Epidemic and Bioterrorism Preparation among Emergency Medical Services Systems

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EMS = emergency medical services
SARS = severe acute respiratory syndrome

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Abstract

Introduction: The purpose of this research was to determine the preparedness of emergency medical services (EMS) agencies in one US state to cope with a massive epidemic event.

Methods: Data were collected primarily through telephone interviews with EMS officials throughout the State. To provide a comparison, nine out-of-state emergency services agencies were invited to participate.

Results: Emergency medical services agencies from nine of the 23 counties (39%) provided responses to some or all of the questions in the telephone survey. Seven of the nine out-of-state agencies provided responses to the survey. Most of the EMS agencies do not have broad, formal plans for response to large-scale bio-terrorist or pandemic events.

Conclusions: The findings indicate that EMS agencies in this state fundamentally are unprepared for a large-scale bioterrorism or pandemic event. The few existing plans rely heavily on mutual aid from agencies that may be incapable of providing such aid. Therefore, EMS agencies must be prepared to manage a response to these incidents without assistance from any agencies outside of their local community. In order to accomplish this, they must begin planning and develop close working relationships with public health, healthcare, and elected officials within their local communities.

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Introduction

Ten years ago, clinicians, researchers, administrators, and government officials gathered to develop the science and needs-based criteria to guide emergency medical services (EMS) development and funding. The resulting *EMS Agenda for the Future* does not include the word "terror" and the only use of the word "epidemic" is in reference to injuries.[1] Since then, the world has experienced anthrax and severe acute respiratory syndrome (SARS), and now waits with dread anticipation for the coming of an inevitable pandemic.[2,3]

Recent findings that the 1918 pandemic was an avian flu[4] have created an interest in learning from that event. Although the estimates vary, experts believe that >500,000 Americans, and perhaps 50 million people worldwide perished during that pandemic.[5,6] If the next pandemic is as virulent, 100 million cases can be expected, along with three million fatalities in the US. At the community level, it means that one-third of the population could be stricken.

There is a paucity of literature demonstrating the degree of EMS preparedness for an epidemic. However, some authors have described various disaster-related roles and responsibilities for EMS. Walz *et al* described the potential for EMS personnel to mitigate epidemics by providing personnel to work in vaccination campaigns.[7] Some EMS jurisdictions have utilized EMS personnel to both inject vaccines and monitor patients in the immediate post-vaccination period.[8,9] Miller *et al* explored EMS plans to protect response personnel during

an infectious disease outbreak, and found great variability in exposure plans among emergency service agencies.[10]

Barbera and Macintyre, while not specifically addressing EMS, note the need for improved integration of all response agencies in order to achieve an effective response to a bioterrorist-induced event.[11] Other authors have noted the need for better integration between EMS and the rest of the healthcare community.[12–16] From these studies, it can be inferred that a dysfunctional EMS system or poor communication between EMS, healthcare administrators, and public health officials may become one of several weak links in a system's attempt to respond to the needs of the public during an epidemic.

Hong Kong and Toronto both have recent experience with EMS responses to the SARS outbreaks that struck those cities in 2003. Toronto, which had 224 confirmed SARS patients, suffered significant personnel and logistical problems in providing EMS during the outbreak; for example, about half of Toronto's EMS personnel were exposed and many workers had to be quarantined.[17]

The purpose of this research was to determine the preparedness of EMS agencies in one US state to cope with a massive epidemic event. A preliminary study of Maryland's state of EMS preparedness for response to a large epidemic, the roles that EMS might play during such an event, barriers to effective EMS deployment, and strategies for overcoming such obstacles was performed. In order to broaden the external validity of this study, data also were obtained from select EMS jurisdictions outside of Maryland. This study represents a preliminary study performed on a short timeline to explore an important topic that merits further research.

Methods

Data were collected from two distinct groups. The first group included EMS providers and related personnel in Maryland. These providers ranged from regional administrators, dispatchers, health department officials, and emergency managers to emergency medical technicians working with volunteer rescue squads. Data for Maryland also were obtained via a review of written jurisdictional EMS disaster plans. A second comparison group was comprised of a select group of out-of-state EMS agencies; for this group, the authors interviewed agency representatives and reviewed written plans.

In-State Data Collection

A telephone survey of EMS administrators in 23 counties and one independent city in Maryland was performed in June and July 2005. Student research assistants received a one-hour training and orientation session from one of the co-authors who also oversaw their work and conducted random checks for quality compliance.

In addition to the telephone survey, four nominal group sessions were organized and held during July 2003. They took place in one urban county, one suburban county, and two rural counties. Two questions were asked in each session.

1. "What factors would determine our ability to respond to a massive epidemic?"
2. "In the event of a massive epidemic, what would be the range of possible EMS responses?"

The nominal group sessions were led by a professional facilitator under contract to the grant project. Attendance at the sessions ranged from 3–16 persons and each session lasted approximately two hours.

Out-of-State Agencies

Nine high-population EMS jurisdictions in North America and in Asia were selected as a purposive sample. Initial contact was made via telephone or e-mail. Interview questions focused on current plans related to preparation, legal factors, alternative transportation vehicles, surveillance, the role of EMS personnel, worker safety, and barriers to effective EMS deployment in epidemics.

This study was certified as exempt by the university Institutional Review Board (Exemption #: Y05RB08191).

Results

In-State

Nine of 23 (39%) the county EMS agencies responded to all or some of the questions in the survey. Eight of these agencies (34.7%) had a plan if there are more sick calls than available ambulances, but in most cases, this plan simply employed the use of mutual aid (Table 1). Six agencies (26.0%) had a plan in case they were overwhelmed with sick calls. Four (17.4%) used some form of priority dispatching on a daily basis, and stated they also would use these protocols in this situation. Four had a plan to replace contaminated ambulances, but one municipality plans to run the ambulances "dirty" and used masks and body bags to prevent patient contamination.

Only one agency had a plan to prevent ambulances from being "captured" by hospitals when the hospitals are full and ambulances are unable to unload patients in a timely manner at their facilities. Four of six have plans to cope with full hospitals, but these plans include the use of mutual aid and reliance on the Maryland Institute for Emergency Medical Services Systems (the State EMS Agency) for assistance. Three had plans for dealing with large numbers of employees being unable to work due to illness, and five have succession plans; four reported plans for the extended recall of personnel.

Out-of-State Agencies

Seven of the nine (78%) agencies responded. Representatives of two of the nine EMS agencies (22.2%) indicated that they had no plan for a bioterrorism or epidemic event. The Asian jurisdiction said they did not have a specific EMS plan, but they would use their city-wide, public health plan during a pandemic. Four EMS agencies had plans; the leaders of these agencies were selected for telephone interviews.

A summary of the interviews is divided into the following sections: (1) preparation; (2) legal factors; (3) alternative transportation vehicles; (4) surveillance; (5) the role of EMS personnel; and (6) worker safety.

Preparation efforts included regular drills and classes devoted to disseminating and discussing the written plans. One administrator discussed the agency's lack of awareness of and need for familiarity with local public health policies and personnel. In fact, only one agency representative indicated that there was a close working relationship between EMS and the health department.

The results of the four nominal group process meetings are in Tables 2 and 3. Table 2 shows the responses to the question "What factors would determine your ability to

EMS	Yes	No	Note
Plan to prevent capture of ambulances by hospitals	1	8	MIEMSS will handle
Plan to replace contaminated units	4	5	1 state's plan is to use contaminated units
Plan if more sick calls than available ambulances	8	0	
Plan if incoming lines are overwhelmed	4	3	
Plan if employees call in sick	3	4	3 will use mutual aid
Plan if overwhelmed with sick calls	6	1	"done daily"
Plan if hospitals full	4	2	MIEMSS and mutual aid
Succession planning	5	1	"plan in infancy"
Plan for extended recall of personnel	4	0	

Table 1—Results of telephone survey on existing plans of Maryland County agencies in summer 2005 (n = 9) (MIEMSS = Maryland Institute of Emergency Medical Services Systems)

respond to a massive epidemic?" The responses to the question, "In the event of a massive epidemic what would be the range of possible EMS responses?" are shown in Table 3.

Legal Factors—One administrator emphasized that legal factors were a major hurdle in that jurisdiction. There, medics legally can only transport patients to hospitals, and they are not legally permitted to triage a patient as non-transport, be involved in home health care, or administer vaccines.

Alternative Vehicles—Two administrators noted specific plans for the use of mass-transit vehicles in their response plans. One administrator noted that the agency recently had purchased a number of new mass-casualty transport vehicles.

Surveillance—Two administrators emphasized their agencies' role in surveillance. At one of the agencies, the agency data are examined on a daily basis by personnel from the Department of Health who look for potential indicators of an outbreak.

Role of EMS Personnel—Three administrators expressed plans to examine alternate roles for EMS personnel, including providing home care for quarantined victims and the ability to administer vaccinations.

Worker Safety—One administrator recounted that 50% of the EMS personnel in one SARS-affected city had been exposed to an epidemic before officials were aware that there was an epidemic. All emphasized that training and equipment are needed to improve safety for EMS workers.

Discussion

The survey of jurisdictions in Maryland found that many of the plans for coping with large numbers of calls rely on the use of mutual aid. Although this is an important resource in the event of a localized incident, this option likely will not be available in the event of a regional or national disease outbreak.

The reliance on mutual aid and assistance from the state EMS agency was expected. Maryland emergency services agencies have a long tradition of providing seamless mutual aid, even across state lines. Large fires and mass-casualty incidents are managed routinely with mutual aid assistance, thus, extending this concept to an infectious disease situation seems straightforward for most services. Likewise, Maryland has a strong, coordinated statewide EMS system utilizing statewide protocols and communications networks. The state EMS agency has been a leading force in establishing polices and procedures for EMS and medical situations outside the normal scope of 9-1-1 responses. Therefore, EMS agencies have come to rely on the state EMS agency to provide leadership and direction in these areas. In the event of a large scale infectious disease outbreak, EMS agencies in the state would look to the state EMS agency for guidance and operational procedures. In contrast to EMS agency interaction with the state EMS agency, local and state health department contact and interaction with EMS agencies has been limited, if at all. Thus, EMS agencies have not had the opportunity to develop an understanding and appreciation for the legal and supportive role health departments would play in such events.

Emergency medical services agencies were prepared to expand current routines such as priority dispatching and mutual aid to cope with a large influx of calls. However, as noted above, mutual aid may not be available from adjoining counties if a disease outbreak is regional. Only one county had a plan to prevent ambulances from being captured by hospitals if hospitals were full and could not quickly accept additional patients. An experience in Canada demonstrated this quickly can compromise the ability of EMS to continue operations in such a situation.[18,19]

Provider safety and support for both responders and their families also were identified as a critical areas. Providing responders and their families with shelter and prophylactic medications may be necessary in order to maintain services. Experience during Hurricane Katrina revealed the problems caused when responders' homes and families were in danger.[20]

The use of alternative modes of transportation and treatment were mentioned frequently. This also included expanding the role of EMS providers so that they might provide additional treatments and medications, but also expanded the services provided by EMS to include support for alternate treatment facilities (e.g., gymnasiums), support to persons confined to their homes, and the role of EMS in mortuary services such as body removal.

Factors	Frequency
Event and Environmental Factors	
How quickly recognize event	4
Size and scope of event	3
Time of day	2
Weather	2
Number of patients	1
Communication and Control	
External communications with public	4
Incident management capabilities	3
Command quality	2
Internal communications	2
Lack of information	1
Functionality of EOC	1
Adequate planning	1
Public and patient control	1
Provider Issues	
Protection	4
Support for provider families	3
Training of providers	2
Availability of providers	2
Available prophylactic medications for providers	2
Rehab of personnel	1
Response and Patient Care Issues	
Logistics and supplies	4
Mutual Aid	3
Other calls for service	3
Decontamination	2
Unit scheduling availability	2
Containment of hot zone	1
Availability of medication	1
Triage	1
Hospital, Quarantine, Morgue Issues	
Alternative triage and care centers	3
Hospital overload	3
Morgue capacity	2
Hospital turnover time	1
Alternative treatments	1
Shelter capacity	1
Quarantine and isolation plans	1
Other	
Tracking expenditures	1
Lack of plan for additional resources	1
Plan for security	1

Table 2—Factors determining an agency's ability to respond to a massive epidemic as identified in nominal group sessions by frequency of response (n = 4; EOC = emergency operations center)

Conclusions

The EMS agencies must be aware of and integrated with public health response plans. Markenson *et al* found that only a very small percent of EMS agencies had received any training from local or state health departments.[21] It also seems reasonable to believe that few public health personnel have received any training on the operations or capabilities of EMS.

It is clear that EMS agencies must be prepared to handle a response to these incidents without any assistance from agencies outside of their local community. Not only will a pandemic result in an unprecedented demand for EMS services, but EMS and healthcare agencies must expect a substantial reduction of their workforces in the early period of the event. Emergency medical services agencies immediately must begin identifying and training alternate groups of people who may be able to meet some of the needs of an epidemic-stricken population. Reasonable target occupations include school teachers, business professionals, artists, and other occupations without disaster-related responsibilities. These personnel must become integrated into the EMS system prior to any outbreak.

Emergency medical services leaders should work with hospital and local health officers to create plans that identify alternate treatment facilities and triage methods to determine which patients will be taken to hospitals and which will be transported to alternate care sites. Any alter-

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Possible EMS responses	Frequency
Provider issues	
Debriefing and crisis intervention	3
Maximize provider protection	2
Additional training	1
Provider absences	1
Support for families of responders	1
Rotate crews on medical, trauma, sick calls	1
Staff and responder support	1
Command and Control	
Public education	4
Staffing of command centers	3
Communications	2
Manage mutual aid	2
Assessment of event	1
Early decision making	1
Identify resource needs	1
Liaison with local, state, federal agencies	1
Moving supplies into danger zone	1
Patient care	
Mobile triage	3
Treat and release	3
Isolation and quarantine of patients	2
Support to hospitals and treatment sites	2
Contain outbreak	1
Expanded role of first responders	1
Flexibility with treatment protocols	1
Patient tracking system	1
Physician at scene	1
Provide immunizations and medications	1
Treatment of patients	1
Response issues	
Transport including to alternative treatment sites	4
Identify transport alternatives	3
Checking on welfare of households, make deliveries	2
Continue routine responses	2
Continue emergency transports	1
Decontamination	1
Law enforcement	1
Limited response	1
Mortuary support	1
Priority dispatching	1

Table 3—Range of possible emergency medical services (EMS) responses to a massive epidemic as identified in nominal group sessions by frequency of response (n = 4)

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native EMS roles should be anticipated during the planning phase, and suitable training must be developed and provided prior to an outbreak.

The EMS agencies must develop closer working relationships with public health, healthcare, emergency management and elected officials within their local communities. States can provide legal flexibility, but county and local officials must fund work toward identifying and resolving local needs in such a manner that EMS personnel are involved intimately in the preparedness effort. Only in this way will EMS capabilities and limitations be integrated into the local planning effort, maximizing the potential for EMS to effectively work on behalf of the public during a significant infectious disease outbreak. Otherwise, counties may face losing the ability for EMS to respond to any emergency during an epidemic.

Plans and policies must be developed prior to an outbreak that will prevent ambulances from being "captured" by hospitals or other receiving sites. In the early stages of an outbreak, if ambulances are unable to offload patients, the entire EMS system may cease to function.

Personnel and vehicle decontamination methods and supplies must be updated in order to prevent the EMS system from serving as a vector and spreading the disease throughout the community.

Health departments and EMS agencies must develop plans for protecting EMS providers and their families. Employment in emergency medical services occupations already has been identified as a high-risk occupation,[22–24] and the need for additional disaster-related occupational safety plans has been identified.[25] Plans must include family members in order to encourage providers to remain at their posts at a time when staffing will be critical.

For the foreseeable future, the primary responsibility for pandemic preparedness and response will rest upon local communities. The US Department of Health and Human Services Secretary Leavitt stated: "Any community that fails to prepare with the expectation that the federal government will come to the rescue will be tragically wrong."[26] Close working relationships must be developed between EMS, health agencies, and elected officials in order to be prepared to mitigate the consequences of a pandemic on a local level.

Emergency medical services have escaped the attention of local and federal bioterrorism response planners and researchers, who apparently assume that when an outbreak occurs, EMS will be there. The findings indicate that EMS agencies essentially are unprepared for a large-scale bioterrorism or pandemic event. The few existing plans rely heavily on mutual aid from agencies that will most likely be incapable of providing such aid.

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