IQP MQF 2842

Researching the 9-1-1 System and EMS Response

An Interactive Qualifying Project

Submitted to the Faculty

of the

WORCESTER POLYTECHNIC INSTITUTE

in Partial Fulfillment of the Requirements for the

Degree of Bachelor of Science

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Abstract

Numerous 9-1-1 calls for EMS (Emergency Medical Services) are made every day across the United States. The people that make these calls receive the care they need and rarely encounter any problems with the 9-1-1 system. However, there may be issues that the patients are not aware off. For example, the crew members that responded may not have arrived as quickly as they could have, which may have be the difference between life and death. A reduction in the time it takes to dispatch EMS is hugely beneficial to all parties involved in an emergent situation.

The goal of this project isn't to create a product to accomplish the reduction in dispatch time or even find a solution to the time delay in responses but rather to examine the ongoing efforts to improve response times to 9-1-1 calls. This project reviewed two major parts of the EMS system, specifically the 9-1-1 call taking and dispatching portion as well as the organizational structure of EMS. The research of the 9-1-1 system focuses on the evolution of 9-1-1 and all of the different sub-systems that exist within it. Then information on the components of the PSAP (Public Safety Answering Point) and the tools used by dispatchers is presented. The second chapter finishes by examining the statistics of 9-1-1 calls across the United States. The third chapter looks at EMS organizations beginning with their structure. This includes the personnel and equipment that EMS organizations employ. Then this report presents the statistics and reports of EMS agencies across the US. In particular, the annual report of Boston EMS is studied and presented. The third chapter finishes with an analyzation of the vital statistics that Boston EMS publishes every year.

This report provides an opportunity for future IQP teams to find solutions to the challenge of reducing dispatch time for EMS departments across the United States. It will allow future teams to focus on specific locations in the 9-1-1 and EMS systems where delays in response times are present and use the experience gained to reduce those times. The social impact of this project will result in faster response times to 9-1-1 calls which will improve the quality of care that patients receive.

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CHAPTER 1. Finding Delays in Emergency Response

1. Introduction

Six hundred thousand 9-1-1 calls are made every day in the US. (National Emergency Number Association, 2014). When those three buttons are pushed on a phone, a series of tiny, electrical signals travel through miles of wire and air to connect one person to another. These people are a caller in distress and a person that can help. A significant number of these 9-1-1 calls, calls for help, are for a medical emergency. When someone falls and breaks their leg or over exerts themselves and has a heart attack, the men and women of Emergency Medical Service (EMS) organizations across the US respond with the knowledge and equipment needed to save a life. The patients that are in need of help wait an average of just over eight minutes for EMS providers to arrive at a scene (Elevaed Medical Inc., 2011). This IQP focuses on collecting data on 9-1-1 calls and EMS responses. The purpose of doing this is to provide the foundation for future projects to work on reducing dispatch and response times for EMS organizations across the US. A recent study that was published in BMJ showed just how effective a reduction of time without care is. They revealed that a mere five-minute decrease in EMS response time almost doubled the chance of survival in most cases of cardiac arrest outside of a hospital setting (Pell, Sirel, Marsden, Ford, & Cobbe, 2001).

The goal of this project is to gather information and statistics on both the 9-1-1 system and EMS organizations. The first thing that is examined in this project is the current 9-1-1 system and the changes that are happening to it in the United States. Examining the transition from a landline only system, to adopting cell phones, and onto the most recent generation, NG9-1-1 (Next Generation 9-1-1), provides an opportunity to gather information on equipment and signal paths. The switch to NG9-1-1 involves changing from the phone based 9-1-1 system to an IP based 9-1-1 system. The advantage of an IP based 9-1-1 system is that it allows for easy integration of all the major forms of communication that are currently used. The downside of this transition is that it is costly and, in large parts of the US, is still completely unnecessary. The largest reason behind these areas not moving beyond basic 9-1-1 service is the simple fact that

they are still without Cellular coverage or internet access. The second theme that is examined in this project is the organization and statistics of EMS providers, calls, and responses. Statistics were obtained from the city of Boston's Emergency Medical Services. Information that was collected included the types of calls, the available assets, the locations of calls, and the call volumes. This information then allowed us to examine trends in EMS and supply the data necessary to reduce the dispatch times of medical providers.

This report starts by examining the history of 9-1-1, specifically the legacy systems that were created with the birth of 9-1-1. Then it moves on to cover the architecture and call flow of legacy, enhanced, and next gen 9-1-1 systems including the equipment and personnel involved. Next chapter two covers the systems that PSAPs (Public Safety Answering Point) use for receiving and responding to 9-1-1 calls. The equipment that is used in PSAP's, specifically the computer aided dispatch software, is described and the role it plays in NG9-1-1 is presented. The final part of Chapter 2 focuses on the statistics of 9-1-1 calls in the United States including the volume and methods of making 9-1-1 calls. Chapter 3 of this report reviews the organization and structure of EMS organizations and the statistics of EMS responses. This chapter begins with an explanation of EMS organizational structure starting with the leadership and command. Then the chapter moves on to discuss the personnel and vehicles used in EMS organizations. Next this report covers the statistics on the function and operation of the City of Boston Emergency Medical Services. This part of the report starts by looking at the statistics on the types and locations of calls that Boston EMS receive. Then it moves on to look at the response times based on priority. The final theme that this report examines is the statistics on the personnel that Boston EMS employs and the staffing that they run. This report finishes with a discussion of the social impact of this project in Chapter 4.

CHAPTER 2. NG9-1-1 and PSAP Systems

2. Introduction

It's the worst day of someone's life. Their world has fallen apart. They have spent their entire life learning and practicing problem solving skills and preparing to deal with all of the anxiety that comes with this moment. Any number of things could have happened to cause it. Whether it be a fire, a car accident, a robbery, or even a heart attack, one thing is common among all of these incidents, the person has reached their breaking point. They no longer know what to do or how to handle the situation that they are in. What do they do? Who do they turn to and contact for help when they can't help themselves? They pick up the phone and dial 9-1-1.

The goal of this chapter is to describe how the 9-1-1 system works, what happens when 9-1-1 is called, and why the system works the way it does. The history of 9-1-1, the development of its system, and the future of emergency response were researched as part of this project. The purpose of having done this research is to provide background on how 9-1-1 works and to show where and how there are flaws in the system that introduces delays to responses. The hope is that by the end of this chapter, the reader knows and understands how the 9-1-1 system operates. The research for this chapter mostly comes from reports and other documents published by the National Emergency Number Association (NENA) and the Federal Communications Commission (FCC). This chapter describes the history of the 9-1-1 system, its origins and regulations. It also reviews the legacy "classic" 9-1-1 system, its components, and operation. The expansion of 9-1-1 to handle cellular devices is discussed by examining the upgrade to Enhanced 9-1-1 (E9-1-1). This report then reviews the future of 9-1-1, focusing on the development, features, and downfalls of NG9-1-1. Next the Public Safety Answering Points and the systems that they incorporate are described. These systems give the call takers and dispatchers the tools that they need to initiate a response to a 9-1-1 call in a timely

manner. This Chapter ends by examining the statistics of 9-1-1 calls gathered in the United States including call volumes and methods of making 9-1-1 calls.

2.1 History of 9-1-1 System

The 9-1-1 system is at an interesting place in its history in the US. In 1967, the Federal Communications Commission was tasked with creating a single, easy to remember number for all emergency public services to use in the US. The FCC contacted American Telephone & Telegraph (AT&T) and asked them to find an available number that fit the requirements. They went back to the FCC with the number 9-1-1. In those days, the only option for phone communication was a hardwired home phone. This made the entire system and its implementation very simple, and thus the first 9-1-1 call was made in early 1968 (National Emergency Number Association, 2014).

As this new system was being implemented, new technology was released in the telecommunication industry. In a society that was increasingly dependent on instant communication in the United States, the invention of the wireless telephone was long awaited and quickly adopted into society. This also opened up a host of new challenges and opportunities in the world of emergency communications. Suddenly the call taker at the local Public Safety Answering Points had no way of knowing the location of the caller. However, the time it took from an incident happening to a phone call being made was significantly reduced as a witness to an event likely had a cell phone and could call 9-1-1. As this new technology continued to develop, the need to know the location of the caller had to be addressed. Methods of doing this were developed and Enhanced 9-1-1 (E9-1-1) began to stand out as the best option. It was developed in two different phases, Phase I and Phase II. Phase I was very limited in its capability and only provided the PSAP with who the owner of the calling line was and the location at which the call entered into the Public Switched Telephone Network (PSTN). The first officially recognized use of a Phase I E9-1-1 system was in March of 1998 in Allen County, Indiana. Phase II Enhanced 9-1-1 enabled the PSAP to query the carrier for the exact location of a particular cellular device. This was accomplished either through the use of onboard GPS or triangulation using cellular towers. This finally solved the problem of locating a caller. The first implementation of Phase II E9-1-1 took place in St. Clair

County, Illinois, in October of 2001 (Allen, n.d.) (National Emergency Number Association (NENA) Phase I and II Features and Functions Working Group, 2003).

More recently, the telecommunication industry has seen a push to use Internet Protocol (IP) based telephone systems. This again created opportunity to expand and improve the 9-1-1 system; however, it added further problems and challenges. An IP based telephone system allows for the transmission of larger amounts of data, but is more challenging to integrate into the classic 9-1-1 system. In 2003, a conference was held to discuss the creation of NG9-1-1 (Next Generation 9-1-1). The conference created a method that would be used to convert the 9-1-1 system into an IP based system (National Emergency Number Association). An IP based 9-1-1 system creates a potential for the transmission of more than just audio. IP based telecommunication systems can transmit audio, text, images, and video. Some features of NG9-1-1have already seen real world use in the form of text 9-1-1 where callers that aren't able to speak can communicate detailed information to a 9-1-1 call taker. As the standards for NG9-1-1 were written and States across America started to adopt them and implement the system, one thing became obvious; it was going to be expensive. The National 911 Program, run by the Office of Emergency Medical Services at the National Highway Traffic Safety Administration released a report in 2013 titled "Review of Nationwide 911 Data Collection". In the report they included a list of components that were needed to implement a NG9-1-1 system. This list included twelve pieces of hardware and eleven software programs. Unfortunately, there isn't currently information available on a first year cost to implement NG9-1-1, but the United States Congress has required the National 911 program to provide one. They are currently in the process of creating this report, but it will not be available until September of 2017 (National 911 Program, 2013) (National Highway Traffic Safety Administration, 2016).

2.2 The Architecture and Call Flow of a 9-1-1 System

What happens when 9-1-1 is dialed on a phone? It depends on a lot of different things, including some factors that aren't obvious. Is the caller a human? It may seem that the answer is simply yes, but it isn't always the case. There are a number of automated 9-1-1 calls made every year. A home's burglar alarm, a building's fire alarm, even some medical alert bracelets are all automated systems that call 9-1-1 when activated. These automated callers work in a similar fashion as many fax machines. When one of them gets activated, the controller inside these devices picks up a landline and dials 9-1-1. The call then passes through the local telephone network office where it is forwarded to the Public Safety Answering Point. At this point a machine reads a code that is sent along the line and answers the call, printing out the basic information that the alarm provides.

What if the caller really is a human? Once again, the answer depends on a number of different factors. If the caller is calling from a hardwired landline, the call follows the same path as the previous situation with the exception that a person, not a machine answers at the PSAP. If the caller is on a mobile phone, the call goes directly to the nearest cellular tower. From this point the call enters the phone network and travels to either the state police or the county EMA (Emergency Management Agency) office with jurisdiction over the area where the receiving cellular tower is located. A call taker at the PSAP center will answer and direct the call to the local PSAP that will be responding to the 9-1-1 call. A second call taker will answer at this point and complete the call (Fedral Communications Commission, n.d.).

There are a couple of other methods that can be used to contact a PSAP. While these methods are less common, they are gaining popularity in many parts of the US. If the call is from a monitored alarm system, the alarm will contact the monitoring agency's call center. They, in turn will attempt to contact the location where the call is coming from. If they get no response or a response confirming the alarm, they will call the dedicated interagency phone line at the PSAP that is local to the alarm and convey the

alarm's information. If the caller is calling on a voice over internet protocol (VOIP) phone, the call will travel through the internet system at the caller's location and arrive at the phone network's VOIP integration center closest to the local PSAP. At this point, the call will get converted to a standard telephone protocol. The call gets routed to the PSAP where a call taker answers the call. Figure 1 shows a diagram of the physical architecture of current 9-1-1 and NG9-1-1 systems including how they are interconnected.

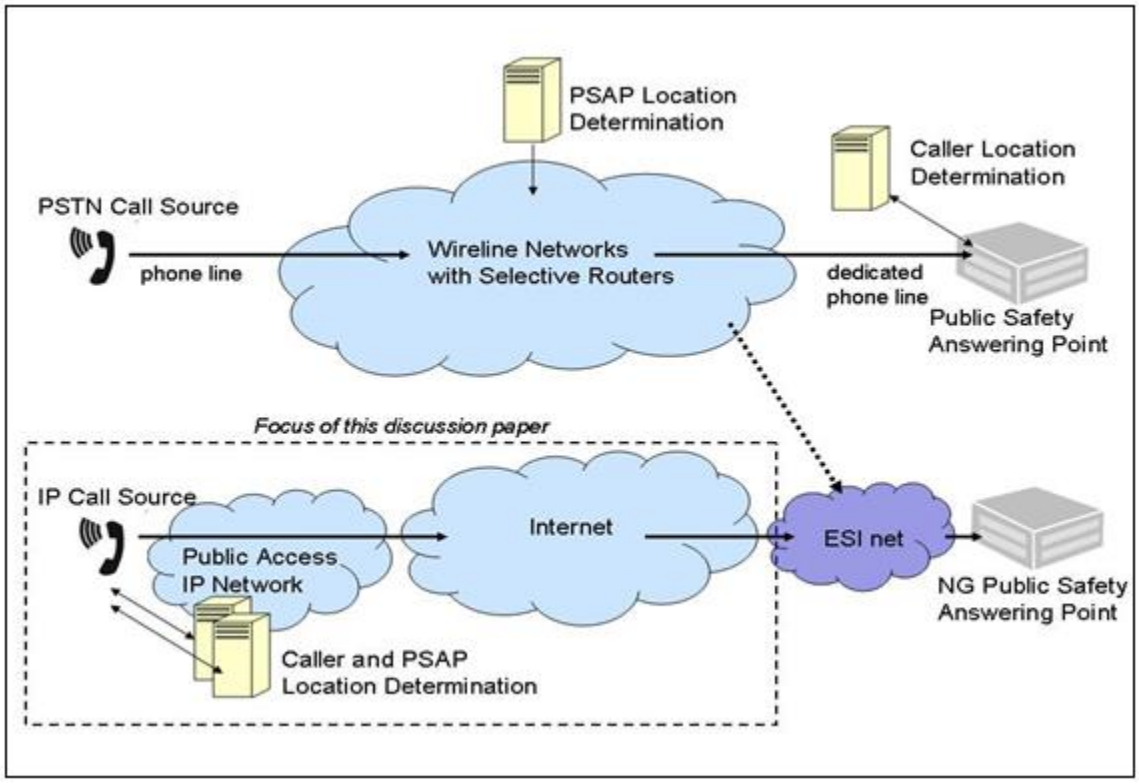

Figure 1: 9-1-1 Physical Architecture (Fedral Communications Commission, n.d.)

The physical architecture shows how the calls get routed through their respective networks. This particular diagram uses the abbreviation PSTN (Public Switched Telephone Network) which encompasses all non-IP based forms of telephone communication. The diagram also highlights where and how the legacy system integrates with NG9-1-1. The top half of the Figure shows the legacy 9-1-1 system while the bottom half shows the architecture of NG9-1-1. The line that connects the Wireline Networks with Selective Routers cloud to the ESI net cloud is what signifies the interconnection between legacy 9-1-1 and NG9-1-1. The introduction of VOIP in 1995

and its rapid adoption into telephone networks started the chain reaction that led to the NG9-1-1 redesign of the 9-1-1 system (Fedral Communications Commission, n.d.).

2.3 NG9-1-1 Architecture and Call flow

The purpose of NG9-1-1 was to redesign the whole way the 9-1-1 system works. Instead of being designed around a hardwired system, NG9-1-1 utilizes VOIP as its platform. The features provided by a VOIP based system allow for the transfer of any information that the internet allows the transfer of. This includes, but is not limited to: voice, images, video, and text. Figure 2 shows a visual of the NG9-1-1 call flow.

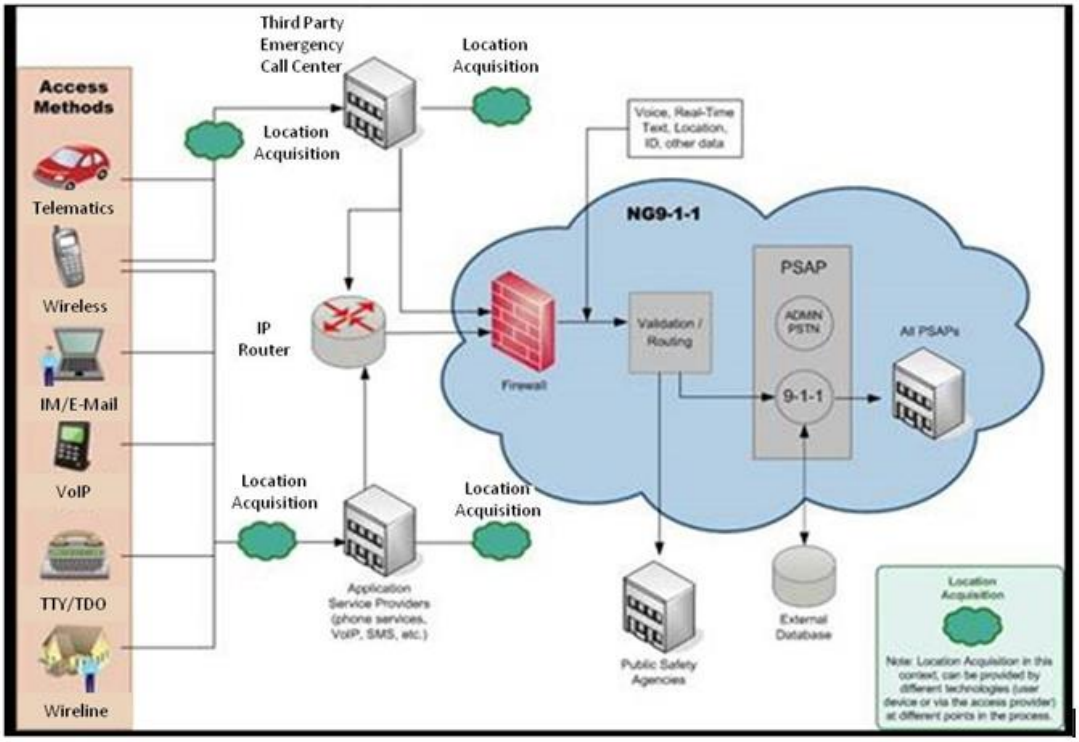

Figure 2: NG9-1-1 call flow (Fedral Communications Commission, n.d.)

As it can be seen from the diagram, NG9-1-1 not only improves the 9-1-1 communications, but also improves the PSAP to PSAP communications. The call routing in NG9-1-1 is, for the most part the same for every type of caller. The calls get converted to IP as close to the caller as possible if it isn't already an IP based call. Either before or after the conversion an organization, likely third party, will perform location acquisition on the caller. Then the call passes through firewalls and security/routing equipment

where it gets passed to the appropriate PSAP's. NG9-1-1 also integrates information databases directly into the PSAP's console. Telematics is an automated call system that exist in some vehicles and medical alert bracelets. When a car calls 9-1-1 if it's been in an accident or a medical bracelet calls 9-1-1 when it's owner falls, that call gets filed under the category of telematics. A TTY (teletypewriter) is a device used by deaf people to make phone calls. The architecture used to pass a call to the PSAP is quite simple as long as the call is originating from a phone, but with access to other communications methods, how are the non-voice based calls integrated into a dispatch console? (Fedral Communications Commission, n.d.)

2.4 Computer Aided Dispatch System

Computer Aided Dispatch is a tool used by many PSAP's in the United States. It utilizes computer software to organize incoming calls and track all the incidents that an agency has. It organizes and displays all the information a dispatcher needs and provides them access to tools that they need to do their job. The result is that the dispatcher is able to provide responders with the information that they need to respond in a timely manner. This resource to the dispatcher becomes very important in the evolution of NG9-1-1. In NG9-1-1, a telephone, radio, and notepad no longer suffice as all the tools necessary for a dispatcher to perform their job. With the introduction of data communication in 9-1-1, the dispatch console now needs the sophisticated equipment needed to interpret the data sent to it. This equipment comes in the form of a Computer Aided Dispatch system which not only provides the ability to generate, track, and record calls, but also interface with the many different forms of data communication being used in 9-1-1 systems. Shown in Figure 3 is a screenshot of a Computer Aided Dispatch system that would be displayed to a dispatcher.

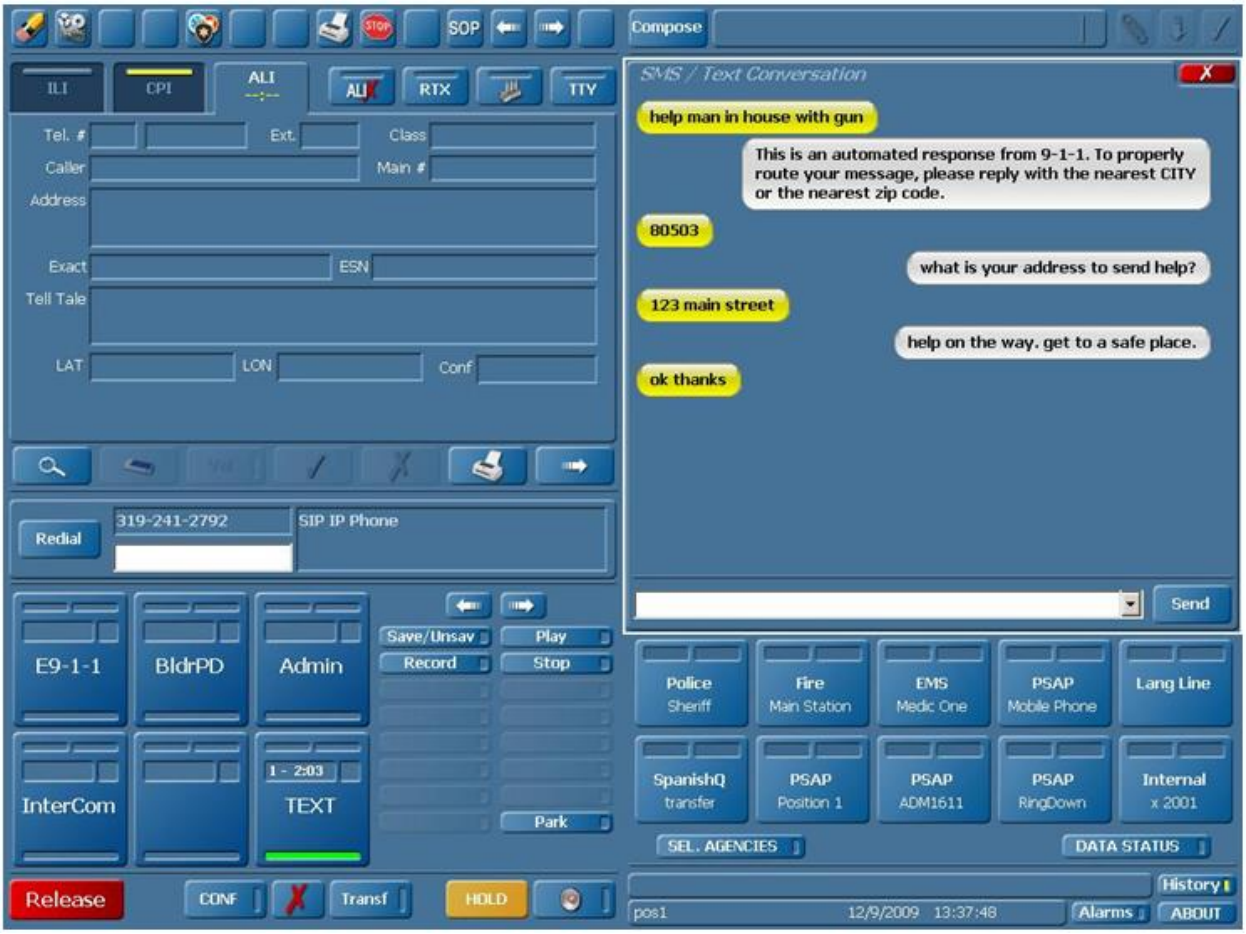

Figure 3: Screenshot of Computer Aided Dispatch System (Fedral Communications Commission, n.d.)

Figure 3 shows the Computer Aided Dispatch screen that dispatchers would be looking at as they work. The upper right shows a conversation with the "caller" who is texting the dispatcher in this case. The upper left of this screen shows the data entry into the call tracking system. The lower left of the screen shows the call taker's incoming communication, this is where phone calls, text conversations, and other telephone communications are organized, managed, and taken. The lower right is what gives the dispatcher access to the radio systems they use to communicate with responding personnel (Fedral Communications Commission, n.d.).

2.5 Statistics on 9-1-1 Calls in the US

In 2013, there were almost 174,000,000 9-1-1 calls made from within 19 of the 27 States that responded to the Review of Nationwide 911 Data Collection. For all of the recorded sub categories, a varying number of the States chose not to provide their data for that statistic. Table 1 shows the collected statistics on 9-1-1 call volumes from 2013.

Table 1: 2013 US 9-1-1 Call Volumes (National 911 Program, 2013)

911 System Operations	
Call Volume	Total call volume: 173,958,226 (19 of 27 states reported a positive value) • The state with the lowest call volume reported 197,000 calls • The state with the highest call volume reported 89,605,140 calls • 8 states chose "no response"
	Total wireline call volume: 46,556,017 (16 of 27 states reported a positive value) • The state with the lowest number of wireline calls reported 78,000 • The state with the highest number of wireline calls reported 30,604,220 • 11 states chose "no response"
	Total cellular call volume: 119,330,763 (18 of 27 states reported a positive value) • The state with the lowest number of cellular calls reported 118,200 • The state with the highest number of cellular calls reported 59,000,920
	Total VoIP call volume: 1,126,398 (11 of 27 states reported a positive value) • The state with the lowest number of VoIP calls reported 3,845 • The state with the highest number of VoIP calls reported 394,802 • 16 states chose "no response"
	Total multi-line Telephone System (MLTS) call volume: 703,073 (4 of 27 states reported a positive value) • The state with the lowest number of MLTS calls reported 1,242 • The state with the highest number of MLTS calls reported 591,576 • 23 states chose "no response"
	Total telematics call volume: 18,378 (3 of 27 states reported a positive value) • The state with the lowest number of telematics calls reported 800 • The state with the highest number of telematics calls reported 17,578 • 24 states chose "no response"
	Total "other" call volume: 1,294,352 (4 of 27 states reported a positive value) • The state with the lowest number of "other" calls had 1,841 • The state with the highest number of "other" calls had 1,286,488

As Table 1 shows, the copper, wireline phones that were used to make every 9-1-1 call in the early years of the system are falling to the wayside. (Bettman, 2014) In this age of instant communication and accessible, modern technology, the vast majority of 9-1-1 calls come from wireless, cellular devices. In fact, approximately sixty eight percent of 9-1-1 calls in 2013 were made from cellular devices. Figure 4 also contains two lesser known categories that while making up a small number of 9-1-1 calls still account for about a half a percent. The first of these is Multi-Line Telephone Systems (MLTS), these

are mostly made up of PBX (Private Branch Exchange) systems which act largely like another phone switchboard added into the communication chain. The most common experience that people have with a PBX system comes in the form of making a phone call to a large corporation. When a phone call is made and an answering machine picks up asking for a party's extension or to hold for the operator, that answering machine and all of the party's extensions are all part of a PBX system. The other interesting statistic that was collected as part of this report were calls received from telematics. The definition of telematics as stated in the Oxford dictionary is "The branch of information technology which deals with long-distance transmission of computerized information." In terms of 9-1-1 telematics deals with the 9-1-1 calls that come from automated call sources. Things like autonomously or manually activated mayday devices that may be mounted in vehicles or worn in the form of a medical bracelet are the most commonly found devices that fall under the category of telematics. These devices often have a component that measures sudden acceleration and long periods of no significant movement. If the devices "trigger" conditions are met, then 9-1-1 is called. They also tend to have some sort of a push button that will also trigger a call to 9-1-1. Figure 4 shows the data from Table 1 in the form of an easier to read pie chart.

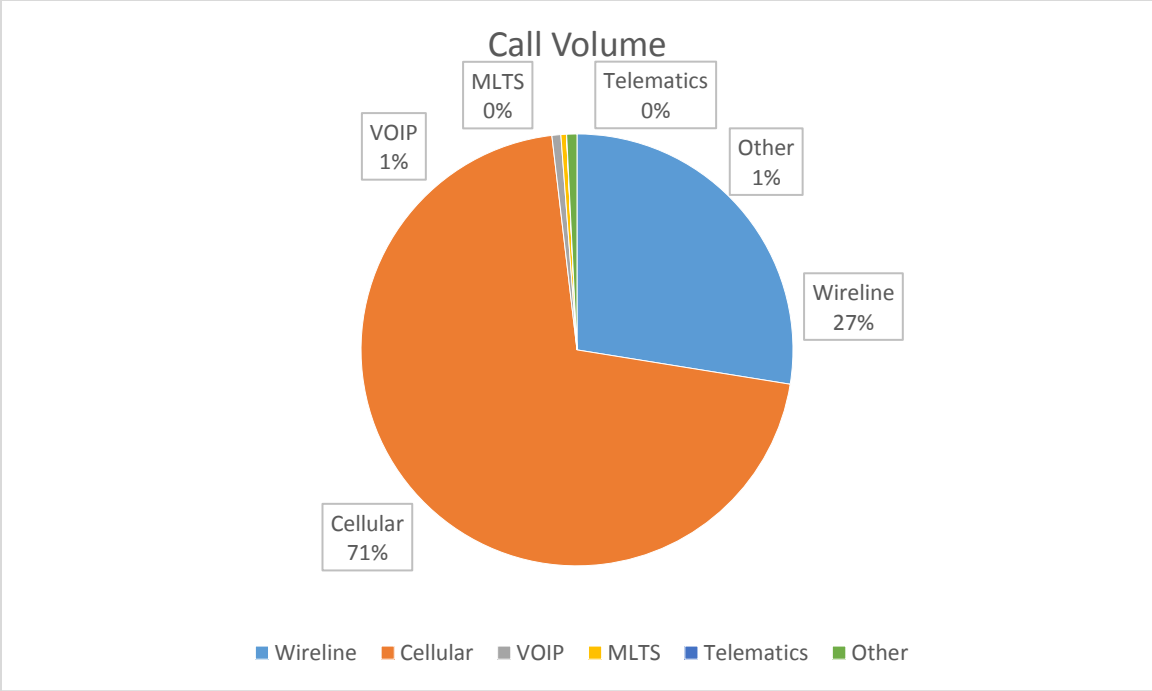

Figure 4: 2013 9-1-1 US Call Volumes

The pie chart in figure 4 shows the source and volume of 9-1-1 calls within a limited number of States in the US in 2013. The States that responded to the survey that this information was taken from are listed in Appendix C. (National 911 Program, 2013) (National Emergency Number Association Data Technical Committee, 2008) (Oxford University Press, 2017) (National Emergency Number Asociation, 2007)

CHAPTER 3. EMS Statistics: Responding to 9-1-1 Calls

3. Introduction

It's 03:48 on Wednesday morning in a dark, cold, cinderblock room with four grown adults lying asleep on recycled dormitory bunks. The whole scene looks like a recreation of an elementary school overnight field trip to a museum. As the clock ticks over to 03:49, the lights snap on and an alarm sounds followed by the calm, deep, professional voice of the over tired, over caffeinated dispatcher. "This is WPKU903 West Newbury Fire Department on the air requesting medical aid to one twenty-three Main St. for a sixty-seven-year-old female experiencing difficulty breathing. Time of tone 03:49." Somewhat grudgingly four people running purely on adrenaline climb out of bed and wander off to respond to the call. How long do these responses take? Will the patient get the care they need in time? These are all questions that typically get answered in annual reports that are issued by the agencies that respond to medical emergencies.

This chapter looks to organize and explain the structure and statistics of EMS. The resources consisting of personnel, vehicles, and equipment that are available to EMS agencies were researched and examined. The annual reports of various organizations were gathered and the different fields of information were compared to identify trends and locate issues that may cause delays in response. The information presented should paint a picture of EMS responses and highlight the locations where improvements can be made to reduce the amount of time from a call being made to 9-1-1 till an ambulance arrives on the scene of the incident.

The annual reports and vital statistics from the City of Boston Emergency Medical Services, which provides EMS coverage for Boston, Massachusetts, were used to provide statistics on EMS responses. Charts that contain the various organizational structures within EMS were created and are included in this chapter. The compatible statistics from the four cities were gathered into a table comparing them to each other. There is historical data available for Boston EMS that was gathered together in a chart to

show the historical tracking of response times, call types, and call locations. All of this information is used by the organizations that gather it to perform quality control on the care that they provide and feed back to those care providers, highlighting where and how they should improve. It is also provides necessary data for organization officials to adjust managing and operating procedures appropriately.

3.1 Organization and Structure of EMS

The organization and structure of EMS is made up of many different parts. The structure can change depending on the type of EMS organization being looked at. Most EMS organizations fit in to one of four different categories: privately run, fire department run, government run, and hospital run. Regardless of which type of organization is being considered, they all tend to have similar components. There are physical components, and human components. The human components contain various groups such as command structures, and personnel classifications. The physical components contain things like vehicles, buildings, equipment, and supplies.

3.1.1 Command Structure

The command structure within EMS varies widely depending on the organization or department that is being examined however, there are certain key elements that generally stay the same across the board. No matter how an organization is designed, it generally has EMS officers that fall into three different categories. These categories are as follows: Executive EMS Officers, Managing EMS Officers, and Supervising EMS Officers. (National EMS Management Association, 2014)

The executive EMS officers are the highest level of management in any organization. They are often referred to as chief, deputy chief, or director. Depending on the organizations status, either being in the private sector or part of a governmental structure, these officers will either manage and report to a board of directors or report to the government official in charge of emergency management. Executive EMS officers are responsible for ensuring that the expectations and goals of the organization are met and that overall, the organization operates at peak performance. The extent of their field work is typically limited to a command or staff position in incidents where a multi-agency unified command structure is established. Their job extends beyond the

day to day operations however to include planning and preparing for future changes and expectations. (National EMS Management Association, 2014)

Managing EMS officers are the middle level of management in any organization. They typically carry the title of captain, coordinator, or manager or chief when accompanied by the name of a division or section. The managing EMS officers are responsible for managing major portions of the organization, acting as department heads, and performing specialist administrative or clinical functions. They are responsible for planning and coordinating the work of all personnel and ensuring the daily operations have all the necessary recourses. They typically operate in an office environment; however, they will almost always respond to incidents where an ICS (Incident Command Structure) is established. (National EMS Management Association, 2014)

Supervising EMS officers are the first level of management in any EMS organization. They carry the title of supervisor or lieutenant depending on the organization. Their responsibility consists of crew scheduling and assignment as well as daily resource management. They typically function in the same capacity as standard personnel and act as the initial incident commander in an ICS when one is activated for an event. (National EMS Management Association, 2014)

3.1.2 Emergency Medical Care Providers

The people that provide medical care in an EMS organization are the whole reason that the organization exists. They come in many different forms and levels of training. The providers that are most likely to be seen in EMS fall into six categories: EMR (Emergency Medical Responder), EMT-B (Emergency Medical Technician – Basic), EMT-I (EMT – Intermediate), AEMT (Advanced EMT), EMT-P (EMT – Paramedic), and Prehospital Physician.

EMR's are the lowest level of emergency medical response. They are not allowed to transport patients. The EMR certification is designed mainly for firefighters and police officers to gain some limited medical certification. They are trained to use basic

airway adjuncts and positive pressure ventilation. They are allowed to suction upper airways and administer oxygen therapy. They are allowed to administer unit dose auto injectors of life saving medications in hazardous material situations. They are capable of stabilizing fractures and controlling bleeding in traumatic injuries. The last things that they are trained to do is move patients and use AED's (Automated External Defibrillators) during CPR (Cardio Pulmonary Resuscitation) efforts. (The National Highway Traffic Safety Administration, 2007)

EMT-B's are the life blood of any EMS organization. They are trained in basic life support and will often be the first medical providers on scene of any incident. They can recognize and treat most medical and traumatic emergencies. They can also provide transport services and will sometimes perform extrication. They also write PCR's (Patient Care Reports) and track the quality of patient care. After every call, they are responsible for cleaning or replacing all supplies and equipment that was used. They must maintain a high level of professionalism as well as both gaining and maintaining patient confidence throughout their entire encounter. They are trained to perform all tasks that EMR's are plus assisting in the administration of certain prescribed medications. They are also able to administer oral glucose and aspirin. Additionally they are allowed to use more advanced fracture stabilization devices. (New York State Department of Health) (The National Highway Traffic Safety Administration, 2007)

EMT-I's are almost entirely phased out now. The EMT-I license was replaced by the AEMT license and those that still exist are few and far between. EMT-I's came in two different varieties, the EMT-I85 and the EMT-I99. EMT-I85 had a smaller set of skills than EMT-I99. The EMT-I85 was created in 1985 and added IV (Inter Venous) therapy and advanced airway management to the EMT-B skill set. Although they added IV therapy to the skills, the drugs are largely the same as EMT-B's except they added Narcan (an opioid overdose drug) and a couple of drugs used to handle diabetic emergencies. The EMT-I99, created in 1999, took the EMT-I skills almost up to those

of a paramedic. It added the ability to perform chest decompressions and cricothyrotomies as well as advanced cardiac monitoring. They were also given the ability to administer various drugs used in the treatment of cardiac arrhythmias. (Mattvct, 2006)

AEMT's, which replaced the EMT-I85 and EMT-I99, have almost the same skill set that EMT-I85's had. The AEMT skills are described as high benefit, low risk advanced emergency medical skills. The AEMT adds Needle decompression, CPAP (Constant Positive Air Pressure) devices, establishing IO (Inter Osseous) access, Tracheobronchial suctioning on previously intubated patients, and administering Nitrous Oxide pain relief to the skill set of theEMT-I85. (The National Highway Traffic Safety Administration, 2007)

The EMT-P is the highest level of medical certification for first responders. They are allowed to perform all of the skills of an AEMT plus the following. They can perform intubations and cricothyrotomies to gain adequate access to a patient's airway. They can perform plural and gastric decompressions to inflate collapsed lungs and decrease pressure on the pericardium. EMT-Ps are allowed to perform a wide variety of pharmacological interventions. They are able to administer medications via every route of administration. They can administer approved prescription medications and infuse blood products. They are also able to access indwelling catheters for administering medications. The last major intervention that EMT-P's are able to perform is ACLS (Advanced Cardiac Life Support). They are able to perform cardiac monitoring, cardioversion, manual defibrillation, and transcutaneous pacing. (The National Highway Traffic Safety Administration, 2007)

Prehospital Physicians are something that is rare in the US, but are still occasionally seen. They are not considered first responders and will only show up at scenes where a EMT-P calls for them. They do not transport patients and as a result travel in fly cars. The Prehospital Physicians can provide triage on difficult cases and are able to provide a more varied care than EMT-Ps are. Since they are full Physicians,

they are not operating under the direction of a medical director and are able to practice medicine under their own license. Prehospital Physicians tend to push higher quantities of stronger medications at higher rates to patients that need it and as a result, typically have a higher success rate with improving patient outcome. (Skow, 2010)

3.1.3 Other Personnel

In an EMS organization, there are many other personnel that are used to make the organization run smoothly. There are various office administrators, cleaning staff, financial experts, legal teams, and billing agents. There are also dispatchers that coordinate all of the organizations resources and take calls for help. They quite often carry the EMD (Emergency Medical Dispatcher) certification, a certification that trains call takers to provide medical care over the phone utilizing the bystanders on scene as their hands, eyes, and ears.

3.1.4 EMS Vehicles

In EMS, there are many different vehicles that are used not only in the treatment and transport of patients, but also the transport of personnel and equipment. The types of vehicles fall into categories of transport vehicles, special operations vehicles, and fly cars. The typical transport vehicles are ALS (Advanced Life Support) trucks, BLS (Basic Life Support) trucks, and Bariatric trucks. The special operations vehicles consist of MCI (Mass Casualty Incident) vehicles, bicycles, and other special operations vehicles. The fly cars are typically supervisor vehicles, but occasionally there are other quick response/intercept vehicles.

ALS trucks (ambulances) are the high end, advanced transport vehicles of the EMS world. To be defined as an ALS truck the truck needs to be staffed by at least one EMT-P and one additional EMT-P, AEMT, or EMT-B. They are required to carry more equipment and supplies than BLS ambulances. ALS Ambulances typically respond to calls where an advanced level of care is required and where injuries/illnesses are immediately life threatening. ALS trucks typically come in the

form of a box truck as the larger area provides more room for equipment and personnel. (Ambulance Service Categories)

BLS ambulances are the bread and butter of the EMS world. A BLS truck will respond to the majority of ems calls. They are staffed by two EMT's or AEMT's. They respond to a wide variety of calls ranging from stubbed toes to cardiac arrests. Their response to advanced calls serves to reduce the time till care is provided. BLS ambulances are either box trucks or vans depending on the service that purchased them. (Ambulance Service Categories)

Bariatric trucks are specially designed trucks that are used to transport overweight patients. They come in the form of a box truck. Bariatric trucks contain specialized equipment that is used to lift and move the patients. They are typically equipped with a lift gate to lift the patients into the truck. The stretchers they have are also larger and utilize hydraulic lift systems. Bariatric trucks are either set up for BLS or ALS. (Smeltmann, 2011)

MCI vehicles are special vehicles that larger organizations use to deal with mass casualty incidents. They carry large quantities of equipment and supplies that is divided into sections that can be used during an MCI. These vehicles also provide communications equipment and can serve as communications centers. In some layouts of MCI vehicles, they are capable of patient transportation. These vehicles are usually based off of bus chassis. MCI vehicles are usually set up with supplies to be capable of restocking ambulances. Figure 5 shows a few of the types of vehicles and setups used for MCI vehicles.

Figure 5: Various Types of MCI Vehicles (Disaster Responce Solutions, INC., n.d.) (W., 2014) (Vaccaro & Heightman, 2014)

Figure 5 shows photos of three categories of MCI vehicles. The first of these, on the bottom, is a trailer. These are commonly used by mid to large size town fire departments. MCI trailers will often be multi-purpose and serve as a rehab trailer during fires just as much as a supply trailer during a medical MCI. The upper right corner shows a supply truck that would typically be used by small cities or private ambulance services. They carry additional supplies and equipment. The upper left corner shows an MCI transport vehicle. They are used by large cities and carry supplies as well as providing transport for a large number of patients in varying conditions. (Raphael M. Barishansky, 2005)

Bicycles are typically operated by private ambulance services and large city fire departments for use during large public events and gatherings. The bicycle allows ems personnel to weave in and out of crowds and respond to emergencies over a variety of terrain. Bicycles carry packs that have all of the supplies the EMT or paramedic needs.

Bike medics are also very popular in airports and sports arenas for their speed and maneuverability. (Bergal, 2017)

Fly cars are mostly used by supervisors, paramedics, physicians and command personnel. They serve to get small numbers of personnel with specialized equipment from one location to another quickly. In some services, fly cars serve to respond to non-transport 9-1-1 calls and prevent ambulances from being tied up. This also can help to prevent overcrowding in emergency rooms. (Vetter, 2006)

3.2 Boston EMS statistics

Every year, most large EMS organizations release an annual report that contains information and statistics on the organization and what it had done over the previous year. Boston EMS is one of these organizations, and provides a quite extensive report. It contains information about Boston EMS's community outreach programs, operational information, and statistics on their year's performance. The statistics that they collect consist of the types and locations of their incidents, response times, and personnel. (City of Boston Emergency Medical Services, 2012)

3.2.1 Types and Locations of Boston EMS Incidents

Boston EMS tracks the number of incidents that occur in each of the Boston neighborhoods. Their reports break down their calls into categories as to what type of incident they responded to. They also include the breakdowns of incidents by priority, level of care, and patient age. In 2011, Boston EMS responded to a total of 108,343 clinical incidents. Out of these incidents, 78,692 resulted in patient transports to a hospital. Figure 6 shows a heat map of the number of incidents that Boston EMS responds to in each of Boston's neighborhoods in 2011.

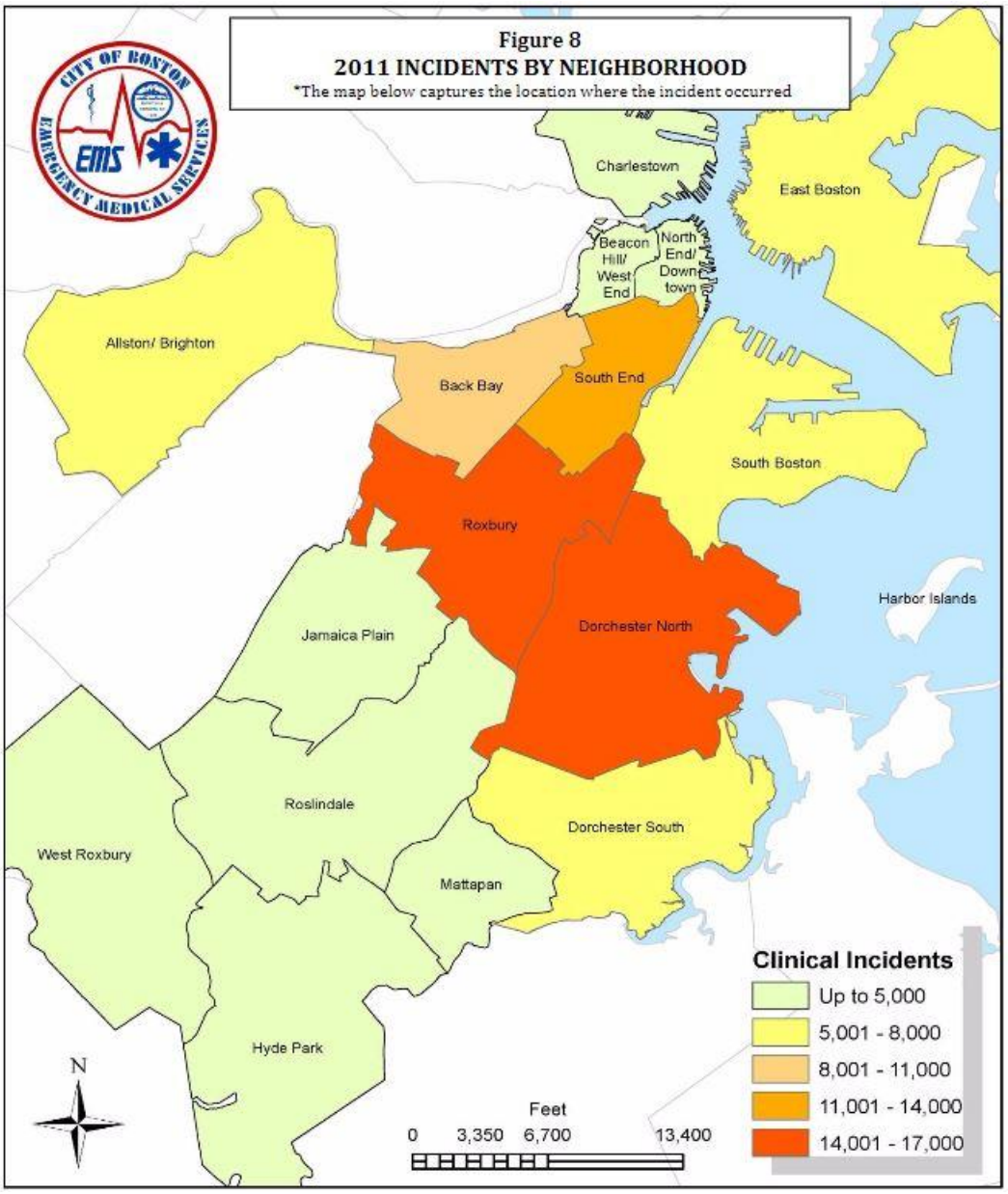

Figure 6: 2011 Boston EMS Incidents by Neighborhood

Roxbury and North Dorchester having the highest number of incidents is not surprising due to the high crime rate. What is surprising though is the low number of incidents in the greater downtown area considering that the population density is higher than most of the surrounding neighborhoods. Appendix A contains the full 2011 Boston EMS annual report including the tables and charts that break down the number of incidents. (City of Boston Emergency Medical Services, 2012) (Location, Inc., 2017) (Urban Mapping, Inc., 2017)

3.2.2 Boston EMS Response Times

Response time is the amount of time that elapses between a call being dispatched and a unit arriving on scene. Boston EMS breaks down their response times based on the priority of the call that they responded to. The priority of the call falls into one of three categories. Priority one calls are the highest priority and typically are made up of major trauma, cardiac arrests, and any other urgent/life threatening emergencies. Priority two calls are mid priority calls and are typically made up of non-major trauma, allergic reactions, and potentially life threatening incidents. Priority three, the lowest priority of call, is the most common type of call and typically consists of broken bones, intoxication, and other non-life threatening illnesses or injuries. Figure 7 shows a chart of the Boston EMS target vs. actual response time in 2011.

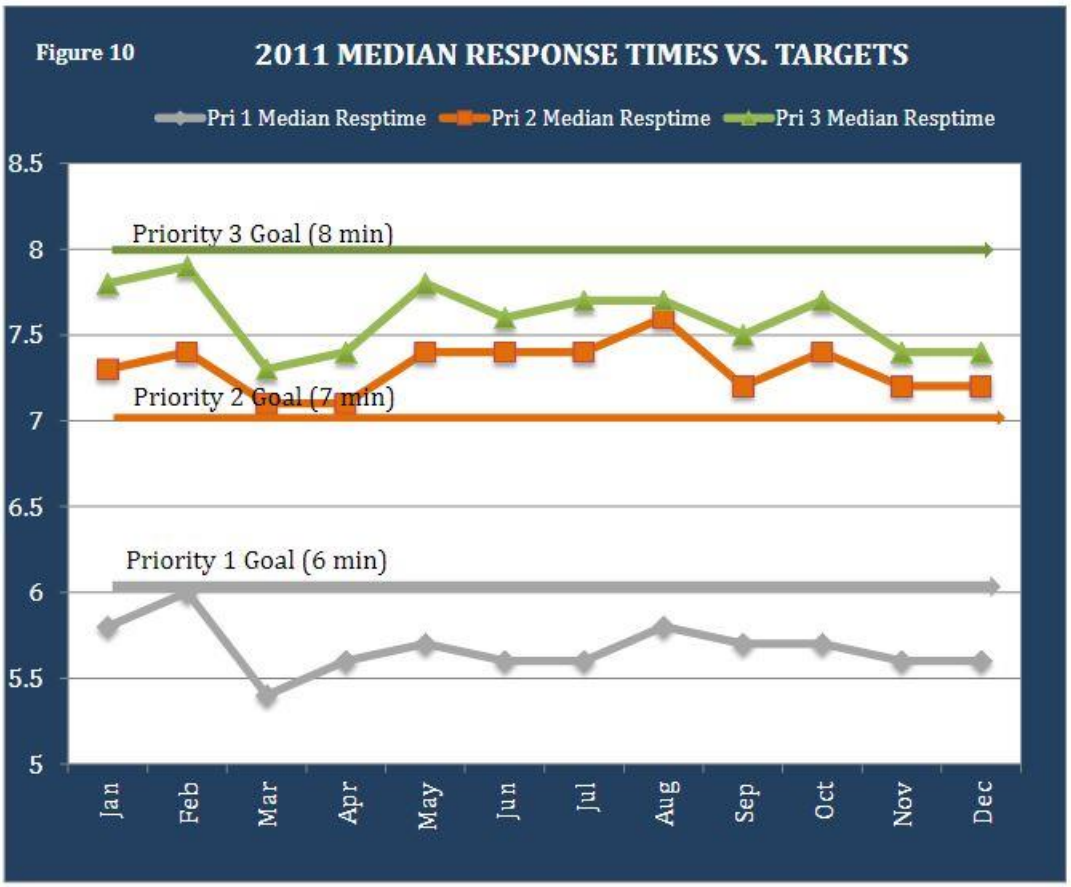

Figure 11 **2011 MEDIAN RESPONSE TIMES**

Priority Level	2011	Goal
Priority 1 (urgent/life threatening)	5.7 minutes	6.0 minutes
Priority 2 (serious/potential life threatening)	7.3 minutes	7.0 minutes
Priority 3 (non-life threatening illness or injury)	7.6 minutes	8.0 minutes

Figure 7: 2011 Boston EMS Response Time

The most interesting feature of figure 7 is the relationship between priority two and priority three response times. In 2011 there was very little difference between the two. This could be due to failures in their system, but another quite likely cause could be human error. Priority one calls often are very obvious, quickly showing that the patient has life threatening injuries. Priority two and three on the other hand regularly have a fuzzy line drawn between them. When on scene, the medical personnel have a clear view of what level of care the injuries require, but the decision of what priority response to initiate is made by the dispatcher or EMT handling the call using only the

information that is given over the phone. This means that if someone calls 9-1-1 and states that they broke their leg (typically not a life-threatening emergency) when they really broke their femur (a leg bone that when broken is considered a possibly life threatening injury) and the dispatcher can't get any further information, they would get a priority three response that would later get categorized as priority two. Therefore, some priority two incidents get priority three response times, resulting in the sub-goal response times shown in figure 7. (City of Boston Emergency Medical Services, 2012)

3.2.3 Boston EMS Personnel

Boston EMS operates with a total of four hundred two personnel working in both the office and the field. Forty-four of these are ununiformed "office" workers and the remaining 358 are uniformed personnel. 241 of the uniformed staff are EMT-B's that work in the field and seventy more of them are EMT-P's. This leaves the remaining forty-seven as non-field service uniformed staff, likely serving as dispatchers. These personnel are spread out in seventeen different stations across the city of Boston. The field staff serve on nineteen BLS and five ALS trucks. They serve the roughly six hundred thousand full time and nine hundred thousand daytime people in Boston twenty-four hours a day all year long. (City of Boston Emergency Medical Services, 2012)

3.3 Boston EMS Over the Years

Boston EMS releases vital statistics every year as part of their annual report. One major feature of having this information is that it makes tracking the progress of Boston EMS very easy. It also allows for the tracking of Boston's EMS needs. Looking at the data from 2011 to 2016 (minus 2012 when they didn't release any data) many obvious, expected trends show up. However, a few interesting points are sprinkled throughout. The total number of clinical incidents has steadily increased over time, but the total number of ALS and BLS responses hasn't. In fact, it has bounced up and down at around 140,000 for the past seven years. This shows that Boston EMS has

improved their resource management and is better at not sending both an ALS and BLS truck to an incident that only needed one or the other in the first place. Another trend that Boston EMS has broken in the last six years is the steady increase of response times. 2016 is the first time since 2012 that their response times have decreased. Unlike the changes in 2012 where response times barely decreased, they managed to shave three tenths of a minute off of every priority of response in 2016. One last point of interest in Boston EMS's structure is the continued trade of paramedics for EMT basics. Over a six-year period from 2011 to 2016 Boston EMS has decreased their number of EMT-Ps by nineteen and increased their EMT-B staff by thirty-six. The editor in chief at the Journal of Emergency Medical Services, A.J. Heightman, interviewed the chief of Boston EMS, James Hooley, in the summer of 2015. One of the points that was discussed in this interview was the use of BLS trucks in favor of ALS trucks and the affect that it had on Boston's EMS. (Journal of Emergency Medical Services, 2015) Appendix B contains a side by side comparison of the vital statistics that Boston EMS has released since 2011. One trend it presents about Boston's use of EMS is that the age of transported patients has increased. The number of transported patients twenty-four and under has decreased while the number of patients over the age of twenty-five that have been transported has increased since 2011. There isn't an obvious answer for why this is, but it could be due to an ageing population in Boston. (City of Boston Emergency Medical Services, 2012) (City of Boston Emergency Medical Services, 2014) (City of Boston Emergency Medical Services, 2015) (City of Boston Emergency Medical Services, 2016) (City of Boston Emergency Medical Services, 2017)

CHAPTER 4. Conclusion

While this project wasn't able to produce a product to assist with the reduction in EMS dispatch time, it was able to collect and organize the data that would be necessary to do so. The history and structure of past, current, and future 9-1-1 systems were discussed and explained. Then the software that is used by call takers and dispatchers was presented along with its integration into 9-1-1. Then the EMS system was discussed, starting with information on the leadership and types of personnel that exist in EMS organizations. Then the report discussed the vehicles that EMS providers use in everyday situations and in unusual planned and unplanned events. Then the report presented the statistics of Boston EMS, both in their 2011 annual report and over a six-year time span.

All of this information comes together in the well tested system that is used throughout the United States and Canada for the public to request emergency medical service. This system works and serves the public all day every day, but it does leave some points where improvements could be made to reduce the amount of time a patient spends without medical assistance. The places that appeared to leave the most room for improvement were call taking and dispatching. The biggest delay that exists in call taking is the time occupied by the call taker obtaining the information that they need. If the caller had the ability to know what information would be needed and have it organized and ready to relay before they made the call a lot of time would be saved. The delay that exists in dispatching is the time occupied by call taking. If the unit that would be receiving a call could get a notification as soon as a call is made, more time would be saved. This would allow the unit to get ready to roll while the call information is being gathered and given to the crew. This would likely be more time saving in rural, volunteer departments than in urban, full time organizations.

This information would be useful in future projects to study the time delays that exist in the system and further projects to find and implement solutions. Removing these time delays can be lifesaving in incidents where seconds count. As the report by Pell, et al stated, a five-minute

decrease in response time could double the chance of surviving a cardiac arrest. This isn't likely to be possible in an urban environment where response times are already around five to eight minutes. In rural EMS organizations however, a five-minute reduction in response time is quite possible due to responses taking up to twenty or thirty minutes.

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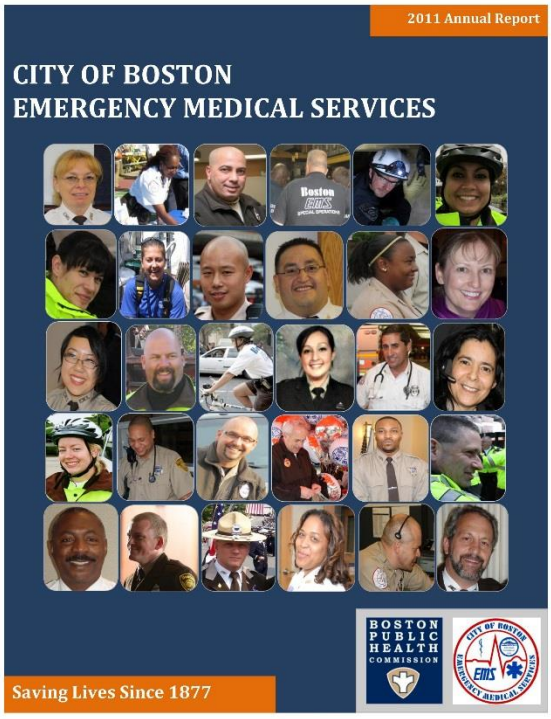
Appendices

Appendix A: Boston EMS 2011 Annual Report (City of Boston Emergency Medical Services, 2012)



BOSTON EMS 2011

ANNUAL REPORT

785 Albany Street · Boston, MA · 02118 · 617-343-2367 · www.cityofboston.gov/ems

78,692 Transports

108,343 Clinical Incidents

358 EMTs & Paramedics

69 Community EMT Course Graduates

477 Car Seats Checked

95% Overall Patient Satisfaction Rating

2,600+ People Trained by the DelValle Institute

18 New Boston EMS EMTs

3,513 People Trained in CPR

5.7 min Priority 1 Median Response Time

1,010 Public Access AEDs in the Database

Saving Lives Since **1877**

9-1-1

THE ONLY NUMBER YOU NEED TO KNOW

TABLE OF CONTENTS

A WORD FROM THE CHIEF

Each and every day Boston EMS EMTs and Paramedics serve the people of Boston with pride. They deliver exceptional pre-hospital emergency medical care 24 hours a day, 365 days a year. While Boston EMS is widely recognized as one of the best emergency medical providers in the country, we continually strive to improve service delivery and elevate our standards of excellence. Our team works tirelessly to bring high-quality, compassionate care to the streets of Boston.

2011 was a year of great achievement for Boston EMS. Our EMTs and Paramedics responded to over 108,000 emergency medical calls and transported nearly 79,000 patients to area hospitals. We continued to surpass our response time goal for urgent/life threatening calls and earned honors both regionally and nationally. The Department graduated a class of 18 new EMTs from the Boston EMS Training Academy and marked the promotions of one Superintendent, two Deputy Superintendents, and one Lieutenant.

Additionally, we officially opened a new Boston EMS Headquarters at 785 Albany Street, consolidating all administrative functions into one building. To better serve our public health and public safety partners, Boston EMS' DelValle Institute for Emergency Preparedness launched an online "Learning Center", which provides access to various emergency preparedness training courses and resources. Further, our Community Initiatives Division continued to provide educational community programming teaching over 3,500 people CPR.

As part of the Boston Public Health Commission (BPHC), Boston EMS strives to improve access to healthcare across the City. In 2011, Boston EMS launched a new program in collaboration with BPHC's Division of Healthy Homes and Community Support to better serve patients with asthma. The "Asthma Project" links patients with severe asthma ages 9-24 to support services that will help them better manage their asthma and improve their quality of life. Through the Asthma Project, Boston EMS has created a model for future support and referral programs that will help improve the overall health of Boston residents.

As Chief of Department, I can proudly say that Boston EMS' greatest asset is our personnel. The achievements we earned in 2011 are a direct result of the hard work and dedication of the entire Boston EMS workforce. While our field staff may be the "face" of the Department, we are incredibly fortunate to have an equally committed and talented support staff that works behind the scenes to ensure a smooth and efficient operation.

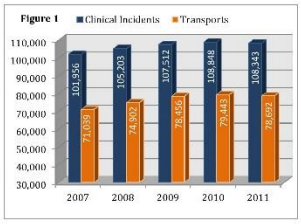
I anticipate that the year ahead will bring new challenges and opportunities for achievement. I am confident that through hard work and dedication, we will continue to strengthen what is already an exemplary organization and reach new heights in the years ahead.

Jim Hooley
Chief of Department

BOSTON EMS AT A GLANCE

Boston Emergency Medical Services is the primary provider of emergency medical services for the City of Boston. As a bureau of the Boston Public Health Commission, Boston EMS is one of the nation's oldest providers of pre-hospital care, tracing its roots back more than 100 years. In fact, Boston EMS has been saving lives since 1877.

Figure 1 ■ Clinical Incidents ■ Transports



With a resident population of over 600,000 which expands to approximately 900,000 people during the work day, the City of Boston is the largest city in Massachusetts, and the 22nd largest in the country. Given Boston's size, diversity, historical significance and designation as the capital city of Massachusetts, Boston EMS operates in an exciting and vibrant urban environment.

The Department employs 350 Emergency Medical Technicians (EMTs) and Paramedics and responds to over 100,000 emergency medical calls each year, making Boston EMS one of the largest and busiest municipal emergency medical services providers in the country. Boston EMS utilizes a two-tier response model offering Basic Life Support (BLS) and Advanced Life Support (ALS) services and leverages the latest advances in both medicine and technology. In addition to patient care, the Department also plays a critical role in the City of Boston's emergency preparedness efforts and provides community programming designed to educate the public about important health and safety topics. The men and women of Boston EMS provide excellent pre-hospital care to every patient they treat and serve the people of Boston with pride and compassion.

Figure 2 **SERVICE AREA OVERVIEW**

Area Served: The City of Boston
Boston Land Area: 45.7 sq mi
Resident Population: 617,594[1]
Daytime Population: ~900,000[2]
Residents Living Below Poverty Line: 19%[3]
2010 Homeless Population: 7,286[4]
Residents Who Report Speaking a Language Other than English at Home: 34%[5]
EMS Services Provided: ALS (Advanced Life Support) and BLS (Basic Life Support)

[1] http://2010.census.gov/2010census/
[2] http://www.census.gov/population/www/socdemo/daytime/daytimepop.html
[3] U.S. Census Bureau, 2008 American Community Survey
[4] Homeless Counts, City of Boston Emergency Shelter Commission
[5] U.S. Census Bureau, 2009 American Community Survey

A YEAR OF REUNIONS

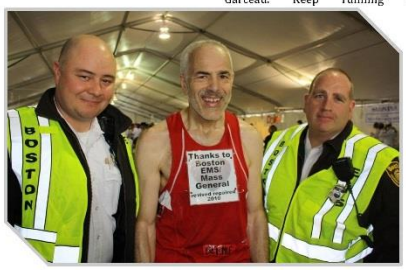
A RUNNER'S TALE

Just a month before what would have been his 14th marathon and fourth Boston Marathon, Bernie Zelitch collapsed on the commuter rail at North Station and went into cardiac arrest. Boston EMS EMTs Mike Regan and Steven Garceau along with Paramedics Greg Bond and Robert Locke responded within minutes and provided lifesaving treatment. Boston EMS revived Bernie with CPR and AED and applied therapeutic hypothermia, a process of cooling the body which helps to protect brain function and improve survival and neurological outcomes of cardiac arrest victims.

Boston EMS EMTs and Paramedics respond to an average of 300 emergency medical calls each day. It is not often that department members have the opportunity to reunite with the patients they treat, but in 2011 several crews had the chance to reconnect with their patients celebrating some absolutely wonderful health outcomes.

Boston EMS transported Bernie to Massachusetts General Hospital for further treatment. After undergoing quadruple bypass surgery, Bernie feared that he would never be able to run again. But not long after his surgery, Bernie began the rehabilitation process. His walk slowly turned into a jog which eventually turned into a run.

Thirteen months after he nearly died, Bernie ran the 2011 Boston Marathon on April 22nd, finishing well ahead of his expected time. Sporting a sign that read "Thanks to Boston EMS/Mass General – Revived Repaired 2010", Bernie served as a running Boston EMS testimonial, literally. Upon finishing the race, Bernie reunited with Boston EMS Paramedics Bond and Locke who saved his life along with EMTs Regan and Garceau. Keep running Bernie!



A YEAR OF REUNIONS

WHEN EVERY SECOND COUNTS

In July 2008, a then 24-year-old Mark Nielsen fell down a flight of stairs at the Arlington T station, causing serious head and brain injuries. EMTs Tom Smith and Matt Furlotte, as well as Paramedics Laura Lee and Mike Yaffe, responded within minutes and swiftly transported the unconscious patient to Beth Israel Deaconess Medical Center.

On September 15, 2011, Mark along with his parents visited Boston EMS Headquarters to reunite with the EMTs and Paramedics who saved his life. Today, Mark is healthy and doing well. His doctors credit his excellent recovery to the immediate care he received from Boston EMS, among other factors. Mark and his parents could not thank the crews enough. Mark's recovery is proof that in an emergency, every second counts.

IT'S A GIRL!!

On October 12, 2011 a couple from the Norwood area was traveling to the hospital on I-93 when their baby just couldn't wait any longer to greet the world. Boston EMS responded to the couple's 911 call with no time to spare. EMT Recruit Michelle Chu along with Field Training Officer Miguel Diaz delivered a beautiful, healthy baby girl named Serene.

The baby was EMT Chu's first delivery. Upon graduating from the Boston EMS Training Academy two weeks after the baby's birth, EMT Chu had the opportunity to reunite with Mother Ena El-Hadidy and Baby Serene at the Boston EMS graduation ceremony. EMT Chu proudly presented the mother with a pink "Delivered by Boston EMS" onesie. Baby Serene was one of 24 babies delivered by Boston EMS in 2011. Congratulations to mom and dad!

BOSTON EMS BY THE NUMBERS

The Department's top priority is to provide excellent pre-hospital care. In order to ensure optimal service delivery, Boston EMS systematically monitors and analyzes key operational and clinical performance data on a routine basis. The Department utilizes data such as call volume, patient satisfaction results, response times, and various patient outcome measures, among others, to make strategic decisions. With a tireless commitment to quality, Boston EMS attempts to maximize efficiency and effectiveness with every response.

Figure 3

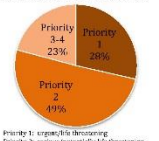
2011 INCIDENTS BY TYPE	NUMBER	PCT.
Illness (abdominal pain, fever, etc.)	31,181	29%
Investigations ("man down", alarm, etc.)	20,458	19%
Injury (lacerations, fractures, etc.)	15,587	14%
Cardiac Related (unconscious, CPR, etc.)	11,135	10%
Respiratory (asthma, CHF, etc.)	8,702	8%
Psychological/ Suicidal	6,777	6%
Motor Vehicle (MVA, pedestrian, cyclist struck, etc.)	5,711	5%
Neurological (CVA, seizures, etc.)	4,520	4%
Fire/ Hazmat/ Standby/ Environ.	2,014	2%
Trauma (penetrating injury, long fall, etc.)	1,289	1%
Overdose	969	<1%
2011 Total	108,343	100%

Figure 5*

2011 INCIDENTS BY NEIGHBORHOOD	NUMBER	PCT.
Allston/ Brighton	6,395	6%
Back Bay	8,610	8%
Beacon Hill/ West End	2,944	3%
North End	3,754	3%
Charlestown	2,185	2%
East Boston	6,788	6%
South Boston	5,899	5%
South End	12,412	11%
Roxbury	15,936	15%
Dorchester North	16,310	15%
Dorchester South	7,543	7%
Roslindale	4,138	4%
Jamaica Plain	3,225	3%
West Roxbury	2,838	3%
Hyde Park	4,763	4%
Mattapan	3,419	3%
Long Island	415	<1%
Other/Not Listed	769	1%
2011 Total	108,343	100%

*Figure 5 captures the location where the incident occurred

Figure 4
2011 INCIDENTS BY PRIORITY



Priority 1: urgent/life threatening
Priority 2: serious/potentially life threatening
Priority 3-4: non-life threatening illness or injury

Figure 6
2011 TRANSPORT MIX

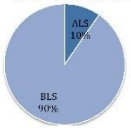
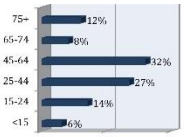
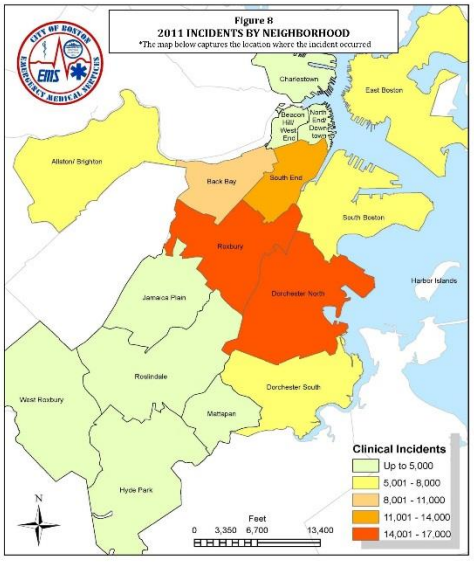


Figure 7
2011 TRANSPORTS BY AGE



BOSTON EMS BY THE NUMBERS

Figure 8
2011 INCIDENTS BY NEIGHBORHOOD
*The map below captures the location where the incident occurred



**Note: This map does not control for neighborhood geographic or population size. Generally speaking, larger and more densely populated areas have a higher number of clinical incidents.

BOSTON EMS BY THE NUMBERS

As one of the busiest EMS services in the country, Boston responds to an average of 300 calls per day. Figure 9 below details 2011 response and transport activity by unit.

Figure 9 — 2011 RESPONSES AND TRANSPORTS BY UNIT

Unit*	Responses 2011	Responses 2010	% Chg	Transports 2011	Transports 2010	% Chg
24 HOUR/DAY BLS						
A1	6,555	6,825	-4%	4,268	4,366	-2%
A2	**7,933**	8,360	-5%	**5,372**	5,787	-7%
A3	6,375	6,451	-1%	4,383	4,464	-2%
A5	4,350	4,216	3%	2,747	2,718	1%
A6	7,223	6,908	5%	4,620	4,515	2%
A7	4,775	4,918	-3%	2,703	2,928	-8%
A11	6,601	6,666	-1%	4,199	4,596	-2%
A13	6,476	6,513	-1%	4,260	4,400	-3%
A14	4,388	4,370	0%	2,768	2,862	-3%
A15	4,049	4,433	-9%	2,372	2,645	-10%
A18	4,217	4,081	3%	2,769	2,629	5%
20 HOUR/DAY BLS						
A8	5,539	5,613	-1%	3,189	3,334	-4%
A10	6,178	6,192	0%	4,124	4,231	-3%
A12	5,936	5,811	2%	**4,218**	4,004	5%
A16	**6,650**	6,274	6%	4,064	4,031	1%
16 HOUR/DAY BLS						
A4	**5,721**	5,811	-2%	**3,421**	3,692	-7%
A9	3,686	3,466	6%	2,366	2,335	1%
A17	3,816	3,871	-1%	2,541	2,546	0%
A19	3,887	4,026	-3%	2,709	2,849	-5%
24 HOUR/DAY ALS						
P1	5,459	5,284	3%	1,496	1,448	3%
P2	**6,305**	5,896	7%	**1,703**	1,601	6%
P5	4,408	4,144	6%	1,557	1,420	10%
16 HOUR/DAY ALS						
P3	3,233	3,173	2%	1,148	1,256	-9%
P16	**3,823**	3,612	6%	**1,185**	1,134	4%

*See page 25 for unit location
**Note: The table above includes only BLS and ALS transport units and does not include Supervisor, Command Staff or Special Operations unit responses
***2011 figures in bold indicate the busiest BLS and ALS units categorized by hours in service

BOSTON EMS BY THE NUMBERS

Patients expect a quick response when they call 911 for help. As outlined in the Boston EMS Service Zone Plan[6], the Department's response time goals establish aggressive response time targets; Boston EMS strives to arrive on scene at priority 1 calls (urgent/life threatening calls) within 6 minutes. The Department consistently surpassed its response time goals for both priority 1 and 3 incidents, but narrowly missed its goal for priority 2.

Figure 10 — 2011 MEDIAN RESPONSE TIMES VS. TARGETS

Figure 11 — 2011 MEDIAN RESPONSE TIMES

Priority Level	2011	Goal
Priority 1 (urgent/life threatening)	5.7 minutes	6.0 minutes
Priority 2 (serious/potential life threatening)	7.3 minutes	7.0 minutes
Priority 3 (non-life threatening illness or injury)	7.6 minutes	8.0 minutes

[6] http://www.cityofboston.gov/ems/service_zone.asp

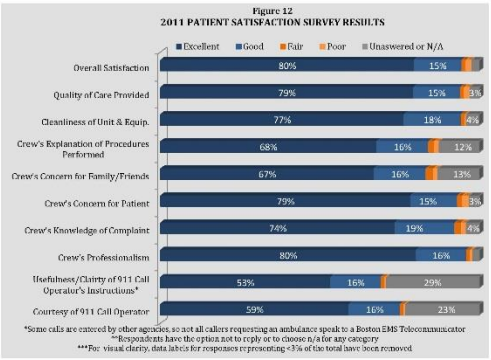
BOSTON EMS BY THE NUMBERS

Boston EMS highly values input from its patients. Among other things, the Department relies on patient feedback to help identify areas where service delivery can be improved. In 2011, Boston EMS continued to send patient satisfaction surveys to every patient transported asking them to rank 10 specific areas of the service as excellent, good, fair or poor. The Boston EMS Patient Satisfaction Survey also provides respondents the opportunity to submit written comments about their experience. While only 7% of individuals transported returned surveys, the Department was incredibly pleased to learn that 95% of respondents felt Boston EMS' overall service delivery was either excellent or good (80% and 15% respectively). Additionally, 94% of respondents felt Boston EMS' quality of care was either excellent or good (79% and 15% respectively).

WHAT OUR PATIENTS ARE SAYING...

"My rapid recovery is due to your excellent staff and their wonderful service and care." ** "The EMTs were compassionate and provided outstanding care." ** "They saved my life. Thank you." ** "I was treated with dignity and respect." ** "The service I received was superior. It could not have been better." ** "They're wonderful. End of story" ** "They could not have been kinder or calmer."

Figure 12 — 2011 PATIENT SATISFACTION SURVEY RESULTS



*Some calls are entered by other agencies, so not all callers requesting an ambulance speak to a Boston EMS Telecommunicator
**Respondents have the option not to reply or to choose n/a for any category
***For visual clarity, data labels for responses representing <3% of the total have been removed.

BOSTON EMS BY THE NUMBERS

Boston EMS has several diversified revenue streams including funds from commercial insurance providers, Medicaid, Medicare, private payers, grants, as well as the City of Boston. In fiscal year 2011, approximately 76% of the Department's annual revenue came from billing and insurance. In mid-2010, Boston EMS developed a new relationship with a company that specializes in EMS billing. As a result, the Department experienced an increase in overall net patient service revenue over the course of FY11. However, just like many other City departments, Boston EMS has felt the effects of the economic downturn and has remained vigilant in its efforts to operate in the most fiscally responsible and cost-efficient manner possible.

As a key member of the City of Boston's public safety triad, Boston EMS delivers a critical service to the people of Boston. The Department remains committed to focusing all available resources toward the execution of its core mission, providing excellent patient care to the visitors and residents of the City of Boston.

Figure 13 — FY11 FUNDING BREAKDOWN

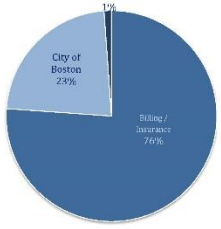
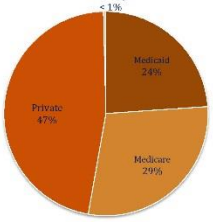


Figure 14 — FY11 PAYER BREAKDOWN



EVERYDAY HEROES

Working as an EMT or Paramedic in a busy urban environment is physically and mentally demanding and fraught with risks from vehicle crashes, exposure to communicable diseases, injury and assault. Boston EMS EMTs and Paramedics demonstrate great bravery and compassion on a regular basis as they serve the people of Boston. EMTs Joe Anderson, Rick Chiaravalloti, and Edmund Burke are just three examples of those who exhibited true heroism in 2011.

Joe Anderson, EMT-B
Rick Chiaravalloti, EMT-B

EMTs Joe Anderson and Rick Chiaravalloti were on duty the morning of August 10th when shots rang out in the neighborhood of Brighton. An elderly man had been shot in an apartment building. As Boston Police and Boston EMS arrived, the shooter continued to fire shots. Boston Police took up a defensive position in a basement apartment and were able to protect EMTs Anderson and Chiaravalloti as they entered the building to provide aid to the victim. The victim was in critical condition and required immediate treatment and transport. As the EMS crew was about to extricate the patient from the building, another shot was fired forcing the crew and the police officers escorting them to take cover. During a second attempt out of the building, another shot was fired. In the best interest of the patient, Boston EMS and Boston Police decided to proceed. Throughout the entire incident, the patient remained the main concern of both EMTs Anderson and Chiaravalloti. With police forming a circle around the EMS crew, the patient was rushed out of the building without further injury. The crew transported the victim to the hospital for further treatment and evaluation. The tremendous bravery and selflessness exhibited by EMTs Anderson and Chiaravalloti undoubtedly make them every day heroes.

Edmund Burke, EMT-B

On August 24th, off-duty EMT Burke, who has been with Boston EMS since 1996, was on his way to work when he heard a call on the radio about a fire in Brighton. Burke immediately rushed to the scene arriving before fire crews. He raced into the burning house and rescued a 10-year-old boy who was unconscious and in respiratory distress. Burke carried the child out as other emergency responders arrived. The child suffered from smoke inhalation and was taken to the hospital for further treatment. EMT Burke demonstrated great bravery as he fearlessly risked his life to save that of another.

DISPATCH OPERATIONS

Dispatch Operations is responsible for prioritizing incoming emergency medical calls, dispatching emergency units and coordinating with other public safety agencies as well as local hospitals. The Division also manages the Metro-Boston Central Medical Emergency Direction (CMED) radio system which allows for coordination between EMS field providers and area hospitals throughout the 61 cities and towns in Metro Boston. All Boston EMS Telecommunicators are uniformed EMTs who have received an additional 19 weeks of specialized training in Emergency Medical Dispatch. Boston EMS Telecommunicators serve as the critical link between the public and the EMS crews on the street.

In 2011, Dispatch Operations continued to focus on improving communication with the Department's partners as well as the public. The Division implemented new policies to allow for direct communication with the dispatch centers of Logan Airport and MassHighway Operations, which has resulted in better coordination and streamlined response. Dispatch Operations also expanded the use of the Boston Area Ambulance Mutual Aid Network (BAMA), a radio network allowing interoperability with partnering ambulance services. Additionally, the Division updated some of its pre-arrival instructions including those for CPR. Telecommunicators provide pre-arrival instructions to callers to initiate medical care before ambulance crews arrive. Updated CPR pre-arrival instructions reflect the latest CPR guidelines which have proven to increase the survivability of patients suffering from sudden cardiac arrest.

The Boston EMS Operations Center also underwent a complete renovation in 2011 and now features updated radio consoles, new furniture, and the latest equipment providing a much more efficient and ergonomically friendly workplace for Dispatch Operations personnel.

A CRITICAL LINK...

On December 31st, EMT Sara Curry received a 9-1-1 call from a pregnant female in active labor who was attempting to drive to the hospital. The caller also had children in the car, the oldest her 12-year-old daughter Tanisha. After instructing the patient to pull over, Curry quickly determined the location of the vehicle. She then calmly instructed Tanisha how to help her mother deliver the baby. Together, Curry and Tanisha helped to keep the new baby safe before crews arrived. Both EMT Curry and Tanisha were honored at the 2012 Massachusetts 9-1-1 Heroes Awards® Ceremony.

CLINICAL INNOVATION

As a leader in the field of pre-hospital emergency medicine, Boston EMS has long held a reputation for clinical excellence and is committed to remaining at the profession's forefront. The Department provides the latest advancements in pre-hospital emergency care, conducts significant research and operates a comprehensive quality assurance program. In 2011, Boston EMS Paramedics achieved an intubation success rate of 96.5%[7] and the City of Boston remained ranked as one of the top cities for cardiac arrest survival rates.

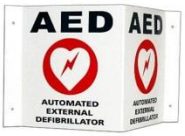
Boston EMS' Research, Training, and Quality Improvement (RTQI) team, made up of emergency department physicians, EMTs, Paramedics, and Training Officers, works to ensure that the Department's EMTs and Paramedics are prepared to consistently deliver high-quality patient care. The team is currently researching best practices in cardiac resuscitation, the effectiveness of alternative intravenous access devices, and the impact of new breathing equipment, among other pre-hospital care interventions.

In 2011 Boston EMS continued to participate in the Massachusetts Department of Public Health EMS Stroke Quality Improvement Initiative. Throughout the year, members of the RTQI team participated in state-wide meetings and educational forums designed to improve stroke care. Further, the Department continued its stroke quality improvement and management program. Over the course of 2011, RTQI reviewed an average of 40 medical records of stroke or potential stroke patients each week assessing specific performance indicators. Data gathered through the quality improvement program was utilized in Department training and education sessions and has ultimately led to improved stroke patient care by Boston EMS EMTs.

Over the last year the Department has also continued to carefully monitor cardiac arrest data. Since 2004, RTQI has reviewed all cardiac arrests that occur in the City of Boston. In order to identify ways to improve patient care, RTQI evaluates each incident individually and enters case information into an internal cardiac registry. Additionally, RTQI downloads and assesses pre-hospital electrocardiographic (EKG) information. Such comprehensive data collection allows RTQI to conduct in-depth research with the goal of identifying new methods and treatment protocols to enhance clinical care.

[7] Each time a Boston EMS Paramedic attempts an intubation, the incident is reviewed by a Paramedic Research Coordinator and at least one Boston EMS Physician as part of the Boston EMS Airway Registry

CLINCIAL INNOVATION



In addition to carefully monitoring cardiac arrest data, Boston EMS continued to enhance and expand its innovative "AED Alert" program. Through AED Alert, the Department has been formally tracking the location of public automatic external defibrillators (AEDs) since 2009. All reported public AED data is entered into the Department's computer aided dispatch (CAD) system.

When a 911 call comes in from a public facility and an AED is on site, CAD will trigger an alert prompting Boston EMS Telecommunicators to provide the caller with instructions on where to retrieve the device and how to apply it. Studies have repeatedly shown that immediate bystander CPR combined with defibrillation within 3-5 minutes of a collapse can help significantly improve cardiac arrest survival rates. Additionally, studies have shown that a large proportion of cardiac arrests happen in public places such as athletic facilities and office buildings. Through AED Alert, Boston EMS Telecommunicators have the tools to provide 911 callers with lifesaving instructions immediately after a witnessed cardiac arrest.

In July 2011, Boston EMS launched a new online AED report form on its website (www.cityofboston.gov/ems) with the assistance of the City's Department of Innovation and Technology.[8] The online form allows organizations to easily input and submit their AED information. Boston EMS experienced an increase of 15% in reported AEDs during 2011 bringing the total number of AEDs tracked in CAD to 1,010.

In 2011, Boston EMS continued its application of therapeutic hypothermia, the process of cooling the body and maintaining mild hypothermia (32-34°C) in the first 12 - 24 hours after cardiac arrest. Therapeutic hypothermia has proven to help protect brain function as well as improve survival and neurological outcomes of individuals suffering from cardiac arrest. The Department became one of the first adopters of pre-hospital therapeutic hypothermia in 2008. In 2011, Boston EMS Paramedics provided this life-saving therapy to 116 patients.

[8] http://www.cityofboston.gov/ems/aedlocation/

ASTHMA PROJECT

Leveraging EMS data to improve patient outcomes

In early 2010, Boston EMS transported a 12-year-old to the hospital whose symptoms were suggestive of a severe asthma attack. Shortly thereafter, the hospital reviewed his case during clinical rounds. As part of this process, the nurse supervisor asked Boston EMS for the patient's electronic medical record. When searching for it, the Department discovered that the patient had been transported multiple times within a short time frame. The record further indicated a trend of his symptoms becoming increasingly severe with each transport.

Asthma is a chronic and relatively common illness, which is controllable with appropriate medication and care. This teenager's case highlighted the need to more closely monitor EMS transports for youth with asthma-related illness.

After conducting thorough data analysis and convening an interdepartmental working group, Boston EMS established a program in partnership with the BPHC's Division of Healthy Homes and Community Support to identify individuals with uncontrolled asthma in order to link them with appropriate healthcare services. With guidance from the Boston EMS Medical Director, the target group was identified as children and young adults ages 9 to 24 who had been transported by Boston EMS more than two times within the last six months and showed positive signs of 'increased work of breathing' (including wheezing, retractions, and prolonged expiratory phase) and specific pre-hospital interventions for asthma (such as administration of Albuterol or Combivent, common asthma medications).

THE ASTHMA PROJECT

Launched: July 2011

Staff: Specially trained Paramedics

Direction: ePCR Manager & Medical Director

Criteria for inclusion: Patient between the ages of 9 and 24 with asthma-related illness who has been transported 2 or more times within 6 months

The Asthma Project, launched in July 2011, is currently staffed by two Boston EMS Paramedics who utilize the Department's electronic patient care reporting system to identify patients who meet the established criteria. Upon identification, the Paramedics contact the patient (or, in the case of a child, their guardian) by phone to assist them with referral services. With the assistance of the Medical Director, patients can also be linked directly to their primary care provider. The Asthma Project is a referral service only. In 2011 Boston EMS successfully linked several young people with services that will help them better manage their asthma, reducing the severity and frequency of severe attacks.

TRAINING & EDUCATION

The Training Division within Boston EMS' Research, Training and Quality Improvement (RTQI) team, is responsible for the initial and ongoing training as well as the professional development of Boston EMS EMTs and Paramedics. Through its accredited Training Academy, the Division operates a comprehensive 6-month course designed to prepare EMT recruits for the challenges of delivering pre-hospital emergency medicine. The course, taught by training personnel with extensive field experience, includes classroom work, rigorous field instruction, exercises, and drills. In August 2011 Boston EMS proudly graduated 18 new recruits from the Training Academy.

Boston EMS continued its partnership with Northeastern University's College of Professional Studies in 2011. In the year prior, the Department launched an 18-month Paramedic course led by Northeastern instructors and Boston EMS staff educators. The program not only provides a strong foundation for Boston EMS students to achieve their clinical goals, but affords the opportunity to earn and apply credit hours toward an undergraduate degree at Northeastern. Eighteen students graduated from the first class in July 2011 and are certified as paramedics. Due to the program's success, Boston EMS and Northeastern launched a second class in early 2011. Eight students successfully completed the classroom portion of the program and will participate in clinical rounds at Boston Medical Center in 2012.

In addition to training Boston EMS field staff, the Training Division provides a low-cost community Basic EMT Course designed to prepare aspiring EMTs for a career in pre-hospital emergency medicine. The 150 hour course offers exceptional classroom training, emergency room observation at Boston Medical Center and the opportunity to observe Boston EMS Operations during an ambulance ride-along. The Training Division offered two community courses in 2011, successfully preparing 69 graduates to pursue state EMT-Basic certification. The Department is currently awaiting results from the state to determine how many individuals successfully passed the examination.

SPECIAL OPERATIONS

The Special Operations Division plans for and responds to major emergencies within the City of Boston including both planned special events and unplanned natural and man-made disasters. The Division is responsible for overseeing Boston EMS' Bicycle Defibrillation Unit, Harbor Patrol Unit, Tactical Response Unit as well as its hazardous materials response efforts and rapid deployment team activities. A multitude of agencies, both public and private, rely heavily on Boston EMS to facilitate medical coverage and to participate in the coordination of assets, resources and logistics during special events and emergencies.

Every year, Boston hosts several major events such as the Boston Marathon and 4th of July Celebration which bring millions of people together and require significant emergency medical support. Boston EMS uses these events as "controlled" mass casualty incidents (MCIs) to test disaster protocols, systems and resources. In addition to these events, the Department also provides EMS support at hundreds of festivals, parades, and other gatherings citywide. In 2011, Special Operations oversaw the provision of medical services at 443 events.

In May 2011, Special Operations coordinated Boston EMS' participation in the Metro Boston Homeland Security Region's Urban Shield Boston Exercise. The exercise was used to assess the region's ability to successfully respond to and manage multiple terrorist events and other emergencies occurring simultaneously throughout the Boston Area. Through the exercise, Boston EMS personnel had the opportunity to test its ability to provide mass casualty triage and expedient field treatment of multiple casualties while law enforcement tactical teams provided force protection.

Photo Credit: http://jamaicaplainpatch.com

In preparation for Urban Shield, Special Operations worked with the Office of the Boston EMS Medical Director and the Boston Police Academy to develop an 8-hour active shooter training designed to better prepare EMS and police personnel to work more effectively together in response to an active shooter incident. The training consisted of three parts: (1) tactical and situational awareness, (2) focused medical care under force protection, and (3) active shooter rescue tactics. A total of 256 Boston EMS members received training in 2011 which has strengthened communication and integration with Boston Police.

EMERGENCY PREPAREDNESS

Boston EMS is committed to protecting the City's residents and visitors from disasters of all size and scope. The Department plays a key role in the City's emergency preparedness efforts. Through the DelValle Institute for Emergency Preparedness and the Boston Metropolitan Medical Response System (MMRS), Boston EMS offers specialized trainings and public health coordination preparing the City for large-scale emergencies.

DelValle Institute for Emergency Preparedness

The DelValle Institute for Emergency Preparedness provides high quality all-hazards training for the Boston community, the Metro Boston Homeland Security Region, and Eastern Massachusetts. DelValle serves emergency medical services, public health, health care and public safety personnel.

Through education and training, DelValle supports capabilities-based preparedness with the goal of reducing the public health and safety consequences of disasters. The Institute's programs are based on the core functional areas of Emergency Support Function 8 (Public Health and Medical Services) with an emphasis on:

- capabilities specific to emergency medical services, public health, and healthcare;
- interrelated roles and responsibilities across all first responder and first receiver disciplines in a disaster; and
- emergency planning and preparedness for the community, particularly those most vulnerable.

In 2011, DelValle conducted over 100 programs for 2,600 public health and public safety professionals throughout Massachusetts. In February, over 300 participants attended the seminar *Managing Mass Fatalities*, which focused on exploring approaches to the implementation of the Commonwealth of Massachusetts' Mass Fatalities Management Plan at the local level. In August, the DelValle Institute launched the "Learning Center", an innovative online portal into trainings and resources, featuring the e-course *Continuity of Operations Planning: Awareness*.[9] From August to December 2011, there were approximately 30,000 visits to the site.

The DelValle Institute for Emergency Preparedness programs sustain the vision of a coordinated preparedness system of public, private, and community stakeholders with the collective capabilities and capacity to protect against, respond to, and recover from all hazards with a focus on the public health and safety of all communities.

[9] http://delvalle.bphc.org/

EMERGENCY PREPAREDNESS

Boston Metropolitan Medical Response System

Boston MMRS is a Federal Emergency Management Agency (FEMA) Grant Program that serves to support the integration of emergency management, health and medical systems into a coordinated response to mass casualty incidents caused by any hazard. Boston MMRS works to strengthen the health and medical preparedness of the City of Boston and its surrounding communities. Much of MMRS' work focuses on facilitating preparedness and planning efforts amongst a range of partners in the healthcare community.

During 2011, MMRS supported initiatives to protect Boston EMS' first responders by maintaining the first responder emergency pharmaceutical cache, procuring various types of personal protective equipment, and continuing the TLD (thermoluminescent dosimeter) card program to measure chronic levels of radiation exposure.

In addition to supporting Boston EMS' first responders, MMRS worked extensively with community partners including Boston's community health centers, hospitals, private EMS services, and long term care facilities to develop and augment their internal and regional preparedness plans. MMRS lead and actively participated in several committees and workgroups including: Patient Tracking, Medical Response to Radiation Events, the Go Team, UASI Medical Surge, and the Boston Healthcare Preparedness Coalition.

MMRS also served in an operational support role for the Boston healthcare community in 2011. MMRS worked with several hospitals and community health centers to identify solutions for addressing power outages, closings, flooding and other weather-related issues to prevent any major disruptions in their services.

In 2011, MMRS hosted several events to support preparedness and response efforts. Noteworthy events include:

- Supporting Patient Tracking efforts during the Boston Marathon & Fourth of July Celebration
- Emergency Preparedness Basics Training for community health centers
- Continuity of operations planning for Boston community health centers
- Support for city-wide flu clinics
- Bi-monthly Medical Intelligence Center Briefings

FLEET SERVICES

In January 2011, Boston EMS launched the use of a bariatric ambulance designed to more effectively accommodate obese patients. The Fleet Services Division played a lead role in retrofitting the vehicle, which is equipped with a special stretcher that can hold 850 pounds and a hydraulic lift with a 1,000 pound capacity. Over the course of 2011, the bariatric truck responded to 128 emergency medical calls and has not only improved the comfort-level of patients but has helped to reduce the risk of injury among crew members.

The Fleet Services Division's primary focus is to ensure both vehicle and crew safety. Fleet Services staff is responsible for the maintenance of Boston EMS' entire fleet including ambulances, supervisor vehicles as well as Special Operations vehicles. The Fleet Services Division has a team of in-house mechanics all of whom have at least 10 years of repair experience and are ASE (Automotive Service Excellence) certified.

Fleet Services maintains a wide variety of specialty vehicles which are capable of supporting the City in any emergency large or small. Chief among them is the state-of-the-art Boston EMS ambulance. The Department's ambulances are capable of meeting the dynamic emergency medical services demands of a major metropolitan area like Boston. Each truck is outfitted with the most advanced pre-hospital care equipment and is staffed by two field providers. The Division's mechanics perform routine preventative maintenance and ensure that every Boston EMS ambulance passes the annual inspection conducted by the State Office of EMS. The skills and expertise of the Fleet Services Division is critical to the success of the Boston EMS operation.

COMMUNITY INITIATIVES

Boston EMS' Community Initiatives Division is a dedicated and trusted partner of the community. The Division is charged with conducting outreach to help raise awareness about important public health topics. Along with its many partners, Community Initiatives operates several programs designed to improve the health and safety of Boston.

One of the key areas of focus of the Community Initiatives Division is teaching the lifesaving skill of CPR. According to the American Heart Association, approximately 80% of cardiac arrests occur at home and about 92% of sudden cardiac arrest victims die before they reach the hospital. [18] Bystanders who are able to: (1) recognize a medical emergency, (2) quickly call 9-1-1 for help, and (3) begin CPR, have the power to be life-savers. In 2011, Boston EMS trained 3,513 individuals in CPR. The Department hosts CPR classes in English and Spanish and utilizes a kit called "CPR Anytime" that includes a DVD and mini-mannequin, which allows participants to easily teach others what they have learned.

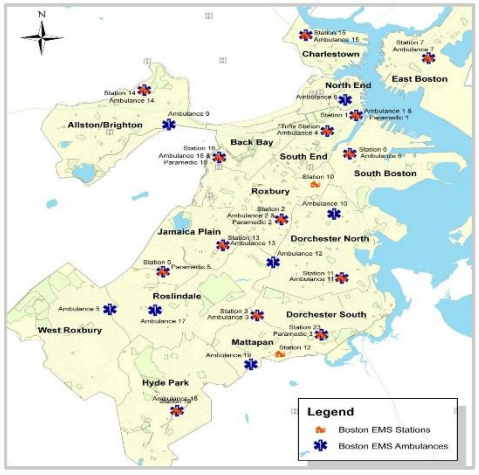
[18] http://www.heart.org/HEARTORG/

In 2011, Boston EMS focused its community outreach efforts toward the elderly, one of Boston's most vulnerable populations. In partnership with the Elderly Commission and the Boston Housing Authority, the Department launched a series of weekly seminars to discuss health and safety issues that largely impact the elderly. Seminar topics included: weather safety tips, File of Life, blood pressure screenings, stroke awareness, diabetes management, among others. Sessions were incredibly successful with over 400 seniors attending.

In addition to working with the elderly, Boston EMS also helped to keep Boston's youngest residents safe by conducting car seat installation safety checks. In 2011, Boston EMS' 15 certified technicians held weekly appointments with new parents which resulted in 477 car seat checks.

STATION LOCATIONS

Boston EMS deploys 19 Basic Life Support (BLS) ambulances and 5 Advanced Life Support (ALS) ambulances during peak hours to ensure quick response times. The department's stations are strategically located throughout the City. Based on call volume, several EMS crews shift change at a station and subsequently re-post to locations that typically experience a higher demand for service.



BOSTON EMERGENCY MEDICAL SERVICES

2011 VITAL STATISTICS
www.cityofboston.gov/ems

Boston Emergency Medical Services (Boston EMS), the primary emergency medical services provider for the City of Boston, is a nationally recognized leader in the field of pre-hospital emergency medicine. The Department leverages the latest advances in both medicine and technology to bring high-quality, compassionate care to the people of Boston. Boston EMS also plays a key role in the City's emergency preparedness efforts and provides community programming designed to educate the public about important health and safety topics.

Boston Land Area: 45.7 sq. miles
Boston EMS Uniformed Staff: 358
Paramedics: 70

Resident Population: 617,594
Non-uniformed Staff: 44
Number of Stations: 17

Daytime Population: ~900,000
Emergency Medical Technicians: 241
Peak Staffing: 19 BLS & 5 ALS Units

SYSTEM WIDE CALL VOLUME

	2011	2010	Pct. Change
Total Clinical Incidents	108,343	108,849	.5% decrease
Total ALS and BLS Responses	134,522	136,653	2% decrease
Total Transports	78,692	79,443	1% decrease
Total ALS Transports	7,594	7,633	.5% decrease
Total BLS Transports	71,098	71,810	1% decrease

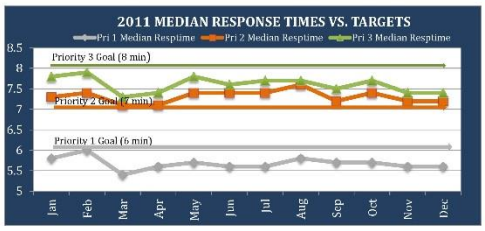
MEDIAN RESPONSE TIMES

	2011	2010	Goals
Priority 1	5.7 min	5.4 min	6.0 min
Priority 2	7.3 min	7.0 min	7.0 min
Priority 3	7.6 min	7.1 min	8.0 min

INCIDENTS BY PRIORITY	NUMBER	PCT.
Priority 1	30,441	28%
Priority 2	52,732	49%
Priority 3	23,214	21%
Priority 4	1,956	2%
Total	108,343	100%

NEIGHBORHOOD	INCIDENTS	PCT.
Allston/ Brighton	6,395	6%
Back Bay	8,610	8%
Beacon Hill/ West End	2,944	3%
North End	3,754	3%
Charlestown	2,185	2%
East Boston	6,788	6%
South Boston	5,899	5%
South End	12,412	11%
Roxbury	15,936	15%
Dorchester North	16,310	15%
Dorchester South	7,543	7%
Roslindale	4,138	4%
Jamaica Plain	3,225	3%
West Roxbury	2,838	3%
Hyde Park	4,763	4%
Mattapan	3,419	3%
Long Island	415	<1%
Other	769	1%
Total	108,343	100%

INCIDENTS BY TYPE	NUMBER	PCT.
Illness (abdominal pain, fever, dizzy)	31,101	29%
Investigations ("man down", alarm)	20,450	19%
Injury (lacerations, fractures, etc.)	15,587	14%
Cardiac Related (unconscious, CPR, etc.)	11,135	10%
Respiratory (Asthma, CHF, etc.)	8,702	8%
Psychological/Suicidal	6,777	6%
Motor Vehicle (MVA, pedestrian)	5,711	5%
Neurological (CVA, seizures)	4,520	4%
Fire/ Hazmat/ Standby/ Environ.	2,014	2%
Trauma (penetrating injury, long fall, etc.)	1,289	1%
Overdose	969	< 1%
TRANSPORTS BY AGE	**NUMBER**	**PCT.**
Under 15	5,047	6%
15-24	11,213	14%
25-44	21,071	27%
45-64	25,344	32%
65-74	6,438	8%
75+	9,579	12%
Total	78,962	100%



OTHER SYSTEM HIGHLIGHTS

Specialized Clinical Care		Community Initiatives / Training / Patient Satisfaction	
# of Naloxone Uses by Boston EMS BLS Providers[12]	86	Car Seat Checks Performed	477
# of STEMIs Identified[13]	97	Individuals Taught CPR	3,513
# of Pts. Treated with Therapeutic Hypothermia[14]	116	Individuals Trained through DelValle Institute	2,600+
Overall Intubation Success Rate	96.8%	New Recruits who Graduated from the Academy	18
# of Pts. Treated with CPAP[15]	191	Students who Completed Boston EMS EMT Course	72
Public Access AEDs in Database (15% increase from '10)[16]	1010	Pct. of Patients who Rated Service as Excellent or Good	95%

SIGNIFICANT EVENTS

- In January, Boston EMS launched the use of a new bariatric truck with custom made hydraulic lift designed to more effectively accommodate obese patients; the bariatric truck responded to 128 emergency medical calls in 2011.
- Boston EMS' DelValle Institute for Emergency Preparedness held the seminar *Managing Mass Fatalities* in February, which focused on the Commonwealth of Massachusetts' Mass Fatalities Management Plan.
- In March, Boston EMS officially opened a new headquarters at 785 Albany Street.
- The Department's innovative "ARD Alert" program was recognized by the Computerworld Honors Program in June.
- In July Boston EMS launched an asthma follow-up program targeting patients ages 9-24 who had been transported more than two times within a six month period; the program aims to link patients with asthma referral services.
- In August 2011, the DelValle Institute for Emergency Preparedness launched "The Learning Center", an online portal into various trainings and resources; the site received ~30,000 visits through 2011.
- As part of September's National Preparedness Month, Boston EMS and BPHC hosted a series of neighborhood events to teach residents CPR and help prepare them for emergencies of all type.
- In October, Boston EMS graduated 10 new recruits and celebrated the promotions of 1 Superintendent, 2 Deputy Superintendents, and 1 Lieutenant.
- Boston EMS members were recognized in four categories at the 112th Annual Metropolitan Boston EMS Council (EMS Region IV) awards ceremony in October.

[12] BLS Naxel Naloxone (Narcan®) – a Special Project Waiver allowing Boston EMS BLS providers to provide Naloxone to patients with known or suspected narcotic overdose.
[13] Boston EMS Paramedics are trained to read 12-lead ECGs and can identify various types of cardiac incidents including STEMIs (ST – Segment Elevation Myocardial Infarction). As a result, Boston EMS ALS units notify and transport these patients to specially designated cardiac centers with the goal of improving survival rates.
[14] The process of cooling the body and maintaining mild hypothermia (32-34 C) in the first 12 – 24 hours after cardiac arrest. Boston is among the first services in the nation and second in Massachusetts to utilize this advanced treatment in the pre-hospital arena.
[15] Typically used in the hospital setting, Boston EMS began applying Continued Positive Airway Pressure (CPAP) in 2007. CPAP, a non-invasive procedure that forces oxygen into the lungs, is applied to patients in severe respiratory distress. CPAP often reduces the need for incubation and minimizes complications resulting in shorter hospital stays.
[16] In 2009 Boston EMS launched "ASD Alert", allowing call takers to identify the location of public AEDs throughout the City.

KEY DEFINITIONS

Boston EMS Emergency Medical Technician (EMT): A Department employee, certified by the Massachusetts Office of Emergency Medical Services (OEMS) as an EMT-Basic, who has successfully completed the Boston EMS recruit training and field internship, and is certified by the Department to perform Basic Life Support Skills in accordance with statewide and Boston EMS protocols and special project waivers.

Boston EMS Paramedic: A Department employee, certified by the Massachusetts Office of Emergency Medical Services (OEMS) as an EMT-Paramedic, who has successfully completed the Boston EMS Paramedic selection process, and subsequently successfully completed the Boston EMS Advanced Life Support (ALS) clinical training and field internship. A Boston EMS Paramedic is certified to perform ALS skills in accordance with statewide and Boston EMS protocols and special project waivers.

Basic Life Support (BLS): An EMT unit or the procedures and skills performed by an EMT-Basic. At peak times there are typically 19 BLS units in service, each staffed by two EMTs.

Advanced Life Support (ALS): A Paramedic unit or the advanced procedures and skills performed by a Paramedic. At peak times there are typically 5 ALS units in service, each staffed by two Paramedics.

Incident: Any request for emergency medical service which generates a distinct entry in the computer aided dispatch (CAD) system. A single incident may generate the response of multiple EMS vehicles or may involve multiple patients (i.e. a train crash would be considered one "incident").

Response: A response is generated for each EMS unit assigned to a request for service. A response is distinct from a clinical incident in that an incident is a request/need for EMS, while a response is the dispatch of a unit (i.e. a train crash would generate multiple "responses").

Response Time: Unlike some systems that calculate response time from call dispatch until unit arrival, Boston EMS measures response time from call entry (i.e. the point at which a call taker determines the nature and location of an emergency and enters it into the computer aided dispatch system) to EMS unit arrival on scene.

Priority One: An incident category representing time sensitive, life threatening emergencies such as cardiac arrest, uncontrollable arterial bleeding, unconsciousness, etc.

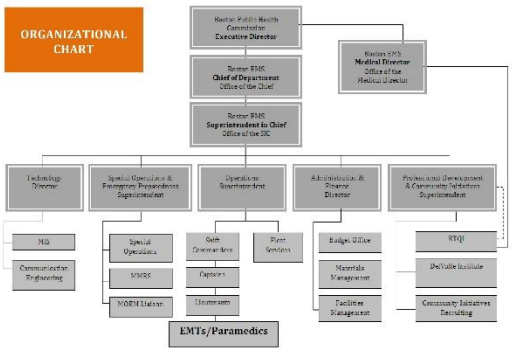
Priority Two: An incident category representing potentially life threatening emergencies such as orthopedic injury, lacerations with controlled bleeding, abdominal distress, etc.

Priority Three: An incident category representing non-acute injury or illness.

Priority Four: An incident that does not automatically generate an EMS response until there is verified need from another responding agency. This process is designed to reduce the number of EMS responses to incidents unlikely to result in a transport, thus freeing up EMS resources for other simultaneously occurring emergencies.

Neighborhoods: Back Bay includes Kenmore, Fenway, and Chinatown; North End includes portions of Downtown; Roxbury includes Longwood and Mission Hill; "Other" includes Boston Harbor and areas outside of Boston.

ORGANIZATIONAL CHART



MISSION

Boston EMS, the provider of emergency medical services for the City of Boston, is committed to compassionately delivering excellent pre-hospital care and to protecting the safety and health of the public.

PATIENT ADVOCACY
The health and well-being of the patient is always our first priority. We are professionals who treat every patient with respect and compassion.

PEOPLE
Our people are our greatest asset. The knowledge, experience, and compassionate nature of our employees make our service exceptional. Our workforce includes skilled professionals from different backgrounds and cultures, reflecting the diversity of the communities we proudly serve.

VALUES

COLLABORATION
We strive to work effectively with our public safety and public health partners to solve problems, make decisions and achieve common goals.

PRIDE & UNITY
We are proud of the work we do and the strength of our service. We are committed to one another and the patients we serve.

LEADERSHIP & INNOVATION
As a leader in the field of pre-hospital emergency medicine, we pride ourselves on innovating and leveraging the latest advances in both medicine and technology, bringing cutting edge care to the streets of Boston.

PREPAREDNESS
We are a leader in the field of emergency preparedness and take an active role in planning, training, response and recovery efforts to mitigate the medical consequences of a disaster. We maintain the highest level of organizational and individual preparedness.

CLINICAL EXCELLENCE
The members of Boston EMS are highly skilled and specially trained to provide state of the art pre-hospital emergency medical services. We provide every patient with excellent clinical care.

VISION

Boston EMS' vision is to expand upon our role as a critical public safety agency that delivers exceptional pre-hospital emergency medicine in an urban environment. The Department will remain at the forefront of EMS advancements, driving progress in clinical care, operations, research and training. As a leader in all-hazard emergency preparedness, we will enhance our workforce and community's ability to be resilient when confronted by man-made and natural disasters. Boston EMS will continue to be viewed as a challenging, diverse and rewarding place to work as well as a model for other EMS agencies

BOSTON EMERGENCY MEDICAL SERVICES

785 Albany Street
Boston, MA 02118
617-343-2367
www.cityofboston.gov/ems

Appendix B: Comparison of Boston EMS Vital Statistics (City of Boston Emergency Medical Services, 2012) (City of Boston Emergency Medical Services, 2014) (City of Boston Emergency Medical Services, 2015) (City of Boston Emergency Medical Services, 2016) (City of Boston Emergency Medical Services, 2017)

System wide call volume	2010	2011	2012	2013	2014	2015	2016
Total clinical incidents	108,848	108,343	111,074	116,637	120,013	122,161	125,585
Total ALS & BLS responses	136,653	134,522	138,352	142,341	135,040	144,711	148,426
Total transports	79,443	78,692	81,422	83,144	83,405	85,487	86,717
Total ALS transports	7,633	7,594	7,295	7,379			
Total BLS transports	71,810	71,098	74,136	75,761			

Median response times	2010	2011	2012	2013	2014	2015	2016	Goals
Priority 1	5.4	5.7	5.7	5.9	6.4	6.6	6.3	6.0
Priority 2	7.0	7.3	7.2	7.4	8.1	8.7	8.4	7.0
Priority 3	7.1	7.6	7.6	8.0	8.6	8.9	8.6	8.0

Incidents by priority	2011	2013	2014	2015	2016
Priority 1	30,441	31,348	32,400	32,660	33,209
Priority 2	52,732	50,721	53,031	56,997	57,682
Priority 3	23,214	32,519	31,938	29,453	31,979
Priority 4 & other	1,956	2,047	2,644	3,051	2,698
Total	108,343	116,637	120,013	122,161	125,585

Neighborhood	2011	2013	2014	2015	2016
Allston/Brighton	6,395	6,771	6,601	6,592	6,390
Boston Central	27,720*	29,900*	31,678	31,642	29,721
Back Bay	8,610	9,002			
Beacon Hill/West End	2,944	3,384			
North End	3,754	4,175			
Charlestown	2,185	2,603	2,493	2,394	2,407
East Boston	6,788	7,570	7,521	7,313	7,181
South Boston	5,899	6,308	6,491	6,467	5,618
South End	12,412	13,339			
Roxbury	15,936	17,367	17,672	19,654	23,521
Dorchester	23,853*	25,634*	26,162	26,266	28,750
Dorchester North	16,310	17,785			
Dorchester South	7,543	7,849			
Roslindale	4,138	4,258	3,714	3,348	3,557
Jamaica Plain	3,225	3,422	4,933	6,107	5,871
West Roxbury	2,838	3,113	3,040	3,079	2,808
Hyde Park	4,763	4,693	4,407	4,475	3,939
Mattapan	3,419	3,798	4,326	4,442	5,419
Long Island	415	536	315		
Other	769	664	660	382	403
Total	108,343	116,637	120,013	122,161	125,585

Personnel	2011	2013	2014	2015	2016
EMTs (Field/Dispatch)	241	244	244	259	277
Paramedics	70	64	64	53	51
Supervisor/Command	47*	44	43	39	43

Incidents by Type	2011	2013	2014	2015	2016
Illness	31,181	34,438	35,284	35,998	37,270
Investigations	20,458	23,619	25,848	23,843	24,788
Injury	15,587	16,044	15,814	15,965	15,986
Cardiac Related	11,135	11,396	11,213	12,469	12,610
Respiratory	8,702	8,626	8,450	8,874	9,030
Psychological/Suicidal	6,777	7,455	7,695	8,538	9,008
Motor Vehicle	5,711	5,768	5,852	6,096	6,382
Neurological	4,520	4,561	4,891	4,980	5,106
Fire/Hazmat/Standby/Environ.	2,014	2,280	2,340	2,537	2,361
Trauma	1,289	1,243	1,249	1,317	1,265
Overdose	969	1,207	1,377	1,544	1,779
Total	108,343	116,637	120,013	122,161	125,585

Transports by Age	2011	2013	2014	2015	2016
Under 15	5,047	5,308	4,960	4,832	4,721
15-24	11,213	10,880	10,596	10,305	9,956
25-44	21,071	21,870	22,137	22,951	23,430
45-64	25,344	27,554	27,997	28,666	29,517
65-74	6,438	7,409	7,631	8,028	8,523
75+	9,579	10,115	10,144	10,710	10,649

*Calculated

Appendix C: States that Responded to 2013 9-1-1 Data Collection Survey (National 911 Program, 2013)

Arizona

California

Colorado

Connecticut

Delaware

Florida

Georgia

Hawaii

Illinois

Indiana

Iowa

Kansas

Kentucky

Maine

Maryland

Montana

New Hampshire

New Mexico

North Dakota

Oregon

Pennsylvania

Tennessee

Texas

Vermont

Virginia

Washington

West Virginia