Consultant Report

Performance Evaluation of Nova Scotia Emergency Health Services

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November 2001

PERFORMANCE EVALUATION OF
NOVA SCOTIA EMERGENCY HEALTH SERVICES

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I.
EXECUTIVE SUMMARY

In 1995 the Province of Nova Scotia embarked on a restructuring of the emergency health services system. A single provider was selected to provide emergency medical services to all but two areas of the Province. The Province and the provider (Emergency Medical Care, Inc.) acquired and consolidated approximately 50 ambulance service areas.

The primary objective was to provide higher levels of care with more consistency and reliability throughout the Province. This process has been extremely effective as demonstrated by the number of major improvements that have occurred over the last few years.

SYSTEM IMPROVEMENTS

The following paragraphs highlight some of the major improvements made in the system.

CONSISTENCY AND EQUITY

Prior to the amalgamation of the multiple ambulance providers, the level of service, the responsiveness of service, and the quality of care was dependent upon the patient's location. There was wide variability and response times and quality of care.

Currently, the Province enjoys high levels of consistency and equity for its citizens and visitors. The Emergency Health Services (EHS) system's ambulances are distributed throughout the Province delivering reliable response times to those who need emergency ambulance.

The ambulance crews operate under a single set of clinical protocols that are state-of-the-art and represent the highest standards for emergency care of the sick and injured.

CLINICAL PERFORMANCE

Part of the mission undertaken by the Province and its ambulance provider is to increase the level of care to that of an advanced level paramedic (P-3). Much of the Province was traditionally covered by personnel with only basic life support (BLS) capabilities. These individuals could provide splints, bandages, CPR, and oxygen but were limited in their clinical care capabilities.

An advanced level paramedic provides the basic life support care levels but can also deliver sophisticated treatment to the patients including endotracheal intubation, cardioversion, intravenous fluids, powerful IV medications, and a number of other complex procedures. The contract between Emergency Health Services (EHS) and Emergency Medical Care (EMC) calls for the gradual increase of advanced level

paramedics so that by the year 2007 every ambulance responding to an emergency call will have advanced life support (ALS) services available to the patients.

RESPONSE TIMES

One of the key measurements of performance in any emergency health system is the response time of its ambulances. EMC has dramatically improved its response time performance throughout the Province. EMC working with EHS continues to find ways to shorten the response time to emergency events.

LABOUR STABILITY

The creation of the Province-wide Emergency Health Service's system created job opportunities for more than 600 paramedics. The previous system operated with a large number of volunteer and casual employees. Establishing a full-time cadre of professional emergency paramedics has allowed the system to mature and as further experience is gained within the workforce even higher expectations for the delivery of high quality care can be met.

EQUIPMENT AND VEHICLES

A key characteristic of Nova Scotia's emergency health system is that the Province leases nearly 130 ambulances. The ambulances within the fleet are retired after three years therefore reliability and performance is enhanced. The critical failure rate where an ambulance fails on an emergency is less than one per 10,000 ambulance transports. This demonstrates the high reliability of the vehicle fleet.

In addition, the Province supplies the necessary medical equipment and insures that it is available, operational, and state-of-the-art.

PROFESSIONALISM

EMC is barely three years old yet has made great strides in selecting, training, and recruiting managerial, supervisory, support, and field personnel. The organization has undergone some growing pains but now is beginning to function well as a $40 million company with more than 600 employees.

EMC has adopted some of the industry's innovative techniques for deployment of ambulances that can match any service in North America. There are other pockets of excellence within the organization as the various departments continue to mature.

A key barometer of the success of an organization in achieving its mission is the level of professionalism demonstrated by the front line personnel. EMC has done well in developing a personable and professional corp of caregivers.

TECHNOLOGY

EHS has acquired and installed sophisticated technology necessary for delivering high quality services in a responsive and efficient manner.

The Province has installed a state-of-the-art computer aided dispatch (CAD) system to manage the provincial fleet and its responses. Satellite locators and onboard electronic maps facilitate ambulance crews in finding patient locations. EMC has also taken advantage of the internet to facilitate its internal communications and reporting. The Province and EMC continue to make good use of available technology.

EXCESS CAPACITY PROJECT

In the more remote areas of the Province ambulance crews respond to emergency calls very infrequently. This availability of personnel represents excess capacity within the system. EHS and EMC have undertaken an excess capacity project on the Long and Brier Islands where on-duty ambulance personnel assist in delivering other specialized health services, public education, and injury prevention.

This use of excess capacity should represent a model to be more widely incorporated within the system in the future where health services are delivered on a more integrated basis. This is particularly advantageous in isolated communities where there is an absence of nursing or physician resources.

POSITION FOR THE FUTURE

The Emergency Health Service system of Nova Scotia is well positioned for the future. It is adaptable and can respond to changes in healthcare and the population demographics. The service is well positioned to be more fully integrated in the delivery of other health services and can be redeployed to match variations in demand and population shifts.

The EHS system is also a valuable resource in the event of a major disaster. Having more than 600 caregivers and 125 ambulances under the control of the single entity allows for rapid and overwhelming response to an emergency event. A single command structure, radio system, and operational policies and procedure facilitate this type of response.

COST EFFECTIVENESS

The Provincial government has supported the EHS system with significant allocation of funds over the last four years. The effective use of these funds has been demonstrated in the improvements in quality, responsiveness and equity throughout the Province.

Comparing the costs of providing emergency health services in Nova Scotia with other high performance systems reveals that Nova Scotia is able to deploy an ambulance at a lower rate than any other service; while the costs per transport and per capita are higher.

The reasons for these higher per capita and per transport costs are the resources required to provide coverage for the vast area of the Province to achieve reasonable response times and the quantity of long distance transports from primary and secondary health facilities to the tertiary care facility in Halifax. Some transports are 1,000 km round-trip and consume 12 hours of ambulance time.

The total cost per hour of ambulance service is the true measure of cost effectiveness in Nova Scotia. In this comparison with other high performance systems, Nova Scotia deploys an ambulance at a lower cost per hour than any other service. This indicates that EHS and EMC excel in delivering ambulance hours on a reasonable cost basis.

AREAS FOR IMPROVEMENT

While EHS and EMC have made great strides in the delivery of emergency health services within the Province of Nova Scotia, there are still areas that can be best classified as "works in progress." Additional work and improvement is needed for the EHS/EMC system to advance to the next level.

MEASUREMENT

Some of the performance standards to be achieved by EMC have not been finalized. For example, the areas of the Province that would fall into the zones 3-5 have not been identified in order to measure against a defined response time. The non-emergency response times are inadequately measured and reported. EHS and EMC have not been able to quantify progress toward having an all ALS ambulance service. Even though the progress is mandated in the agreement, the system has not adequately measured its performance.

QUALITY IMPROVEMENTS PROCESSES

There has been effective progress in implementing quality improvement processes in the EHS system. A few steps remain to be finalized including the linkage between EHS' medical direction and oversight and EMC's management and responsibility for its employees. Establishing the envisioned multi-disciplinary medical advisory board to support the systems' Medical Director and formalizing the link between medical oversight and auditing with managerial responsibility should be a next step in the evolution of the quality improvement programs. The Medical Control Physicians are actively involved in the system with defined roles in support of the Medical Director and the paramedics.

GOVERNANCE AND ACCOUNTABILITY

When the Province undertook the mission of amalgamating and improving emergency health services within the Province, expertise and experience in high performance emergency medical service operations and management was lacking. EHS and EMC worked together, and have advanced the system to where it is today. During this maturing process the roles of EHS and EMC blended. The result is that EHS in

some instances has taken on a more direct managerial role by dictating not only the standards but often the means and methods to be used by the contractor. The contractor on the other hand has balked at some of these interventions. This has resulted oftentimes in an adversarial relationship rather than the collegial relationship that is desired. Both EMC and EHS recognize that this is the situation and are working toward resolving some of the key issues.

This is not an unexpected situation and has been repeated in almost every public utility model in North America. But, in order for both EMC and EHS to move forward productively it will be necessary to reestablish the roles and responsibilities. EHS should have the responsibility for developing policy, clinical protocols, providing medical oversight, and monitoring this system. EMC should be free to determine the means and the methods of delivering the services but should be held accountable for its performance.

CONCLUSION

The Nova Scotia EHS system has made dramatic improvements over the last few years. As performance continues to improve, both EHS and EMC can work on some of the remaining issues to insure that the citizens of Nova Scotia can receive the highest level of emergency health services possible within the resources available. A pertinent question to be asked is: Are the taxpayers of Nova Scotia receiving good value for the money spent on its emergency health services? The answer is an unequivocal-yes.

This summary has highlighted many of the system improvements that have been achieved in Nova Scotia's Emergency Health Services system. The following report focuses on areas for improvement, not to denigrate the system's advancements, but to guide its development.

II.
INTRODUCTION

TERMS OF REFERENCE

In July 2000 the Nova Scotia Department of Health (NSDOH) distributed a request for proposals for the clinical performance evaluation of EMC (Emergency Medical Care, Incorporated), the provinces' emergency medical service contractor. Fitch and Associates, LLC was selected to conduct the evaluation and a contract was signed in March 2001.

The purpose of the project is to "provide a clinical evaluation of the provinces' ground ambulance services. Specifically, a clinical performance evaluation of the Emergency Medical Care (EMC) ground ambulance and communication and dispatch operations."

The request for proposals further identifies the main objective of the evaluation as "to assess if the emergency medical services being provided by EMC, are effective and efficient from a clinical performance perspective as compared to the contract terms and conditions, and in relation to the cost incurred."

While the focus of this review is on the clinical performance of the ground ambulance service system, it is necessary to evaluate operations, human resources, financial systems, and legal and political issues as well as the clinical components. All aspects of delivery of emergency medical and ground ambulance services are interdependent and are difficult to evaluate in isolation without understanding the context, available resources, and operational activities. The request for proposals recognized the relationship between outcome and processes by requesting that the project include evaluating the effectiveness and efficiency in operations and fiscal management.

Multiple questions need to be answered to insure that the citizens and taxpayers of Nova Scotia are getting good value for the resources invested in their emergency medical and ground ambulance system. Overriding questions for the government are: What is the difference in clinical care between the old system and the new system? and, Have the performance improvements warranted the increased investment by the government? Based upon the outcome of the clinical performance analysis the Department of Health has requested that the consultants answer the following questions: Where are the operations effective? Where are operations ineffective? Where are operations excelling? And, where are areas where EMC/EHS (Emergency Health Services) need to improve upon?

The request for proposal further delineates a set of twelve categories with a question to be answered in each. They are:

- Management direction – are the nature of EMC's emergency medical and response service objectives clear, well integrated and understood?
- Relevance – does the EMC emergency response structure make sense in regards to the nature of emergency health services it is intended to provide?
- Appropriateness – is emergency response system design logical in light of the specific objectives to be achieved?
- Achievement of intended results – how well is EMC meeting and realizing its objectives?
- Acceptance – how has the emergency response system been judged by key players?
- Secondary impacts – have there been any other notable consequences of the emergency response system that has been put in place that have either intended/unintended or positive/negative effects?
- Cost of productivity – how productive is the emergency response system in relation of the level and success of the emergency medical care being provided, and in relation to associated costs being incurred?
- Responsiveness – how adaptable is the emergency response system to changes in standards, population make-ups, findings, technology, etc.?
- Financial results – how are EMC's financial results in relation to emergency response system in place and the associated contract budget and expectations of EHS?
- Working environment – how well is EMC providing appropriate working atmosphere opportunities for development and achievement, as well as promoting commitment, initiative and safety?
- Protection of assets – how well is EMC/EHS safeguarding its important assets?
- Monitoring and reporting – how well are key performance matters being identified, monitored, and reported by both EMC and EHS?

Ultimately, the deliverable for the project is a report that includes:

1) A set of findings and recommendations for the effectiveness and efficiency improvements on the ambulances' operations in relation to:
   a) contract terms and conditions,
   b) cost being incurred, and
2) A conclusion as to the effectiveness and efficiency of the ambulance operations clinical performance in relation to the:
   a) contract terms and conditions, and
   b) cost being incurred.

This report addresses the terms of reference and specifically identifies findings, issues, and recommendations for consideration by Emergency Medical Care, Inc., Emergency Health Service of the Nova Scotia Department of Health, and the provincial government.

PROJECT METHODOLOGY

The project entailed a number of different activities including:

- Interviews with key EHS personnel
- Interviews with EMC personnel
- Direct observation of communication centre activities
- Direct observation and tour of EMC bases, facilities, and service centres
- Examination of hundreds of pages of documents and reports
- Multiple telephone calls to collect specific information
- Examination of reports specifically generated by the EMC/EHS computer aided dispatch system
- A two-day facilitated workshop with EHS and EMC representatives to define and model clinical performance
- Examination of performance standards and levels of other communities throughout North America
- The analysis and collection of data resulting in the preparation of the project report

The consultants spent more than twenty days onsite in Nova Scotia beginning in April 2001 and continuing through June 2001. These site visits were used to interview representatives from EMC and EHS and to observe activities within Nova Scotia's prehospital emergency care system.

A two-day workshop was held in June to convene an expert panel to assist the consultant team in evaluating clinical performance levels of the current system and comparing them to the provincial ground ambulance system prior to amalgamation.

We used a wide variety of tools in assessing Nova Scotia's prehospital emergency care system. Many of these tools have been adapted from value for money auditing techniques frequently used by the Canadian federal government. These techniques are designed to assess effectiveness and efficiency in the provision of emergency medical services. Comparisons with other North American high performance EMS systems were also accomplished and significant findings are included in the text of the report.

DESIRED PROJECT OUTCOME

Emergency Health Services are an extremely important government function. The citizens and visitors of Nova Scotia expect emergency medical services to be available and prompt, with clearly defined quality. In addition, changes in the provincial healthcare system have increased the importance of non-emergency transportation to insure that individuals can receive the most appropriate care specific to their condition of illness. Given that emergency medical care services are highly visible and very important to the citizenry, the services' evaluation and delineation of its achievements are essential in garnering and maintaining public support and understanding this component of the healthcare system.

The Province has invested a considerable amount of funds in its prehospital emergency care system. The initial investment included the purchase of multiple ambulance services, the establishment of a province-wide ambulance fleet, and the implementation of a single medical communications centre. The government continues to support ambulance service operations and through the contractor, the employment of more than 600 paramedics deployed throughout the province to respond to medical emergencies.

The key question to be answered as a result to this project is: Has the provincial investment in prehospital emergency medical services resulted in faster response, better reliability, and higher quality for the patients using the service?

III.

HIGH PERFORMANCE EMERGENCY MEDICAL SERVICE SYSTEMS

Beginning in 1995, Nova Scotia embarked on a process to modernize its prehospital emergency care system to one of the premiere systems in the world. A handful of emergency medical service systems throughout North America are referred to as high performance EMS systems. Many of these systems are designed around the public utility model where a government or quasi governmental entity oversees a private contractor. In public utility models, the government frequently retains ownership and control of the essential assets of production such as vehicles, communications infrastructure, and facilities. The contractor on the other hand is responsible for day-to-day operations and the employment and management of all the personnel. Variations exist between all of the public utility model EMS systems. But, one key characteristic of these models is that they have defined performance standards for the operators. High performance EMS systems typically have standards for:

- Response times
  - Life threatening emergency
  - Non life threatening emergency
  - Urgent
  - Scheduled transports
  - Non scheduled transport
- Clinical care levels defined by
  - Personnel certification levels
  - Training and continue of education programs
  - Protocol compliance
- Fiscal parameters
  - Cost per unit hour
  - Cost per transport
  - Revenue recovery
- Customer satisfaction levels
- Fleet and asset management programs
- Public education
- Other areas

Nova Scotia has developed performance standards in all of the above areas with a focus on: clinical care, response time reliability, and financial performance.

Too often, the understanding of emergency medical services and ground ambulance systems are confined to the emergency ambulance response to acute illness and injury. This is a very superficial perspective in that it understates the components that make effective emergency medical services. Prehospital emergency care reflects the entire continuum of patient care, treatment, and transportation for patients outside of the hospital environment. This broader definition of emergency medical services allows for a better understanding of the multiple providers and agencies required to ensure prompt response, effective treatment, and appropriate medical transportation for patients within a healthcare system.

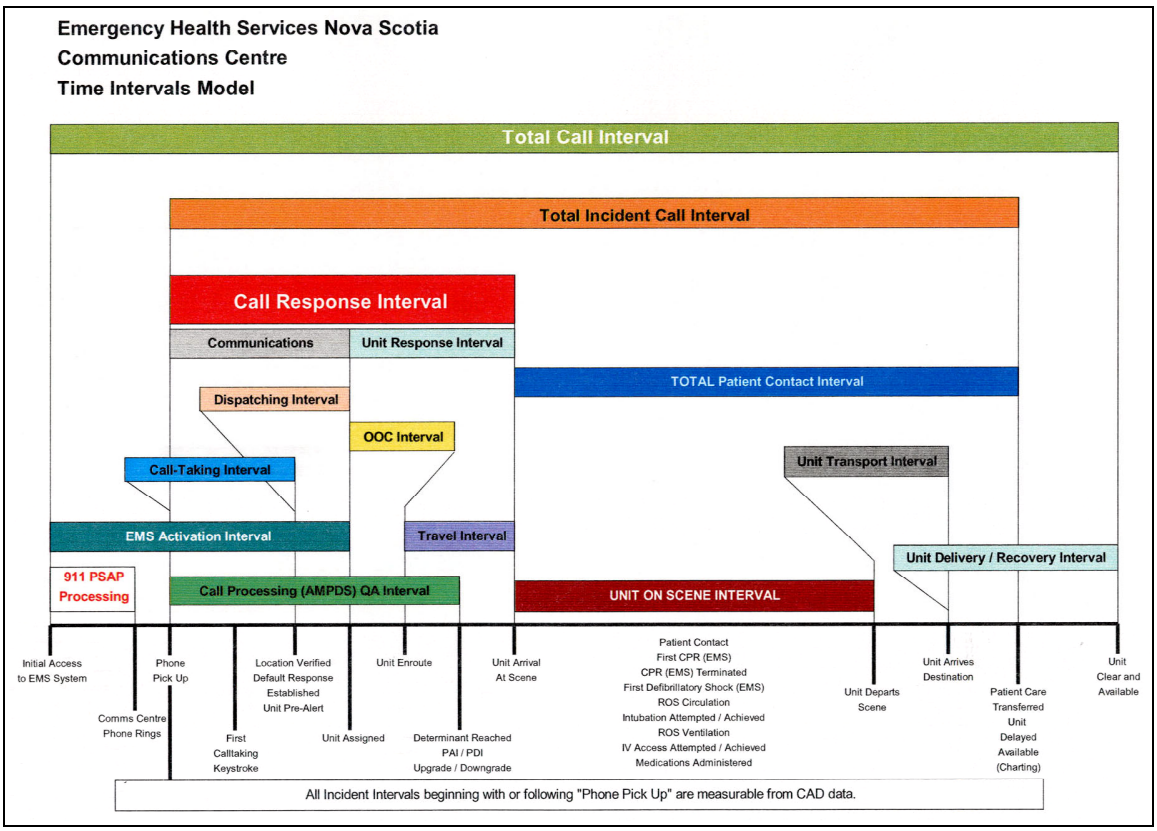
The participants in an effective emergency medical services system include members of the communities, patients, first responders, public safety agencies such as law enforcement and fire services, paramedics, healthcare providers at clinics, physicians overseeing patient care and protocols, dispatch centre, and medical personnel in hospital emergency departments. The patients' needs in emergency events can only be met through the collective cooperation of multiple individuals and agencies. One way to better understand the relationship and workings of emergency medical services is to walk through the anatomy of a call.

ANATOMY OF A CALL

EMC and EHS use a model which encompasses the continuum of an emergency care event from the time that the EMS system has been accessed until the unit is clear and available for an additional response. Figure 1 shows the EHS time intervals model. Two components are not included on this model. The first being the time from the event occurrence until the time that the EMS system is accessed and a second component is from the time the unit is clear and available to respond to a call until it has been redeployed to the appropriate location to maintain emergency ambulance coverage.

An emergency event begins with the sudden onset of acute emergency condition. Depending upon the understanding of the patient or bystanders regarding the emergency medical service system, help is summoned. This generally occurs through dialing 911 or other emergency numbers. If the community has a sound basis and understanding of the EMS system, the time lapse from the onset of symptoms to the summoning of help can be very short. Bystanders or family members may be able to initiate certain prehospital treatments such as cardiopulmonary resuscitation (CPR) in critical events.

Figure 1: Time Intervals Model



The emergency call is typically answered at a public safety answering point (PSAP) where the operator will ask whether the emergency is for fire, police, or ambulance services. This emergency caller is then forwarded to the appropriate dispatch centre depending on the type of emergency. The EMS call is received in a single dispatch centre where the call-taker identifies the location of the patient and the nature of the problem. Depending upon the nature of the problem, additional instructions may be provided to the patient, the patient's family, or bystanders for treatment and aid prior to the arrival of emergency medical personnel. Concurrently, the call-taker Paramedic identifies the location, selects the closest ambulance to respond to the event, assigns a priority/severity level to the call, dispatches the appropriate ambulance, and in many circumstances sends first responders to the patient's location. In rural areas the first responders will arrive at the scene and begin to stabilize the patient and provide emergency treatment at a basic level prior to the arrival of the ambulance. Medical first response is of critical importance in rural Nova Scotia where ambulance response is expected to be longer, and as support for paramedics in other areas of the Province.[1]

After the ambulance arrives, the crew continues providing treatment and stabilization to the patient and prepares the patient for transport to the nearest medical facility capable of treating the patient's condition. If necessary, advanced level personnel, such as paramedics, may request consultation with a physician via

[1] NOTE: Approximately 50% of the fire departments in Nova Scotia provide Medical First Response.

radio or telephone in order to provide more advanced treatment therapy such as the administration of certain medications.

Once the patient is prepared for movement, the ambulance crew transports the patient to the nearest appropriate medical facility, which is typically the emergency department of a hospital. The ambulance crew will unload the patient at the hospital and turn over care responsibility to emergency department personnel and provide both a written and verbal report regarding the patient's condition and prior treatment.

Each of the components identified in the anatomy of a call consumes time. In some emergency conditions, time is critical in determining the final outcomes of the patient. Therefore, every effort is made to minimize the time from the onset of the medical event until delivery to definitive care. The time interval that begins at the receipt of a call at the emergency dispatch centre, through the collection of adequate information to respond an ambulance (location and nature of the problem) until a fully staffed ambulance arrives at the scene that is capable of treating and transporting the patient, is called the response time. The diagram in Figure 1 indicates the call response interval as from the time of phone pick-up in the medical communications centre until the unit arrives at the scene. From the patient's perspective, this is the most critical time element in the entire event. From the time of the call for help until someone arrives to treat and transport the patient.

Response time performance is dependent on a number of factors including rapid identification of the exact location of the patient, the system deployment of ambulance resources throughout its coverage area, the selection of the closest appropriate ambulance for emergency response, the ability of the ambulance crews to find the patient's location, and the current workload demand within the system at the time of the event.

Ultimately, an EMS system strives to shorten response times for ambulances to patients in emergency medical situations and to ensure that personnel with appropriate levels of training are delivered to the scene in order to stabilize and transport the patient.[2]

[2] Generic information adapted from the project report on the Saskatchewan EMS development project.

DEFINING HIGH PERFORMANCE EMS

High performance emergency medical service is an often-bantered term without a consensus definition. The National Association of Public Utility Models associates "clinical excellence combined with effective cost containment" with the definition of high performance EMS. Attributes of the high performance EMS (HPEMS) system include:

- All advanced life support ambulances and personnel
- Sophisticated dispatch protocols that predict demand for services
- Matching supply and demand
- Defined response times requirements

These general criteria used to describe a high performance EMS system are not definitive. In other words, agreement has not been reached upon what is the most appropriate response time performance standard. High performance EMS systems staff their ambulances with different crew configurations including two paramedics or one paramedic and one basic level EMT. Variations also exist in additional courses required by the caregivers. While a characteristic of the HPEMS systems is matching resources with demand, there are no specifics on how that should be accomplished. Other examples of variation include multiple processes for call prioritization, delivering pre-arrival instructions, and definitions of life threatening, non-life threatening, and other emergency or urgent events.

The lack of consistent definitions of criteria and standards among high performance EMS systems has caused significant problems for Nova Scotia. In Nova Scotia, organizations and individuals have created their own assumptions with regard to what attributes are present in a high performance EMS system and how these performance standards should be defined within the context of Nova Scotia prehospital emergency care.

NOVA SCOTIA'S PREHOSPITAL EMERGENCY HEALTH SYSTEM

An emergency medical services system's ability to perform is largely dependant upon the system design. Dramatic improvements and changes in the system design require a well planned evolutionary process. Significant changes have occurred in Nova Scotia in the last six years. In order to understand where the Province is today it is necessary to review the historical changes in the delivery of prehospital emergency care in the Province.

HISTORY OF PREHOSPITAL CARE IN NOVA SCOTIA

Prior to 1995 ground ambulance services were delivered by a variety of providers throughout the Province. Funeral homes, volunteer agencies, municipalities, fire departments, and private companies were responsible for ground ambulance services within the Province.

The best description for the service provided under these arrangements was variable. Response times varied widely from one part of the Province to another, the certification and training levels of personnel ranged from the bare minimum in basic life support training to sophisticated paramedic level services. There were no Province-wide medical protocols and quality improvement programs were essentially nonexistent. Each of the services made its own arrangement for dispatch including phones ringing at homes, dispatch by local government agencies, to full time professionally operated medical communications centres.

One's ability to survive a severe medical emergency was largely dependent upon luck and the location of the incident.

In 1995 the Province undertook an effort to improve emergency medical services. The defining study on the provincial EMS system was the Murphy/Jones Report released in 1995. It was from this report's findings and recommendations that a process was undertaken to develop a "public utility model" system throughout the Province. In the last six years the EHS and EMC have consolidated nearly all of the fifty-four ambulance services existing in 1995. Emergency Health Services (EHS) developed performance standards and system specifications to select a private company as the province-wide ambulance contractor.

EHS signed a contract with Emergency Medical Care, Inc. in January of 1999. Under the arrangements of the system design and structure, the Provincial government through the EHS owns or leases all the vehicles, communications infrastructure, facilities, and other pieces of essential equipment. The contractor, EMC, employeed all the management staff, ambulance personnel, fleet maintenance personnel, communications centre staff, and other support employees. The arrangement is intended to provide performance standards for the contractor to achieve while EHS is to function as the contract administrator and oversight entity. This arrangement is intended to continually improve the level and quality of emergency health services in the Province.

Figure 2: EHS Activity Levels

	1999/2000	2000/2001
Ambulance Requests	93,454	92,253
Patient Transports	83,386	83,745

Figure 2 reveals the activity level of EHS. In fiscal year 1999/2000 EHS responded to 93,454 ambulance requests. Of those, the service transported 83,386 patients. In fiscal year 2000/2001 the service responded to 92,253 requests for ambulance service of which 53,861 were emergency or urgent requests and 38,392 were transfers. The service transported 83,745 patients in 2000/2001.

With the exception of two services, the Province now has a single ground ambulance provider with standardized medical protocols, fleet, equipment, and human resource policies. The system has progressed from one with fragmented and variable levels of care and service to one with predictable and reliable performance and has dramatically improved the quality of care for its patients.

IV.
CLINICAL PERFORMANCE EVALUATION

The primary objective of this project is to determine if the radical changes made in the Nova Scotia emergency health services system have resulted in improved clinical outcomes for the patients using the system. Unfortunately, it is very difficult to quantify the effects of emergency medical services to the point where it is possible to identify the number of lives saved or specific reductions in patient morbidity. The science is too imprecise and there are too many external variables that impact patient outcomes. For example, did a patient survive an acute myocardial infarction (heart attack) because of the treatment received from the first responders, the ambulance paramedics, the emergency department, the treating cardiologist, or the cardiovascular surgeons? Treatment of a particular illness or injury is not reserved to one group of healthcare professionals, but represents a team effort including the full continuum of recognition, treatment, definitive care, and rehabilitation.

Even so, there are certain indicators that are used to describe the clinical effectiveness of emergency medical services. Much research has been conducted in the area of treatment of cardiac arrest patients, particularly those suffering from ventricular fibrillation. Research methodology has been established and these types of studies have been conducted in numerous emergency medical service systems. The Medical Director of EHS has monitored the survival rate for cardiac arrest in Nova Scotia for the last three years.

Research also indicates that the implementation of a trauma system has a positive impact on survival rates. While it is impossible to identify which component of a trauma system provides the greatest benefit, it is clear that when all components are in place and the system is used on a regular basis, the outcomes of patients are improved.

One process used in this project to define clinical effectiveness was to convene a panel of experts from EHS, EMC, and the consulting team to quantify improvements in the delivery of emergency health services in Nova Scotia. This process focused on the effectiveness of the clinical protocols and the rate of compliance of Nova Scotia paramedics in following the protocols. In addition, two other factors were introduced into the clinical performance evaluation process – these are the response time performance of ambulance services to emergency events and the satisfaction level of the patients that use the system. A direct correlation between positive outcomes and timeliness of response has been established for certain illnesses and injuries such as cardiac arrest and multiple system trauma. Therefore, the ability of the EMS system to provide prompt response times is strongly believed to have a positive impact on patient outcomes.

A lot has been written about the relationship between psychological factors and improvement in patient health. Therefore, the factor of patient satisfaction has also been introduced as an important indicator not

only for the service of the EHS/EMC emergency medical service system, but also its likelihood to have a positive effect on patient recovery.

The clinical performance evaluation focused on six components of the EHS system. They include:

- Protocol compliance and effectiveness for six patient group
  - Cardiac patients
  - Patients with altered levels of consciousness
  - Cardio-vascular accident (stroke) patients
  - Patients with difficulty breathing
  - Trauma patients
  - Patients with other medical conditions
- Response time performance
- Patient satisfaction
- Cardiac arrest statistics
- Trauma system statistics
- Level of care provided.

BACKGROUND

Prior to 1996, Nova Scotia citizens received their ambulance services through a conglomeration of various services throughout the Province, ranging from funeral services that provided ambulance response and transport to volunteer basic life support services, to professional advanced life support EMS services in the metropolitan areas. Where one lived determined the quality and speed of the ambulance response with a wide range that could determine survival.

PUBLIC-PRIVATE MODEL

About three years ago Nova Scotia DOH elected to transition to a full-time, all professional, protocol-driven (ultimately to be at the paramedic ALS level) service with response times approaching standards common in advanced life support systems, taking into account the population density and remoteness of the population.

To do this, instead of creating a province-wide system, NSDOH (through its EHS division) contracted for ambulance services with a single private entity (EMC, Inc.). Originally the contract was limited to simply requiring performance on the "ambulance response side" of EMS (qualified ambulance response and transport), but in 1999 dispatching responsibility was added to the contract. Being responsible for both ambulance response (and all that implies) and for dispatching them assures a consolidation of accountability for "the performance of the system" and avoids finger pointing and blame shifting for problem or controversial ambulance responses. It permits the provider to manage the system as a whole and gives the provider the tools to do so. If financial arrangements are crafted properly, the primary

incentive for the provider becomes optimizing efficiency while avoiding degradation of required quality, the advantage of such public-private models.

MEDICAL RESULTS PERFORMANCE ISSUES

In all of this, however, *medical measures* of system effectiveness are not as straight forward. They are more complicated and their causal chain is more convoluted and imprecise than the usual measures of system performance. For example, there are more interdependencies (between organizations). But more significantly, the causal connections between protocol, including both procedures and medications, and the effect in the patient, especially ultimate medical outcomes, is subject to variables outside of the control either of protocol designers or providers. Furthermore, no protocol can anticipate all the individuality and uniqueness inherent in the care of human beings, especially under the circumstances of urgent prehospital care.

The final test of value, nevertheless, lies with whether the system and the investment results in improved prehospital medical care and medical outcomes. The latter are much more difficult to measure and test for effectiveness. Therefore, most approaches look at the intermediate medical care procedures and near term indicators that are assumed to be logically linked with a higher likelihood of favorable medical outcomes in the longer run. In some cases research is available that supports this logic, and sometimes it is taken on faith in the logic. For example, it is assumed that timely, medically correct care of stroke victims should result in or facilitate an improved outcome for the patient. However, there are many variables in between initial care and outcome, and proving that link is difficult. Nevertheless, consciously or by policy (or resources) *not* providing the best and timeliest of care, as currently defined, is nearly unthinkable and subject to potential litigation.

Performance measurement, whether that of a mechanical process or of medical outcomes, requires thinking carefully about the process or system that gets to the desired results. Although, in modern management circles it is acknowledged (though not necessarily practiced) that measurement should be for improvement and understanding and not for judgment (otherwise all sorts of perverse organizational behaviors result, including hiding or altering the data). Confusion of roles and responsibilities (and, hence, accountability) within the system will frustrate attempts at measurement and improvement and will distort the organizational behavior that must produce the result. Clarity of accountability is vital, not to blame but to fix responsibility for correcting and improving performance. Knowing outcomes achieved for the cost involved is also vital to prudent purchasing.

Given the potential for fuzziness and confusion in the complex causal chain leading to optimum medical results, especially in the public-private model, this problem of effectiveness measurement and accountability confusion has a high potential of manifesting itself. Consequently, it is vitally important to align governance with structure, with accountability, and with measurement and analysis.

DEVELOPMENT OF AN APPROACH TO MEASUREMENT

Given the above, it was necessary that structure and the consequent accountability "chain" be clear. If that could be accomplished, a constructive set of measurements and a performance measurement system would emerge.

Structure

Guidance on the structural relationship between EHS and EMC can be found in the government's planning document, *"The Courses Ahead."* It states, "we all know that you cannot row and steer at the same time. Over the past few years governments have been spending way too much time rowing the boat while neglecting the tiller...It's time government assumed its proper role as a navigator."

This describes the desired relationship of EHS and EMC. EHS navigates by establishing and reviewing policy and monitoring the system's result.

EMC is charge with "rowing" by providing the production component of the system and achieving the agreed upon performance levels.

The structure is, of course, determined by the organizational arrangement crafted by the EHS. A private company is responsible (and paid) for running the ambulance system under contract to EHS. But what does that mean? It depends on the nature of the contract and those interpreting it and overseeing it. Ideally, such a contract should call for measurable performance indicators of some sort, indicators that the contractor has the resources and capability to meet. EHS's responsibility becomes monitoring those

performance requirements and exercising any consequences (penalties, rewards, etc.) tied to the performance.

However, the ultimate objective of any system and that of EHS certainly, no matter the structure, is to improve the lot (a technical term including everything from quality and compassion of care to final outcome beneficial to the recipient) of the citizen as victim and patient needing prehospital care. Consequently, EHS's final judgment of the system *as a whole* is based on whether it meets those outcome objectives in its citizenry and does so as efficiently as possible for the resources available. But can the contractor be held accountable for that? It depends on the contract and the power provided the contractor. In this case the contractor can only be held accountable for the portion of the chain of events it controls. Thus, measuring the cost compared to the benefit (medical effectiveness) would be difficult without identifying all the component costs. EHS retains a key part of that causal chain leading to ultimate effectiveness, that of the effectiveness of the medical protocols. Therefore, the two organizations are partners and must cooperate in producing the desired final result.

What should be the structure of a measurement system with this arrangement?

Governance Implications

It was noted that accountability must be divided based on the structure (which is tied to logic of the agreement). However, accountability can be distorted or undermined in many ways, and the participants in this collaborative model must understand that. A typical and common way that contracting authorities undermine accountability is to try to do the contractor's job. Some call that "micromanagement" of one sort or another, but in any form it is the dictation of means (methods) when ends have already been stipulated, e.g. performance ends. Dictating means shifts accountability, whether acknowledged or not, back to the individual or agency dictating the means. (In reality it destroys accountability, since the agency dictating the methods rarely acknowledges that, in so doing, it has become responsible for the Ends.) Usually the distortion of accountability is not recognized, and the downstream entity originally responsible (e.g. the contractor) is still held accountable for the ends, although that capacity has been taken away in small "helpful" instructions by the person or entity dictating the means. Of course, this leads to resentment, distrust, and resistance of any measurement system attempting the tie between performance and accountability.

On the other hand, if the contractor does not support a clearly defined set of performance standards, accountability can be lost. Lack of quantifiable standards, consensus or definitions, and declining to measure and report performance makes it impossible for the oversight agency to hold the contractor accountable for its performance.

That is why clarity of the governance principles resulting from the structure is so vital. The handoff or division of accountability between agencies must be clear to assure trust and cooperation. At that point a performance measurement system can be designed and agreed to.

Since, as noted earlier, both share in producing the desired medical ends or outcomes, clarifying the governance and accountability division is not an academic exercise but is necessary for equity of accountability and a mutually satisfying measurement system that can provide and point toward improvement opportunities. In other words, the performance measurement system must recognize the "structure" of accountability. What does that structure look like?

Tracing Accountability Through the Process

The consulting team sought, with the participants, the simplest way to model or illustrate the process while not oversimplifying the structure of the process so as to muddle accountability. Three major domains of process emerged. Working backwards, medical effects represent what is ultimately desired in the process. What creates those effects is the care rendered, with all the implications of the term, herein intended to include response time, quality of the contact with the patient and family and the medical care process itself. What determines the care rendered is set, narrowly or broadly, by a stipulated *way* to give care, the medical protocol. When medical protocols are designed, the intent is that, if carried out properly, the protocols will generally result in or tend to the desired outcome in the patient. But, remember our stroke problem mentioned earlier. That connection may be arguable at best. Nevertheless, it is the best that medicine can do at this time.

Protocol designs in high performance EMS system are, in the main, the purview of physicians and usually physicians trained and knowledgeable in the medical conditions covered by the protocols. Legally, this also establishes a clean linkage of accountability to a licensed physician for the requisite medical judgment reflected in the protocol. In this structure, who sets and controls the protocols? EHS (its medical director to be exact). Logically, then, accountability for the *effectiveness* of the protocols as designed remains with EHS.

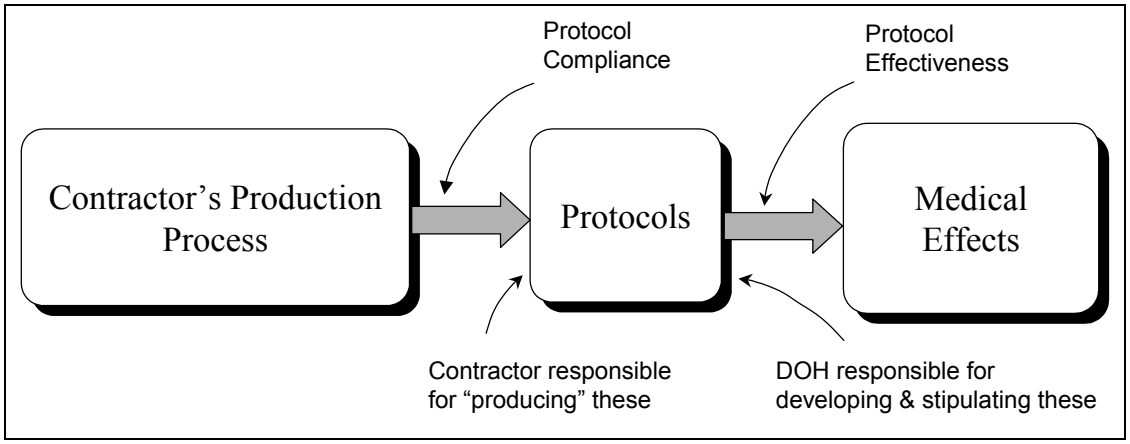
What about achieving or performing the protocols? When protocols are developed it is assumed by the developing physician(s) that there will be certain competencies, capabilities, levels of licensure, medications on board, equipment, and radio capability.

That process of successfully executing the protocol is what the contractor must achieve, and consequently, can be held accountable for. Thus, the compliance for *achieving* the protocols has been separated from the effectiveness (or quality) of the protocols themselves.

The contractor is responsible for structuring and conducting its internal resources and processes to accomplish the achievement of the protocols. That responsibility remains with the contractor. (Recall that dictation of means or methods across a line of accountability undermines or nullifies accountability.) EHS should stay out of methods dictation but insist on stipulated results in terms of compliance.

The macro process flow is diagrammed in Figure 3 below:

Figure 3: EHS and EMC Clinical Accountabilities



Implications for Measurement

Separation of the production process, into separate accountabilities that lead ultimately to the desired medical results permits clarity for designing the measurement system, (in order to improve and assess cost/benefit questions and their policy consideration).

Clarifying the process "chain" reveals two key components to performance effectiveness

1) The effectiveness of the protocol if conducted successfully, and
2) The degree to which it was conducted successfully, (its "compliance").

It is important that the reader remember that the term "protocol" includes the desired response time along with the expected or desired care to be rendered, coupled with appropriate transportation and transport care.

This model or construct permits the separation of responsibilities and hence, accountabilities. It is possible to designate who is responsible for protocol development and determination (EHS) and who is responsible for compliance (EMC).

EMC must marshal resources and design processes to "conduct" or "deliver" the appropriate protocol – that stipulated by medical professionals working under EHS direction.

Therefore, there must be an adequate protocol *compliance* measurement system and an adequate protocol *effectiveness* assessment system. Although protocol effectiveness can, in some cases be inferred from the professional research literature, to measure protocol effectiveness "on the street" under real time conditions requires that compliance be sufficiently high. Otherwise variable compliance introduces too much "noise" to detect effect dependably.

An additional significant advantage to this clarifying framework of the production of desired medical outcomes is that it sets the stage for the ability to do research. If compliance is stable, the effectiveness of protocols can be examined quantitatively and researchable questions crafted by the medical experts responsible for protocol development.

Current Measurement System Status and Alternative Approach

While the measurement systems in this system are in place to measure compliance they cannot assess effectiveness data reliably. Data collection systems have been developed and are very implemented which allows for this type of measurement in the future. Therefore, it was elected to take an "expert" or "consensus" panel approach. This turned out to be a double advantage in that it permitted the facilitated discussion to occur concerning the required coherence between structure of relationships, governance (along with the attendant issues of accountability, responsibility, etc.) and performance measurement.

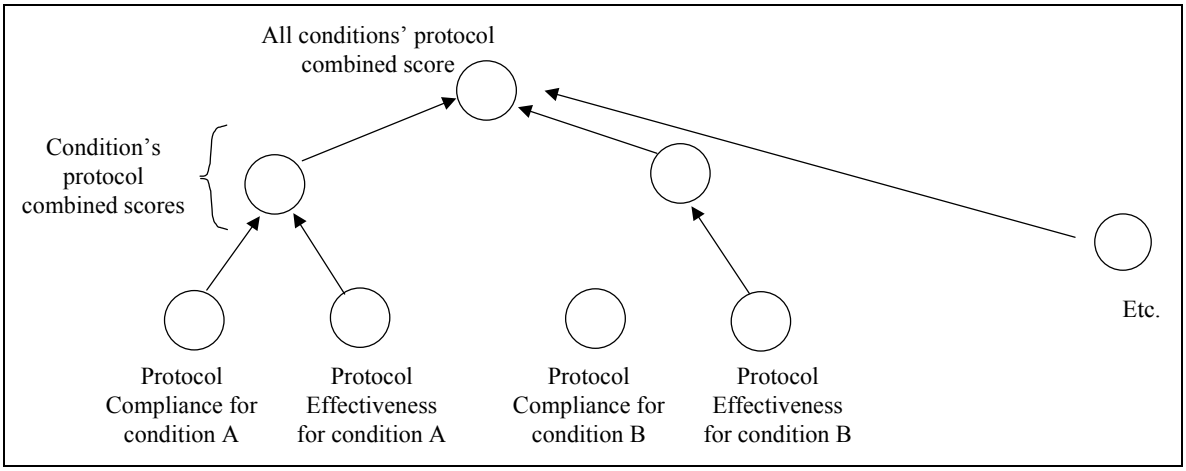
Using a highly flexible dynamic modeling or simulation software application (*ithink* by High Performance Systems), (rather than the traditional static tools such as spreadsheets), a set of relations was constructed that could account separately for the impact of the two measurement domains (compliance and effectiveness) and then merge their relationship into a clinical score for each of six key clinical indicators plus customer satisfaction plus response times. Each could be controlled separately. The software model also permitted the participants to estimate the separate scores or effects over several years, from 1995 to 2001. The software then dynamically ran the entire set of relationships over that period of time and permitted examination of the model at any level, up to an aggregate score.

Six medical conditions were selected by the group to examine and integrate into the assessment equation. These were selected on the basis of their perceived importance both to professionals and to citizenry in judging the medical performance of any EMS system. They were:

1) Cardiac events,
2) Stroke events (CVAs),
3) Trauma,
4) Conditions of altered mental state,
5) Shortness of breath, and
6) Other.

Each of these eight measurement entities (or results domains) were modeled so that they received, in the equation, contribution from both a function for compliance and a function for effectiveness, illustrated below:

Figure 4: Compliance and Effectiveness Model



Each condition's protocol combined score, plus response time and customer satisfaction score was then weighted. All the eight weighted combined scores were multiplied together to create an overall score that could be graphed over the time period indicated earlier, 1995 to 2001, based on the group's best assessment of the factors over this period.

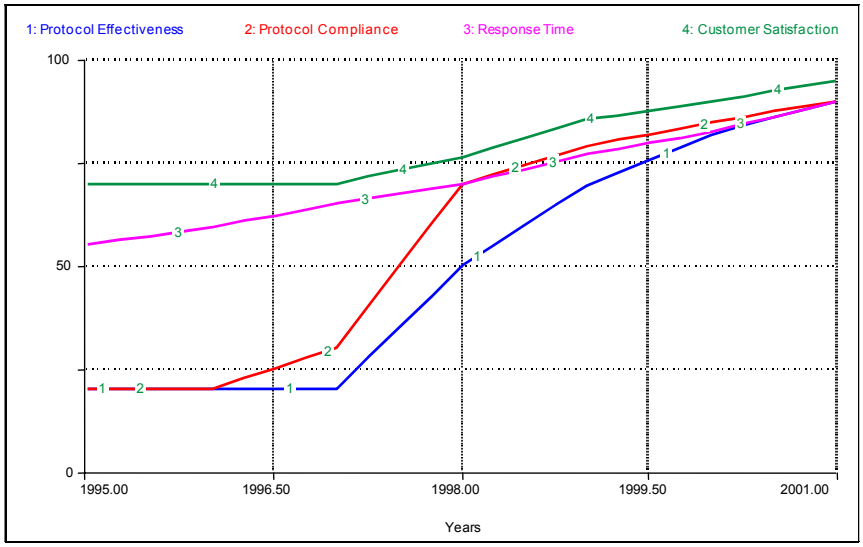
A detailed discussion of the process and analytical process is included in Appendix A.

RESULTS OF ANALYSIS

Appendix A includes the detailed process used to measure changes in clinical performance of the emergency health care system over the last six years. It is impossible to be precise and quantify the number of lives saved or patients who have benefited from changes in the system. Even so, it is possible to describe trends using the modeling process in conjunction with the convening and participation of the expert panel.

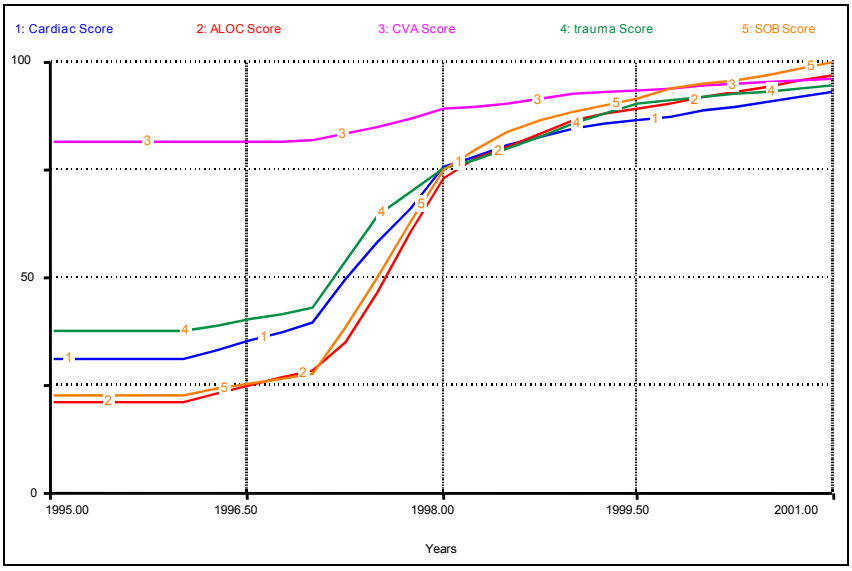
The following figures are included here to demonstrate the trends. They are repeated in the Appendix A where the detailed methodology is presented. Figure 5 demonstrates the relative improvements in (1) Protocol Effectiveness, (2) Protocol Compliance, (3) Response Times, and (4) Customer Satisfaction. The graph demonstrates drastic improvements in protocol effectiveness and compliance and continued improvement in response times and customer satisfaction.

Figure 5 Trends for Protocol Effectiveness, Compliance, Response Times, and Customer Satisfaction



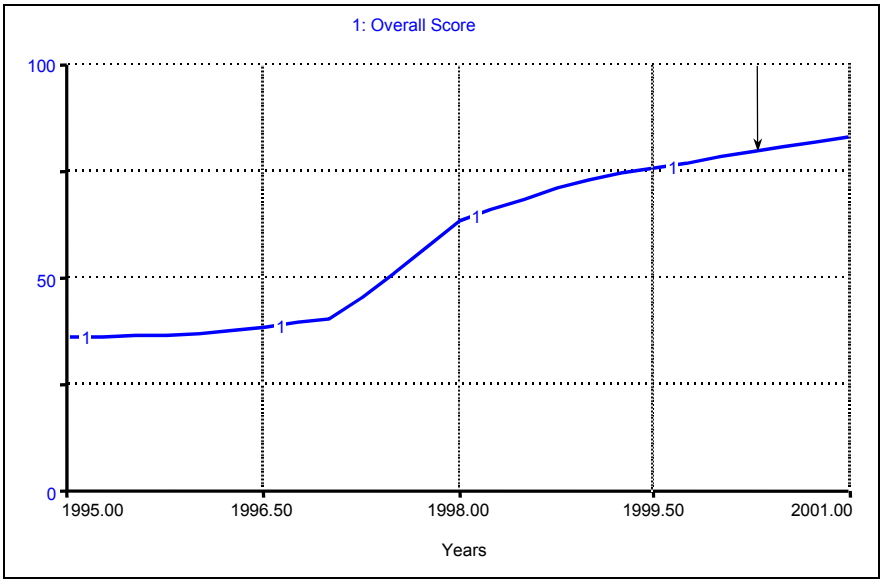
The improvements identified by the expert panel for the treatment of specific medical conditions are demonstrated in Figure 6. The panel believed that there was significant performance of the system has made great strides in the last six years.

Figure 6 Trends for Treatment of Five Medical Conditions



All of the eight components were weighted and combined into an overall score. This is presented in Figure 7. The results reveal rapid improvement upon the amalgamation if the ambulance's services and continued advancement (at a slower rate) in the last few years.

Figure 7 Adjusted Overall Score



This demonstrates the impact of changes in the system and the ongoing maturing process showing fine-tuning and continued advancement.

SUMMARY

The nature of the software coupled with the analytical design explained above also gives the ability to test different scoring patterns and the independent effects of compliance versus effectiveness on medical outcome total score. This is valuable for strategic planning purposes and resource and study effort allocation.

As a performance measurement system is designed and refined to meet the criteria of protocol compliance assessment and of protocol effectiveness measurement, the actual data can substitute for expert panel judgment as data is accumulated in each of the categories. This approach fits sound quality improvement science methodology and becomes iterative, adding progressively to the information base and hence, the joint organizational learning it offers.

Further Refinement – The Future

The group had earlier developed a list of possible measures prior to the discussion concerning separating compliance from effectiveness. When the group reviewed that list, it is notable that virtually every indicator suggested fell into either a compliance measurement category or an effectiveness measurement category. That list is in Appendix B. These indicators are good starting measures in each category (compliance and effectiveness) and as the emergency health services industry becomes more sophisticated in its approaches to performance measurement this robust conceptual approach will stand the partners here in good stead for the future.

OUT-OF-HOSPITAL CARDIAC ARREST

For the calendar years 1998, 1999 and 2000 EHS has monitored the out-of-hospital cardiac arrests in Nova Scotia. A positive outcome was defined as, survival to discharge from the hospital. These statistics reveal significant improvement in Nova Scotia's survival rates from cardiac arrests. In 1998, 2.7% of the patients resuscitated survived to discharge from the hospital. That number improved to 5.5% in 1999 and further improved to 6.9% in the year 2000. Over the short three-year period, survival rates for cardiac arrests due to cardiac disease improved by 155%.[3] While the sample is relatively small, the pattern and trend is extremely positive. It is likely that this dramatic improvement in cardiac arrest survival rates is due to improved response time, more sophisticated treatment capabilities due to the increase in the number of paramedics, and overall attention of the system in improving clinical care delivered to the patients.

NOVA SCOTIA TRAUMA SYSTEM

As described earlier, the presence and use of a well-defined trauma system improves patient outcomes. In 1997, the Emergency Health Service launched the Nova Scotia trauma program. The trauma program mandate includes designation/accreditation of trauma centres, professional education, and a trauma registry. The system is constantly reviewed by the Trauma Advisory Council and includes quality improvement activities and an injury prevention program.

The trauma system is an integral part of the overall Emergency Health System. It coordinates the activities of the field paramedics, emergency department personnel, trauma surgeons, facilities and resources to improve the provincial survival rate from serious injuries.

These are the key components of a functioning and performing trauma system and therefore, would indicate that the citizens and visitors in Nova Scotia enjoy the benefits of improved patient outcome due

[3] Data from Emergency Health Services Nova Scotia annual report 2000/2001 draft.

to having a comprehensive trauma program in place. The department continues to work on improving the program, particularly in areas of data collection and measurement.

TRANSITION TO ALL ALS

A key determinant of clinical care capability of an Emergency Health System is the competency level of the caregivers. The Nova Scotia system is elevating the clinical care capability of its field personnel. The mandate for the system is to ultimately staff all emergency ambulances with paramedics capable of providing advanced life support to their patients. Paramedics are categorized as P-1, P-2, and P-3. Each step represents a higher level of care capability. The Essential Competencies for each paramedic classification is included in Appendix C. Patients with acute medical emergencies, such as heart attacks, can greatly benefit from receiving treatment and medications that can only be delivered by higher level paramedics (P-2 and P-3). The movement toward providing personnel with advanced training on all emergency ambulances is critically important to the patients and is one of the key characteristics of a high performance EMS system.

The agreement between EHS and EMC calls for the transition to an all ALS system in which every ambulance call would receive paramedics at the P-2 or P-3 level of training. Figure 8 demonstrates the transition schedule with performance standards for each fiscal year. For example, in fiscal year 2001/02, 20% of the emergency calls should receive a paramedic trained to the P-3 level, 40% would receive a minimum of a P-2 level paramedic, and the remaining 38% of the emergency calls would be responded to by basic P-1's. The percent of higher level trained paramedics responding to emergency calls increases through the fiscal year 2003/04. In the next fiscal year of 2004/05, measurement changes from percent of paramedics on emergency calls to percent of different levels of paramedics staffing the total unit hours of the service. Ultimately, in fiscal 2006/07, 75% of all ambulance hours will be staffed with the highest level of paramedic (P-3). The remaining 25% of the unit hours would be staffed with the intermediate paramedic (P-2) and the minimum certification level. None of the unit hours would be staffed with the basic level trained P-1's.

Compliance with the performance standards included in the contract is not being tracked. EMC has indicated that the CAD computer cannot easily monitor the staffing level for emergency calls. It is anticipated that an additional module, which is to be installed on the CAD computer will be able to monitor the staffing levels. There is no way to determine EMC's compliance with this important provision of the contract.

The only information to support the advancement of EMC in achieving the desired staffing mix is the total number of registered paramedics and their certification levels. See Figure 9. EMC employs 609 paramedics; 327 paramedic P-1's, 204 paramedic P-2's, and 78 paramedic P-3's. The staffing mix includes 54% trained at the basic paramedic P-1 level, 33% are paramedic P-2's, and 13% are paramedic P-3's. The percentage of emergency calls that are supposed to be responded to by P-3's in fiscal year

2000/01 is 22%. 40% of the calls are supposed to be responded to with a minimum of a P-2 on board and 38% of the emergency calls can have a paramedic P-1 as the highest level caregiver. One cannot translate the percentage of employed paramedics at the P-1, P-2, and P-3 levels to the number of emergency responses receiving the specified level of care.

It is clear that the system is transitioning to a higher level of paramedic in the field but it is impossible to determine whether the progression is meeting the performance standards delineated in the EHS/EMC contract. Ultimately, when the transition to every call receiving at least a paramedic P-2 the patients of Nova Scotia will enjoy clinical care capabilities of a high performance EMS system.

Figure 8 ALS Transition Schedule

Year	Staffing Configuration	Percentage of Emergency Calls	Percentage of Unit Hours
1999/00	P-1 and P-3	10%	N/A
	P-1 and P-2	35%	N/A
	P-1 and P-1	55%	N/A
2000/01	P-1 and P-3	15%	N/A
	P-1 and P-2	40%	N/A
	P-1 and P-1	45%	N/A
2001/02	P-1 and P-3	22%	N/A
	P-1 and P-2	40%	N/A
	P-1 and P-1	38%	N/A
2002/03	P-1 and P-3	32%	N/A
	P-1 and P-2	35%	N/A
	P-1 and P-1	33%	N/A
2003/04	P-1 and P-3	45%	N/A
	P-1 and P-2	35%	N/A
	P-1 and P-1	20%	N/A
2004/05	P-1 and P-3	N/A	60%
	P-1 and P-2	N/A	30%
	P-1 and P-1	N/A	10%
2005/06	P-1 and P-3	N/A	70%
	P-1 and P-2	N/A	25%
	P-1 and P-1	N/A	5%
2006/07	P-1 and P-3	N/A	75%
	P-1 and P-2	N/A	25%
	P-1 and P-1	N/A	0%

Figure 9 EMC's Paramedic Certification

Paramedic Level	Number	Percentage
P-1	327	54%
P-2	204	33%
P-3	78	13%
	609	

V.
OPERATIONAL ISSUES

The focus of the project is primarily on the clinical performance outcomes but based on those outcomes the consultants were asked to express an opinion regarding the effectiveness and efficiency of the certain operational activities. It is impossible to separate operational impacts from clinical performance. A service cannot deliver good clinical medicine without the systems and processes to ensure a timely response of appropriately trained and certified personnel, with access to necessary and functional equipment, supplies, and medications. The assets of the system (human and physical) must then be combined with effective direction in the form of well-researched and solid policies, procedures and protocols.

This section of the report discusses key areas of operations, briefly describes the specific activities in the context of high-performance emergency medical service systems and describes the current status in the EHS/EMC system.

This section will address:

- The vehicle fleet
- Equipment and supplies
- The use of technology
- The communications centre
- Ambulance deployment
- Quality improvement and training
- Management and supervision

FLEET MANAGEMENT

In 1995 the Nova Scotia Department of Health signed a contract with Tri-Star Industries Limited in Yarmouth to provide ambulances to the multiple ambulance providers operating with the Province. This leasing arrangement has been renewed and EHS continues to lease vehicles for use by EMC. Importantly, the lease calls for a three-year life cycle for the vehicles with a kilometer limit of 200,000. Significant penalties and lack of revenue recovery occur if the vehicles exceed 200,000 kilometers when they are turned in to Tri-Star or if there is excessive damage beyond normal wear and tear. Both EHS and EMC have devoted enormous amounts of time and energy in maintaining and managing the provincial fleet.

There are 129 patient transport capable vehicles in the fleet. One vehicle is not under EMC's control and three are patient transport units (PTU).

A key question to be asked is, is the fleet size adequate to provide prompt and reliable ambulance service province-wide? There are two essential components that must be factored into this analysis – are there an adequate number of vehicles and does the service have access to enough kilometers under the leasing plan to meet its responsibilities?

SIZE OF AMBULANCE FLEET

As indicated, there are 127 patient transport capable vehicles in the provincial fleet. To determine if this quantity is adequate, it is necessary to identify the peak staffing levels and compare them with industry benchmarks with regard to the percentage of vehicles required over and above peak staffing levels to ensure adequate opportunities for maintenance, repair, and staffing of additional vehicles in the case of unanticipated demand. Peak staffing levels in Nova Scotia are 106 units during the busiest time of day on the busiest day of the week. With 127 total available units, the vehicle fleet represents 120% of the peak staffing level. Comparing this reserve level to other high-performance EMS systems indicates that Nova Scotia is on the lower end of ambulance availability. In very confined EMS systems with small geographic coverage and a centralized, single vehicle maintenance facility, it is possible to have 115-120% ratios of total ambulances to peak demand. In EMS systems with larger geographic areas and stringent response time requirements, it is necessary to increase the percentage of total fleet compared to fleet demand. In these types of systems it is common to have 125-133% of total vehicles compared to the peak demand.

An appropriate percentage of total vehicles compared to peak staffing levels for Nova Scotia would be 130%. This would mean that the Province would need to increase its fleet size by ten additional vehicles.

FLEET KILOMETER CAPACITY

Even more important in Nova Scotia is the total number of kilometers available for EMC operations. The 200,000-kilometer maximum allowance on the leased vehicles severely restricts the system. The 127 primary and PTU vehicles would have available to them 8.47 million kilometers per year under the terms of the lease agreement. Currently, these vehicles are logging in excess of 8.3 million kilometers per year. This equates to an excess capacity of only 2% and severely restricts EMC's ability to manage its fleet effectively and economically. It is impossible to distribute the excess 170,000 kilometers per year evenly over the 127 primary vehicles. EMC's attempt to manage kilometer usage has impaired its ability to effectively manage the fleet. The addition of nine vehicles recommended in the previous section would increase the excess kilometers to 7% or 600,000 kilometers per year. While this is a very tight level of excess capacity, it is more workable than the current limitations.

RETIREMENT OF PROVINCIAL VEHICLES

Vehicles are returned to Tri-Star at the end of the three-year leasing period. There are significant penalties if the kilometer levels exceed the 200,000 limit or if there is excessive wear and tear. Up to June 2000, EMC and EHS returned vehicles to Tri-Star that were initially operated by the local ambulance services that were acquired by EMS and the Province. EMC has limited some liability on each of these vehicles that were not initially within their control to a maximum of $1,000 per vehicle. Some of the vehicles incurred penalties, which reduced the amount of revenue that was anticipated to be available for the leasing of new vehicles. During discussions with EMS personnel, no vehicle that was within the total realm of control of EMS incurred penalties. This issue caused significant concerns and problems between EHS and EMC. This issue has now been resolved. The intense focus on the condition of the fleet, the inspection programs, and the returning of the fleet to the leasing company has caused both EHS and EMC to devote enormous time, effort and energy to managing the fleet at the expense of managing and overseeing the entire EMS system.

VEHICLE INSPECTIONS

EHS employs a full-time vehicle inspector who is responsible for monitoring the condition of the vehicles and equipment. The inspector is expected to inspect each of the 129 vehicles and the equipment contained on the vehicles twice per year. The inspection process continues to evolve and EHS is currently developing a manual with reference to specifics on how inspections are to be conducted. Both EHS and EMC need to collaborate on putting in place a program that ensures the proper care and maintenance of the provincial fleet.

EMC lacks some of the standards and processes necessary to optimize its fleet management capabilities but during discussions it was also apparent that EHS and/or the leasing company may have unrealistic expectations for managing a fleet that has limited reserve units and marginal excess capacity in kilometers. This heavily used and extremely mobile fleet presents challenges for both the operator and the Province in overseeing and protecting the provincial assets.

MANAGEMENT INFORMATION SYSTEMS

The vehicles and equipment inventory and maintenance practices and information systems of EMC are rudimentary and in need of further development. Both EMC and EHS lack the benefit that could be gained from a well-coordinated approach supported by comprehensive management information systems for the services, vehicles, and equipment. The deficiency has been recognized and a consultant engaged to identify the needs and assist in the process of selecting and acquiring the appropriate management information systems. This should have occurred much sooner. Implementation of a comprehensive preventive maintenance program supported by proper information technology could have eliminated many of the current problems and questions.

FLEET MAINTENANCE OPERATIONS

EMC's fleet operations are divided into four divisions; north, east, central and west. Given the geography and expanse of Nova Scotia, this is an appropriate division of operating units.

Each division has a certified mechanic with responsibility for maintaining the fleet assigned to that division. Casual mechanics are also available to support these activities. The paramedic fleet supervisor in each division coordinates between operations and fleet services. A fleet manager currently oversees the overall operations. EMC is recruiting a senior manager as Director of Fleet and Physical Resources to provide senior corporate leadership for this area. Contractually, EHS must approve the individual for this position.

SUMMARY

The attention of managing the ambulance fleet has diverted the focus of both EMC and EHS from more important operational issues. The fleet size is inadequate to allow EMC to effectively manage and operate the fleet. Management information systems need to be acquired and put in place along with the identification of a well-qualified Director.

Even so, one of the most important measures on the effectiveness of a system's ability to manage its fleet is the number of critical failures per 10,000 patient transports. The EHS/EMC emergency medical system has less than one critical failure per 10,000 patient transports. This is a commendable ratio and matches or exceeds the performance capabilities of other high-performance EMS systems in North America.

EQUIPMENT AND SUPPLIES

Generally, the onboard equipment supplies were observed to be adequate. The paramedic personnel did not indicate problems with resupply or with equipment on the vehicles.

As mentioned previously, EMC lacks sophisticated tracking capabilities of the equipment and vehicles. There was no indication that there was a mutually agreed upon equipment schedule between EMC and EHS. These schedules should identify each piece of equipment, inventory quantities, total percentage of inventory based on fleet size, and an acceptable attrition control factor should also be included. For example:

- A 120% inventory level for primary stretchers for fleet of 100 vehicles would equal 120 stretchers.
- An acceptable attrition rate of 2% would be 2.4 stretchers annually.
- A useful life of five years would require funding of 24 stretchers annually.
- Total annual funding for stretchers would be 26.6 units.

Each major equipment item should have such an analysis conducted in order for EHS to proactively budget for annual replacement of equipment. Given these benchmarks and an annual inventory of all equipment by EMC, adjustments could be made and funded by EMC should its inventory control systems fall short. This comprehensive process could create reliable and predictable equipment levels and eliminate questions of accountability and responsibility for replacement of the units.

THE USE OF TECHNOLOGY

EHS and EMC have taken advantage of many of the advances in technology to increase efficiency and effectiveness of operations. Key elements include wide area networks (WAN), local area networks (LAN), a sophisticated communications centre with state-of-the-art computer aided dispatch (CAD), radio communications, and telephone communications. Upgrading and improving many additional technology capabilities is occurring on a consistent basis and therefore, EHS and EMC have not been able to take full advantage of all of the multiple systems' capabilities. This is a gradual process and progress (while frustratingly slow in some areas to both EHS and EMC), it is appropriate and positive. The following paragraphs highlight some of the most significant technological capabilities of the service.

TECHNOLOGY IN A COMMUNICATIONS CENTRE

The three important technology systems located within the communications centre include the computer aided dispatch system, radio system, and telephone system.

The computer aided dispatch system (CAD) is a Tri-Tech software system, which allows communications personnel to manage the entire fleet of ambulances and resources and to best match the demand with those resources. The CAD documents all requests for services and is capable of interfacing with the global positioning satellite equipment located on the ambulances so that the communications technicians would be able to identify the exact location of all ambulances throughout the Province. This interface is not fully functional because a commercial province-wide data transmission system is not in place, but the capability exists in the vehicles and is envisioned by both EHS and EMC.

The radio communications system is a trunked mobile radio network operated by the Province, MTT, and Motorola Canada. This province-wide radio network allows communications personnel to communicate among ambulance paramedics, paramedic ground bases, hospitals, air ambulance, and other personnel.

Adequate telephone lines and equipment exist to receive all 911 calls forwarded from the public safety answering points. The enhanced 911 system allows for capture of the caller's phone number and location, which is automatically input into the computer aided dispatch system.

The dispatch centre can accommodate up to 13 positions with 12 local workstations and a remote workstation. EHS has a backup site location that can operate remotely in the case of a catastrophic failure of the primary dispatch centre.

ONBOARD TECHNOLOGY

Each EHS ambulance is equipped with a workstation that is integrated with a digital map of Nova Scotia. The automatic vehicle locator (AVL) system using satellite technology allows each ambulance to identify its exact location and the location of the incident on the provincial map within the ambulance.

A system that measures and monitors driving behavior has been installed in each of the vehicles. This has been proven in many other systems to decrease the number of accidents and reduce the wear and tear on vehicles and maintenance requirements.

INTERNET AND OTHER TELECOMMUNICATIONS CAPABILITIES

EHS and EMC have taken advantage of the availability of modern computer communications technology. EMC uses computer communications to share information among its various bases and within departmental headquarters. EHS has developed a comprehensive website to not only share information with the EHS system participants but also the public. An example of the use of internet technology is that EHS has loaded the system's medical protocols online along with the evidence in research and literature to support the majority of the protocols that have been developed for use in Nova Scotia.

COMMUNICATIONS CENTRE OPERATIONS

As indicated previously, the technology used in the EHS/EMC communications centre is state-of-the-art. EHS' commitment to ongoing improvements and enhancements should allow the centre to continue as a premier model of a provincial EMS communications centre coordinating a high-performance EMS system. The communications centre capability, particularly the computer aided dispatch, is essential in managing the systems resources through its flexible deployment plans. Deployment will be discussed later is this report.

The functions of the communications centre are to answer calls for ambulance requests, identify the nature and location of the problem through an interrogation process with the caller, provide prearrival instructions to the patient, family member or bystander as appropriate, select the most appropriate ambulance unit for response, notify first responders as appropriate, provide information to the ambulance crews regarding the nature of the event, assist the crews in finding the location, monitor the ambulances and their status at all times, and to deploy and redeploy the EMS resources according to changes in demand and event locations.

Communications centre personnel are functioning appropriately in responding to nearly 100,000 requests for ambulance service each year and the real time management of up to 106 units at any given time.

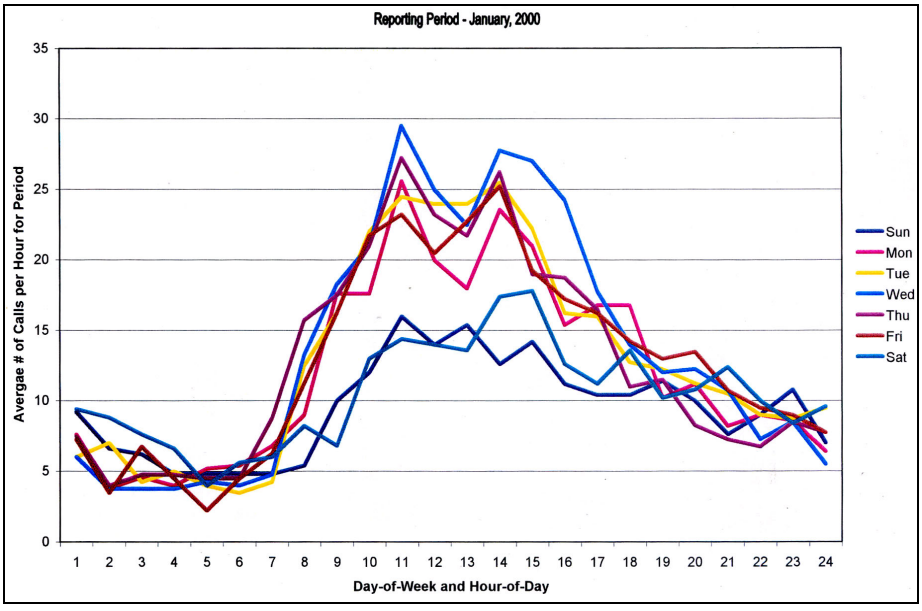
Performance in the communications centre particularly with regard to call processing has well defined benchmarks. Using the Medical Priority Dispatch System, the communications personnel identify the severity of the call and determine the problem.

Specific benchmarks have been developed internationally to measure how well a communications centre processes these calls. EMC provides quarterly reports to the medical director, which identifies the communications system performance using emergency medical dispatch protocols. This constant monitoring is part of the quality improvement process and helps to ensure that the provincial EMS communications system performs well.

AMBULANCE DEPLOYMENT

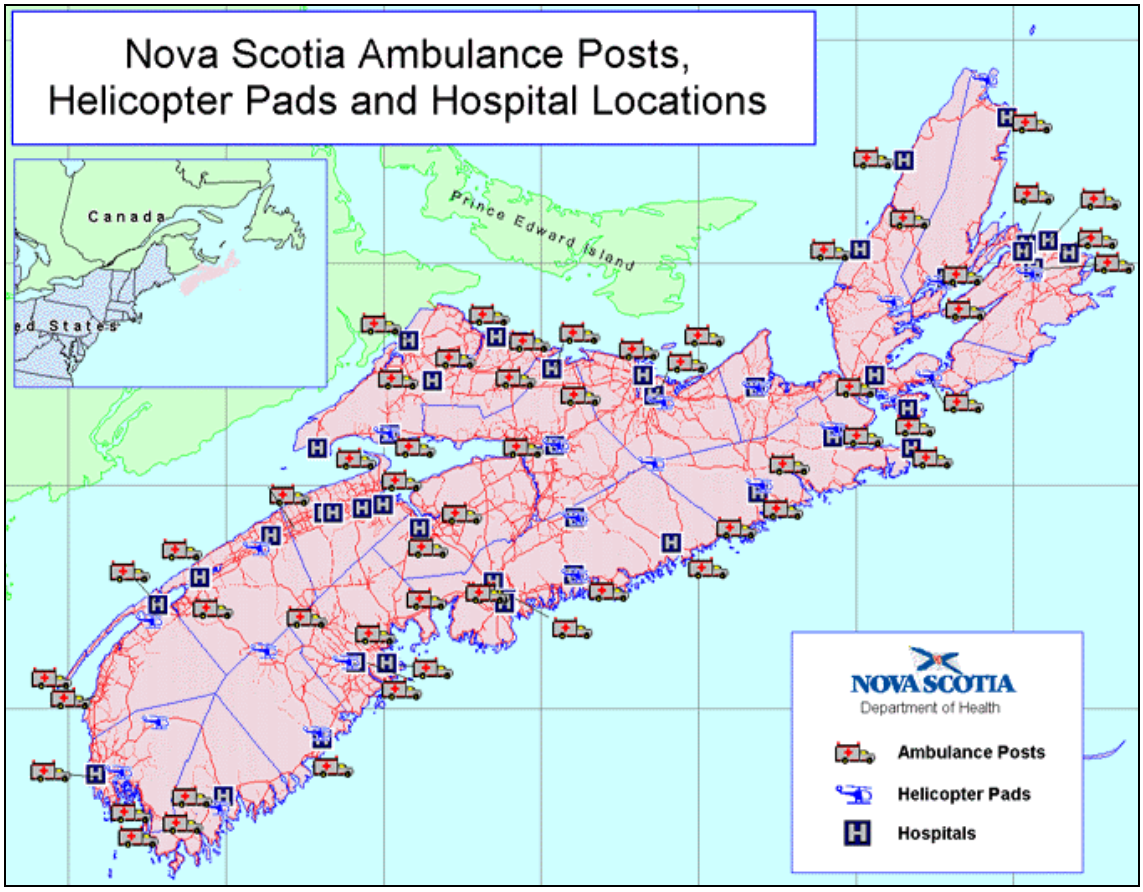
The most complex component of ambulance operations is the establishment of a flexible deployment plan, which matches the resources to demand and anticipated location of calls. It has been demonstrated that there are historical patterns to requests for ambulance services. These patterns repeat themselves by hour-of-day, day-of-week and week-of-year. See Figure 10. In Nova Scotia, Wednesdays have the highest demand followed by Tuesdays, Thursdays and Fridays. Weekends, as expected, have fewer requests for ambulance services. By understanding these anticipated demand levels it is possible to match staffing levels to meet the anticipated demand with fewer resources. This process is called system status management or flexible deployment.

Figure 10: Nova Scotia Ambulance Demand



There are two components to developing a deployment plan for a given service area. First, are the geographic considerations. Based upon the response time requirements, vehicles have to be deployed geographically throughout a given service area in order to meet the defined response times. This deployment must occur even if there are few or no calls in a given area. The first step in establishing a deployment plan is the identification of these geographic posts for ambulance deployment to cover the service area. Figure 11 shows the distribution of ambulance posts throughout the Province. These posts provide the geographic coverage.

Figure 11: Ambulance Posts



The second component that has to be considered is the demand. If ambulances are distributed throughout a given region and one area has a significantly higher demand, it requires more ambulances in order to meet the next emergency response within the appropriate time parameters. Figures 12 and 13 present the demand patterns for emergency calls and the combined urgent and non-emergency calls, respectively.

Figure 12: Demand Pattern of Emergency Calls

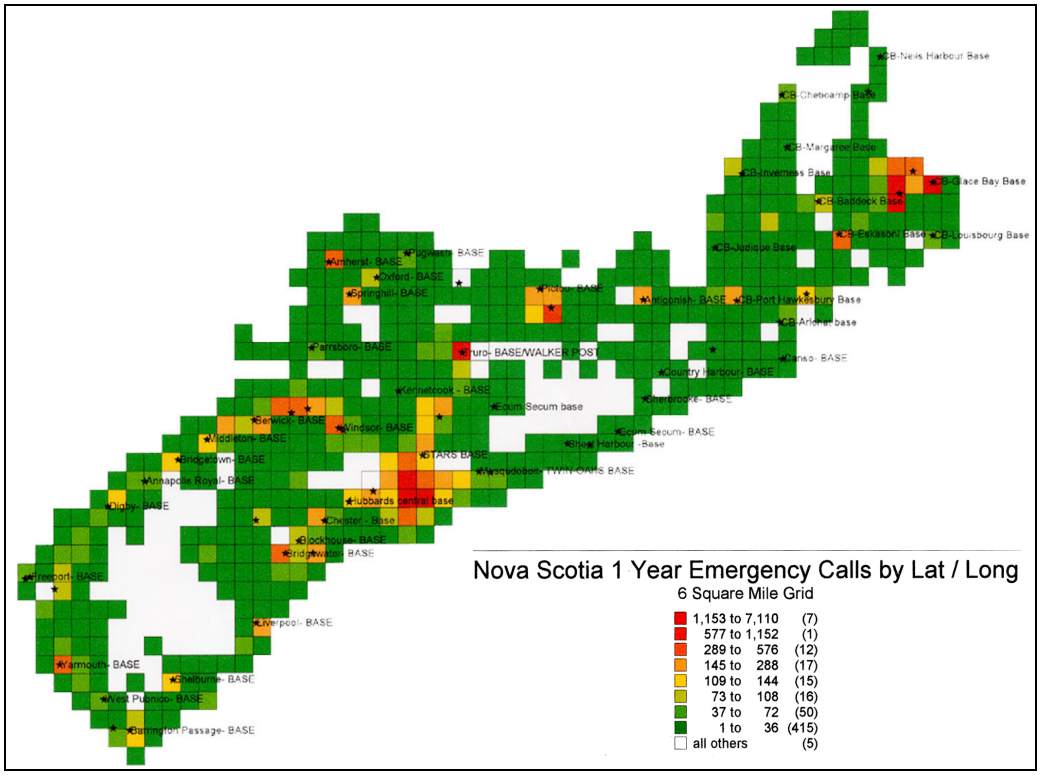
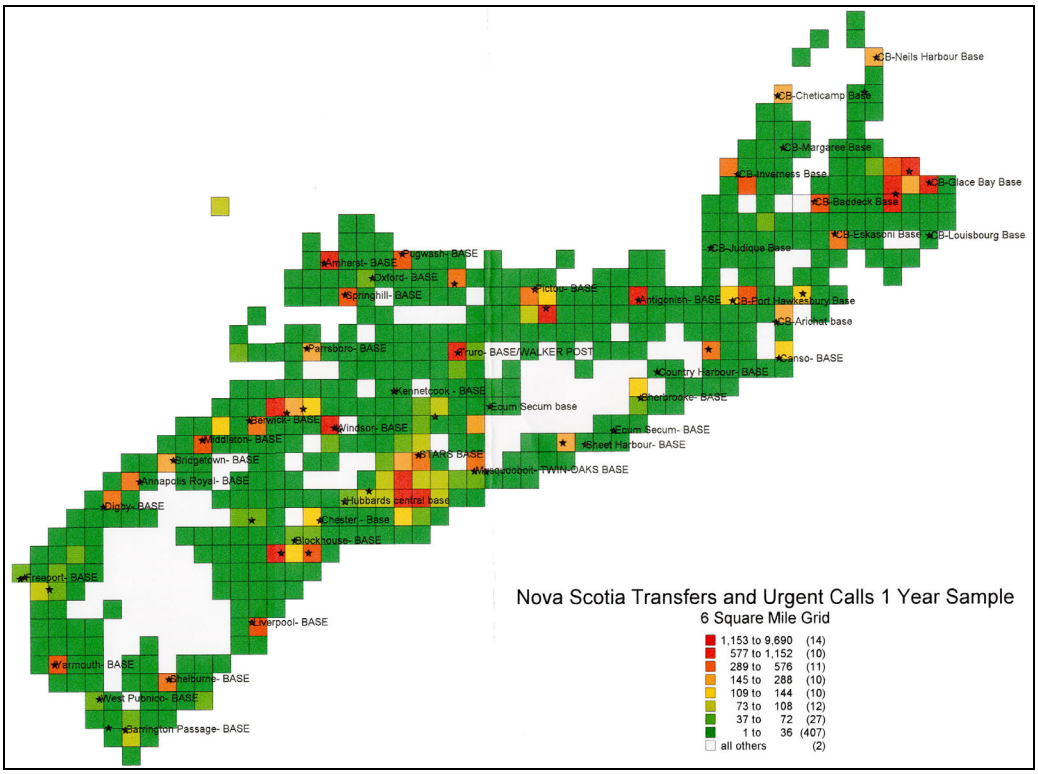


Figure 13: Demand Pattern for Urgent and Transfer Calls



Knowledge of the geographic deployment requirements and the number of staffed ambulance hours (unit hours) required to meet the demand tells the managers how many units must be deployed during a given hour on a specific day. From there, the organization is able to build a schedule and identify the number of employees required to meet the system's response time performance standards.

The consultants were impressed with the level of sophistication and knowledge of EMC managers on how to create and manage a system status management plan. They have been effective in matching resources and demand with the appropriate consideration for geography. In fact, EMC has been able to reduce the total number of unit hours deployed on an annual basis by approximately 57,000 per year while achieving response time requirements. Currently, EMC is deploying approximately 794,500 unit hours per year. Its budget calls for the deployment of over 851,600 units annually. This results in more than $1.3 million savings annually. The ability of EMC to reduce the number of unit hours is based almost entirely upon its scheme to deploy ambulances throughout the Province. Careful reduction in unit hours must be weighed with the impact on the service's ability to meet its response time requirements.

The most important performance standard defined by the EHS/EMC contract is that of response time performance. Figure 14 shows the response time performance requirements based on the category of call and call type. The category reflects the population density of the specific service area and the call type determines how urgent of a response is required. This target was anticipated to be phased in after the definition of the base response time performance levels prior to EMC's take over of operations.

Figure 14: Response Time Requirements

Category Type	Emergency Priority 1 and 11	Urgent Priority 2 and 22	Scheduled Transfer Priority 4,6,8	Non-Scheduled Transfer Priority 3,5,7,9
Category 1	<9 minutes	<15 minutes	<15 minutes	<60 minutes
Category 2	<15 minutes	<20 minutes	<20 minutes	<60 minutes
Category 3	<20 minutes	<30 minutes	<30 minutes	<60 minutes
Category 4	<60 minutes	<60 minutes	N/A	N/A
Category 5	Best Efforts	Best Efforts	N/A	N/A

Figure 15 defines the category definitions used in Figure 14. Appendix D contains information from EMC that identifies emergency response time performance for the first quarter of 2001 for categories 1 and 2, and a combined column for categories 3, 4 and 5. The goal for the department is to achieve a response time within the given response time standard on at least 90% of calls after April 1, 2005. Examining the category 1 calls for emergency responses (priorities 1 and 11) the goal is less than nine minutes 90% of the time to be achieved by April 1, 2005. For the first quarter of 2001, EMC is achieving a response to 85.63% of the calls in less than nine minutes. Likewise for category 2 calls, the 2005 goal for emergencies is 90% within less than 15 minutes. EMC is exceeding that goal by reaching 94.34% of the emergency calls within 15 minutes.

Figure 15: Response Time Categories

Category Type	Area Population
Category 1	>15,000
Category 2	2,500 to 14,999
Category 3	<2,500
Category 4	*Low Call Volume Areas
Category 5	Designated Wilderness and Report Areas

Geographic identification of where categories 3, 4 and 5 apply has not been developed by EHS and EMC. They are currently being reported in aggregate. The goal for 2005 for category 3 emergency calls is less than 20 minutes 90% of the time, category 4 calls less than 60 minutes 90% of the time and category 5 calls have been assigned a best efforts requirement. In fact, the first quarter of 2001 data reveals that the combined category 3, 4, and 5 calls are responded to in less than 20 minute 81.6% of the time and less than 30 minutes 94.25% of the time.

For comparison purposes, EMC has data for response times for the fourth quarter of 1998, which reveals that category 1 emergency responses were made in less than nine minutes only 68.93% of the time. Category 2 emergency responses were achieved within 15 minutes 90.65% of the time and in the combined categories 3, 4, and 5 calls were responded to 81.93% of the time within 20 minutes and 93.82% of the time within 30 minutes. This data reveals significant improvements particularly with the category 1 response time performance levels.

In summary, EMC has essentially achieved its target for emergency response times in areas for categories 1 and 2 areas. It has also achieved response time performance in the combined categories 3, 4, and 5 at the level of 90% within 30 minutes. Without a clear definition of category 3 service areas, it is impossible to determine how well the service is doing for emergency responses in less than 20 minutes in these areas.

Other performance standards should exist for scheduled and non-scheduled transfer calls. The contract requires EHS and EMS to work together to decide on these standards. Although work has been done in this area, the standards have not been finalized because agreement on definitions and appropriate performance levels has not yet been reached.

PRODUCTIVITY ANALYSIS

One of the measures of an EMS system's efficiency is a productivity measure called unit hour utilization (UhU). North American public utility models and high-performance EMS systems monitor productivity levels to determine their efficiency. As described before, a unit hour is an hour in which an ambulance is staffed and available or is responding on assignments. The productivity measure of unit hour utilization determines the number of transports per unit hour. For example, if an ambulance service were to transport one patient for every staffed ambulance hour, the unit hour utilization would equal 1.0. If the service were to transport one patient every two hours, the UhU would equal 0.5. The factors that impact the ability of a service to have high productivity levels include:

- The percentage of non-emergency versus emergency calls.
- The geographic area that must be served.
- The response time performance requirements.
- The available resources.
- The time on task for each ambulance transport.

The Nova Scotia EMS system covers approximately 33,000 square miles. The National Association of Public Utility Models collects data for a number of public utility and modified public utility services. Nova Scotia is one of those services providing information.

Of the 14 systems, Nova Scotia has 10 times the service area in square miles when compared to the next largest system. In addition, the rural expanse of Nova Scotia requires longer response and transport times, particularly for long-distance transfers. For example, if an ambulance is tied up for five hours on a long distance transport, the UhU for that unit is 0.2 even though there is a patient on board for 100% of the time. For these reasons, the Nova Scotia system has the lowest unit hour utilization rate of 0.10. In other words, for every ambulance transport accomplished, there are 10 hours of staffed ambulance time consumed. Figure 16 shows the 14 communities studied by the National Association of Public Utility Models with the service area population and unit hour utilization rates.

Figure 16: EMS System Comparisons

System	Service Area (square mile)	Population	UHU	Unit Hours/ Sq Mile	Transports/ 10,000
Davenport	447	156,000	0.41	89.2	1,048.1
Ft. Wayne	70	200,000	0.38	605.1	804.8
Ft. Worth	396	621,988	0.29	420.3	776.1
Nova Scotia	33,300	925,000	0.10	25.7	924.5
Kansas City	433	588,000	0.34	504.9	1,264.1
Lincoln	70	213,000	0.28	574.4	528.6
Little Rock	1,845	370,570	0.20	74.5	741.9
Mecklenburg	540	650,000	0.26	307.3	663.8
Monterey County	3,324	386,200	0.17	28.8	421.7
Oklahoma City	900	600,000	0.26	131.1	511.2
Pinellas County	309	895,000	0.50	680.1	1,174.0
Reno	3,000	310,000	0.38	17.5	643.2
Richmond	62	200,000	0.39	1,409.0	1,703.5
Tulsa	330	400,000	0.31	268.3	686.1

The above figure presents other interesting information. For example, comparing unit hours per square mile reveals that Nova Scotia has the second fewest unit hours per square mile. Only Reno has fewer unit hours per square mile and that is largely due to a vast area of the county served by the Reno system is desert and the system does not attempt to provide ambulance coverage for this extensive area. The transport per 10,000 population figures indicates that Nova Scotia falls mid-range with 924.5 persons per 10,000 population transported annually.

Even though the productivity measure for the Nova Scotia system is low (0.10), this is an appropriate unit hour utilization rate given the immense service area, the required response time performance levels, and the distances that patients have to be transported. Little can be done to significantly increase the productivity level without impacting and delaying responses to emergency events.

QUALITY IMPROVEMENT AND TRAINING

Much work has been accomplished by EMC in establishing a quality and learning department. The program can best be described as mid-way upon its journey. Plans are in place and policies have been developed to establish a comprehensive program but implementation of many of the activities have yet to occur. Next steps in the quality and learning process include additional training of the regional supervisors and the fine-tuning of some of the reporting and measurement systems.

One of the essential components of a quality and learning program is the ability to respond to identified deficiencies in the field. EHS has retained nearly complete control of monitoring and coaching functions for field caregivers. Little communication and sharing of information occur between EHS and EMC with regard to clinical care variations.

A quality improvement program is designed to identify the systemic and individual deficiencies. Without the involvement of the management team responsible for compliance in addressing identified weaknesses, it is impossible to optimize the effectiveness of the quality improvement program. At the same time, over-involvement of operations management can lead to reluctance of individual caregivers to share information about discrepancies or errors for fear of disciplinary action. A balance between the sharing of and identification of problems and how those problems shall be resolved must be achieved between the system monitor (EHS) and the system provider (EMC).

MANAGEMENT AND SUPERVISION

EMC has established four regions for operational management and supervision of personnel within the Province. The employment of hundreds of people over a relatively short period of time has challenged the organization's ability to recruit, promote, and train its mid-management staff. This weakness was identified during interviews with EMC administration.

It is unrealistic to expect that EMC will be able to attract significant numbers of experienced supervisory personnel from outside the Province. It will be incumbent upon the organization to provide adequate mechanisms to identify potential supervisory and mid-management personnel and to ensure that comprehensive training programs are put in place to provide the individuals with the tools they need to fulfill their human resource functions. This will continue to be an ongoing challenge for EMC.

A management academy or similar training program should be considered that is specifically designed to define the roles and responsibilities for each managerial and supervisory position. While progress is being made, the key to running a successful organization as wide-spread and diverse as EMC will be in the development of a strong and competent supervisory and management team distributed throughout the Province.

VI.
FINANCIAL ISSUES

The Province of Nova Scotia has made a significant investment in its emergency medical and ground ambulance service system. This is clearly demonstrated in EHS's budget. In fiscal year 1995/96 the EHS budget was approximately $20 million. In fiscal year 1997/98 this increased to $39 million. In fiscal year 1998/99 the budget grew to approximately $58 million. In the last two fiscal years 1999/00 and 2000/01 the EHS budgetary allotment has remained relatively stable at $53 million, annually.

The ground ambulance and emergency medical services program is by far the most costly program overseen by EHS. Figure 17 summarizes some of the major components of EHS' budget and the expenses for the ambulance and communications centre. Approximately 90% of EHS budget is dedicated to the communications centre and the ground ambulance program. In EHS budget approximately $468,000 is allocated to administration, $700,000 to medical oversight, and $206,000 to communication centre oversight and support. These expenses cannot be purely allocated to the EMS and ground ambulance program because all categories are involved in the administration oversight and direction of the other EHS programs such as air medical services, trauma program, training, etc.

Figure 17: EHS Budget

Total EHS Budget[1]		$53 million
	Administration[2]	468,000
	Medical Oversite[2]	700,000
	Communications[2]	206,000
	Fleet	3,277,157
	Flow-thru Recovery	1,359,883
Ambulance & Comm Centre Budget		
	Contractor	$ 42,252,976

[1] Approximate budget for all programs
[2] Expenses are for all programs, not just ground ambulance

Over $2.6 million has been allocated to the communication centre operations on an annual basis. The fleet is responsible for approximately $3.3 million annually while operations (the EMC contract) requires nearly $40 million annually. An additional $1.3 million dollars has been identified as flow-through recovery in which EMC pays for certain items that are not their responsibility under the contract and then are reimbursed by EHS. The total communication centre, fleet, and operation budget is nearly $47 million.

SYSTEM COMPARISONS

As discussed previously it is difficult to compare one EMS system with another in operational performance. This is also true for financial performance due to the enumerable variables that exist between systems. Even so there is value looking at certain cost factors in order to determine whether a specific system is widely variable in its use of resources. Figure 18 identifies some calculated cost comparisons between the 14 public utility models and modified utility models. This table presents the information in US dollars. The approximate expenditure per capita for Nova Scotia is (US) $32.44. The total system expenditures identified in the table represent the total expenses for ambulance ground operations, the communication centre, the fleet, and the flow-through expenditures. It does not include the administration and oversight expenses from EHS. The average expenditure per capita among the 14 communities studied is (US) $26.49. Nova Scotia's expenditures on a per capita basis are approximately 29% higher than the other communities surveyed.

Figure18: Cost Comparisons (U.S. Dollars)

System	Expenditure Per Capita	Cost Per Unit Hour	Cost Per Transport	Total Expenditure
Davenport	$ 22.69	$ 88.76	$ 216.49	$ 3,539,640
Ft. Wayne	24.77	116.96	307.79	4,954,000
Ft. Worth	20.28	75.78	261.31	12,613,917
Nova Scotia	**$ 32.44**	**$ 36.63**	**$ 358.35**	**$ 30,009,610**
Kansas City	39.35	105.84	311.29	23,137,800
Lincoln	22.42	118.77	424.18	4,775,460
Little Rock	23.07	62.19	310.95	8,549,050
Mecklenburg	21.95	85.97	330.65	14,267,500
Monterey County	22.62	91.19	536.41	8,735,844
Oklahoma City	22.39	113.88	438.00	13,434,000
Pinellas County	25.84	110.05	220.10	23,126,800
Reno	22.68	134.00	352.63	7,030,800
Richmond	49.96	114.38	293.28	9,992,000
Tulsa	20.33	91.86	296.32	8,132,000
Average	$ 26.49	$ 96.16	$ 332.70	
NS variance	29%	(65%)	9%	

Nova Scotia's cost per transport is (US) $358.35 while the average of all 14 communities was (US) $332.70. Nova Scotia's cost per transport is marginally higher at 9% over the average.

Another important factor is the cost per unit hour within the system. Nova Scotia's cost per unit hour is (US) $36.63 while the average cost per unit hour of all the communities surveyed is (US) $96.16. Nova Scotia's cost per unit hour is 65% less than the average.

In summary, what does this mean? Simply stated, this information indicates that Nova Scotia is able to deploy very economical unit hours at (US) $36.63. Since it serves such an immense area and is only able to produce relatively low utilization rates the cost per transport and expenditure per capita are higher than the geographically smaller communities surveyed.

VII.
MAJOR ISSUES AND RECOMMENDATIONS

The previous sections provide a brief history of the EHS/EMC EMS and ground ambulance system. The report focused on current performance levels and incorporated opinions regarding their status and whether the performance is appropriate given the system transition. While standards and progress have been significant in the key elements of response times, clinical quality and financial responsibility, there are significant issues the system must address if it is to reach the full potential of a high performance ambulance service. This section will address those issues within the system and specific recommendations on how to address these components that will help decide whether or not the contractor can achieve the desired performance levels that may impact the system's ability to provide the clinical care envisioned when the system was reorganized.

In the final accounting there is one overriding issue which is interwoven in each of the five subsidiary issues. The primary issue deals with the need of EMC and EHS to clearly define their individual roles and constrain their activities to these roles and responsibilities. The subsidiary issues deal with fleet management, the transition of the system to all ALS, response times and the community categories, flow-through funding and extra funding processes, and the quality improvement linkage and feedback loop. Each of these areas will be addressed in specific detail.

CLARIFY EHS AND EMC ROLES, RESPONSIBILITIES, AND ACTIVITIES

ISSUE

EHS has not maintained its role of focusing on policy development, monitoring, and oversight of the system. Likewise, EMC has not been effective in demonstrating achievement of all of its performance standards and contractual requirements.

DISCUSSION

The contract with EMC was signed in 1999. At that time EMC had no experience in the provision of emergency medical services and ground ambulance transportation. In 1999, EHS had a number of individuals with significant experience in emergency medical services. EMC was able to tap in to that expertise as it developed its systems and its management matured in the operation of a province-wide ground ambulance system. EHS assisted the contractor by providing input into operational and business issues. This relationship should not have been unexpected nor was it undesirable since the system benefited from expertise from both EMC and EHS. But what did happen during this process was that precedent was established where the role of EHS as the system overseer devolved into one that included EHS attempts to dictate the means of accomplishing the desired performance levels.

Over time EHS' dictation of means has usurped accountability from EMC. As discussed earlier in the report if the oversight entity dictates the means of accomplishing the contractors' tasks then the oversight entity has become accountable for the performance.

This involvement of the contracting agency in the contractor's affairs has been demonstrated in almost every public utility model at one time or another. While appropriate and beneficial in the initial stages of program development, the practice has led to differences between EHS and the management team of EMC. It has also been a barrier to resolving some of the key performance issues that must be addressed under the contract.

EMC, on the other hand has inadequately developed systems to measure its performance in some areas. The result of this blending of roles is that an environment has been created where actions and decisions may not be appropriate to the respective responsibilities, leading to a lack of decision making in some areas. These symptoms were evident in discussions with both EMC and EHS personnel.

Some of the issues that surfaced these undesirable behaviors included;

- The management of the fleet especially the inspection and the lease return process
- Ambulance deployment strategies; including fixed base or street corner deployment
- The selection and recruitment of a Director of Fleet Services
- Flow-through and extra funding processes
- The process used to replace EHS-owned equipment
- The need to resolve the category 3, 4 and 5 area designations
- The need to determine compliance with the standard of moving to an all ALS system
- The process for monitoring clinical care where EMC must be in the loop on personnel performance
- The development of procedures to be followed in the communication centre
- The decision to implement new technology by EHS with limited EMC involvement

SUMMARY

While the symptoms and the issues that have arisen out of this blending of roles and responsibilities have caused and continue to cause problems in the relationship between EMC and EHS personnel, it can be understood given the rapid change in the EMS system. For the system to progress effectively for the next two years it will be necessary for both agencies to identify the specific issues and revert back to their intended roles: 1.) of establishing policy, monitoring and holding the contractor accountable and 2.) achieving the performance standards required under the contract and by the system.

RECOMMENDATIONS

Conduct a series of formal facilitated workshops with EMC and EHS leadership to redefine the roles and responsibilities of each entity. As a part of that process procedures should be developed to resolve conflict and to address issues on a timely basis. The example used during the clinical performance workshop of clearly defining accountability structures and the determination that the role of EHS is to establish the clinical standards of care including the medical protocols whereby EHS will be solely responsible for their effectiveness. And likewise it was determined that EMC is responsible for its personnel's compliance with those protocols therefore could be held accountable for providing the services in accordance with the protocols. Other activities that occur within the EMC and EHS organization can likewise be delineated and clearly defined. The processes of who is responsible for each component can be defined and the accountability assigned the appropriate entity responsible for delivering the activity.

FLEET MANAGEMENT

ISSUE

The fleet size is inadequate to cover the Province, the fleet lease agreement restricts the number of kilometers that are available to the point that it limits operational capacity, EMC has inadequate management information systems to monitor and track the fleet, a permanent Director of Fleet Services has not been employed, and the focus of EHS and EMC on the fleet has been to such an extent that it has diverted both entities from more important areas.

BACKGROUND

EHS has entered into an agreement with Tri-star to provide ambulances for the Provincial fleet. This agreement has a three-year life cycle and a 200,000 kilometer cap on each vehicle. Significant penalties exist for vehicles turned in with more than 200,000 kilometers and if their condition does not conform to what is defined as normal wear and tear by the lease agreement.

EHS depends on the revenue recovered from turning in ambulance vehicles with 200,000 kilometers or less and without penalties for excessive wear and tear in order to lease additional vehicles. EHS spends a significant amount of time and resources in order to maximize this revenue recovery. EMC in its attempt to respond has been unable to meet the expectations of EHS and in some cases has resisted some of the directives.

The service has 129 transport capable vehicles. Each vehicle is allowed to accumulate up to 200,000 kilometers over three years. This would allow the service to log approximately 8.47 million kilometers per year. Currently EMC is putting in excess of 8.3 million kilometers on its fleet. This 2% excess capacity is unreasonable and severely restricts EMC's ability to manage its fleet.

In addition, the peak staffing level in Nova Scotia for ambulances is 106 units during the busiest times. With 129 total available units, this represents 122% of peak staffing. Again this is inadequate to manage a high performance EMS system fleet when it is dispersed over 33,000 square kilometers in four separate regions. A minimum of 130% of fleet vehicles to peak demand should be maintained.

SUMMARY

The fleet size is inadequate to insure the availability of ambulances for deployment on a dynamic basis in order to maintain response time performance. This will be particularly true if EMC reduces the total number of unit hours. A reduction in unit hours increases the amount of movement needed by the fleet in order to provide optimal coverage.

Regardless of the number of vehicles, the limitation on the total number kilometers that can be logged on each ambulance is too restrictive. The system is operating at 2% of excess capacity. It is impossible for EMC to appropriately distribute such a minimal excess capacity level over the 127 vehicles.

The focus and the attention by both EMC and EHS on the fleet has resulted in inappropriate emphasis on the fleet to the expense of attention on other substantial areas of EMS operations. In essence, in the Nova Scotia system the fleet dictates operational decisions and performance levels rather than the performance levels defining the size, the capacity, and operational procedures for the fleet.

Even though there has been an inappropriate level of attention from EHS focused on the fleet, its maintenance, and the fleet manager; EMC has yet to install appropriate management information systems to monitor repairs, fleet usage, and system costs. EMC has also been unable to identify a permanent Director of Fleet Services to address these shortfalls.

RECOMMENDATIONS

The following recommendations are made in regards to the Nova Scotia ambulance fleet:

1) Increase the size of the fleet by 9 ambulances to create a ratio of total fleet to peak deployment of 130%. This will also increase the total number of kilometers available from 2% to 7%. This 7% is likely to be inadequate and consideration should be given to increasing the total kilometers allowed on each vehicle to 210,000 or 220,000 kilometers over the three-year cycle.
2) EMC should select and implement a management information system to direct and monitor its fleet within the next six months.
3) Within that same six-month period, EMC should identify the permanent Director of Fleet Services for the system.
4) EHS should not dictate the means of ambulance fleet operations but should work with EMC and Tri-star to develop specific performance parameters for which EMC is responsible with the appropriate incentives or consequences for nonperformance.

TRANSITION TO ALS

ISSUE

EMC and EHS have not been able to document or provide information to the consultants which would allow for the determination of whether the movement to all ALS is meeting the requirements contained within the contract.

BACKGROUND

Part of a high performance EMS system is that it will provide all ALS level care to the patients. In the contract between EHS and EMC there is a schedule whereby this standard would be achieved by the fiscal year 2006/07. Each year EMC is supposed to be able to demonstrate progress toward achievement of that benchmark. In fiscal year 2001/02 62% of the emergency calls are to be responded to by paramedics at the level of P-2 or P-3.

The consultants were informed that the computerized information system is unable to track the care levels on each emergency response. Therefore it is impossible to ascertain whether the 2000/01 performance standards are being achieved. It was indicated that a new module for the CAD system would facilitate the measurement of this key contractual component. This is scheduled to be in place 01 April 2002.

SUMMARY

EMC and EHS are unable to determine whether a key contractual provision for migrating the EMS system to one with all ALS capability is being achieved.

RECOMMENDATIONS

An immediate analysis of emergency calls should be conducted to determine compliance with this key contractual provision. If the computer aided dispatch system cannot produce an accurate report to definitively identify performance levels, at a minimum a statistically relevant random sample should be taken of emergency calls to determine the care levels provided on those calls.

The necessary programming with report generating capabilities should be implemented in the computer aided dispatch system to provide for ongoing monitoring of this component.

AMBULANCE DEPLOYMENT ISSUES

ISSUE

Two primary issues exist involving ambulance deployment. First, EHS and EMC need to reach agreement on the designation of categories 3, 4, and 5 service areas to measure response time performance within those areas. Secondly, the design of the system and the contract encourages EMC to reduce the cost of the system by deploying fewer unit hours. EMC has been able to reduce the number of unit hours by 57,000 per year but has reached a point where further reductions are going to cause potential health and safety and definitely political consequences.

DISCUSSION

It is very difficult to draw lines on a map to determine the boundaries to define performance levels. For example, a line on a map could cause one side of the street to require ambulance performance within nine minutes 90% of the time and across the street the performance expectations would be defined at 90% within 15 or 20 minutes. EMC and EHS have been challenged in defining these service areas and frankly, such delineation is difficult.

EMC has proposed that categories 3, 4 and 5 be combined into one overall category and the response time performance for emergency calls would be targeted at 90% in less than 30 minutes. This would increase the category 3 emergency response times from less than 20 minutes to less than 30 minutes and decrease category 4 emergency response times from 90% within one hour to 90% within 30 minutes. The category 5 best efforts response times would also be accumulated into this group. EMC has indicated that this contract modification would not incur additional cost to the system.

A high performance EMS system is designed to be one that meets its performance obligations in a cost effective basis. The primary cost of EMS is the deployment of ambulance unit hours throughout the system to meet emergency response times. One of the envisioned characteristics of the Nova Scotia system was that over time it would be able to reduce the number of unit hours deployed within the system while achieving the designated response times. EMC has made a number of unit-hour reductions within the system while still improving response time performance and responding to an increased volume of calls since the new system was put in place. The next significant decrease of unit hour will change performance to specific areas of the Province. It is possible to meet contractual response time requirements as long as they are not changed to amalgamate categories 3, 4, and 5 and still reduce a significant number of unit hours. Unit hours could be significantly reduced in the following locations and EMC would still be able to achieve contractual response time requirements:

- Annapolis
- Arichat
- Baddeck
- Cape North
- Liverpool
- Lunenburg
- Margaree
- Musquodobit
- New Germany
- Oxford
- Pugwash
- Sherbrooke
- Wolfville

As many as 70,000 to 80,000 unit hours can be reduced annually from the system and the contractual response times can still be achieved. Potential savings from these unit hour reductions could exceed $2 million dollars annually or 4% of the system's total budget.

EMC, contractually can make these decisions to reduce unit-hours, as long as performance is maintained. However, political consequences of such a drastic reduction in unit hours and the ramifications on the citizens surrounding those locations require that more than EMC be involved in the reduction decisions. EMC, EHS, and the Provincial government need to revisit the incentives in the contract for EMC to reduce unit hours significantly below current levels. This may require a contact amendment.

RECOMMENDATIONS

1) EMC and EHS should agree upon designation of categories 3, 4 and 5 or EHS should accept EMC's proposal to amalgamate the three categories and establish overall response times for each of the types of calls with emergency responses being 90% in less than 30 minutes.

   If the decision is made to further identify the specific category areas, then the density of call volume should be used rather than population parameters. EMC and EHS have the capability to monitor call density through the CAD system. This truly reflects the deployment requirements for ambulance services and can be used to determine what areas can be responded to within given periods of time. The six mile square grids used in figures included in this report would be adequate to make the determination on which areas should be identified as categories 3, 4, and 5.

2) Reduction in the ambulance deployment of more than 25,000 unit hours annually should be done through a process in which support can be gained from EMC, EHS, and the Provincial government prior to implementation. Provincial government may determine that the decrease in the service level for identified communities that would lose some of their ambulance coverage cannot be justified by the savings.

   The process should include EMC establishing a unit hour reduction request specifically identifying the service areas in which unit hours would be removed, quantifying the impact on response times in those service areas, and determining potential savings. This request should be referred to EHS for further analysis including an assessment by the medical director on the potential clinical impacts of such reductions. If both EMC and EHS agree that the reductions can be implemented with minimal impacts, then the request should be forwarded to Provincial government for approval. Reducing or large-scale elimination of ambulance unit hours will have political ramifications and therefore such a step should fall within the realm of public policy.

EXTRA AND FLOW-THROUGH FUNDING REQUESTS

ISSUE

The flow-through and extra funding requests where EMC provides initial funding or purchase equipment and then is reimbursed by EHS or where new programs are implemented and extra funding is required by EMC has been cause for considerable concern and frustration.

DISCUSSION

Provisions in the EMC/EHS contract allow for extra funding to be paid to EMC. Extra funding would be allowed if EHS imposes additional requirements on EMC that were not envisioned. Flow-through funding is used when EMC does the initial purchasing of items approved by EHS and EHS reimburses EMC. Some equipment items are purchased and reimbursed in this manner. There seems to always be questions on whether these flow-through and extra funding requests are appropriate and often there are discussions on who should pay for a particular piece of equipment or training program or other component.

Many of the items that are funded extraneous to the contract should have been incorporated into the contract and be EMC's responsibility. There are mechanisms that EHS can retain ownership or access to items even if they are not purchased directly by EHS.

Total extra and flow-through funding represents approximately 3% of the total budget but cause much more difficulty than is justified by the amounts.

RECOMMENDATIONS

Extra and flow-through funding requests for the last two years should be reviewed. The majority of these expenses should be rolled in to the EHS/EMC contract with EMC held accountable for maintaining, replacing, or provision of the equipment items or services identified in these requests.

QUALITY IMPROVEMENT LINKAGE AND FEEDBACK

ISSUE

EHS has retained sole responsibility for monitoring compliance with field protocols and competency of field personnel. The issue is that EMC is being held accountable for its personnel's performance in compliance with protocols while EHS is providing the monitoring and retaining the coaching and feedback components to itself.

DISCUSSION

Quality improvement programs inherently are challenged with identifying system and individual deficiencies and then remediating those deficiencies. If a program is too judgmental or aggressive the tendency is for those individuals being reviewed to hide or modify information. But, if the management team responsible for the individual and systemic performance it is not in the loop to understand the system shortcomings, changes cannot be effectively made to improve the system or to help the individuals.

The system in Nova Scotia has moved too far to the isolation of clinical quality improvement from operations. Little feedback is given to EMC's management team with regard to systemic performance and particularly in regard to individual performance. If individual deficiencies are identified the medical director and the medical control physicians take it on themselves to deal with the situation. Only in extreme situations is the management team at EMC involved.

A quality improvement system is dynamic and must be inclusive of the people providing the service, the people monitoring the service, and the people responsible for overall delivery of the service.

EMC's development of a Quality and Learning Department is an ideal mechanism to link QI activities, auditing activities, remediation, and identification of system problems through a comprehensive quality improvement process. But, this can only be accomplished if the information is shared between EHS and EMC on a regular and comprehensive basis.

RECOMMENDATIONS

Integrate EMC's Quality and Learning Department into EHS's quality improvement and patient audit activities. Regular reports should be available to EMC management to identify systemic issues and information on a on a one-to-one basis when individual performance issues are concerned. Again, it cannot be stated strongly enough that in order to hold EMC accountable for its employees' performance its management team must be notified and made aware of performance deficiencies.

Appendix A

Clinical Performance Modeling Process

APPENDIX A
CLINICAL PERFORMANCE MODELING PROCESS

DETAILS OF THE STEPS OF THE ANALYTICAL PROCESS

The expert panel developed their scores by following a four-step approach. The four steps were as follows:

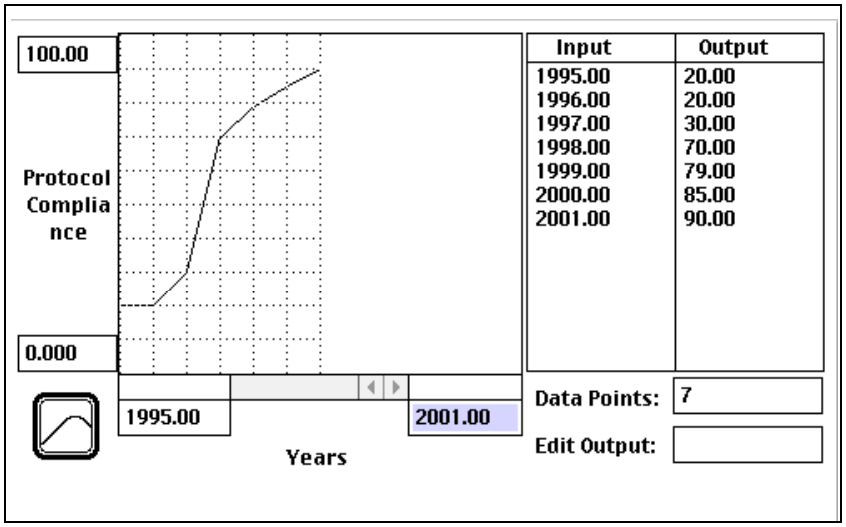
- Develop trend estimates (from 1995 to 2001) for protocol effectiveness, compliance, response time and customer satisfaction,
- Estimate protocol impacts on the six clinical success measures,
- Develop scoring curves for the six clinical success measures,
- Set weights for overall score.

1. DEVELOP TREND ESTIMATES FOR PROTOCOL EFFECTIVENESS, COMPLIANCE, RESPONSE TIME AND CUSTOMER SATISFACTION

The first step in the process was to have the panel estimate historical trends for the four key variables: protocol effectiveness, protocol compliance, response time, and customer satisfaction. Some of these variables are well-measured, like response time; others, like protocol effectiveness are much more difficult to measure and lack hard data. In the absences of data, an expert panel provides a good vehicle for developing historical trends. Using the ithink software, the panel was asked to sketch a curve for each of the variables from 1995 to 2001. Where possible they could input the data they have. Lacking that, the panel was asked to reach a consensus on what the curves should look like.

The panel sketched a curve for both protocol effectiveness and protocol compliance using a potential range of 0 (no effectiveness or compliance) to 100 (total effectiveness or compliance). An example for protocol compliance is shown in Figure A-1. The expert panel believed that in year 1995 compliance was at the 20% level (in the graphical display at right the Input is 1995, the Output is 20). There was then rapid improvement in compliance from 1997 to 1999, which has tapered off in recent years plateauing at about 90% compliance (Input of 2001, Output of 90). Protocol effectiveness also showed a similar improvement trend.

Figure A-1 Protocol Compliance



The panel then estimated response time and customer satisfaction (also on the 0 to 100 scale). Although the panel believed these two performance measures had improved over the years of the analysis, they agreed this improvement wasn't as dramatic as for the measures for protocol.

2. ESTIMATE PROTOCOL IMPACTS ON SIX CLINICAL SUCCESS MEASURES

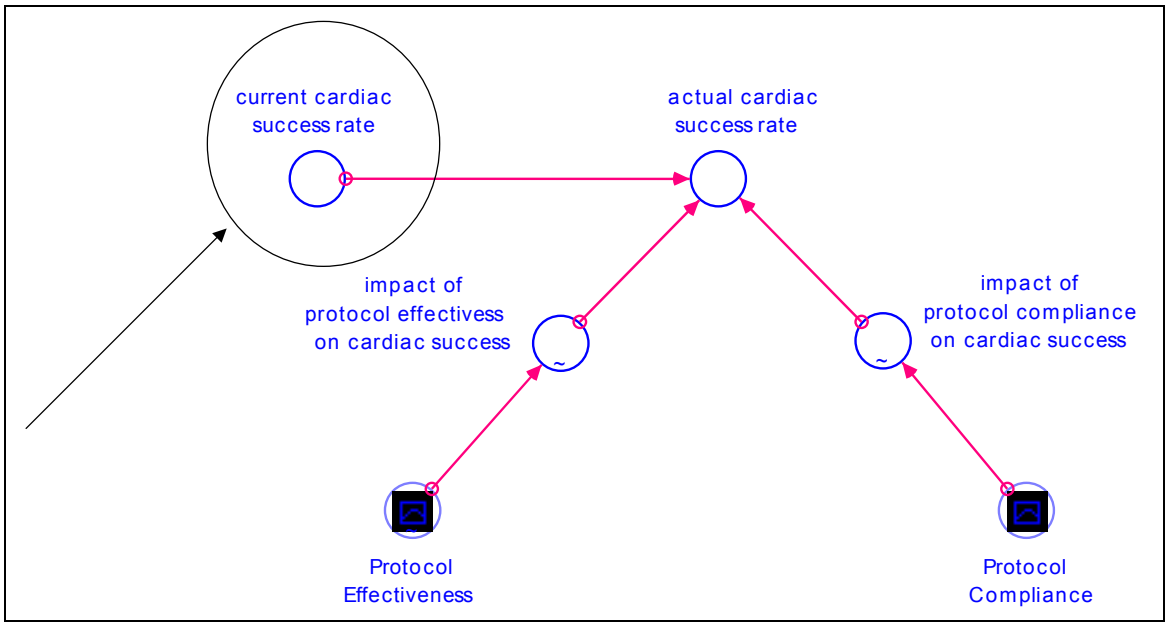
The panel's next step was to make explicit assumptions about the impacts of the two protocol measures on six clinical success measures (medical conditions). As described earlier, these are:

1) Cardiac events,
2) Stroke events (CVAs),
3) Trauma,
4) Conditions of altered mental state,
5) Shortness of breath,
6) Other.

This important step required an expert panel because there is very little validation of what the impacts of protocols (effectiveness and compliance) are on these medical conditions. The software proved an excellent tool for making these "soft and squishy" assumptions more explicit. The relationships were first sketched out as described earlier and modified as shown in Figure A-2.

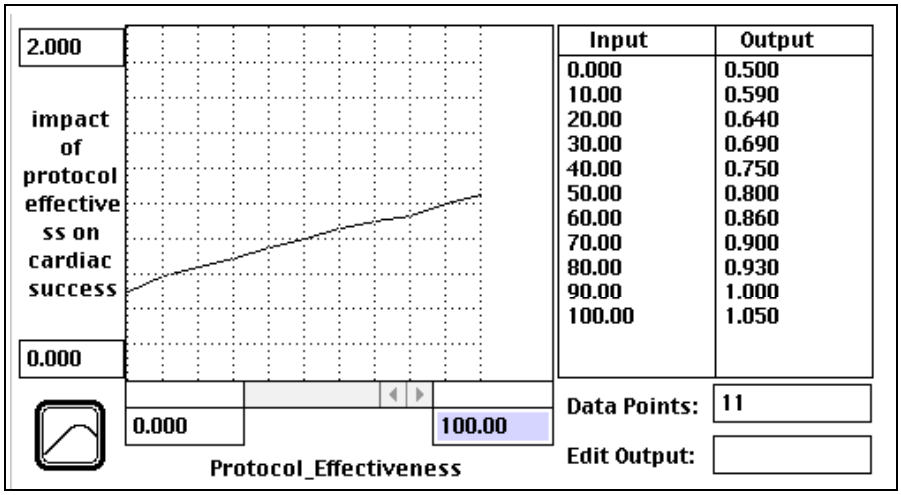
The first step was to create an anchor point for the analysis. The easiest anchor point was to use the current value for medical condition success rate. In Figure A-2, the current cardiac success rate was estimated at 50%. The panel then chose the current estimate of Protocol Effectiveness (90%) and set that equal to 1 in the impact curve. In layman's terms, this means that if protocol effectiveness is at 90%, the actual cardiac success rate (ignoring any impact of compliance) would be the current cardiac success rate. [The equation is current/anchor cardiac success rate (50) * impact of protocol effectiveness (1) = actual cardiac success rate (50); in this case the actual rate is the same as the anchor rate.]

Figure A-2 Relationships of Protocol Compliance and Effectiveness



Once the original anchor point was chosen, the panel determined what percentage of the anchor cardiac success rate might be achieved if Protocol Effectiveness went to 0%. The panel decided this would be 50% (a multiplier of .5 in the graphical function) of the current cardiac success rate. Since the anchor success rate is 50%, .5 the success rate for a Protocol Effectiveness of 0 would be 25% (50% * .5). Finally chosen, the last point on the curve was the impact on cardiac success if the protocol was 100% effective. In this case, the panel thought this might result in a slight 5% (a multiplier of 1.05) improvement over current cardiac success. So the most this curve could contribute would be to create a success rate of 52.5% (50% * 1.05).

Figure A-3 Impact of Protocol Effectiveness

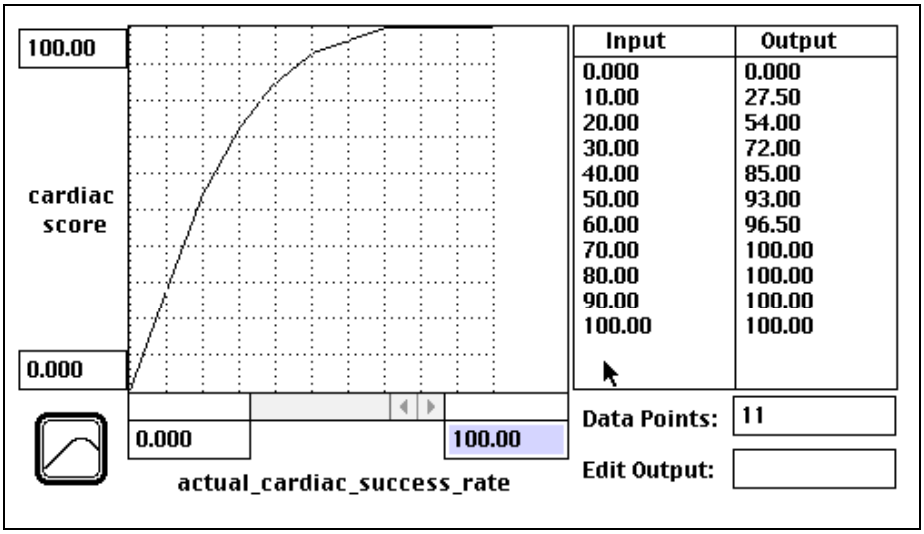


The same logic was used to complete an estimate for the impact of Protocol Compliance on cardiac success rate. And then it was repeated for effectiveness and compliance for the other five medical conditions.

3. DEVELOP SCORING CURVES FOR SIX CLINICAL SUCCESS MEASURES

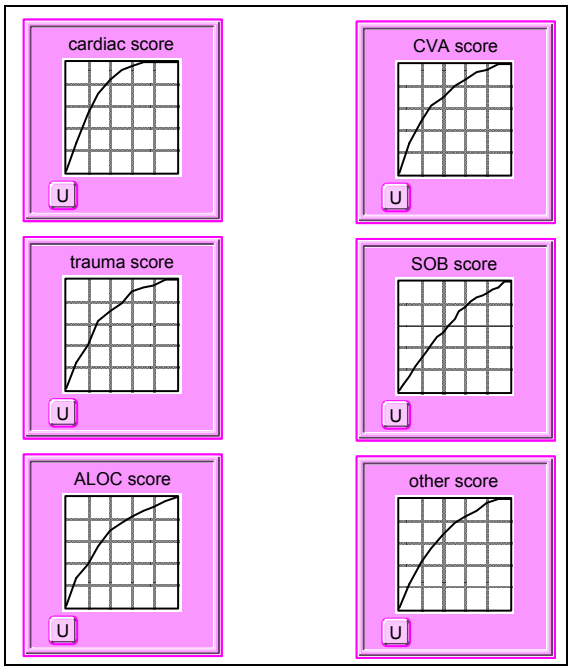
The panel's next step was to develop scoring curves for each of the clinical success measures. The range for these scores was 0 to 100; this is an estimate for the value of a given medical condition success rate. For example, it was determined that a cardiac success rate of 70% or above would get a score of 100 (Input 70, Output 100), meaning that the panel thought it would be hard to improve upon a success rate above 70%. Similarly, a success rate of 0% would get a score of 0; it couldn't be any worse. The panel then sketched a scoring curve relating cardiac success rate to a score (on the 0 to 100 scale). See Figure A-4. The curve indicated that the panel believed the current cardiac success rate of 50% rated a score of 93 (Input 50, Output 93).

Figure A-4 Scoring Curve



The panel then developed similar curves for each of the other five medical conditions using graphical input devices like the ones shown in Figure A-5.

Figure A-5 Scoring Curves For Six Medical Conditions

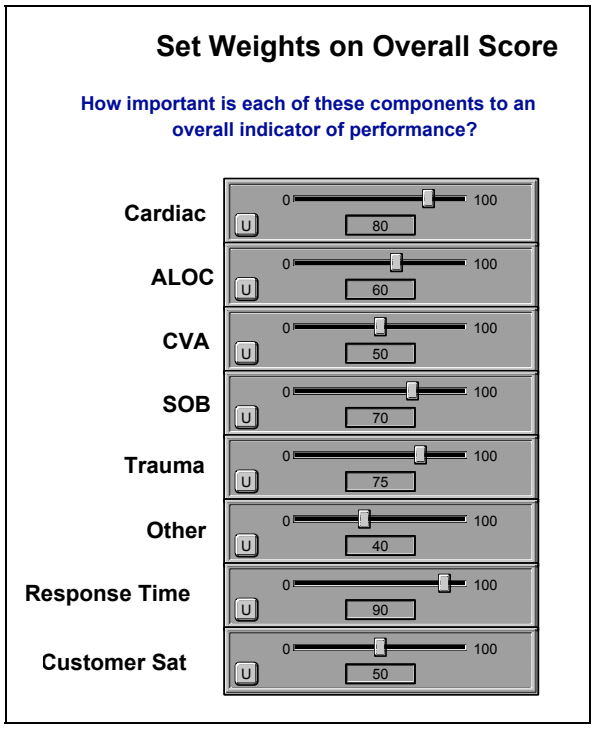


4. SET WEIGHTS FOR OVERALL SCORE

The panel was given a goal of creating one overall score for system performance. They determined that the key components of this score would be an aggregation of the eight scores: the six medical conditions, as well as scores for customer satisfaction (already on a 0 to 100 scale) and response times (also on a 0 to 100 scale).

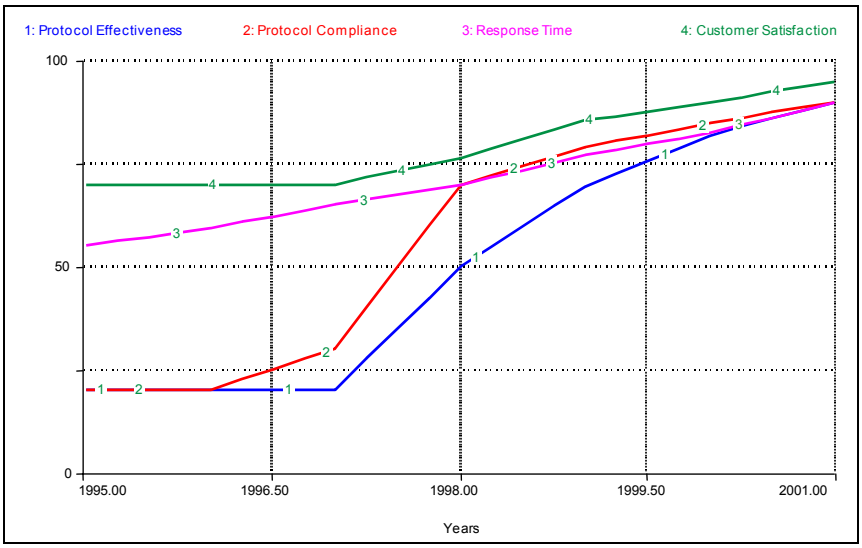
In order to create this aggregated score, the panel of experts needed to determine the relative weights of each of the eight scores. The panel was given the set of sliders shown in Figure A-6 to determine the relative importance of each of the scores. They were instructed to set the relative importance for each score by moving the slidebar to the appropriate position. For example, the cardiac score was deemed extremely important in its impact on an overall score, so the panel set it at 80 (on a 0 to 100 scale), while customer satisfaction was deemed much less important and set at 50.

Figure A-6 Relative Weights



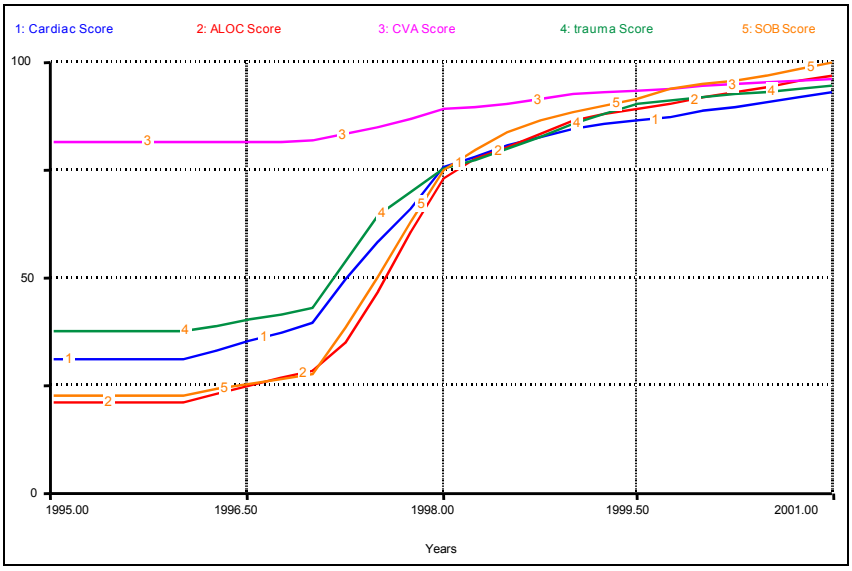
The final analysis was to calculate all of the scores. The first graph (Figure A-7) contains the historical trends the panel estimated for Protocol Effectiveness (1), Protocol Compliance (2), Response Time (3), and Customer Satisfaction (4). All trends indicate an increase in each of these variables.

Figure A-7 Trends for Protocol Effectiveness, Compliance, Response Times, and Customer Satisfaction



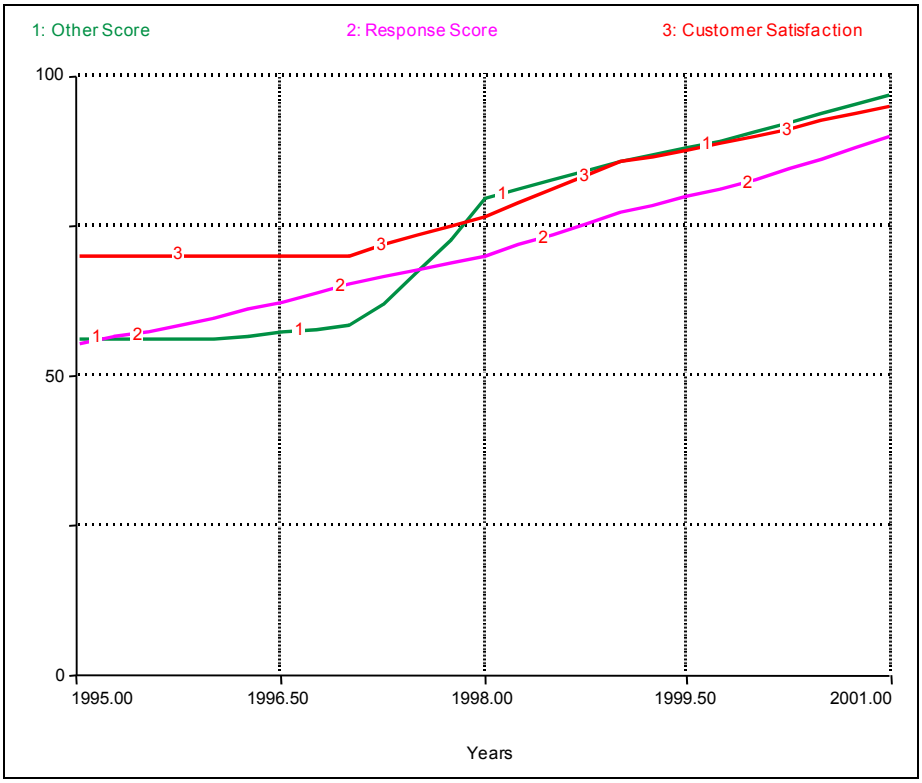
The next graph (Figure A-8) shows the trends in scores for five of the six medical conditions: Cardiac (1), ALOC (2), CVA (3), Trauma (4), SOB (5).

Figure A-8 Trends for Treatment of Five Medical Conditions



The third graph (Figure A-9) shows the scores for the three variables: Other (1), Response Time (2), and Customer Satisfaction.

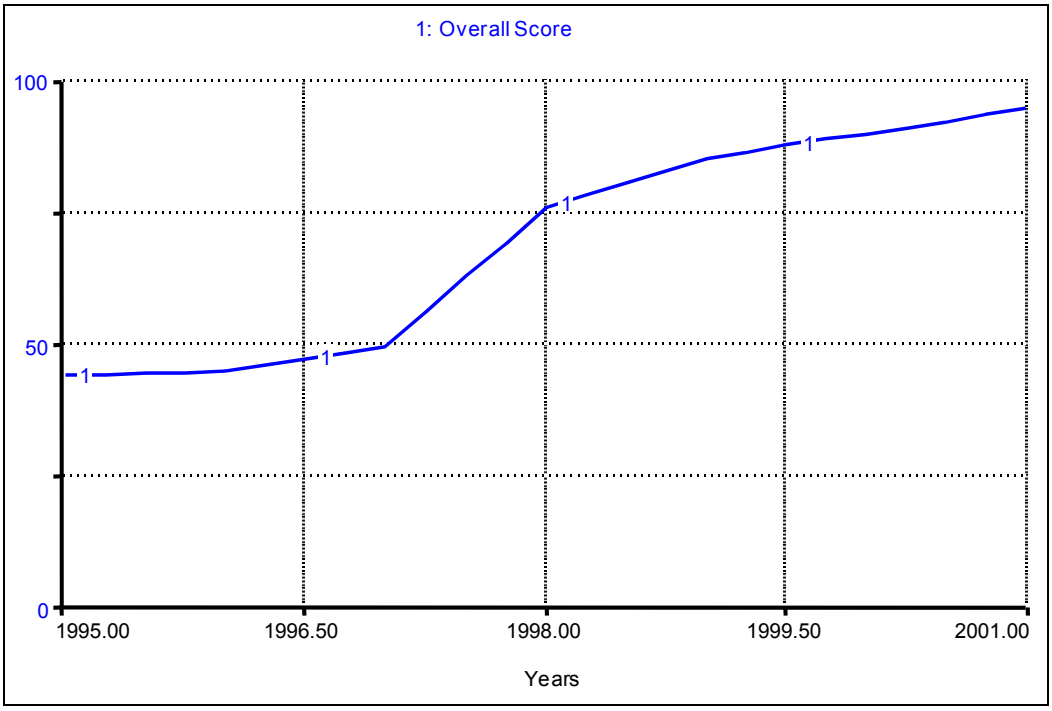
Figure A-9 Trends for Customer Satisfaction, Response Times, and Other Medical Conditions



Finally, the panel looked at a graph for the overall score. This graph is shown next (Figure A-10). It was at this point that members of the panel, who had been in agreement with the various assumptions made up to this time, decided that the overall score looked too positive.

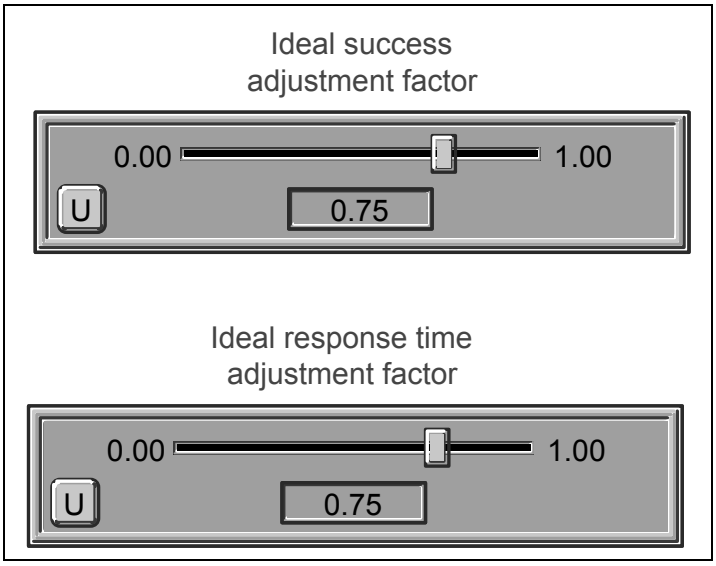
A lengthy discussion ensued, during which it was finally agreed that estimates for some of the four key variables (Protocol Effectiveness, Protocol Compliance, Response Time, and Customer Satisfaction) might have been overly optimistic (i.e. upwardly biased). For example, although the panel agreed that Protocol Effectiveness was very high currently (and they had given it a 90% value for the present), they finally concluded that in the best of all possible worlds, the current performance for effectiveness was less than 90 in that it is impossible to foresee what new treatment developments could occur that would increase protocol effectiveness.

Figure A-10 Overall Score



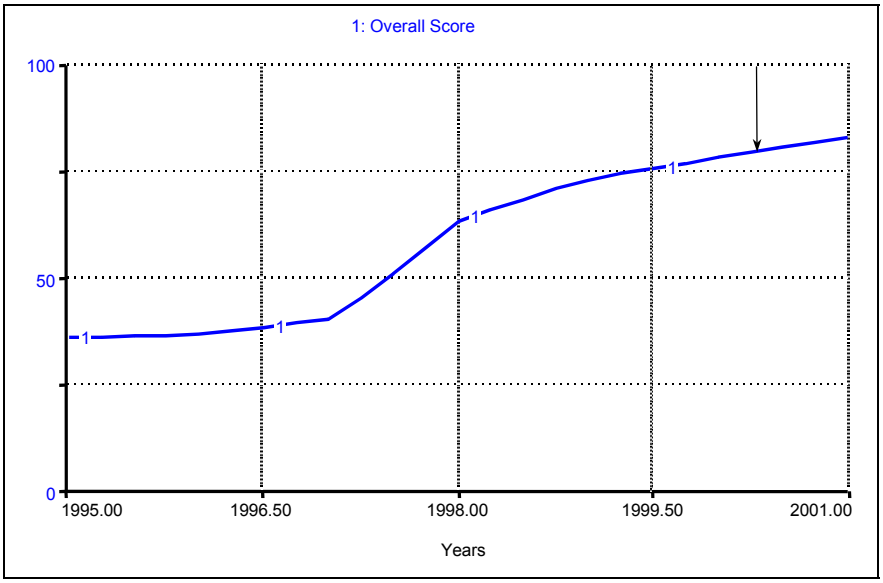
How overly optimistic were some of the estimates? There was not time at the session to actually reach agreement on this. For this reason, the consultants have created a revision to the model that will allow the panel to reconvene and revise their scoring. The revision contains a set of two sliders (Figure A-11) where the panel (or a subset of the panel) can adjust the slope of the curves for protocols (both effectiveness and compliance) and response time. For example, if what the panel currently believes to be a 100% of effectiveness were analyzed against a "best of all possible worlds" scenario, what percentage would that be? In the example of the sliders shown here, the analyst would be saying that it's only 75% as good as what could ultimately be achieved. This will bring the overly optimistic bias down into a more reasonable range.

Figure A-11 "Ideal World" Adjustment



The example consequent, Figure A-12, is shown here, where it is obvious that the curve is not nearly as steep as in the previous, upwardly biased scoring curve.

Figure A-12 Adjusted Overall Score



Appendix B

List of Possible Measures as Developed by Group

Appendix B

List of Possible Measures as Developed by Group

Measure	Compliance	Effectiveness
Call answer time	X	
Customer satisfaction	X	
Competence of on-site care	X	
Safe care	X	
Traffic safety	X	
Response times	X	
Caring – empathetic	X	
Accuracy of diagnosis (within reasonable expectations)	X	
Time spent on scene	X	
Continuity of handoffs (e.g. at the hospital)	X	
Destination choice appropriateness	X	
Interhospital transport timeliness	X	
Staffing of transport	X	
In-transit patient care	X	X
Medical communication (to base physician)	X	
Time (code choice)	X	
Quality of caller-dispatch communication		
Non-traditional services		
PCR review	X	X
Stakeholder education		
Equipment reliability	X	
Intubation success rates	X	X
IV success rates	X	X
Call processing performance		
Response time	X	
Protocol compliance	X	
Patient satisfaction	X	
EMDQ Q&A	X	
Reduced ischemia in cardiac events		X
Successful treatment of arrhythmias		X
Airway maintenance	X	X
Diabetes diagnosis and treatment	X	X
Correction of hypoxia		X
Trauma – time to definitive care	X	
BP maintenance	X	X
Hemorrhage management	X	X
CVA – diagnosis and transport	X	
Reduce ischemia		X
Left on-scene results	X	

Appendix C

Paramedic Essential Competencies

Appendix C

Scope of Practice - P1

ESSENTIAL COMPETENCIES FOR A P1

1. Assess and manage the health crisis scene.

2. Perform a primary patient survey.

3. Provide basic airway management techniques using oropharyngeal / nasopharyngeal* airway adjuncts and suctioning.

4. Perform basic management of breathing dysfunctions including:

    a) administration of oxygen using mask or nasal cannula.
    b) use of bag-valve-mask unit and barrier device.

5. Recognize external and internal hemorrhage and apply basic management techniques.

6. Administer cardiopulmonary resuscitation (CPR) to an adult, child or infant.

7. Obtain, document and communicate an organized and appropriate patient history.

8. Perform a secondary patient survey.

9. Perform chest ausculation to assess air entry.

10. Provide psychological support to a patient and their significant others.

11. Perform basic radio operation and communication.

12. Provide basic care for wounds and environmental injuries.

13. Perform immobilization techniques for actual and suspected fractures.

14. Manage medical and traumatic emergencies, identifying those patients requiring immediate transport.

15. Recognize the indications for and administer oral glucose.

16. Manage emergency childbirth, including postnatal, maternal and neonatal care and transport.

17. Use management techniques for a patient undergoing an emotional and/or mental health crisis.

18. Apply techniques for packaging and safe removal of an entrapped patient using basic extrication principles.

19. Use lifting and moving techniques (biomechanics) essential to patient care and safety of the pre-hospital care practitioner.

20. Recognize the role of medical control and medical direction in the provision of pre-hospital care.

21. Incorporate legal considerations in the provision of pre-hospital care.

22. Perform rapid triage skills.

23. Recognize and manage mass casualty incidents.

24. Employ the principles of infection control and universal precautions.

25. * Perform Automated External Defibrillation.

26. * Upon successful completion of EHS approved training and under Medical Control with ongoing medical audit may provide by Protocol:

    a) Subcutaneous epinephrine, beta agonist by puffer, ASA, and sublingual nitroglycerin.
    b) Blood glucose monitoring.
    c) Routine care for common drainage tubes, excluding chest tubes.
    d) Maintenance of peripheral intravenous locks or infusions without medications or blood products to include calculations, monitoring and adjusting flow rates as well as recognizing and managing complications.

* A grace period of one year will be given for these two competencies.

Scope of Practice - P2

ESSENTIAL COMPETENCIES FOR A P2

1. Assess and manage the health crisis scene.

2. Perform a primary patient survey.

3. Provide basic airway management techniques using oropharyngeal/nasopharyngeal airway adjuncts and suctioning.

4. Provide advanced airway management including:

    a) foreign body removal by direct techniques.
    b) endotracheal intubation and suctioning.
    c) other devices or procedures excluding crycothyrotomy.
    d) alternative methods after auscultation for confirming endotracheal tube placement.

5. Perform basic management of breathing dysfunctions including:

    a) administration of oxygen using mask or nasal cannula.
    b) use of bag-valve-mask unit and barrier device.

6. Recognize external and internal hemorrhage and apply basic management techniques.

7. Administer cardiopulmonary resuscitation (CPR) to an adult, child or infant.

8. Perform automated external defibrillation.

9. Obtain, document and communicate an organized and appropriate patient history.

10. Perform a secondary patient survey.

11. Perform chest ausculation to assess air entry and recognize and interpret adventitial breath sounds.

12. Provide psychological support to a patient and their significant others.

13. Provide basic care for wounds and environmental injuries.

14. Perform immobilization techniques for actual and suspected fractures.

15. Manage medical and traumatic emergencies, identifying those patients requiring immediate transport.

16. Maintain peripheral intravenous locks or infusions without medications or blood products, calculate, monitor and adjust flow rates, recognize and manage complications of intravenous catheters and infusions.

17. Provide routine care during transport for common drainage or feeding tubes, excluding chest tubes.

18. Recognize the indications for and administer oral glucose.

19. Manage emergency childbirth, including postnatal, maternal and neonatal care and transport.

20. Manage patients undergoing an emotional and/or mental health crisis.

21. Apply techniques for packaging and safe removal of an entrapped patient using basic extrication principles.

22. Use lifting and moving techniques (biomechanics) essential to patient care and safety of the pre-hospital care practitioner.

23. Recognize the role of medical control and medical direction in the provision of pre-hospital care.

24. Incorporate legal considerations in the provision of pre-hospital care.

25. Perform systems assessment based on the patient's clinical presentation.

26. Perform phlebotomies.

27. Initiate intravenous therapy including:

    a) peripheral venipuncture including external jugular.
    b) fluid administration and rate calculation.
    c) saline locks.
    d) pressure infusion techniques.

28. Recognize and manage mass casualty incidents.

29. Administer emergency drugs as per Provincial Protocols and Policies.

    a) To include at a minimum:

        i) Epinephrine 1:10,000
        ii) Atropine
        iii) Lidocaine
        iv) Bicarb
        v) Epinephrine 1:1,000 S/C
        vi) Nebulized Beta Agonists
        vii) ASA po
        viii) Nitroglycerine S/L
        ix) D50 IV
        x) Diazepam
        xi) Dimenhydrinate (Gravol)
        xii) Glucagen
        xiii) Morphine
        xiv) Topical anaesthetic eye drops
        xv) Narcan

    b) Perform procedures for:

        i) drawing up medications from a vial or ampule.
        ii) use of medication in prepackaged disposable syringe.

    c) By routes including:

        i) subcutaneous
        ii) intramuscular
        iii) intravenous by push and infusion
        iv) endotracheal
        v) sublingual
        vi) nebulized
        vii) po

30. Integrate advanced skills into the overall management of patient care.

31. Employ the principles of infection control and universal precautions.

32. Perform basic radio operations and communications.

Scope of Practice - P3

NOTE: This is a draft

ESSENTIAL COMPETENCIES FOR A P3

1. Assess and manage the health crisis scene.

2. Perform a primary patient survey.

3. Provide basic airway management techniques using oropharyngeal/nasopharyngeal airway adjuncts and suctioning.

4. Provide advanced airway management including:

    - foreign body removal by direct techniques.
    - endotracheal intubation and suctioning.
    - other devices or procedures.
    - alternative methods after auscultation for confirming endotracheal tube placement.

5. Nasogastric tube placement.

6. Perform basic management of breathing dysfunctions including:

    - administration of oxygen using mask or nasal cannula.
    - use of bag-valve-mask unit and barrier device.

7. Recognize external and internal hemorrhage and apply basic management techniques.

8. Administer cardiopulmonary resuscitation (CPR) to an adult, child or infant.

9. Perform automated external defibrillation.

10. Obtain, document and communicate an organized and appropriate patient history.

11. Perform a secondary patient survey.

12. Perform chest ausculation to assess air entry and recognize and interpret adventitial breath sounds.

13. Provide psychological support to a patient, and their significant others.

14. Provide basic care for wounds and environmental injuries.

15. Perform immobilization techniques for actual and suspected fractures.

16. Manage medical and traumatic emergencies, identifying those patients requiring immediate transport.

17. Maintain peripheral intravenous locks or infusions with or without medications or blood products, calculate, monitor and adjust flow rates, recognize and manage complications of intravenous catheters and infusions.

18. Provide routine care during transport for common drainage or feeding tubes, excluding chest tubes.

19. Recognize the indications for and administer oral glucose.

20. Manage emergency childbirth, including postnatal, maternal and neonatal care and transport.

21. Manage patients undergoing an emotional and/or mental health crisis.

22. Apply techniques for packaging and safe removal of an entrapped patient using basic extrication principles.

23. Use lifting and moving techniques (biomechanics) essential to patient care and safety of the pre-hospital care practitioner.

24. Recognize the role of medical control and medical direction in the provision of pre-hospital care.

25. Incorporate legal considerations in the provision of pre-hospital care.

26. Perform systems assessment based on the patient's clinical presentation.

27. Perform phlebotomies.

28. Initiate intravenous therapy including:

    - peripheral venipuncture.
    - intra osseous access.
    - fluid administration and rate calculation.
    - saline locks.
    - pressure infusion techniques.

29. Recognize and manage mass casualty incidents.

30. Perform cardiac monitoring and rhythm interpretation.

31. Utilize a pulse oximeter and adapt treatment accordingly.

32. Perform cardioversion, defibrillation (including manual) and external pacing.

33. Manage cardiac emergencies according to the Advanced Cardiac Life Support Guidelines of the Heart and Stroke Foundation of Canada.

34. Administer emergency drugs as per Provincial Protocols and Policies, including:

- Chronotropic/inotropic agents	- Antipsychotics
- Antiarrhythmics	- Anticoagulants
- Bicarb	- Activated characoal
- Bronchodilators	- ASA
- Vasodilators	- D50
- Antiemetics	- Glucagen
- Benzodiazepines	- Topical anaesthetic eye drops
- Narcotics	- Narcan
- Antibiotics	- MgSO4

35. Perform procedures for:

    - drawing up medications from a vial or ampule.
    - use of medication in prepackaged disposable syringe.

36. By routes including:

    - subcutaneous
    - intramuscular
    - intravenous by push and infusion including IV pumps
    - endotracheal
    - sublingual
    - rectal
    - nebulized
    - intra osseous by push and infusion including pumps
    - po

37. Perform chest decompression.

38. Integrate advanced skills into the overall management of patient care.

39. Employ the principles of infection control and universal precautions.

40. Perform basic radio operations and communications in accordance with Transport Canada's Land Communications and language.

In order to work as an Air Medical Transport (AMT) paramedic, the following essential competencies are required:

41. Assess and stabilize those patients identified for aeromedical transport.

42. Perform patient care while incorporating the principles of flight physiology.

43. Demonstrate the basic principles of CXR and c-spine interpretation.

44. Interpret routine lab results.

45. Establish percutaneous femoral lines.

46. Employ the use of a mechanical ventilator

47. Apply Heimlich valve to chest needle decompression catheter.

48. Employ Thrombolytic protocols.

49. Perform blood gas punctures (fem./rad.)

50. Perform Conscious Sedation

51. interpret acute ischemic patterns in 12 lead EKGs.

52. Monitor Swan Ganz, CVPs and other invasive/central lines.

53. Maintain transvenous pacers.

54. Perform urinary catherization.

55. Perform skin closure.

56. Access portacaths.

57. Utilize End-tidal CO2 monitoring and adjust treatment accordingly.

58. Administer medication as per AMT protocols:

    - Antihypertensives
    - Vasopressors
    - Thrombolytics
    - Betablockers
    - Diuretics
    - Calcium Channel Blockers
    - Anti-inflammatory agents
    - Anaesthetics
    - Insulin (regular)
    - Potassium
    - Oxytocin

59. Competent with Transport Canada Air and Sea Communications protocols and language.

Appendix D

Response Time Performance Report

Appendix D

EHSNS
Contract Management Group

1st Quarter, 2001
Overall Response Times
Emergency Responses

Category One

	Count	Fractile	Cum. Ct.	Cum. %
00:00 - 06:59	3009	68.22%	3009	68.22%
07:00 - 07:59	466	10.56%	3475	78.78%
08:00 - 08:59	302	6.85%	3777	85.63%
09:00 - 09:59	185	4.19%	3962	89.82%
10:00 - 10:59	141	3.20%	4103	93.02%
11:00 - 11:59	101	2.29%	4204	95.31%
12:00 - 12:59	47	1.07%	4251	96.37%
13:00 - 13:59	36	.82%	4287	97.19%
14:00 - 14:59	28	.63%	4315	97.82%
15:00 - 15:59	12	.27%	4327	98.10%
16:00 - 17:59	19	.43%	4346	98.53%
18:00 - 19:59	18	.41%	4364	98.93%
20:00 - 21:59	16	.36%	4380	99.30%
22:00 - 23:59	11	.25%	4391	99.55%
24:00 - 25:59	6	.14%	4397	99.68%
26:00 - 27:59	5	.11%	4402	99.80%
28:00 - 29:59	4	.09%	4406	99.89%
30:00 - 34:59	3	.07%	4409	99.95%
35:00 - 39:59	2	.05%	4411	100.00%
40:00 - 44:59			4411	100.00%
45:00 +			4411	100.00%

Category Two

	Count	Fractile	Cum. Ct.	Cum. %
00:00 - 06:59	933	61.38%	933	61.38%
07:00 - 07:59	140	9.21%	1073	70.59%
08:00 - 08:59	77	5.07%	1150	75.66%
09:00 - 09:59	71	4.67%	1221	80.33%
10:00 - 10:59	59	3.88%	1280	84.21%
11:00 - 11:59	61	4.01%	1341	88.22%
12:00 - 12:59	42	2.76%	1383	90.99%
13:00 - 13:59	26	1.71%	1409	92.70%
14:00 - 14:59	25	1.64%	1434	94.34%
15:00 - 15:59	9	.59%	1443	94.93%
16:00 - 17:59	28	1.84%	1471	96.78%
18:00 - 19:59	18	1.18%	1489	97.96%
20:00 - 21:59	7	.46%	1496	98.42%
22:00 - 23:59	7	.46%	1503	98.88%
24:00 - 25:59	3	.20%	1506	99.08%
26:00 - 27:59	4	.26%	1510	99.34%
28:00 - 29:59	1	.07%	1511	99.41%
30:00 - 34:59	7	.46%	1518	99.87%
35:00 - 39:59			1518	99.87%
40:00 - 44:59			1518	99.87%
45:00 +	2	.13%	1520	100.00%

Category 3, 4, 5

	Count	Fractile	Cum. Ct.	Cum. %
00:00 - 06:59	767	20.82%	767	20.82%
07:00 - 07:59	239	6.49%	1006	27.31%
08:00 - 08:59	247	6.70%	1253	34.01%
09:00 - 09:59	221	6.00%	1474	40.01%
10:00 - 10:59	234	6.35%	1708	46.36%
11:00 - 11:59	212	5.75%	1920	52.12%
12:00 - 12:59	190	5.16%	2110	57.27%
13:00 - 13:59	149	4.04%	2259	61.32%
14:00 - 14:59	163	4.42%	2422	65.74%
15:00 - 15:59	151	4.10%	2573	69.84%
16:00 - 17:59	243	6.60%	2816	76.44%
18:00 - 19:59	190	5.16%	3006	81.60%
20:00 - 21:59	155	4.21%	3161	85.80%
22:00 - 23:59	121	3.28%	3282	89.09%
24:00 - 25:59	70	1.90%	3352	90.99%
26:00 - 27:59	70	1.90%	3422	92.89%
28:00 - 29:59	50	1.36%	3472	94.25%
30:00 - 34:59	89	2.42%	3561	96.66%
35:00 - 39:59	55	1.49%	3616	98.15%
40:00 - 44:59	29	.79%	3645	98.94%
45:00 +	39	1.06%	3684	100.00%

Appendix D

EHSNS
Contract Management Group

4th Quarter, 1998
Overall Response Times
Emergency Responses

	Category One				Category Two				Category 3, 4, 5			
	Count	Fractile	Cum. Ct.	Cum. %	Count	Fractile	Cum. Ct.	Cum. %	Count	Fractile	Cum. Ct.	Cum. %
00:00 - 06:59	2124	50.19%	2124	50.19%	807	58.48%	807	58.48%	931	24.38%	931	24.38%
07:00 - 07:59	445	10.52%	2569	60.70%	106	7.68%	913	66.16%	253	6.63%	1184	31.01%
08:00 - 08:59	348	8.22%	2917	68.93%	67	4.86%	980	71.01%	276	7.23%	1460	38.24%
09:00 - 09:59	285	6.73%	3202	75.66%	67	4.86%	1047	75.87%	206	5.40%	1666	43.64%
10:00 - 10:59	239	5.65%	3441	81.31%	59	4.28%	1106	80.14%	214	5.61%	1880	49.24%
11:00 - 11:59	169	3.99%	3610	85.30%	47	3.41%	1153	83.55%	194	5.08%	2074	54.32%
12:00 - 12:59	131	3.10%	3741	88.40%	45	3.26%	1198	86.81%	171	4.48%	2245	58.80%
13:00 - 13:59	72	1.70%	3813	90.10%	32	2.32%	1230	89.13%	178	4.66%	2423	63.46%
14:00 - 14:59	81	1.91%	3894	92.01%	21	1.52%	1251	90.65%	159	4.16%	2582	67.63%
15:00 - 15:59	42	.99%	3936	93.01%	16	1.16%	1267	91.81%	116	3.04%	2698	70.67%
16:00 - 17:59	86	2.03%	4022	95.04%	26	1.88%	1293	93.70%	235	6.16%	2933	76.82%
18:00 - 19:59	46	1.09%	4068	96.12%	21	1.52%	1314	95.22%	195	5.11%	3128	81.93%
20:00 - 21:59	30	.71%	4098	96.83%	15	1.09%	1329	96.30%	131	3.43%	3259	85.36%
22:00 - 23:59	24	.57%	4122	97.40%	13	.94%	1342	97.25%	112	2.93%	3371	88.29%
24:00 - 25:59	22	.52%	4144	97.92%	7	.51%	1349	97.75%	86	2.25%	3457	90.54%
26:00 - 27:59	12	.28%	4156	98.20%	7	.51%	1356	98.26%	70	1.83%	3527	92.38%
28:00 - 29:59	17	.40%	4173	98.61%	5	.36%	1361	98.62%	55	1.44%	3582	93.82%
30:00 - 34:59	19	.45%	4192	99.05%	6	.43%	1367	99.06%	101	2.65%	3683	96.46%
35:00 - 39:59	14	.33%	4206	99.39%	5	.36%	1372	99.42%	53	1.39%	3736	97.85%
40:00 - 44:59	9	.21%	4215	99.60%	2	.14%	1374	99.57%	35	.92%	3771	98.77%
45:00 +	17	.40%	4232	100.00%	6	.43%	1380	100.00%	47	1.23%	3818	100.00%