No Ambulances Anywhere:
The Reality in Pre-Hospital Transport Systems

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In a report titled "Ambulances to Nowhere: America's Critical Shortfall in Medical Preparedness for Catastrophic Terrorism"[1] the authors present a vivid picture of how the American medical system is unprepared for the surge of patients which would follow a large-scale terrorist attack using weapons of mass destruction on a civilian population. Their assertion is that, with the lack of sufficient capacity and the current strain on the medical system under daily loads, there would be nowhere for ambulances to transport the victims.

This assertion is successfully defended in their paper, however, it is my assertion that not only would the ambulances have no where to go, there would not be sufficient ambulances for even a small portion of the affected population.

HISTORICAL PERSPECTIVE

One incident which may be used as a model in identifying the insufficiencies in medical transport capability in the face of a terrorist attack is the Tokyo Subway sarin attack of 1995, as reported in a paper on the consequence management of that incident.[2] As stated in that report:

> *"A second aspect of the surge capacity is the ability to transport patients to functioning medical facilities. By the end of the day on March 20, 1995, 1,364 emergency medical technicians and 131 ambulances had responded to patients at fifteen subway stations. The emergency medical system and medical transportation were overtaxed: 688 patients of the sarin attack were transported during the course of the day. Hospitals outside the center of disaster offered to help the overcrowded hospitals such as St. Luke's, but they could not be fully used due to the lack of available transportation."*

Other events which precipitated such tremendous demand on limited EMS capacity are not common, but have occurred. Some, such as the blitz on London during the Second World War II, are long-scale events, which have the advantage of allowing for the development of mechanisms to cope with the demand. In addition, the demand also supports the need to establish the requisite capacity.

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1 Barbera, Joseph A., MD, Macintyre, Anthony G., MD. And DeAtley, Craig, PA-C, Discussion Paper 2001-15 of the Telfer Center for Science and International Affairs.

2 Pangi, Robyn, "Consequence Management in the 1995 Attacks on the Japanese Subway System", BCSIA Discussion Paper 2002-4, February, 2002

The two United States short-scale events which can be used to evaluate the capacity of the typical large-city EMS system and its effectiveness in responding to such an event are the first terrorist attack on the World Trade Center in 1993, and the bombing of the Murrah Federal Office Building in Oklahoma City in 1995.

In the case of the WTC bombing in 1993, New York City responded with its available EMS units which were overwhelmed by the events, and many of which were committed to treatment and triage. Taken from a report prepared by the United States Fire Administration[3] the following excerpt provides some insight as to not only the events of that attack, but what might well happen in a future attack:

> *"Initial transport resources included police cars and buses as well as school vehicles that were waiting for several visiting kindergarten classes whose children were trapped in the south tower. Many of the early-arriving ambulances were deadlined in the staging area, as their crews were put to work inside the complex. Ultimately, mutual-aid ambulances performed many of the transports to hospitals, enabling NYC*EMS members to continue operating at the scene."*

The fact that the city had not even contemplated using mutual aid prior to this event and was unprepared to do so is demonstrated by the following statement from the same report:

> *"Although there was no precedent for mutual aid coming into New York City, mutual aid was monumental and contributed heavily to the success of medical operations. Through informal mutual-aid plans, NYC*EMS . . . has sent resources to assist neighboring communities but has never had an occasion to require it."*

This represents a classic example of how large cities think that they have the capability to manage any event on their own, and have no need to work with their surrounding communities.

Events following the bombing of the Federal Building in Oklahoma City were very similar. In a report on these events[4] they observe the following:

> *There were three distinct phases of the medical response: 1) Immediately available local*

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3 "The World Trade Center: Report and Analysis", United States Fire Administration Technical Report Series, United States Fire Administration, Fire Management Programs, 16825 South Seton Avenue, Emmitsburg, Maryland 21727.

4 "The EMS Response to the Oklahoma City Bombing", Peter A. Maningas, MD, FACEP, Merk Robison, NREMT-P, Sue Mallonee, RN, MPH.

EMS ambulances and staff; 2) Additional ambulances staffed by recalled, off-duty personnel; and 3) mutual-aid ambulances and personnel from surrounding communities."

The important issue in these reports is that in each case, outside, mutual aid ambulances played an important part in the transport of victims – the city, in and of itself – lacked sufficient capacity to handle the massive number of injured on its own.

THE CHANGING ROLE OF EMS

As is the case with the hospitals, the public has changed its perspective and relationship with EMS providers. At the time emergency medicine became a discipline within the hospital setting, EMS was evolving from the basic first aid trained responder to EMT's and Paramedics. With this change to a more highly trained workforce came an increase in demand for services. It is not merely a coincidence that this increased demand was seen shortly after the television show "Emergency!" was broadcast. The demand for service since then has only increased; and the nature of the event which precipitates a call to 9-1-1 has changed, as well. Prior to the 1970's a call for an ambulance was made only when the caller truly believed the situation was "life or death." Today, we see calls ranging from minor cuts and scrapes to bumps, bruises and even mosquito bites. What has precipitated this change is cause for great speculation, ranging from the decline in the availability of health care, to the aging population, to just a perception that since the person pays for it, they should be entitled to use it. One other factor may be the availability of the 9-1-1 emergency number. This change may seem innocuous, but it may have more of an impact than is realized. Part of the reason is that in the past a person requesting an ambulance had to dial a seven digit number – an act requiring some effort, including locating the appropriate number to call. Today, even the youngest child learns to call 9-1-1 for any and all "emergencies" as one of the first steps in learning to use the telephone.

CURRENT CAPACITY

In the United States medical transport systems are almost entirely locally funded with the level of care, number of units and number of staff dictated by local needs, resources, and levels of comfort. In some areas, the primary responders for EMS are volunteers or part-time (paid-on-call) personnel who respond as available. Even in major urban centers the level of EMS varies based on regional or local initiatives.

In large cities the availability of ambulance service may belie the fact that the service is rather limited in actual numbers. One example is the City of Chicago. The City covers 228 square miles with a population

of just under 3,000,000. Serving this population are a total of 71 ambulances (a ratio of 1:42,253). Even assuming an attack as limited and unsophisticated and the Tokyo sarin incident, the resulting 688 patients would overwhelm the city's resources. Each ambulance would be transporting an average of 9.7 patients, and this would be if the entire ambulance services of the city were sent to the single incident. Not included are the other patients needing ambulance service on a normal day. The city does have a disaster plan which, by invoking a mutual aid agreement[5], could bring in a large number of ambulances from the suburbs, however, getting into the city following a terrorist attack would be difficult, and the delay in response would leave many waiting for transport.

Chicago is certainly no worse (and actually may be better) than most other cities, for example Phoenix, Arizona or Seattle, Washington. Phoenix, which is considered one of the more progressive fire departments in the U.S. operates 29 "rescues" – i.e., ambulances – for a population of 1,374,000 (1:47,379.) Seattle, one of the first cities to provide paramedic service operates 6 BLS and 6 ALS units for a population of 540,000 (1:45,000). While the ratio of ambulances to population is relatively the same, the available units to assist in a WMD incident is significantly different (71 v. 29 v. 12), yet the number of casualties requiring transport to medical facilities following an attack would be approximately the same.

SURGE CAPACITY

As is the case with the hospital-based EMS the surge capacity of the EMS system may provide too little - too late. Although mutual aid plans are becoming more common, as in the case of Chicago, they still have inherent shortcomings. First, the ambulances designated to respond may already be committed to emergencies in the communities they serve. Second, suburban EMS agencies may be reluctant to sent an ambulance to known terrorist incident, realizing that the unit may be temporarily – or even permanently – lost due to contamination. Third, the EMT's, themselves, may be reluctant to go into a terrorist event, unless properly prepared and equipped.

Another issue in using mutual aid from surrounding communities is also spelled out in the discussion paper on Tokyo. If the suburbs are stripped on available units, who will provide ambulance coverage for the communities who are providing the aid? This could result in a situation similar to one of the issues identified

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[5] Chicago has recognized the need, and is a member of a large mutual-aid organization (Mutual Aid Box Alarm System or MABAS) which includes all of the suburbs surrounding the city.

in the Tokyo incident:

> *"Upon receiving the first call for assistance, the [Tokyo] fire department sent all of their personnel to the Tsukiji station, the first station to call in the emergency, leaving minimal resources for other emergency calls. When calls began pouring in from the other affected stations, there were no firefighters left to respond."*[6]

This has been addressed to a degree in Illinois by the implementation of the Statewide Disaster Mutual Aid Plan. Under this plan, communities well outside the effected area are mobilized and send a limited portion of the resources from their area to assist the community which is involved. By mobilizing resources over a large area, sufficient capability is generated to cover the needs of the stricken community without stripping all of the resources from those who responded to assist. Unfortunately, this response plan is better suited for long-time-scale events, such as flood or tornadoes, than for a quick event such as a WMD attack.

OTHER FACTORS IMPACTING TRANSPORT EFFICIENCY

It is not solely the number of ambulances which would be a limiting factor to the transport of patients. Other factors which impact the efficiency transport system, and limit the number of persons which could be transported in any given time frame, include communications, protocols, distances, contamination and decontamination, and patient delivery.

Communications

Communications systems vary widely by area and need, as does the system providing medical care. Communications may be radio, or more recently, mainly through cellular communications. While the radio system has difficulties as only a single ambulance may transmit at any time, cellular communications will be quickly overwhelmed and lost in a major incident. Unlike the events in Tokyo, American EMS systems my be designed to allow ALS personnel to perform ALS care if they are unable to communicate with their

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[6] Pangi, Robyn, "Consequence Management in the 1995 Attacks on the Japanese Subway System", BCSIA Discussion Paper 2002-4, February, 2002

resource hospital.[7,8,9] Another aspect of our systems are that they designate a control hospital which oversees the flow of patients to various hospitals in the area, and that all communications between the control hospital and the field are limited to the Transportation Sector Officer of the Incident Command System. Individual ambulances, once assigned to a particular hospital do not communicate directly with them; information is collected and relayed by the resource hospital.

Medical Protocols

Paramedic protocols differ slightly from area to area, but for the victim of a WMD event, especially if chemical warfare agents are used, they differ very little. Administration of epinephrine and 2-PAM, whether by Mark I kit, or traditional methods, along with respiratory support will be the primary field intervention. Implementing these protocols will take additional time, as the intubation (if required) will most likely be performed prior to transport. In addition, EMS personnel are programmed to take detailed medical history and vital signs before transporting. In a WMD event, these normal protocols may have to be scrapped and a "load and go" process employed. Patient care will be limited to those interventions which can be performed in a moving ambulance by a single EMS provider.[10] Abandoning their protocols may be difficult as EMS personnel consider the ramifications of failing to follow Standing Medical Orders. Both thoughts of civil action in the form of lawsuits for "willful and wanton negligence", and criminal charges for abandoning their patient (by failing to render appropriate care) are not easily dismissed.

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[7] "There is no system that provides for doctors to ride along with ELST's [Emergency Life Saving Technicians], but the Tokyo Metropolitan Ambulance Control Center (TMACC) has a staff physician on call 24 hours a day who may permit ELSTs to perform advanced medical procedures."*Consequence Management in the 1995 Sarin Attacks on the Japanese Subway System",* Pangi, Robyn, February 2002

[8] "As a result of communications overload, emergency medical technicians lost radio contact with the TMACC, and were thus unable to secure permission to perform advanced medical treatment such as intubations. This directly affected patient care: all but one victim had to wait until admission to a hospital in order to receive intubation and adequate ventilation.", Ibid.

[9] "Another result of communications system overload was that EMTs could not acquire hospital availability information, and thus were forced to find out which hospitals had beds available via public telephone, or simply to take patients to the nearest or largest hospital. This method made tracking the number, location, and medical status of patients all but impossible.", Ibid.

[10] Most EMS systems and providers respond with two personnel, only one of which may be required to be a paramedic. The other responder is the driver, and assists only when the ambulance is parked.

Distance/Travel Time

The issue of distances is also one which may be problematic. In large cities, the issue may not be distance but traffic. As people try to evacuate the city, the roadways become clogged and even the use of emergency sirens and lights has little impact on the movement of ambulances. In rural areas, or smaller cities which would rely on facilities outside the metropolitan area, the actual road distance becomes factor in how quickly any one unit can return for additional patient(s).

Contamination

Contamination of vehicles may be another barrier to effective operations. As noted above, most EMS systems are locally funded. A single modern ALS equipped ambulance can easily cost in excess of $150,000, and is not easily replaced. If contaminated, concerns over "how clean is clean" may make providers reluctant to commit their only vehicle to assisting others. In regard to decontamination, who and how will it be performed are unanswered questions. Will it be up to the crew to do it themselves, will it be done by others, or will professionals be required to complete the decon procedure? In some events the issue is minimal; in others, such as anthrax or radiological, the issue is paramount.

Patient Intake

The last of the concerns listed is patient intake - how quickly with the hospital be prepared to receive patients, and will they be able to handle a patient who has undergone only gross field decontamination and may require more detailed decontamination? Under current protocols, hospitals may require units bringing patients who are – or may be – contaminated to wait in a holding area until the hospital is prepared to receive them. And, depending on the hospital's plan and preparations, this might take minute to hours. Ambulance personnel must also wait to transfer the patient to a hospital gurney or stretcher, freeing up their stretched to allow them to return to service. Ambulances, themselves, may need to be decontaminated prior to returning to the scene to prevent the medical personnel or subsequent patients from becoming exposed. All these contribute to a prolonged "turn around time" for any one unit.

ALTERNATIVE SURGE CAPACITY

In some metropolitan areas there is an alternative surge capacity which may be tapped into. This is the private ambulance providers. The "privates" could provide a large number of transport units quickly, and without depleting the coverage of the area for routine emergencies. Private ambulances – in most metro area

– are independent, and do not routinely transport emergency patients.[11] The difficulty in using these ambulances lies in both cultural and operational difficulties. The cultural issues arise out of competition between the community based (public sector) service and the privates, as the private companies are often seen by as attempting to take over ambulance services in some areas. This is increased where union organization is present in the fire department, as unions routinely call their members to action in opposing privatization of the emergency services. The operational issues would likely arise from difficulties with communications systems, as most private ambulances are not equipped to communicate on fire department radio frequencies. In areas where ambulances (both public and private) use common medical frequencies, this may help resolve this issue, provided the radio system is not overloaded with traffic. One additional concern in using private ambulances arises out of the lack of training and equipment for handling contaminated patients. While fire-based EMS systems have personnel who are trained to use personal protective equipment, and are trained in hazardous materials,[12] paramedics and EMTs employed by private ambulance companies have no mandate for such training or equipment , and therefore, seldom do. One example of an exception to this was the WTC bombing of 1993, where the city's commercial (private) ambulance providers provided 49 additional ambulances to the response,[13] however, no hazardous materials or chemical agents requiring personal protection were involved.

The second method which may become necessary is to use non-ambulance transport systems. School buses, taxi cabs, fire trucks and police cars may be required to carry victims who have been decontaminated to medical facilities. Those who are asymptomatic, show no signs of exposure, and have been decontaminated could be loaded en-mass and transported to outlying facilities, thus relieving the load on closer in locations. One additional advantage to using such en-mass transportation methods is that a large number of persons could be taken to a remote triage facility where they could be assessed prior to being entered into the acute care systems.

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11 This is not always true, as some large metro areas use private ambulances for transport, or even as the primary emergency transport service, which may reduce the number of private ambulances which might be called into use.

12 Under OSHA requirements, first responders who are or may be required to respond to a hazardous materials incident must be trained to the Operations level.

13 "The World Trade Center: Report and Analysis", United States Fire Administration Technical Report Series, United States Fire Administration, Fire Management Programs, 16825 South Seton Avenue, Emmitsburg, Maryland 21727.

ROADBLOCKS TO INCREASING EMS CAPACITY

While national standards[14] establish a four minute time as the desired response time for an EMS unit to arrive on the scene of a medical emergency, many large cities cannot meet that standard. Inherent difficulties in traffic congestion, location of stations, and simply the number of available units to meet the demand all contribute to response times which may be greater than 10 minutes. The difficulties in funding more units becomes an obstacle which cannot be overcome as different government function compete for the tax dollars. Most citizens never – or seldom – call for an ambulance, but all will be impacted by a snowstorm. Thus, the public works may receive more money for snow removal than the emergency medical services do for patient transport.

A second issue is the increasing cost of training paramedic personnel. National standards for paramedic training have increased the didactic and field hours to a point where completion of the course may take as much as two years; this on top of a year spent completing basic EMT training and working in the field. The number of persons applying for paramedic programs has decreased, even as the demand has increased. Fire departments in many jurisdictions can no longer hire untrained persons, then wait for three years before they are fully trained. It may be only in larger cities where the EMS system conducts their own training programs where departments can afford to hire untrained personnel. Many smaller departments are finding that they must require paramedic certification at the time of hire; they simply cannot afford to hire an employee and pay them for three years before they have the certification necessary to be a fully operational employee.

The third issue is, as is the case with hospitals, funding excess capacity which is seldom – if ever – used. For smaller departments the availability of and reliance on mutual aid agreements provides the excess capacity required for day-to-day needs. In addition, by large city standards, the current EMS capacity in most smaller communities exceeds that of the larger cities. A typical community of 15,000 may have only one ambulance, but that equates to a ratio of 1:15,000 – well in excess of the approximately 1:45,000 previously cited for the larger cities. Some departments may even have a reserve unit, available for second calls, further decreasing this ratio.

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[14] One standard, the National Fire Protection Association (NFPA)1710 - "Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments" requires the an EMS first responder be on the scene within 4 minutes, and an ALS unit on scene within 8 minutes.

A review of publications and reports dealing with the ability of the medical system to deal with a WMD attack, revealed what may be another obstacle – the very fact that physicians at the hospital or planning level are not even aware of how EMS services are provided in most communities. This is based on a statement made in a planning guide for bioterrorism events, which states, in regard to finding personnel to guard "Points of Distribution" for pharmaceuticals:

> *"One potentially untapped source could be the fire department, although firefighters may also be involved with security and responding to acts of vandalism and malfeasance."*

It appears that the author neglected to take into account that fire fighters are often the EMS providers within the community, and that in the event of such an attack they would be hard-pressed to keep up with the demands for ambulance transport, let alone become guards!

PATH FORWARD - ENHANCING EMS CAPACITY

What actions might be taken which would provide the necessary surge capacity to handle the needs of the community in the event of a large-scale WMD attack? The challenge is to find the resources and have them available, without investing millions of dollars in unused capacity. This issue has two dimensions - first, the providing the vehicles necessary to perform the transports, and second, enlisting and training the personnel to operate those vehicles.

With a modern ambulance and requisite equipment costing in excess of $150,000 per unit, purchasing ambulances just for reserve capacity is unrealistic. Providing the vehicles necessary for transporting patients, might need to include the use of alternate strategies. Buses, taxis, prisoner transport vans, and other vehicles could accommodate those who were ill, but not incapacitated, leaving the ambulances for the critical patients.

Current legal and regulatory restrictions dictate who may transport a patient in an ambulance, limiting this to those having completed an EMT or Paramedic course, and therefore the use of quickly trained reserve volunteers – as was the case in England during WWII – is currently not an option. Changing the legislative or regulatory requirements to allow for relatively untrained persons to provide transport only would be one step, even if this was limited to allowing such transports only under defined conditions of a disaster or act of terrorism would be required to allow this to be a possibility. In fact, this might become a necessity should a biological agent be employed and the primary emergency medical transport providers - EMTs and Paramedics – be depleted by illness.

The private ambulance services may still provide one alternative in many areas. Large cities may have several hundred ambulances being used for routine transports, inter-hospital transfers, and sub-acute patient care which could be used. This might require entering into an agreement with the private ambulance services which would guarantee their response in the event of an emergency. In addition, the city may have to provide training and personal protective equipment for the private companies, as their personnel are generally not equipped or trained for such emergencies. One additional concern which might need to be resolved is the legal and personal issues surrounding using private sector employees in a public sector role. Unlike public sector employees, the private sector employees have little or no protection if they are injured or become ill, other than whatever relief workers' compensation may provide. Further, if a public sector employee were to die as a result of their work state and federal funds would be available to help their families cope with their loss; no such safety net is present for the privates.

CONCLUSIONS

There has been considerable debate, discussion and investigation of the surge capacity of hospitals and their ability to absorb a large influx of critical patients following a terrorist attack. What is absent from these discussions is the mechanism by which the patients will be taken from the scene of the event to the care facilities. Even accepting that the majority of the patients presenting will be "self transported",[15] the number of patients requiring medical transport will quickly overwhelm the most effective EMS system.

Providing the "surge capacity" in the EMS system presents many of the same challenges faced in overcoming the inadequacies in hospital surge capacity.[16] Unfunded mandates for training and ambulance equipment, increased normal patient loads, changes in the public perception of EMS, and the lack of driving forces to increase available reserve capability all contribute to the problem.

The answer to this question will most likely have to be found in the private sector, where private ambulance providers are brought into the system as partners in an emergency transport system. This must be facilitated through a number of initiatives, including providing training, communications, contracts, and resolving legal issues.

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15 In the Tokyo sarin attack only 688 of 5,500 persons seeking medical attention were transported by ambulance.

16 See "Ambulances to Nowhere: America's Critical Shortfall in Medical Preparedness for Catastrophic Terrorism", BCSIA-2001-15

In addition, regulations on ambulance personnel, such as requirements that the drive of the ambulance must also be a certified or licensed EMT or paramedic must be provided with “escape clauses” which can be invoked in times of local, regional, or national emergency.

In the desire to maintain a system which is based on the standards of an everyday world, it may be that the desire far exceeds the ability. It may well be that we will find it necessary to invoke the methods and systems which served well during WWII, or those employed during the Influenza outbreak of 1918, as archaic as those methodologies may seem.