ENHANCING EMERGENCY MEDICAL RESPONSE THROUGH THE FIRE SERVICE
Executive Summary

Firefighters Deliver Emergency Medical Care

Today, in Canada and the U.S., more than 90 percent of professional paid fire departments deliver emergency medical care at some level, making fire departments the largest group of providers of pre-hospital EMS care in North America. The same infrastructure that was put in place for response to fire events is used to deliver emergency medical services in many communities.

This emergency response system design works because many times, patients not only have medical needs, but may also require simultaneous physical rescue, protection from the elements and the creation of a safe physical environment, as well as management of non-medical surroundings. The fire service is uniquely equipped to simultaneously address all of these needs. First response medical care in Ontario should continue to include firefighters to provide a fully integrated front-line service.

Simultaneous Dispatch

Currently, in many Ontario municipalities there is a delay in getting trained firefighters to the scene of an emergency due to the disconnect that occurs at the dispatch level. In other words, firefighters and the ambulances are not simultaneously dispatched to time-critical medical emergencies causing a delay in first responder arrival. This delayed arrival prevents firefighters from intervening in all types of medical emergencies.

Simultaneous notification and communication are critical elements in saving lives. A fundamental objective of dispatch centres should be to provide service with a minimum number of stages or call transfers between the call intake in the communication centre and the dispatch (notification) of appropriate personnel and equipment. Simultaneous notification or dispatch links and response protocols should be standardized in communities throughout Ontario to ensure equal access to the best available services. This standardization could be accomplished through tiered agreements in all municipalities that have full-time fire fighters.

System Design

Firefighters are trained to the level necessary to provide the initial first response to medical emergencies. The additional training for firefighters necessary to further enhance the overall emergency response system is a fraction of the cost of adding more ambulances, equipment and personnel to the street. Therefore, to assess the options for continued EMS system improvement, decision makers should consider a number of factors including the costs of continuing to train existing firefighters compared to the costs of hiring new EMS personnel and the associated ongoing operating costs.

Effective and Efficient Use of Existing Resources

In terms of the rapid delivery of emergency medical care in the out-of-hospital environment, fire departments have the advantage of having an available, free-standing team of trained personnel ready to respond anytime and anywhere. Municipalities are urged to use existing fire department resources to their full extent to enhance the emergency response system as this would not require the need for additional provincial funding.

Whether firefighters are used to ensure an effective and efficient EMS response and care system or not, the same level of fire department resources are necessary to ensure adequate distribution and concentration of firefighters for fire suppression, hazardous materials responses and other natural and man-made threats to the public and the environment. Any reduction in a fire department’s ‘all hazard’ infrastructure to supplement a ‘band-aid’ to the EMS response system would have devastating impacts on the overall impact on the entire emergency response system.
Introduction

Decision makers must look at the facts while sorting through mounds of information pertaining to all aspects of the broader emergency response system. The research and objective facts that follow result from widely accepted industry standards and recent independent studies.

Call Intake and Responder Dispatch

How Responder Dispatch is Handled Now

Fire and ambulance response times to medical calls are too often compared incorrectly because in a number of dispatch systems, firefighters are dispatched after the ambulance — sometimes several minutes later. As a result, firefighters may arrive at a medical call later than the ambulance even though the fire station was closer to the incident scene. The confusion in comparing response times for both a Fire Department response and EMS response results when response times for each service are measured from the time of the initial 911 call intake and not the time when the fire department, for example, was actually dispatched. In other words, there is a longer delay between when 911 gets the call and when the fire department is notified than the delay between 911 call intake and EMS notification. The only way to achieve an “apples-to-apples” comparison is to implement and enforce simultaneous notification of both fire and EMS resources on relevant medical emergency calls.

When a Central Ambulance Communication Centre (CACC) is notified of a medical call and local area protocols for fire dispatch are met, the ability does not currently exist for the ambulance service and fire department to be dispatched simultaneously. CACCs are typically staffed by two types of positions — a call taker and a dispatcher. It should be noted that a pilot project is underway to assess the efficiency of simultaneous notification in several communities in Ontario. Results are pending and will be relevant to this discussion.

An indication of the importance of simultaneous notification and communication in Ontario came from jury recommendations in two coroner’s inquests over recent years. The first set of recommendations came from a Toronto coroner’s jury in 2000. The coroner’s jury made some important recommendations regarding emergency dispatch in the wake of the tragic death of an 18-year-old man who suffered an asthma attack at his home. While the main issue in that case was the so-called “Critical Care Bypass” that diverted the ambulance from a nearby hospital to one 11 kilometres away, the issue of communication was also raised. The jury recommended the implementation of a “communication and/or information system that would permit ambulance dispatch information to be sent to fire dispatch” when a call is identified as a serious medical emergency, and that two-way updates on the call (between ambulance and fire dispatch) be made available.

In the second case, a 2002 coroner’s jury in Sudbury was tasked with proposing recommendations as they heard evidence concerning the deaths of two small children and their great grandmother in a house fire. The jury heard detailed evidence about all aspects of the fire service including dispatch and the relevant industry standard from the National Fire Protection Association, NFPA Standard 1221. As a result of this evidence, the jury recommended that the province of Ontario adopt a standard for installation, maintenance and use of emergency services communications systems for all emergency communications dispatch facilities and operations in Ontario.

The ability of the fire service to access subsequent call information after initial dispatch is one that affects public and firefighter safety. Subsequent call information, received by EMS but not the fire department, may reveal that the call is a shooting or stabbing, for example, and that the suspect is still on the scene. The 2000 Toronto coroner’s jury also recommended that the possibility of enhanced medical training for firefighters be studied, as a means of maximizing the number of ALS units available to serve the city of Toronto.

Need for Simultaneous Notification

The Ontario Prehospital Advanced Life Support (OPALS) Study, conducted in the mid to late 1990s, was a controlled study of cardiac arrest survival rates in the 36 months before (Phase I) and 12 months after (Phase II) the implementation of a rapid defibrillation program in an urban centre. The study includes data from 19 Ontario municipalities ranging in size from 16,000 to 750,000. OPALS Phase II results showed that a community can more than double its cardiac arrest survival rate and do so inexpensively, if a defibrillator unit can be on scene within five minutes of the call 90 percent of the time.

Full-time fire departments across Ontario typically have a response time of six minutes. This time includes notification, turnout time and travel time to the scene. Currently, in many municipalities there is a delay in getting trained firefighters to the scene due to the disconnect that occurs in dispatch. In other words, if firefighters and the ambulance are not simultaneously dispatched there is often a delay and the suggested five minute response [noted in the OPALS study] is not met. This is only one example of how the fire service is not being used to its potential in EMS delivery.

The OPALS study also showed that the proportion of cases in which firefighters were first on the scene with defibrillators rose from two percent in 1993 to 50 percent in 1997. It should also be noted that standard dispatching policies and central dispatching were key elements of the study parameters and that equipping firefighters in these communities with defibrillators was inexpensive. In fact, in an article in the Journal of the American Medical Association, the OPALS Study Group commented: “We estimate that the crude startup cost of establishing the rapid defibrillation programs was approximately $36,500 per 100,000

1 The Ontario Prehospital Advanced Life Support Study (OPALS) represents the largest prehospital study yet conducted, worldwide.
residents and that the annual cost would be small. Hence, we believe that this study has demonstrated that the implementation of a rapid defibrillation program is an effective and inexpensive approach to significantly improving out-of-hospital cardiac arrest survival.”

Simultaneous notification and communication are critical elements in saving lives. A fundamental objective of dispatch centres should be to provide service with a minimum number of stages or call transfers between the call intake in the communication centre and the dispatch (notification) of appropriate personnel and equipment.

Emergency response systems can further increase system effectiveness by utilizing emergency medical dispatch (EMD) triage algorithms. Most communities in Ontario use one of two dispatch algorithms.

- Medical Priority Dispatch (MPD)
- Dispatch Priority Card Index (DPCI II)

These algorithms are used by call takers to rapidly elicit patient symptom profiles from callers. Based on the information provided, call takers then dispatch the responders best suited to deal with the emergency. *Simultaneous notification or dispatch links and response protocols should be standardized in communities throughout Ontario to assure equality of service to all. This standardization could be accomplished through tiered agreements in all municipalities that have full-time fire fighters.*

**Simultaneous Notification and Dispatch Protocols Lead to Opportunity for Tiered Response**

For example, in Toronto, a “Computer Aided Dispatch or CAD-to-CAD data link” was established in October of 2003. This link reduced the delay between call receipt and the notification of firefighter first responders. Since that time, the Toronto Fire Department has been involved in a field study assessing the efficacy of rapid intervention in patients with absent vital signs using CPR and CPR adjunct devices.

In an advisory memo from the Toronto Fire Chief dated November 22, 2007, it was noted that, *“We are making a difference.* With the introduction of the 2005 CPR and advanced cardiac life support guidelines by TEMS and TFS in 2006-7, the rate of cardiac arrest survivors discharged from hospital alive in Toronto has climbed from 3.5% to 5.7% from 2006 to 2007. Most had good neurologic outcome and were able to return home. This translates into 38 more people alive and well per year with our new CPR and defibrillation protocols.”

Dispatch system links that allow simultaneous notification of responders and tiered response protocols will continue to provide emergency response system enhancement in Toronto. Decision makers should recognize that this same opportunity awaits all municipalities in Ontario.

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2 JAMA. 1999;281(13):1175-1181./ JAMA, April 7, 1999—Vol 281, No. 13/ jama.281.13.1175
Technicians (EMTs) and the remainders are first responders. Most of the early EMS systems recognized in the U.S. were established in fire departments including Seattle, Miami, Los Angeles, Columbus and Baltimore. EMS is not an incongruity in the fire service.

**Building Tiered Emergency Response Systems**

Virtually all communities across the U.S. and Canada have some form of emergency medical service (EMS) delivery component as part of their overall emergency response system. In most cases, each community has designed the overall emergency response system according to their specific needs. These needs typically include high risk target hazards, construction types, population density, geographic elements, and socioeconomic demographics of the population. In fact, the emergency response systems now in place throughout Canada are the result of the work of individuals, groups, and policymakers at the federal, provincial and local levels of government. As communities grow and change, there is a need to reassess the level and type of resource deployment and adjust the use of resources based on the changing needs. Community decision makers can look to industry standards for guidance in making necessary adjustments and in measuring their effectiveness.

For example, the National Fire Protection Association (NFPA) Standard 1710 states, “Units that provide [Basic Life Support] BLS transport shall be staffed and trained at the level prescribed by the state or provincial agency responsible for providing emergency medical services licensing” (5.3.3.2). Additionally, Section 5.3.3.4 of the same standard states, “Personnel deployed to [Advance Life Support] ALS emergency responses shall include a minimum of two members trained at the emergency medical technician-paramedic level and two members trained at the emergency medical technician basic level arriving on scene within the established response time.” Though the standard provides guidance in the number and level of training, it does not specify the type of apparatus on which responders arrive. Therefore, decision makers can choose how best to use the resources available to them in the most cost efficient and effective manner.

**The Province of Ontario and Tiered Response Agreements**

The Ministry of Health and Long Term Care — Emergency Health Services, the Ministry of Community Safety and Correctional Services – Office of the Fire Marshall and the Ontario Association of Fire Chiefs support the implementation of formal tiered response agreements between public and/or private safety agencies. Such written agreements provide a framework for cooperation between, and coordination of, emergency services on a local level. The coordination of safety agencies is a teamwork approach that improves upon the response to specified emergency situations and overall level of public safety in the community.

Tiered response is recognized internationally as an effective method of coordinating public or private safety agencies to provide rapid first response assistance to the public in the timeliest and efficient manner possible. Tiered response endeavours to send the closest appropriate emergency response agency, based on time, to render assistance at the scene of an emergency incident until the primary response agency can arrive.

Tiered Response Agreements are formal written documents negotiated between two or more public and/or private sector safety agencies. Its intent is to establish local protocols for a multi-agency response to a life threatening or public safety incident.

**GUIDELINES ON DEVELOPING TIERED RESPONSE AGREEMENTS FOR EMERGENCY SERVICES DELIVERED IN ONTARIO**

— Ontario Fire Marshal Communiqué

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**Improving Emergency Response System Components**

**Initial Response (First Response): Use Existing Fire Department Resources**

For any single community, the components of the system and the level of service must be tailored to the needs and wants of that community. While an EMS system is unique to the jurisdiction, the industry recognizes a standard approach to assessing local needs and meeting those needs with specific service components. One mechanism for measuring the effectiveness of delivering service components to the public is response time. When someone calls for help, their primary assessment of the performance of the department and the responders is how quickly they arrive to handle the problem.

Fire departments are well positioned geographically to deliver time critical response and effective emergency care. The fire service is capable of meeting the most stringent response time requirements because the fire service was designed (stations located and apparatus staffed) to meet the need for time critical response and performance of time critical tasks on scene. This model is perfectly suited for EMS response as well. The same infrastructure that was put in place for response to and mitigation of fire events can be used to deliver emergency medical services in communities across Ontario.

Deployment refers to the procedures for distributing emergency response vehicles throughout a defined area of response. The location, number, and type of vehicles in an emergency response system must be specified. Like the other components of the system, decisions regarding appropriate deployment can be made only after decision makers have settled on an appropriate level of service and response times for the community. For example, as
noted above, the goal of a four-minute response time\(^3\) for BLS units and an eight-minute response time for ALS units is an industry-wide standard. These targets can regularly be met by firefighters in urban and most suburban communities.

Firefighters with minimal additional training can be effective on any emergency medical scene. The community-based fire station, with its readily available personnel 24 hours a day, coupled with the unique nature emergency medical care delivery outside of the hospital, creates a symbiotic blend of the traditional duties of the fire department with rapid delivery of prehospital first responder care.

Traditionally, fire stations are strategically placed across geographic regions, typically commensurate with population densities and workload needs. This creates an all-hazard response infrastructure to meet the routine AND catastrophic emergency needs of all communities regardless of the nature of the emergency.

As noted previously, rapid response times are a pivotal advantage to the fire department. For example, if and when firefighters are equipped with automated defibrillators [to reverse sudden cardiac arrest] they, coupled with bystander CPR, can become one of the greatest life-saving tools in Ontario.

Today, in the U.S., essentially every firefighter receives emergency medical training and the fire service provides the majority of medical services during emergencies that occur out of the hospital. Of the 200 most populous cities in the United States, 100% have fire department emergency medical first response \(^4\). This emergency response system design works because many times, patients not only have medical needs, but may also require simultaneous physical rescue, protection from the elements and the creation of a safe physical environment, as well as management of non-medical surrounding. The fire service is uniquely equipped to simultaneously address all of these needs. The mission of the fire service is to protect and save lives and property. There are no other conflicting agendas. Firefighters and first response medical care should be intimately intertwined.

Tiered System Attributes: Fire Department First Response Coupled With EMS /ALS and Transport

Emergency response data for the province show that the current call volume is higher for medical emergencies than for fires. Notwithstanding, political decision makers must understand the overall emergency response system infrastructure prior to assuming that eliminating fire response resources and adding more ambulances makes sense. But call volume is only one of the many key considerations that must be addressed. Another consideration is the capability to cover a geographic area. As noted above, fire departments are well positioned geographically to deliver time critical response and effective emergency care. The fire service is capable of meeting the most stringent response time requirements because Ontario’s urban fire services\(^3\) was designed (stations located and apparatus staffed) to meet the need for time critical

\(^3\) Response time defined as travel time denoted as wheels rolling toward the incident until wheels stopped at the scene.

response and performance of time critical tasks on scene. This model works well for emergency medical response as well. The same infrastructure that was put in place for response to and mitigation of fire events can be used to deliver emergency medical services in your communities.

Whether firefighters are used to ensure an effective and efficient EMS response and care system or not the same level of fire department resources are necessary to ensure adequate distribution and concentration of firefighters for fire suppression, hazardous materials responses and other natural and man-made threats to the public and the environment. Any reduction in a fire department’s ‘all hazard’ infrastructure used to supplement a ‘band-aid’ to the EMS response system will have devastating impacts on the overall emergency response system.

Another key consideration in system improvement is the issue of cost. The obvious question in this consideration is whether it is cheaper to train firefighters to provide initial basic emergency medical intervention using existing resources in each community or whether municipal fire resources should be eliminated in exchange for EMS resources that are paid for by both the municipality and the provincial government. To assess the options for continued EMS system improvement, decision makers should consider a number of factors including the costs of continuing to train existing firefighters compared to the costs of hiring new EMS personnel and the associated ongoing operating costs.

In considering additional training for existing firefighters, it should be noted that all prehospital emergency medical providers must meet and adhere to minimum legal standards to operate at a given level of service. These standards apply with equal force to fire departments [firefighters] and EMS agencies [emergency medical technicians and paramedics].

A final consideration is that clinical capability and reliability of all emergency medical response personnel is assessed by evaluating training and personnel certification types, condition of medical equipment and vehicles, adherence to medical protocols, and system direction and control. Each of these key areas directly affects patient care at the scene and is regulated by standards set by the Ministry of Health and Long Term Care. This being so, firefighters can be trained to the level necessary to provide the initial first response to medical emergencies and held to the same quality performance as EMS agency employees.

In light of the information above, it is expected that the additional training for firefighters to enhance the overall emergency response system is clearly a fraction of the cost of adding more ambulances, equipment and personnel to the street. At least one study has measured the incremental cost effectiveness of various improvements to emergency medical response systems with the goal of increasing survival following out-of-hospital cardiac arrest (Nichol, 1996). The results revealed that the incremental cost for a 48-second improvement in response time in non-fire based one-tiered systems was $368,000 per quality-adjusted life year (QALY) when the improvement was achieved by adding providers.

The study also examined two-tiered systems and noted that adding Basic Life Support (BLS) defibrillator fire response units to the system could improve response times for $53,000 per QALY compared with adding ambulances at $159,000 per QALY. Finally, the study examined the cost of changing a one-tiered EMS system to a two-tiered system. The researchers found that the change was more cost effective if done by adding BLS-defibrillator fire response units at a cost of $40,000 per QALY compared with adding more ambulances at a cost of $94,000 per QALY.

Sunnybrook Centre for Prehospital Medicine, Letter dated October 20, 2011

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6 The QALY is the basic unit used for health care cost-effective analysis and is equivalent to one year at full health for one individual, resulting from improved treatment.
Firefighter Capability to Train and Perform on EMS Incidents

Fire department personnel are very familiar with rigorous training requirements and ongoing skills testing. Mock incidents, in-service testing, and regular training are all routine events for fire service personnel. Equipment maintenance and testing are also part of each department’s standard operations. Additionally, the fire service paramilitary structure will ensure that personnel, equipment, communications, and incident management will operate as effectively at emergency medical incidents as they do at other type emergency incidents in the jurisdiction.

Additional Resources at Medical Emergencies

There are opportunities on an emergency medical scene to reduce scene time by completing tasks simultaneously rather than sequentially thus increasing operational efficiency. When enough hands are available at the scene to complete tasks simultaneously, this leads to overall time reductions relative to smaller crews that are forced to complete tasks sequentially. Therefore, when scene time is important to patient outcome, having first responders on scene will reduce the overall scene time and contribute to positive patient outcome regardless of the type of medical emergency. For example in emergency incidents involving patient trauma such as motor vehicle crashes or acts of violence where extrication or spinal immobilization are necessary, having sufficient number of trained personnel on scene not only reduces overall scene time but also reduces time to completion of critical task and reduces the risks of injury to the responders when completing labour intensive tasks. This time-to-task measurement was the subject of a 2010 study conducted by a broad coalition in the scientific, firefighting, EMS, and public-safety communities in the U.S.\(^7\) The study, funded by the U.S. Department of Homeland Security showed that the size and configuration of an EMS first responder crew and an advanced life support (ALS) crew have a substantial effect on an emergency response system’s ability to respond to both trauma and cardiac events.

Specifically, the study revealed that crews with three- or four-person first responders completed patient removal between 1.2–1.5 minutes faster than smaller crews with just two first responders. All crews with first responders completed removal substantially faster (by 2.6–4.1 minutes) than the ambulance-only crew.

Four-person first responder crews completed a trauma response faster than smaller crews. Towards the latter part of the task response sequence, four-person crews start tasks significantly sooner than smaller crews.

For trauma patients, when assessing crews for their ability to increase on-scene operational efficiency by completing tasks simultaneously, crews with an ALS provider on the engine and one ALS provider on the ambulance completed all required tasks 2.3 minutes faster than crews with a basic life support (BLS) engine and two ALS providers on the ambulance. Additionally, first responders with four-person first responder crews completed all required tasks 1.7 minutes faster than three-person crews and 3.4 minutes faster than two-person crews. The graph below shows the significance of when specific tasks are started as well as their duration to completion. Of particular note are the start, duration and completion times of labour intensive tasks such as patient immobilization (backboard) and patient packaging for transport (final task).

\(^7\) Report on EMS Field Experiments, 2010 DHS (EMW-2008-FP-01603)

Report on EMS Field Experiments, 2010 DHS (EMW-2008-FP-01603)
By removing the first responder all together, these times further increase. The patient removal results show substantial differences associated with crew size. Crews with three- or four-person first responders complete removal between 1.2 – 1.5 minutes faster than smaller crews with two first responders. All crews with first responders complete removal substantially faster (by 2.6 - 4.1 minutes) than the ambulance-only crew. Results for cardiac patients mirror the result for trauma patients.

**Opportunity for Reduction in Illness and Injury Rates in EMS Employees**

In U.S. single role EMS systems, where providers respond in ambulances only with little or no co-response from first responders, employee illness and injury rates are high. This phenomenon should be assessed in the Ontario system with appropriate employee data. These data were unavailable for analysis and reporting in this document.

**Staffing factor calculation**

A staffing factor is typically used to calculate the total number of personnel required to staff field positions 24 hours a day/7 days a week. The factor is based on current staffing patterns and employee leave patterns.

**Consideration in Ontario**

Decision makers should acquire sufficient data to assess the staffing factor associated with staffing additional ambulances. This staffing factor will be useful in calculating the total cost of adding more ambulances compared with the option of training current firefighters to supplement emergency medical response.

**Conclusion**

In today’s environment of increased responsibilities and decreasing budgets, local government and fire department leaders must constantly evaluate and justify current systems and be prepared to propose system design changes to protect the quality of publicly funded emergency response systems.

In terms of the rapid delivery of emergency medical care in the out-of-hospital environment, fire departments have the advantage of having an available, free-standing team of trained personnel ready to respond anytime and anywhere. **Municipalities are urged to use existing fire department resources to their full extent to enhance the emergency response system** prior to requesting additional monies from the provincial government. Provincial funding for EMS resources should be independent of the employer of the paramedics.

Prehospital emergency medical response is one of the essential public services. Fire department resources are strategically positioned to deliver time critical response, effective patient intervention and scene safety. Fire departments accomplish this while emphasizing responder and public safety, providing competent and compassionate workers, and delivering cost-effective operations. As the provincial and municipal governments consider their strategic plans for ‘all hazards’ emergency response system improvement, emergency medical response should be included in those considerations and decision makers should recognize that the fire department is an ideal first response agency.

**Recommendations**

- **Simultaneous notification or dispatch links and response protocols should be standardized in communities throughout Ontario to ensure equal access to the best available services. This standardization could be accomplished through tiered agreements in all municipalities that have full-time fire fighters.**

- **To assess the options for continued EMS system improvement, decision makers should consider a number of factors including the costs of continuing to train existing firefighters compared to the costs of hiring new EMS personnel and the associated ongoing operating costs.**

- **Municipalities are urged to use existing fire department resources to their full extent to enhance the emergency response system.**

> “… As medical directors at the Sunnybrook Centre for Prehospital Medicine, we are privileged to work with paramedics, firefighters and other emergency responders every day. It is our opinion that the best pre-hospital care is provided by highly skilled paramedics supported by trained first responders through a structured and evidence-based tiered response system. We encourage constructive discussion and urge all the parties involved to keep the needs of the patient first and foremost in their minds.”

Sunnybrook Centre for Prehospital Medicine, Letter dated October 20, 2011