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NATIONAL QUALITY FORUM

TO: NQF Members & Public

FR: NQF Staff

RE: Voting draft for *Evaluating Regionalized Emergency Medical Care Systems Using an Episodes of Care Approach*

DA: September 28, 2011

BACKGROUND
This framework provides guidance for the measurement of regionalized emergency medical care systems (REMCS). The guidance is intended for use by stakeholder groups and individual measure developers. It provides a roadmap for introducing and developing REMCS measures, and includes guiding principles, domains, and subdomains to help specify key areas for that development of measures. It does not recommend individual performance measures (or specific clinical areas) for endorsement. This framework offers an approach to help increase the value and usefulness of measures developed for REMCS, and to stimulate action toward the improvement of REMCS.

Comments and Revised Draft Report
The comment period for the draft framework report, *Evaluating Regionalized Emergency Medical Care Systems Using an Episodes of Care Approach*, concluded on August 23, 2011.

NQF received 43 comments from 22 organizations on the draft report. The distribution of comments by Member Council follows:

Consumers: 0	Health Professionals: 7
Purchasers: 5	Public Health/Community: 1
Health Plans: 2	Quality Measurement, Research, and Improvement: 4
Providers: 6	Supplier and Industry: 0
Non-members: 18	

All comments on the framework were referred to the project's steering committee. A table of complete comments submitted during the comment period, with the responses to each comment and the actions taken by the committee, is posted to the project webpage. Revisions to the draft report are identified below as redlined changes.

COMMENTS RECEIVED
Overall, the comments were positive and supportive of the framework. The majority of concerns raised focused on the need to clarify the goals of the framework report. Commenters felt it was important that this report set a clear path for future measure development, and that it articulates how regionalized emergency medical care systems and individual patient populations can be evaluated with the episodes of care model used for this framework report.

CHANGES TO FRAMEWORK IN RESPONSE TO COMMENTS
The Committee reviewed each of the comments during its September 1st, 2011 conference call. During that discussion, the committee agreed to revisions to the framework including:

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EPISODES OF CARE MODEL:
The Episodes of Care (EOC) model, proposed within the framework to evaluate REMCS, was extensively discussed and overwhelmingly supported by the Steering Committee. The Committee felt that it allows for the discussion and conceptualization of all types of measures, while maintaining a patient-centered approach. Concerns about this model, however, were expressed by different commenters. Individuals questioned whether the EOC model allows for the evaluation of multiple patients in individual systems (and comparisons across systems), and that it may be perceived as an outcomes-based approach focused on a single patient, not appropriate for an effort which should also incorporate structural and process-based measurement at the system level. In response, sections were added to the framework ("Patient Oriented Care and Patient Centered Care" and "Additional Importance of Measuring the Performance of Underlying Systems") to focus on the advantages and limitations of the EOC model, and the Committee reiterated the importance of patient-oriented system-level evaluation. The new sections also note that as the model captures individual points in an episode of care and transitions between those points, it allows for continuous comparison of the system as a whole. While the model does not inherently cause comparisons across systems, it does focus on creating a platform for the continuity of patient care within an individual system. This facilitates comparing episodes of care across other systems and organizations for a range of emergency clinical conditions.

PURPOSE
Sections were added to the executive summary and introduction to better emphasize the purpose of the REMCS framework -- "The purposes of this framework for REMCS measurement are to guide the identification and subsequent improvement of performance measures and to identify where gaps exist in measures and measure concepts, thereby designating areas for future research and measure development."

"SYSTEMNESS"
To further address concerns about the episodes of care model, this revised version includes an updated section on systemness entitled: "*Additional Importance of Measuring the Performance of Underlying Systems.*" The new language notes how the episodes of care model can be modified for both individual patient populations and system-wide concerns.

NEXT STEPS
Another key change is that this revised framework further articulates how it can be used as a tool for measure development. It reads, "The next steps of this work include a review of this framework's domains, subdomains, and guiding principles by measure developers and stakeholder groups. The components of the framework should serve as a roadmap to measure developers and stakeholders for introducing and developing of individual performance measures within REMCS."

NQF MEMBER VOTING
Information for electronic voting has been sent to NQF Member organization primary contacts. Accompanying comments must be submitted via the online voting tool.

Please note that voting concludes on Thursday, October 13, 2011 at 6:00 pm ET – no exceptions.

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NQF MEASUREMENT FRAMEWORK:

EVALUATING REGIONALIZED EMERGENCY MEDICAL CARE SYSTEMS USING AN EPISODES OF CARE APPROACH

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CONTENTS

I. EXECUTIVE SUMMARY

The Institute of Medicine recently highlighted the strain on the nation's emergency medical care systems and called for analysis and improvement of these systems.[1,2] The concept of "regionalization" has been identified as a potential method for improving emergency medical care through efficient resource utilization.[3] Additionally, performance measurement has been recognized as an important method for evaluating healthcare in general, including emergency services. By using valid and reliable measures of healthcare performance, stakeholders can set benchmarks for evaluating and improving healthcare delivery to patients.

The National Quality Forum (NQF), a primary standards-setting organization for performance measurement, uses a formal Consensus Development Process (CDP) to endorse healthcare performance measures, including measures of quality and resource use.[4-6] Given the healthcare system's current focus on regionalization as a model for improving the efficiency and effectiveness of emergency care systems, NQF has begun a multiphase project to identify and endorse performance measures of regionalized emergency medical care systems (REMCS). As part of the project, NQF convened a workgroup, including a Steering Committee of national experts, staff from the U.S. Department of Health and Human Services, and a team from the University of North Carolina at Chapel Hill, to develop a framework to guide measurement of regionalized emergency care systems. The completed framework can then be used to guide the broader process of measure development. Measure developers from across this area of healthcare can use the framework to develop and submit measures to NQF for consideration as voluntary consensus standards.

The purpose of this report is to:

- provide context and direction to key healthcare system stakeholders regarding the evaluation of regionalized emergency care systems;
- propose a mechanism for identifying the current measurement landscape within regionalized emergency care systems, as well as gaps in measurement; and
- identify where performance measures are needed in this healthcare area, and serve as a catalyst for future development of measures and measurement concepts.

By analyzing the effectiveness of current systems and identifying gaps in measurement, NQF aims to establish a roadmap for regionalization of emergency systems at the national, state, and regional levels.

The REMCS Framework consists of the following:

1. definitions and key terms to establish a common vocabulary for understanding constructs within this REMCS project. A glossary clarifies specific terms and concepts;
2. delineation of the framework's purpose;
3. Episodes of Care paradigm;
4. domains and subdomains of REMCS measurement;

5. guiding principles, which are broad themes integral to regionalized emergency medical care systems as a whole, and are intended to provide scope and direction for service and measure development in this healthcare area; and
6. criteria for evaluating measures within the framework per NQF guidelines.

Of note, this framework does not contain a catalog or evaluation of specific measures. It does not introduce, propose, or develop specific performance measures, nor does it endorse specific clinical areas or metrics for care.

The next steps of this work include a review of this framework's domains, subdomains, and guiding principles by measure developers and stakeholder groups. The components of the framework should serve as a roadmap to measure developers and stakeholders for introducing and developing of individual performance measures within REMCS. Please see Appendix A of this report for further information about the criteria by which NQF evaluates measures for endorsement.

Key Elements of the REMCS Measurement Framework

Terms and Definitions

Regionalization[7-10] is defined as an established network of resources that delivers specific care (e.g., protocols, definitive procedures, higher care levels or care pathways) to a defined population of patients or within a defined geography. These defined populations or geographies can be self-organized groupings, dependent upon the episode of care being considered. Regionalization requires planning and cooperation to ensure patients have timely access to the appropriate level of care based on their needs. Regionalized care does not necessarily equal centralized care.

Regionalized emergency care systems[11-15] are deliberate and planned networks of both in- and out-of-hospital resources that deliver clinical services to a population of patients defined by having potentially life threatening acute illnesses or injuries.

Framework Purposes

The purposes of this framework for REMCS measurement are to guide the identification and subsequent improvement of performance measures and to identify where gaps exist in measures and measure concepts, thereby designating areas for future research and measure development.

In addition, the framework provides a conceptual model for evaluating regionalized emergency medical care at the system level. Although earlier measurement efforts focused on discrete parts of a system,[16-18] new models should focus on evaluation of the integration of the discrete service units that make up a system as well as the entire system.[19-25] A major goal of the Framework is to provide the context for evaluating the system as a whole, rather than just its component parts. Thus, the Framework would not only allow for the categorization of individual measures, but also would identify measurement bundles or possible composite measures for system-level evaluation in this healthcare area.

Episodes of Care Approach

To evaluate healthcare delivery to patients within regionalized emergency medical care systems, a continuous, longitudinal paradigm can provide structure for evaluating care from the moment it begins until definitive treatment is concluded, that is, an "episode of care." While an episode of care can be a conceptual model for tracking care over time, measurement within this model should consider the actual clinical effect of care on a patient or population, and should allow auditors to evaluate specific data associated with clinical care to patients. Figure 1 illustrates a generic episode of care, tracking a patient through multiple phases of care over time, as conceptualized in a earlier NQF framework.[26]

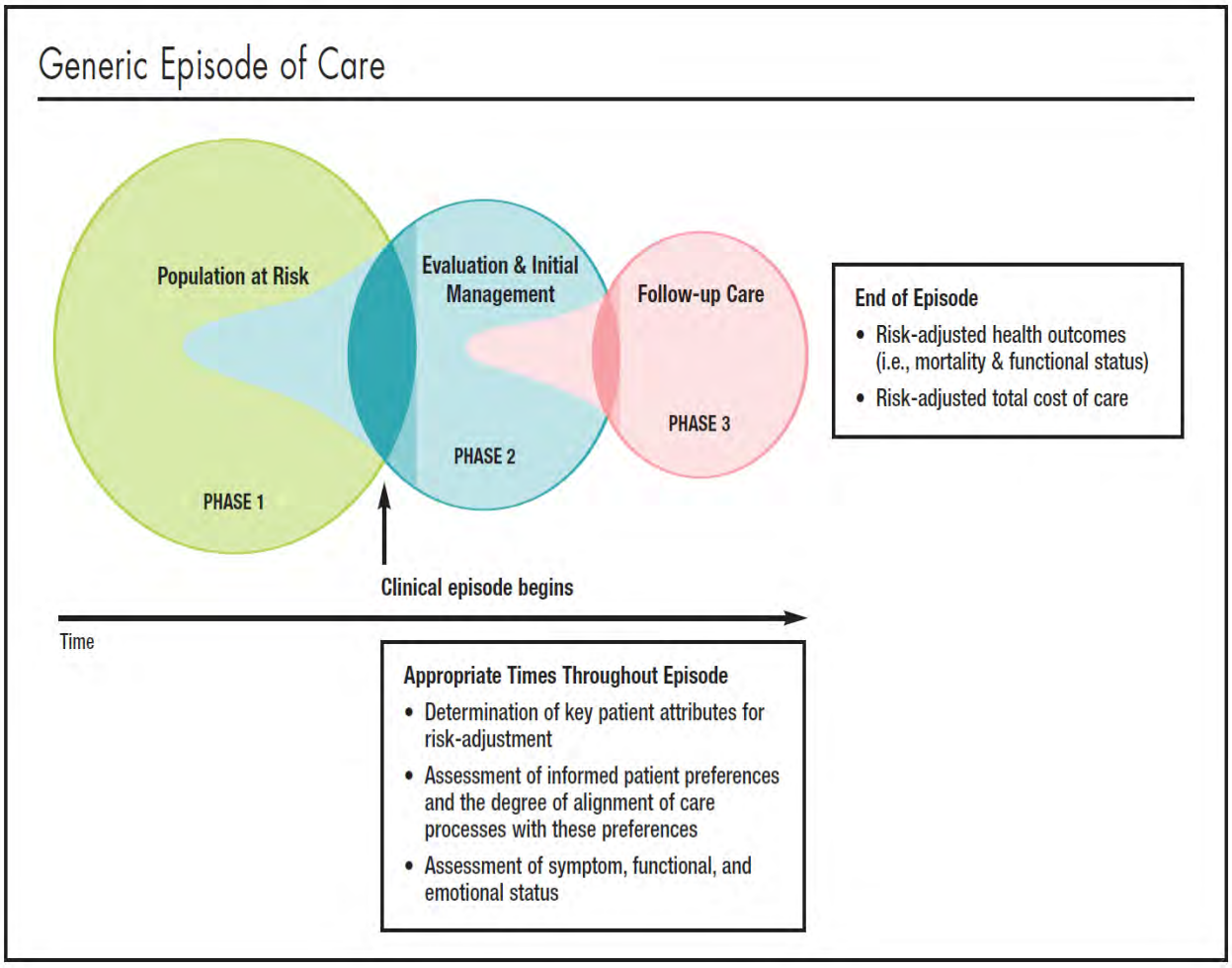


Figure 1: A generic episode of care (taken from *Measurement Framework: Evaluating Efficiency Across Patient-Focused Episodes of Care*).[27]

Domains

The following domains and subdomains represent the comprehensive and essential components of REMCS measurement, and should guide future measure development. They are specific areas that measure developers can focus on to identify and create measures:

1. Capability, Capacity, Access
   1.1 Public Health Initiatives
   1.2 Pre-hospital capabilities
   1.3 Real-time capacity information
   1.4 Categorization of participating agencies, organizations, and facilities
   1.5 Preparedness, monitoring, and data sharing
   1.6 Enabling legal and regulatory framework

2. Recognition and Diagnosis
   2.1 Community awareness
   2.2 Training
   2.3 Technology
   2.4 Evidence-based pathways

3. Resource Matching and Use
   3.1 Guidelines and evidenced-based triage and protocols
   3.2 Tele-health
   3.3 Efficiency and overuse

4. Medical Care
   4.1 Care provided by bystanders
   4.2 Pre-hospital and EMS-provider care
   4.3 Emergency department care
   4.4 Inpatient care
   4.5 Care of special populations

5. Coordination of Care
   5.1 Governance and shared accountability
   5.2 Handoffs and transitions
   5.3 Communication

6. Outcomes
   6.1 Access to data
   6.2 Data linkage across settings of care
   6.3 Feedback

Guiding Principles

The following principles are overarching themes intended to provide direction to the standard implementation of the framework and to the future development of measures and measure concepts within regionalized emergency medical care ~~services~~systems. They are themes that should be considered when designing performance measures of REMCS.

1. Regionalization of emergency care is a method of matching resources to patient needs in a timely fashion with the goal of improving patient-oriented care outcomes and population health. Regionalization does not equal "centralization" of care; it may involve moving care resources to patients or patients to care facilities, depending on the needs of the patient and the system's capabilities.

2. The effective delivery of regionalized emergency medical care requires ongoing measuring and monitoring of system capabilities and capacity to ensure that the appropriate resources and workforce (including appropriate specialty care) are available.

3. Identifying and evaluating measures of entire systems of emergency care is difficult, but essential. Measurement of regionalized emergency care systems should strive to measure the effectiveness, cost-effectiveness, and efficiency of the system as a whole, as well as individual system components. Measures used to judge the effectiveness of a system should include patient-oriented outcomes, patient-centered processes of care, and community-centered outcomes. Desired outcomes should consider patient preferences and experiences, and REMCS models should ensure that the systems are accountable to the patient as well as to the healthcare system.

4. System evaluation should promote transparency and shared accountability for the system's successes and failures across units of service within the system.

5. The development of regionalized emergency medical care systems is an ongoing process with flexible and adaptive structural and process elements. Valid system-level measures should detect and recognize improvement (or lack thereof) due to changes to a system's component parts and the communication and coordination between them.

6. Regionalized emergency care systems should exist for the public good and should fully integrate with each other in a transparent, shared model with a common oversight structure (taking into consideration federal, state, and local regulations) regardless of geopolitical boundaries in order to provide optimal care for a population. Incentives should be aligned so that a successful system yields positive outcomes and appropriate compensation for each agency, organization, and facility within the system.

7. REMCS measurement should be data driven. Data on REMCS structures, processes, and outcomes, as well as on the populations the systems serve, should be collected, shared, and used to validate evidence-based REMCS measures and measure gaps.

~~Criteria for Evaluating Measures~~

~~The following are general criteria by which measures can be assessed to ensure that they evaluate important areas of REMCS performance, are reliable and valid, can be understood by intended audiences, and are feasible to carry out. These measure evaluation criteria are informed by NQF and other sources,[28-30] and their descriptions are placed in the context of measuring regionalized emergency care systems. NQF evaluates measures against these criteria when making endorsement recommendations. Although the Framework should identify areas where no measures exist, it is important that measure developers consider these criteria when measures and measure concepts are identified and when the endorsement process begins.~~

a. ~~**Importance:** Whether or not the measure evaluates a component of healthcare that is clinically relevant or notably contributes to care within a regionalized emergency care system.~~
b. ~~**Scientific Acceptability:** How well the measure is defined, supported by evidence, and valid and reliable.~~
c. ~~**Usability:** Whether the measure is meaningful to the intended audiences and whether the relationship between measure use and intended outcomes is of sufficient magnitude to be important and quantifiable.~~
d. ~~**Feasibility:** Data for the measure calculations are readily available across systems of care, and the implementation of the measure (or subsequent intervention(s) to improve the measure) is cost-effective.~~

II. INTRODUCTION

Overview

Efficient resource use is paramount to providing effective, quality healthcare. The Institute of Medicine (IOM) highlighted the strain on the nation's emergency medical care systems and called for analysis and improvement of these systems.[31,32] Recently, the concept of "regionalization" has been identified as a potential method for improving emergency medical care through efficient resource use.[33]

Although new models of regionalized care networks are under development,[34,35] emergency care services such as trauma, neonatal care, and poison control have been coordinated across geographic areas for many years. More recently, care for patients suffering time-sensitive emergency conditions, such as stroke and acute myocardial infarction (AMI), has been regionalized on a statewide basis. As emergency care systems continue to expand in breadth and scope, the healthcare system must evaluate their evolution to ensure they are optimizing resource use and maximizing patient outcomes.

An important method of evaluating healthcare, including emergency services, is performance measurement. The role of performance measurement in healthcare is well described by Pines et al.,[36] who state: "Performance measurement…attempts to quantify the quality of care that healthcare providers or organizations deliver, with the goal of comparing and improving it. The basic principle is: 'If you can measure it, you can manage it.'"

The National Quality Forum (NQF), a primary standards-setting organization for performance measurement, uses a formal Consensus Development Process (CDP) to endorse healthcare performance measures, including measures of quality and resource use.[37-39] Given the healthcare system's current focus on regionalization, NQF has begun a multiphase project to identify and endorse measures of regionalized emergency medical care systems (REMCS). The first phase of the project has two parts: 1) completion of an environmental scan for projects and measures related to regionalized emergency medical care systems to evaluate the current landscape of performance measurement in this healthcare area, and 2) creation of a measurement framework that can serve as a roadmap to evaluate measures and guide future measure development.

The environmental scan has been completed and publicly posted,[40] and it serves as a resource for this report on a measurement framework for regionalized emergency medical care services. The next phase of the project, if initiated, would utilize this framework and seek to endorse measures as voluntary consensus standards.

Of note, this framework does not contain a catalog or evaluation of specific measures. It does not introduce, propose or develop specific performance measures, nor does it endorse specific clinical areas or metrics for care.

The next steps of this work would include a review of this framework by measure developers, and the encouraged involvement of various stakeholder groups. The framework should serve as

a guide to measure developers and stakeholders for the introduction and development of individual performance measures within REMCS.

Strategy and Goals

To assess and improve the quality of regionalized emergency medical care systems, diverse stakeholders must embrace performance measurement as a pathway to improving healthcare quality. To create a framework that informs measure development in the area of regionalized emergency medical care, NQF convened a Steering Committee composed of national experts on emergency care and regionalization to collaborate with teams from the University of North Carolina-Department of Emergency Medicine and the U.S. Department of Health and Human Services (HHS). The goals of this collaboration are to:

- utilize Steering Committee experts, HHS staff, the environmental scan,[41] and other available resources such as the National Institutes of Health Emergency Research Roundtables,[42-44] documentation from the 2010 Society for Academic Emergency Medicine Consensus Conference titled "Beyond Regionalization: Integrated Networks of Emergency Care,"[45-66] and the 2010 Institute of Medicine Workshop on Regionalizing Emergency Care[67] to review the current landscape of regionalized emergency medical care systems to determine where we are and where we need to go for quality improvement in this healthcare area;

- create a pathway for identifying measures, measure gaps, and measure concepts for regionalized emergency medical care ~~services~~ systems to guide future research as well as measure development and endorsement; and

- develop a comprehensive framework for measuring and evaluating regionalized emergency medical care ~~services~~systems, including consensus definitions of key terms and guiding principles for future measure development.

The r~~egionalized emergency care systems (~~REMCS~~)~~ framework contains:

- definitions and key terms to establish a common vocabulary for understanding constructs within this REMCS project;
- purpose of the framework;
- presentation of the Episodes of Care paradigm;
- domains and subdomains of REMCS measurement; and
- guiding principles, which are broad themes integral to regionalized emergency care systems as a whole, and are intended to provide scope and direction for service and measure development in this healthcare area;
- criteria for evaluating measures within the framework, as per NQF guidelines;

III. FRAMEWORK FOR MEASURING REGIONALIZED EMERGENCY CARE SYSTEMS

Key Terms and Definitions

The following terms and associated definitions are essential concepts for clarifying the meaning of "regionalized emergency care systems." These definitions represent the Steering Committee's collaboration and establish consensus within the context of this REMCS project. Please refer to Appendix B for explanations of related terms and concepts.

Regionalization[68-71] refers to an established network of resources that delivers specific care (e.g., protocols, definitive procedures, higher care levels or care pathways) to a defined population of patients or within a defined geography. Regionalization requires planning and cooperation to ensure that patients have timely access to the appropriate level of care based on their needs. Regionalized care does not necessarily equal centralized care.

Regionalized emergency medical care systems (REMCS) [72-76] are deliberate and planned networks of both in- and out-of-hospital resources that deliver clinical services to a population of patients defined by having potentially life threatening acute illnesses or injuries.

Framework Purpose and Role of a Performance Measurement System

Performance measurement is a mechanism for assessing healthcare quality, including whether care is safe, effective, patient-centered, timely, efficient, and equitable.[77] Through the establishment of goals and benchmarks via measurement, healthcare delivery and quality can be improved across these six aims. Key to this concept is establishing appropriate and valid metrics for quality assessment. Regionalized emergency care systems could benefit from increased performance measurement, although appropriate metrics to measure the systems are early in development in many cases.

Healthcare leaders and organizations have embraced the concepts of performance measurement to varying degrees across individual disease conditions, diagnoses, and "service units"[78] (911 system, emergency medical services [EMS], emergency department [ED]) within the REMCS realm.[79] For example, the Centers for Medicare & Medicaid Services (CMS) follows several "pay for performance" measures relevant to emergency services for cardiac disease,[80] and NQF has endorsed several performance measures for emergency cardiac care.[81] However, other areas of care within regionalized emergency care systems (e.g., psychiatric care[82]) have received less attention in terms of performance measure development.

Also, multiple groups have developed data and information-gathering systems that can inform performance measurement at a regional level. Examples include the National Emergency Medical Services Information System (NEMSIS),[83] the Cardiac Arrest Registry to Enhance Survival (CARES),[84] and the American College of Surgeons' Committee on Regional Trauma Systems Programs, including the National Trauma Data Bank™.[85-87] Although these national-level models and repositories are a rich source of planning and foundational data elements that can and should aid performance measurement, and should be a primary source and reference for measure developers in the future; they are currently not always utilized within regions and across

the country for performance measurement of the system as a whole. Furthermore, even within care pathways for a given clinical condition, performance measure development varies depending on the service unit (e.g., NQF-endorsed® measures for stroke care essentially evaluate ED-based care; stroke care measures for out-of-hospital EMS providers are less well developed[88]) and may not focus on the performance of the overall system.

The purpose of this framework for REMCS measurement is not to only guide the identification and subsequent improvement of performance measures, but also to identify where gaps exist in measures and measure concepts, thereby designating areas for future research and measure development.

In addition, the framework provides a conceptual model for emphasizing the evaluation of emergency medical care within a population or geographical region, rather than within an individual facility or single part of the system. Although earlier measurement efforts have focused on discrete parts of a system,[89-91] new models should focus on evaluating the integration of the discrete service units that make up a system, and how the entire system performs.[92-98] Thus, a major goal of this framework is to provide the context for evaluating the system as a whole, rather than just its component parts.

Although different perspectives could exist on whether a specific measure or set of measures or a given database is valid for system-level evaluation, having a framework model provides a context for that debate from multiple perspectives. It is conceivable that the proposed framework will not only allow for the categorization of individual measures, but also will identify measurement bundles, or possible composite measures for system-level evaluation in this healthcare area.

The proposed framework is intended to be a comprehensive model for evaluating the broad spectrum of structures and services that comprise regionalized emergency medical care. This spectrum ranges from identification of the population at risk and the public health educational and prevention initiatives targeted at that population, to initial out-of-hospital evaluation and treatment, to definitive or ongoing care and system-level feedback. The framework should create pathways for evaluating both the system components as well as the sum of the system's parts. It should provide structure for both the organization of known measures and measures under development. In addition, the structure should reveal areas of measurement gaps and opportunities for future measurement concepts.

Episodes of Care

Rationale

Given the complex nature of regionalized emergency medical care systems, it is challenging to develop a model that captures its diverse components and measures the system as a whole. The framework should evaluate healthcare delivery to patients, recognizing that healthcare delivery occurs across and between multiple diverse settings and is provided by a range of practitioners. Although medical treatments, infrastructure, and care pathway benchmarks should be

individually evaluated, the transitions between them, as well as the resultant system-level outcomes, also should be evaluated. While the episode of care can be a conceptual model for tracking care over time, measurement within this model should consider the actual clinical impact of care on a patient or population, and should allow auditors to evaluate data associated with clinical care to patients. To evaluate healthcare delivery to patients, a continuous, longitudinal paradigm can provide structure for evaluating care from the moment it begins to the conclusion of definitive treatment to the provision of feedback, that is, the "Episode of Care."

Description

Specifically, an "episode of care" is defined as "a series of temporally contiguous healthcare services related to the treatment of a given spell of illness or provided in response to a specific request by the patient or other relevant entity."[99,100] This theoretical construct, well described in other NQF measurement frameworks, including "*Measurement Framework: Evaluating Efficiency Across Patient-Focused Episodes of Care*,"[101] allows for care to be evaluated over time and across service units for a given episode. It takes into consideration the various settings and care providers within an episode, as well as the transitions between them as the patient moves through the healthcare delivery system. An episodes of care approach, given its continuity through the patient's experience, allows for evaluation of where measurement and measurement gaps occur and of patient-centered outcomes. This approach may yield the most complete model for evaluating care within regionalized emergency medical care systems.

Focus

Figure 1 above illustrates a generic Episode of Care, tracking a patient through multiple phases of care over time. This conceptual model can be used in many healthcare realms to provide a structure for evaluating healthcare delivery to a patient over time. The three phases of a generic episode (population at risk, evaluation and initial management, and follow-up care) create a foundation on which to base use of this model regardless of the type of illness or healthcare problem (e.g., acute, chronic, time-sensitive, or long-standing).

For regional emergency care systems, the traditional focus within this paradigm has been on Phase 2: Evaluation and Initial Management. Measurement in this phase primarily assesses the clinical processes and outcomes (both intermediate and final) of care elements and care pathways. For regional emergency care systems, these elements of care are not only clinical and evaluative of units of service (e.g., did the AMI patient get an aspirin in the ED?) but also structural and evaluative of the transitions between units (e.g., did the EMS system appropriately communicate with the hospital?).

Yet all three phases of this model are relevant and important to consider when discussing newer concepts of regionalized networks of emergency care. Phase 1, dealing with the "population at risk," may include planning and structural elements in place to evaluate and measure system capabilities and capacities. For example, measurement in this phase may evaluate systems in place to address ED boarding, crowding, surge capacity, and EMS ambulance diversion.

In Phase 3, "follow-up care" may include maintenance of definitive treatment, or ongoing treatment for time-sensitive illness or injury that occurs at specialty centers (e.g., ongoing intensive care-level medical treatment after the evaluation and initial management of critical illness or injury). Measurement in this phase may also focus on the end-of-episode evaluation of care coordination and communication between medical providers and between service units (although care coordination should occur across and between all of the phases). Phase 3 follow-up also should include mechanisms for the system to evaluate itself.

Indeed, the episodes of care paradigm for regional emergency care systems must incorporate a feedback pathway such that the system can evaluate performance, identify and implement interventions, and demonstrate improvement. All phases, including Phase 3 when an episode "ends," should focus on measurements not only of definitive and ongoing care but also of system performance, and should provide a mechanism for communication of those measurements to Phase 1. The system should have the capability to ensure feedback to the population at risk and the key components of all phases so that system structures and processes (e.g., field EMS infrastructure, emergency medical dispatch, surge plans, and even patient-level prevention strategies) can be flexible and adaptive over time.

~~Advantages and Limitations~~ Patient Oriented Care and Patient Centered Care

The episodes of care approach has multiple advantages as a paradigm for evaluating regionalized emergency care systems. This patient-centered approach not only focuses on healthcare performance measurement, but also provides a pragmatic approach to determining measure relevance (i.e., does what is being measured directly relate to ultimate patient outcomes). In addition, this approach can incorporate important aspects of patient-centered care, including preferences. In this manner, an episodes of care approach, while acknowledging that different aspects of care are needed at different points in the episode, forces evaluation of the system as a whole, rather than just its component parts.

This systems approach for an individual patient is also continuous and longitudinal, in contrast to performance measurement within a specific healthcare setting (e.g. the ED), a specific provider (e.g., emergency physician), or a specific disease (e.g., stroke) at a single point in time. The entire set of service units for a given episode, and the transitions between them, can be seen as potential targets for measure identification and development. The seamless nature of this approach also readily allows for the identification of measurement gaps along the continuum of interrelated services and care elements. Lastly, the continuity of this patient centered episode of care model also allows for a more direct assessment of correlations between service units and the overall outcomes of an episode of care.

It will be important to focus efforts on whether the care was appropriate for a given patient or condition. For example, a patient may receive a timely procedure, facilitated by seamless communication through service units in his or her episode of care, but the procedure may not be what was indicated for that particular patient. This limitation can be partially addressed by ensuring that patient-oriented outcomes are measured for a system and by placing special

emphasis on system components that are closely related to quality and appropriateness of care (e.g., accurate diagnosis).

Additional Importance of Measuring the Performance of Underlying Systems

Measuring could be seen as focusing exclusively on an individual patient's care experience, and not on the underlying emergency care and support systems. Important systems and population-level issues in emergency medical care may not be addressed adequately using this approach. For example, system load and capacity for multiple patients are not inherent to the episodes of care model (e.g., a regionalized system's performance in the event of a disaster or other mass-casualty incident). This limitation can be addressed by conceptualizing a modified episodes of care model: measurement of a system's preparedness, capability, and potentially expandable capacity in preparation for a clinical episode or across phases of care as a key component of Phase 1. Within the REMCS episodes of care model, emphasis is also placed on measuring a system's attempts to mitigate risk for a population (e.g., Phase 1 preparedness), the communication, coordination, and delivery of clinical care (Phase 2), and how that system performs when system load and capacity are stressed (e.g., Phase 3 performance and feedback to modify Phase 1 structures).

~~The Episodes of Care approach has limitations that should be considered. First, this model emphasizes measuring care as it occurs, and does not necessarily focus on whether the care was appropriate for a given patient or condition. For example, a patient may receive a timely procedure, facilitated by seamless communication through service units in his Episode of Care, but the procedure may not be what was indicated for that particular patient. This limitation can be partially addressed by ensuring that patient-oriented outcomes are measured for a system and by placing special emphasis on system components that are closely related to quality and appropriateness of care (e.g., accurate diagnosis).~~

Another limitation is that this approach essentially focuses on Episodes of Care within a given regionalized system or organization and therefore does not inherently create comparisons between various organizations with similar systems. This approach focuses on creating a platform of continuity within a system, to evaluate completely that system's units and transitions, rather than on comparing similar elements and relationships across systems. For example, an episode of care paradigm may provide a thorough and novel approach to measuring a regionalized Segment Elevation Myocardial Infarction (STEMI) system, but may not necessarily identify or highlight subtle differences between one regionalized STEMI system and another. Although many systems may "meet" given performance metrics, important differences and efficiencies may be present across systems that would improve healthcare delivery and quality if applied broadly. Deliberate emphasis should be placed on comparing episodes of care across institutions for similar clinical conditions to take advantage of evaluating system-specific efficiencies that may translate to other organizations or systems. In addition, there is a need to compare and evaluate episodes of care for patients, time periods, and discrete events across REMCS systems.

~~Another limitation is that the Episodes of Care approach, at least in other areas of healthcare, can be seen as focusing on an individual patient's care experience. One could argue that broader population-level issues, or even concerns regarding system load and capacity for multiple patients (e.g., a regionalized system's performance in the event of a disaster or other mass-casualty incident), are not adequately addressed using this approach. However, this limitation can be addressed by conceptualizing that measurement of a system's preparedness, capability, and potentially expandable capacity (Phase 1) before a clinical episode begins or across phases of care. Within the RECS Episodes of Care model, emphasis should be placed on measuring a system's attempts to mitigate risk for a population (e.g., Phase 1 preparedness), the communication, coordination, and delivery of clinical care (Phase 2), and how that system performs when system load and capacity are stressed (e.g., Phase 3 performance and feedback to modify Phase 1 structures).~~

Domains and Subdomains

The primary purpose of this framework is to define a structure for measuring regionalized emergency care systems. The following domains comprise the necessary components of a structure that includes and evaluates the diverse parts of this broad and unique healthcare area. These domains facilitate the systematic evaluation of the many facets of regionalized emergency medical care services that a patient might encounter, longitudinally, in a time-sensitive fashion, during an episode of care.

Each domain includes an explanation of its subject matter and subdomains to further delineate its components. Although the domains are meant to represent distinct parts of regionalized emergency care systems, the measurement concepts discussed within each domain also may be applicable to other domains. The domains and subdomains of measuring regionalized emergency care systems include:

1. Capability, Capacity, Access
   - 1.1 Public Health Initiatives
   - 1.2 Pre-hospital capabilities
   - 1.3 Real-time capacity information
   - 1.4 Categorization of participating agencies, organizations, and facilities
   - 1.5 Preparedness, monitoring, and data sharing
   - 1.6 Enabling legal and regulatory framework
2. Recognition and Diagnosis
   - 2.1 Community awareness
   - 2.2 Training
   - 2.3 Technology
   - 2.4 Evidence-based pathways
3. Resource Matching and ~~Utilization~~Use
   - 3.1 Guidelines and evidenced-based triage and protocols

3.2 Tele-health
3.3 Efficiency and overuse

4. Medical Care
   4.1 Care provided by bystanders
   4.2 Pre-hospital and EMS-provider care
   4.3 Emergency department care
   4.4 Inpatient care
   4.5 Care of special populations

5. Coordination of Care
   5.1 Governance and shared accountability
   5.2 Handoffs and transitions
   5.3 Communication

6. Outcomes
   6.1 Access to data
   6.2 Data linkage across settings of care
   6.3 Feedback

Domain 1: Capability, Capacity, Access

An essential prerequisite to evaluating emergency medical care is to understand a regionalized system's ability to provide for the emergency care needs of its population. This domain focuses on measuring what a system can do (capability), how much it can do (capacity), and who can enter the system and how they enter it (access).

1.1 Public health initiatives

Educational and preventive initiatives undertaken by the regional public health system and local and regional emergency management systems can have a great impact on the use, and hence the organization of regional emergency medical care systems. For example, timely and effective public health announcements broadcast via electronic media outlets could limit the numbers of individuals seeking care during seasonal epidemics of influenza like illnesses, thereby decreasing the demand upon regionalized emergency care services. The extent to which such services partner with local public health agencies in developing accurate and appropriate messages for risk communication is therefore a vitally important measure of system performance. In addition, emergency management coordination systems can be key links between local and state-level emergency response to a broad geography of patients during mass causality a number of events, from natural or man-made disasters to disease outbreaks.

1.2 Pre-hospital capabilities

A capable system that can expand and contract as capacity demands is suboptimal unless it can be effectively accessed by the population that it serves. Evaluation of system capability, capacity, and access is a broad and overarching theme of REMCS measurement that includes a

range of concepts from measuring emergency medical dispatch (911 center) protocols and processes, to measuring the adequacy of emergency management plans and infrastructure, to evaluations of numbers of field EMS service units, to monitoring ED and hospital system status with technology such as regional "dashboards."[102] For example, whether or not ambulances are being diverted from particular hospitals may be a surrogate indicator of a system's overall capability, capacity, and access.

1.3 Real-time capacity information

Measures of ED boarding and crowding (e.g., are patients being "boarded" in the ED, or is the ED so crowded that patient care unacceptably delayed) should be readily available and regularly updated (i.e., hour to hour). Measures also should evaluate the status of infrastructure and processes to support regionalized emergency medical care systems. For example, technology that assesses the current capacity and acuity within a given ED via electronic surveillance has been shown to enhance capacity and patient flow across a regional system of hospitals, while also decreasing ambulance diversion.[103] Measures that assess whether such systems are in place, and their operational status and effectiveness, are within this domain's realm.

In addition, this domain includes evaluation of the system's capacity at baseline levels of care demand, when imbalances occur within the system (e.g., one hospital within the system has reached its patient capacity, causing ambulance diversion to other hospitals within the system), during increased demand within a system (e.g., influenza season), and during an acute disaster event (e.g., a weather event covering a large geographic area, mass casualty event, etc.). System capacity needs can change rapidly. Therefore, measuring the immediate surge capacity of a regional system to provide timely emergency care is critical.

1.4 Categorization of participating agencies, organizations, and facilities

There is a need to understand a system's healthcare workforce and resources within a region in order to provide appropriate care for a population. Thus, this domain includes measures of personnel and facility resources, as well as of the presence and use of system infrastructure from pre-hospital equipment and transportation to end-destination specialty services, hospital beds, and intensive care units. Cataloguing a region's medical providers (advanced practice medics, specialty physicians) as well as its facilities (e.g., how many ambulances and trauma bays are available in a system) can identify systems gaps as well as help plan for a disaster.

1.5 Preparedness, monitoring, and data sharing

This domain includes measurement of a system's readiness for disaster or a mass-casualty incident. The system should not only be prepared for such events, but also should be able to maintain a state of readiness and communicate that readiness to system component agencies and facilities, as well as other systems. Examples of current models that attempt to measure these preparedness constructs include the Hospital Preparedness Program[104] of the HHS Office of the Assistant Secretary for Preparedness and Response and the Centers for Disease Control and Prevention's Public Health Preparedness Capabilities.[105] These programs evaluate whether hospitals[106] as well as state and local jurisdictions[107] achieve and maintain targeted infrastructure

and capability requirements (e.g., interoperable communication systems, pharmaceutical caches, emergency public information and warning, volunteer management) that would fall within the realm of medical surge capacity. State and local emergency management officials and groups often play a key role in ensuring that these targets are met, and may provide a context for performance measurement in this area. Where possible, established common data systems such as the National Emergency Medical Services Information System (NEMSIS), as referenced above, should be utilized to facilitate data sharing. Such measurement constructs exemplify Domain 1 and provide a foundation for evaluating critical REMCS structures, processes, and outcomes.

1.6 Enabling a legal and regulatory framework for REMCS

Measurement within this domain encompasses whether or not a system is operating within its relevant statutory limits. For example, various governmental strategies and regulations regarding ambulance diversion[108] exist to decrease this practice and therefore affect system capability and capacity. For more than 20 years, the Emergency Medical Treatment and Active Labor Act (EMTALA)[109] has governed aspects of emergency care system access, communication, and transfer. Measuring REMCS compliance with such statutes is within the realm of this domain.

Multiple federal and state agencies and statutes are involved in the regulation and oversight of emergency care systems. Also, future changes in these legal and regulatory statutes may enable or could impair will impact regionalization of care. Any changes should be reviewed and monitored to ensure

As the ~~Institute of Medicine's~~IOM's Committee on the Future of Emergency Care in the United States Health System suggested, there is a clear need to address the issues surrounding the strain on the capacity of the nation's emergency care systems. In addition, there is a clear need to address the competition among health systems as a barrier to providing efficient, cost-effective regionalized emergency care. One method of addressing these issues may be via REMCS performance measurement. Measuring a system's ability to enhance its operational efficiency, increase its use of technology, and generally improve its level of preparedness for an acute strain on its capacity or a disaster may provide a regulatory framework for improvement in REMCS.

Domain 2: Recognition and Diagnosis

Essential to measuring regionalized emergency care is the evaluation of how an episode of care is initially recognized. As discussed, emergency care is defined in part by time-sensitivity. Therefore, the rapid detection and identification of the nature of an emergency clinical episode is important to assessing an episode of emergency care.

2.1 Community awareness

Early identification of critical illness and injury is a key function of the EMS system.[110] Indeed, the first point in the EMS "Star of Life" (Figure 2) represents "detection" as a primary function of the system.[111] However, the EMS system must first be activated, which often occurs via bystanders in the community. Indeed, bystanders not only are 911 callers, but also they often

provide initial emergency medical care to patients by following the instructions of 911 dispatchers. Measures of a community's involvement and participation in the emergency care system (e.g., rates of CPR training and automated external defibrillator (AED) knowledge) are within the realm of this domain.

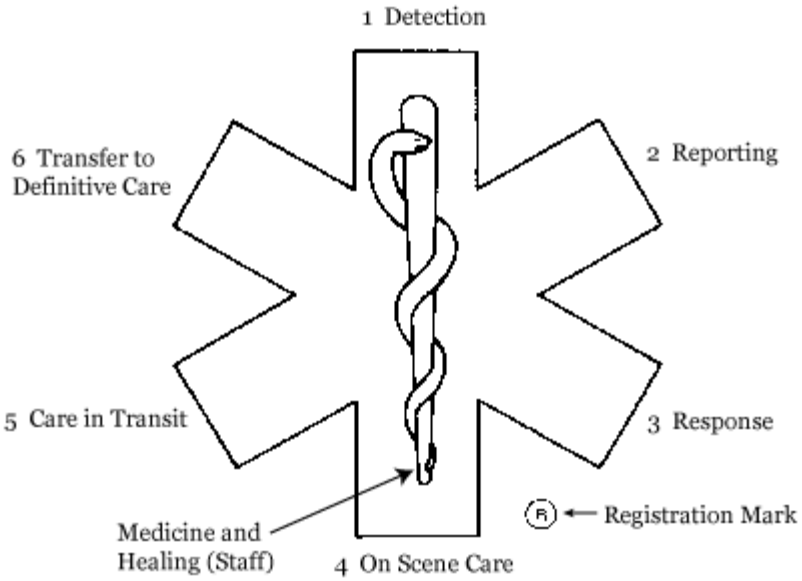


Figure 2: The EMS "Star of Life" is the commonly known six-pointed cross, originally designed by National Highway Traffic Safety Administration (NHTSA), which represents the six functions of the EMS system.[112]

2.2 Training

Also within the realm of this domain are measures of both community and healthcare providers' training, as well as the training and education of patients and lay caregivers, in the recognition and diagnosis of emergency conditions. Continuing education for both lay and professional healthcare providers, as well as bystanders and patients, is paramount to creating an environment for high-quality care. Measures in this domain include benchmarks for EMS provider/personnel training, bystander and patient training, and physician and nursing continuing education.

2.3 Technology

Technological constructs to be measured in this domain include the 911 telecommunications system, emergency response communication systems and networks, and data systems to identify and track episodes of care.[113-115] Data and technology systems not only can assist in the recognition of an episode, but also can catalog episodes for comparison, analysis, and meaningful feedback across the phases of an episode of care.

2.4 Evidence-based approaches

This domain also includes the recognition or initial diagnosis of an emergent clinical condition that previously has been shown to be amenable to regionalized emergency medical care. Measuring the performance of a regionalized care system first depends on the system being activated when an episode of care meets the criteria for inclusion into such a system. Examples of this concept include medical practitioner recognition of STEMI, acute stroke, and trauma patients who meet the criteria to be transported to a trauma center.[116-119]

A particular focus of this domain is the reconciliation of the measurement gap between when an episode of care actually begins and when an episode of care begins to be measured. The Steering Committee agreed that an episode of care begins with the onset of patient symptoms, but currently the first reliable measurement point may not occur until the patient (or bystander) makes contact with the medical system (e.g., by calling 911 or walking into an ED). It is a priority to measure both when the patient makes contact with the system, and the interval between symptom onset and episode recognition. The establishment of evidence-based practices to measure this interval and the development of strategies to shorten or prevent ~~this interval~~ it should be developed.

Domain 3: Resource Matching and ~~Utilization~~ Use

At its most basic level, the regionalization concept is about matching resources to patients. An emerging description of this concept is of a network model of emergency care that serves to "get the right resource to the right patient at the right place at the right time."[120-122.] This domain evaluates the structural and process components of regionalized emergency medical care.

3.1 Guidelines and evidenced-based triage and protocols

Matching patients to healthcare resources does not necessarily mean bringing the patient to the resource facility. Whereas a centralized approach to regional care may result in patients being funneled one way to one hospital, a network model of REMCS demonstrates multi-directional flow of patients and resources across an interconnected web.[123,124] This domain evaluates the structures and processes that make up that web. It identifies which patients need to be transferred and which can safely remain at decentralized facilities. For example, the standard use of accepted protocols for triage of trauma patients can help systems categorize patients who are appropriate for transfer to a trauma center, and those who may remain at an outside hospital. In addition, when inter-facility transfer should occur within a regionalized emergency system, this domain should evaluate the processes and care provided during the transfer.

3.2 Tele-h~~H~~ealth

One gap that this domain should address is the need for infrastructures (e.g., communication resources, availability of on-call specialty care) to allow a system to appropriately allocate resources to a patient. For example, standardized communication and information technology systems should be developed and measured that allow for patient tracking within a system, as well as communication between "nodes" in the system web. One approach is the concept of

"tele-health," whereby a remote resource (e.g., a specialist physician) ~~is able to~~can communicate electronically with a patient and other healthcare providers to care for the patient. Tele-health has been implemented as a successful method of delivering emergency care, as exemplified in Mississippi's "TelEmergency" system.[125] Given that on-call specialist physicians may be a scarce resource within some regionalized systems,[126,127] tele-health may represent an information technology model that can efficiently and cost-effectively bring vital care resources to patients across a wide geography.

3.3 Efficiency and overuse

By cataloguing and measuring the availability and use of emergency care physical infrastructure and resources within a regionalized system, both redundancies and gaps can be identified and evaluated in an effort to create a system that is effective as well as efficient. Measuring the inventory of resource distribution within a system can improve coordination of timely medical care.[128] In addition, measuring whether a system's component facilities and agencies appropriately ~~utilize~~ use resources such as trauma triage guidelines, interfacility transfer protocols, and tele-health can allow for evaluation of whether a system is efficiently using ~~or is over- or under-utilizing~~ a particular resource.

Domain 4: Medical Care

This domain evaluates the actual medical care to patients within an episode of care. Measures within this domain attempt to answer the question: "Did the patient receive medical care that met accepted standards?" In other words, within the episode of care, did the patient receive care that was timely and in accordance with broadly accepted standards and protocols for a given emergency medical condition.

Donabedian asserts that "outcomes… remain the ultimate validators of the effectiveness and quality of medical care."[129] Thus, measuring the individual process steps in an episode of care, as well as the structural elements that support those outcomes, can be valuable. ~~,~~ This does assum~~e~~ing that the processes being measured are essential contributors to the success and effectiveness of the whole system. Measurement should focus on processes that can be validated as necessary components of a high-quality episode of care.

This domain can be divided into five subdomains, based on where and to whom care is provided:

4.1 Care provided by bystanders

As noted, bystanders play a critical role in the recognition and initial care of an emergency episode. Measuring the community-wide effectiveness of bystander care can be relevant across a broad range of emergency conditions, such as cardiac arrest and trauma.

4.2 Pre-hospital and EMS-provider Care

Measurement of all care provided by pre-hospital professionals, from emergency medical responders to paramedics, is within the realm of this domain.~~Measurement of all care provided~~

~~by pre-hospital professionals, from firefighters to paramedics to helicopter EMS professionals, is within this domain's realm~~ First responders and paramedics are traditionally the first "professional" caregivers in an emergency episode of care. Measuring their medical care includes not only considering traditional markers of appropriate emergency care practice, but recognizing pre-hospital providers' ability to provide effective nontraditional care. For example, paramedics may provide effective treatment in the community without transport to the hospital.[130]

Indeed, the range of out-of-hospital care from medical professionals is broad. Aeromedical services provide an example of a broad range of care. Although aircraft (helicopters, fixed wing) are traditionally regulated by the Federal Aviation Administration, air ambulances are key components of regionalized emergency care systems. The Association of Critical Care Transport has recently supported legislation (i.e., the "Air Ambulance Patient Safety, Protection, and Coordination Act") that aims to "ensure that patient safety, quality patient care and coordination of helicopter medical services are properly overseen by State emergency medical services (EMS) and public health authorities." This legislation would integrate air ambulances more fully into regionalized emergency care systems by allowing state oversight of the care they provide just as states currently oversee ground ambulances, hospitals, and other healthcare entities.[131]

4.3 Emergency department (ED) care and 4.4 Inpatient care

Most of the examples of measures within these subdomains are process measures that evaluate whether a standard of care was met. Examples include "Was aspirin given for acute MI?" and "Did the acute STEMI patient receive primary percutaneous coronary intervention (PCI) within 90 minutes of hospital arrival?" Indeed, process measures evaluating the clinical elements of ED and hospital care comprise the largest share of the currently well-defined and accepted performance measures of regionalized emergency medical care services.[132]

Nevertheless, there remains a need to identify and develop more comprehensive measures of quality medical care. Although many efforts have identified performance measures of ED and hospital-based emergency care, these measures often are not comprehensive in their assessment of "quality." A recent analysis of existing pediatric emergency care performance measures[133] indicated that measures most often focused on one aspect of care quality (timeliness) rather than on all six of the IOM's quality domains (safe, effective, patient-centered, timely, efficient and equitable).[134] This analysis also highlights the need for measure developers to focus on systematic and comprehensive measurement of the quality of healthcare, rather than just how quickly it is provided.[135]

4.5 Care of special populations

Unique performance measures should be developed to evaluate care to unique patient groups, populations, and geographies. Performance measurement should take into account the logistical, budgetary, and personnel challenges of these groups, such as the many rural environments in which regionalized emergency care occurs. Furthermore, the care for caregivers and families should be considered, as well as the care of patients. For example, measuring the processes and

outcomes of a total system of care for pediatric and geriatric patients[136,137] and their caregivers, or of psychiatric care, may be different than evaluating care for a myocardial infarction.[138] Additionally, non-English speaking patients present a challenge to regionalized emergency care systems: Are interpreters available to each agency within a system? How do ambulance-based providers communicate with non-English speaking patients?

Domain 5: Coordination of Care

This domain evaluates the connections among the various "service units"[139] within an Episode of Care. Regionalized emergency medical care systems are comprised of many discrete components that must interact efficiently and effectively to achieve the maximum outcome for the patient. This concept is illustrated by Cairns et al.'s description of service units for a severely injured victim of a motor vehicle collision (Figure 3). In this example, the service units may include the EMS system, trauma center ED, operating room, etc.[140]

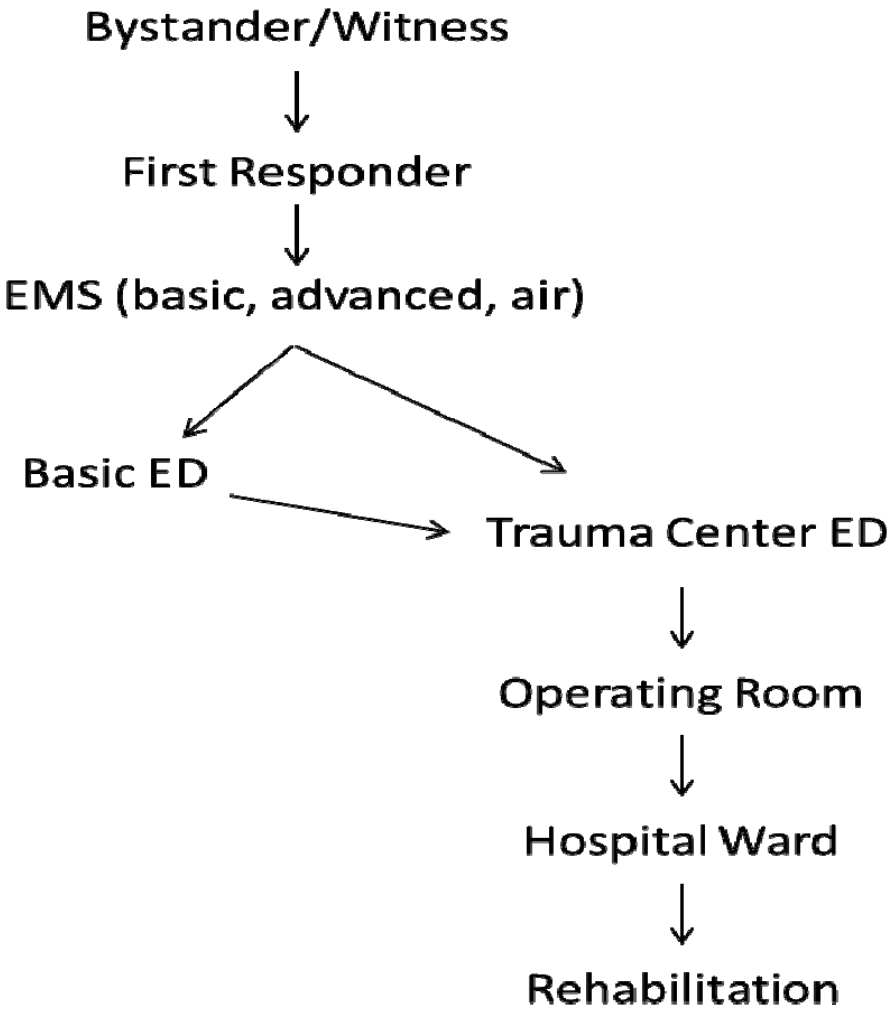


Figure 3. Service units for a severely injured victim of a motor vehicle collision.[141]

5.1 Governance and shared accountability

Emergency care coordination will require a common oversight structure and shared accountability for system measurement and outcomes. Individual service units within a regionalized emergency care system are inextricably bound to each other (via communication and patient transfer) in an episode of care for a patient. Thus, the structures, actions, and benchmarks of one system component affect other system components. A challenge of this domain will be to identify an appropriate oversight structure and metrics that appropriately align a service unit to system-level outcomes. Implementing common oversight and a shared-accountability model that is fair to individual stakeholders and service units will be the key to making a regionalized emergency medical care system work.

5.2 Handoffs and transitions

Regionalized emergency care systems are networks composed of individual parts, with each part taking some responsibility for patient care at some point in the episode of care. The transitions among service units and across network nodes are key places for measurement of system functions. For example, there is a need for improved quality measurement for inter-facility transfers, in addition to measuring care provided at each specific clinical site. Within a regionalized system, important aspects of patient care are undertaken during transitions and transports, and these steps should be measured. The "hand-off" of a patient from one node to another is a critical juncture where communication and collaboration are vital to effective and high-quality care. Measuring these handoffs and transitions within an episode of care is important to assessing regionalized emergency care systems.

5.3 Communication

Measuring communication between the individual units of care, as well as the flow of information and intermediate outcomes for each unit, is critical to evaluating the system as a whole. The optimal outcome for the patient in a given episode of care depends on the effective integration of these discrete service units. Specific examples of measures within this domain would include "advance hospital notification for suspected stroke."

Domain 6: Outcomes

Measuring patient-oriented outcomes of an episode of care is an important method of evaluating the effectiveness of a system. Although measuring structure and process elements is critical to evaluating a system's functioning parts, the end result (i.e., outcome) of an episode of care may be the most obvious illustration of whether the system works. For example, if a patient who suffered out-of-hospital cardiac arrest survives neurologically intact to hospital discharge, then the patient's episode of care was most likely marked by timely, high-quality, integrated care that met relevant performance measures.

However, because of the inherent complexity and multiple components of an episode of care ~~within regionalized emergency medical care services~~, it is possible that an outcome measure

might be met despite not meeting one or more structure or process measures along the way (e.g., the cardiac arrest patient may have survived despite not receiving acute coronary intervention within 90 minutes of first medical contact). Also, when an outcome measure is not met, challenges arise regarding the accountability for not achieving the measure (i.e., which system component was responsible for not meeting the measure?).

6.1 Access to data

The process of measuring medical care, and regional emergency care systems in general, should be data driven. Although many local, regional, and national-level databases exist that catalogue medical care within regional emergency care systems, they are varied in their level of use and development, are often not interconnected, and their use is often not mandated. Measure developers are encouraged to use these data systems (e.g. CARES, NEMSIS, and the NTDB) when identifying and developing performance measures. In addition, competition between hospitals and health systems may limit access to key system-level data. This competition may be a barrier to quality REMCS care, and these barriers should be addressed by REMCS performance measurement. To improve the data foundation on which REMCS measurement is built, a common data infrastructure should be used, with a mandate for collection, transparency, and shared use.

6.2 Data linkage across settings of care

In addition, regionalized emergency care systems should not exist in individual, top-down, disease-specific silos, and efficiencies realized in one network or via one service unit should be evaluated and shared to possibly achieve more cost-effective care across systems. Similar to Subdomain 6.1, competition between hospitals may limit data linkage. Nonetheless, these barriers should be addressed by REMCS performance measurement to improve care. Data linkage across networks and even between systems can not only improve an episode of care, but also can allow for system-level feedback and performance improvement via both patient and population-centered research.[142-144]

Furthermore, evaluating linked data can provide critical reference and monitoring information for new avenues of regionalized emergency care. For example, limiting field EMS providers to their traditional role of transporting patients to the hospital via ambulance may not be the most efficient or cost-effective outcome of their service to some patients. Treatment in the field, non-emergent referral to other healthcare providers, and triage of certain patients (e.g., psychiatric patients without active medical problems) to facilities other than the ED are within the skill set of advanced field EMS providers. Accountability and reimbursement models should evaluate the effectiveness of these nontraditional outcomes of an episode of care and should ensure that regional emergency care systems are set up to reward cost-effective care.

6.3 Feedback

Patient outcomes of Episodes of Care are important measures for systems of emergency care, , but they should not be the sole determinant of a system's efficiency or effectiveness. Measure development within this domain also should focus on evaluating whether a given measure or

measure concept has a strong evidence base that links the overall outcome of an episode of care to other earlier components of that episode (e.g., intermediate outcomes of individual service units within an episode of care should reliably predict the overall outcome of the episode). In addition, systems should incorporate mechanisms to mandate system-level feedback of outcomes to earlier phases in the episode. Feedback should occur across and between all phases in an episode of care, but outcome information in particular should be integrated into process improvement. Lastly, before consequences are attached to failure to meet outcomes, measures should be validated as true system-level measures, and measures should produce reliable results across other similar systems.

Guiding Principles

The following principles are overarching themes intended to provide direction to the standard implementation of the REMCS framework and future development of structural, process, and outcome measures and measure concepts within regionalized emergency care systems.

- Regionalization of emergency care is a method of matching resources to patient needs in a timely fashion with the goal of improving patient-oriented care outcomes and population health. Regionalization does not equal "centralization" of care; it may involve moving care resources to patients or patients to care facilities, depending on the needs of the patient and the system's capabilities.

- The effective delivery of regionalized emergency medical care requires ongoing measurement and monitoring of system capabilities and capacity to ensure that the appropriate resources and workforce (including appropriate specialty care) are available.

- Identifying and evaluating measures of entire systems of emergency care is difficult, but essential. Measurement of regionalized emergency care systems should strive to measure the effectiveness, cost-effectiveness, and efficiency of the system as a whole, as well as individual system components. Measures used to judge the effectiveness of a system should include patient-oriented outcomes, patient-centered processes of care, and community-centered outcomes. Desired outcomes should consider patient preferences and experiences, and REMCS models should assure the systems are accountable to the patient as well as to the healthcare system.

- System evaluation should promote transparency and shared accountability for the system's successes and failures both within and across units of service within the system.

- The development of regionalized emergency medical care systems is an ongoing process with flexible and adaptive structural and process elements. Valid system-level measures should detect and recognize improvement (or lack thereof) due to changes to a system's component parts and the communication and coordination between them.

- Regionalized emergency care systems should exist for the public good and should fully integrate with each other in a transparent, shared model with a common oversight

structure (taking into consideration federal, state, and local regulations) regardless of geopolitical boundaries, to provide optimal care for a population. Incentives should be aligned such that a successful system yields positive outcomes and appropriate compensation for each agency, organization, and facility within the system.

- REMCS measurement should be data driven. Data on REMCS structures, processes, and outcomes, as well as on the populations that the systems serve, should be collected, shared, and used to validate evidence-based REMCS measures and measure gaps.

~~**Measure Evaluation Criteria**~~

~~The following are general Measure evaluation criteria against which measures can be assessed to ensure that they evaluate important areas of RECS performance, are reliable and valid, can be understood by intended audiences, and are feasible to carry out. These measure evaluation criteria are informed by NQF and other sources,[145-147] and the descriptions below are placed into the context of measuring regionalized emergency care systems. NQF evaluates measures against these criteria when making endorsement recommendations. Although the Framework should identify areas where no measures exist, it is important that measure developers consider these criteria when measures and measure concepts are identified and when the endorsement process begins.~~

a. ~~**Importance:** Whether or not the measure evaluates a component of healthcare that is clinically relevant or notably contributes to care within a regionalized emergency care system.~~
b. ~~**Scientific Acceptability:** How well the measure is defined, supported by evidence, and valid and reliable.~~
c. ~~**Usability:** Whether the measure is meaningful to the intended audiences and whether the relationship between measure use and intended outcomes is of sufficient magnitude to be important and quantifiable.~~
d. ~~**Feasibility:** Data for the measure calculations are readily available across systems of care, and the implementation of the measure (or subsequent intervention(s) to improve the measure) is cost-effective.~~

IV. FURTHER EFFORTS IN MEASURING REGIONALIZED EMERGENCY MEDICAL CARE SYSTEMS

Several groups have previously identified and developed performance measures within various service units that comprise regionalized emergency medical care systems.[148-158] These measures mostly evaluate individual elements of care, are at various stages of development, and vary widely in the manner in which they are used.[159] Rarely have measure development efforts had the primary purpose of identifying or promoting performance measures that systematically approach regionalized emergency care. This framework is meant to add to earlier efforts by proposing a standard structure to evaluate regionalized emergency medical care services using episodes of care. By evaluating systems using comprehensive domains and a longitudinal approach through

an episode of critical illness or injury, healthcare delivery for time-sensitive, life-threatening conditions can be improved.

In addition, this framework's approach easily highlights areas within regionalized emergency medical care services where there are measurement gaps. These gaps may be in areas where measures should improve in terms of validity and reliability or in areas where measures do not exist at all. Areas identified for further research include:

a. the need for development of new measures or adaptation of existing measures to ensure patient-oriented measurement of systems, not merely isolated elements of systems;

b. a focus on measuring transitions and communication (face to face, verbal, and long-distance) between service units within regionalized systems. Earlier efforts have largely focused on the function of the units themselves;

c. further evaluation of concepts of system capability, capacity, and access on the utilization and growth of regionalized emergency care systems. Although unscheduled, episodic care at varying levels of acuity is provided in both in and out-of-hospital REMCS settings, this project's focus is on measuring systems of care for time critical, potentially life-threatening clinical conditions. Nonetheless, the effectiveness and capacity of regionalized emergency care systems are inextricably linked to the increasing challenges of such systems to provide unscheduled, episodic care to other patients at the same time in the same systems and locations;

d. a focus on communication between service units (e.g., the EMS system and EDs), emphasizing electronic technology and industrial engineering concepts to improve system efficiency and preparedness for system strain and surge;

e. identification of measures or measure concepts that support effective and efficient continued development of healthcare delivery systems;

f. identification of measures or measure concepts to evaluate care in areas where there are current measurement gaps (e.g., critical care medicine, toxicology, psychiatric care). Gaps include areas where measures exist but are not sufficient, areas where measures require development to ensure they are valid indicators of system performance, and areas where no measures exist at all. New measure concepts should support an REMCS delivery system that is improved in both efficiency and quality.

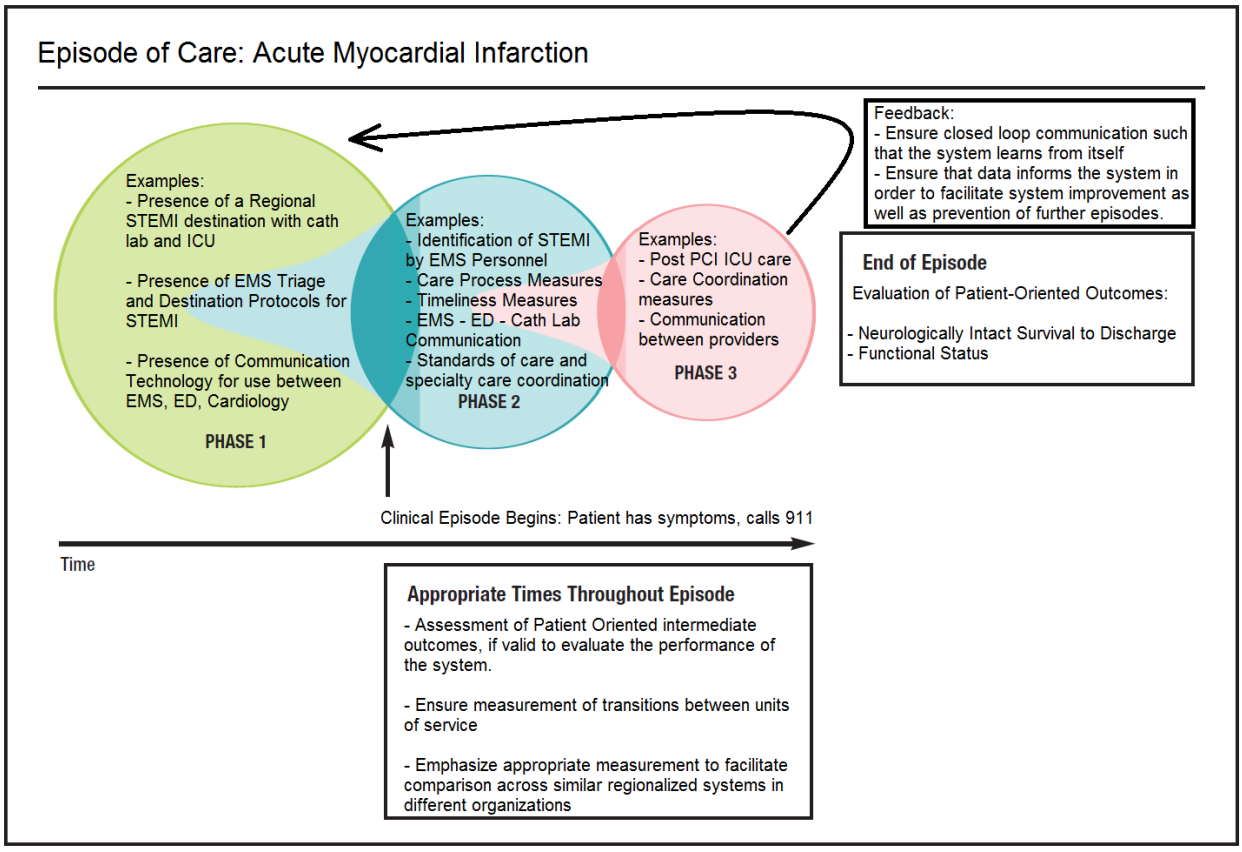
V. APPENDIX A – CRITERIA FOR EVALUATING MEASURES

The following are general criteria by which measures can be assessed to ensure that they evaluate important areas of REMCS performance, are reliable and valid, can be understood by intended audiences, and are feasible to carry out. These measure evaluation criteria are informed by NQF and other sources,[28-30] and their descriptions are placed in the context of measuring regionalized emergency care systems. NQF evaluates measures against these criteria when making endorsement recommendations. Although the framework should identify areas where no measures exist, it is important that measure developers consider these criteria when measures and measure concepts are identified and when the endorsement process begins.

a. **Importance:** whether or not the measure evaluates a component of healthcare that is clinically relevant or notably contributes to care within a regionalized emergency care system.
b. **Scientific Acceptability:** how well the measure is defined, supported by evidence, valid and reliable.
c. **Usability:** whether the measure is meaningful to the intended audiences and whether the relationship between measure use and intended outcomes is of sufficient magnitude to be important and quantifiable.
d. **Feasibility:** data for the measure calculations are readily available across systems of care, and the implementation of the measure (or subsequent intervention(s) to improve the measure) is cost-effective.

~~V.~~VI. APPENDIX B – EXAMPLE OF AN EPISODE OF CARE EVALUATION WITHIN REGIONALIZED EMERGENCYCARE SYSTEMS: ACUTE MYOCARDIAL INFARCTION

To exemplify the framework's approach to providing a context for REMCS measurement, an evaluation of an acute myocardial infarction (AMI) episode of care is provided below.



Example measures within the framework domains are categorized by the episode phases. These measures are included here to represent the broad and inclusive measure set that would be highlighted via use of the framework and domains rather than to indicate their necessity or validity for evaluating AMI care. In some cases, measures are in use and NQF-endorsed®, while in other cases, measure concepts become obvious when AMI care is considered in this manner (e.g., further development of measures of care coordination).

Phase I

Measurement of AMI care should begin with an evaluation of the structures in place to provide needed care. Relevant domains include: Capability, Capacity, and Access, Recognition and Diagnosis, Resource Utilization, and Coordination of Care. Examples of measures and measures concepts include, but are not limited to:

- Do regionalized systems have the capacity to meet AMI care demands (e.g., are there enough percutaneous coronary intervention suites and intensive care unit beds, are staff available 24 hours/day)?
- Do EMS systems have policies and protocols in place to maximize efficiency and timeliness when treating AMI (e.g., capability to perform pre-hospital electrocardiograms)?
- Do EMS systems have plans to transport to appropriate destinations within regionalized systems of AMI care?
- Is technology in place to facilitate the efficient communication and transfer of data between service units (e.g., pre-hospital electrocardiograms to the ED and/or hospital catheterization lab)?

Phase 2

As a clinical AMI episode begins, care measurement should continue with an evaluation of the processes and outcomes associated with that care. All six domains are relevant in this phase. Examples of measures and measure concepts include, but are not limited to:

- Did the 911 telecommunicator recognize the onset of a time-critical illness and initiate appropriate triage and emergency system response?
- Did the EMS system respond, confirm the diagnosis of a time-sensitive AMI, and begin treatment and transport in a timely fashion?
- Were standards of medical care met (e.g., appropriate medication administration, timely reperfusion therapy)?
- Were standards of communication between service units met?
- Did the system effect proper treatment and transport to the most appropriate end-destination care setting for consideration and possible receipt of definitive specialty care that is not universally available within a regionalized system?

Phase 3

As care for an AMI episode continues, measurement should focus on whether care is of a consistently high level and coordinated and on whether patient-oriented outcomes representative of high-quality care are being met. Relevant domains include: Resource Utilization, Medical Care, Coordination of Care, and Outcomes. Examples of measures and measure concepts include, but are not limited to:

- Did the various medical providers across phases adequately communicate vital information to each other and to the patient?
- Does ongoing time-sensitive care (e.g., medical critical care, post-AMI care) continue to meet accepted and evidence-based standards?
- Did appropriate patient care records accompany the patient from the beginning to the end of the episode of care in a timely fashion?

- Does the system have adequate data collection and distribution procedures such that the patient is well informed and the components of the system (e.g., emergency medical dispatchers and field EMS providers) can be evaluated and improve performance?

~~VI.~~VII. APPENDIX C~~B~~: GLOSSARY

The glossary's purpose is to ~~further~~ explain terms used in this report that may be industry-specific to regional emergency care systems or healthcare in general. The terms are explained here as they relate to this project's purposes and were derived from multiple sources, including the expert opinions from the REMCS Steering Committee.

Ambulance Diversion: The process and practice of preventing field EMS units (ambulances) from bringing unscheduled patients to an emergency department (ED), usually because of the ED's or hospital's crowding and lack of capacity. The ambulances are "diverted" from a closer or intended ED "at capacity" to a farther or unintended hospital ED.

Boarding ("ED Boarding"): The practice of retaining patients in the ED for an extended period of time. Usually, the term refers to patients who are admitted to the hospital but remain in the ED (perhaps overnight, or even for days) because of a lack of hospital bed availability~~,~~ or other hospital-capacity problems.

Centralization: In contrast to "regionalization," centralization or "centralized care" refers to the unplanned referral and transport of patients to one location from another, without primary focus on patient-oriented processes and outcomes, or system-level feedback.

Crowding ("ED Crowding"): A condition in which the number of patients needing ED evaluation and treatment exceeds the capacity and current resources of the ED. In addition, crowding may exist when there is a significant delay in treating patients needing emergency care because of the number of patients requiring evaluation and treatment at a given time.

Emergency Care, or Emergency Medical Care: The treatment of high-acuity or potentially life-threatening medical or traumatic conditions in an expedited fashion, recognizing that timely care of emergent patients may prevent mortality or significant morbidity. Emergency care is a distinct type of care that is separate from other types of medical care that often occur in the same setting ~~as emergency care~~. For example, "emergency" departments and "emergency" medical services exist, in part, to provide unscheduled, episodic care for patients. However, much of the care that is provided in these "emergency" settings, while unscheduled, is not potentially life threatening ~~and/~~or does not require timely evaluation and treatment to prevent the worsening of a condition or death. For this project's purposes, the term "emergency care" (context: regionalized emergency medical care systems) refers to the subset of unscheduled care that is of high acuity or potentially life threatening.

Emergency Medical Dispatch (EMD): Commonly known as "the 911 call center," EMD encompasses the people and protocols that comprise a planned system of receiving emergency calls for service, evaluating and triaging those calls, providing medical help and instructions to callers, and directing and managing responding emergency services vehicles and personnel.

Field Emergency Medical Services (EMS): Denotes the pre-hospital component of the broad term "emergency medical services" and includes: out-of-hospital EMS practitioners, such as emergency medical technicians and paramedics (i.e., first responders); initial out-of-hospital treatment; and transport, by air or by ground, to a hospital.

Service Unit: A discrete component of a certain type that provides a specific service or type of care to a patient within a regionalized emergency medical care system. Service units interact and transfer patients among each other within a care network. Emergency medical dispatchers, field EMS, the ED, inter-facility transfer, the operating room, and the intensive care unit are all examples of service units.

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REFERENCES

1. Institute of Medicine (IOM), *Hospital-Based Emergency Care: At the Breaking Point*, Washington, DC: The National Academies Press; 2007.
2. IOM, *Emergency Medical Services at the Crossroads*, Washington, DC: The National Academies Press; 2007.
3. IOM, *Regionalizing Emergency Care: Workshop Summary*, Washington, DC: The National Academies Press; 2010.
4. National Quality Forum (NQF), Measure Evaluation Criteria, December 2009. Available at www.qualityforum.org/Measuring_Performance/Consensus_Development_Process%e2%80%99s_Principle/Candidate_Consensus_Standard_Review.aspx. Last accessed October 2010.
5. NQF, The ABCs of Measurement; 2010. Available at www.qualityforum.org/Measuring_Performance/ABCs_of_Measurement.aspx. Last accessed November 2010.
6. NQF. Consensus Development Process; 2010. Available at www.qualityforum.org/Measuring_Performance/Consensus_Development_Process%e2%80%99s_Principle/Call_for_Candidate_Standards.aspx. Last accessed October 2010.
7. IOM, *Regionalizing Emergency Care: Workshop Summary*, Washington, DC: The National Academies Press; 2010.
8. National Association of State EMS Officials, Regionalization of care: position statement of the National Association of State EMS Officials, *Prehosp Emerg Care*, Jul-Sep 2010;14(3):403.
9. Carr BG, Asplin BR, Regionalization and emergency care: the Institute of Medicine reports and a federal government update, *Acad Emerg Med*, 2010;17(12):1351-1353.
10. Carr BG, Martinez R, Executive Summary—2010 Consensus Conference, *Acad Emerg Med*, 2010;17(12):1269-1273.
11. IOM, *Emergency Medical Services at the Crossroads*, Washington, DC: The National Academies Press; 2007.
12. IOM, *Regionalizing Emergency Care: Workshop Summary*, Washington, DC: The National Academies Press; 2010.
13. Carr BG, Asplin BR, Regionalization and emergency care: the Institute of Medicine reports and a federal government update, *Acad Emerg Med*, 2010;17(12):1351-1353.
14. Carr BG, Martinez R, Executive Summary—2010 Consensus Conference, *Acad Emerg Med*, 2010;17(12):1269-1273.
15. Carr BG, Conway PH, Meisel ZF, Steiner CA, Clancy C, Defining the emergency care sensitive condition: a health policy research agenda in emergency medicine, *Ann Emerg Med*, Jul 2010;56(1):49-51.
16. American College of Emergency Physicians/Physician Consortium for Performance Improvement/National Committee for Quality Assurance, Emergency Medicine Physician Performance Measurement Set; 2007. Available at www.ama-assn.org/ama1/pub/upload/mm/370/emergency-medicine-ms.pdf. Last accessed December 2010.

17. National Highway Traffic Safety Administration, Emergency Medical Services Performance Measures: Recommended Attributes and Indicators for System and Service Performance; 2009. Available at www.nasemsd.org/Projects/PerformanceMeasures/. Last accessed December 2010.
18. Williams JG, Mears G, Brice JH, Raisor C, Cairns C, National Quality Forum Environmental Scan: Regionalized Emergency Medical Care Services; 2011. Available at www.qualityforum.org/Projects/n-r/Regionalized_Emergency_Care/Regionalized_Emergency_Care__Phase_1.aspx#t=2&s=&p=1%7C. Last accessed March 2011.
19. IOM, *Regionalizing Emergency Care: Workshop Summary*, Washington, DC: The National Academies Press; 2010.
20. Carr BG, Martinez R, Executive Summary—2010 Consensus Conference, *Acad Emerg Med*, 2010;17(12):1269-1273.
21. Williams JG, Mears G, Brice JH, Raisor C, Cairns C, National Quality Forum Environmental Scan: Regionalized Emergency Medical Care Services; 2011. Available at www.qualityforum.org/Projects/n-r/Regionalized_Emergency_Care/Regionalized_Emergency_Care__Phase_1.aspx#t=2&s=&p=1%7C. Last accessed March 2011.
22. Cairns CB, Garrison HG, Hedges JR, Schriger DL, Valenzuela TD, Development of new methods to assess the outcomes of emergency care, *Acad Emerg Med*, 1998;5:157-161.
23. Glickman SW, Kit Delgado M, Hirshon JM, et al. Defining and measuring successful emergency care networks: A research agenda, *Acad Emerg Med*, Dec 2010;17(12):1297-1305.
24. Martinez R, Keynote address—Redefining regionalization: merging systems to create networks. *Acad Emerg Med*, 2010;17(12):1346-1348.
25. Rokos IC, Sanddal ND, Pancioli AM, Wolff C, Gaieski DF, Inter-hospital communications and transport: turning one-way funnels into two-way networks, *Acad Emerg Med*, Dec 2010;17(12):1279-1285.
26. NQF, *Measurement Framework: Evaluating Efficiency Across Patient-Focused Episodes of Care*, Washington, DC: NQF; 2009.
27. Ibid.
28. National Quality Forum (NQF), Measure Evaluation Criteria, December 2009. Available at www.qualityforum.org/Measuring_Performance/Consensus_Development_Process%e2%80%99s_Principle/Candidate_Consensus_Standard_Review.aspx. Last accessed October 2010.
29. Glickman SW, Schulman KA, Peterson ED, Hocker MB, Cairns CB, Evidence-based perspectives on pay for performance and quality of patient care and outcomes in emergency medicine, *Ann Emerg Med*, May 2008;51(5):622-631.
30. Spertus JA, Eagle KA, Krumholz HM, Mitchell KR, Normand ST, American College of Cardiology and American Heart Association methodology for the selection and creation of performance measures for quantifying the quality of cardiovascular care, *Circulation*, 2005;111:1703-1712.
31. Institute of Medicine (IOM), *Hospital-Based Emergency Care: At the Breaking Point*, Washington, DC: The National Academies Press; 2007.

32. IOM, *Emergency Medical Services at the Crossroads,* Washington, DC: The National Academies Press; 2007.
33. IOM, *Regionalizing Emergency Care: Workshop Summary*, Washington, DC: The National Academies Press; 2010.
34. Glickman SW, Kit Delgado M, Hirshon JM, et al. Defining and measuring successful emergency care networks: A research agenda, *Acad Emerg Med,* Dec 2010;17(12):1297-1305.
35. Martinez R, Keynote address—Redefining regionalization: merging systems to create networks. *Acad Emerg Med,* 2010;17(12):1346-1348.
36. Pines JM, Fee C, Fermann GJ, et al., The Role of the Society for Academic Emergency Medicine in the development of guidelines and performance measures, *Acad Emerg Med,* 2010;17(11):e130-e140.
37. National Quality Forum (NQF), Measure Evaluation Criteria, December 2009. Available at www.qualityforum.org/Measuring_Performance/Consensus_Development_Process%e2%80%99s_Principle/Candidate_Consensus_Standard_Review.aspx. Last accessed October 2010.
38. NQF, The ABCs of Measurement; 2010. Available at www.qualityforum.org/Measuring_Performance/ABCs_of_Measurement.aspx. Last accessed November 2010.
39. NQF. Consensus Development Process; 2010. Available at www.qualityforum.org/Measuring_Performance/Consensus_Development_Process%e2%80%99s_Principle/Call_for_Candidate_Standards.aspx. Last accessed October 2010.
40. Williams JG, Mears G, Brice JH, Raisor C, Cairns C, National Quality Forum Environmental Scan: Regionalized Emergency Medical Care Services; 2011. Available at www.qualityforum.org/Projects/n-r/Regionalized_Emergency_Care/Regionalized_Emergency_Care__Phase_1.aspx#t=2&s=&p=1%7C. Last accessed March 2011.
41. Ibid.
42. Cairns CB, Maier RV, Adeoye O, et al., NIH Roundtable on Emergency Trauma Research, *Ann Emerg Med,* Nov 2010;56(5):538-550.
43. D'Onofrio G, Jauch E, Jagoda A, et al., NIH Roundtable on Opportunities to Advance Research on Neurologic and Psychiatric Emergencies, *Ann Emerg Med,* Nov 2010;56(5):551-564.
44. Kaji AH, Lewis RJ, Beavers-May T, et al., Summary of NIH Medical-Surgical Emergency Research Roundtable held on April 30 to May 1, 2009, *Ann Emerg Med,* Nov 2010;56(5):522-537.
45. Carr BG, Asplin BR, Regionalization and emergency care: the Institute of Medicine reports and a federal government update, *Acad Emerg Med,* 2010;17(12):1351-1353.
46. Carr BG, Martinez R, Executive Summary—2010 Consensus Conference, *Acad Emerg Med,* 2010;17(12):1269-1273.
47. Glickman SW, Kit Delgado M, Hirshon JM, et al. Defining and measuring successful emergency care networks: A research agenda, *Acad Emerg Med,* Dec 2010;17(12):1297-1305.

48. Martinez R, Keynote address—Redefining regionalization: merging systems to create networks. *Acad Emerg Med,* 2010;17(12):1346-1348.
49. Rokos IC, Sanddal ND, Pancioli AM, Wolff C, Gaieski DF, Inter-hospital communications and transport: turning one-way funnels into two-way networks, *Acad Emerg Med,* Dec 2010;17(12):1279-1285.
50. Acosta CD, Kit Delgado M, Gisondi MA, et al., Characteristics of pediatric trauma transfers to a level i trauma center: implications for developing a regionalized pediatric trauma system in California, *Acad Emerg Med,* 2010;17(12):1364-1373.
51. Baumlin KM, Genes N, Landman A, Shapiro JS, Taylor T, Janiak B, Electronic collaboration: using technology to solve old problems of quality care, *Acad Emerg Med,* 2010;17(12):1312-1321.
52. Carr BG, Addyson DK, Geographic information systems and emergency care planning, *Acad Emerg Med,* 2010;17(12):1274-1278.
53. Carr BG, Matthew Edwards J, Martinez R, Regionalized care for time-critical conditions: lessons learned from existing networks, *Acad Emerg Med,* 2010;17(12):1354-1358.
54. Cone DC, Baren JM, A (growing) history of the Academic Emergency Medicine Consensus Conference, *Acad Emerg Med,* 2010;17(12):1267-1268.
55. Cone DC, Brooke Lerner E, Band RA, et al., Prehospital care and new models of regionalization, *Acad Emerg Med,* 2010;17(12):1337-1345.
56. Epstein SK, Regionalization findings in the national report card of the state of emergency medicine, *Acad Emerg Med,* Dec 2010;17(12):1349-1350.
57. Ginde AA, Rao M, Simon EL, et al., Regionalization of emergency care future directions and research: workforce issues, *Acad Emerg Med,* Dec 2010;17(12):1286-1296.
58. Govindarajan P, Larkin GL, Rhodes KV, et al., Patient-centered integrated networks of emergency care: consensus-based recommendations and future research priorities, *Acad Emerg Med,* 2010;17(12):1322-1329.
59. Kocher KE, Sklar DP, Mehrotra A, Tayal VS, Gausche-Hill M, Myles Riner R, Categorization, designation, and regionalization of emergency care: definitions, a conceptual framework, and future challenges, *Acad Emerg Med,* 2010;17(12):1306-1311.
60. McLeod B, Zaver F, Avery C, et al., Matching capacity to demand: a regional dashboard reduces ambulance avoidance and improves accessibility of receiving hospitals, *Acad Emerg Med,* 2010;17(12):1383-1389.
61. Mears GD, Rosamond WD, Lohmeier C, et al., A link to improve stroke patient care: a successful linkage between a statewide emergency medical services data system and a stroke registry, *Acad Emerg Med,* 2010;17(12):1398-1404.
62. Mehrotra A, Sklar DP, Tayal VS, Kocher KE, Handel DA, Myles Riner R, Important historical efforts at emergency department categorization in the United States and implications for regionalization, *Acad Emerg Med,* 2010;17(12):e154-e160.
63. Muelleman RL, Sullivan AF, Espinola JA, Ginde AA, Wadman MC, Camargo Jr CA, Distribution of emergency departments according to annual visit volume and urban–rural status: implications for access and staffing, *Acad Emerg Med,* 2010;17(12):1390-1397.
64. Pilgrim R, Hilton JA, Carrier E, et al., Research priorities for administrative challenges of integrated networks of care, *Acad Emerg Med,* 2010;17(12):1330-1336.
65. Pilgrim R, Martinez R, Jouriles N, et al., Administrative challenges to regionalization, *Acad Emerg Med,* 2010;17(12):1359-1363.

66. Rao MB, Lerro C, Gross CP, The shortage of on-call surgical specialist coverage: a national survey of emergency department directors, *Acad Emerg Med,* 2010;17(12):1374-1382.
67. IOM, *Regionalizing Emergency Care: Workshop Summary,* Washington, DC: The National Academies Press; 2010.
68. Ibid.
69. National Association of State EMS Officials, Regionalization of care: position statement of the National Association of State EMS Officials, *Prehosp Emerg Care,* Jul-Sep 2010;14(3):403.
70. Carr BG, Asplin BR, Regionalization and emergency care: the Institute of Medicine reports and a federal government update, *Acad Emerg Med,* 2010;17(12):1351-1353.
71. Carr BG, Martinez R, Executive Summary—2010 Consensus Conference, *Acad Emerg Med,* 2010;17(12):1269-1273.
72. IOM, *Emergency Medical Services at the Crossroads,* Washington, DC: The National Academies Press; 2007.
73. IOM, *Regionalizing Emergency Care: Workshop Summary,* Washington, DC: The National Academies Press; 2010.
74. Carr BG, Asplin BR, Regionalization and emergency care: the Institute of Medicine reports and a federal government update, *Acad Emerg Med,* 2010;17(12):1351-1353.
75. Carr BG, Martinez R, Executive Summary—2010 Consensus Conference, *Acad Emerg Med,* 2010;17(12):1269-1273.
76. Carr BG, Conway PH, Meisel ZF, Steiner CA, Clancy C, Defining the emergency care sensitive condition: a health policy research agenda in emergency medicine, *Ann Emerg Med,* Jul 2010;56(1):49-51.77. IOM, *Crossing the Quality Chasm: A New Health System for the 21st Century.* Washington, DC: National Academy Press; 2001.
78. Cairns CB, Garrison HG, Hedges JR, Schriger DL, Valenzuela TD, Development of new methods to assess the outcomes of emergency care, *Acad Emerg Med,* 1998;5:157-161.
79. Williams JG, Mears G, Brice JH, Raisor C, Cairns C, National Quality Forum Environmental Scan: Regionalized Emergency Medical Care Services; 2011. Available at www.qualityforum.org/Projects/n-r/Regionalized_Emergency_Care/Regionalized_Emergency_Care__Phase_1.aspx#t=2&s=&p=1%7C. Last accessed March 2011.
80. Glickman SW, Schulman KA, Peterson ED, Hocker MB, Cairns CB, Evidence-based perspectives on pay for performance and quality of patient care and outcomes in emergency medicine, *Ann Emerg Med,* May 2008;51(5):622-631.
81. Williams JG, Mears G, Brice JH, Raisor C, Cairns C, National Quality Forum Environmental Scan: Regionalized Emergency Medical Care Services; 2011. Available at www.qualityforum.org/Projects/n-r/Regionalized_Emergency_Care/Regionalized_Emergency_Care__Phase_1.aspx#t=2&s=&p=1%7C. Last accessed March 2011.
82. Ibid.
83. National Emergency Medical Services Information System, NEMSIS Project Overview and Version 3 Information, *National Emergency Medical Services Information System Web Site.* Available at www.nemsis.org/theProject/index.html. Last accessed June 2011.

84. McNally B, Stokes A, Crouch A, Kellermann AL, CARES: Cardiac Arrest Registry to Enhance Survival, *Ann Emerg Med,* Nov 2009;54(5):674-683 e672.
85. American College of Surgeons Committee on Trauma, *Regional Trauma Systems: Optimal Elements, Integration, and Assessment: Systems Consultation Guide,* Chicago, IL; 2008.
86. American College of Surgeons Trauma Programs, National Trauma Data Bank, 2008-2010. Available at www.facs.org/trauma/ntdb/index.html# and www.ntdsdictionary.org/. Last accessed May 2011.
87. Health Resources and Services Administration of the U.S. Department of Health and Human Services, Model Trauma System Planning and Evaluation; 2006. Available at www.ncdhhs.gov/dhsr/EMS/trauma/pdf/hrsatraumamodel.pdf.
88. Williams JG, Mears G, Brice JH, Raisor C, Cairns C, National Quality Forum Environmental Scan: Regionalized Emergency Medical Care Services; 2011. Available at www.qualityforum.org/Projects/n-r/Regionalized_Emergency_Care/Regionalized_Emergency_Care__Phase_1.aspx#t=2&s=&p=1%7C. Last accessed March 2011.
89. American College of Emergency Physicians⁄Physician Consortium for Performance Improvement⁄National Committee for Quality Assurance, Emergency Medicine Physician Performance Measurement Set; 2007. Available at www.ama-assn.org/ama1/pub/upload/mm/370/emergency-medicine-ms.pdf. Last accessed December 2010.
90. National Highway Traffic Safety Administration, Emergency Medical Services Performance Measures: Recommended Attributes and Indicators for System and Service Performance; 2009. Available at www.nasemsd.org/Projects/PerformanceMeasures/. Last accessed December 2010.
91. Williams JG, Mears G, Brice JH, Raisor C, Cairns C, National Quality Forum Environmental Scan: Regionalized Emergency Medical Care Services; 2011. Available at www.qualityforum.org/Projects/n-r/Regionalized_Emergency_Care/Regionalized_Emergency_Care__Phase_1.aspx#t=2&s=&p=1%7C. Last accessed March 2011.
92. IOM, *Regionalizing Emergency Care: Workshop Summary,* Washington, DC: The National Academies Press; 2010.
93. Carr BG, Martinez R, Executive Summary—2010 Consensus Conference, *Acad Emerg Med,* 2010;17(12):1269-1273.
94. Williams JG, Mears G, Brice JH, Raisor C, Cairns C, National Quality Forum Environmental Scan: Regionalized Emergency Medical Care Services; 2011. Available at www.qualityforum.org/Projects/n-r/Regionalized_Emergency_Care/Regionalized_Emergency_Care__Phase_1.aspx#t=2&s=&p=1%7C. Last accessed March 2011.
95. Cairns CB, Garrison HG, Hedges JR, Schriger DL, Valenzuela TD, Development of new methods to assess the outcomes of emergency care, *Acad Emerg Med,* 1998;5:157-161.
96. Glickman SW, Kit Delgado M, Hirshon JM, et al. Defining and measuring successful emergency care networks: A research agenda, *Acad Emerg Med,* Dec 2010;17(12):1297-1305.

97. Martinez R, Keynote address—Redefining regionalization: merging systems to create networks. *Acad Emerg Med,* 2010;17(12):1346-1348.
98. Rokos IC, Sanddal ND, Pancioli AM, Wolff C, Gaieski DF, Inter-hospital communications and transport: turning one-way funnels into two-way networks, *Acad Emerg Med,* Dec 2010;17(12):1279-1285.
99. NQF, *Measurement Framework: Evaluating Efficiency Across Patient-Focused Episodes of Care*, Washington, DC: NQF; 2009.
100. Hornbrook MC, Hurtado AV, Johnson RE, Health care episodes: definition, measurement and use, *Med Care Rev*, 1985;42(2):163-218.
101. NQF, *Measurement Framework: Evaluating Efficiency Across Patient-Focused Episodes of Care*, Washington, DC: NQF; 2009.
102. McLeod B, Zaver F, Avery C, et al., Matching capacity to demand: a regional dashboard reduces ambulance avoidance and improves accessibility of receiving hospitals, *Acad Emerg Med,* 2010;17(12):1383-1389.
103. Ibid.
104. Office of the Assistant Secretary for Preparedness and Response of the U.S. Department of Health and Human Services, Hospital Preparedness Program, 2002-2011. Available at www.phe.gov/Preparedness/planning/hpp/Pages/overview.aspx. Last accessed May 2011.
105. Office of Public Health Preparedness and Response of the Centers for Disease Control and Prevention, Public Health Preparedness Capabilities: National Standards for State and Local Planning; 2011. Available at www.cdc.gov/phpr/capabilities/. Last accessed May 2011.
106. Office of the Assistant Secretary for Preparedness and Response of the U.S. Department of Health and Human Services, Hospital Preparedness Program, 2002-2011. Available at www.phe.gov/Preparedness/planning/hpp/Pages/overview.aspx. Last accessed May 2011.
107. Office of Public Health Preparedness and Response of the Centers for Disease Control and Prevention, Public Health Preparedness Capabilities: National Standards for State and Local Planning; 2011. Available at www.cdc.gov/phpr/capabilities/. Last accessed May 2011.
108. ED was well prepared for no-diversion law, *ED Manag,* Mar 2010;22(3):33-34.
109. United States Code, Examination and treatment for emergency medical conditions and women in labor, *42 USC § 1395dd.*
110. Mears G, Glickman S, Moore F, Cairns C, Data based integration of critical illness and injury patient care from EMS to emergency department to intensive care unit, *Curr Opin Crit Care,* 2009;15:284-289.
111. U.S. Department of Transportation National Highway Traffic Safety Administration, Star of Life Emergency Medical Care Symbol: Background, Specifications, and Criteria; 1995. Available at www.ems.gov/vgn-ext-templating/ems/sol/index.htm. Last accessed May 2011.
112. Ibid.
113. National Highway Traffic Safety Administration, Emergency Medical Services Performance Measures: Recommended Attributes and Indicators for System and Service Performance; 2009. Available at www.nasemsd.org/Projects/PerformanceMeasures/. Last accessed December 2010.

114. Mears G, Glickman S, Moore F, Cairns C, Data based integration of critical illness and injury patient care from EMS to emergency department to intensive care unit, *Curr Opin Crit Care,* 2009;15:284-289.
115. Mears GD, Pratt D, Glickman SW, et al., The North Carolina EMS Data System: a comprehensive integrated emergency medical services quality improvement program, *Prehosp Emerg Care,* Jan-Mar 2010;14(1):85-94.
116. Glickman SW, Schulman KA, Peterson ED, Hocker MB, Cairns CB, Evidence-based perspectives on pay for performance and quality of patient care and outcomes in emergency medicine, *Ann Emerg Med,* May 2008;51(5):622-631.
117. Acosta CD, Kit Delgado M, Gisondi MA, et al., Characteristics of pediatric trauma transfers to a level i trauma center: implications for developing a regionalized pediatric trauma system in California, *Acad Emerg Med,* 2010;17(12):1364-1373.
118. Myers JB, Slovis CM, Eckstein M, et al., Evidence-based performance measures for emergency medical services systems: a model for expanded EMS benchmarking, *Prehosp Emerg Care,* Apr-Jun 2008;12(2):141-151.
119. NQF, *National Voluntary Consensus Standards for Ambulatory Care: Specialty Clinician Performance Measures*, Washington, DC: NQF; 2007. Available at www.qualityforum.org/Publications/2007/01/National_Voluntary_Consensus_Standards_for_Ambulatory_Care__Specialty_Clinician_Performance_Measures.aspx. Last accessed December 2010.
120. IOM, *Regionalizing Emergency Care: Workshop Summary,* Washington, DC: The National Academies Press; 2010.
121. Martinez R, Keynote address—Redefining regionalization: merging systems to create networks. *Acad Emerg Med,* 2010;17(12):1346-1348.
122. Kellermann AL, Martinez R, The ER, 50 years on, *N Engl J Med,* 2011 Jun 16;364(24):2278-9.
123. IOM, *Regionalizing Emergency Care: Workshop Summary,* Washington, DC: The National Academies Press; 2010.
124. Martinez R, Keynote address—Redefining regionalization: merging systems to create networks. *Acad Emerg Med,* 2010;17(12):1346-1348.
125. Galli R, Keith JC, McKenzie K, Hall GS, Henderson K, TelEmergency: a novel system for delivering emergency care to rural hospitals, *Ann Emerg Med,* Mar 2008;51(3):275-284.
126. Menchine MD, Baraff LJ, On-call specialists and higher level of care transfers in California emergency departments, *Acad Emerg Med,* Apr 2008;15(4):329-336.
127. Rudkin SE, Langdorf MI, Oman JA, Kahn CA, White H, Anderson CL, The worsening of ED on-call coverage in California: 6-year trend, *Am J Emerg Med,* Sep 2009;27(7):785-791.
128. Carr BG, Addyson DK, Geographic information systems and emergency care planning, *Acad Emerg Med,* 2010;17(12):1274-1278.
129. Donabedian A, Evaluating the quality of medical care, *Milbank Q,* 1966;44(3):166-206.
130. Mason S, Knowles E, Colwell B, et al., Effectiveness of paramedic practitioners in attending 999 calls from elderly people in the community: cluster randomised controlled trial, *BMJ,* Nov 3 2007;335(7626):919.

131. The Association of Critical Care Transport, About ACCT; 2011. Available at www.acctforpatients.org/. Last accessed June 2011.
132. Williams JG, Mears G, Brice JH, Raisor C, Cairns C, National Quality Forum Environmental Scan: Regionalized Emergency Medical Care Services; 2011. Available at www.qualityforum.org/Projects/n-r/Regionalized_Emergency_Care/Regionalized_Emergency_Care__Phase_1.aspx#t=2&s=&p=1%7C. Last accessed March 2011.
133. Alessandrini E, Varadarajan K, Alpern ER, et al., Emergency department quality: an analysis of existing pediatric measures, *Acad Emerg Med,* May 2011;18(5):519-526.
134. IOM, *Crossing the Quality Chasm: A New Health System for the 21st Century.* Washington, DC: National Academy Press; 2001.
135. Alessandrini E, Varadarajan K, Alpern ER, et al., Emergency department quality: an analysis of existing pediatric measures, *Acad Emerg Med,* May 2011;18(5):519-526.
136. Cairns CB, Maier RV, Adeoye O, et al., NIH Roundtable on Emergency Trauma Research, *Ann Emerg Med,* Nov 2010;56(5):538-550.
137. Kaji AH, Lewis RJ, Beavers-May T, et al., Summary of NIH Medical-Surgical Emergency Research Roundtable held on April 30 to May 1, 2009, *Ann Emerg Med,* Nov 2010;56(5):522-537.
138. D'Onofrio G, Jauch E, Jagoda A, et al., NIH Roundtable on Opportunities to Advance Research on Neurologic and Psychiatric Emergencies, *Ann Emerg Med,* Nov 2010;56(5):551-564.
139. Cairns CB, Garrison HG, Hedges JR, Schriger DL, Valenzuela TD, Development of new methods to assess the outcomes of emergency care, *Acad Emerg Med,* 1998;5:157-161.
140. Ibid.
141. Ibid.
142. McNally B, Stokes A, Crouch A, Kellermann AL, CARES: Cardiac Arrest Registry to Enhance Survival, *Ann Emerg Med,* Nov 2009;54(5):674-683 e672.
143. Mears G, Glickman S, Moore F, Cairns C, Data based integration of critical illness and injury patient care from EMS to emergency department to intensive care unit, *Curr Opin Crit Care,* 2009;15:284-289.
144. Mears GD, Pratt D, Glickman SW, et al., The North Carolina EMS Data System: a comprehensive integrated emergency medical services quality improvement program, *Prehosp Emerg Care,* Jan-Mar 2010;14(1):85-94.
145. National Quality Forum (NQF), Measure Evaluation Criteria, December 2009. Available at www.qualityforum.org/Measuring_Performance/Consensus_Development_Process%e2%80%99s_Principle/Candidate_Consensus_Standard_Review.aspx. Last accessed October 2010.
146. Glickman SW, Schulman KA, Peterson ED, Hocker MB, Cairns CB, Evidence-based perspectives on pay for performance and quality of patient care and outcomes in emergency medicine, *Ann Emerg Med,* May 2008;51(5):622-631.
147. Spertus JA, Eagle KA, Krumholz HM, Mitchell KR, Normand ST, American College of Cardiology and American Heart Association methodology for the selection and creation of performance measures for quantifying the quality of cardiovascular care, *Circulation,* 2005;111:1703-1712.

148. American College of Emergency Physicians/Physician Consortium for Performance Improvement/National Committee for Quality Assurance, Emergency Medicine Physician Performance Measurement Set; 2007. Available at www.ama-assn.org/ama1/pub/upload/mm/370/emergency-medicine-ms.pdf. Last accessed December 2010.
149. National Highway Traffic Safety Administration, Emergency Medical Services Performance Measures: Recommended Attributes and Indicators for System and Service Performance; 2009. Available at www.nasemsd.org/Projects/PerformanceMeasures/. Last accessed December 2010.
150. Glickman SW, Schulman KA, Peterson ED, Hocker MB, Cairns CB, Evidence-based perspectives on pay for performance and quality of patient care and outcomes in emergency medicine, *Ann Emerg Med*, May 2008;51(5):622-631.
151. Pines JM, Fee C, Fermann GJ, et al., The Role of the Society for Academic Emergency Medicine in the development of guidelines and performance measures, *Acad Emerg Med*, 2010;17(11):e130-e140.
152. National Emergency Medical Services Information System, NEMSIS Project Overview and Version 3 Information, *National Emergency Medical Services Information System Web Site.* Available at www.nemsis.org/theProject/index.html. Last accessed June 2011.
153. American College of Surgeons Trauma Programs, National Trauma Data Bank, 2008-2010. Available at www.facs.org/trauma/ntdb/index.html# and www.ntdsdictionary.org/. Last accessed May 2011.
154. Mears GD, Pratt D, Glickman SW, et al., The North Carolina EMS Data System: a comprehensive integrated emergency medical services quality improvement program, *Prehosp Emerg Care*, Jan-Mar 2010;14(1):85-94.
155. Myers JB, Slovis CM, Eckstein M, et al., Evidence-based performance measures for emergency medical services systems: a model for expanded EMS benchmarking, *Prehosp Emerg Care*, Apr-Jun 2008;12(2):141-151.
156. NQF, *National Voluntary Consensus Standards for Ambulatory Care: Specialty Clinician Performance Measures*, Washington, DC: NQF; 2007. Available at www.qualityforum.org/Publications/2007/01/National_Voluntary_Consensus_Standards_for_Ambulatory_Care__Specialty_Clinician_Performance_Measures.aspx. Last accessed December 2010.
157. Dunford J, Domeier RM, Blackwell T, et al., Performance measurements in emergency medical services, *Prehosp Emerg Care*, Jan-Mar 2002;6(1):92-98.
158. Dawson DE, National Emergency Medical Services Information System (NEMSIS), *Prehosp Emerg Care*, Jul-Sep 2006;10(3):314-316.
159. Williams JG, Mears G, Brice JH, Raisor C, Cairns C, National Quality Forum Environmental Scan: Regionalized Emergency Medical Care Services; 2011. Available at www.qualityforum.org/Projects/n-r/Regionalized_Emergency_Care/Regionalized_Emergency_Care__Phase_1.aspx#t=2&s=&p=1%7C. Last accessed March 2011.