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THE PROBLEM OF NEEDS ASSESSMENT IN THE DELIVERY OF EMS*

Judith A. Golec and Patrick J. Gurney

Department of Sociology, Disaster Research Center, Ohio State University, Columbus

INTRODUCTION

The assessment of a community's health needs generally and emergency health needs specifically is understandably carried out according to the normal, everyday situation and not to the disaster situation. Furthermore, such assessments are based upon certain population characteristics and utilization patterns of existing community health facilities. While these factors have some, although indirect, bearing on the delivery of emergency medical services during a disaster, they are totally inadequate as guides for assessing the disaster emergency health needs. Such assessment requires, indeed demands, an examination of the population affected by the disaster agent.

Assessment of emergency health needs during a disaster is, in practice, neglected. The basic problem any Emergency Medical Services (EMS) must face is how to quickly and accurately assess needs. If this fundamental fact which underlies the following discussion is correct, it is certainly paradoxical.

In part, the raison d'être for EMS planning is to facilitate the construction of EMS delivery systems based upon an accurate assessment of emergency health needs and an equitable distribution of victims among existing community health facilities during mass casualty and disaster situations. In fact, most community and hospital EMS disaster plans implicitly or explicitly assume that needs assessment *will* be carried out. However, few plans actually specify who has the responsibility for such assessment, exactly how needs assessment at the site is to be done, and what criteria are to be used. Finally, the popular and widely used concept of triage at the site incorporates the notion of needs assessment and attests to its importance. Unfortunately, on-site triage, when it is done, seems to be limited to an evaluation of the condition of an individual patient rather than of the situation as a whole.

The negative consequences of failing to assess emergency health needs at the disaster site are experienced by hospitals. In American society hospitals have the primary responsibility for emergency medical care. But, the assessment of emergency health needs is only one side of the equation in estimating the total magnitude of a disaster in terms of EMS for any given community. The other side of the equation is at least a rough estimate of the current capabilities of the hospitals. The magnitude of the EMS demands for the system depends upon the extent and severity of the emergency health needs relative to the current capabilities of the hospitals. Obviously, an equitable distribution of casualties among the

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different hospitals would reduce the demands upon any given hospital and would increase the efficiency and effectiveness of delivering emergency medical services to the disaster victims. What appears to be less obvious is that an equitable distribution of patients presupposes a prior assessment of emergency health needs at the disaster site. Consequently, it is the hospitals that experience the most severe effects when on-site needs assessment is neglected.

This discussion will be organized in two parts. First, the typical pattern of what occurs in hospitals immediately following a disaster will be explored. Second, in an effort to explain why needs assessment is neglected, we will examine the factors which tend to exacerbate problems in the assessment of emergency health needs at the disaster site. However, a short section describing the research on which this description is based precedes the two major parts and immediately follows.

METHODOLOGY

These preliminary findings are from a larger ongoing research project conducted in the United States by the Disaster Research Center (DRC) to study the delivery of EMS in mass casualty situations. Some findings of this research are reported elsewhere in this issue of the journal. The research project is divided into studies of three different types: the first monitors EMS activity in a number of disaster-prone cities; the second focuses on scheduled events that have the potential for producing a mass casualty situation; and the third examines the EMS response to natural and technological disasters.

The data reported here are from studies of the last type only, natural and technological disasters. A total of 18 disasters, occurring between May, 1975 and November, 1976 are included in this article. Of these, six are natural disasters, including floods and tornadoes, and twelve are technological disasters, including fires, explosions, plane and train crashes, traffic accidents and a dam break.

Disasters included in this study are not representative of all disasters which occurred in the United States over the specified period. Due to the research focus – the delivery of EMS in mass casualty situations – only those disasters that produced either moderate to large numbers of casualties or unusually severe casualties were included. Consequently, caution must be exercised in generalizing the findings from this study to other disasters which produce (as for example sometimes occurs in disasters in Third World countries) either few casualties or massive numbers of casualties.

Findings are based on three sources: (1) open-ended interviews with EMS, hospital and related health care personnel, including ambulance and search and rescue units; (2) official agency statistics; and (3) documented materials.

TYPICAL PATTERNS IN HOSPITAL RESPONSE FOLLOWING A DISASTER

In American society, the current trend to improve EMT training and equipment notwithstanding, there appears to be considerable agreement that the identification of the injured, first aid, stabilization of patients' conditions, and transportation of casualties are ancillary to the provision of sound medical evaluation and treatment in a hospital setting. Consequently, it is within the hospital that the effects of needs assessment at the site are most dramatically experienced. An examination of the typical patterns and general trends which occur in hospitals immediately following a disaster will provide some needed information with which to decide if a reconsideration of the problem of assessment of emergency needs at the disaster site is warranted.

The following general trends become evident from the 18 studies; though they recur frequently enough to be considered trends, they do not necessarily occur in every instance (see Table I).

TABLE I

Casualty Report on a Number of Natural Disasters

Disaster agent	Total number of victims or casualties	Dead on arrival (DOA)	Dead after arrival	Treated	Treated and released	Admitted	# of Hospitals Used/ # of Hospitals Available	# treated in *one* hospital/ total # treated in all hospitals used
Tornado	250	3	0	132	122	10	8/12	55/132
Tornado	62	3	0	59	43	16	1/1	59/59
Tornado	103	5	0	34	22	12	4/11	22/34
Tornado	155	2	1	155	121	15	2/6	150/155
Tornado	28	2	0	26	18	8	2/3	23/26
Flash flood	242	139		103	90	13	4/4	94/103
Casualty Report on a Number of Technological Disasters								
Train collision	140	0	0	140	124	16	4/17	125/140
Bus accident	45	0	1	45	17	28	3/3	27/45
Gas explosion	94	0	4	94	72	22	2/7	56/94
Bomb explosion	71	10	1	61	5	56	7/17	31/61
Multiple car pile-up	105	0	0	55	40	10	4/5	30/55
Train crash	398	0	1	398	277	61	11/105	207/398
Explosion	71	20	0	41	27	14	1/1	41/41
Fire	45	12	1	35	4	29	4/105	25/35
Plane crash	91	37	0	54	35	19	1/1	54/54
Tank explosion	204	4	2	200	142	58	13/26	84/200
Dam break	11	10	0	1	0	1	4/4	1/1
Explosion-fire	55	0	4	51	20	30	5/12	40/51

Hospital/Other as Primary Receiver of Casualties

Before preceding directly with the patterns between and within hospitals, it should be noted that the hospital is the overwhelmingly preferred setting for evaluation and treatment. Occasionally a secondary facility, such as a school or warehouse, is temporarily established to relieve the demands made on hospitals. Since generally 50–75% of the total number of casualties seen in a hospital emergency room (ER) are treated and released, this may represent a viable alternative mode of providing medical services in certain situations. This pattern, although rare, tends to occur:

1. Where the primary need of victims is shelter rather than medical aid. First aid or medical attention, then, is a secondary and accidental occurrence in extra-hospital facilities;
2. At a time considerably distant from the time of impact: many hours and sometimes days later;
3. When the area of impact is large with low population density, i.e. a flood, and when search and rescue may take days to complete;
4. Where the extrication of the more seriously injured and directly affected, i.e. in a multiple car collision, may delay efforts and require the most concentrated attention.

Inequitable Distribution of Patients Across Hospitals

One hospital typically receives an inordinately large number of casualties. Obviously, those communities which have only one hospital must be excluded from this pattern. However, even in this instance, a larger community which has a complex of hospitals that typically service the disaster community in a normal situation is generally only a few (15–30) miles away. Of the 18 communities studied 15 had more than one hospital.

The hospital which receives the most victims is usually that closest to the disaster site and the one with which the Emergency Medical Technicians (EMTs) and ambulance attendants have a close rapport during normal conditions.

Two examples will illustrate the range and magnitude of this pattern. Both were chosen because the communities typically experience more than one mass-casualty situation per year and have extensive and well-developed EMS systems.

Example 1. Of a total of 140 casualties seen in a hospital ER, 125, or roughly 90%, were taken to one hospital out of a total of 17 in the community. The remaining 15 were distributed among three other hospitals. This occurred despite the fact that the goal of this system is to prevent overloading any single hospital. A central communications center, with each hospital's ER capabilities and bed census on hand, was to redirect patients away from overloaded hospitals. Furthermore, the network was to notify the hospital of the disaster, but according to hospital officials it did not. Apparently communications, and therefore coordination, broke down.

Example 2. Of a total of 398 casualties seen in hospital ERs, 207, or roughly 50%, were taken to one hospital. A total of 105 hospitals are available in this city. 181 of the remaining 191 patients were distributed over four other hospitals.

Typically, one hospital receives not only the largest number of casualties but the most severely injured as well. Two different cases will illustrate this point.

Example 1. From a total of 45 casualties, one hospital received 25, all serious enough to be admitted and all judged to be serious or critical. Of the 20 remaining patients taken to three hospitals, 14 were serious enough to be admitted but all were judged to be in fair or good condition.

Example 2. Of 51 casualties, one hospital received 40, 30 serious enough to be admitted and 28 judged serious or critical. Of the remaining 11 patients taken to four hospitals none were judged serious enough to admit.

As well as receiving the most severely injured and the largest number of casualties one hospital typically receives the most victims dead on arrival (DOAs). In Example 1 above, one hospital received 25 of a total of 45 casualties, all of the serious or critically injured, and 10 of a total of 12 DOAs.

Even in those communities where a relatively large number of hospitals participate in the EMS response, the basic pattern of inequitable distribution continues to be observed. What we judge to be one of the best illustrations of an equitable distribution of the casualties between hospitals has been selected.

Thirteen hospitals participated in this EMS response. Four hospitals received 166 of the total of 200 casualties, i.e. hospital A 84; hospital B 46; hospital C 22; and hospital D 14. The remaining 34 patients were divided among the nine other hospitals which participated. In this illustration the serious injuries appear to be more fairly and equitably distributed (4-5-3-3-1-1) than one usually finds.

It follows logically from the above that when more than one hospital is involved in the EMS response, the secondary hospitals tend to receive fewer numbers of casualties, the less severely injured patients, and fewer DOAs. There have been several cases where more than one hospital is involved in the EMS response and the secondary hospitals become involved only after the first and/or preceding hospitals have been filled to capacity.

Time of Arrival Relative to Hospital Notification

In many instances the arrival of the first wave of casualties in the ER precedes or is itself the first notification the hospital receives of the disaster and the fact that it will be receiving casualties. The hospital may receive advance notification of the disaster through: (1) a large explosion or a dramatic change in weather conditions; (2) the hospital staff hearing the news over public media; or as in one case, (3) the weather bureau office being located in the hospital that was the primary receiver.

In only a few cases, however, were hospitals activated for preparation by official notification in advance of the arrival in the ER of the first casualties.

Flow of Casualties Through the ER

Casualty flow can be analyzed along two dimensions; volume and severity of the injuries to patients.

In respect to volume, three trends can be identified:

1. Time of onset – the first casualties typically arrive within the first half hour after the impact.
2. Duration of time over which casualties arrive – most casualties arrive in the ER over a relatively short period of time, i.e. one to four hours.
3. Peak of casualty flow – the largest percentage of casualties arrive in the ER within one to one and one-half hours following impact.

Example 1. Following an explosion which occurred at 9.30 a.m., 41 victims had arrived in the ER by 10.30 a.m.

Example 2. After a disaster which occurred at 7.36 p.m., 56 casualties arrived in the ER between 8 and 9.30 p.m., with the largest number arriving at about 9 p.m.

There may be more than one peak within the flow of casualties, depending upon how many are transported in any single vehicle. A commercial bus dropped between 60–70 ambulatory victims at one ER. Similarly, in another disaster, the first three vehicles arriving at an ER contained 5, 12, and 9 casualties, respectively. In this case, the onset of first arrivals constituted one of the several peaks in the flow of casualties.

The severely injured arrive at any time over the duration of the casualty flow, while the less severely injured tend to be concentrated at an early phase of the casualty flow. A large number of ambulatory cases arriving before the severely injured can create problems in that the ER may become overcrowded, resulting in confusion.

The ambulatory casualties and those with relatively minor injuries arrive before the more serious cases when taxis, buses, private cars, vans, police squadrons, and fire rescue units transport the less severely injured in large numbers at one time. Ambulances usually transport the more severely injured with fewer people in each vehicle. Also, those severely injured who require extrication tend to arrive later than the less severely injured. When the severely injured are readily visible and free from falling debris or heavy structures they tend to arrive in the ER early.

Information Input to ER

It is generally assumed that a more effective and efficient response in any given ER will be facilitated by prior knowledge concerning the number of casualties to expect, the type of injury, and the severity of injuries. In the overwhelming majority of cases information regarding number, type and severity of injuries is non-existent, while in some cases, where estimates concerning the number of injured are available, they are grossly under- or over-estimated. For example, one hospital which received 28 severely burned casualties, as well as 12 other patients, had received a call from an anonymous source telling them to expect a "few burns." In another instance, a hospital ER which received 41 patients was anticipating a total of 80 casualties, a figure which was widely circulated.

Ongoing information is rarely, if ever, received through official EMS channels. Most information concerning the magnitude of the casualty situation comes via rumor networks – patients seen in the ER, ambulance attendants, police officers, etc.

EMS systems are supposedly designed to counter the trends previously discussed. However, it seems that these goals have not yet been achieved due to malfunctions at the point of entry into the system and the neglect of on-site needs assessment. Needs assessment is a rational model based on the relative conception of needs on the one hand and resources or capabilities on the other. Controlled and accurate information concerning these two facets must be present to accurately assess needs in a mass-casualty situation. In practice, needs assessment implies a system or at least a network with three fundamental requirements for efficiency and effectiveness:

1. An inventory of EMS needs which includes number of injuries, type of injuries, seriousness of injuries and projection of specialized treatment modes that might be required. This inventory should originate at the disaster site;
2. An inventory of existing hospital facilities;
3. Control over information by relatively centralized means of communication and coordination.

If done properly needs assessment should equitably distribute casualties, thereby reducing the magnitude of the demands made on any single EMS component. This in turn will increase the efficiency and effectiveness of the delivery of EMS to all victims.

FACTORS WHICH EXACERBATE PROBLEMS OF NEEDS ASSESSMENT AT THE SITE

An accurate assessment of needs requires temporary site stabilization so that an evaluation can be made. To accomplish this, either action at the site can be halted or victim removal can be controlled according to the severity of the casualty. Obviously, this necessitates that those making the assessment have control over activities and information.

However, there are several factors, intrinsic to the disaster situation, which interfere with assessing needs. Uncertainty might prevail right after impact due to the debris which results from the disruption. Also, the geographical scope of the catastrophe can be a deterrent factor; the disaster site may be very large or there may be several disaster sites. Often extensive visible material damage leads to the assumption of mass casualties. The situation can be further complicated by a sense of urgency among the EMS personnel who believe that visible casualties represent only the tip of the iceberg.

In many cases the initial assessment, facilitated by a lack of rumor control is the one which prevails. Usually the system is originally advised by a public-spirited citizen with a report which is generally vague and almost always grossly exaggerated. This message activates the system and sets expectations for a casualty count of significant magnitude. Frequently this count is a wild guess, and the magical process of numbers is set in motion. This number is picked up by the press, circulated among agencies through rumor networks and seems to stick as reality.

Example 1. Nine minutes after a tornado hit at 3.18 p.m., an ambulance was dispatched to the scene by the communications center of the EMS. The EMT on the ambulance was told to observe, ask questions and report back. When interviewed, this EMT said, "As you just go around and see, everything had been levelled. I asked a couple of questions of people that were there and in their right senses. I estimated 150 people as being hurt. I radioed in and told them to send everything available – it's a big one." This assessment was made in two minutes, and ambulances arrived from all over the state. According to the EMS project director, this estimate was totally wrong, "Outside ambulances weren't needed, we had three times more than we needed." Many of these ambulances got flat tires and blocked the roadways.

Example 2. In one disaster, which actually produced one injury and ten deaths, injury estimates exceeded 1,000 shortly after impact. Incidently, that figure of 1,000 continues to appear in written reports to this day.

Generally police or fire personnel are the first on the scene. As a rule, they lack EMS training. These officers, whose orientation is different from that of medical personnel, emphasize security, swift evacuation of casualties, resumption of traffic flow, and minimizing community disruption. Furthermore, an effort is made to insure that no one else is hurt by falling debris.

Speed is also emphasized when the primary responders are EMTs or ambulance attendants. This philosophy is based on the criteria of efficiency and effectiveness used in "normal" times: a rapid response rate from call to arrival and from arrival on scene to arrival at the hospital. Typically, less than half the casualties are transported from a disaster site by ambulances. Other transportation has been provided by police squadrons, cabs, buses, vans and private cars, all of which act independently of EMTs and often remove casualties before the ambulances arrive.

Another reason for faulty or nonexistent needs assessment is that control and centralization at the site rarely occurs. First, there are explicit competing demands made on the different agencies involved. Each agency seems to have someone in charge who is not recognized as a legitimate authority by the others. Many times a medical doctor may not respond to the orders of an EMT, even though, according to disaster plan, the latter is supposed to take command of the scene. Secondly, the picture is complicated by various agencies arriving at different times. One agency may have the responsibility to assume control but because members arrive late its duties may have been performed by some other agency. When the former arrives an ambivalent control situation exists for it may be unrealistic to change command in the middle of the situation.

One last factor which complicates a proper needs assessment is the lack of integration of the medical component into the community response. Generally an EMS representative with authority is not present at the site. In some cases a medical team has been in transit to the site and has been refused admittance to the area because it was not seen as legitimate by police or was unknown to the police. In other cases, a medical officer has been designated the authority at the site, but because of late notification and transportation problems this person arrives too late.

Another problem to consider is conflicting tasks. By plan, an EMT may be in charge of medical triage at the site. But assessment on the one hand and treatment, stabilization, and transport on the other are contradictory functions, if carried out by the same person. Thus assessment breaks down.

The final point to be mentioned is that in most cases an EMS representative – administrator or planner at any system level – receives information after the response is over. This means that upper echelon EMS representatives rarely play an active role in the actual delivery of services and more importantly, in the on-site assessment of EMS needs.

CONCLUSIONS AND SUGGESTIONS

This paper has discussed the most important component of the delivery of EMS – a quick and accurate needs assessment. Since most EMS systems have a centralized apparatus for communications, one which is capable of disseminating messages quickly, it is imperative to have an accurate assessment of needs for the system to work efficiently. The deleterious effect of an improper assessment has been demonstrated above. Much of this problem stems from the attempt, as almost all systems do, to use normal everyday techniques in disaster situations – to handle disaster situations as routine. EMS planners and practitioners must ask themselves if this is feasible in mass casualty situations.

The emphasis on speed has been discussed. Some might argue that to stabilize the disaster site consumes valuable time. Yet time can be saved in other areas to compensate for this. To perform needs assessment an EMT must get to the site quickly (many ambulance drivers do not realize how long their initial response time actually is). Getting there more quickly will help, as will shortening the distance to be traveled. Ambulances or ambulance companies can each occupy a primary response zone, thus avoiding the need for a trip across town to make an assessment, when an ambulance was actually located nearer to the site.

Perhaps a mobile communications van, which most state and many large city police have, can be sent to the site in order to improve the quality of messages sent, thereby decreasing the rumors which tend to proliferate. Quite possibly this van can communicate with the hospitals to avoid inequitable distribution of patients. Furthermore, this vehicle could forewarn the hospitals to expect and prepare for a certain type and number of casualties. Although many systems have centralized communication networks, they often break down. On-site communication control could eliminate one link in the normal process of ambulance to control to hospital. Hospitals need direct and accurate information from the scene.

Of major importance to needs assessment and therefore to EMS is the point of entry into the system. More attention must be given to the screening of casualties entering the health care system. Patience and good judgment are essential when making referrals at the site. Since our data indicate that only 15% of ambulance deliveries are emergencies – i.e. are serious enough to be admitted to hospital – efforts should be made to identify and attend to these cases first.

In order to ease the conflict which EMTs experience between the tasks of transportation and assessment, perhaps these tasks could be divided. A first responder team should be designated whose function would be to stabilize and assess only, leaving transportation and triage to different EMTs and ambulance attendants. Since fire stations are located throughout many cities, the fire department appears to be a logical nominee for first responder. One city in our sample has tried to develop such a system, which does not yet function adequately. Part of the problem in this case may be that a physician is designated as part of the on-site team. Inclusion of a physician, while a fine idea in principle, is often a problem in practice, because physicians are not continuously monitoring community events and may participate only partially or sporadically in emergency communications networks. Thus, they often arrive on the site later than other responders, and can be of only limited assistance.

Unfortunately there have been more questions raised in this paper than answers offered. It is hoped that we have at least drawn attention to a very important but neglected issue in EMS – on-site needs assessment – and that others are stimulated to move beyond this preliminary work.

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