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THE EVALUATION OF EMERGENCY MEDICAL SERVICES

An Interactive Qualifying Project Report

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Abstract

This proposal, prepared for the city of Worcester, Massachusetts, will define Emergency Medical Services (EMS) systems and generate a standard model of EMS systems. Working from literature and interviews, we will describe the components of EMS and use it to compare different types of systems in order to illustrate strengths and weaknesses. This analysis will allow us to construct a tool by which communities can evaluate current emergency services, determine any weaknesses, and make necessary improvements.

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Chapter 1: Literature Review

Gathering information through literature is an important step in understanding the EMS system. This chapter will first summarize literature on the history of EMS to show how the service has evolved over time and where it is today. The second section will cover legal issues concerning EMS such as minimal requirements through city, state, and national laws. The third section will provide a more in depth view of what Worcester's EMS system is comprised of.

1.1 History of Emergency Medical Services

It has taken humans thousands of years to reach the level of medical treatment we are at today. Surprisingly, the majority of advancement has taken place in only the last 40 years. Since then, there has been a rapid growth in medical response and the created of the Emergency Medical System we know today. 40 years ago, this service did not even exist, but through great advances in medicine and the creation of training programs both on the battlefield and in cities, EMS has saved countless lives. The first section of the history will provide a general background on the advances in vehicles and logistics of EMS while the second section will provide a more in depth look at how training and EMS regulations have evolved over time.

1.1.2 History of training and policies

Qualified EMS personnel working in the field are providing an invaluable level of treatment unheard of forty years ago. The advance of medicine since the beginning of civilized man has been slow progress up until recently. Although the level of care today

is extremely more beneficial than the care of years past, it has taken hundreds of years to develop it.

In 1966 Congress created the National Highway Safety Administration under the already existent United States Department of Transportation. This new administration was given the authority to issue guidelines for state emergency medical systems and to formulate the emergency medical technician (EMT) training program. The administration established professional requirements for EMT's, and their capabilities were expanded well beyond those of earlier ambulance personnel. Paramedics were originally trained military medical personnel who were first utilized in the Korean War. Under certain circumstances these specialists were parachuted into hard-to-access locations. The name Paramedic came from a military medic who also was trained to parachute. Today the prefix "para" is taken to mean "closely resembling" (Emergency Medical Technicians, 5).

The goal of the Department of Transportation was to package all the information gained from military experience of medical care in the field into a system able to be used in the private sector. This system must be able to train personnel who could provide field intervention medicine or technical intervention that quickly turned near death victims into surviving patients (Department of Transportation I-8).

In 1967 one of the first such systems was set up in Pittsburgh. Everyday people were trained in basic life support for pre-hospital, ambulance use. For these individuals, who were not accustomed to the medical profession, the world of emergency care was a shock. Special stresses and constraints existed when rendering CPR in a crowded

restaurant, childbirth in a city park, or patient care through the window of a wrecked automobile (Caroline, ix).

In California the Wedworth-Townsend Paramedic Act, passed in 1970, provided permission for certain counties to establish experimental programs to test the use of Paramedics for emergency care in the field. It not only established advanced life support as the scope of practice for Paramedics, but introduced the idea of a MICN. A Mobile Intensive Care Nurse, or MICN, is a registered nurse licensed by the county health department to provide emergency medical care or to give instructions. These instructions could be given either in person or by radio, to Paramedics working in the field. Originally, MICN's worked in the field with Paramedics, but this was later found to be impracticable. Currently, MICN's provide instructions to Paramedics from the hospital either by radio or phone (Calif. Health & Safety Admin, 2).

The concepts of field emergency medical care were just being recognized in 1971. But the need for easy identification and a unique symbol was recognized quickly. The fact that not many people were familiar with the new form of medical care made such identification necessary. It was decided that Emergency Medical Services, or EMS, would possess its own distinct symbol visible to the public. In 1973 the U.S. Department of Transportation adopted the "Star of Life" as the nationally recognized symbol for EMS. Its use to date by both state and federal offices has greatly contributed to the process of identification. Use of the symbol on highways and other areas has helped to alert citizens to the presence of the EMS system and the location for help (Department of Transportation I-9).

For any medical care in the field to be effective, the personnel responding to help must first arrive at the scene. Early indications revealed that a dependence on lights and sirens was not only dangerous, but unnecessary. An early U.S. Department of Transportation and EMS study titled "Ambulance Design Criteria" recommended the uniform use of specific colors and markings. Later, in 1974, The Department of Transportation developed the federal specifications for ambulances. The standard color is white. The standard markings are an orange stripe, blue lettering, and the "Star of Life". The specifications prefer that any additional lettering be placed below the orange stripe, as not to distract from the basic markings. The colors changed in some cases later, when fire departments began to staff their own ambulances. In these cases the ambulance is normally the same color as any of the department's other fire apparatus (Department of Transportation I-9)

In 1974, the then very experienced EMT's in Pittsburgh began new training. They became some of the first ambulance personnel trained in advanced life support, or the scope of medical practice for Paramedics. The doctors that accompanied the EMT's in the field for training were also not accustomed to the out-of-hospital working conditions that the EMT's had first experienced seven years earlier. The sterile insertion of a needle in the hospital to establish an intravenous drug treatment became much more difficult in the streets of downtown or the moving ambulance speeding down Main Street. Emergency Medical Technician-Paramedics were first recognized as an allied health organization in 1975. The recognition issued by the American Medical Organization opened the door for accredited entry-level educational programs geared for professional careers in EMS.

In 1975 the California Office of Statewide Health Planning and Development established pilot programs for another scope of practice termed limited advanced life support. Those operating in that field were labeled EMT-II's. The lower level of training required to be an EMT-II opened the opportunity for smaller, poorer communities to spend the money on the less expensive training programs. There are several differences between the level of training of an EMT-II and a Paramedic. There are eleven fewer drugs that EMT-II can administer. Additionally there are certain airway, cardiac, and defibrillation maneuvers that an EMT-II cannot perform. Traditionally the EMT-II's worked in the rural area while the Paramedics worked in the urban areas. This meant that EMT-II's were spending more time in the ambulance en route to the hospital. It seemed paradoxical that the superior level of care available in the urban areas was not being used to its full potential. This led to a decline in EMT-II's. The EMT-II classification still exists today although it is difficult to find training or employment. The superior level of care able to be provided by a Paramedic, in the end, outweighed the cost of training.

Seeing the progression of EMS and the necessity to pass laws protecting and governing it, the governor of Michigan passed the Emergency Personnel Act in 1976. The act addressed not only the EMT, but the EMT-Paramedic. The purpose of the new Michigan law was to license and regulate the emergency medical personnel practicing in that state. It also limited their liability under certain conditions, permitted local government to establish regulation, and provided penalties for violations.

1976 brought the concerted effort by many organizations to begin development of educational standards, or Essentials, that would be used to evaluate programs seeking to

provide EMT-Paramedic accreditation. Several drafts of the Essentials were proposed. After wide distribution to the appropriate medical communities of interest, the American Medical Association Council on Medical Education finally adopted the Essentials. The adoption in 1978 represented a collaboration of many organizations other than the AMA, including the American College of Emergency Physicians, and American College of Surgeons.

The National Association of Emergency Medical Technicians, in 1978, issued "A Code of Ethics for Emergency Medical Technicians". Among other things, the code states, "The fundamental responsibility of the EMT is to conserve life, to alleviate sufferings, and to promote health." Although the code was established for the EMT it also applies to the EMT-II and the EMT-Paramedic because their basic purpose is the same, even though they provide additional services (Department of Transportation I-10).

A broad based coalition of groups responsible for the various aspects of pre-hospital care cooperated in 1980 to formally establish a permanent EMS system in California. The act allowed the appointment of local EMS agencies, divided by counties, to administer local EMS systems for the purpose of establishing statewide standards for pre-hospital emergency medicine. It set up the training required for licensed personnel and the operation of EMS systems. These standards, in the form of additions to the health code, went officially into effect the beginning of 1981. The stated purpose for such legislation was to establish an EMS authority that would coordinate and integrate all state wide activities concerning EMS (Calif. Health & Safety Admin, 4).

Seeing the many changes and confusion regarding the EMT, EMT-II and EMT-Paramedic curriculums, the United States Department of Transportation, National Highway Traffic Safety Administration chose to revise its national standards. The changes, made in 1984, provided a more concise working outline from which preparation could be made to create course training programs (Heckman, xiii).

When an individual phones 911 requesting medical assistance there are several agencies notified. First, there is the private ambulance company, if the local fire department does not provide ambulance service. Second, there is the local fire department. And third, the local law enforcement may possibly respond. Depending on the first unit to arrive on scene, the personnel first coming in contact with the patient may have any one of several levels of training.

The first level of training would be the family members or public citizens who may or may not have any medical training. These individuals, or possibly a police officer or fireman, may have training limited to only basic first aid or CPR. Although early CPR is invaluable in cases of medically caused cardiac arrest, basic first aid is valuable in only the most minor injuries (Emergency Medical Services, 7).

The next level of care would be the First Responder. These are individuals who have attended a forty hour course in CPR and the essentials of basic life support. This training is similar to an EMT although its scope of practice is significantly more limited. First Responders can give treatments of oxygen and provide basic airway management and circulation assistance. They also are able to secure the spine through cervical spine immobilization. Unlike EMT's, though, First responders cannot give oral glucose to

diabetics, transport to a hospital by ambulance, or communicate with hospital personnel. Their patient care is limited to basic life support until a more highly trained person arrives at scene (Emergency Medical Services, 8)

After the trained level of First Responder comes the EMT. They are licensed to provide full basic life support, including the use of oxygen and the administration of oral glucose. Oxygen and Glucose are the only two treatments an EMT can give to a patient. They can also transport a patient or patients to a medical facility via ambulance, communicating with the hospital personnel en route. There is a special classification of EMT that applies only to firefighters. It allows all the functions of an EMT to be performed, although transport to the hospital is not part of the training. This special classification allows the firefighter to work as an EMT in the fire service, but does not certify him to work at a private ambulance company (Emergency Medical Technicians, 12).

An EMT-D is a recent classification of EMS worker. It is a fully licensed EMT who is able to not only provide basic life support, but utilize the use of automatic defibrillators for patients experiencing cardiac arrest. To become an EMT-D requires an additional eight hours of training and the need for monthly refresher courses. EMT-II's, although nearly extinct, are the next level of care available in the field. As mentioned earlier, there are eleven more drugs a Paramedic can use, as opposed to an EMT-II. Certain methods of providing a stable airway are also excluded from the EMT-II scope of practice. Additionally, certain treatments to the assist the heart are unavailable to the EMT-II. The final level of training for EMS in the field is the EMT-Paramedic, EMT-P,

or just Paramedic. A Paramedic is able to establish an IV, use a monitor/defibrillator and perform all airway stabilization functions. There are many medications that a Paramedic can administer. Their level of care allows them to treat most patients at the scene, to more adequately stabilize a patient before transport to the hospital (Emergency Medical Services 11).

All levels of EMS personnel, including the EMT, communicate with the hospital to inform the doctors of the patient's status and to receive orders. For all levels of EMS personnel, the purpose of their existence is to attempt to improve or stabilize the condition of their patient.

The Emergency Medical Services program has been in existence for only about thirty-five years. In those thirty-five years an ambulance has progressed from a taxi, to an advanced life support facility able to keep someone alive for a certain amount of time. Helicopters have gone from an aviation experiment, to an invaluable method of transferring patients quickly from the scene of an emergency to a hospital.

Advancements in pre-hospital patient care are endless. The use of external pacemakers is just now coming into use. For patients who have experienced massive blood loss, interosseous infusion, a new fluid replacement method, adds volume through the bone marrow, instead of by needle. Thrombolytics, drugs that eliminate clots in a matter of minutes, have been used in hospitals for several years and are now being considered for field use. Additionally, there are plans to allow the use of more potent diuretics to reduce inter-cranial swelling, and blood substitutes to combat blood loss (Emergency Medical Services, 35).

Pre-hospital emergency medical care is an idea that has come of age and is still maturing. The existence of EMS personnel has saved, and will continue to save, many lives. Those who would have died several years ago from heart attacks in their homes are now easily surviving and living many more healthful years. Individuals, who may have died from trauma in years past, are now living because they are transported quickly to a trauma center.

1.2 *Laws and regulations of EMS*

As mentioned in the history of training and policies, laws and regulations at every level of government have always played a role in guiding EMS. In recent years, there has been an increase in lawsuits over legality issues in EMS only scrutinizing regulations further. Today, these laws play an important role in how EMT's and Paramedics can perform their jobs and save lives. Due to these reasons there has also been a significant increase in the number of publications written on these matters.

The profession of emergency medical technicians (EMTs) and paramedics can only function by virtue of statutory authority provided by the state. Each state statute should define specific "acts allowed." (IAFF Monograph 3). It is a violation of civil law to act beyond or in violation of these provisions. However all state laws must comply with the laws of the Federal government. The following three sections break down laws and regulations regarding EMS into federal, state, and local roles.

1.2.1 Federal government

The federal government defines the basic components of EMS systems and directs nationwide system development. They also oversee the development of national

training guidelines. Furthermore they promote EMS data collection and research. The federal government also provides technical assistance to State EMS offices.

The Federal Government first intervened in the delivery of EMS in 1973. (IAFF Monograph 3) At this time the Emergency Medical Services Act was passed. This law listed fifteen basic components that all EMS systems require. The list was not extremely specific so varied system configurations were permitted. (Insert information from the history section...and from Interview #1 with Bill Lynch) As of 1997 the role of the federal government in EMS was split among several agencies. These agencies include but are not limited to, the National Highway Traffic Safety Administration (NHTSA) of the Department of Transportation, the Maternal and Child Health Bureau of the Department of Health and Human Services, and The United States Fire Administration (USFA).

The federal government passed laws, which greatly affect the duties of EMTs. One such law was passed in 1990. The law that was proposed by the Food and Drug Administration (FDA) was entitled Medical Device User Facility and Manufacturer Reporting, Certification, and Registration (21 CFR Parts 803 & 807). The purpose of the act was to increase the information that the FDA and manufacturers receive about serious problems with medical devices. According to law, a medical device is any item that is used for diagnosis, treatment, or prevention of a disease, injury or any other condition that is not biological. The law required that all "device user facilities" must report deaths and serious injuries that may have been caused by a device, even if the device only contributed to the injury. This law affected all ambulance services and EMTs because they now had an additional legal responsibility. On June 16, 1992 the President signed

the Medical Device Amendments of 1992. These amendments established a single reporting standard for user facilities, manufacturers and importers. This aided EMS providers in the fact that they were then able to create a standard, for which in the event of a death or serious injury EMTs could then fill out. The reporting requirements defined by the law were all incorporated into this form.

In 1976, the United States government enacted the Federal death and Disability Act. In 1986 it was amended to include public-service EMS providers. The Public Safety Officer's Benefits Act (P.L. 94-430) was further amended in 1989. Now, EMTs and paramedics can receive death and disability benefits on par with other public officers. However under this law those working for "private" ambulance companies are excluded.

Another role of Federal Legislation is to clearly define who is responsible for the payment of Emergency Medical Care that is delivered to people with and without insurance.

1.2.2 State government

All EMS programs and activities must abide by state laws. All states have legislation that provides the basic structure for EMS however the laws vary greatly from state to state. The role of the state authorities is to oversee the execution of EMS within their own state. They are responsible for implementing regulations, licensing personnel and vehicles, certifying training programs and defining required record keeping. Usually the state health department serves as the lead EMS agency however a few exceptions exist.

In most states an EMS advisory council exists. The role of the advisory council is to bring together EMS professionals, consumers, and various special interest groups

involved in EMS and to provide direction to lead the agency in policy development. The council may also serve as a mediator between different groups whose cooperation are crucial to the optimal delivery of EMS. Although the councils vary from state to state members usually include EMS physicians, EMS providers, nurses, firefighters, police officers, EMS educators, and members of the public. In some cases members must be appointed to the council where as in other cases volunteers are allowed to be members of the committee.

In addition to an advisory committee, all states have an office of the State EMS Director. This position has several titles, which vary from state to state but each state has a single individual who is in the director of the state's EMS. This individual is responsible for the administrative direction of EMS programs within the state. Another position that many states have is the position of State Medical Director. The State Medical Director is usually a physician who has had a significant amount of experience with Emergency Medical Care.

States that do not have medical directors at the state level usually are more strictly governed at the regional or local levels. In general this is more common west of the Mississippi River. (IAFF Monograph 3)

State laws specify programs and activities that state governments regulate and identify lead agencies along with their relationship to other agencies within the state. The laws often give agencies the authority to establish minimum standards and set penalties for non-compliance with the standards. In the delivery of Emergency Medical Services it is extremely important to have clearly defined laws so that First Responders, EMTs, Police Officers, Firemen and paramedics may be aware of their roles during an

emergency. Their awareness of their roles in an emergency is crucial to producing the best possible patient outcomes.

State laws usually define terms that are relevant to EMS. The definitions put forth by the state may exclude certain companies from being the primary providers of EMS in a given city or region. They may also explicitly define the level of involvement that different parties are allowed. Other sections of the state laws outline basic responsibilities and levels of involvement entailed by different employees/volunteers participating in EMS. In Massachusetts the Office of Emergency Medical Services oversees the laws governing the state.

1.2.3 Local government

The main responsibility that local governments face is to be the providers of EMS. The local governments, which may be appointed to this duty, are counties, cities, fire districts, or any other geo-political jurisdiction. Each of these different regions has a slightly different form of legislation and legislation across region boundaries also differs.

On the local level the term incorporation describes the result of legal proceedings that bring a municipal corporation into existence. (Rhyne). Municipalities must be granted existence through a legal procedure which may be conducted in one of the following manners; special legislation, general incorporation laws, optional charter laws. Special legislation; this method is far less common than it was in the past due to more stringent litigation of state laws concerning the prohibition of the creation of special acts or acts that place duties upon the state to reorganize municipalities. General Incorporation Laws; after disparities in treatment of municipalities under special legislation reforms were put into place that prohibited special acts and organizations of

municipalities under general laws. General Incorporation laws serve to classify municipalities so that similar municipalities may operate under state wide regulations, rather than specific regulation. This directly aids in optimal patient care across municipality boundaries. Optional Charter laws; give voters within the municipality the right to elect to be governed by different forms of municipal charters. Different types of municipal charters include but are not limited to the governance by a mayor-council, commission, or city manager plan.

Home Rules are the laws that are specific to each region/district. In many states home rules must receive the approval of the state legislature before they may be proposed or passed. In other states this is not the case. The purpose of home rules is to allow local governments to deal with matters of local concern without the interference of the state government. Due to the special nature of home laws, these laws often supersede state laws insofar to laws that specifically deal with local situations which are unique within the state. (IAFF)

Legislation on the local level often plays a pivotal and significant role in the manner, which EMS is delivered. Charter Amendments and local ordinances/resolutions are the two types of legislation that usually have the greatest impact on EMS.

A municipal charter (city or county) is an official document or constitution granting certain rights and privileges to its citizens and outlining the principles, functions, and organization of the corporate body. Amendments are made on a regular basis to charters. Laws that concern the content of amendment are allocated by higher levels of government (state and federal). Each local government must follow a clearly stated process based upon the methods specific to their municipal incorporation. In some states

municipalities may amend their own charters. This may be done by local officials or by voters of the municipality. Additionally no particular form of wording is required for municipal charters, unless specified in the state statutes. This grants local governments an extreme amount of power concerning the provision of EMS within their municipality.

Municipal ordinances and resolutions also play a critical role in EMS. A municipal ordinance is defined as a by-law, local law, regulation or legislative act of the municipal governing body (Rhyne). A resolution is not the equivalent of an ordinance but is a more temporary act. Differences between the legal interpretation between ordinances and resolutions vary by state. However the general enforcement of each is similar. The name that the council chooses for the law does not change the procedure that the law must be passed. This procedure is stated within the local charter.

In most cases if a municipal council has the power to enact an ordinance it has the power to repeal it. However the procedure of repealing an ordinance is usually the same as the procedure to enact the ordinance. This power held within the local governments, in most cases the power to decide who shall service the municipality's EMS.

Chapter 2: Methodology

1. Identify the parts of an EMS system.
 - a. List all equipment needed for each level of ambulance
 - i. According to state laws
 - ii. Compare to AHA standards
 - iii. Compare UMASS and WFD proposals for equipment
 - b. List costs of ambulance, maintenance, repair, garaging
 - c. List all salaries to be paid (include analysis of retirement benefits for publicly employed persons)
 - d. Identify regional boundaries
2. Identify the legal requirements for a city, private provider, and hospital to comply.
 - a. EMTALA
 - b. COBRA

- c. Mass Chapter 111C
 - d. Local Jurisdiction Protocols- What towns?
 - e. Hospital Protocols (Steven Hanes)
 - f. Medicare (Social Security Act)
 - g. Medicaid (Social Security Act)
 - h. CMED
 - i. Mass Dept. Communications
 - j. Mass Dept. Transportation
 - k. OEMS (Massachusetts Office)
 - l. Training Regulations
3. Describe the EMS delivery system.
- a. Communication between different parties
 - i. Questions/content
 - ii. Recurring problems
 - iii. Methods of backup
 - iv. Regulations/Protocols
 - v. Misuse
 - vi. How miscommunication is dealt with
 - b. Equipment
 - c. Information relayed/recorded/disregarded
 - d. Records Kept
 - e. General procedure for
 - vii. Priority 1 call
 - viii. Priority 2 call
 - ix. Priority 3 call
 - x. Priority 4 call
 - 1. Touch upon medical classifications, other parties involved and the key role that the CMED call-taker plays.
4. Communication within the E.R.
- a. Who Talks with CMED
 - b. Communication between EMT/Dr.
 - c. Off-line protocols
 - d. R.N. duties and responsibilities
 - e. Communication between R.N./EMT
 - f. Communication between R.N. /Dr.
 - g. Role Insurance plays
 - h. Forms, treatment, diagnosis
5. Identify the Worcester EMS history in the context of national trends.
- a. When did Worcester start paying for EMS?
 - b. Volunteer >Paid
 - c. Look at other cities which are still public/volunteer
 - xi. Regional studies
 - xii. Special cases
6. Identify and describe different methods of providing EMS in the USA.
- a. Summarize the different systems
 - b. List major strengths of each system and determine if other systems could benefit from those strength/unique characteristics or if they are due to the environment
7. Identify the distribution of those providers and the trends across the USA.
- a. Identify what type of “trend” we are looking for
 - xiii. Providers

- xiv. Equipment
 - xv. Response time
 - xvi. Emergencies
 - b. Primary providers vs. population
 - c. Hospital based
 - d. Systems may vary based upon population density, and hospital localities
8. Construct diagrams of the EMS system that is currently in Worcester
 - a. Actions that each participant takes in the event of an emergency call
 - b. Legal influences on each party involved
 - c. Costs that may influence the delivery of each step in the process
 9. Identify types of care.
 - a. Advanced Life Support (Worcester has all ALS vehicles at UMASS)
 - b. Basic Life Support
 - c. First Responders
 10. Describe personnel requirements needed to provide the types of care.
 - a. Training for each level
 - xvii. Varies from state to state
 - b. Requirements to provide training (CMEMS) (WPI EMS)
 11. Describe the financial requirements needed.
 - a. Where do funds come from
 - b. Who ensures that bills are paid
 - c. Who assumes responsibility for unpaid bills
 - d. Goodwill and its influence on the system
 12. Identify the training needed for the personnel of the system
 - a. First Responder
 - b. EMT-B
 - c. EMT-I
 - d. EMT-P
 - e. Dispatcher
 - xviii. Regulations set by OEMS (MGL 111C section k)
 - xix. Discuss how experience may also be a crucial factor in quality of care
 13. Identify the political influence that goes into the start of such a system
 - a. Unions
 - b. Government
 - c. Money
 - xx. Evaluate the probability of success of these suggestions
 14. Describe the financial analysis of current EMS systems
 - a. Identify costs
 - b. Look at annual report
 15. Look for any legal ramifications from situations caused by the problems of current EMS systems
 - a. Majority of this section come from http://www.ama-assn.org/sci-pubs/amnews/pick_01/gvsa0423.htm (Albert)
 - b. Case Law
 - c. Amendments
 - d. Malpractice
 16. Identify who is able to make changes in the current system
 - a. What cooperation would be needed from other parties
 - b. Cost of changes
 - c. Benefits of changes
 - d. Specifically focus on a single system that has changed over (IAFF Mon 2)

17. CMED
 - a. Perform background research on CMED, by reviewing the website, and discussing Ma CH111c with the group
 - b. Directions
 - c. Interview on Tuesday January 22, 2002 at CMED
 - d. Learn about CMED's role in Mass EMS
 - e. What they do
 - f. Why they are "essential" to the system
 - g. Make further contacts through CMED
 - h. Restructure/Edit our own system based upon new knowledge
18. Visit UMASS
 - a. ER
 - b. Dispatch center
 - c. Perform Interviews
 - d. Library
19. Visit the Dispatch center in Police station
 - a. Interviews
 - b. Reconstruct system
20. Identify Differences Between Different Types of System
 - a. Fire-based
 - b. Hospital-based
 - c. Privatized
21. Create Tool for Evaluation by Communities
 - a. Shows differences between types of systems
 - b. Shows strengths and weaknesses of community
 - c. Compared to needs and desires of said community
 - d. Draw conclusions

Chapter 3: EMS System Components

This section will break down an EMS system into seven components. Each component is found in any EMS system and provides a general model by which a system in any town or city can be compared. Once the seven areas are identified and broken down, it is then possible to investigate a particular system within a town or city.

The eight components are:

- Staffing
- Training
- Communication
- Transportation
- Medical Facilities
- Other Emergency Responders
- Mass Casualty Incidents and Mutual Aid Agreements

3.1 Staffing

The first and most important component of the system is staffing. People are involved in the EMS process from the second the phone call is made until the injured person is placed in secondary medical care. Staffing can be broken down into the four general areas:

- Notification and dispatch
- Scene response
- Hospital response
- The overview and directing of the system

Notification and dispatch is comprised of a group of call takers and dispatchers. Throughout different EMS systems the numbers of each and how they perform their

duties may differ, but the one common theme that exists is their purpose. They must obtain information of emergencies and pass that information on to the respective emergency services that are needed. Each emergency service will dispatch the vehicle(s) that are needed.

The first person involved is the call taker. This person receives a call about an emergency. This is typically performed using a 9-1-1 system. In any system, the call is answered by the call taker. This person listens to the caller, and analyzes the situation. The call taker will most likely ask more questions of the caller, and will then pass on the call information to the appropriate dispatcher(s). There are criteria that each call taker uses to evaluate emergency calls in order to decide who is (are) the appropriate dispatcher(s). Through this criteria and the information communicated over the phone, the call taker will decide whether the police, fire department, EMS, any other emergency service, or any combination of these are needed. In most situations, multiple dispatchers exist and each emergency service has its own.

Once the dispatcher has obtained the information, the proper vehicles must then be dispatched. In the case of EMS, The dispatcher must decide what services are needed by the injured person. This will depend on what type of injury it is and how serious it is. Based upon this, the dispatcher can determine which vehicle(s) must be sent. Out of the vehicles that have the capabilities to respond, the dispatcher will generally send the closest one.

The response team is the second area of staffing in the timeline. In the event of a medical emergency, an ambulance, staffed with a minimum of a driver and two others are sent in response. The second two people may be trained at a number of different levels,

but usually at least one is an EMT or paramedic. Training will be discussed more in detail in the next section. The police, fire department, or other service may also be dispatched to the scene to help the ambulance crew.

After being dispatched, the ambulance must first find its way to the scene. Different towns and cities use different methods of direction finding in the ambulances. Some ambulances may be assigned to a small area and will therefore know every street and intersection within that area. Others may use a Global Positioning Satellite system with an on-screen display or communicating over radio to someone with a map. Whatever the system may be, it must be efficient and guide the ambulance to the scene as quickly as possible. In general, ambulances will rush to the scene with the same urgency for any call. This is because the information they have been given is not always the actual case. Information can be misinterpreted or wrong and the situation may be more severe than expected. Ambulance workers must also act quickly since they are dedicated to one call at a time and therefore out of commission for any other calls until they can unload the wounded. If this happens in a larger community where ambulances are dedicated to neighboring areas, a close by ambulance will drift between the two areas to help cover for the other.

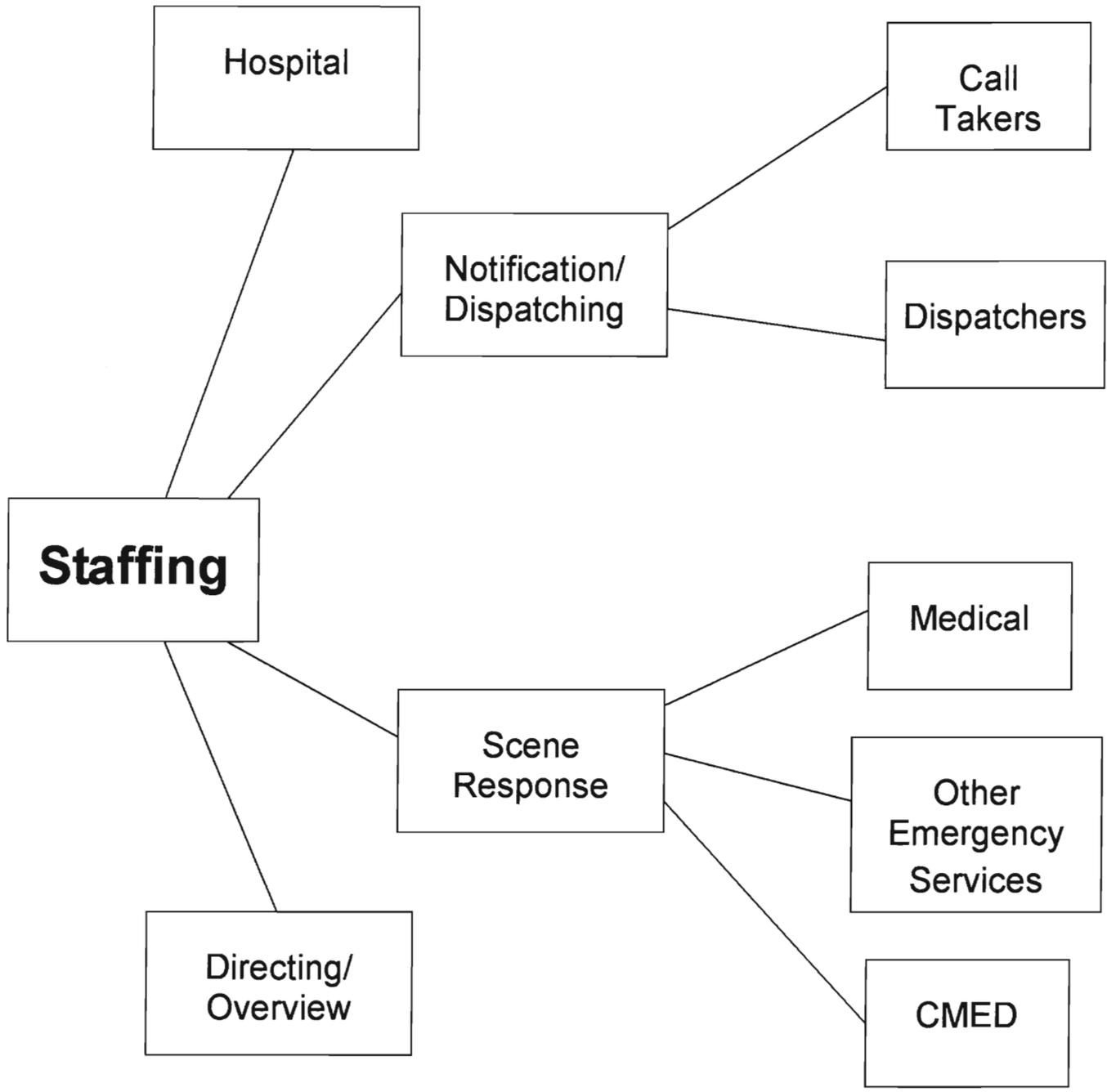
Upon arrival, the medical team must analyze the situation. This is comprised of surveying the area, looking for any dangers to themselves, and finding the wounded. Once this is established they will then begin treatment of the injured person. They will ask questions, analyze the injury, begin care for the person and transport the person into the ambulance once it is safe to do so.

During the transport of the person to the hospital, the ambulance medical team will continue treatment and prepare for arrival at the hospital. To prepare for arrival, the crew will communicate with the hospital. In the state of Massachusetts, the ambulance is required to contact CMED (Central Massachusetts Emergency Dispatch) who will then patch the ambulance crew through to the hospital and a doctor if needed. The ambulance medical team is trained to administer help to a certain point. There are some things such as certain medications that need a doctor's approval first. The ambulance medical team can receive permission from a doctor over the radio for these things.

While the ambulance transports the injured person, the hospital staff prepares for its arrival. This staff includes doctors, nurses, and other hospital workers. There is always someone communicating with incoming ambulances over a radio. This person will relay the information to doctors or nurses so that they can prepare. When the ambulance arrives, a nurse or other hospital worker(s) will meet the ambulance medical team and take over the care of the injured person.

The last component of staffing is the directing and overview of the EMS system. Each part of the system has a chain of command in order to keep quality and control over EMS. For different types of systems, the directing will be different. For instance, if the ambulances are owned by a hospital, as in Worcester, MA, then most likely, a medical director is in charge of the ambulance crews as well as the emergency room staffing. The city, state, and federal governments also help oversee EMS and create laws by which the systems must operate. For example, in Massachusetts, CMED monitors all radio conversations between the ambulance and the hospital and records how the ambulance crew has cared for the injured person. Efficient and thorough directing is necessary no

matter how a system is set up. This will help ensure the highest quality emergency medical care available for each community.



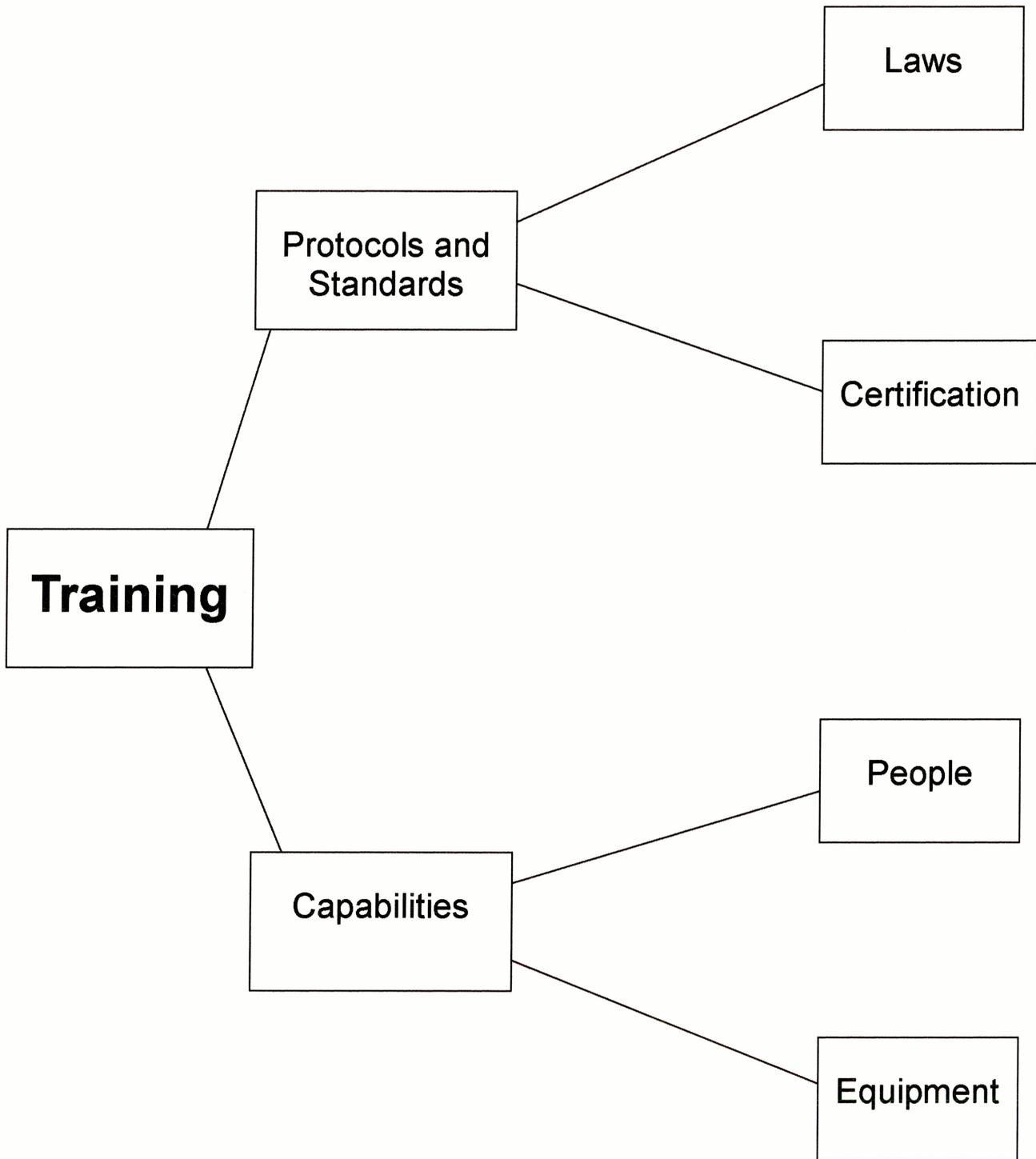
3.2 Training

Another component of the EMS system is training. This element can be directly related to staffing and is a major background factor in the effectiveness of the staffing. Training can be broken down into two major sections. The first is the protocols and standards set forth by governments and companies involved and the second is the capabilities of every person in the system.

Protocols and standards are extremely important to an EMS system because they allow communities to set minimums for the people within the system. These standards can be set by many different groups. The city, state, and federal governments all play a large role in creating the laws which govern EMS. There also may be companies involved which can set standards as well. The ambulance company may be owned by a hospital or a separate private company and create its own rules and protocols on top of following governmental laws. It may also be operated by a fire department and fall under their jurisdiction. There are many different ways in which an EMS system may be set up, but in any case, protocols and standards are set by those involved and those who oversee.

It is crucial that an EMS team be capable of doing its job. The two limiting factors for this are the capabilities of the equipment and the people. A paramedic may have the knowledge and ability to care for the person, but without the proper equipment, that person is useless. Likewise, equipment without a medically trained person is useless as well. Proper equipment is a matter of proper funding and keeping updated, but making sure a person is capable of caring for an injured person in all the different ways that may be required is a more difficult task. The method in which this is done is through training.

Proper training can be guaranteed through certification requirements. This allows communities to ensure that any person involved in the EMS system has undergone specific training requirements and has successfully completed them. There are different levels of certification to help differentiate between abilities of those trained. Certification is also not a one time class. Recertification is required and ensures that everyone is trained with the most current techniques. Through these methods of instruction, a community can guarantee that the staff in an EMS system is able to perform at the level of care which is expected of them.



3.3 Communication

Communication is a central theme that is necessary for any EMS system. From the phone call to the hospital, the entire process involves communication by every person. The communication component can be broken down into three categories:

- Equipment
- Training and experience
- CMED

The staff of the EMS system utilizes these components to effectively communicate between one another.

Equipment is the basis for all communication. There are many different types used and because of modern technology, they are continuously changing and evolving. Communication equipment can be broken down into private and public usage. Private usage pertains to the initial emergency call, most likely with a 9+1+1 system. Recently, Massachusetts has implemented a more advanced E-9+1+1 which allows caller information to be immediately displayed for the call taker. Other places which have not implemented the 9+1+1 system may have other emergency phone numbers which are used. The initial call can be from several different kinds of telephones. Hard line telephones which are customary in households, public pay phones, and cellular phones are the three typical ways in which an emergency call is made.

The more advanced E-9+1+1 system in Massachusetts works well with most hard line phones including public pay phones and household phones, but there are exceptions. In large businesses where there are multiple buildings in the same complex, the advanced system is not as useful. No matter where a 9-1-1 call is made from anywhere within the complex, the same phone number and address will appear on the screen for the call taker.

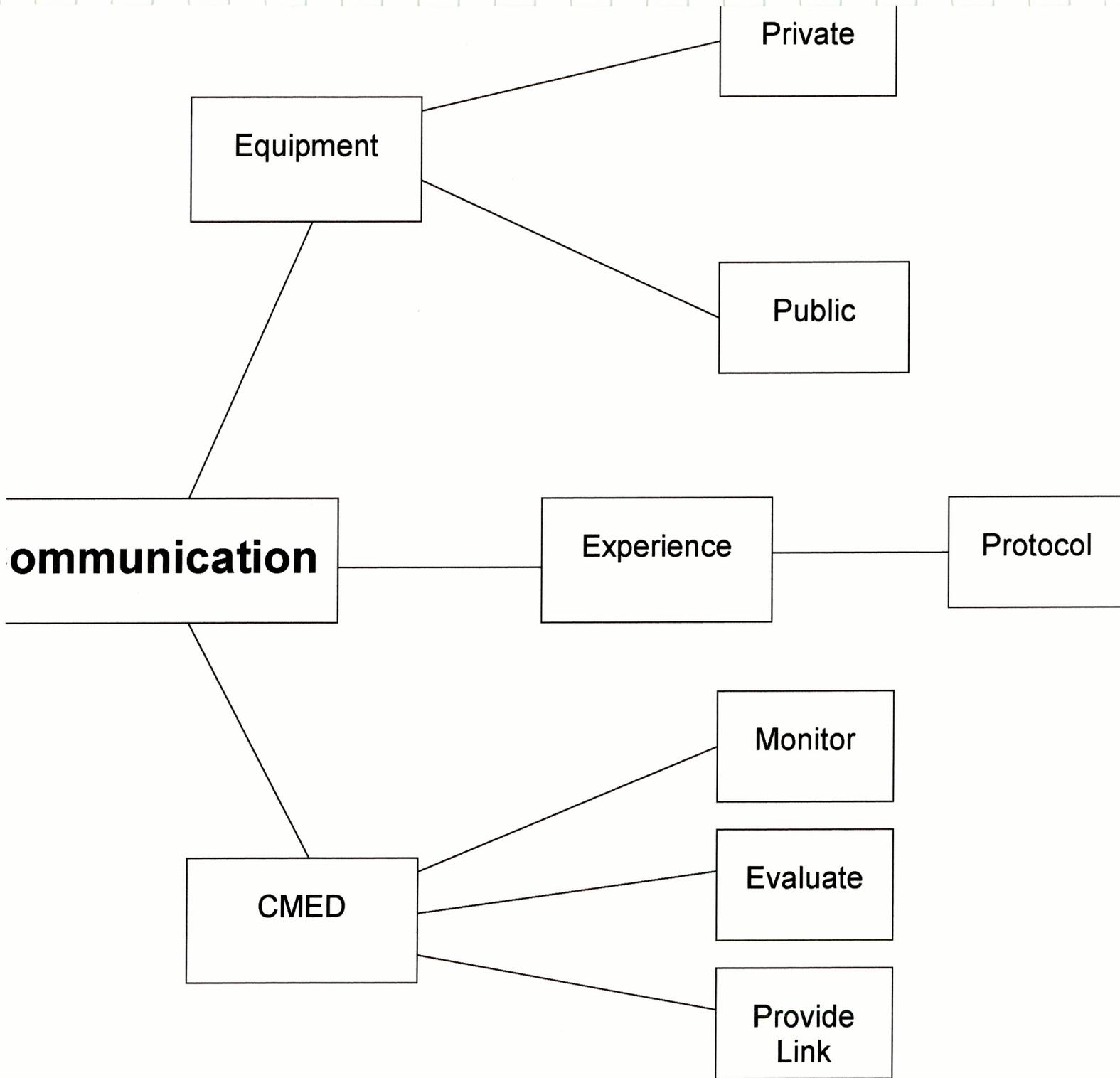
This misleading information may cause an ambulance to be dispatched to the wrong building and cause a costly delay. Even though these problems do arise, they only occur a fraction of the time and the E-9+1+1 has proven to be quite successful.

Public communication equipment plays a much larger role than private telephones in the system. The different types of public equipment used are the cell phone, radio, Nextel, and CMED radio. Communication between the call taker and dispatcher will depend upon the distance between them. The dispatcher(s) may be located in the same room as the call taker, or even in a different building like a fire station, police station, hospital, or ambulance company. In some cases these two positions may even be the same person. If it is the same person, the communication is obviously simple but in any other circumstance, an effective method must be used to communicate the information needed. It may be passed on by word of mouth, phone, radio, written cards, electronic text, or any other method that may be conceived. From the dispatcher, the information must be passed on to the emergency vehicle. This is often accomplished by radio, but a Nextel or cell phone may also be used.

Training and experience also play a large role in communication. There are several major areas where this can be seen. The first is the initial emergency call. The call taker must be well trained in any matter that may arise and have the knowledge in order to ask the right questions of the caller. This is also true for the medical response team when they show up at the actual scene. Each scenario is different and common sense plays a large role for the team. Medical Responders may come across difficulties such as language barriers or mental disabilities and training and experience must be used to cope with these situations. There is also communication between the medical response team

onboard the ambulance and hospital workers. If a paramedic onboard needs permission from a doctor to administer medication, the two need to quickly and effectively communicate back and forth so the patient may receive timely care.

CMED plays a very important part in communication by controlling all communication between the ambulance and hospital. The state of Massachusetts mandates CMED be used in every ambulance call. After picking up an injured person, the medical response team will call the CMED radio operator on the CMED radio. The CMED dispatcher will then call the hospital to which the ambulance is going and establish a connection between the two. CMED will then listen to the conversation between the ambulance and the hospital and record it. The patient's vitals are recorded as well as any medication given to the patient. CMED oversees the medical response team by making reports and handing out fines for any EMT or paramedic who administers certain drugs without a doctor's permission.



3.4 Transportation

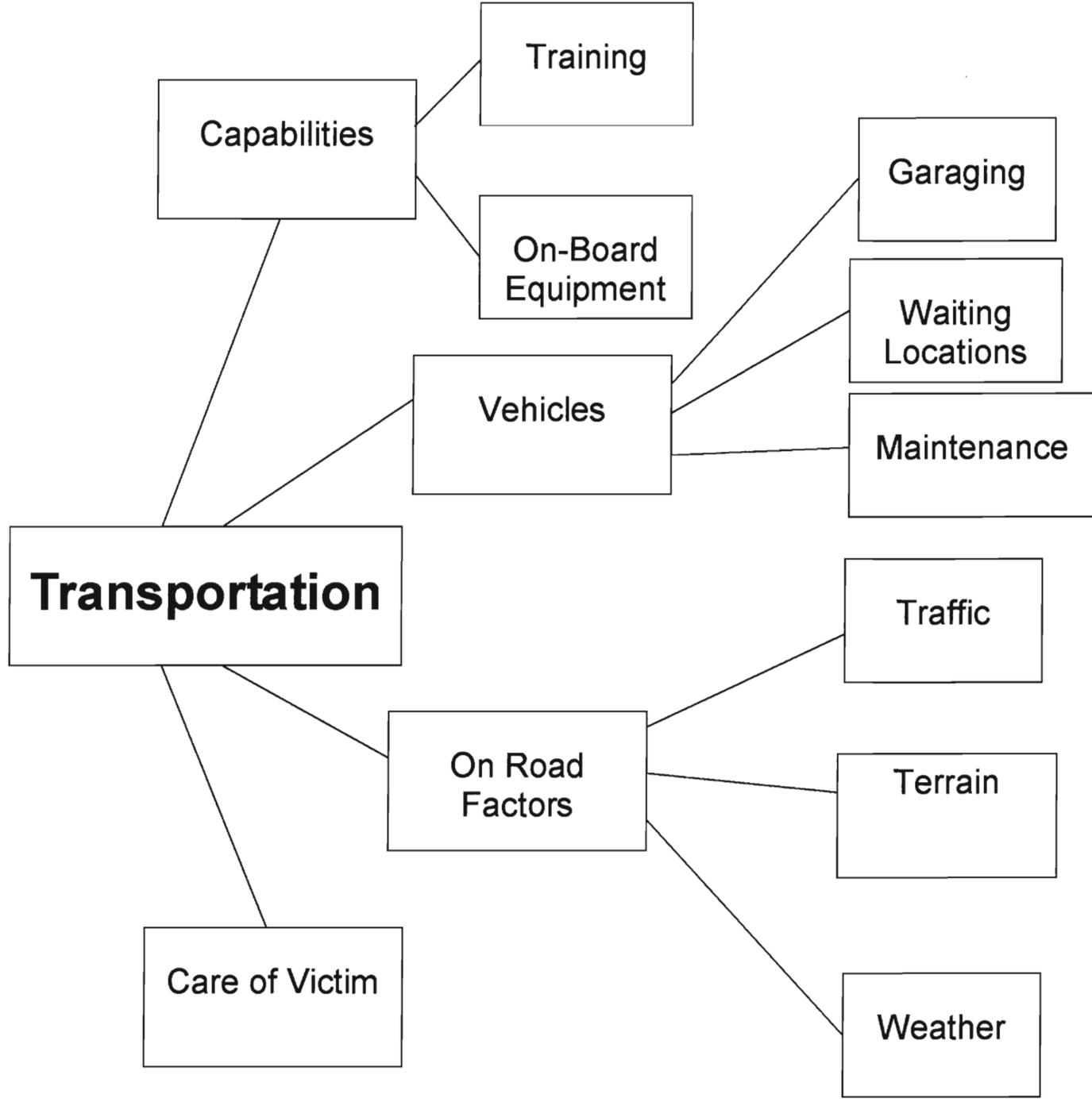
Transportation is another component of EMS. Similar to communication, transportation is also greatly affected by technology. Since it started with horse drawn carriages, it has come a long way. Today, the typical vehicle used for transporting an injured person is the ambulance. This is a complex piece to the system and involves much more than just the vehicle itself. Besides the vehicle, the other major components of transportation are capabilities and many on the road factors.

The first two, vehicles and capabilities are both behind the scene factors that are set in place before any injury occurs. Knowing the capabilities of each ambulance is crucial because it allows a dispatcher to know which ambulances can handle which tasks. The two factors that make up the capabilities of an ambulance are the training of the people and the equipment onboard. In larger communities it is important to make sure the capabilities of ambulances are evenly dispersed.

The actual vehicles are obviously important as well. There are many factors that must be considered for the vehicles in a system though. Garaging is important as well as deciding whether the vehicles should roam an area during a shift or stay garaged. If the system requires the vehicles to stay in a garage until it is needed for a call then it is important for garaging to be located in a central area to the community being serviced. Vehicles also age, depreciate, and ultimately become less reliable. Communities need to make wise decisions on upkeep and know when to replace a vehicle. Refueling the vehicle is also an expensive factor especially if the vehicle roams an area throughout a shift.

Once an emergency call has been made, there are a whole separate set of factors concerning an emergency vehicle. Traffic, terrain, and weather are all uncontrollable forces which must be paid attention to. By knowing traffic patterns and predictions of weather, a driver may be able to save time and transport a victim to the hospital in a safer manner. A certain degree of danger and risk is involved with an ambulance because of these conditions. Due to urgency, ambulances often speed and bend other traffic laws for the sake of an injured person.

The final and most important major factor is the care of the victim. The team must use the equipment and supplies available and communicate with the hospital to make the transition from ambulance to hospital as fluid as possible. In some cases, an ambulance must deal with divergence, when a hospital is at its maximum capacity. This may force an ambulance to reroute creating a longer trip, but with proficient communication, time delays can be minimized. When all of the factors are combined and efficiently managed, a victim can receive the best possible care.



3.5 Medical facilities

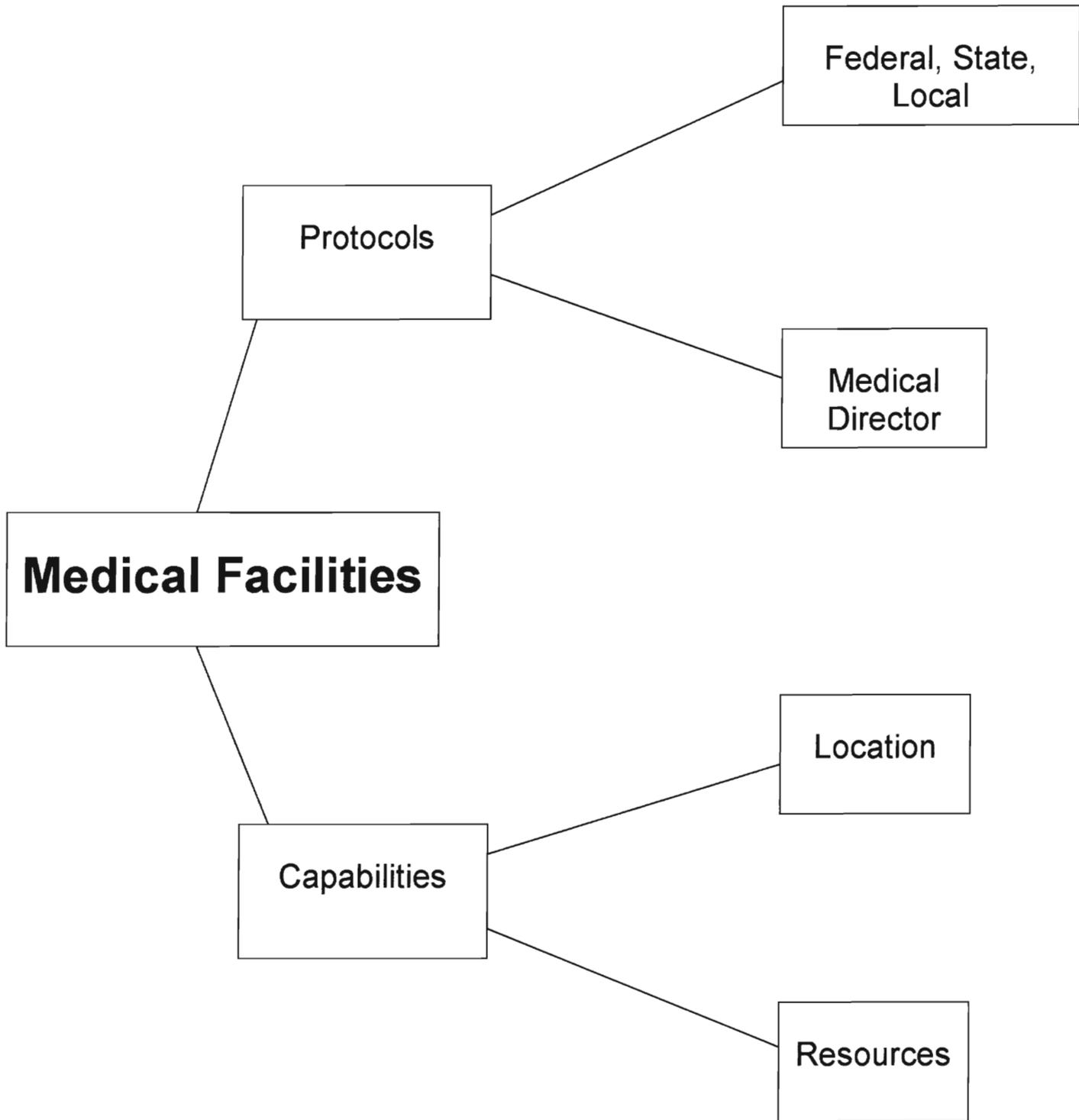
The Medical Facilities are the last physical component of the EMS timeline. A medical facility has numerous components essential to EMS. These can be broken down into two major categories, protocols and capabilities.

Protocols and standards govern medical facilities like every other component of the system. The city, state, and federal governments all create laws and standards by which a hospital must operate. Once protocols have been set, it is important to follow up and ensure the standards are being met. A medical director plays a large role in this and manages the emergency room and incoming patients. In some cases, the medical director also manages the ambulances and their crews. In this respect, the medical director can view the entire operation from the pick up of the wounded to recovery. Feedback is also very helpful in this situation for the ambulance crews since they can receive reports on how their patients recovered and also know if they could have done something differently in the ambulance.

The second major factor of a medical facility is its capabilities. A hospital's capabilities can be limited by its location or its resources. Central location is vital because the closer it is to the greatest number of injuries, the shorter the ambulance ride will be for victims. Also, location can be either beneficial or detrimental when it comes to traffic and terrain. A hospital needs to be easily accessible.

Resources also affect a hospital's capabilities immensely. The most apparent resource is people. When a hospital goes on diversion, it is often because the staff cannot care for anymore people. Some doctors also have specialties which may be needed by certain injured people. It is obviously favorable to have as many specialties as possible so

an ambulance does not have to travel any farther than necessary. The physical hospital with its limited number of rooms is also a resource. Although it does not happen often, if a hospital runs out of rooms then it is no longer helpful to the community and must go on diversion. Equipment is also another resource of the hospital. Equipment is needed for trauma units and other specialties and is limited. Equipment also ages, and newer technologies are continuously researched and put into practice which makes older equipment outdated and useless.



3.6 Other emergency responders

Other emergency responders can play an important role in EMS as well. The other typical responders are the police and fire department. Their wide variety of training can prove useful to a medical emergency. This section can be broken down into:

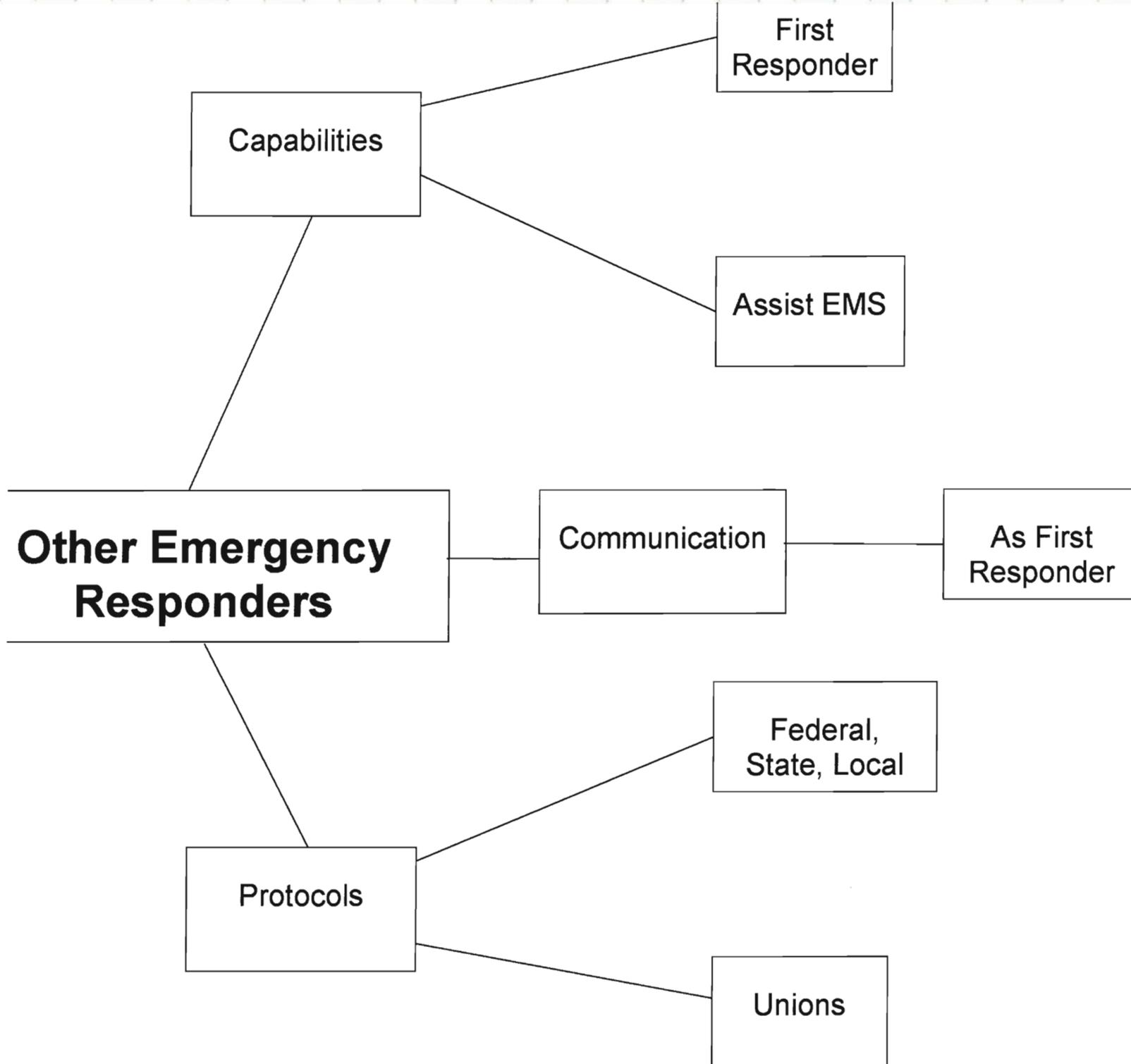
- Capabilities
- Communication
- Protocols

There are two main capabilities of other emergency responders that are useful for a medical emergency. The first is their role as a first responder. Police and fire fighters have the superior advantage of having more staff evenly dispersed throughout a community. This will enable them to arrive at almost any scene before an ambulance. While police and fire fighters may not have as much medical training or equipment, they can act as first responders and start treating the injured person. In this case, it is important for a fluid transition from the first responder to the ambulance crew. This is not always the case, but cross-training, joint training, and better communication between the different groups can help improve this.

Another role of other emergency responders is to provide assistance for an EMS team. They may do this in a number of ways. If it is a vehicle accident, the police department may help direct traffic or the fire department may help the medical responders reach the victims. An EMS team may also need help entering a building or any number of tasks. The police and fire departments have equipment and training that EMT's and paramedics do not possess yet still need in order to fulfill their job.

Communication is important in any scenario where other emergency responders are needed. Efficient communication with dispatchers will help them arrive on a scene as quickly as possible. They may also need to talk to an incoming ambulance in order to discuss a situation. Once an ambulance is on the scene, all people must work together and communicate in order to achieve fluidity and provide the fastest care and treatment possible.

Like any other component of the EMS system, other emergency responders must be governed by protocols and standards as well. Along with government laws, police and fire departments also have unions who have some control. This may not affect EMS much, but it is still a factor. Certification and training is beneficial for all emergency responders. Through this, wounded can receive better care and faster care. Probably the most important aspect for other emergency responders in a medical emergency is knowing when to respond. In any system there must be criteria laid out for any situation. Call takers and dispatchers must be trained and know when a medical emergency will need more than just an ambulance.



3.7 *Mass casualty incidents and mutual aid agreements*

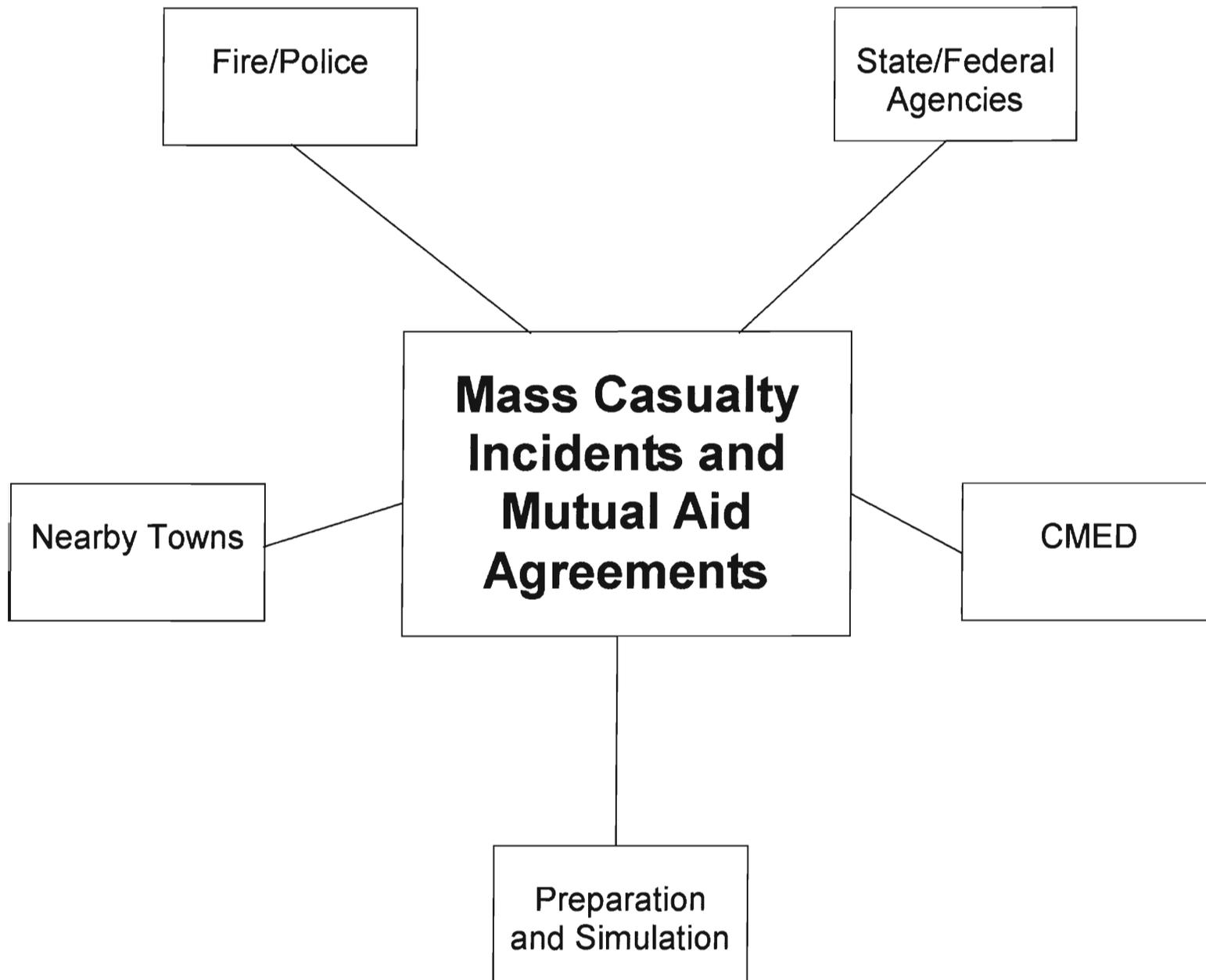
A mass casualty incident is something that rarely happens. Even though this is true, it must be prepared and trained for as much as possible. Most of this is executed through laws and protocols and is not actually practiced. Preparing for something with such a large magnitude but yet very open-ended is a difficult and complex task.

Many different components are needed for such an incident and need to be prepared. Hospitals must have their own protocols for something of this manner and have the resources to adjust within a certain amount of time in order to accommodate more patients. Towns and cities must work with one another and draw up plans for allocating resources for each other. Fire and police departments as well as ambulance services must be part of the mutual aid agreements between towns. At the state and federal levels, different agencies and responders such as a bomb squad must be prepared for as well. There are also other cases where The Center for Disease Control, National Guard, or Red Cross among others may be called upon. Taking all these groups into perspective, any community should have a plan of action for such an incident.

CMED also plays a role in MCI. In the case of such an event, the director of CMED has a vehicle that can be used primarily for communication. This person can take over the communication responsibilities of dispatchers, the CMED radio worker, and can coordinate a large relief effort.

Since September 11, 2001, preparation for MCI has changed. It is taken much more seriously and seen as much more of a threat now. Communities should take this into account and review all plans and preparations. While that one day in history was a horrific event, people should use it as a learning experience for any future occurrences.

Something of that magnitude has not taken place in over fifty years in The United States, but now that it has, preparation for it can be compared to results in order to plan better in the future.



Chapter 4: Differences between EMS systems

This chapter will dissect the different aspects of EMS systems and how they relate to each type of provider. By examining the differences, we can see the strengths and weaknesses of various systems. Most differences between systems are based on the provider. An EMS system can be hospital, fire, or privately based. Each has its own strengths, weaknesses, and differences that go along with it. By understanding the positives and negatives of the different types a town can apply its own needs and desires to the model in order to find a type that best fits. The model can also be used to understand why a particular EMS system may be lacking in a certain area and how switching providers may improve that weak point.

Between 1982 and 1992, fires in the United States fell 23%. This statistic is evidence that with increased fire-protection technology, firemen are left with time to respond to emergency calls. Over the past decade, cities across the nation have been debating over who should provide emergency services to their respective constituents. A big part of the problem is the financial aspect. Cities and towns must decide which type of system is most financially viable. Fire-based systems may not cost the tax-payers as much as a private or hospital based system. The subsidies provided by some areas to private companies can become expensive. Private companies can charge what they see fit for their services. These charges can become extravagant compared to what the fire-department can provide. It is a trade-off between money and service. Obviously more-money means better service but it is up to the city or town to determine exactly what is needed and what the tax-payers are willing to spend.

4.1 Staffing

In order to organize the strengths and weaknesses, this chapter will use the same order developed in the previous chapter by dividing EMS into the seven components. Therefore, staffing will be the first area analyzed. One major staffing difference between the types of systems is who employs the medical responders. As far as medical care is concerned this should not be a factor. However, some argue that having a fire based system is the most efficient use of staffing since the medical responders are also fire fighters and will be on duty anyway. However, fire-based systems may only be able to handle critical patients which could be as little as twenty percent of the ambulance business. The fire department would then turn the rest of the cases over to private ambulance companies who would be no longer required to have full paramedic staffing. In such a case, what would happen if the patient took a turn for the worse? Unfortunately, staffing private companies can be expensive. Some counties will subsidize certain ambulance companies to cover the costs. In Alameda County, California, American Medical Response West is in charge of handling all emergency response. Less than a decade ago, the company was losing money every year due to patients being on medicare or having no insurance. In this case, the company needed more subsidy money to balance out costs. The only alternative was lowering response time regulations. If the response times were lowered, less people needed to be on call at any given time. Or, instead of requiring two paramedics in each ambulance, a paramedic and emergency medical technician would suffice and cost less. More staffing costs more money and this is a reason private companies can be more expensive. The staffing of the

call takers and dispatchers can also be analyzed. In this respect, having a fire based system is also ideal. When the call taker transfers a phone call to a dispatcher, having a private or hospital based systems only adds to the number of dispatchers and may add confusion or lengthen the time before appropriate responders are dispatched. In many towns and cities today if either a medical or fire emergency is called in, both EMS and the fire dept. are dispatched. If the two dispatchers were the same person, it would make the system more efficient. Many 911 systems can dispatch police, fire and emergency personnel at the same time, depending on what is needed. Private ambulance companies must listen to the cities fire and police dispatchers to know where to go and this can cause confusion and problems with getting people to the scene of an incident in a timely fashion.

4.2 Training

Training is the next component of the system and will therefore be the next area analyzed. Different towns may have different levels of training requirements for medical response personnel. In general, training is governed by state and federal law. So within Massachusetts, all towns and cities have very similar training requirements. However, there may be some training differences between a hospital or privately based system and a fire based system. Medical responders who are also fire fighters gives them an added advantage. They have extra training and may be able to provide better care in a situation with a fire. They also have experience getting into buildings with locked doors and better understand the dangers of fire and how to avoid them. Another difference between the

types of systems is that fire based medical responders may be trained differently than other types. Since they are also fire fighters, medical training may be slightly different based on their previous training or knowledge. In contrast, private companies, depending on what city or county they are located in, may be in a position to spend more money on training and technology. They hire more people and buy newer, better ambulances. Private companies may charge more for their services but the quality of care is better and faster. According to statistics, more lives are saved by private ambulance companies than by any other provider.

4.3 Communication

There may be many communication differences between each type of EMS system. The first and most important difference comes from the viewpoint of the medical director. In a hospital based system, the medical director can oversee the emergency room, but if not, he or she still has access. This is a very important aspect since the medical director can supervise the entire process from when the ambulance is dispatched to when the person is fully treated. Being able to see each step of the procedure will help the medical director understand the EMS system more clearly and can also help determine its strengths and weaknesses. The ambulance team can then receive improved feedback from the results of the patients to better educate themselves and hopefully provide better care in the future. The medical responders, also hospital employees, will most likely have a better relationship with those working in the emergency room and can also benefit and educate themselves from that association.

However, there are parts of EMS where communication would be better with a fire based system. Often, especially in larger communities, the fire dept. is sent to a medical emergency because it can respond faster. In these cases, the fire fighters act as first responders. Once the ambulance arrives, ambulance workers communicate with first responders and take over. In a fire based system, there would most likely be no need for this since the ambulance would arrive at the same time as the other fire fighters. This removes any confusion or transition period that would only delay the care of the patient and arrival to the hospital.

4.4 *Transportation*

Mentioned in the previous section, a fire based system would be a strength since it would have a shorter response time. In general, fire departments are more numbered and spread out than hospitals and would be able to respond to an emergency much more quickly. This would ultimately result in better care of patients. On the other side, a fire based system would be less efficient since there would be more ambulances at more fire departments. This may even cause some confusion if multiple ambulances respond to the same incident. In this situation, transportation can be seen as a weakness for fire based systems and strength for hospital and privately based systems. Since there are more ambulances in a fire based system, each would cover a smaller geographic area. With a smaller area, each ambulance crew will know its streets, addresses, and traffic patterns better. This may result in shorter response times as well. Private contractors face fines or a dismissal by the city they work for if their ambulances don't arrive in a specified time period 90 percent of the time. Fines can be anywhere from \$90,000-\$150,000 per year.

Some cities will charge for every minute past the required response time, the ambulance is late. Therefore, these companies are forced to provide good service and transportation.

Another part of transportation would be the maintenance of the ambulances and the equipment located on them. Privately owned and operated systems stock their ambulances as they see fit. It is only in situations where the service and quality of equipment is lacking where a city or county would need to step in. Inventory checks and diagnostics of the ambulances are up to the responsibility of the provider. If there are too many incidents where it is obvious the provider is lacking, the city has the authority to step in and demand an inspection. For fire-based systems, city regulations keep everything in order and in good maintenance. However, because private and hospital-based systems generate more revenue in most cases, they can afford to purchase better equipment. For example, a heart monitor that a paramedic may carry can provide a better readout than one a firefighter may carry. This would mean that a paramedic could detect a “fine ventricular fibrillation” or a faint heartbeat which would indicate the patient has a chance for resuscitation whereas a firefighter would be forced to presume the patient dead based on the flat line reading of their equipment. This is not to say that people may die because a city has a fire-based system, there are just certain advantages a private system may have when it comes to equipment.

4.5 Medical facilities

The effectiveness a hospital based system is partly dependent upon the medical facilities in the area. If there are a greater number of hospitals in a given area, the advantage of a fire based system or a hospital based system in response times is

diminished. Along with the quantity of hospitals, effective positioning within a community is also very important for a hospital based system.

One weakness of a hospital based system with respect to medical facilities is politics. Ambulances with ties to a particular hospital may be reluctant to bring patients to another hospital even if the other hospital may provide better care in a particular field or the driving time is shorter because of driving conditions. In this respect, a fire or privately based system would be more beneficial since it would be non-biased.

4.6 *Other emergency responders*

In cities and towns where the emergency services are hospital-based or privatized, they must work in conjunction with other emergency responders such as the fire and police departments. A perfect example of this is New York City. In NYC, the emergency services are handled by NYC*EMS, the largest EMS provider in the country. However, there are many times where they need the assistance of the fire and police. In situations where police arrive on the scene of a crime, they are trained in emergency services enough to know what to do and what not to do so when the emergency personnel arrive, they can do their job to the best of their ability. Police officers and firefighters are trained on how to stabilize and care for patients until more experienced people can make it to the scene. The police and fire departments also carry emergency equipment to do the best they can while waiting for an ambulance. In these situations, time is critical and the more that can be done as soon as possible, the better. The teamwork and professional courtesy required in such situations is a necessity in protecting and caring for the people living in a certain area.

4.7 *Mass casualty incidents and mutual aid agreements*

In a mass casualty incident, all responders must cohesively work together. A fire based system would be best here since it would mean one less organization involved. A fire based EMS team would most likely be able to communicate better with the fire department resulting in less confusion. Also, another issue to consider is what type of systems the surrounding towns may have. No particular system would be best in this case, but having the same type of system as surrounding towns may prove beneficial in a mass casualty incident where there are mutual aid agreements and multiple towns would be working together.

4.8 *Financial Planning*

Good financial planning is the backbone of any efficient EMS system. Emergency Medical Services require an adequate amount of funding to deliver a sufficient level of care and to meet the needs of the community in which it operates. This funding is used for medical supplies, equipment, salaries, training, vehicles, insurance, licensing, communication, and any computer technology. An EMS system, whether fire-based, hospital-based, or privatized cannot operate properly unless it has a well-planned budget factoring in all revenues and costs. The most efficient way to look at the financial aspects of emergency services is to factor out everything in the system that will cost money and how the funds will be provided.

4.8.1 Funding

The funding for an EMS system can come from any number of sources. One major source would be taxes. Taxes are the most common resource when it comes to EMS. These taxes include property taxes; local income taxes, special taxes, and property transfer taxes. The state and local governments then transfer these taxes to the different EMS systems. They also budget a certain amount of money each year to the Fire Departments or Emergency and Rescue Departments of their individual cities depending on what type of EMS system they each may have. Each state distributes funding differently to their respective systems. Cities and towns may also subsidize money to private companies as well. Privatized EMS services can get contracts from different cities to be the primary provider of EMS in those areas. EMS systems also generate revenue by charging for their services. These charges are usually for the transport and care that they provide.

Insurance companies play a large role in the payment of EMS services. Because the vast majority of those who utilize and type of emergency medicine have insurance, that is how the service gets paid for. Programs such as Medicare and Medicaid are providers of health insurance for a large number of the senior citizens in the country and they contribute to a large portion of the calls made to EMS services. Unfortunately, when a patient is picked up and transported their selection of hospitals may be limited by the insurance they have. Certain services and care may be out of reach due to the fact that the hospital may not accept the insurance a person carries. This is a big problem in the healthcare world. However, because of specific laws passed, EMTs are required to

provide the proper care to a patient when they arrive on the scene. It is not their job to determine what type of insurance a person has; they are only required to treat the person as best they can without concern for how it is paid for.

If the EMS system in a certain area is fire-based then the majority of the funding will be from state, local or federal governments, if the system is hospital based then the majority of the funding will come from insurance, the billing of their services and from the hospital itself, if the system is privatized then funding will come mostly from insurance and billing, this can become expensive. Private systems will charge more to offset the large costs they have. In many EMS systems, the costs are greater than the revenue taken in so it is difficult to actually turn a profit in the emergency service business.

4.8.2 Overhead and Variable Costs

The costs of EMS can be divided into overhead costs and variable costs. The overhead costs are those that are one-time costs such as buildings, vehicles, licensing, and communication equipment. Variable costs are those that are constantly changing or cannot be adequately predicted. Examples of variable costs include medical supplies, upgrades on equipment, radios, both stationary and hand-held, and repairs and maintenance on buildings and vehicles.

The vehicles used in an EMS system vary from ambulances to helicopters. These are relatively expensive items, considering the modifications they require to be useful to an EMS system. There are certain specifications for each type of vehicle regulated by the state before they can be used for emergency care. Each vehicle must be equipped with

the proper medical supplies and medical tools. Certain things included are defibrillators and trauma control supplies as well as the most common supplies used to care for someone in an emergency situation. Unfortunately, an ambulance is a constantly depreciating vehicle. They need to be fueled, kept in working order, and quickly repaired if needed. Vehicles also need to be stored. They need to be insured and registered for and this all costs a certain amount of money each year. This is budgeted in every EMS system because it is absolutely essential. A helicopter must be kept at an airfield and the ambulances must have proper garaging where they can be suited with the proper medical supplies on a daily basis. The vehicles are essential to any EMS system. They need to be able to transport patients quickly and safely and also need to have the room where an EMT can perform his duties on the patient in a sufficient manner. Laws and policies regulate all the details and rules by which EMTs operate.

Communication is vital in the EMS industry, the dispatchers need to be able to contact the fire department, police department and EMS, and the medics need to be able to contact the hospitals to speak with the doctors. The equipment used in EMS is constantly improving and getting cheaper the more the technology improves. Phones, hand-held radios, consoles, CB's and walkie-talkies are just a few of the tools used to communicate in and emergency situations. All this equipment must be kept in good-working order and may sometimes be upgrades when new technology is created. Towers sometimes need to be built and maintained as well. Also along with the communication equipment is recording equipment to record all the calls placed over 911. The good communication between parties doesn't cost anything but the equipment used to pass

information along and receive instruction is very expensive. The 911 services themselves have to be paid for, usually by the state or area in which it is used.

In current times, computers are used virtually everywhere, EMS is no exception. Computers are used extensively and have to be accounted for when figuring the cost of any EMS system. Computers are used for record keeping; call recording, communication, and information technology. Computers need the proper software to operate in an EMS environment. This equipment is very expensive and can become outdated quickly. It needs to be upgraded and updated on a regular basis and this can cost quite a bit of money.

An EMS system cannot work without a good staff of employees. Positions in emergency care include emergency medical technicians (EMT), call-takers, dispatchers, drivers, paramedics, firemen, administrative personnel, and instructors to properly train these people. Employees need to be trained, paid, given certain benefits, insured and licensed. This is all budgeted for, when creating an EMS system. There cannot be a good EMS system without good employees so it is important to pay them fair wages as well as good benefits. The amount paid and benefits given vary depending on the area located and the type of system used. Proper training is required to give quality care to those who need it. Many hours of instruction are needed before someone can go and be an EMT or dispatcher or first responder. Those who instruct in this particular field need to be compensated for. EMS employees also need to be covered in terms of liability. They require licensing, which costs money on a certain timely basis. They also require insurance; insurance against malpractice lawsuits or accidents involving patients. They also require insurance for if and when they may be injured while working. If the EMS

system is fire-based, the chances are good that these people will be considered employees of the county, town, city and or state in which they work. If the system is hospital based, they are considered employees of the hospital and are therefore paid by the hospital through the revenue the hospital takes in through patient care and EMS.

Every aspect of EMS is linked to money in some way or another. Every little thing must be budgeted for and taken into account when planning a proper EMS system. Every employee must be paid, every piece of equipment must be funded, and every vehicle must be purchased, maintained and insured. All the services must be paid for in some way. Funding can come from a variety of sources. In the healthcare industry, the key is to find every possible way of funding the system. No matter what type of EMS system is used or who runs it, the expenses must be accounted for and the income must be budgeted in properly. EMS is an expensive business and it is very complicated in a financial sense. As long as everything is accounted for, the system can work in an efficient, productive manner.

Chapter 5: Community Evaluation

It is necessary for a community to periodically review and possibly revise its emergency service policies. Going over regulations and procedures can ensure that the community is getting the care it needs and deserves. Part of this review would be to evaluate its current system and the main provider of this system. There are a few main steps to the evaluation that will guarantee it is done properly and thoroughly. The first

step would be to define the resources of the community. This would entail specifying exactly what kinds of services are already in place. Things to take into consideration would be the location of all local fire, police and emergency dispatch stations, the number of personnel allotted to each of these departments, the amount of money budgeted for each of these departments, as well as the amount willing to be spent on emergency services. If the city or town is having financial difficulties because of the costs of emergency response, alternatives must be considered. Staffing costs money as does training and equipment. Without proper funding, emergency services will become poor and the people of the city or town will suffer because of it.

The community must determine what needs it has as far as emergency response is concerned and what characteristics of emergency services are the most important to their particular area. The community should look at how much can be spent on emergency response and try to obtain the best possible service for that amount. This could be a large factor in deciding who the main provider will be. The model described previously should be used as a guide to establish who can provide the best care and service to a community at a reasonable cost to the tax-payers. It should also be used to evaluate the current system in place. The model can uncover areas that need improvement and can also offer options by looking at the advantages of alternate providers. By prioritizing and being fiscally efficient, a community should have no problem providing the best emergency care for every man, woman and child.

After studying a model of EMS and analyzing its differences, a community is then ready to evaluate its own system. The following model lists the important attributes that make up the differences between the different types of systems. To the right of each

attribute is a ranking for each type of EMS system, 3 or 2, 3 being the best. This is the model that will be used by communities as a basis for comparison for its evaluation.

Ranking of Attributes by Type of System

Attributes	Fire Based	Hospital Based	Privatized
Efficiency of Staffing	3	2	2
Staffing Quality (Training)	2	2	3
Secondary Training (fire fighting)	3	2	2
Management of EMS (Medical Director)	2	3	2
Communication Between Ambulance Crew and First Responders	3	2	2
Response Time	2	2	2
Efficiency of Vehicles and Equipment	2	3	3
Cost of Operation	3	2	2
Quality of Equipment	2	3	3
Unbiased Deliver to Hospitals	3	2	3
Communication with Other Responders	3	2	2
Mass Casualty Effectiveness	3	2	2
Fluidity from Ambulance to Emergency Room	2	3	2
Ambulance Crew Feedback from Hospital	2	3	2

Table 5.1

The next step in the evaluation process is for the community to decide which attributes are most important. This requires background research into the needs and desires as well as the resources of the community. Once these have been established, the following table can be used to evaluate the current system and decide which type of system works best for that community. This is done by ranking the attributes in the first empty column to the right of the attributes under the heading, Community Ranking. Either a 3 or a 2 should be placed in each row depending upon the importance of each particular attribute for the community. Since there are 14 attributes, seven 3's and seven 2's must be placed in the boxes. The following table is an example of how a community might complete the community ranking.

Ranking of Attributes by Type of System

Attributes	Community Ranking	Fire Based	Hospital Based	Privatized
Efficiency of Staffing	3			
Staffing Quality (Training)	3			
Secondary Training (fire fighting)	2			
Management of EMS (Medical Director)	2			
Communication Between Ambulance Crew and First Responders	2			
Response Time	3			
Efficiency of Vehicles and Equipment	3			
Cost of Operation	2			
Quality of Equipment	3			
Unbiased Deliver to Hospitals	3			
Communication with Other Responders	2			
Mass Casualty Effectiveness	2			
Fluidity from Ambulance to Emergency Room	3			
Ambulance Crew Feedback from Hospital	2			

Table 5.2

After this has been completed, the next step is to compare the community's rankings with those of each type of system. This will compare and contrast the needs and desires of the community with attributes that it currently possesses as well as provide a recommendation for which type of system is most suitable for the community. This is performed by taking the difference of the community ranking of each attribute and the ranking of each attribute for each type of system. Once this is completed, the columns of the differences for each type of system should be totaled at the bottom. The lowest summed number at the bottom is the closest type of system to the needs and desires of the community. The following table is an example of how this is done.

Ranking of Attributes by Type of System

Attributes	Community Ranking	Fire Based	Hospital Based	Privatized
Efficiency of Staffing	3	0	1	1
Staffing Quality (Training)	3	1	1	0
Secondary Training (fire fighting)	2	1	0	0
Management of EMS (Medical Director)	2	0	1	0
Communication Between Ambulance Crew and First Responders	2	1	0	0
Response Time	3	1	1	1
Efficiency of Vehicles and Equipment	3	1	0	0
Cost of Operation	2	1	0	0
Quality of Equipment	3	1	0	0
Unbiased Delivery to Hospitals	3	0	1	0
Communication with Other Responders	2	1	0	0
Mass Casualty Effectiveness	2	1	0	0
Fluidity from Ambulance to Emergency Room	3	1	0	1
Ambulance Crew Feedback from Hospital	2	0	1	0
		10	6	3

Table 5.3

In this case, since the privatized system has the lowest difference between needs and desires of the community and attributes of the type of system, a privatized system would be ideal. It is the conclusion of the project that there is no one best type of EMS system and instead it depends on the particular community. No community is the same and each has its own resources and requirements for EMS service. Since this is true, it is unknown which type of system would work best for Worcester, MA, but this report provides a tool for the city to use in order to better understand the EMS system and ultimately obtain the best EMS service it demands.

Appendix A

DEFINITIONS OF RELEVANT EMS TERMS (Massachusetts)

Massachusetts State Laws Provides a list of definitions in Chapter 111C, Section

Ambulance- any air craft, boat motor vehicle or any other means of transportation, however named whether privately or publicly owned, which is intended to be used for, and is maintained and operated for, the response to and the transportation of sick or injured individuals.

Ambulance service- the business or regular activity, whether for profit or not, of providing emergency medical services, emergency response, primary ambulance response, pre-hospital emergency medical care, with or without transportation, of sick or injured individuals by ambulance.

Board- the emergency medical services system advisory board established under section 13.

Commissioner- the commissioner of public health.

Department- the department of public health.

Emergency- a condition or situation in which an individual has a need for immediate medical attention, or where the potential for such need is perceived by individual, a bystander or an emergency medical services provider.

Emergency medical services- the pre-hospital assessment and treatment and other services utilized in responding to an emergency or provided during the transport of patients to appropriate health and care facilities as defined in regulations promulgated by the department.

EMS- emergency medical services.

EMS first responder- a person who has, at a minimum successfully completed a course in emergency medical care approved by the department pursuant to section 201 of chapter 111 and who provides emergency medical care through employment by or in association with an EMS first response service.

EMS first response- the dispatch and response of the closest, most appropriate EMS personnel or EMS vehicle in the shortest practicable amount of time by a qualified EMS first response service.

EMS first response service- the business or regular activity, whether for profit or not, by a qualified EMS provider, designed as a service zone provider for the purpose of providing rapid response and EMS.

EMS first response vehicle- any aircraft, boat, motor vehicle or any other means of transportation, whether privately or publicly owned, which is intended and is maintained and operated for the rapid response of EMS personnel, equipment and supplies to ambulance service and is not utilized for patient transport.

EMS personnel- EMS first responders and emergency medical technicians.

EMS plan- a plan that includes an inventory and assessment of EMS resources and a plan for the optimal maintenance, coordination and utilization of those resources (i) to improve the EMS system and its component elements, and (ii) to coordinate with all state and municipal public safety agencies' mass casualty and other public emergency plans.

EMS provider- an EMS first response service, an ambulance service, a hospital including, without limitation, a trauma center or an individual associated with an EMS first

response service, an ambulance service or a hospital engaged in providing EMS, including, without limitation, an EMS first responder, a medical communications system operator, an emergency medical technician and a medical control physician, to the extent such physician provides EMS.

EMS system- all EMS providers including, without limitation, personnel, EMS first response services, ambulance services, hospitals, including, without limitation, trauma center and equipment; communications systems linking them to each other; training and education programs; the regional EMS councils and all of their operations; EMS plans, protocols, statutes, regulations and guidelines; and all components of such system, and their interaction with each other and with patients, providing equally for all patients to quality care, operating under the leadership and direction of the department, as more specifically described in section 2.

EMS vehicle- an EMS first response vehicle or an ambulance.

Emergency medical technician or “EMT”- a person who has successfully completed a course in emergency medical care, approved by the department or offered by an accredited course sponsor, and who is certified by the department. The term “emergency medical technician” shall include EMT-Basic, EMT-Intermediate and EMT-Paramedic.

Emergency response- the dispatch and response of the closest appropriate ambulance, EMS personnel and other EMS vehicle to an emergency in the shortest practicable amount of time in conformance with the service zone plan.

Hospital- a hospital licensed or certified by the department pursuant to section 51 of chapter 111 or other applicable law, with an emergency department, and the teaching hospital of the University of Massachusetts Medical School.

Local jurisdiction- an entity empowered by the legislative body within a city, town, fire district or water district to select service zone providers, including, but not limited to, a city council, board of selectmen, board of aldermen, mayor, or town manager.

Medical control- the clinical oversight by a qualified physician to all components of the EMS system, including without limitation, treatment protocols, medical direction, training of and authorization to practice for EMS personnel, quality assurance and continuous quality improvement

Medical direction- the authorization for treatment established in statewide EMS treatment protocols provided by a qualified medical control physician to EMS personnel whether on-line, via direct communication or telecommunication, or off-line via standing orders.

Primary ambulance response- first line ambulance response, pre-hospital treatment and transportation by an ambulance service selected and designated by a local jurisdiction as a service zone provider pursuant to section 10.

Primary ambulance service- the business or regular activity, whether for profit or not, by a qualified ambulance service, designed by a local jurisdiction for the purpose of providing rapid response and pre-hospital EMS, including, without limitation, patient assessment, patient treatment, patient preparation for transport and patient transport to appropriate health care facilities, in conformance with the service zone plan as defined in section 10.

Region- a geographic area of the state defined by the department in regulation as an EMS planning area.

Regional EMS council- an entity created under section 4.

Service- an EMS first response service or an ambulance service.

Service zone- a geographic area defined by and comprised of one or more local jurisdictions, in which a local jurisdiction may select and the department shall designate an EMS first response service and an ambulance service to provide EMS first response and primary ambulance response to the public within that defined geographic area, pursuant to section 10.

Service zone provider- EMS provider, selected by a local jurisdiction and designed by the department to provide primary ambulance service or EMS first response, or both, to the public within a service zone, pursuant to section 10. A service zone provider shall be staffed and equipped to be available for primary ambulance service or EMS first response 24 hours a day, seven days a week.

Special population- any person or group of persons with unique medical, physical or social problems that require other than customary emergency care.

These definitions do not apply to all states but are from the Massachusetts Laws concerning EMS.

Appendix B

Massachusetts Ambulance Regulations 2000

CLASS I

- Used for emergency dispatch and transport of sick or injured.
- Any Class I ambulance must conform to the standards set by the United States Department of Transportation on Ambulance Design Criteria
- A Class I ambulance must be equipped with the minimum equipment described in “Vehicle Equipment Guidelines- Class I”
- They will be equipped with the proper medical supplies described in “Medical Equipment and Supplies-Class I”
- They will be equipped with the supplies to gain access to the patient described in “Equipment to Gain Access-Class I”

CLASS II

- Used for scheduled transportation by prior appointment of persons having known and non-emergent medical conditions. It may also be used as a back-up ambulance in situation where a Class I is not available.
- Must also conform to the standards set by the USDT.
- Must be equipped with the proper supplies described in the same publications with the exception of the designation for Class II ambulances.
- Class II ambulances will not be dispatched to the scene of an emergency except as a backup when a Class I is unavailable

CLASS IV

- “Air Ambulance”-aircraft used to provide safe air transportation of sick or injured persons
- Must conform to standards set by Federal Aviation Administration.
- Must be able to carry a person on a stretcher, horizontally, the cabin area must have a minimum of 30 inches of space over the torso, measured along the center of the stretcher.
- The cabin must be big enough for the EMT to care for the patient
- The doors of the aircraft have to be big enough to accommodate the patient on the stretcher.
- The cabin has to be big enough to accommodate the proper use of any medical equipment.
- The aircraft must be equipped with the proper supplies specified by the requirements in “Medical Equipment and Supplies-Class IV

CLASS V

- Vehicle that does not meet any of the minimum standards by design or by construction of any other ambulance class. However, such a vehicle may be used in the transport of a patient with sufficient room so an EMT may administer care to the patient.
- May be dispatched to the scene of an accident to deliver personnel or supplies
- Vehicle must be equipped with the minimum requirements set forth in “Vehicle Equipment Guidelines-Class V”

- The same goes for medical supplies
- Vehicle should not be used in transport except in the case of a backup when a Class I or II is not available
- “A service licensed to operate and maintain a Class V ambulance, must also be licensed to operate and maintain a Class I ambulance, or provide evidence of a written cooperative arrangement by which a Class I ambulance, and it’s first backup as required in CMR 170.385, are readily available to provide emergency medical transportation in the regular operating area of the service.”

Equipment

- All ambulances must carry the appropriate equipment based upon the level of care designated to them.
- All equipment must be kept in proper working order
- All Defibrillators on ambulances have to be approved by the medical director of the ambulance company.

Ambulance Service License

BLS-\$200 biennially

ALS-\$300 annually

INSPECTION OF AMBULANCES

-premise

-storage

-Records (employee application forms, policies and procedures, Reports of calls for service, accident reports, patient trip records, any info on complaints filed against ambulance company)

Appendix C

Priority Call Information

(Massachusetts Emergency Medical Services Public Web-site)

PRIORITY ONE: Immediate Life Threatening

Immediate patch to medical control request.

Override other traffic, if necessary.

Patch to alternative hospital, if necessary.

Clinical Justification:

Cardiac Arrest Unstable Cardiac

Respiratory Arrest Unstable GI Bleed

Multiple Trauma Airway Obstruction

Acute Pulmonary Edema Major Head Injuries

Anaphylaxis

PRIORITY TWO: Life Threatening

Patch as soon as possible to routine medical control facility.

Clinical Justification:

Suspected Cardiac Symptomatic Cervical Injuries

Stable Trauma Unstable Medical (e.g., diabetic reactions)

Coma (etiology unknown) Suspected Fractures/Dislocations of Joints

CVA (knee, elbow, ankle)

PRIORITY THREE: Routine

Patch to routine medical control facility as soon as channel is available.

Clinical Justification:

Minor Lacerations and other Soft Tissue Injuries.

Suspected Minor Fracture without Circulatory or Nervous System Compromise.

Other Non-Acute Medical Complaints.

PRIORITY FOUR : Other

Administrative information only - patch only if no other traffic requires channel.

Clinical Justification:

Use Only if Patient Does Not Meet PRIORITY 1 or PRIORITY 2 Criteria.

Appendix D

TRAINING

(page 16 of EMS –A guidebook for Fire Based Systems and MA 111c)

DOT-federal Regulations relating to ambulance design and manufacturing requirements

	IAFF National Guidelines	MA 111c (Training)
First Responder	The First Responder uses a limited amount of equipment to perform initial assessment and intervention and is trained to assist other EMS providers.	Programs must write proposal and be approved by OEMS
EMT-Basic	The EMT-Basic has the knowledge and skills of the First Responder but is also qualified to function as a minimum staff for an ambulance. Skills include automatic defibrillation.	110 H DOT Defib>only with approved ambulance service
EMT-Intermediate	The EMT-Intermediate has the knowledge and skills of the preceding levels, but in addition can perform essential advanced techniques including manual defibrillation and administer first line ACLS medications.	220 H (80 field work) State approved DOT program Defib Skills: IV; EOA
EMT-Paramedic	The EMT-Paramedic has demonstrated the competencies expected of a Level 3 provider, but also can administer additional interventions and medications.	800-1, 500H (80 field work) DOT Defib Skills; EOA; M.A.S.T; drug administration

“One fundamental area of disagreement among many EMS professionals is the debate about whether states should continue to have exclusive control over the licenses and credentials of EMS providers. A national accreditation after the completion of a national exam would facilitate career mobility and advancement. Nevertheless, EMS professionals must demonstrate competence in the emergency medical care system specific to state and local jurisdictions. EMS professionals should stay informed about

these issues and remain active in their local unions and professional societies to influence the direction taken by the profession.” (Moore)

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