UNIVERSITY OF DELAWARE
DISASTER RESEARCH CENTER

PRELIMINARY PAPER #34

THE PROBLEM OF NEEDS ASSESSMENT IN THE
DELIVERY OF EMS*

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*The research on which this paper is based was supported in part by PHS Grant 1 R01 HS 01781-01 from the Health Resources Administration.
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 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.

The typical pattern of what occurs in hospitals immediately following a disaster will first be explored here. Secondly, the phenomenon of neglect will be accounted for by examining the factors which tend to exacerbate problems of the assessment of emergency health needs at the disaster site.

Methodology

The data are from a larger, ongoing research project conducted by the Disaster Research Center (DRC) to study the delivery of EMS in mass casualty situations in the United States. This research project includes studies of three different types:

1) Monitoring of base-line cities.
2) EMS planning for and response to scheduled events which have the potential for producing a mass casualty situation.
3) EMS response to natural and technological disasters.

The data reported here are from studies of the last type only: natural and technological disasters. There are a total of 18 such disasters studied which occurred between May, 1975 and November 1976. Of these six are natural disasters, including floods and tornadoes, and twelve are technological disasters including fire, explosions, plane and train crashes, traffic accidents and a dam break.

The disasters included in this study are not representative of all the disasters that occurred in the U.S. over the specified period. Bias, in the direction of casualty-producing disasters, results from the criteria used for inclusion in the study; due to the research focus, only disasters which produced moderate to large numbers of casualties or severe casualties were included.

Findings are based on three sources:
1) Open-ended interviews with EMS, hospital, and related health care personnel, including ambulance personnel and those involved with search and rescue.
2) Official statistics from hospitals and other agencies.
3) Documentary 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 are drawn from the 18 studies; though they recur frequently enough to be considered a trend, they do not necessarily occur in every instance. (See Casualty Report Table on next page).

I. 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--first aid and medical attention, then, is a secondary and accidental occurrence.

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 search and rescue may take days to complete.

4) Where the extrication of the more seriously injured and directly affected, i.e., a multiple car collision, may delay efforts and require the most concentrated attention.

II. 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. At least 15 of the 18 communities studied 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.
| Total Number of Victims or Casualties | Dead on Arrival (DOA) | Dead After Arrival | Treated | Treated and Released | Admitted | Disaster Agent | # of Hospitals Used/
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<td>132</td>
<td>122</td>
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<td>3</td>
<td>0</td>
<td>59</td>
<td>43</td>
<td>16</td>
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<td>5</td>
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**CASUALTY REPORT**
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 despite the fact that the goal of this system is not to overload one 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 of a total of 105 available. 181 of the remaining 191 patients were distributed throughout 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 3 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 uninjured, and 10 of the 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 the best illustration of an equitable distribution of the casualties has been selected.

Thirteen hospitals participated in this EMS response. Four hospitals received 166 of the total of 200 casualties.
Hospital A = 84
Hospital B = 46
Hospital C = 22
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 when more than one hospital is involved in the EMS response; the involvement of the secondary hospitals subsequent to the first and/or preceding hospitals having been filled to capacity.

III. 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 (3) as in one case, 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.

IV. Flow of Casualties Through the ER

Casualty flow can be analyzed along two dimensions; volume and severity of the injuries of the 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-four hours.
3) Peak of casualty flow--the largest percentage of casualties arrive in the ER within one-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 squadrolls, 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.

V. 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 overestimated. 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, though it seems that these attempts have not achieved their goals, due to malfunctions at the point of entry into the system a correct assessment of needs. Needs assessment is a rational model based on the relative conception of needs on the one hand and resources or capabilities on the other and involves controlling information concerning these facets. 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. Too, the geographic 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 is the one which remains, accented by a lack of rumor control. Usually the system is originally advised by a public citizen with a report which is generally vague and almost always grossly exaggerated. This message activates the system and sets expectations of 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--its 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 a disaster which resulted in one injury, estimates sometimes exceeded 1000. In addition, 2000 not needed typhoid doses were sent to the site; no one knew who called for them.
Generally police or fire personnel are the first on the scene. As a rule, they lack EMS training. These people, 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 the hospital. Typically, less than half the casualties are transported from a disaster site by ambulances. Other transportation has been provided by police squadrolls, 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 non-existent needs assessment is that control and centralization at the site rarely occurs. First, there are competing demands of various agencies, which may each have someone in charge who is not recognized as legitimate by the other agencies. Many times a medical doctor may not respond to orders of an EMT, though the latter takes command by design. 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 duty 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 due to late notification and transportation problems to the site arrived too late.

Another problem to consider is conflicting tasks. By plan, an EMT may be in charge of medical triage at the site, but since assessment on the one hand and treatment, stabilization, and transport on the other are contradictory functions, the authority 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, preventing this person from playing an active role in the delivery of services.

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 have a centralized apparatus for communications which is capable of disseminating messages quickly, it is imperative to have an accurate assessment of need
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 response time actually is). Getting there more quickly will help, as will shortening the distance to be travelled. 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 near the site.

Perhaps a mobile communications van, which most state 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 hospital to expect and prepare for a certain type and number of casualties. Although many systems have centralized communication networks, they often break down. Hopefully, communication control at the site will eliminate one link in the normal process of ambulance to control to hospital, by viewing what the ambulance is transporting and communicating this directly to the hospital.

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 only 15% of ambulance deliveries are emergencies, immediate attention should be given to those cases.

In order to ease the conflict between the tasks of transport 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 the EMT's 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 more questions have been raised in this paper than answers provided. It is the hope of the authors to raise a little researched yet very important issue in EMS--needs assessment. This may encourage and stimulate others to move beyond this preliminary analysis.