National Emergency Training Center
16825 S. Seton Avenue
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FEMA

R0158

Dear National Fire Academy Student:

Congratulations on your acceptance to the U.S. Fire Administration's National Fire Academy's (USFA's NFA's) *Emergency Medical Services: Quality Management* course.

Enclosed is a precourse assignment for you to complete before the first day of class. Initial activities will relate to this information. You should be prepared to do a large amount of reading and computer work during the class.

Increasing numbers of students and instructors are bringing laptop computers to campus. You are encouraged, but not required to bring a laptop computer. You alone are responsible for the security and maintenance of your equipment. The Academy cannot provide you with computer software, hardware, or technical support to include disks, printers, scanners, etc. Wireless Internet access is available for student and instructor use in the dormitories only, not in the classroom buildings. There are a limited number of 120-volt AC outlets in the classrooms. A Student Computer Lab is located in Building D and is available for all students to use. It is open daily with technical support provided in the evenings. This lab uses Windows XP and Office 2007 as the software standard.

Should you need additional information related to course content or requirements, please feel free to contact Mr. Michael Stern, Emergency Medical Services Curriculum Training Specialist, at (301) 447-1253 or email at michael.stern@fema.dhs.gov

Sincerely,

Dr. Denis Onieal, Superintendent
National Fire Academy
U.S. Fire Administration

EMERGENCY MEDICAL SERVICES: QUALITY MANAGEMENT

PRECOURSE ASSIGNMENTS

PRECOURSE ASSIGNMENT LIST

I. Complete the following worksheets to be turned in on the morning of the first day of class.

- Questionnaire (p. 5)
- EMS Quality Management Problem/Issue/Concern (pp. 7-8)

II. Complete the following readings:

- Readings that accompany lecture on the first day of class (included in this packet):
  - "Introduction to the DMAIC Process"
  - "History and Quality Management Models"
  - "Scope of Quality Management"

- National Highway Traffic Safety Administration. *A Leadership Guide to Quality Improvement for Emergency Medical Service Systems.* U.S. Government, 1996.

  Please obtain this document at
  www.nhtsa.dot.gov/people/injury/ems/leaderguide/index.html

- Myers, B. J., Slovis, C. M., Eckstein, M., Goodloe, J. M., Isaacs, M. S., Loflin, J. R., et al. (2008). *Evidence-Based Performance Measures for Emergency Medical Services Systems: A Model for Expanded EMS Benchmarking*. Prehospital Emergency Care, 12:2, 141 – 151.

III. Optional Assignment--Organizational Self-Assessment

The Organizational Self-Assessment on pp. 37-52 of this packet is a tool for you to evaluate your organization on Baldrige's seven key action areas:

1. Leadership.
2. Information and Analysis.
3. Strategic Quality Planning.
4. Human Resource Development and Management.
5. EMS Process Management.
6. EMS System Results.
7. Satisfaction of Patients and Other Stakeholders.

The assessment can be completed a number of ways. Here are two for your consideration:

1. The primary method is for you to have it completed by **only** the senior leader of your fire/EMS organization or a member of the leadership team responsible for developing your organization's focus on EMS quality.

2. Another more extensive method--time and necessary approvals permitting--is to have your entire EMS leadership team (including you) complete the self-assessment.

When "yes" can be honestly answered to all of the questions in a particular stage, you can be confident that your organization is ready to move into the next stage of development. You should also strive to move forward stage by stage in all seven Baldrige areas simultaneously. You will notice that action areas in one category reference activity in another category. For example, a human resources section task may affect or emanate from the strategic quality plan section.

When you arrive at the NFA for your course you'll find that having already completed the self-assessment will provide "food for thought" during classroom discussions. Also, in Unit 5: Organizational Improvement, we will be directly referencing in broad terms what you learned as a result of completion of the survey.

Note that during the EMS:QM course, instead of Stages I through III, we use the term "Phases" with the three descriptors being "Initiation," "Deployment," and "Integration."

IV. Optional Reading:

Walton, Mary. *Deming Management Method*. New York: Perigree/Penguin Putnam, 1986.

Questionnaire

Name: _____ Your Title: _____

Name of Your Organization: _____

Size of Your Organization:

Total Number of EMS Calls Per Year: _____

# of EMS Transport Units: _____ # of EMS Nontransport Units: _____

Personnel: Career/Volunteer/Combination (circle one)

Location of Organization: _____

What is your past and current experience with Emergency Medical Services quality management? Please include both training and educational coursework.

_____

_____

_____

_____

_____

Is this your first NFA resident class? Yes/No (Circle one)
If not, what other classes have you attended at NFA?

_____

_____

_____

What are your expectations, if any, for this class?

_____

_____

_____

EMS QUALITY MANAGEMENT PROBLEM/ISSUE/CONCERN

Select a problem/issue/concern that you think is within your realm of influence to address. Write a short description of your problem/issue/concern in the space provided below.

You will need to turn in this worksheet within the first hour of class; therefore, it is important to have this done prior to class. Your problem/issue/concern will become the basis of the Quality Management Plan you will develop in this course.

Your problem/issue/concern must be

- of appropriate scope; and
- addressable by a Quality Management Plan with a timeline of **6 months to 1 year**.

As you consider which problem or opportunity to bring to class, we would like to offer some guidance. It is hard to pick a problem/issue/concern that is **too** small for a quality management project. On the other hand, it is very easy and tempting to pick something too big or complicated. Try to avoid the temptation to choose a problem that is too big or complex. It is strongly suggested that your first several projects be small, straightforward, and within your own span of control. This may not always be possible, but have a bias towards these more manageable projects. Your early projects should be as much about learning the model and tools for the process improvement process as the project itself. As you and your organization's management team get more comfortable with the tools and processes of process improvement, you can take on progressively larger projects. Even then, organizations that are very successful and mature in their learning and implementation of process improvement know that it is better to eat an elephant one bite at a time. Big projects are often more successful when they are broken down into a series of smaller 'bite-sized' projects.

So what might a big project broken down in to bite sized projects look like? Consider an elephant-sized project to improving response intervals on medical calls. Smaller bite-sized projects that work to this ultimate goal might include the following:

- improving the call processing interval;
- improving the data capture rate in the communication center for response event times;
- improving the validity of the event time data collected in the communications center;
- improving field data reporting or recording rate for the en route to scene time;
- improving validity of the en route to scene time;
- improving field data reporting or recording rate for the at scene time;
- improving validity of the at scene time;
- improving the field data reporting or recording rate for the patient contact time;
- improving the validity of the patient contact time;
- improving the process for analyzing and reporting event response time interval data;
- improving the process for selecting which unit to assign a call;
- improving apparatus placement to match geographic demand patterns;
- improving scheduling policies to match temporal (timing) demand patterns; and/or
- improving the process for setting response interval targets .

(over)

Statement of EMS Quality Management Problem/Issue/Concern

"INTRODUCTION TO THE DMAIC PROCESS"

INTRODUCTION

The DMAIC approach to conducting process improvement projects is widely used in both services and manufacturing industries as well in the public and private sectors. Most commonly, it is used as a part of the Six Sigma process improvement method.

DMAIC is actually an acronym for a prescribed sequence of phases in a process improvement project.

DEFINE

The D in DMAIC represents the Define phase. During the Define phase, plans are made for an improvement project. Those project plans generally get started in either of two ways. Somebody may want to fix a problem. Or, they want to have an opportunity to make an existing process better – even if the process is not having any particular problems. The plan for the improvement project is put into a specific format called a project charter. In addition to a clear statement of the problem or opportunity that the project is supposed to address, the project charter includes:

- the likely consequences of leaving the problem or opportunity alone
- the potential consequences of making the improvement
- the resources thought to be needed
- the deliverables to be generated
- a timeline for the project

After project charter is written up, it is presented to the senior management team for review. If approved, the project can move ahead to the Measure phase.

MEASURE

The M in DMAIC represents the Measure phase. Its primary purpose is to document a baseline for what the process is now. That would include:

- an examination of what is needed from the process and by who
- how the process is currently structured
- how the process currently performs

ANALYZE

The A in DMAIC represents the Analyze phase. This is where the process will be scrutinized to find what factors may be contributing to the problems or holding the process back from having a higher level of performance.

IMPROVE

The I in DMAIC represents the Improve phase. Now that we have an idea what factors are causing problems or holding back performance, we have an objective basis for coming up with ways to make improvements. Those potential improvements will be implemented and tested

using the scientific method. Some ideas for improvement will work, others may not. Once something is found that yields the desired amount of improvement in performance (or more), the project goes to the next phase.

CONTROL

The C in DMAIC represents the Control phase. After an improvement is successfully implemented, it is during the Control phase that the project team will shift its focus to speculating how the process may fail or falter in the future and pre-planning step to take to restore performance. To do so, it is extremely important to archive the information from all of phases of the project for future reference. Some of that information will be very helpful for other projects as well.

More information about DMAIC can be found in most any text or reference book on the Six Sigma approach to process improvement.

"HISTORY AND QUALITY MANAGEMENT MODELS"

TERMS

Before discussing the history of QM, here are some terms that we'll be using throughout the course.

Benchmarking

This is the practice of setting operating targets for a particular function by studying the top performance levels, either within or outside an organization. In a broader sense, benchmarking involves searching for and adapting new ideas and best practices for the improvement of processes, products, and services.

Continuous Quality Improvement (CQI)

A management philosophy based on the continuous study and improvement of the processes to better meet the needs of customers and stakeholders. Continuous quality improvement focuses on making an entire system's outcomes better by constantly adjusting and improving the system itself, instead of searching out and getting rid of "bad apples" (outliers). *Synonyms and near-synonyms*: continuous improvement (CI); quality improvement (QI); Kaizen; and total quality management (TQM).

Kaizen

(Japanese for "improvement") refers to philosophies or practices focusing on continuous improvement. It came into usage in the 1950s.

Lean Manufacturing or Lean Production

Which is often known simply as "**Lean**", is focused on improving efficiency, decreasing waste, and using empirical methods to decide what matters, rather than uncritically accepting pre-existing ideas.

Malcolm Baldrige Criteria for Performance Excellence

Highly flexible sets of criteria to use in assessing an organization's level and capacity for performance excellence. Versions of these criteria are offered in three realms: general business, healthcare, and education. At the state and national levels, these criteria are used in an external assessment and recognition process, which can culminate in a state or national award for achievement towards performance excellence. At the national level, the Malcolm Baldrige National Quality Award is managed by the U.S. Department of Commerce's National Institute of Standards and Technology and presented to the winners by the President of the United States. Malcolm Baldrige was the Secretary of Commerce after whom the award was named.

Baldrige's criteria served as the basis for "A Leadership Guide to Quality Improvement for Emergency Medical Service Systems", included in this precourse reading.

Quality

1. A character, characteristic, or property of anything that makes it good or bad, commendable or reprehensible; thus the degree of excellence that a thing possesses.
2. The total quality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs.

Quality/Assurance (QA)

1. All planned or systemic actions necessary to provide adequate confidence that a service or product will satisfy given requirements for quality.
2. Designing a product or service, as well as controlling its production, so that quality is inevitable.
3. In health care, the activities and programs intended to provide adequate confidence that the quality of patient care will satisfy stated or implied requirements or needs. 4. The components of a quality management program focused on measuring and improving compliance to process specifications (e.g., a process for determining the level of compliance to steps in an EMS patient care protocol or fireground SOP were properly followed along with the actions taken over time to improve the level of compliance)

Quality of Care

The degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge.

Quality Control (QC)

The process through which actual performance is measured, the performance is compared with goals, and the difference is acted on.

The use of operational techniques and statistical methods to measure and predict quality.

Quality Improvement (QI)

The process of working towards higher level of performance or quality associated with changes in system or process design rather than improving process compliance (QA).

Six Sigma

1. a methodology for improving the performance of processes based on the DMAIC model that will be used in this course
2. a process performance level of 3.4 defects per million opportunities
3. a statistical term referring to six standard deviations from the mean

EMS Stakeholder

Individuals and organizations, usually used in reference to persons other than the patient, who have a 'stake' in the how well the EMS services perform or have some other interest in the operation of the EMS organization (e.g., the patient's family, the community in which the EMS system operates, government officials, the patient's insurer/third-party, and health care providers)

Total Quality Management (TQM)

A continuous quality improvement management system encompassing the entire organization (e.g., not just the clinical processes of an EMS or fire organization). Also see "Continuous Quality Improvement".

HISTORY

This reading on the history and models of QM, lays the groundwork for a more conscious and structured process on quality management.

As EMS is a relatively young profession, it is easy to forget that studying its history can prove insightful. However, there are other programs that describe the history of EMS. This unit looks at **another** history, that of the history of quality management (QM). Indexed into this QM history, though, mention is made of NFA's EMS programs to provide context.

Pre-Industrial Revolution

Craftsmen formed associations or guilds based on their trades, these confraternities of locksmiths, textile workers, masons, jewelers, carpenters, carvers, glassworkers, etc., controlled the secrets of their traditionally imparted technology, the "arts" or "mysteries" of their crafts. These skilled craftsmen managed their own high quality through hard-earned pride of workmanship.

Internships

Crafts guilds had long "internships" of many years, low (or no) pay, and demanding requirements. After being employed by a master for several years, and after producing a qualifying piece of work,

Journeyman

The apprentice was granted the rank of "journeyman" and was given documents that certified him as such. These documents entitled him to travel to other towns and countries to learn the art from other masters and to practice his craft.

Early 1900's - Frederick Taylor, Henri Fayol, and Scientific Management

Scientific management was based on the concept of humans as economic beings, motivated by money and tangible rewards only. It was called "scientific" because actual research, particularly observation of workers and time-motion studies, was done.

Four Basic Principles of Scientific Management:

As a result of the research conclusions were made about what motivates workers and how to best manage them.

These included:

Scientific Task Performance

Any task can be studied to determine the one best way to do it. This included the belief that workers had unique insights into the tasks they preformed. One management theorist noted "Let the worker design the shovel."

Workers should be scientifically selected and trained. This continued to the extent that the assessment center process that many fire departments use today for promotional selection was, essentially, used in World War II to select operatives for the U.S. Office of Strategic Services (the forerunner of American special operations forces).

Management and workers need to cooperate because employees are valuable and adaptable and will learn what is expected of them and why.

There is a clear division of work and responsibility; managers must manage while workers perform the tasks. This leads to specialization. However, it also leads to isolation of the two groups from each other.

Scientific Management Views An Organization As Highly Structured

Each individual has specific duties. These duties were taught in training programs. On the job people were responsible for specific tasks.

Managers organize and control the entire operation. Managers made the decisions; workers worked. This left a disconnect: as noted earlier, there was the belief that workers had unique insights into the tasks they preformed. Yet, they had no venue to communicate these "lessons learned" to management.

There is little interaction between employees and management. Managers stayed in offices; workers were on the factory floor. They worked separately and they lived separately.

Employees have no input, as it is not "part of their job." Again, the workers may have acquired unique knowledge about how best to perform a task. But, if they were not observed as part of a management research effort, their knowledge was not incorporated into the developing job tasks.

Jobs are strictly defined and are task-based. Given this, an employee was expected to complete the assigned tasks … and that is all. Further, a worker attitude developed that he or she was only responsible for that assigned part of the job. This ultimately stunted responsibility for quality.

There were several common features of scientific management:

- Unity of command
- Delegation of authority
- Span of control
- Specialization

These common features are still in use today and, in fact, form part of the basis for the incident command system.

Fayol is Credited With Developing the Familiar Five Steps of the Manager's Role

1. Planning
2. Organizing
3. Staffing
4. Coordinating
5. Controlling

The five steps were viewed as a management model: if the five steps were followed, each in turn, then a positive result would occur. The advantage of this early model was that it described management as a process with a scientific basis. Until this time, management was viewed as an art with no demonstrable steps; rather than an art with a scientific foundation. The disadvantage of this model was that people believed that you followed these steps, and only these steps, in order. There was no iteration cycle.

1950's--W. Edwards Deming Introduces Statistical Process Control to Japan

Here are Deming's 14 points, which he considered essential to insuring quality:

1. Create Constancy of Purpose for Improvement of Product and Service
2. Adopt the New Philosophy
3. Cease Dependence on Mass Inspection for Quality Control
4. End the Practice of Awarding Business on Price Tag Alone
5. Constantly and Forever Improve the System of Production and Service
6. Institute More Thorough, Better Job-Related Training
8. Drive Out Fear
9. Break Down Barriers Between Departments
10. Eliminate Slogans, Exhortations, and Targets of the Work Force
11. Eliminate Work Standards on the Factory Floor
12. Remove Barriers that Rob People of Pride of Workmanship
13. Institute a Vigorous Program of Education and Self-Improvement
14. Put Everybody in the Organization to Work to Accomplish the Transformation

Deming is also credited with developing the Plan-Do-Check-Act (PDCA) model that will be discussed under "Models," below.

January, 1980--National Fire Academy (NFA) Opens on Emmitsburg Campus

The NFA is this country's pre-eminent Federal fire training and education institution. The original purpose of the NFA as detailed in a 1973 report to Congress was to "function as the core of the Nation's efforts in fire service education … model programs, curricula, and information…"

August, 1980--"Management of EMS for the Fire Service" Pilots as an NFA 2-Week Resident Program

This course was built around a virtual city, Metropolis. Students developed an EMS system for this "jurisdiction." Since in many cases EMS was still in its infancy as a fire service function, the focus of the course was on designing an EMS system, rather than improving an existing one.

Little actual class time addressed "quality."However, in one unit students were encouraged to do more that merely review the incident "run sheets" to determine how EMTs were actually performing.

September, 1984--"EMS Administration" Pilots as an NFA 2-Day Field Program

This off-campus course was conducted all around the USA with the intent being to serve as a "teaser" to entice EMS personnel to attend the much more extensive resident version of the course. If students could not later attend the resident course then it was hoped that this two-day condensed version could still serve as an idea generator for developing an EMS system.

1987 - Malcolm Baldrige National Quality Award is Established

Baldrige was the Secretary of Commerce in the 1980's and was known for his managerial excellence. This national award, named for him, has seven key categories:

1. Leadership
2. Information and analysis
3. Strategic quality planning
4. Human resource management
5. Process management
6. System results
7. Customer and stakeholder satisfaction

There have been several hospital and health care winners of the award over the years. And, it has brought interest from all sectors: business, healthcare, government, non-profit organizations, etc. Winning the award is extremely prestigious. However, the real value of it is that it sets an organization on a quest for excellence.

1996--NHTSA's "A Leadership Guide to Quality Improvement for Emergency Medical Services Systems" published

This is the pre-course reading and it represents an attempt to focus EMS leaders on the need for and the methods that can be used to improve EMS Quality. There is a wealth of usual material – theoretical as well as practical in this document.

1990's to the 2000's--Quality Programs Spread to Service Industries

A proliferation of quality programs and concepts, introduced earlier, has "caught on": TQM, Six Sigma, Kaizen, Benchmarking, CQI, etc. All of these terms are included in the "Terms" section, above. A component of Six Sigma, the DMAIC model, will be used extensively throughout this course, starting with Unit 6.

There are several NFA management course that address quality issues. These include Fire Service Organizational Theory in Practice, Interpersonal Dynamics, Executive Development, and Executive Leadership, to name a few. Upon completion of this course, you may wish to consider enrolling in further management training.

2008--Congress passes the "United States Fire Administration Reauthorization Act of 2008"

Congress amended the "Federal Fire Prevention and Control Act of 1974" with the "United States Fire Administration Reauthorization Act of 2008." This impacted National Fire Academy Training Programs, especially training programs for Emergency Medical Services. Specifically, NFA was authorized to develop "advanced emergency medical services training" (USC 2206(d)(1)).

Additionally, Section 9 "Coordination Regarding Fire Prevention and Control and Emergency Medical Services" of the "Federal Fire Prevention and Control Act of 1974" was amended by Congress as follows:

> The Administrator is authorized to conduct, directly or through contracts or grants, studies of the operations and management aspects of fire service-based emergency medical services and coordination between emergency medical services and fire services. Such studies may include the optimum protocols for on-scene care, the allocation of resources, and the training requirements for fire service-based emergency medical services. (15 USC 2207(c)(2))

The "United States Fire Administration Reauthorization Act of 2008" lays the groundwork for model programs to be developed for fire-based emergency medical services at the national level.

MODELS

Models are simplified graphical summaries of reality, designed to aid further study or action. In our situation using QM models has several advantages:

- It insures that no important steps are left out or missed. In fact, some organizations have developed checklists, much like the ones used in EMS to check off the supplies and equipment on an ambulance. As a project transpires, the checklist is used to insure completion of each step: when it was done, who completed it, and so forth.
- There is a better chance of unity of work effort. Since everyone knows the steps, using a model provides a better guide for the goal and the process to be used to get there.
- Team members know what is being attempted and why. Specific training and assignments are completed. In addition, everyone knows how the tasks fit into the "big picture."

A "process model" simply uses a model to explain a process. This implies that there are steps that must be followed, the steps are arranged in a particular order, and completion of these steps in that specific order increases the chances of a successful outcome. Often these process models use acronyms and graphical representations to increase understanding and retention.

The DMAIC Model

The DMAIC model, a component of Six Sigma, has five phases:

1. Define the problem, the voice of the customer, and the project goals, specifically.
2. Measure key aspects of the current process and collect relevant data.
3. Analyze the data to investigate and verify cause-and-effect relationships. Determine what the relationships are, and attempt to ensure that all factors have been considered. Seek out root cause of the defect under investigation.
4. Improve or optimize the current process based upon data analysis using techniques such as design of experiments, and standard work to create a new, future state process. Set up pilot runs to establish process capability.
5. Control the future state process to ensure that any deviations from target are corrected before they result in defects. Control systems are implemented such as statistical process control, production boards, and visual workplaces and the process is continuously monitored.

Strengths of DMAIC

This model provides a robust QM system, with iteration built in. It has gained a wide following and has many historical precedents, such as the "ReACT" problem-solving model that was taught in the NFA's 1982 "EMS Administration" course: Recognize the problem, Analyze the situation, Consider the options, Take action." As mentioned earlier the DMAIC model will be used extensively throughout this course, starting with Unit 6.

Weaknesses of DMAIC

On the face of it, the model does not clearly show the role of the internal environment, nor of the external environment. However, these elements are actually referenced in the model.

The FADEE Model

The FADEE model, developed by Organizational Dynamics Institute of Wakefield, MA, has five phases:

1. Focus: Define and verify the process to be improved.
2. Analyze: Collect and analyze data to establish baselines, identify root causes and point toward possible solutions.
3. Develop: Based on the data, develop action plans for improvement, including implementation, communication, and measuring/monitoring.
4. Execute: Implement the action plans, on a pilot basis as indicated.
5. Evaluate: Install an ongoing measuring/monitoring (process control) system to ensure success.

Strengths of the FADEE Model

It has similarities to other QM Models (such as DMAIC, above) and it encourages the use of pilot programs. By their nature pilot programs imply that their purpose is to gather information to "fine tune" a product or process. After the pilot is concluded improvements are made as needed.

Weaknesses of FADEE

On the face of it, the model does not clearly show the role of either the internal environment or the external environment.

The PDCA Model

The PDCA model, developed by Deming, has four phases:

8. Plan: Plan a change or test of how something works.
9. Do: Carry out the plan.
10. Check: Look at the results. What did you find out?
11. Act: Decide what actions should be taken to improve.

Strengths of PDCA

It is simple and it is easy to remember. Given that, PDCA has a wide following.

Weaknesses of PDCA

A strong case can be made that more analysis needs to be done earlier, such as during the first or second step. It does not appear that there is an ongoing review process after taking action.

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"SCOPE OF QUALITY MANAGEMENT"

MULTIDISCIPLINARY COLLABORATION

Definitions

Given the array of people, agencies, levels of private and public sector interaction, concepts, regulations, laws, etc., which EMS must deal with, it should be clear that identifying these interrelated processes and groups is necessary to address QM. Let's break our definition into several manageable parts:

Definition of "Multidisciplinary"

In framing our understanding of the word "multidisciplinary," it will be used in its broadest, most inclusive sense. "Multidisciplinary" is defined as 'multiple organizations and roles that impact on your ability to perform your job effectively.'

Definition of "Collaboration"

The etymology of the word, collaboration" has a Latin base (com + laborare), which essentially means to "labor with" someone. Our definition of "collaboration" is "working with people."

Definition of "Multidisciplinary Collaboration"

Now, let's put "multidisciplinary" and "collaboration" together. Our definition of this term is: "The process of working effectively with people from multiple career fields to accomplish EMS goals."

As it pertains to our definition of "multidisciplinary collaboration," the phrase "working effectively with people" is worth closer examination. It implies reciprocal communication, tact, trust, and a comprehensive understanding of how all of the pieces fit together to produce an effective high quality system.

Advantages of Multidisciplinary Collaboration

There are many advantages of multidisciplinary collaboration that impact directly on quality management. They include:

- Greater "buy-in" as people become involved in the process.
- Ability to draw on a larger range of skills, resources, experiences, and backgrounds.
- Development of reciprocal relationships that can be used in the future. Some of these will be the result of formal networks and others of informal networks. Both can bring resources to bear on future issues.

Of course, an additional advantage is the synergy that builds when motivated people bring diverse skill sets to bear on a QM problem. This can provide that extra, almost intangible "something" that takes a work effort over the top.

Internal and External Collaboration

Multidisciplinary collaboration can be further delineated into "internal collaboration" and "external collaboration."

Internal Collaboration

Internal Collaboration means the daily, face-to-face effective interaction that must occur within your organization. If internal collaboration does not already exist – essentially, if you are "at war" with others in your primary work unit – you will be unable to devote much time or effort to external collaboration.

External Collaboration

External Collaboration refers to the effective interaction that must occur outside of your organization. One way to identify these external collaborators is to determine who -- outside of your organization -- has similar goals, patient interaction, legal or regulatory authority, etc., that touch on your specialty.

Stakeholders

Stakeholders are all of these people and organizations -- internal and external, formal and informal –considered together. A working definition of the term "stakeholder" is "a person, group, organization, or system that positively or negatively impacts or can be impacted by an organization's actions." No QM project should be undertaken without a clear understanding of what the stakeholders think and feel about that QM project.

ORGANIZATIONS AND AGENCIES

There are many organizations and agencies that can positively or negatively impact on EMS QM. Any quick "laundry list" would include state regulatory agencies, regional EMS Councils, Local Emergency Planning Committees (LEPC), mutual aid agencies, labor-management committees, training organizations, and so on.

Each agency will probably have a different list of other such agencies. Yet, there are clearly commonalities, such as regulatory and training groups. In addition, local hospitals, medical directors, the American Red Cross and other disaster planning and response groups, medical examiners, law enforcement, etc., all would also be included.

Role of Outside Organizations and Agencies

Roles will vary to some extent, but usually include regulatory, grant or funding distribution, and planning. However, a useful way of looking at these roles is from this format:

Federal

These would include regulatory, standard-setting, and grant-distributing agencies, such as the National Highway Traffic Safety Administration (NHTSA) and the Department of Health and Human Services (DHHS).

In addition, the training function of the National Fire Academy and the Emergency Management Institute should also be considered. As it relates to terrorism countermeasures, the National Domestic Preparedness Consortium, which is managed by the Department of Homeland Security, includes both governmental and non-governmental member/training organizations.

Tribal

These include all federally-recognized tribes under Public Law 93-638, or the Indian Self-Determination and Education Assistance Act of 1975.

State

These would include regulatory and grant-distributing agencies, such as the state agency that oversees these items (usually the State's Health Department). Similar to the federal level, there may also be training agencies at the state level.

Local

These would include any planning groups (such as an LEPC), mutual aid associations, etc. These groups perform valuable functions, beyond the planning work itself, as formal networks become informal as well. Trust --- that difficult to obtain commodity --- often develops.

Other

These would include non-governmental organizations, such as a regional EMS Council, a hospital disaster planning group, or a Voluntary Organizations Active in Disasters (VOAD). Each area has its own such groups.

Although not all roles will be "captured" by using these four terms, a significant number will be. Part of understanding your environment involves knowing who the "players" are and working with them.

Impacts of Labor-Management Organizations

Labor-management organizations can positively or negatively impact your EMS system. Even volunteer organizations can have labor-management issues.

Positive Example

Positive Example: Both labor and management have keen interests in personnel safety and potentially could work effectively on any such issues.

Negative Example

Negative Example: Labor and management may disagree, however, on whether a specific type of PPE is as effective as another type, perhaps citing different research sources, cost factors, training required, maintenance needed, etc.

Clearly, any attempt to address EMS QM should include representation from both labor and management. You must recognize the history and personalities involved. Yet, be open to continuing to work together, if prior relationships have not been productive. On the positive side, you can build on that goodwill as you move into new areas.

Impacts of Laws, standards, and Regulations

Laws and regulations may also impact on EMS QM. To clarify:

Laws are enacted by elected officials, such as the U.S. Congress or a state legislature.

Standards, although they do not have the mandatory effect of law, do indeed set an environment that implies compliance.

Regulations are written by governmental agencies to clarify how laws are specifically applied to those regulated.

Laws and regulations frequently change, so it is important to monitor them on at least an annual basis, if not more often, for their potential impact on EMS QM and other facets of EMS. Further, laws and regulations require interpretation. If needed, have your jurisdictional attorney or state's attorney general provide guidance.

Impacts of Political Structure

By "political structure" is meant all of those elected groups that may impact on EMS QM. Traditionally, this has only referred to elected federal, state, and local jurisdictional officials. Our focus is broader. There may be an elected board of directors of your regional EMS Council, an elected board of directors of your Voluntary Organizations Active in Disasters, etc. --- all of these groups and people may impact on EMS QM.

Often jurisdictions will have a committee of elected officials specifically tasked with monitoring public safety, including EMS. If that is the case in your jurisdiction, you should work closely with this committee. In other jurisdictions, the function is performed by a sole elected official. Meet that person and work with him or her.

Volunteer departments are often non-profit corporations and have an elected board. To that extent, they have "politicians."

SUMMARY

This reading has discussed Multidisciplinary Collaboration including its definition as well as the difference between internal and external collaboration.

Also discussed were the Organizations, Agencies, and other Stakeholders that could impact on an EMS system's QM, positively or negatively.

The role of outside agencies was discussed, with special reference to their impact on EMS quality.

The impact of labor-management organizations, laws and regulations, and political structures were also discussed.

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ORGANIZATIONAL SELF-ASSESSMENT

Organizational Self-Assessment

This organizational self-assessment is extracted from the NHTSA's "A Leadership Guide to Quality Improvement for Emergency Medical Service Systems" and modified for use in this National Fire Academy course.

This self-assessment can be completed a number of ways. Here are two for your consideration:

- The primary method is for you to have it completed by only the senior leader of your Fire/EMS organization or a member of the leadership team responsible for developing your organization's focus on EMS quality.
- Another more extensive method – time and necessary approvals permitting -- is to have your entire EMS leadership team (including you) complete the self-assessment.

When "yes" can be honestly answered to all of the questions in a particular stage, you can be confident that your organization is ready to move into the next stage of development. You should also strive to move forward stage by stage in all seven Baldrige areas simultaneously. You will notice that action areas in one category reference activity in another category. For example, a human resources section task may impact or emanate from the strategic quality plan section.

When you arrive at the NFA for your course you'll find that having already completed the self-assessment will provide "food for thought" during classroom discussions. Also, in Unit 5, Organizational Improvement, we will be directly referencing in broad terms what you learned as a result of completion of the survey.

Note that during the EMS QM course, instead of Stages I through III, we use the term "Phases" with the three descriptors being "Initiation," "Deployment," and "Integration."

Leadership

Stage I: Building Potential for Success

- Is the senior leader (Fire Chief, EMS Chief) of your Fire/Organization knowledgeable regarding quality management theory and the benefits for your organization to the point where he/she could effectively explain and endorse these topics to others in your organization or elsewhere in the EMS system?

- Has your senior leader established a new strategic quality planning group within your organization? OR Has an existing group (such as your senior management committee, the executive committee, or quality council) taken on new focus and responsibility with respect to strategic quality planning?

- Does the senior leader (or designee) of your organization lead the meetings of the strategic quality planning group?

- Are all other leaders of your organization knowledgeable about Quality Improvement (QI) theory and the benefits for your organization? Can they effectively explain and endorse QI and its operation to others in your organization or elsewhere in the EMS system?

- Does your organization have a set of documents that describes the EMS mission, vision, and values? Are these posted or distributed in such a way that all can see them?

- Did all the members of your organization have input into the development of the mission, vision and values statement?

- Are the leaders developing a systematic approach for evaluating their own leadership effectiveness and involvement in QI?

- Are the criteria that the leaders use to evaluate their own leadership and involvement compatible with your organization's vision and values statements?

Stage II: Expanding Knowledge

- Do leaders effectively communicate your organization's vision and values to all workforce members? Are most, if not all, leaders directing or participating in educational efforts to increase QI knowledge and awareness throughout the entire organization?

- Have the leaders supported the implementation of programs that demonstrate your organizations community citizenship? For example, are workforce members organizing public CPR courses, injury prevention educational programs including, e.g., violence prevention, bike safety, fire prevention and safety or other EMS related community service programs?

Stage III: Integration and Commitment

- If necessary, has the leadership restructured your EMS operations or organizational to promote a constant focus on efficiency, high performance, and meeting internal and external customers?

- Do leaders take an active role in regularly reviewing all performance measures related to strategic quality planning goals and objectives?

- Is your organization active in general community support activities that go beyond EMS? For example, do your workforce members participate in and/or organize charity fund raisers, newspaper drives, holiday toy collection or repair, housing rehabilitation for the poor and elderly, adult literacy programs, or other charitable or service activities?

Information and Analysis

Stage I: Developing Potential for Success

- Has your organization designed data collection and reporting systems around the needs of those who use the data to plan and make decisions?

- Does the data collection strategy identified in the strategic quality plan include a broad focus on information needs including: customer satisfaction, employee satisfaction, financial performance (if applicable), service quality, supplier performance, and operational performance?

- Has an assessment been completed of your organization's ability to collect data and process information for each key performance indicator listed in the strategic quality plan?

- As a result of the assessment, have objectives been listed in the strategic quality improvement plan, that are directed at improving the availability and reliability of data used in key performance indicators?

Stage II: Expanding Knowledge

- Do all EMS managers, employees or volunteers understand the correlation between different types of measures of key performance objectives and customer satisfaction, financial performance (if applicable), or patient health status?

- Has your organization been successful at collecting information on at least several key performance indicators and successful at processing that data into information and feeding it back to employees, volunteers and managers on a regular basis?

- Has your organization continued to question managers, employees and volunteers about how better to meet their decision making needs with improved data collection and information processing?

- Has your organization made plans to collect data that will facilitate comparisons of performance with other organizations providing similar services, especially in the areas of service quality, patient care, customer satisfaction, supplier performance, employee data and internal operations and support?

Stage III: Integration and Commitment

- Has your organization evaluated and made many major improvements in its measures and data collection and reporting methods over the last few years?

- Does your organization regularly collect competitive (if appropriate) and benchmark data on: 1) service quality, including patient care; 2) customer satisfaction; 3) supplier performance; 4) employee data; 5) internal operations and support functions; and 6) other appropriate processes and functions? Is all bench marking data reliable?

- Does your organization systematically evaluate and improve the scope, sources, and uses of its competitive (if appropriate) and benchmark data?

- Is data from all areas of your organization and on all aspects of performance summarized into a few key indices, and results analyzed to identify trends and opportunities for improvement?

- Is there evidence that all key organization decisions and plans are based upon analysis of performance data?

Strategic Quality Planning

Stage I: Developing Potential for Success

- Has an initial strategic quality plan for your organization been completed?
- Does the strategic quality plan use as a key reference your organization's mission, vision, and values statements?
- Does the strategic quality plan reflect the opinions and feedback of members of your organization beyond those actually involved in the drafting of the plan?
- Does the strategic quality plan include a list of internal and external customers and their requirements for quality of services?
- Does the strategic quality plan describe 12-month goals and objectives for expanding the knowledge and use of QI techniques throughout your organization?
- Has an initial list of key drivers of your organization been developed and included in the strategic quality plan?
- Does the initial list of key drivers also include at least one key performance indicator for each key driver?

Stage II: Expanding Knowledge

- Has the strategic quality plan been improved over the initial Phase 1 version?
- Was the revision to the initial strategic quality plan based on a thorough analysis of customer needs, competition (if applicable) and potential risks to your organization if internal and external customer needs were not met?
- Does the revised strategic quality plan describe the needs of internal and external customers? Is there a clear connection between customer needs and your key EMS drivers?
- Does the strategic quality plan include a list of performance measures for each of the key drivers of your organization?
- Does the strategic quality plan identify long and short-term goals, objectives and strategies for each performance measure?

Stage III: Integration and Commitment

- Has your organization evaluated and improved its strategic quality planning process several times over the last several years?

- Has your organization developed and included in the plan specific projections or forecasts illustrating how performance will compare to benchmark organizations? Is performance in key driver areas projected to be superior?

Human Resource Development and Management

Stage I: Developing Potential for Success

- Has the level of worker satisfaction been determined on multiple dimensions, including compensation, opportunity for self-improvement, work safety, and job satisfaction?
- Has your organization made a review of all its operational goals and strategies to see if adequate human resource support exists to meet these goals?
- Did the review of human resource needs and the worker satisfaction survey include consideration of the need to improve selection, training, involvement, empowerment and recognition plans?
- Within the strategic quality plan, does your organization have specific quality goals and improvement strategies identified for human resource processes, such as hiring, career development including training, education, and recognition programs?
- Does your organization have a structured training/education curriculum for training all levels and functions of workers; is that curriculum based upon a thorough analysis of worker training needs?
- Are training needs derived from an analysis of competencies needed to meet key organizational goals as defined in the strategic quality plan?
- Does your organization employ systematic and effective mechanisms to promote on-the-job reinforcement of skills learned in training?
- Does your organization tailor the message and medium used for training to the audience and content?

Stage II: Expanding Knowledge

- Has your organization begun the process or already implemented a number of innovative approaches to job and work design such as self-directed teams wherever appropriate in your organization?
- Are there new goals and strategies in place for improving worker satisfaction, safety, health, and ergonomics?
- Has your organization developed a strategy to evaluate the effectiveness of its training programs and has it begun to evaluate at least some of them?
- Has your organization determined the needs for special services to workers, e.g., counseling, recreation, day care, cross-training, re-training, basic education, special benefits, drug/alcohol treatment, etc.?

Stage III: Integration and Commitment

- Does your organization use several different approaches to recognizing and rewarding individuals and groups of workers?

- Do the workers feel well-recognized for their accomplishments?

- Does your organization evaluate the effectiveness of all the EMS education and training programs it conducts? Is there evidence of continuous improvements in all EMS education and training programs provided by your organization as a result of the evaluations?

- Does your organization have a well-defined and multi-faceted strategy in place for providing special services to workers such as counseling, recreational programs, day care, cross-training, re-training, basic education, special benefits, drug/alcohol treatment, etc.?

- Are several methods used to measure and improve worker satisfaction; is there evidence that worker satisfaction has improved as a result?

EMS Process Management

Stage I: Building Potential for Success

- Has your organization developed a strategy to identify and evaluate all key processes that define or support your EMS operations to insure that critical work functions are designed and operate to meet the needs of internal and external customers?

- Has your organization completed identifying and documenting via flow charts some of the key processes that define and support your EMS operations and that must function properly if internal and external customer needs are to be met?

- For documented key processes, has your organization begun to identify process quality measures (key indicators) based on customer requirements and have quality standards been identified for the measures?

Stage II: Expanding Knowledge

- Has your organization completed documenting its key processes and identified process quality measures (key indicators) and standards based on internal and external customer quality requirements?

- Has your organization considered what the future needs of internal and external customers are likely to be and used them as a driver to begin the process of designing new processes to meet new service needs?

- Has your organization thoroughly defined quality requirements for all of your key equipment, materials, and service suppliers? Have those requirements been adequately communicated to the suppliers?

- Does your organization require your suppliers to have preventive and corrective processes in place to ensure that they will be able to consistently meet your equipment, materials and service requirements?

- Are data on key process measures collected on a regular basis? Does your organization use valid control strategies to keep all process measures within standards or acceptable levels?

- Has the documentation of key organizational processes been expanded to include important support functions within your organization? Is data on process measures collected for which specific standards or goals have been set?

Stage III: Integration and Commitment

- Does your organization design new and/or improved EMS services and support processes using an approach that is based upon a thorough analysis of internal or external customer requirements?

- Does the design of new and/or improved EMS services and support processes include the use of key indicator variables that will signal if customer need is being met?

- Does the design of new and/or improved EMS services and support processes include the implementation of strategies, policies, or technology that will keep in control the amount of variation in these new or improved processes, as measured by the key indicator variables?

- Are your existing EMS services and support process designs reviewed, tested and validated by taking into consideration your service performance record, the use of your services, your process capabilities, your supplier capabilities, and the future requirements of your internal or external customers?

- Does your organization systematically appraise its evaluation process? Does your organization implement new policies and procedures to improve the process of evaluation in an effort to shorten the time between evaluation and introduction of improvements?

- Does your organization use research, bench marking, new technology, and information from customers to initiate process improvement efforts?

- Have any of your organization's key production and delivery processes been re-engineered or improved in dramatic ways over the last few years?

- Have any of your organization's key EMS support processes been re-engineered or improved in dramatic ways, resulting in improvements in cycle time, productivity, and customer satisfaction?

- Has your organization implemented cooperative efforts to improve supplier quality such as partnerships, joint training for vendors and buyers, contractual incentives, supplier certification programs, and recognition for exemplary results?

EMS System Results

Stage I: Building Potential for Success

- Are active steps underway to help employees or volunteers increase their focus on achieving quality goals?
- Are demonstration projects planned which will show to all personnel the relationship between quality improvement efforts and quality and service improvement outcomes?
- Do all efforts to orient employees and volunteers to achieving quality and operational results emphasize the role of measurement and how these measurements will be used?

Stage II: Expanding Knowledge

- Do all the employees or volunteers in your organization understand the purpose and meaning of the organization's increasing focus on continuous improvement of service quality, and efficiency? Are all personnel aware that these results will be clearly measured for the purpose of demonstrating the impact of quality improvement efforts?
- Within your organization, have there been some successful demonstrations of the impact of quality improvement efforts on any of your internal or external service outcomes?
- Do plans exist to allow comparison of your organization's quality improvement results with other EMS or non-EMS bench mark organization quality efforts in other geographic areas or jurisdictions?

Stage III: Integration and Commitment

- Has your organization shown steady improvements in the quality of your internal and external services over the last three or more years?
- Are improvements in quality results seen on all key indicator variables used to assess product/service quality?
- Do your organization's quality results compare favorably to those of your peer organizations and, if applicable, your major competitors?
- If applicable, do sales, cash flow, operating expenses and other financial results show significant improvement trends over multiple years and levels of performance that are superior to competitors?
- Do the trends indicate excellent gains in reducing cycle time in applicable EMS or support services?
- Is there evidence over the last three years that your organization has been able to significantly reduce operational costs without damaging quality?

- Do measures of your EMS-related public health performance show excellent improvement trends and levels of performance that are clearly superior to other organizations in your local or regional geographic area?

- Do measures of employee or volunteer satisfaction or morale show excellent improvement trends and levels of performance that are clearly superior to employee satisfaction levels in organizations of similar size?

- Do the measures of personnel safety show clear and impressive improvement trends and levels of performance that are better than other organizations in your local area or region?

- Does your organization have data to demonstrate a trend of three years or more worth of improvements in quality or service and/or product by all of your major suppliers?

- Is the quality of your suppliers' products and/or services superior to the quality of all major competitor suppliers?

Satisfaction of Patients and Other Stakeholders

Stage I: Building Potential for Success

- Has your organization determined how it will continuously evaluate its methods for identifying customer requirements?

- Has your organization identified a set of improvements in the organization's approaches to building positive relationships with customers? Does the information collected on customers and their specific needs appear useful for decision-making on how to increase satisfaction levels?

- Are systems being developed for frequently collecting data on hard measures of customer satisfaction, such as increased public financial support or repeat business, and soft measures such as opinion surveys or focus groups?

- Do plans exist for developing ways of determining levels of customer satisfaction among peer organizations or if applicable, key competitors?

Stage II: Expanding Knowledge

- Do methods exist for determining levels of customer satisfaction among peer organizations, or if applicable, key competitors?

- Does your organization segment your customers according to common needs and characteristics, and use multiple methods to frequently determine customer needs and requirements relating to your EMS products and services?

- Does your organization have many ways to make it easy for customers to seek information, comment, or complain about your EMS products or services?

- Does a formal system exist for tracking and resolving formal and informal complaints in a timely manner?

Stage III: Integration and Commitment

- Does your organization evaluate and show evidence of continuous improvement over the last few years in your approaches to measuring customer satisfaction?

- Is there data to indicate that all major measures of customer satisfaction show a continually improving trend over at least the last three years?

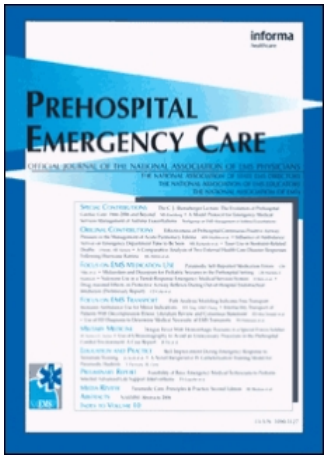
- Have significant improvements been made in the levels of customer satisfaction over the last three years?

- Is there data on all major adverse indicators (e.g., complaints, unpaid bills, legal actions) that show decreasing trends?

- Is research conducted to project future customers and predict what their key requirements are likely to be? Are customers of peer organizations or competitors also studied over at least the last three years?

- Does customer satisfaction data for all your major EMS products and services show continuous improvement over the last three years?

- Is your organization's level of customer satisfaction superior to that of your peer organizations?



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Evidence-Based Performance Measures for Emergency Medical Services Systems: A Model for Expanded EMS Benchmarking

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SPECIAL CONTRIBUTIONS

EVIDENCE-BASED PERFORMANCE MEASURES FOR EMERGENCY MEDICAL SERVICES SYSTEMS: A MODEL FOR EXPANDED EMS BENCHMARKING

A STATEMENT DEVELOPED BY THE 2007 CONSORTIUM U.S. METROPOLITAN MUNICIPALITIES' EMS MEDICAL DIRECTORS (APPENDIX)

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ABSTRACT

There are few evidence-based measures of emergency medical services (EMS) system performance. In many jurisdictions, response-time intervals for advanced life support units and resuscitation rates for victims of cardiac arrest are the primary measures of EMS system performance. The association of the former with patient outcomes is not supported explicitly by the medical literature, while the latter focuses on a very small proportion of the EMS patient population and thus does not represent a sufficiently broad selection of patients. While these metrics have their place in performance measurement, a more robust method to measure and benchmark EMS performance is needed. *The 2007 U.S. Metropolitan Municipalties' EMS Medical Directors' Consortium* has developed the following model that encompasses a broader range of clinical situations, including myocardial infarction, pulmonary edema, bronchospasm, status epilepticus, and trauma. Where possible, the benefit conferred by EMS interventions is presented in the number needed to treat format. It is hoped that utilization of this model will serve to improve EMS system design and deployment strategies while enhancing the benchmarking and sharing of best practices among EMS systems.

Key words: emergency medical services; paramedics; performance improvement; quality assurance; evidence based medicine; STEMI, acute myocardial syndrome; asthma; pulmonary edema; status epilepticus

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INTRODUCTION

Evidence-based clinical measures of emergency medical services (EMS) system performance have been few in number, largely due to the limited quantity and quality of research committed to the prehospital arena.[1–4] Although there is a 9-1-1 call for EMS response every other second in the United States, and despite the fact that survival from various acute illnesses and injuries are determined in that prehospital setting, evidence for out-of-hospital emergency care procedures are clearly lacking.[1–3] This paucity of prehospital research is due to a number of factors, including the relatively young age of EMS as a distinct field of medical care, difficulties in terms of obtaining informed consent and accurate data collection in the prehospital environment, lack of targeted funding, the small number of dedicated EMS-focused researchers, inconsistencies in investigational protocol compliance, and actual or perceived resistance to participation in research by EMS personnel and receiving facilities.[2–4]

In the absence of a distinct body of literature evaluating the full spectrum of medical interventions provided in the prehospital setting, EMS performance measures have been limited to the relatively few benchmarks that have been established scientifically, such as survival from out-of-hospital cardiac arrest.[5,6] Although treatment of cardiac arrest represents a major function of most EMS systems, it only constitutes a small fraction (1–2%) of all EMS responses. Lacking data, other performance standards generally have been based on measures of nonclinical endpoints and inconclusive, surrogate clinical markers, such as response intervals and training standards. In most cases, crude measures of stakeholder satisfaction (surveys) and other anecdotal measures are utilized to judge the performance of EMS systems.[3]

Even when implemented, utilization of such performance measures for the purposes of establishing system benchmarks is also limited by a lack of common definitions and other standardized nomenclature for data elements and clinical outcome endpoints.[6–9] In many EMS systems, response-time intervals and rates of cardiac arrest survival to the point of hospital admission are the primary measures reported in analyses of system performance.[5,6] However, despite many published attempts to standardize those data, the definition of response interval and survival still remain nonuniform when reported.[5–10]

In an attempt to begin a process that will expand the list of evidenced-based EMS performance measures and to do so with uniform definitions and reporting standards, the *2007 Consortium of U.S. Metropolitan Municipalities' EMS Medical Directors'* reviewed the available scientific literature and, accordingly, developed an applicable consensus statement. The following discussion is the written product of that consensus process, which was formally developed during the Consortium's symposium in February 2007, similar to previous consensus documents.[11] Specifically, the discussion will address some of the common performance measures currently in use, and it will also describe a new model for more appropriate evidence-based benchmarking and performance measurements in large urban and suburban EMS systems.

Traditional Performance Measures

Response Time Intervals

EMS system response-time intervals are attractive quality measures, as they are easily quantifiable, objective, and readily understood by both the public and policy makers. Much of the public's day-to-day expectations in 9-1-1 emergency situations, regardless of true time-dependency of the clinical scenario, is based on how soon responders arrive and attend to their family members.[12] Overemphasis upon response-time interval metrics may lead to unintended, but harmful, consequences (e.g., emergency vehicle crashes) and an undeserved confidence in quality and performance. First, much of the clinical research utilized to establish an acceptable "advanced life support (ALS) response time interval" was conducted in a period when only paramedics could operate a defibrillator, and the compression component of basic cardiopulmonary resuscitation (CPR) received much less emphasis.[13] Now that basic life support (BLS) providers and lay rescuers can provide rapid automated defibrillation as well as basic CPR, the relative importance of the ALS response-time interval has been challenged, both for cardiac arrest as well as for other clinical conditions.[14–23]

Nevertheless, in many EMS systems, the ALS response-time interval, rather than that of the nearest CPR and automated external defibrillator (AED)-equipped unit, remains the focus of system performance and enhancements. Many communities are still not measuring the intervals for the most important predictive elements for optimal outcome: time elapsed until initiation of basic chest compressions and time elapsed until defibrillation attempts.[15,24]

For the purposes of benchmarking response times must also be measured using the same standard in all EMS systems.[25–29] Current *National Fire Protection Association* (NFPA) standards measure response intervals as beginning when the responding EMS unit reports that it is enroute and ending when the unit reports to be "on-scene" (at the address of record and not necessary at the patient's side). Accordingly, as a national standard, many EMS systems use this definition.[30] However, from a physiological (and bystander) point of view, a better measure of an appropriate response interval would be the time elapsed from the moment that the telephone rings at the 9-1-1 call center until the responding personnel with a defibrillator make actual patient contact or deliver the shock. This is particularly important when access to the patient is delayed from arrival at the street-address location, as in urban high-rise structures or in mass gathering events with logistical barriers.[31] Accordingly, we are placing more of an emphasis on time elapsed to the actual medical care interventions rather than surrogate variables of EMS response-time intervals.

Traditionally, managers of EMS systems that focus on response-time interval goals often determine that they must either add paramedics to the system or increase the efficiency of EMS units currently being deployed. As more paramedics are added to a particular system, however, the frequency with which each individual paramedic has the opportunity to assess and manage critically ill or injured patients in the primary or "lead" paramedic role may decrease. Pragmatically, considering that ALS cases constitute a small minority of all EMS 9-1-1 responses, adding more paramedics into the system may actually reduce an individual paramedic's exposure to critical decision-making and clinical skill competencies.[32–36] Additionally, in order to enhance system efficiency, scarce financial resources must be expended on technologic or operational solutions, such as automated vehicle location (AVL) technologies, adoption of sophisticated computer aided dispatch (CAD) systems, and/or system status management (SSM) plans. Such high-level technology solutions have their place, but their relative importance in terms of improving outcome and EMS system quality should be kept in context. Specifically, these technologies are often deployed only for the ALS response element, rather than for the evidenced-based, time-dependent response interval of the basic CPR and AED-equipped BLS element.

Ultimately, each community must evaluate response-time interval goals not only in the broader context of satisfying public policy and public expectations,

but also in terms of protecting both the driving and pedestrian public as well as what is best for the patient, their family, and the ultimate outcome of the sick and injured. Ideally, the response-time interval goals to which an EMS system should be held accountable should have as much clinical significance as political relevance. With the exception of basic CPR and AED response (in the case of cardiac arrest), there is insufficient evidence to strongly recommend a specific *ALS* (paramedic) response-interval target as part of an evidence-based model for performance evaluation of an EMS System.[15,18,19]

In terms of ALS transport-time intervals, there have been some inferential survival data that may demonstrate the importance of ALS and transport times following post-traumatic circulatory arrest.[37,38] When paramedics provided definitive prehospital airway management, they extended the time interval that such patients will tolerate pulselessness and CPR conditions until emergency thoracotomy.[37,38] However, there is no hard and fast scientific evidence (e.g., controlled studies) that explicitly proves this particular measure of performance.

Out-of-Hospital Cardiac Arrest Survival Rates

The probability of survival to emergency department arrival for out-of-hospital cardiopulmonary arrest patients is directly related to a multifactorial performance of the EMS system. Such factors include response intervals for BLS and AEDs, immediate performance of basic CPR by bystanders, and the many dynamic variables that drive those factors, such as efficiencies in dispatch operations, quality assurance of protocols for first responders, community AEDs, and CPR training programs.[6,16,17] Therefore, while such cases represent only 1–2% of 9-1-1 calls for medical emergencies, it is appropriate to devote sufficient resources for these responses. Also, this particular measure involves dramatic, highly visible life-saving outcomes for many persons in their prime of life and middle age, thus carrying significant weighting in the spectrum of EMS system duties.

Nevertheless, measuring EMS system performance solely on this aspect of EMS activities does not provide a complete picture of clinical performance for the other 98% of EMS 9-1-1 responses. Also, depending on the definition used for a performance measure of survival (e.g., "survival to hospital admission," "survival to discharge," or "neurologically intact survival"), final outcomes may not be fully attributable to prehospital care alone.[39]

In addition to these difficulties, one must account for the differences between rural, suburban, and urban EMS systems. An AED response time interval goal of five minutes from first 9-1-1 center call receipt to arrival at the patient's side may be reasonable for a relatively low-volume suburban community EMS agency with well-positioned first responders. This same goal, however, may be fiscally or logistically impossible for a rural community with very low population density or physically impossible for an urban community with significant vertical response-time delays.[40,41]

In essence, while the traditional performance measures of response intervals and cardiac arrest survival have clear value, they also have their limitations. They also do not fully reflect clinical performance (or are inapplicable) in the great majority of EMS responses. There are many other opportunities for performance measurements, ranging from evaluation and documentation of treatments for myocardial infarction and status epilepticus to respiratory distress and traumatic injuries, just to name a few of the other critical clinical scenarios. Therefore, it is recommended that a more expanded model of performance be considered to evaluate EMS systems in addition to cardiac arrest survival.

Proposed Model for Clinical Performance Benchmarking

The purpose of the following discussion is to provide a framework for improved benchmarking of performance in large suburban and urban EMS Systems based on currently available evidence. While the role of the emergency medical dispatcher is critically integral to the overall performance of an EMS system, this discussion is focused primarily upon the hands-on medical care provided to patients and thus does not include performance elements related to dispatch. Accordingly, essential elements of patient care interventions and management for several key clinical presentations are central to the proposed model.

In many cases, there may be only evidence for a complete spectrum of care, rather than validation for each isolated clinical intervention. For example, evidence suggests that nebulized beta agonists and sublingual nitroglycerin each significantly reduce mortality for certain patients in respiratory distress.[42] In contrast, in the case of flash pulmonary edema/congestive heart failure (CHF), the evidence regarding improved patient outcomes with the provision of ALS (paramedic level support) versus limited BLS care is quite compelling. Still, it is not yet possible to describe the relative benefit of any single ALS treatment modality in isolation that those paramedics provide.[42] The same is true for cardiopulmonary arrest scenarios not requiring countershocks (e.g., cases presenting with asystole, pulseless electrical activity).[43] It is clear that ALS support overall can be life-saving, but it is not clear which individual interventions contribute to (or even detract from) the positive survival rates. Accordingly, for some clinical entities, the magnitude of benefit is associated with a "treatment bundle." In these cases, it is likely that patients receive some benefit from at least one or more

of each individual suggested intervention, but, based on available science, the reported benefit may only be conferred if all elements of the bundle or management strategy are provided.

Additionally, in some clinical situations for which improved outcomes have been demonstrated in large-scale trials, the key issue is to provide the proven therapy, bundled or not, and to document its timely implementation. The treatment of ST-Elevation Myocardial Infarction (STEMI) is an exemplary consideration of bundling treatment interventions with applicable management strategies (e.g., destination hospital protocols) along with documentation of timely interventions.

ST-Segment Elevation Myocardial Infarction (STEMI) Performance Measures

Based on the best available evidence, the most recent *American College of Cardiology/American Heart Association* guidelines for the prehospital management of STEMI patients support the implementation of specific destination protocols for select patients.[44,45] In particular, patients at high risk of death, those in cardiogenic shock, and those with contraindications to fibrinolysis should be transported primarily (or secondarily transferred) to facilities capable of cardiac catheterization and rapid revascularization. Evidence also suggests that when STEMI patients can be transported promptly to facilities with a moderate-to-high volume of interventional cases, percutaneous coronary intervention (PCI) is preferred over fibrinolysis for all STEMI patients, thus strengthening the case for direct transport to applicable facilities that meet these criteria.[46,47]

As this part of the proposed model is intended for implementation in large suburban and urban EMS systems, the following assumptions are made: First, at least one moderate-to-high-volume interventional cardiac facility (at least 225 acute interventions/year) is available to the community.[24,48–51] Second, patients can be transported to such a facility in a reasonable period of time (less than 60 minutes from initial dispatch to arrival at the hospital).

Given these assumptions, the proposed expanded model (Table 1) for performance for urban and large suburban EMS systems includes implementation and individual case documentation of the following key treatment elements for *patients with signs and symptoms consistent with ischemia with either ST elevation of at least 1 mm in 2 contiguous leads or left bundle branch block not known to have been present previously*:

1. Administration of aspirin (not enteric-coated), unless a contraindication or a recent previous ingestion is documented
2. Acquisition of a 12-lead electrograph (ECG) with appropriate, training-based interpretation by a paramedic and/or transmission to a designated emergency physician for interpretation
3. Direct transport to an identified appropriate interventional (PCI) facility for STEMI patients with a written plan to activate the cardiac catheterization team prior to EMS arrival
4. Elapsed time from acquisition of the diagnostic ECG (STEMI identified) to balloon inflation of less than 90 minutes

TABLE 1. Key Treatment Elements for Various Clinical Entities Encountered by EMS Systems

Clinical Area	Elements in Model
ST-Elevation Myocardial Infarction (STEMI).	Aspirin (ASA), if not allergic
	12-Lead electrocardiograph (ECG) with prearrival activation of interventional cardiology team as indicated
	Direct transport to percutaneous coronary intervention (PCI) capable facility for ECG to PCI time < 90 minutes
Pulmonary edema	Nitroglycerin (NTG) in absence of contraindications
	Noninvasive Positive Pressure Ventilation (NIPPV) preferred as first-line therapy over endotracheal intubation
Asthma	Administration of beta-agonist
Seizure	Blood glucose measurement
	Benzodiazepine for status epilepticus
Trauma	Limit non-entrapment time to < 10 minutes
	Direct transport to trauma center for those meeting criteria, particularly those over 65 (with time consistent caveats for air medical transport situations)
Cardiac arrest	Response interval < 5 minutes for basic CPR and automated external defibrillators (AEDs)

In an effort to quantify the magnitude of benefit for STEMI patients who receive all elements of this treatment bundle, results from the DANAMI-II and PRAGUE-II trials were utilized to determine a number-needed-to-treat (NNT).[46,47] While these trials include intravenous (IV) heparin and IV aspirin (Aspegic) and thus do not identically reflect the prehospital situation for many EMS systems in the United States, the similarities have been judged to be sufficient to make an estimate of benefit. In both of these studies, there was an absolute reduction of 6% in the composite endpoint of diminishing stroke, second nonfatal myocardial infarction (MI), or death. This calculation would result in a NNT of 15 to avoid stroke, a second MI, or death for just one patient (Table 2).

Again, data demonstrating the benefit for individual interventions are lacking. A recent meta-analysis

TABLE 2. Numbers-Needed-to-Treat (NNT) by Clinical Scenario

Clinical Area	Elements	NNT	Harm Avoided
ST-Segment Elevation Myocardial Infaraction (STEMI)	Aspirin 12-lead electrocardiograph (ECG), direct transport to percutaneous cardiac intervention (PCI) interval from ECG to balloon < 90 minutes[46,47]	15	Either a stroke, 2nd myocardial infarction, or a death
Seizure	Administration of benzodiazepine for status epilepticus[66]	4	Persistent seizure activity
Pulmonary edema	Noninvasive positive pressure ventilation (NIPPV)[59]	6	Need for an endotracheal intubation
Trauma	Patients with an Injury Severity Score (ISS) > 15 to trauma center[72]	11	1 death
Trauma	Patients over 65 years of age with ISS > 21 to trauma center[69]	3	1 death
Cardiac arrest	Defibrillator to the scene < 5 minutes rather than < 8 minutes[15]	8	1 death

failed to demonstrate definitive evidence of a mortality benefit for the prehospital 12-lead, although it was acknowledged that the five studies included in the analysis were not sufficiently powered to evaluate for such a benefit.[52] Given the magnitude of benefit demonstrated in DANAMI-II and PRAGUE-II, as well as recent publications documenting the importance of rapid reperfusion and the role of EMS in a reperfusion strategy, use of the EMS ECG to assist with hospital destination decisions and to activate the interventional cardiology team prior to arrival is still strongly endorsed.[46,47,53–56] Accordingly, it is essential that the prehospital 12-lead ECG analysis not only be performed, but that the results be utilized to activate the interventional cardiac treatment team prior to EMS arrival as well as to direct patients to capable PCI centers rather than the nearest hospital.[57,58] At the same time, in those areas that do not yet have the ability to direct patients to a PCI Center in a timely manner, the prehospital ECG still can be utilized to provide thrombolytic therapy sooner in appropriate cases.[52] Finally, it is recognized that the actual door-to-balloon time is not entirely in the control of EMS; the actions of EMS, however, have direct impact upon this time-critical clinical intervention. The performance measure includes the interval from ECG acquisition to balloon inflation, rather than a surrogate measure, because this is the interval that has been demonstrated to have the greatest impact on patient outcome. Also, in part, it is the EMS system's obligation to establish and monitor compliance with transport policies.

Respiratory Distress Performance Measures

Flash Pulmonary Edema/Congestive Heart Failure (CHF)

The Ontario Prehospital Advanced Life Support (OPALS) investigators noted that addition of paramedic level intervention in the treatment of severe respiratory distress reduced mortality by 2%, and that the majority of this benefit was conferred upon patients with pulmonary edema/CHF.[42] As with many prehospital studies, the incremental benefit of the individual ALS interventions was not established, but rather the complete bundle of treatment was evaluated and found to be life-saving. More recently, studies have suggested that there is a reduction in the proportion of pulmonary edema patients requiring endotracheal intubation (ETI) with the use of noninvasive positive pressure ventilation (NIPPV).[59–61] Importantly, although nearly 25% of patients in one study were ultimately found to have a cause of their respiratory distress other than pulmonary edema, the outcomes of this subset of patients still were not adversely affected by the provision of NIPPV.[59]

Given these assumptions, the proposed model for performance for urban and large suburban EMS systems includes implementation and individual case documentation of the following key treatment elements for *patients with respiratory distress assessed and presumed to be due to pulmonary edema/left-sided congestive heart failure (CHF):*

1. Administration of nitroglycerin (NTG) to patients without contraindications (e.g., a given lower limit of systolic blood pressure, recent sildenafil citrate use)
2. Prehospital provision of NIPPV to avoid ETI (both prehospital and in-hospital)

In prehospital- as well as hospital-based studies, the absolute reduction in the need for ETI by the utilization of NIPPV has been measured at 16–20%, yielding an NNT of 6.[59–61] However, based on the available evidence, the consensus opinion during the applicable discussion was that, in EMS systems with very short transport times (e.g., 10–15 minutes), the absolute value of the prehospital role of NIPPV remained unproven and should be considered, but not mandated, under such circumstances.

Bronchospasm

The provision of beta-agonists to patients with bronchospasm remains the mainstay of therapy, and this treatment may even be performed by EMT-basics.[62,63] Preliminary evidence now suggests a decreased odds of admission for the moderate-to-severe asthmatic patient who receives very early prehospital (vs. in-hospital) corticosteroid administration.[64] After extensive discussion, however, the group concluded the evidence for prehospital steroids to be of insufficient strength to include this treatment in the model. Therefore, the critical therapy of choice, by either EMT-basics or paramedics, remains the beta-agonist intervention.

Given these assumptions, the proposed model for performance for urban and large suburban EMS systems includes implementation and individual case documentation of the following key treatment element for *patients with respiratory distress found to have prolonged expiratory phase breathing/indicative of wheezing or known history of asthma/reactive airways disease:*

1. Provision of beta-agonist by the earliest-arriving, trained, and qualified personnel

The evidence for beta-agonist treatment of bronchospasm is not sufficiently robust to estimate a NNT, but it clearly is an intervention that can provide immediate relief of discomfort to the patient and also provide objective, measurable improvement in pulmonary status with early use.[65]

Status Epilepticus Performance Measures

In addition to general supportive interventions, the primary goal in the treatment of ongoing or recurring seizures is the cessation of convulsive activity. While most seizures stop spontaneously prior to EMS arrival on-scene, up to one-third of seizure patients will either have convulsive activity that continues until EMS arrival or have recurrent seizures in the presence of EMS.[66] A recent controlled, clinical trial demonstrated that IV benzodiazepines administration (compared with placebo) will not only diminish convulsive recurrences and ongoing seizures, but that they do so without incurring significant complications.[66] This elegant study deserves much credit, not only because it provides evidence-based confirmation of the efficacy for these specific anticonvulsives, but because it also examined the risk: benefit of such intervention. While benzodiazepine-induced respiratory failure is a known complication, the study itself showed that those risks are generally negligible with basic airway and ventilatory procedures, which should be considered part of this intervention.

Accordingly, given these assumptions, the proposed model for a performance measurement for urban and large suburban EMS systems includes implementation and individual case documentation of the following key treatment elements for *patients with seizure activity that persists for more than 15 consecutive minutes or has two or more seizures without an intervening period of clear mental status:*

1. Obtain and measure a blood glucose level
2. Administer a benzodiazepine (lorazepam or diazepam) by the best available route (IV, intramuscular [IM], rectal, or intranasal)

Intervention with appropriate benzodiazepines by EMS personnel will terminate 42–59% of these episodes, compared with only 21% resolution with placebo.[66] The former success rate is associated with diazepam and the latter with lorazepam, yielding NNTs of 5 and 3, respectively. Given this range, an estimated NNT of 4 to terminate a seizure that would not have otherwise terminated is utilized in the model.

Trauma

Rapid evacuation of severely injured patients to a trauma center has been associated with improved outcomes.[67–72] There is conflicting evidence, however, regarding the risk-benefit ratio of prehospital ALS interventions in trauma patients, particularly in the area of airway management.[73–76] Based on evidence available to date, it appears that rapid evacuation of trauma victims should have greater priority than advanced prehospital interventions.[77,78] While rapid evacuation, for example, may not be precluded by performance of ETI enroute, placement of the tube should not delay transport. In addition, before it is advocated, the other caveats about appropriateness of prehospital ETI need to be considered, including the ETI skills experience of the providers and their control of delivered positive pressure ventilations.[79,80]

Accordingly, the proposed model for a performance measurement for urban and large suburban EMS systems includes implementation and individual case documentation of the following key treatment elements for *patients meeting American College of Surgeons trauma center triage criteria:*

1. In general, transporting paramedics (or transporting basic EMTs) should limit on-scene time to less than 10 minutes or document reasons for the exception (e.g., entrapment, scene safety, etc.).
2. Transport should be provided immediately and directly to designated trauma center.
3. If on-scene time is extended while awaiting air medical rescue crews to arrive, the total presumed ground and transport time intervals for the air crews should not exceed that of the time that

would have been required by ground crews to get the patient to the trauma center.

It is recognized that the Injury Severity Score (ISS) is a retrospective measurement and thus is not determined in the prehospital setting. The available evidence that allows an estimate of the NNT incorporates age and ISS, however, and thus ISS is included in the model, requiring cooperative data exchange with the trauma center. For patients with an ISS of 15 or greater, the number needed to treat (i.e., direct transport to a trauma center) is 11 for all age groups and 3 for patients over the age of 65.[69,72]

Other Performance Measures

Clearly, there are other performance measures that could be used by EMS systems, including compliance with nontransport criteria, qualitative or quantitative measurement of end-tidal carbon dioxide after airway placement, application of cervical collars and spinal immobilization, administration of supplemental oxygen to patients with presumed strokes, respiratory distress or coronary artery syndromes, provision of pain relief, IV or intraosseous access for patients with unstable vital signs or cardiac rhythms, rapid termination of atrial tachycardias with adenosine, treatment of anaphylaxis with epinephrine, or myriad of other emergency therapies and management protocols. While these actions are all well-accepted treatments and procedures and, while they are excellent targets for internal quality assurance audits and performance measurements, they are not all fully substantiated by scientific literature, are controversial in some situations, or are infrequent in occurrence, and thus not necessarily appropriate to use for benchmarking EMS systems. Nonetheless, it is hoped that such additional measures can be studied further and subsequently utilized as performance criteria for intersystem comparisons.

CONCLUSIONS

This document proposes a multifactorial model of EMS system performance measurement for large urban and suburban EMS Systems, based on the currently available scientific evidence. Beyond the traditional benchmarking focus on cardiac arrest survival rates and response-time interval performance, an expanded evidence-based model, including documentation of care for ST-segment elevation MI, pulmonary edema, bronchospasm, seizure, and trauma patients, is presented. This approach not only allows local EMS leaders to more accurately report a broader picture of the performance of their system in a method that can be understood by all stakeholders, but it also may be utilized in a benchmarking fashion so that best practices in urban and suburban EMS systems may be quantified and reproduced. Based on sound, large-scale scientific studies, the number of lives saved by a particular EMS system can be extrapolated for these particular measures with some relative confidence. For example, based on existing literature, if an EMS system has encountered 90 patients with STEMI and appropriately completed the appropriate treatment bundle in 60 cases, then one could presume and report that a second heart attack, stroke, or death had been likely avoided for four patients. In the same way, it also could be presumed and reported that if the EMS system had been functioning optimally, six patients would have realized this same benefit. Once the element (or those elements) of the treatment bundle are identified that are preventing 100% compliance, focused efforts for performance improvement can be justified by a quantifiable metric.

There are limitations to this type of model, including a lack of a sufficient number of high-quality trials for many other infrequently occurring conditions. It is anticipated that the Consortium that developed these new benchmarks and other professional organizations will still attempt to update this model as more evidence does become available. For the time being, it is hoped these guidelines will serve as a new prototype and a starting point for future performance measurements and benchmarking in appropriately-sized EMS systems.

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APPENDIX

Participants from the U.S. Metropolitan Municipalities' EMS Medical Directors' Consensus Panel on Evidence-Based Performance Measures, February 15–18, 2007, Dallas, Texas

2007 Consortium Members:

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