the District of Columbia, and the U.S. Virgin Islands. Field research has consisted of three kinds of studies : the baseline or Time One, studies used to gain information on EMS disaster planning and normal EMS operations in six disaster-prone U.S. communities; on-the-spot research of five pre-planned events where the possibility of excessive casualties was anticipated; and studies of Time Two operations, or the EMS response in twenty-two mass casualty events. Included in this last category were both natural disasters (six events) and technological disasters (sixteen events). Disaster agents included four tornadoes, two floods, eight transportation accidents, one major fire, and seven explosions and toxic leaks. Often, more than one trip was made to a community by DRC personnel, so that knowledge could be gained concerning EMS operations in pre-, trans-, and post-disaster settings.

Approximately 506 interviews were conducted in the course of this research, and there were perhaps twice that number of informal contacts with personnel of emergency organizations. Additionally, extensive documentary data (e.g. from emergency department logs, newspapers, and disaster plans) was obtained, and thousands of hours of observation were performed.

This paper will discuss: 1) the substantive issues and theoretical focus of this research; 2) the data-gathering strategies employed in these studies; 3) some preliminary findings derived from the cases which were studied; and 4) some implications of these findings for EMS planning and operations.

Theoretical Focus and Substantive Issues

DRC research has focused upon EMS as an open system response. According to this view, all organizations involved in the various phases of patient care in disasters are seen as interfacing and acting in a more or less integrated fashion to deliver services. System imagery was used in this research for several reasons. First, this parallels the approach used by DRC in the study of other aspects of community disaster response, e.g. the reaction of the group of organizations collectively termed the "political system". Thus, the EMS system was viewed in this research as one of a set of community systems which could become active in the pre-, trans-, and post-disaster settings. Another advantage of the adoption of the concept of system is that its use requires that attention be paid to the environment or context in which a group of organizations operates. EMS delivery in mass emergencies is seen as being affected by both internal system factors and factors external to the system, including other community systems. Finally, the concept "system" was employed because of its wide currency in the health care disciplines. Indeed, system imagery is becoming increasingly common in many areas of scientific study, from biological science (Miller, 1965) to social science (Buckley, 1967).

Use of imagery from general systems theory had implications for research design. For example, it required that close attention be paid, not to the capabilities of specific EMS system subunits, but to the overall capability of the EMS complex. Similarly, the relationships and the dynamics exhibited by subunits--two system characteristics--were focused upon more than, for example, structural properties of a single subunit.

Three basic topics were pursued throughout. First, there was an interest in determining the pre- and trans-disaster conditions affecting disaster-related EMS. Second, the research sought to determine the nature and the range of the medical services delivered in mass emergencies--the characteristics of disaster-related EMS delivery. Last, there was an effort made to discover the consequences of disaster-related EMS for the emergency health care systems involved.

Methodology

DRC's focus on gathering comparative data on sudden mass casualty-producing events, together with its use of the interorganizational, open-systems theoretical model, dictated a research strategy that was both distinctive and appropriate. Essentially, three things were required. First, a large number of cases, exhibiting a variety of system characteristics were needed. As indicated, there was a wide range of cases, both in terms of disaster agent and of community type, present in the sample. Studies were undertaken in communities as small as 5,000 as well as in several major American cities. Communities at all phases of EMS development, from those with only the most rudimentary capability to those with sophisticated systems, were included in the research. Second, field teams had to be present on the scene as soon as possible after a mass casualty incident. DRC's mode of organization made this task possible. In preplanned events such as Mardi Gras, teams of researchers were on hand before and during the event. Third, in order to understand system organization and functioning, it was necessary to have contact with key EMS officials and operational personnel in a variety of emergency health care organizations. In-depth, open-ended interviews were conducted with persons responsible for a number of tasks related to EMS delivery in mass emergencies: hospital administrators; hospital personnel responsible for disaster planning; physicians, nurses and other medical staff; providers of ambulance and other transportation services; persons involved in normal and disaster EMS communications; providers of emergency first aid; and others. Documentary and statistical information, both on EMS operations during the disaster period and on normal operations, were obtained. Observational data, obtained on-site by field personnel, was invaluable as a source of information about the reliability and validity of data obtained by other means as well as information about the reality as opposed to the ideal of EMS delivery in high-demand situations.

Research Findings: EMS Delivery in Mass Emergencies

Earlier analysis conducted by DRC on data collected in pilot studies indicated that a number of factors appear to contribute to a viable EMS response in disasters. These factors include: preplanned linkages among

hospitals; understood relationships between ambulance services and first-responders, e.g. police and fire departments; pre-disaster professional ties among key EMS personnel; and a clear division of labor among those groups and organizations responsible for the various phases of care. Field work during the intensive phase of the research was intended to validate, strengthen, and make more specific these and similar generalizations.

Analysis of data from the more than two dozen studies conducted to date has served as the basis for the findings discussed below.

A. EMS Planning for Mass Emergencies

1. Few community health-care systems have undertaken realistic overall planning for handling large numbers of casualties. Most planning and operational personnel assume that the everyday EMS system can be extended in mass emergencies and that a system which functions adequately during normal times will also do so in disasters. Interviewees frequently espoused this view; in fact, it is commonly argued by EMS professionals on all levels that everyday and disaster EMS are simply two points on the same continuum. DRC research indicates that for several reasons this is not the case. Mass emergencies create demands that differ qualitatively, as well as quantitatively, from everyday EMS demands. For example, disasters can create large numbers of "walking wounded" who, while not necessarily requiring the services of a hospital emergency room (ER), may nevertheless intensify demands by converging on hospitals. Indeed, convergence of press, relatives, medical personnel, etc. presents a major problem in disaster, as opposed to normal, EMS delivery. Another distinction between everyday and disaster EMS is that the former is designed to function with great speed in meeting the specialized problems of sick and injured individuals, problems such as cardiac arrest and multiple trauma. In disasters, which produce large numbers of casualties whose medical problems exhibit different degrees of urgency, speed of the response may not be crucial to effective operations; instead, the overall coordination of the response--among hospitals, between first responders, hospitals, and the transportation component, for example--becomes the essential task. DRC research indicates that the EMS system which actually functions in disasters is, at least in part, an emergent system, different in many important respects from the everyday EMS system. (See Worth and Stroup, 1977, for a lengthier treatment of EMS in disasters as an emergent system response).

2. There is a widespread lack of knowledge about the overall EMS system in many communities, even within subunits of the system itself. Only a few officials appear to recognize this as a problem, and even these are uncertain regarding how to go about diffusing greater knowledge. Where mass emergencies are concerned, attitudes of either faith or fatalism are prevalent: on the one hand, there is a faith that necessary assistance will be forthcoming from some quarter in situations of extremely high EMS demand; on the other, there is in some communities a fatalistic notion that some disasters are probable to which there could be no effective community response, e.g. a massive earthquake in California.

3. Political considerations enter into all aspects of EMS planning and response, even in disasters. Self-interested organizational actions based on city/county, public sector/private sector, and other jurisdictional distinctions are common. Interviewees throughout the nation repeatedly singled out as problematic a number of EMS matters over which various interest groups differed. Examples of these include: funding issues; participation by private hospitals in publicly controlled EMS systems; categorization of hospital emergency departments; the use of telemetry and the rendering of certain forms of treatment to victims by EMT's or paramedics on site or during transport as these relate to the possibility of later legal action and the issue of patient accessibility to care.

Communities frequently assume stands either for or against the use of federal monies in the design and operation of EMS systems. The issue of federal intervention in local affairs was raised in several communities studied, and it is probably safe to assume that the funding question influences perceptions on EMS in every community. The application for, or the granting of large amounts of money, however desperately needed, frequently signals the beginning of intense conflicts at the local level.

These kinds of disputes are important to note because they can result in a lack of interorganizational cooperation, or even outright conflict, which can eventually have a greater impact on disaster planning and/or response than does the magnitude of the resources available to the system. Conflict can reduce the extent to which resources such as EMS expertise, communications equipment, and transportation vehicles are used effectively when required.

Additionally, mass emergencies seldom occur in politically convenient locations. Any number of organizations and agencies on a variety of governmental levels may feel compelled to act in an emergency situation. Often, overlapping jurisdictions lead to confusion in service delivery, loss of coordination, and patient treatment that may be less than satisfactory. (For a good analysis of this phenomenon, together with illustrative case studies, see Neff, 1977).

B. EMS Operations in Mass Emergencies

1. Accurate on-site assessment of the need for EMS almost never occurs. The large geographic scope of some disasters, a lack of adequate security and rumor control at the site, the atmosphere of uncertainty and urgency that prevails in disasters, and the absence of personnel trained in recognition of emergent and urgent medical cases are all factors that can hamper efforts towards accurate needs assessment in the first moments following disaster (Golec and Gurney, 1977). Very frequently the need for personnel and emergency transportation vehicles is overestimated, leading to dysfunctional mass convergence at the disaster scene and to a diminution of EMS coverage in other, non-stricken areas.

2. Meaningful on-site triage and initiation of treatment is seldom attempted in disasters and mass casualty situations, in spite of the comparatively large numbers of "walking wounded" which are produced by such events. Lack of adequate on-site triage and first aid results in several problems, particularly for hospitals: emergency departments become overcrowded; treatment may be initiated on the less seriously injured in the ER, just as critical patients begin arriving; casualties may be treated or admitted simply because of their involvement in the disaster, rather than because of the severity of their injuries. The rendering of hospital emergency care in disasters to those who do not require it is too often at the expense of patients who do.

Studies of on-site triage and treatment in pre-planned events such as Mardi Gras and the Bicentennial celebrations indicate their effectiveness in relieving the distress of those sustaining minor injury and in lessening demands on ambulance services and hospital emergency departments.

3. Poor intra- and inter-organizational communications are common in disasters. Despite the emphasis in many communities on notifying hospitals of the imminent arrival of patients, hospitals are still quite likely to receive no word that a disaster has occurred until the first stream of patients arrives in the ER. Ambulance-to-hospital and hospital-to-hospital communications linkages are seldom utilized effectively. This failure to communicate is not always due to a lack of communications facilities per se. Rather, factors such as a lack of experience in utilizing communications equipment on an everyday basis, absence of trained personnel, equipment failure, confused or distorted messages, critical communications gaps (e.g. site-to-hospital), and information overload, combine to reduce communications effectiveness.

Particularly in the area of EMS communications, DRC has found an over-reliance on technology and a failure to appreciate the fact that effective communications are most likely to occur where organizations have already established cooperative relations in the areas of planning and operations. The existence of a radio network cannot bring into being a workable division of labor where one does not exist, and it is the value of the latter that communities need to realize.

4. Extrication, transportation, and distribution of victims of mass emergencies leave much to be desired. In part, this is due to the tendency, present to some extent in everyday EMS operations, but even more marked in disasters, for initial victims to be found by non-medically-trained personnel. First responders frequently make decisions for patient transport and distribution which are detrimental to the quality of medical care. Inaccurate needs assessment, lack of triage, and poor communications, mentioned above, interact with problems in the transportation/distribution task, and all of these together produce undesirable effects. For example, the majority of disaster victims are transported to hospitals by means of private vehicles which are not linked to any EMS networks, almost always resulting in maldistribution of casualties. This pattern obtains everywhere, even in communities where sophisticated central dispatch systems exist. As Worth and Stroup note (1977:4).

While the existence of central dispatch can ameliorate convergence because whereabouts of the vehicles is known, the participation of groups and individuals not normally associated with EMS delivery may alter the complexion of the transportation process...

Another pattern presents itself in almost all communities, regardless of the degree of sophistication of the EMS system: one hospital (usually the hospital closest to the disaster site) receives the largest number of casualties, the most severely injured, and the largest number of DOA's. Golec and Gurney (1977) illustrate this pattern by citing the following two cases, among others: in one community, 125 of a total of 140 casualties were seen at one hospital, out of a possible total of 17 hospitals; and in another community, of a total of 45 casualties, one hospital received 25, all in conditions serious enough to require admission as "serious" or "critical", while three other hospitals received the other 20 patients, 14 of whom were admitted, but in "fair" or "good" condition.

A third significant pattern observed in many mass emergencies is that the less severely injured patients are transported first and arrive at the hospital relatively soon after the incident, while the more severely injured may arrive at any time during the first few hours. This pattern, attributable at least in part to a lapse in coordination in the first moments following the disaster event, has obvious consequences for the hospital phase of patient care.

5. In some instances, although by no means in the majority of cases, DRC has found that the care given to regular hospital patients during the trans-disaster period may fall below acceptable standards because so much attention is given to providing EMS to disaster victims. For example, in one case studied, several staff members left a coronary care unit (CCU) to render services to disaster victims in the emergency department; there were two fatalities in the CCU that same night, and informants at the hospital attributed the deaths directly to this lack of supervision. This point is noted because few hospital disaster plans consider the question of regular patient care in precipitous mass casualty situations.

6. There is a tendency of EMS deliverers to give relatively little attention to standardized record keeping--one of the fifteen EMS components--during everyday operations. This tendency is even more marked in disasters. This not only causes problems in tasks such as patient identification and billing, but also makes it difficult for EMS personnel to observe the ways in which EMS demands in a disaster situation differ from everyday demands. Additionally, if systematic evaluation of EMS is to be attempted by EMS systems accurate and complete records are essential.

7. Centrally coordinated EMS responses are rare in mass emergencies. This seems to be true particularly in incidents producing large numbers of casualties, in very large communities, and in communities where interorgani-

zational expertise is scarce. The size and complexity of a community's resource base also appears to affect the probability of a centralized response. Seemingly paradoxically, presence of a larger number of resources, say ambulances, made a centralized response less likely. One possible explanation for this is that communities which are richer in resources do not coordinate well during normal operations, because this is not crucial for adequate service delivery, and, thus they are not able to effect a centrally coordinated response in mass casualty incidents (Wright, 1976). Centralized responses, where actualized, do seem to make for effectiveness in EMS delivery, where effectiveness is defined as equitable distribution of seriously injured patients among several hospitals.

C. Post-Disaster EMS Activities

Research findings indicate that EMS organizations are beginning to institute mechanisms, such as group critiques and after-action reports, for learning from their disaster experiences. In some locales community-wide disaster drills are being staged. This constitutes an improvement over earlier drills, which tended to include single system components or at best a few system subunits. It is hoped that these practices will become widespread and that, even more importantly, the recommendations based on disaster critiques and drills will influence hospital and community-wide disaster planning. Additionally, it is hoped that different EMS systems will share disaster experiences with one another, so that knowledge about useful innovations, operational problems, and the like, will become more widely known.

The above observations are based on preliminary impressions. More systematic analysis of the data is underway, and other field studies have either already been completed or will be carried out. No major changes in findings are anticipated as a result of this later work, but refinements in or qualifications to these observations are a possibility.

Conclusion

While the foregoing comments seem to paint a bleak picture where disaster-related EMS planning and operations are concerned, the impression should not be left that EMS delivery in disasters is always inefficient and ineffective or that it has not shown improvement during the past few years. On the contrary, there are positive aspects of EMS in mass emergencies that should not be ignored. For example, key officials and operational personnel in a few EMS systems are beginning to recognize the fact that mass emergencies present EMS demands different from those presented during normal operations.

Disaster planning and response has been recognized as a specialized problem for EMS systems, indicated by the fact that "disaster linkage" constitutes one of the fifteen EMS components. Moreover, DRC research indicates that the establishment of disaster linkages among EMS components may lead to increased

cooperative interaction among system subunits during normal times. If used advantageously, this cooperation could serve as a corrective for some of the competitive and conflictive relationships that often obtain in EMS systems, e.g. concerning hospital categorization.

Another positive outgrowth of well-informed EMS planning was evident in the preplanned EMS situations studied by DRC. New relationships, often involving new organizations, were operative in these settings. A distinct, emergent EMS system functioned quite adequately in caring for non-acute cases and in reducing the demand on EMS components responsible for the care of true emergencies. It is unfortunate that the implications of EMS delivery in preplanned events for disaster-related service delivery have not been recognized. (See Taylor and Tierney, 1977, for a detailed discussion of the organized delivery of EMS in two Bicentennial celebrations).

Finally, DRC research has led us to the conclusion that most confusion and gaps in EMS delivery in disasters can be ameliorated by means of increased communication, interaction, planning, and cooperation among EMS system components. Major financial expenditures, massive reorganization, or the creation of new technologies are not essential to the launching of a good disaster response. Of course, this is not to argue that more EMS resources are not needed in many communities; indeed, in certain areas, the need for resources such as transportation vehicles and trained manpower is so great as to render ineffective even everyday attempts at EMS delivery. Rather, this statement calls for a final reiteration of one of the important distinctions between everyday and disaster EMS. Sophisticated, expensive EMS technologies, such as telemetry, have undoubtedly improved everyday EMS delivery. Likewise, faster response times have improved the life-saving capacity of EMS operations. Yet effective EMS delivery in mass emergencies is less a matter of swiftness and technology than of good overall coordination. Thus, even cutbacks in EMS funding may not necessarily have an adverse effect on a community's chances for effecting an adequate EMS response to a disaster.

In sum, the message of this paper is that, particularly in the area of mass emergencies, there is great potential for increased EMS organizational effectiveness if organizations learn more about human behavior in disasters, plan together, share existing resources, and develop a workable division of labor for disaster operations.

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