

Regionalized Emergency
Medical Care Services:
Emergency Department
Crowding and Boarding,
Healthcare System
Preparedness and Surge
Capacity - Performance
Measurement Gap
Analysis and Topic
Prioritization

FINAL REPORT

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NATIONAL
QUALITY FORUM

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Regionalized Emergency Medical Care Services: Emergency Department Crowding and Boarding, Healthcare System Preparedness and Surge Capacity - Performance Measurement Gap Analysis and Topic Prioritization

FINAL REPORT

Introduction

Background

In 2006, the Institute of Medicine (IOM) highlighted the strain on the nation's acute and emergency medical care systems, calling for analysis of weaknesses and improvements in its function. Research has consistently reported associations between higher levels of crowding and boarding with poorer outcomes for patients, and naturally occurring disasters disturb the ebb and flow normally seen within a health system, causing increased surges of patients as was seen during Hurricane Katrina (2005), H1N1 (2009), and the recent Superstorm Sandy (2012). These events highlight the critical role of our nation's healthcare infrastructure in safely meeting high levels of demand during local and national crises.^{1,2,3,4,5}

It is important to measure and improve crowding in U.S. emergency departments (EDs) and hospitals, not only to improve day-to-day patient care, but to also ensure that hospitals can respond to a surge of patients during a disaster, ensuring patient quality, while maintaining safe hospital operations. The Office of the Assistant Secretary for Preparedness and Response (ASPR) reemphasized the critical need to protect and secure our nation's healthcare system and public health infrastructure with its January 2012 release of "Healthcare Preparedness Capabilities: National Guidance for Healthcare System Preparedness".^{6,7} The document provides national guidance for system preparedness for hospitals, healthcare systems and ASPR Emergency Support Function (ESF) #8 partners (Public Health and Medical Services Annex) in order to prevent, respond to, and rapidly recover from a mass casualty incident or medical surge.⁸

Regionalization is also critical to effective emergency response. The concept of "regionalization" is the process of emphasizing community and population-based approaches to managing acutely ill and injured patients with the goal of reducing system-wide crowding, promoting timely care for all patients, ensuring that patients with time-critical illnesses receive the highest quality care, and holding hospitals accountable for system-wide performance during disasters and daily operations.⁹ Regional-level performance measures hold hospitals and other healthcare entities, such as nursing homes and community health centers, within that region accountable for their peers' performance as well as their own. By measuring performance at this level we can link acute care quality to population health.

Measurement is vital to promoting the cooperation necessary to achieve high quality care. Previous research has shown that when hospitals lack effective ways to coordinate care with their peers the demand for care outstrips supply, and hospitals must divert critically ill patients to other hospitals, or provide rapid transfer of critically ill patients to other facilities because of a time-critical illness (stroke,

trauma, acute myocardial infarction, or post cardiac arrest) that cannot be treated on-site.^{10,11} These issues are only exacerbated during local or national crises and can rapidly overwhelm a hospital.

Objectives

Despite calls for reducing crowding and the IOM's appeal to end the boarding of admitted patients, ED crowding continues to worsen in U.S. hospitals. While there has been a proliferation of proven interventions to reduce ED and hospital crowding and boarding, many hospitals do not have a strategy to address the crowding issue locally.

To improve quality and performance, measurement of hospitals and health care systems related to crowding and boarding is needed for public reporting and accountability purposes. The development of performance measures for emergency preparedness and response will help assess the relationship of boarding and crowding to daily operations and will ultimately help improve the nation's capacity and capability to respond to, and recover from a disaster.

In order to ensure accountability at multiple levels, it is important that performance measures of crowding, boarding, preparedness and response include regionalization. This will encourage hospitals and health systems engage in cooperative competition or "coopetition," where they may continue to compete but will have an incentive to work together for the greater cause of improving ED quality and flow, and ensuring that a local area is prepared for a disaster or mass casualty event.

The National Quality Forum (NQF) is instrumental in advancing efforts to improve quality through the endorsement of performance measures for accountability and quality improvement purposes. NQF, a private, not-for-profit organization, operates under a three-part mission to improve the quality of American healthcare by:

1. Building consensus on national priorities and goals for performance improvement and working in partnership to achieve them.
2. Endorsing national consensus standards for measuring and publicly reporting on performance.
3. Promoting the attainment of national goals through education and outreach programs.

For more than a decade, NQF has been recognized as a voluntary-consensus standards-setting organization as specified by the National Technology and Transfer Advancement Act of 1995 and Office of Management and Budget Circular A-119. NQF employs a formal Consensus Development Process (CDP) to evaluate and endorse consensus standards, including performance measures, best practices, frameworks, and reporting guidelines. Using this rigorous process, NQF fosters consensus among a wide variety of stakeholders around specific standards that can be used to measure and publicly report healthcare quality. An NQF endorsement reflects rigorous scientific and evidence-based review, input from patients and their families, and the perspectives of individuals throughout the healthcare industry.

The intent of this project is to provide guidance to the field regarding priority areas for performance measure development, additional research needs, and the NQF criteria as it relates to the development of future performance measures in this topic area (i.e., measures that could be submitted to NQF in response to a future NQF related project). To develop the report, NQF convened a 27-member, multi-stakeholder Expert Panel for an in-person meeting on October 17th, 2012. In addition, the Panel met several times via conference call.

This report discusses priority areas and reviews issues to consider in the development of candidate voluntary consensus standards for hospitals, healthcare systems and regions in the areas of ED and hospital crowding including, boarding and diversion, emergency preparedness, and surge capacity.^{12,13} This report aims to connect the concepts of crowding, preparedness and response, and regionalization, with regard to how these concepts could be measured and reported at the facility or health system level, and potentially rolled up to the regional or healthcare coalition level (population level) for shared accountability. Finally, the report also provides recommendations on performance measures that address these concepts, and explores potential adaptation of existing performance measures and measure concepts for further development and testing.

Previous NQF Work on REMCS Topics

An existing environmental scan to identify measure concepts and performance measures in the field was used to inform the work of this project. NQF's Regionalized Emergency Medicine Care Services (REMCS) Emergency Preparedness Environmental Scan (Appendix A) yielded 81 performance measures mapped to Domain 1 (Capability, Capacity and Access) of the NQF REMCS Framework, which also includes REMCS measurement definitions, key terms to establish a common vocabulary for understanding constructs within REMCS, and guiding principles regarding future development of structural, process and outcome measures. The scan also included measure concepts within regionalized emergency care systems.

The majority of measures in the environmental scan were developed by federal or state agencies and focus on preparedness and response: responder safety and timing, medical material distribution, and local health department collaborations; none of these measures are NQF endorsed®. While there are some measures addressing ED crowding have been endorsed by NQF, only measure concepts exist in other areas, including ambulance diversion. The scan also confirmed that measuring regionalization in emergency care is still in its infancy.

Regionalization has important policy implications for quality of care, hospital finances and the provision of timely acute and critical care. Without the ability to measure these concepts in EDs and hospitals at a national level, researchers and policymakers cannot understand the baseline level of preparedness and potential capacity within the emergency care system. There is general agreement that grounding these measures geographically—at the hospital, health system, community and regional level—would enable such measurements; however, defining appropriate geographic boundaries remains a challenging task.

Regionalized Emergency Medical Care Services: Phase I

Condition-specific measures related to cardiac care, stroke, trauma and pediatrics were previously identified in the [REMCS Phase I Final Report](#). While gaps were noted in the areas of toxicology and psychiatric care measures, it was recommended that future measurement efforts focus on creating or identifying measures of REMCS that focus on time-sensitive, high-acuity or life-threatening care, and identifying measures that evaluate systems of care. Identification of measure developers and stewards to facilitate development and testing of performance measures was also recommended as part of an intentional process to ensure rigor and standardization of measures for implementation.

National Voluntary Consensus Standards for Emergency Care: Phase I and II

This project also expands on NQF's previous consensus development process work in the emergency care arena ([Emergency Care: Phase I and II](#)) which endorsed consensus standards for emergency care providers and system performance. As part of Phase I, NQF endorsed 12 national voluntary consensus standards related to ED transfers. In Phase II, NQF endorsed additional national voluntary consensus standards that addressed timeliness, access, communication, care coordination, and efficiency in hospital-based EDs. Endorsed performance measures that begin to specifically address the issues around crowding and boarding at the facility level included:

- [0495: Median Time from ED Arrival to ED Departure for Admitted ED Patients](#) (CMS)
- [0496: Median Time from ED Arrival to ED Departure for Discharged ED Patients](#) (CMS); and
- [0497: Admit Decision Time to ED Departure Time for Admitted Patients](#) (CMS)¹⁴

Measures that were not endorsed included:

- *ED-007-08: ED Length of Stay (LSUHCSO)*: This measure examined the mean time between patient presentation to the ED and departure from the ED via admission, discharge, or transfer. The Steering Committee believed that the measure is easy to collect and addresses an important safety issue but lacks granularity. Ultimately, the Steering Committee concluded that the patient population and the intent of the measure were subsumed by other measures and, therefore, did not recommend the measure for endorsement.
- *ED-004-08: Inpatient Admission (LSUHCSO)*: This measure examined the time from first contact in the ED to when the patient first sees the physician (provider). This time period is viewed as important because it is when the patient may leave without being seen. The Steering Committee believed that this measure did not assess the quality of care in the ED because of the varying types of patients seen. The Steering Committee noted that the measure could be routinely collected and could be used as part of a cohort stratification methodology for comparing EDs. Ultimately however, the Steering Committee concluded the measure would serve well as an internal hospital quality improvement initiative rather than for hospital comparison to assess the intensity or severity of the condition of its ED patients.

Emergency Department Crowding and Boarding

In 2006, the Institute of Medicine (IOM) identified ED crowding as a nationwide crisis.¹⁵ Crowding within ED occurs when there is an insufficient supply of resources (e.g., beds or space) during episodes of high demand for services. Across the U.S., crowding is a problem in over 90 percent of EDs.¹⁶ There are several causes of ED crowding, including progressively higher ED volume in the face of shrinking ED capacity, higher complexity care in the ED, and boarding, where often admitted patients spend prolonged periods of time in the ED long after the decision has been made to admit them to the hospital.^{17,18} One of the major causes of crowding is also poor “downstream” flow, where hospital floors themselves are frequently overcrowded for a variety of reasons (i.e., discharge delays for non-medical reasons). Limited availability of specialty physicians can also contribute to crowding and delays in care. Similarly, limitations in hospital bed availability leads to overflow, or boarding in the ED, which in turn causes crowding. As such, “crowding” as a concept is often mislabeled as an ED problem when often time’s downstream bottlenecks are frequently the cause, and ED crowding is the manifestation of poor system-wide flow.

Despite efforts aimed at reducing crowding and ending the boarding of admitted patients, the problem continues to worsen in U.S. hospitals. While there has been a proliferation of proven interventions to reduce ED crowding and boarding, many hospitals have not implemented strategies to address the crowding issue locally. Therefore continued measurement and public reporting is needed in order to hold hospitals accountable, in conjunction with incentives for improvement.

Measurement Issues in Emergency Department Crowding

A recent systematic review, separate from the Environmental Scan performed by NQF, identified 71 unique performance measures of ED crowding in the medical literature, demonstrating the wide variability in metrics and perspective.¹⁹ The review suggested that time intervals and numerical counts of patients in the ED such as waiting room number or ED census are the most prominent in the literature, along with observable results of a crowded ED such as ‘left-without-being-seen’ rates or diversion hours. Broadly, the former two types of crowding measures diverge into two categories: patient flow and nonflow. Patient flow relies on time intervals (ED length of stay, door-to-provider time, or boarding time), but are limited in that they are difficult to observe in real-time and objectively assess how crowded an ED is at a point-in-time. However, time interval measures were found in the review to be more generalizable across sites, in part because timestamps in the ED have been shown to accurately reflect care times.²⁰

Nonflow measures by comparison, reflect the more traditional concept of crowding as this is often what staff observes during episodes of crowding: a fully occupied ED with a packed waiting room. Nonflow measures have primarily been used in hospital-based studies associating the crowded state with patient-oriented outcomes such as quality of care including time to antibiotics or pain medication, and downstream outcomes such as complications, errors, or mortality.^{21,22,23} Examples of these measures include ED patient census, number of waiting patients, and number of boarders. The major advantage of these measures is that they are easier to observe in real-time; however, they are difficult to observe across settings and are not comparable among similar settings.²⁴ Despite this, a major theme of the review was that simpler measures, rather than measures that rely on detailed calculations are more desirable and feasible for the end user.

Conceptual Model of Crowding and the Acute Care System

A widely accepted conceptual framework of crowding and the acute care system²⁵ is the input–throughput–output model.²⁶ (Figure 1) In this framework, input factors are the demand for emergency services. These services fall into three categories: (1) emergency care, (2) unscheduled urgent care that occurs within EDs, and (3) safety net care for vulnerable patient populations with poor access or other barriers to non-ED care. Throughput factors include care that is received in the ED (i.e., initial triage and evaluation of patients) ED care, and treatment decisions. Throughput also encompasses ambulance diversion, which occurs when EDs are overcrowded, and ED boarding, when no inpatient beds are available or there are slow and inefficient transitions of care between the ED and inpatient beds. Lastly, the model includes output factors such as patient disposition or transfer to other hospitals. The Panel discussed several factors that contribute to ED crowding which were not included in the model, including poor hospital and system-wide flow, causing the healthcare system to become congested and “back-up” in the ED. For example, if a nursing home does not have sufficient bed space, then a hospital may not be able to discharge a patient. This in turn leads to boarding in the ED, causing ED crowding as the observed “effect” of poor system-wide flow.

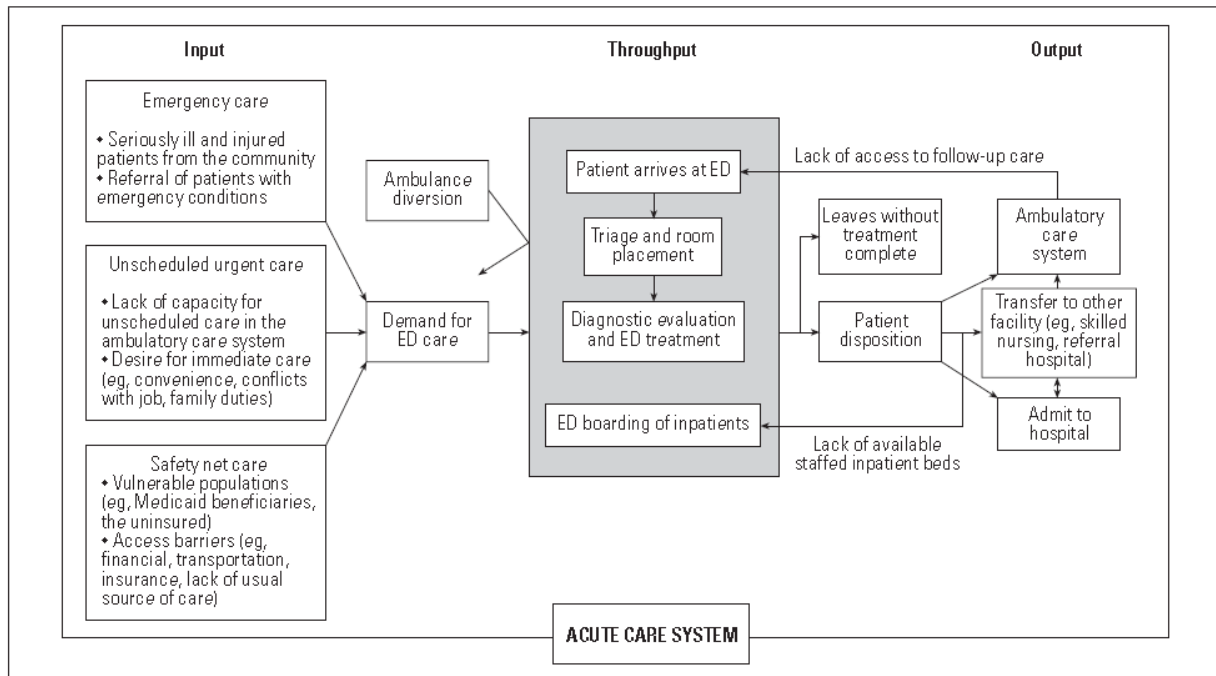


Figure 1: The input-throughput-output model of ED crowding (from Asplin et al. Ann Emerg Med 2003)

The majority of current performance measures and measure concepts of ED crowding focus on ED throughput: detailing the movement of patients from ED arrival, boarding, and transfer to an inpatient bed. The current NQF portfolio of measures includes few measures of downstream system capacity. For existing throughput measures several panelists also thought it was important to differentiate value-added versus non-value added time in the ED, particularly for measures of ED throughput. Value-added time was seen as time that provided direct benefit to the patient (i.e., initial work-up and treatment) while other time increments such as spending time in the waiting room or boarding after admission were seen as non-value-added. Delays in hospital throughput can cause ED crowding and boarding, as the ED is commonly used for hospital overflow. Therefore, measuring hospital-flow, such as assessing the average length of stay for specific conditions, may serve as an indirect measure of ED crowding.

Based on Asplin’s conceptual model of ED crowding, it becomes apparent that input and output measures still need to be developed. Performance measures that capture broader concepts in crowding would be helpful in defining upstream causes and downstream impacts of ED crowding and boarding. Specifically, measure developers may want to consider developing input measures that examine ED input metrics of volume per day, by community or region and measures that are specified to examine triage acuity. Demand for ED services or the “inputs” into the system may serve as a barometer to monitor quality of care and access in a community, outside the ED. For example, these measures could include safety net populations, such as the number of visits by uninsured or homeless patients. Alternatively, direct measures of access could be developed, such as waiting times for doctor’s appointments, or proportion of the population with a regular source of medical care. Examining these inputs would also provide an indicator of the degree to which local outpatient clinics care provide care and prevent complications for low-acuity patients, as care for these patients is often provided in the ED when complications arise.

Measure developers may also want to consider developing output performance measures at the regional and facility level that assess post-discharge placement issues, such as nursing home bed

availability or the availability of psychiatric beds, which frequently contribute to prolonged ED boarding. Using electronic health records and building better data systems to accurately capture patient information or output measures would allow measures to capture information relating to follow-up for ED patients, ultimately impacting both ED and hospital crowding. For example, measures assessing the proportion of patients referred for short-term follow-up care after discharge from the ED who were able to successfully attend a follow-up appointment would be useful. Another example is measuring the quality of care for transfers from EDs to other facilities or alternatively, measures of ED revisit or readmission. However, given the limitations of current data platforms and challenges with system interoperability, developing these measures is challenging. Investments must be made to develop data platforms that can capture meaningful patient data and allow sharing of information to progress regionalization of care.

Unintended Consequences

During the Panel discussion, several members expressed concern over potential unintended consequences of ED crowding measurement in hospitals, one of which could be rushed dispositions. Specifically, the Panel felt that hastening the decision to admit rather than taking more time to coordinate care so that a patient could be discharged, would lead to an increase in admissions for patients who could be effectively managed in the community. In order to avoid potential unintended consequences of individual, single-focus performance measures, it was suggested that balancing measures (measures assessing broader aspects of crowding) be used to address transitions of care, particularly regarding the older adult population, behavioral health patients, and patient transfers to outside facilities.

There were also concerns about the role of observation services in crowding measurement. Panel members agreed measure developers should consider the use of observation units in measuring turnaround time; for example, a measure assessing whether patients in the ED are transitioned to observation status or remain in the ED could balance measures assessing time spent in the ED. Panelists identified transfers as another potential area for balancing measures; for example, measures assessing turnaround time to transfer to another hospital, as well as admit and discharge decisions. Members also noted potential implications for disaster preparedness, depending on how observation and transfers are used by hospitals and systems in times of crisis.

Data Sources

One of the necessary data elements for crowding measurement is timestamps as a patient moves in, within, and out of the ED. Using timestamps allows performance measures such as length of stay to be calculated. These data sources include hospital-based paper systems where timestamps or patient volume can be extracted, electronic patient tracking systems where timestamps are commonly found, and claims-based systems that currently capture many output-related crowding data elements. In addition, other count measures can be used to measure crowding, such as ED patient volume, or left-without-being-seen rates, which may be available in hospital databases. A limitation, however, is that many of the current data systems are not designed to capture data elements for the upstream causes of crowding and downstream causes of crowding, nor consequences of crowding. For example, data that integrates information across settings such as from pre-hospital settings to the ED and between EDs and skilled nursing facilities may be helpful in facilitating and measuring care coordination between settings. Data that can go beyond looking at community access and provide more detailed information, such as patterns of primary care physician referrals to the ED, or information on waiting times for appointments in ambulatory settings could support such measures. Currently, efforts to connect Emergency

Management Services (EMS) data systems and the ED, as well as creating common data platforms to facilitate care coordination are actively being developed at the state level. Such efforts should be undertaken at the national level for future measure development which focuses on ED input and output.

Other types of data such as data exploring access to care, acute unscheduled care, safety net care, or transitions of care back to the community may also be helpful to measure upstream and downstream causes of ED crowding. Finally, deconstructing the consequences related to ED crowding such as medical errors may be a challenge; however, as more robust data systems are developed to record medical errors and their causes, measure developers may consider crowding or boarding-related errors to be measures of patient safety.

Definition of Terms in ED Crowding and Boarding

Consistency in defining key terms for ED crowding and boarding is fundamental for measure development. Two recent reports have described lexicons for ED crowding; specifically, the “times” that a patient experiences as he or she moves through an ED. The definitions from these reports are similar but not identical; and the differences reflect minor discrepancies rather than fundamental differences.^{27,28}

One area of controversy, however, has been the definition of ED boarding time. Several groups have defined ED Boarding differently in recent years.

- In the 2008 NQF endorsed® performance measures, ED boarding time was defined as the median decision to admit to departure time.
- Rather than defining the start of boarding per se, the American College of Emergency Physicians (ACEP) has defined a “boarded patient” as a one who “remains in the ED after the patient has been admitted to the facility, but has not been transferred to an inpatient unit.”²⁹
- In 2010, the Emergency Department Benchmarking Alliance (EDBA) defined the concept of boarding more broadly as “[t]he practice of holding patients who have been admitted to the hospital in the ED for prolonged periods. Defined as a time interval, it encompasses the admit decision time to the departure time” in its Emergency Department Operations Dictionary.³⁰ This definition is similar to the NQF definition from 2008.

The most recent version of the Joint Commission’s Patient Flow Standard, defines “boarding” as four hours or more after the decision to admit. The Panel agreed that given the differences in the definition of when boarding starts, sharing a common language will be essential for performance measure development. The Panel also agreed that the time of the decision to admit should be the start of the ED boarding time, which would continue until the patient physically departs the ED.

One of the reasons for the Joint Commission setting a specific time interval as “allowable” for boarding was the potential for boarding to be construed as a failure of the system. During the Panel discussion, the group stressed that patient boarding should not be construed as a failure, but agreed that prolonged boarding times should be considered system failures and represented “non-value-added” time for patients. The Panel also noted that there is limited evidence about appropriate boarding times. However, given the link to crowding and adverse outcomes, boarding times should be measured and reported consistently across hospitals. The Panel also recommended that measure developers focus on outcomes related to boarding. These include medical errors during the boarding time, and performance measures assessing other complications that may arise after the decision to admit is made and prior to

departure from the ED, as well as patient experience. This is because studies have linked boarding and prolonged length of stay to adverse clinical outcomes.^{31,32} The Panel again highlighted the need for balancing measures to reduce the ability of facilities to game the system (e.g., a very short average boarding time and a very long overall ED length of stay could indicate gaming).

Joint Commission Patient Flow Standard

In May 2012, the Joint Commission revised its [patient flow standard](#) (Standard LD.04.03.11).³³ The standard specifically requires that hospitals must have processes to support flow of patients throughout the hospital and plan for the care of admitted patients in temporary bed locations or overflow locations, such as the ED. In the Joint Commission's standard, hospitals must also have criteria to guide ambulance diversion decisions. They must also set goals and components for the patient flow process; including the safety of areas where patients receive treatment, and provide results to individuals who manage flow processes. These plans and processes could potentially be developed into performance measures for consideration by NQF.

Elements that will go into effect in January 2014 include EP 6-9, which specifically recommends hospitals set goals for managing the boarding of admitted patients in the ED. According to the standard, "it is recommended that boarding timeframes not exceed 4 hours in the interest of patient safety and quality of care."³⁴ In addition, results should be reported and reviewed by leadership to assure that goals are achieved, and actionable steps to improve processes are taken when they are not achieved. Finally, if the hospital has a population at risk for boarding due to behavioral health emergencies, leaders must communicate with behavioral health providers or authorities in the community to foster care coordination.³⁵

Risk-Adjustment

The Panel discussed in detail the possibility of risk adjustment in the measurement of ED crowding and boarding at the level of hospital and healthcare system. Current NQF-endorsed[®] measures of ED crowding, including ED length of stay and ED boarding time, are not specified with a risk-adjustment methodology, yet studies have shown that many factors predict length of stay including: ED volume, metropolitan statistical area, teaching hospital status, age-mix and case-mix.^{36, 37} Similarly there are disparities in care with regards to race and ethnicity.³⁸

Several pros and cons to reporting unadjusted versus adjusted or stratified data were considered by the Panel. Reporting unadjusted data is the most accurate representation of the patient experience. For example, if the average length of stay is five hours, that is most easily understandable by patients and important to patients. However, because exogenous factors have been shown to be major determinants of length of stay according to data from the National Hospital Ambulatory Medical Care Survey, reporting unadjusted data may unfairly penalize hospitals with more complex patient populations. The benefit of risk-adjustment is that it may allow for a fairer comparison of hospital performance after adjusting for intrinsic patient factors. However, risk-adjusted measures may be less meaningful to patients and a complex risk-adjustment system that takes into account patient characteristics has yet to be developed and validated.

The Panel also discussed potential stratification using hospital comparison groups based on Socioeconomic Status (SES) category (comparing hospitals with similar percentages of low SES), as a means to surface any disparities of care, and provide information which might better inform policy decisions especially with regard to the possible unintended consequences associated with diverting

resources away from vulnerable populations based on factors beyond the control of an individual institution. However, NQF measure evaluation criteria indicate that in general, factors associated with disparities in care (i.e., race, ethnicity, SES) should not be included in risk adjustment models.³⁹

Other potential ways to stratify the data may include using ED visit volume or metropolitan statistical area (MSA) versus non-MSA status.

Time Targets

Several countries have set specific time-targets for ED length of stay, including Canada, New Zealand, parts of Australia, and the United Kingdom. The potential benefit of time targets include holding a hospital accountable for a specific time that patients spend in the ED and limiting prolonged ED-based work-ups and boarding times.

In Canada, there is currently a series of time targets, where low-acuity patients should stay less than four hours while higher acuity patients should stay less than 8 hours.⁴⁰ Western Australia currently has a four-hour target.⁴¹ New Zealand recommends that 95 percent of ED patients be treated and discharged within six hours.⁴² Neither Western Australia nor New Zealand stratifies time targets by severity or acuity.

In the United Kingdom, the National Health Service instituted a maximum length of stay of four hours in the ED in 2004.⁴³ At the time of implementation this measure was controversial because no specific data existed to justify a time limit of four hours and the limited number of two-percent exceptions deemed too small to account for all clinical exigencies. The standard was phased in over the next year and as of January 2005, 98 percent of ED patients were treated and discharged or admitted within four hours. By 2008 and 2009, about 97 percent of all ED patients in the United Kingdom spent less than four hours in the ED.⁴⁴ In January 2012, the standard was de-emphasized due to a combination of concerns including unintended consequences, a desire to focus more on quality provided rather than time spent in the ED, a desire reduce the threshold to a more reasonable 95 percent, and a change in government. Studies at that time reported an increase in dispositions in the 20 minutes prior to when a patients four-hour time limit was expected to expire.⁴⁵ This raised the possibility that hasty decisions to meet the four-hour standard were occurring. New data suggests however, that quality was not compromised by use of a four-hour time target.⁴⁶

The unintended consequences of a time targets may be to force a decision (admission or discharge) within a specific time-frame resulting in either early discharge or early admission to the hospital or other setting. However, an alternative argument would be that time targets may be appropriate, and the experience in the United Kingdom may reflect that four-hours may have been too short a time to expect a decision to be made, or that time targets should be stratified by acuity. When developing the next phase of crowding performance measures for U.S. hospitals, consideration may be given to setting specific time targets and possibly stratifying measurement by acuity or another clinical adjustor. The Panel discussed the differences between the United Kingdom approach and the Canadian approach, which uses a standard triage system. The Panel felt that time targets should be considered in the U.S., although a standard, specific time (e.g., the four-hour time target) might not be an appropriate performance measure, without a method of stratifying patients or adjusting for case-mix. Using a time target that does not have a strict endpoint, but rather measures patients along a continuum of time spent in the ED, may also be more appropriate way to measure ED times. Using time targets with a

lower bar, such as 95 percent instead of 98 percent also provides more clinical leeway in assessing ED length of stay.

The Panel expressed a desire for stratification of patients; however, as mentioned before, there is no broad, validated approach to stratification that has been developed using claims data. In addition, because of the heterogeneity in triage scales used in the U.S., it is currently impossible to use triage acuity for this explicit purpose. One possible way to stratify time targets is by patient disposition (admission v. discharge v. transfer); however, unintended consequences of this approach should be considered. Stratification approaches could include ED discharge diagnosis codes, reason for visit, or standardized “reverse triage” strategies. The Panel considered a recommendation relating to standardizing triage acuity scales in the U.S. The recommendation was not pursued as discussion revealed that EDs are increasingly redesigning their input strategies to remove the triage step in order to improve timeliness. Making a recommendation around triage standardization could discourage improvement, and potential measures would fall outside the workflow of EDs and hospitals that have moved away from the triage step.

Measures of Central Tendency

When reporting ED crowding data, current NQF-endorsed® performance measures recommend reporting the median time, as opposed to the mean, due to the skewed nature of length of stay data. However, the Panel agreed that reporting the median alone may not capture the variation of crowding within a hospital, healthcare system, or region. Specifically, because of the periodic nature of crowding, the average or median time may appear relatively short while outlier times (such as the 90th percentile) may be much longer, especially on days of high volume or severity. When reporting ED crowding data, presenting median data along with measures of variance should be considered.

Structural measures

Several ED-based interventions to help alleviate crowding and boarding have been associated with improvements in crowding and patient safety.⁴⁷ These include: the presence of an ED-based fast-track for low acuity patients, a physician-in-triage who is able to treat and discharge minor patients rapidly and initiate care earlier, and immediate bedding where triage is suspended during times where capacity is less than full. Other downstream interventions are also effective such as full-capacity protocols where admitted patients can move to inpatient hallways when the ED is overloaded, early hospital discharge protocols to empty inpatient bed capacity, and surgical schedule smoothing where elective admissions are more evenly distributed throughout the week – all of which even out demands for hospital beds and reducing ED crowding. In addition, interventions that focus on specific populations that aim to reduce crowding may also be appropriate, such as the presence of a pediatric ED or a geriatric ED.

The presence of these interventions within an ED or hospital may serve as structural measures of how a hospital has responded and intervened to alleviate high rates of ED crowding and improve quality for specific high-risk populations who would normally be adversely impacted. There is also some evidence that these interventions are underused.⁴⁸ In addition, structural measures of emergency care workforce may be useful (e.g., specific staffing levels in an ED or hospital, or alternatively, the timely availability of on-call specialists to handle emergencies). Developers should also consider structural measures for specific populations like pediatrics. For example, a structural measure could focus on whether clinical staff has pediatric certifications or whether a pediatric coordinator is present in general EDs to take care of pediatric patients.

A possible model to consider is NQF endorsed measure #[1909: Medical Home System Survey \(MHSS\)](#) (NCQA). This measure includes evidence-based structural elements used to assess a particular domain of the patient-centered medical home. The following 6 composites are generated from the Medical Home System Survey (MHSS).

- Measure 1: Enhance access and continuity
- Measure 2: Identify and manage patient populations
- Measure 3: Plan and manage care
- Measure 4: Provide self-care support and community resources
- Measure 5: Track and coordinate care
- Measure 6: Measure and improve performance

Panel members noted that this construct could serve as a model for boarding and crowding interventions, as well as some preparedness and response structures. However, measure developers would need to provide evidence of an association between specific structures (or groups of structures) and hospital flow, quality, outcomes or preparedness, in order to justify structural measures as performance measures.

Reframing the Issue of “ED Crowding”

During the Panel’s discussion, there were several suggestions to discontinue the use of the term “ED crowding.” The Panel agreed that ED crowding is misnamed because inherently suggests that ED crowding is an ED problem and any solution lies within the ED. Since ED crowding is tightly linked with ED boarding, much of the problem of ED crowding is the end result of hospital-wide flow problems, rather than ED problems. Panel members noted that issues around crowding also relate to system capacity and response at both the hospital and regionalized emergency care levels. From a hospital care standpoint, crowding is a system capacity and response issue that involves daily operations and how hospitals and systems handle daily surge (i.e., where flow, delays, targets around boarding become important). From a regionalized emergency care standpoint, crowding is an indicator of larger capacity and response issues for emergency preparedness. This concept is discussed in greater detail in the section, Reconciling Daily Crowding and Disaster Surge. Ultimately the Panel suggested reframing the issue as hospital crowding or alternatively framing the issue as ED and hospital flow, which may more correctly characterize the causal relationship.

Recommendations for Measure Developers: ED crowding and boarding

The Panel recommends several actions for measure developers to consider, that if undertaken could address these crowding and boarding measurement issues. In developing performance measures for consideration for submission to NQF for potential endorsement, measure developers should consider the following.

1. Explicitly define the timestamps used to calculate ED crowding, ED boarding, and hospital flow measures. These timestamps should be used consistently across hospitals. In addition, timestamp definitions should be harmonized across measure developers.
 - Measure developers should consider measures that define boarding time as the time from the decision to admit to departure from the ED. Decision to admit time should be defined explicitly and documented in the medical record.

- When constructing measures reporting time-based data, measure developers should consider reporting of both measures of central tendency (median), and also include a measure of variance (e.g., 90th percentile values).
 - Measure developers should consider measures that assess boarding times at the level of the local community or region (hospital referral region (HRR), hospital service area (HSA), or other pre-defined geographical or geopolitical area) in order to foster increased cooperation across hospitals.
2. Measure developers should consider developing measures that report unadjusted data for ED crowding and boarding metrics. Measures reporting adjusted or stratified data should also be considered, however, before performance measures in this topic area can move in this direction, a valid risk-adjustment methodology must be developed and validated, or there should be evidence that strata are sufficiently similar to justify stratification.
 3. In order to avoid unintended consequences, measure developers should consider developing measures that are comprehensive and measure all aspects of crowding. Doing so would create balance in the measurement of transitions of care, particularly around the transitions of older adult patients, behavioral health patients, and patient transfers to outside facilities.
 - Measuring turnaround time to transfer as well as admit and discharge decisions is also recommended.
 - Use of observation services or units, including whether patients are transitioned from the ED to observation units or remain in the ED, should also be considered as a factor in measuring turnaround time.
 4. Structural components of ED and hospital design that have been shown to be associated with improved flow should be considered as potential measures for ED crowding and boarding.
 5. Measures of the EMS system (e.g., hospital drop times) may be a way to measure issues around preparedness and crowding.
 6. Measure developers should focus on integrative measures that assess issues related to capacity and response both hospital-wide and across systems. These measures should also include other parts of the health system such as nursing facilities, community health centers and other provider organizations.
 - Measure developers should consider moving away from references to “ED crowding” and use terms that may more accurately reflect the relationship between ED and hospital patient flow.
 - Measures of ED outflow for admitted patients beyond boarding, such as hospital-length of stay for specific conditions may be considered by measure developers as they impact ED flow.
 - Measures of on-call specialist timeliness may also prove useful.
 7. Measure developers should consider measures assessing upstream and downstream causes of crowding stemming from the hospital to other systems. Limited availability of urgent care or primary care are examples of upstream drivers of crowding, while limited nursing home bed availability that impedes hospital outflow is an example of a downstream cause of crowding. Such measurement will allow a better understanding of local causes of ED crowding and allow useful comparisons of regional quality. Measures could specifically assess:
 - The system-wide movement of patients and/or
 - Indicators of bottlenecks or poor service availability.
 8. Research should be conducted to create a severity-adjustment methodology to compare EDs in order to adjust for hospital characteristics and case-mix. This may be important in measuring and reporting measures for ED and hospital flow.

9. Research should be conducted to define appropriate boarding times, with the understanding that value-added versus non-value added transition times should be considered.

Emergency Preparedness and Response

Over the last decade, the federal government has invested more than \$21 billion to help local and state public health departments prepare for national and regional emergencies, such as bioterrorism, disease outbreaks, and inclement weather that may paralyze the healthcare system.⁴⁹ Many levels of organizations, from government agencies to healthcare facilities, have developed emergency plans and protocols, have invested in supplies and equipment, and trained personnel to respond in the event of a public health emergency. Despite these investments, however, many parts of the U.S. remain unprepared for emergencies.

Given the daily crowding of hospital facilities, there may be inadequate resources to care for the potential surges of patients who will seek care during an emergency or a disaster. However, some recent experience has suggested that existing systems may be able to accommodate higher numbers of patients during a short-term disaster, as exemplified by Superstorm Sandy that hit the Eastern U.S. in October 2012 and required the evacuation of several hospitals around New York City and Long Island. Developing reliable and valid performance measures for emergency preparedness and response are important to improve the nation's capacity and capability to respond to and recover from a disaster.

Measurement Issues in Emergency Preparedness and Response

In 2008, the IOM report, *Research Priorities in Emergency Preparedness and Response for Public Health Systems* concluded that “the future of public health preparedness requires validated criteria and metrics that enable public health systems to achieve continuous improvement and to demonstrate the value of society's investment.”⁵⁰ The report called for new quantitative and qualitative approaches to measuring public health systems' activities and associated outcomes, and to assessing whether healthcare systems' performance meets the relevant standards.

The current landscape of preparedness measurement includes metrics such as the critical benchmarks and sentinel indicators and the Bioterrorism Hospital Preparedness Program (formerly created by the Health Resources and Services Administration, and now under ASPR). However these metrics have not been fully validated and lack a strong basis in evidence.⁵¹ Similarly, while the revamping of the Joint Commission's emergency management standards was a step towards strengthening hospital emergency management performance measures, many of the standards lack specific guidance.⁵² These efforts exemplify the inherent measurement challenges in developing national performance measures for emergency preparedness and response.

Performance measures of emergency preparedness and response may ultimately fall into more subjective measure surveys or exercises and quantitative process or outcomes measures. To measure preparedness, surveys, exercises, or simulations can be designed to assess preparedness both offline or outside of an incident, and during response to an incident. Measures should take into account the heterogeneity and variable resource needs behind a disaster response that must by definition, be tailored directly to the unique issues of a specific disaster. In order to meet NQF measure evaluation criteria, these instruments must be reliable and valid so that they are reproducible across hospitals, health systems, and coalitions. In addition, quantitative measures of process and outcome should be

combined with the more subjective assessments of preparedness and response and focus on specific objectives (e.g., were the goals of immediate bed availability met objectively) or outcomes, such as having similar risk-adjusted outcomes during a disaster, which would indicate that a facility would have the flexibility to maintain the same standard of care during a crisis.

Unlike disease-specific performance measurement, many performance measures for emergency preparedness and response lack solid data and evidence to link specific interventions or processes with outcomes. The structure-process-outcome link is also difficult to assess due to the variation between different types of incidents (e.g., bioterrorist attacks, extreme weather, disease outbreaks) as well as the rarity of events, making it challenging for measure developers to apply traditional epidemiological methods necessary to demonstrate valid linkages between processes and outcomes. In addition, unique activities are required for different hazards types. There are, however, common processes that any organization must address during response to different hazards.

One example of a common process is information management: the ability of an organization to effectively communicate with patients and staff during a disaster. The Joint Commission includes this process in its standard of care for Disaster Preparedness and Response for hospitals. A recent assessment was performed of the Department of Veterans Affairs Comprehensive Emergency Management Program (CEMP).⁵³ Several factors were cited as “Leading Indicators of Preparedness” across VAMC facilities.

1. Facilities that have designated an Emergency Management Committee.
2. Facilities that are represented in a regional planning group responsible for all hazards preparedness.
3. Facilities with Emergency Operations Plan procedures for expanding staff availability during mass casualty events.
4. Facilities that have agreements in place for additional medications from sources outside of the facility.
5. Facilities that have identified resources necessary for an Emergency Operations Center.
6. Facilities that have participated in community-wide drills in the past year.
7. Facilities that have prepared and communicated After Action Reports following drills.
8. Facilities that provide all hazards events training to emergency clinicians.

Finally, public health emergency frameworks have identified common business processes required pre-incident, incident, and post-incident: prepare, monitor, investigate, intervene, manage, and recover.⁵⁴ Discussed in a later section, this work may serve as a guide for measure developers in assessing the existence, use and impact of common processes in the field of emergency preparedness and response.

Current Measures and Definitions

A systematic review in 2005 considered 27 instruments that assessed public health preparedness and found a good deal of overlap between the various definitions of preparedness, but little consistency.⁵⁵ Nelson et al. argue that the lack of performance measures is not the reason there is a shortage of preparedness measures, but rather the numerous definitions of preparedness have become a barrier for performance measure implementation.⁵⁶ As one example, Nelson et al. used a panel of experts to define public health emergency preparedness as “the capability of the public health and health care systems, communities, and individuals, to prevent, protect against, quickly respond to, and recover from health emergencies, particularly those whose scale, timing, or unpredictability threatens to overwhelm routine capabilities.”⁵⁷ In order to assess preparedness for measurement purposes, it is necessary to

define emergency preparedness and response explicitly and to reconcile the various definitions of preparedness.

Conceptual Models of Public Health Preparedness

There have been several conceptual models of public health preparedness. For the purposes of this report, we aim to provide guidance for measure development concepts for hospital and health system measurement, not necessarily the wider topic of public health preparedness that other conceptual models were designed to measure. Consensus on a framework and tools to specifically measure healthcare emergency management capabilities (HEMC) is needed.⁵⁸

A recent study compared public health preparedness models and developed the “Common Ground” Preparedness Framework. This framework presents one way to conceptualize preparedness measurement and is designed to specifically identify the business process required when a disaster threatens to overwhelm the daily capabilities of a system.⁵⁹ These processes are grouped into six categories: prepare, monitor, investigate, intervene, manage, and recover. These fall into three time periods pre-incident, incident, and post-incident. During the Panel discussion, participants reiterated the importance of dividing measurement concepts specifically into preparedness and response, which would cover pre- to post-incident.

Prior to an incident, organizations can prepare by developing a capacity for response and use surveillance to identify any new incidents as soon as possible. When an incident happens, there should be an investigation and an intervention to control the problem and any downstream effects. During an incident, organizations should appropriately manage their activities, and have a mechanism to capture and synthesize information on how to prepare and respond to future incidents.

Finally, the recovery period includes processes that deal with the downstream effects of the incident and includes a return to normal operations while integrating the knowledge gained from the incident. During the Panel discussion, the importance of differentiating concepts of preparedness, which would occur “pre-incident” in this framework, should be clearly differentiated from response, which would occur during and after an incident.

Despite current research findings, there is no single, widely accepted, validated framework, related specifically to HEMC that health care facilities can use to guide their preparedness and response during disaster or mass casualty event.⁶⁰ Studies show that there is in fact considerable overlap among the agencies regarding major capabilities and capability-specific elements. Of the five agencies, four identified occupant safety and continuity of operations as major capabilities. An additional five capabilities were identified as major by three agencies. Most often the differences were related to whether a capability should be a major one versus a capability-specific element (e.g., decontamination, management of resources). All of the agencies rely on multiple indicators and data sources to evaluate HEMC.”⁶¹ These tools have not been tested for scientific acceptability and exemplify the idea that consensus on a uniform framework to measure HEMCs is still needed.

Capabilities and Capacities

Emergency preparedness and response may be assessed in two broad categories: capabilities and capacities. From a measurement perspective, it is important to distinguish between capacities (i.e., structural elements) and capabilities (i.e., process measures) to begin the measurement discussion for emergency preparedness and response.^{62,63} Capacities are resources, such as the infrastructure, trained personnel, and response mechanisms that are utilized for an emergency response. Building capacity

through planning, acquisition of equipment, or training of personnel are key tools required to be “ready” for the next incident. However, capacity alone is insufficient to ensure preparedness.

By comparison, capabilities are the functional actions that an organization is capable of taking to identify and respond to a specific incident. This includes surveillance, epidemiology, event mitigation and surge capacity for healthcare services, public communication, and coordination through incident management. Capacities can be measured outside of an emergency while some capabilities can truly be tested when a system encounters an incident or through drills and exercises. Other capabilities, such as having a communication plan can be measured outside of an emergency.

Data Sources

There are several data sources that may be helpful in assessing emergency preparedness and response, including local data, surveys, drills and exercises, actual local event data, and large government databases. Data on ED and inpatient utilization and characteristics of facilities and patients, including principal/first listed diagnosis, are available over time and at the national, regional, state, and local levels (for participating states) through the Healthcare Cost and Utilization Project (HCUP), sponsored by AHRQ. HCUP data can be linked to additional facility-level data (e.g., the American Hospital Association Annual Survey of Hospitals, Trauma Information Exchange Program) and community-level data (e.g., the Area Resource File) and begin to identify areas where measurement of capacity should focus. In the past HCUP has been used to assess system response to surge in the H1N1 influenza pandemic.⁶⁴ Similar analyses using HCUP might be helpful in defining geographic boundaries for coalitions, providing static assessments of system capacity, or measuring an actual response to a disaster and how a particular hospital, health system, or coalition responded and system-wide outcomes.

Drills conducted by ASPR as part of its Hospital Preparedness Program (HPP) will also generate data. In addition, utilizing qualitative assessments of health system performance following mass casualty events such as the Colorado shootings or natural disasters will also help assess system performance. Several studies have described the use of tabletop exercises to evaluate emergency preparedness.^{65,66} Tabletop exercises simulate a response to major emergencies and identify gaps and shortcomings in emergency planning.⁶⁷ Evaluating the conduct during an exercise is a measure of preparedness while evaluating the response procedures during the conduct of an exercise may be a proxy measure of response. In an evaluation of 38 emergency preparedness exercises, one study found usefulness in clarifying workers’ responsibilities, facilitating knowledge transfer, and identifying challenges.⁶⁸ It is important to note there is a certain degree of uncertainty in using tabletop exercises in a simulated environment as performance measures; that is whether they really measure actual preparedness or response.

Several studies have examined the response to specific incidents.^{69,70,71,72,73} For example; one paper assessed the performance in North Carolina to Hurricane Floyd (1999) and Hurricane Isabel (2003). During the intervening years, North Carolina had built new capacity, including infrastructure, enhanced laboratories, and better communications.⁷⁴ According to the authors, this “facilitated implementation of functional capabilities through effective centralized communication, command and control incident management, and a rapid needs assessment and medical surveillance during Hurricane Isabel.” They concluded that, “measuring and implementing functional capabilities during exercises or real events facilitates achievement of preparedness performance standards, goals, and objectives.” Assessing the response to specific incidents or a series of incident with specific performance measures for preparedness may be an effective way to assess hospital or healthcare system response.

In order to improve quality, process maps are a key tool to identify the steps in a process and develop performance measures for testing and targets for improvement.⁷⁵ In assessing the reliability of response systems, defining and mapping the system to identify the different parts of the response operation and articulate what it means for them to function well is particularly useful. For example, incident command at a response can be broken down into several functions, including building situational awareness about the incident, making decisions about resource allocation among response functions, and dispatching response resources. Researchers at RAND adapted a fault tree analysis and failure mode, effects and criticality analysis (FMECA) and four steps for analysis of response systems for large-scale incidents.⁷⁶ The goal was to show that such analysis can help evaluate preparedness and anticipating the likely future performance of emergency response systems in large-scale events. Their results showed that this type of analysis “can potentially contribute to preparedness planning and evaluation in different but complementary ways.”⁷⁷

Regionalization and Healthcare Coalitions

One of the concepts discussed at length by the Panel in reference to emergency preparedness and response performance measures is that in order to have robust systems in place, there must be cooperation across entities, such as participation in healthcare coalitions which differ from the concept of regionalization. In the previous section, regionalization was described as the process of considering health care resources and quality from a population, community, or geographical perspective. Healthcare coalitions by comparison, are networks of health care facilities that choose to work together for a common purpose, such as emergency preparedness. A region, however defined, may include multiple coalitions or a coalition may span multiple regions.

The ASPR Hospital Preparedness Program (HPP) specifically defines a healthcare coalition as,

...a collaborative network of healthcare organizations and their respective public and private sector response partners that serve as a multiagency coordinating group to assist with preparedness, response, recovery, and mitigation activities related to healthcare organization disaster operations. The primary function of the Healthcare Coalition includes sub-state regional, healthcare system emergency preparedness activities involving the member organizations. This includes planning, organizing and equipping, training, exercises and evaluation. During response, Healthcare Coalitions should represent healthcare organizations by providing multi-agency coordination in order to provide advice on decisions made by incident management regarding information and resource coordination for healthcare organizations. This includes either a response role as part of a multi-agency coordination group to assist incident management (area command/unified command) with decisions, or through coordinated plans to guide decisions regarding healthcare organization support.⁷⁸

Keeping this definition in mind, the Panel engaged in considerable debate regarding how healthcare coalition should be defined. The Panel acknowledged challenges in deciding how boundaries should be drawn: whether geographically, functionally, or self-determined. It was also noted that while there are already many different geographically based divisions available (e.g., such as county, healthcare service area) these geographical boundaries may be insufficient to describe the local healthcare utilization across the U.S. Notably, under the current ASPR HPP healthcare coalitions are self-defined by program participants.

The Panel agreed it would be useful for researchers to explore ways to empirically define meaningful geographical areas or coalitions that are driven by demand for time-sensitive emergency services,

geography, information systems and local competition. Members of the Panel were also greatly concerned about the potential for “white space”, or gaps in coalition coverage within a defined area, left by hospitals or regions that may not be included in coalitions. This is a particular concern within self-defined coalitions. Furthermore, there was concern that the existence of white space may threaten the ability to develop valid performance measures at the regional level.

ASPR Hospital Preparedness Program

The Hospital Preparedness Program (HPP) has defined a set of healthcare preparedness capabilities which may be useful to measure developers to identify gaps in performance measurement, prioritize measures, and assess plans to build and sustain the healthcare infrastructure during an effective disaster response. These capabilities were developed from the Centers for Disease Control and Prevention Public Health Emergency Preparedness capabilities.⁷⁹ It is important to note that the measure concepts in the HPP document are not explicitly designed for facilities. In addition, they are not specifically intended for broader non-facility concepts in public health preparedness.

The following eight (8) capabilities have been identified at the level of the hospital and health system, which notably require variable levels of cooperation within and across healthcare facilities.

1. Healthcare System Preparedness
2. Healthcare System Recovery
3. Emergency Operations Coordination
4. Fatality Management
5. Information Sharing
6. Medical Surge
7. Responder Safety and Health
8. Volunteer Management

The table below describes performance measures developed by HPP that may be useful for broader development of measures in the area of preparedness and response (Table 1).⁸⁰

Table 1: HPP Performance Measures

| HPP Performance Measures | | |
|---------------------------------|-----------------------------------|---|
| HPP 1.1 | Healthcare System Preparedness | Percent of healthcare coalitions (HCCs) that have established formalized agreements and demonstrate their ability to function and execute the capabilities for healthcare preparedness, response, and recovery as defined in Healthcare Preparedness Capabilities: National Guidance for Healthcare System Preparedness |
| HPP 2.1 | Healthcare System Recovery | Percent of healthcare coalitions (HCCs) that have developed processes for short-term recovery of healthcare service delivery and continuity of business operations |
| HPP 3.1 | Emergency Operations Coordination | Percent of healthcare coalitions (HCCs) that use an integrated Incident Command Structure (ICS) to coordinate operations and sharing of critical resources among HCC organizations (including emergency management and public health) during disasters |
| HPP 5.1 | Fatality Management | Percent of healthcare coalitions (HCCs) that have systems and processes in place to manage mass fatalities consistent with their defined roles and responsibilities |

| HPP Performance Measures | | |
|--------------------------|-----------------------------|--|
| HPP 6.1 | Information Sharing | Percent of healthcare coalitions (HCCs) that can continuously monitor essential elements of information (EIs) and demonstrate the ability to electronically send data to and receive data from coalition members to inform a common operating picture |
| HPP 10.1 | Medical Surge | Percent of healthcare coalitions (HCCs) that have a coordinated mechanism established that supports their members' ability both to deliver appropriate levels of care to all patients (including pre-existing patients [both inpatient and outpatient], non-disaster-related patients, and disaster-specific patients), as well as to provide no less than 20% bed availability of staffed members' beds, within 4 hours of a disaster |
| HPP 14.1 | Responder Safety and Health | Percent of healthcare coalitions (HCCs) that have systems and processes in place to preserve healthcare system functions and to protect all of the coalition member employees (including healthcare and non-healthcare employees) |
| HPP 15.1 | Volunteer Management | Percent of healthcare coalitions (HCCs) that have plans, processes and procedures in place to manage volunteers supporting a public health or medical incident |

The Joint Commission Disaster Preparedness and Response standards

The Joint Commission has developed a standard of care for Disaster Preparedness and Response for hospitals. Similar to the Joint Commission's flow standard described earlier in this report, Joint Commission's standards related to preparedness and response could serve as the basis for potential performance measures that could be developed in this area. These guidelines center on (1) managing the consequences of, and providing safe and effective care during an emergency, (2) ensuring that staff roles are clearly defined, and (3) ensuring that staff sustain compliance over time. There are a total of six focus areas that accredited hospitals need to demonstrate for plans and response mechanisms during a disaster. Specifically, during planned exercises, a hospital must monitor six areas:

1. Communications (i.e., both internal and external communication with local partners and state or federal agencies).
2. Supplies (i.e., supplies should be at adequate levels).
3. Security (i.e., hospital operations should be secure to protect staff and property).
4. Staff (i.e., there should be defined roles and responsibilities in a standard Hospital Incident Command Structure).
5. Utilities (i.e., facilities should be able to be self-sufficient for as long as possible: goal = 96 hours).
6. Clinical Activity (i.e., standards of care should be maintained, and vulnerable populations supported; there should be clear guidelines when alternative standards of care can be used).

In addition, organizations must regularly test emergency operations plans twice per year, and at least once a year there should be simulations including patients. Additionally, facilities should perform annual evaluations to see how they perform when local community support is unavailable. Organizations with a role in community-wide emergency management must participate in at least one community-wide exercise per year. Exercises are expected to reflect realistic scenarios for organizations and should not only identify the effectiveness of the current plan but also identify opportunities for improvement. Finally, strengths and weaknesses should be communicated within the entire organization. Several of these elements could serve as the basis of potential performance measures for emergency preparedness and response.

Recommendations for Measure Developers: Emergency Preparedness and Response

The Panel recommends several actions for measure developers to consider, that if undertaken could address these emergency preparedness and response performance measurement challenges. In developing performance measures for submission for possible NQF endorsement, measure developers should consider the following.

1. Preparedness performance measures should be standardized so they are reliable and valid, and can be compared against a desired performance threshold. Specifications should include NQF levels of analysis (most appropriately: facility, integrated delivery system, or population: community, county or city, national, regional or state) and the specific time window for measurement. For measures that are reported per capita, population counts are needed for the denominator. In addition, for implementation, measures must identify the data elements required and include mechanisms to obtain consistent, reliable data.
2. Measure developers should consider how measures, that are comprehensive and measure all aspects of emergency preparedness and response, will work together. Developers should consider how these measures will drive prioritization of local resources. For example, organizations may focus only on measured activities to the detriment of unmeasured activities that may also be required for emergency preparedness.
3. The measurement of preparedness and response requires multiple strategies (valid qualitative surveys and quantitative process and outcome data) to adequately capture the heterogeneity of the disasters, the targeted processes, and patient outcomes.
4. Rather than measuring “drill completion,” measure developers should specify standard drills with standard measures to quantify actual drill performance, ensuring the drills are as closely linked to desired outcomes as possible.
5. Groups of best practices available for local preparedness could serve as the basis for structural performance measures. When constructing structural measures, measure developers should consider capabilities that are in place in hospitals or health care systems for children and the elderly.
6. Measure developers should consider performance measures assessing surge recovery of hospitals, including the ability to recover normal operations within a certain time period following a non-disaster surge. Performance at this level could provide an indicator of preparedness in the event of a disaster.
7. Measure developers should consider performance measures assessing the ability of an organization to adapt following a disaster. Measures around adapted implementation strategies using the information learned from an actual event or having a disaster committee or team in place are possible areas of measurement.
8. New performance measures around transfers, the EMS system, and diversion may be good indicators of how well hospitals and hospital systems interact to improve the capacity at the coalition or regional level. Transfers could be used as an indicator of how connected a coalition or region might be, and how well facilities are able to determine patient needs and transfer patients in a timely manner. One suggested way to measure this could be to develop or adapt disease-specific measures and assess:
 - Time from presentation to the ED or triage physician
 - Time of decision to transfer to another hospital
 - Time of transfer.
9. NQF Serious Reportable Events provide a possible construct for measure developers to adapt for preparedness performance measurement. Generally, rare event outcomes do not provide

adequate information for improvement or discrimination; however, serious reportable events that are compared to zero are appropriate outcomes for public reporting and quality improvement.

10. Measure developers should consider adapting existing performance measures that may be scaled up for assessment at facility, integrated delivery system, and population: community, county or city, national, regional, and state levels.
11. Measure developers should consider diversion as another metric of how coalitions and regions work cooperatively to optimize care of patients in the community. For example, if there is little or no diversion within coalitions or regions, it could be an indicator of facilities working together to avoid overloading one hospital versus another in the system.
12. Research is needed to develop a reliable and valid scalable model that allows disasters to be graded from the micro- to the macro- disaster.
 - Research and development of a system to measure both daily surge and the increased patient demands during a disaster would be helpful in creating the link between these two concepts as well as informing response. A study of the application of strategies used in disaster to daily crowding scenarios and vice versa might also yield important findings.
 - Tabletop exercises could be used to extrapolate potential response based on ordinary crowding data, and data from tabletop exercises could be adapted to assess potential response at the regional level, based on what happens in a single hospital in the region.
 - Patient safety and outcomes must be prioritized, even at the most extreme end of the continuum.
 - Additional research may be needed to develop the evidence base with regard to how much or what kind of preparedness is enough; particularly with respect to completeness and timeliness.
13. Research is needed to define meaningful geographical boundaries for a healthcare coalition, and whether self-determined coalitions are the most effective in organizing preparedness and response efforts. The resulting definitions will need to be widely accepted.
 - Coalition boundaries should, if possible, locally include all hospitals within the geographic boundaries of health systems and nationally include all hospitals in the U.S.
 - Research should inform the appropriate characteristics of a region, specifically whether there is an appropriate geographic size or population. Suggestions:
 - AHRQ prevention quality indicators and NQF-endorsed[®] population health performance measure around [late-stage diagnosis for HIV](#) provide good examples of how to approach measurement at the community and population level.
 - Dartmouth Atlas work around regions and geographic variations may be instructive in determining how to best define regions.
 - Developers could consider movement of unplanned critical care patients within a coalition or community; observed variations could indicate opportunities for improvement.
 - Players in the system that are not part of a coalition of cooperating facilities and that overlap coalition partners present an issue that must be considered, especially in urban areas.

Reconciling the Concepts of ED Crowding and Emergency Preparedness

In order to accurately characterize whether an organization is able to respond to an emergency, it is important to reconcile the relationship between daily crowding and emergency response. Reconciling these two concepts was discussed at length by the Panel. The Panel felt that an organization that is already overcrowded (due to a lack of processes in place to encourage efficiency) may be less prepared to respond when a disaster or mass-casualty event occurs. Therefore, performance measures of ED crowding and boarding can be seen as one way to measure preparedness and response. One caveat remains, which is to recognize that operations during a disaster are different than daily operations. This is primarily because there are many other concerns that arise during a disaster that may not be issues in daily operations, such as an overwhelming surge of patients or the inciting event itself (e.g., bioterrorism) compromising staff security and safety. In addition, some organizations that are critically overcrowded on a daily basis may be able to increase capacity and surge in a disaster situation.

The Panel discussion focused on the definition of a disaster, and whether a disaster was a binary phenomenon or was just an extreme version of daily surge. In preparedness terms, a public health emergency or a “disaster” is a situation where health consequences of a specific incident may overwhelm routine local capabilities to address them. In those cases, a facility might need outside resources to effectively handle a disaster and should have a specific plan in place to work with local partners to share resources. In terms of daily surge, an unexpected influx of patients may cause a facility to become overwhelmed and require it to reconfigure how it uses local resources; however that facility may not need to contact outside entities or state or federal agencies for additional assistance.

Principles and structures used in disaster surge situations may also be applicable to daily surge scenarios. A local facility may have specific protocols that would be deployed in the event of a surge of patients that can still be handled internally. However, the link between daily surge and disaster surge as described above is that organizations that have internal processes in place to handle daily surges may use those same processes in the event of disaster. Therefore, preparedness to handle daily surge may a strong indicator of how a facility might perform in a disaster.

Linking Daily and Disaster Surge: A Continuum

Creating a link between disaster and daily surge would involve developing a structure to grade the spectrum of disasters from small scale to large scale. This would in turn link disaster or local surge responses to outcomes, allowing facilities to design interventions to respond to both small increases in demand and much larger ones required in a major disaster. The concept of system flexibility would measure how a system, defined at either the facility-level, health system-level or hospital-coalition level might perform during various patient loads, or even a disaster. A flexible system would be able to maintain the same level of service when there were greater demands for services; the systems would accommodate both daily surge and disaster surge.

Panel members noted that there is a continuum and a transition point from daily surge to disaster surge that moves response from an individual-based delivery of care model to a population-based system of care model in a disaster (Figure 2). One of the ways to conceptualize this would be to state that during both daily surge and a disaster surge, many of the same capabilities are called upon. As seen in figure 2, daily surge and disaster surge are shown to be on a continuum of healthcare capabilities. However, what differentiates a disaster is ‘the tipping point,’ or the event or actions that cause facilities to invoke different rules and regulations, such as an 1135 waiver and the implementation of crisis standards of care.⁸¹ At this point a facility would switch from an individual based delivery of care model with no

regulatory change to a population-based system of care model with regulatory changes required. Therefore, it becomes clearer that developing a system to grade daily surge and disasters on the same scale might be helpful in informing what healthcare capabilities might be necessary to manage both types of incidents. This could be empirically defined through the study of daily surge to assess the relationship between various levels of daily surge and poorer system performance or patient safety. Also, understanding the safety consequences of any changes in standards of care or rules and regulations would be important to monitor.

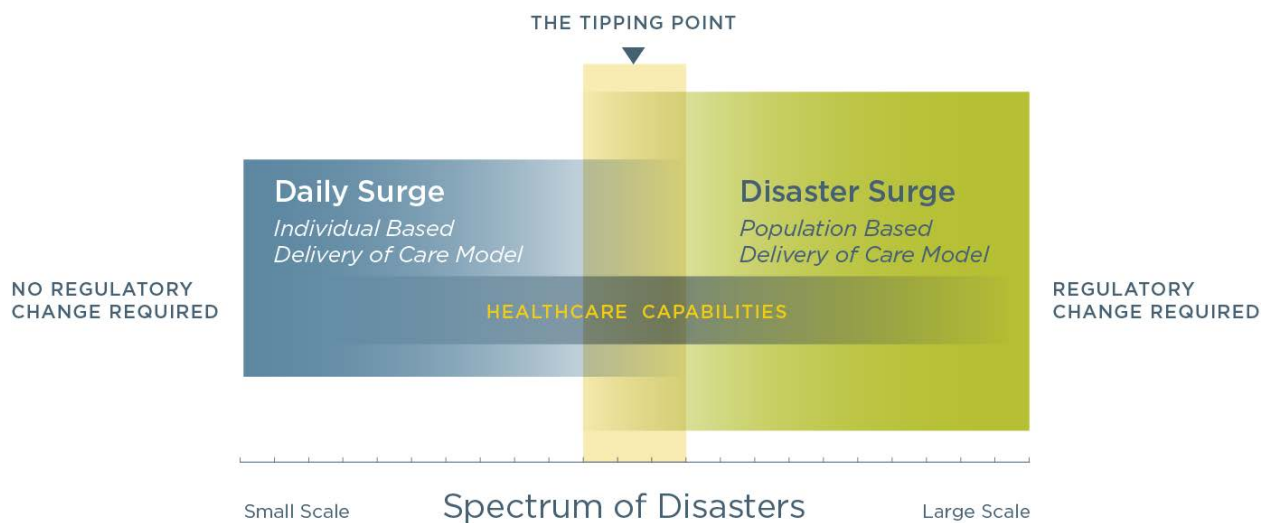


Figure 2: Spectrum of disasters across the continuum of healthcare capabilities.

Additional Concepts Differentiating Daily Crowding and Disasters

With that understanding, the Panel identified several additional concepts that differentiate disasters from daily crowding and surge:

1. True disasters (black swans) are rare while daily crowding and surge (the black squirrel) is common.
2. In a disaster, it is difficult to measure outcomes directly because there is no “counterfactual” of what would have happened if a specific intervention had or had not been implemented. By comparison, the repeated nature of daily crowding and surge enables us to directly measure interventions and differentiate between those that are effective and ineffective.
3. In a disaster, many hospitals may be asked to coordinate together, so there may be issues with accountability, information sharing, and issues with intra-hospital (within system) and inter-hospital (outside the health system) coordination . Daily crowding and surge are typically contained and managed within a hospital; however, system-wide, inter-hospital, and regional, measures may provide incentives for hospitals to better manage the regional demands of patients (i.e., throughput interventions to reduce system-wide diversion).
4. In a disaster, additional challenges are present, such as issues with security and personnel safety, and the potential for other issues that can impact a system, such as a disruption in utilities.

The variability of infectious disease agents such as influenza, provide an example of some the challenges that may occur during a disaster. Preparation for H1N1 for example, which involved a high volume of

less critically ill patients, was managed differently than severe acute respiratory syndrome (SARS), where the case fatality rate was dramatically higher and volume of patients was lower. By comparison, the H5N1 virus, where the case fatality rate and patient volumes are high, may require different resources. In addition, the rarity of public health emergencies leaves minimal objective outcome data from which to conduct assessments of quality. Adding to the measurement challenge is the lack of counterfactual evidence, making it difficult to conduct retrospective examination of an emergency response without a comparison group.

Additional challenges include regional variability. Disasters and health system emergencies impact communities differently based on issues like geography, population density, and local health infrastructure. As such, an ideal response in one community may not be ideal in another. Finally, the issue of accountability is a major concern, because of the shared and diffuse responsibility of public and private stakeholders within a region. The Panel agreed on the following additional assumptions related to disaster and daily operations.

1. Disasters operations and daily operations to handle crowding have similarities (i.e., both involve surges of patients that can outstrip resource supplies) but are fundamentally different concepts.
2. Disaster and daily operations are related because any disaster may be superimposed on an already crowded system.
3. Similar protocols in place to alleviate or prevent daily crowding may be vital in handling a disaster.
4. During a disaster other factors come into play which are not issues in daily crowding: safety and security of personnel and patients, continuity of operations that may be disrupted (i.e., power outages), and dealing with large numbers of patients with unique or specific needs.
5. During a disaster, facilities may have responsibilities to outside entities (i.e., information or assistance to other hospitals, governments).
6. During a disaster the Secretary of Health and Human Services can act under section 1135 of the Social Security Act to suspend certain regulatory requirements, such Emergency Medical Treatment and Active Labor Act (EMTALA).
7. Designating an event as a “disaster” allows for care standards to change.

Members of the Panel recognized that some measures of preparedness are designed to be independent of crowding itself. An example of this is “Immediate Bed Availability” (IBA). Developed by ASPR for the HPP, this measure requires healthcare coalition hospitals to have the ability to make 20 percent or more of their bed capacity available within four hours of a disaster. While this may be more of an issue in a hospital that is already crowded, the expectation is independent of crowding itself. Implementing IBA may involve using the concept of “reverse triage” where hospitalized patients would be prioritized with regard to their relative need for hospital services and patients with the most minor needs would be discharged first. A five-level system of reverse triage has been developed by researchers at Johns Hopkins University.⁸²

Moving from measure concepts to NQF-endorsed performance measures for preparedness will require careful consideration of the aforementioned issues. Application of the Donabedian model may provide additional guidance to measure developers by providing a conceptual framework for emergency preparedness measurement and assessment, and adapting the traditional structure-process-outcome model to structures-capacities-capabilities for healthcare system emergency preparedness.⁸³

Accountability and Regionalization

When considering both ED crowding and preparedness measurement, it is vital to closely consider the unit of measurement (i.e., individual, hospital, healthcare system, healthcare coalition, or region). In order to ensure accountability at multiple levels, it is important that measures of ED crowding, boarding, preparedness and response also include some measures encompassing the region so that hospitals and health systems engage in an environment that not only fosters cooperation but also competition. Under this banner, hospitals would have an incentive to work together for the greater cause of improving ED quality and flow, while ensuring a local area is prepared in the event of a disaster or mass casualty event.

As discussed earlier in the report, more research is needed to appropriately define regional units of measurement which would become the basis for regional emergency preparedness and response. One example that was mentioned by the panel was the use of EMS jurisdictions as a way to define region. Many current preparedness efforts are measured at publically defined boundaries such as cities, counties or states due to the public infrastructure that supports preparedness. The Panel, however, noted that emergency care systems may not map well to such traditionally defined public boundaries such as counties or traditional boundaries used in healthcare such as HAS or HRR. Thus, the development of new performance measures may be necessary to create new collaborative frameworks.

A Pathway to Development for ED Crowding, Boarding, Preparedness and Response Measures

There are several measurement issues in this report that developers will need to consider in the development of NQF endorsed® performance measures for ED crowding, boarding, and emergency preparedness. Issues raised in the development of crowding measures include details of how the data should be presented, and also raise important broader issues in emergency care, such as the lack of a validated severity-adjustment system. While it may be desirable for all EDs in the U.S. to use the same triage system, this is not currently the case. Therefore, measure developers will need to work collaboratively to develop a standardized methodology for risk-adjustment and stratification for ED crowding measures. In addition, the development of input measures at a regional level may be very challenging given that pre-hospital systems are organized very distinctly across local communities. This makes the creation of measure specifications that can be universally applied for accountability very difficult.

The pathway to NQF-endorsed performance measures for emergency preparedness will be a challenge, but one that is potentially surmountable through the guidance in this document. Specific issues include the fact that the evidence-base for preparedness measures may not be sufficient to conform to NQF requirements for endorsement, that process and outcome measures of preparedness are not assessed by direct observation unless a disaster occurs, and accountability is diffuse.^{84,85}

With regard to the basis of evidence, the ideal performance measure will be either a desired outcome (i.e., an effective system wide response to a disaster – which is difficult to know based on there being no counterfactual evidence), process, or structure that is directly related to an effective response. The inherent nature of emergency preparedness makes it very difficult to define an effective response, and even more difficult to decompose what factors lead to an effective response. Therefore, the evidence-base for emergency preparedness measures ultimately submitted to NQF may likely involve expert consensus as defined by the NQF [Guidance for Evaluating the Evidence Related to the Focus of Quality Measurement and Importance to Measure and Report](#). In addition, proposed process measures could use an evidence base that includes outcomes from drills and exercise as well as expert consensus that demonstrate “consistency,” which is an NQF standard that could be modified to serve an important role in evaluation preparedness measures.

Importance Criteria

Impact

Performance measures assessing crowding, boarding and preparedness and response in the setting of surge or large-scale disaster are a high-impact aspect of healthcare (e.g., affects large numbers of patients and/or has a substantial impact for a smaller population; leading cause of morbidity/mortality; high resource use (current and/or future) severity of illness and severity of patient/societal consequences of poor quality). It is also important for developers to consider impact in the context of the National Quality Strategy (NQS) and understand where measure concepts and the NQS align.⁸⁶ The NQS pursues three broad aims around better care, healthy people and communities, and affordable care in six priority areas:

- Working with communities to promote wide use of best practices to enable healthy living
- Promoting the most effective prevention and treatment practices for the leading causes of mortality, starting with cardiovascular disease

- Ensuring that each person and family is engaged as partners in their care.
- Making care safer by reducing harm caused in the delivery of care
- Promoting effective communication and coordination of care, and
- Making quality care more affordable for individuals, families, employers, and governments by developing and spreading new health care delivery models.⁸⁷

Measure developers could consider performance measurement in particular around the NQS priority to promote effective communication and care coordination, as suggested measure concepts include: experience of care transitions, complete transition records, chronic disease control, care consistent with end-of-life wishes, experience of bereaved family members, care for vulnerable populations, community health outcomes, and shared information and accountability for effective care coordination. Measure concepts in the other NQS priority areas should also be considered where issues of access, hospital admissions and readmissions and ED interactions intersect with healthy living and well-being, person- and family-centered care, safer care and affordability. Finally, the body of evidence demonstrating the effect of crowding on delays in care and less effective interventions suggests that many crowding performance measures can also be framed as initiatives to improve the safety of the delivery system.

A potential performance measure might be modeled after the HPP Structural Measure assessing surge capacity, #[10.1 Medical Surge](#) (pp. 38-43): “Percent of HCCs that have a coordinated mechanism established that supports their members’ ability both to deliver appropriate levels of care to all patients (including pre-existing patients [both inpatient and outpatient], non-disaster-related patients, and disaster-specific patients), as well as to provide no less than 20 percent bed availability of staffed members’ beds, within four hours of a disaster.”

Performance Gap

As measure developers establish the opportunity for improvement they could marshal data showing, that there is variation amongst hospitals regarding the ability to create 20 percent more bed capacity above daily operating ability at a certain level of disaster surge, within a certain defined time window. In a surge environment, reverse triage—the process of determining risk for discharge of inpatients—assumes a critical role and is one of the greatest challenges of emergency response. Data demonstrating considerable variation, or overall less-than-optimal performance across providers and/or population groups could include prior studies of drills and exercises with a concordant and consistent systematic assessment (e.g., expert panel rating) that judges a measure focus to be a performance problem.

Evidence

Evidence to support the measure focus is frequently insufficient in the area of preparedness and response.⁸⁸ Developers seeking to create measures in this topic area should measure those aspects with greatest potential of driving improvements; if not important the other criteria are less meaningful. NQF looks at the extent to which the specific measure focus is evidence-based, important to making significant gains in healthcare quality and improving health outcomes for a specific high-impact aspect of healthcare where there is variation in or overall less-than-optimal performance.⁸⁹ Specifically the criteria examine the structure-process-outcome relationship. If the measure focus is one step in such a multistep process, the step with the strongest evidence for the link to the desired outcome should be selected as the focus of measurement or, all steps should be included in a composite measure that measure a program of capacity and capabilities related processes that are considered necessary for performance in combination. Composite performance measures should attempt to demonstrate evidence in support of each component as well as of the global composite measure in concordance with the [NQF Composite Measure Evaluation Criteria](#).

The levels of analysis focused on for this topic area are facility, integrated delivery system, and population: community, county or city, regional, state or national. As described above, performance measures may also be targeted at a healthcare coalition. The data requirements for these levels of analysis may be distinct as the processes measured at each level are different. For example, a hospital's immediate bed availability represents a process that is as important as statewide incident command structures; however the data requirement and sources will be considerably different suggesting that such measures should be distinctly evaluated with different evidence criteria for each level of measurement.

With regard to performance measure types, because process and outcomes are not readily assessed by direct observation in this topic area, structural measures (e.g., HPP 10.1: Medical Surge) have the advantage of being most responsive to policy changes but perhaps least related to outcome; process measures are most responsive to QI efforts by the service providers and are more proximally related to outcomes. Outcomes in the area of preparedness are problematic, as public health emergencies are rare and averted morbidity and mortality difficult to ascertain.⁹⁰

Framing questions for developers include:

- What outcomes are expected if preparedness is improved, or effective? (e.g., adequate surge needs, most vulnerable patients identified, drug availability, reduced avoidable mortality)?
- What evidence based processes exist that impact desired outcomes?
- What types of tools or methods may be used or adapted to create measures that could be endorsed by NQF?

In preparedness and response, few tools rely on scientific studies supporting specific performance measures; other expert bodies are relied on – this becomes an issue when assessing the quality of the body of evidence to support a measure. One possibility is to look to the HPP capabilities in the way developers would look to the USPTF guidelines in a clinical context. Another possibility is for developers to think in terms of how the potential measure will lead to the outcome(s) that are desired, and qualitatively assess for face and content validity using an expert consensus Panel. Empirical data might be looked at in a systematic way and used to show that performance is adequate or inadequate in response to past disasters; that, for example, greater availability of beds led to improved outcomes. However, relying solely on historical examples could create concerns with consistency of results of the body of evidence, given the variation of past disasters.

The goal of regionalized emergency care services is largely to improve population-level outcomes, rather than patient-level performance within an ED. NQF's recent work on [evaluation of population health](#) measures lays an important foundation for regionalized measures of emergency care.

Consistency is an important NQF must-pass criterion, but given that few actual studies will have been conducted for many preparedness concepts, it will be tough to demonstrate that multiple rigorous investigations came to the same conclusion with the same measure focus. Because statistical studies are not available yet, developers should consider whether consistency can be measured in ways different than those used for clinical measures. For example, the ability to demonstrate consistency between evidence from drills and exercises, observations from historical examples and concordant systematic assessments of expert consensus could be used to demonstrate consistency in this framework. Similarly, developers may need to triangulate findings from distinct applications and settings

to demonstrate the consistency of a “level of measurement” as most empirical analysis have used differently defined regions for performance measures at higher than the facility level.

Reliability and Validity Criteria: Scientific Acceptability of Measure Properties

One of the characteristics of good performance measures is that they encode clear standards, with required data elements clearly detailed. NQF will be looking at the extent to which each measure is precisely specified, with the specifications consistent with evidence cited in support of focus, and whether testing of the measure produces consistent (reliable) and credible (valid) results about the quality of care when implemented.

Because process and outcomes are not readily assessed by direct observation In this topic area, structural performance measures have the advantage of being most responsive to policy changes but perhaps least related to outcome; process measures are most responsive to QI efforts by the service providers and are more proximally related to outcomes.

Reliability

Given that many of the potential performance measures for preparedness are structure or process measures and that crowding is covered by many process measures, these are all very amenable to reproducible electronic methods. However, many measures applicable to preparedness are tied to instruments, survey tools, checklists that could be subjective, and time windows are unclear.⁹¹ Methods of reliability assessment (inter-observer agreement, data source reliability assessments between paper and electronic sources, etc.) should still be applied by measure developers in the development of preparedness measures.

Validity

This sub criterion may be challenging for a CDP focused on preparedness performance measures since it is unclear what the authoritative source for comparison would be to demonstrate that the measure reflects quality care. An inherent challenge in evaluation is created by having an expert group define a potential measure as Important and having a Performance Gap while also having an expert group evaluate that measure as a valid measure of a desired outcome. In order to best ensure that intellectual conflicts of interest do not impair measure development, potential developers should utilize existing disclosure practices as well as ensure that measure validity if based on face validity is evaluated by a distinct group of experts.

Measures should also clearly identify accountable entities; however in this topic area accountability is often distributed across several entities. For example, the Medical Surge performance measure distributes accountability across a coalition for the following data elements:

- Do the surge plans of the HCC hospitals and other HCC members include written clinical practice guidelines for Crisis Standards of Care for use in an incident, including triggers that delineate shifts in the continuum of care from conventional to crisis standards of care?
- Has the HCC successfully tested its coordinated mechanism to both deliver appropriate levels of care to all patients, as well as able to provide no less than 20 percent immediate availability of staffed members’ beds, within 4 hours of a disaster?
- Has the HCC successfully implemented lessons learned and corrective action from this exercise or event within the past year?

- Has the HCC demonstrated the ability to communicate regional healthcare surge status in an exercise or event within the past year?
- Does the HCC have the ability to expand its coalition-wide surge capacity according to the scope and magnitude of the incident?

As a result, accountability and division of labor is not clear in many current evaluation instruments. Use of Face Validity to support application of accountability upon new levels of measurement should include expert consensus groups that can be shown to be compromised of multiple stakeholders.

Usability

This criterion focuses on the extent to which intended audiences (e.g., consumers, purchasers, providers and policy makers) can understand the results of the performance measure and are likely to find them useful for decision making.

For this topic area it appears this criterion is very accessible. Potential audiences, in this case, ASPR, CDC and others should be expected to find that the information produced by these measures are meaningful, understandable and useful, as they are already using or could use the performance results for both accountability and performance improvement.

Feasibility

This criterion focuses on the extent to which the required data are readily available, retrievable without undue burden, and can be implemented for performance measurement. Developers must demonstrate that data elements are available in electronic form and there is not susceptibility to inaccuracies or unintended consequences. Developers in this topic area may have a hurdle in demonstrating that the data collection strategy can be implemented – this could be a challenge depending on cooperation of hospitals, system and regions in the collection of data.

A Pathway from REMCS Concepts to REMCS-based NQF-endorsed Performance Measures (REMCS-PM)

NQF has endorsed a number of consensus standards to evaluate the quality of care for topic areas related to emergency care over the past decade. As quality measurement has matured, better data systems have become available, electronic health records are closer to widespread adoption, and the demand for meaningful performance measures has prompted development of more sophisticated measures of healthcare processes and outcomes at the regional level for emergency preparedness.

Future NQF work could include measure endorsement projects that target performance measures for accountability and quality improvement that specifically address regionalized emergency medical care services and could potentially include topic areas related to regionalized emergency medical care services such as:

- Boarding
- Crowding
- Disaster preparedness, and
- Response

The Panel recommended further work defining appropriate boarding times from an evidence-based perspective; measurement related to facilities and coalitions or regions having a disaster plan in place,

coupled with having a boarding standard; performance measures regarding the experience of both patients and their care-givers. Panel members suggested sets of measures at the hospital, healthcare coalition and population level, to include:

- Crowding and boarding in hospitals, including the ED, with preparedness response elements included;
- Throughput (additional elements);
- Coordination of care including the ED;
- Avoidable hospitalization and ED visits;
- Transfers, EMS systems and diversion, and
- Experience of care.

Conclusion

There is a need for standardized measures that are important, scientifically acceptable, useable, and feasible to advance the measurement and improvement of ED and hospital crowding, boarding and healthcare system preparedness and response. Previous NQF work in this topic area illustrated the need for measures of regionalized emergency medical care services focused on time-sensitive, high-acuity or life-threatening care, and the need for measures that evaluate systems of care. NQF also identified considerable gaps in evidence-based performance measures of preparedness and response, and the critical need to broaden the measurement of emergency care and ED and hospital crowding and boarding.

In this project, the REMCS Expert Panel provided a multi-stakeholder evaluation and prioritization of topics and identified not only future direction for measure development, testing and research but also exposed a number of potential challenges that can be expected as the field develops performance measures for hospitals, healthcare systems and regions in the areas of ED and hospital crowding including, boarding and diversion, emergency preparedness, and surge capacity. This report endeavors to connect the concepts of crowding, preparedness and response, and regionalization, with regard to how these concepts could be measured and reported at the facility or health system level, and how these measures could be potentially reported at the population level for shared accountability. This work and the recommendations of the Panel are intended to guide and inform future measure development, testing, and highlight research priorities necessary to bring forward performance measures in this topic area for future NQF endorsement.

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Appendix A: REMCS Emergency Preparedness Environmental Scan

April 20, 2012

Background

This project comprises a focused environmental scan to address the foundational work necessary for evaluation and endorsement of performance measures. This proposed scan builds on the [NQF endorsed framework for Regionalized Emergency Medical Care Services \(REMCS\)](#). In the prior work, an [environmental scan](#) identified found 30 measures related to REMCS, its scope was focused on measures of “healthcare provided in an emergency department or emergency medical services (EMS) system or acute-care areas of a hospital.”¹

This short-term project supplements the prior environmental scan and focuses specifically on performance measures related to prioritized areas of 1) emergency department crowding, including a specific focus on boarding and diversion, and 2) emergency preparedness. Emergency department crowding measures can be further sub-divided into measures that are “real-time capacity” measures, or retrospective flow measures. For example, a real-time capacity measure might be minute-to-minute ED or hospital occupancy while a retrospective flow measure would be the average flow (i.e. length of stay) within a population of patients over a fixed time period.

Emergency preparedness should be distinguished from emergency department crowding and has been defined as the capability of the public health and health care systems, communities, and individuals, to prevent, protect against, quickly respond to, and recover from health emergencies, particularly those whose scale, timing, or unpredictability threatens to overwhelm routine capabilities. Preparedness involves a coordinated and continuous process of planning and implementation that relies on measuring performance and taking corrective action.² Emergency department crowding, which occurs on a daily basis, should be differentiated from preparedness measures because systems tend to function differently in routine rather than disaster modes. Systems function differently because providers, patients, and other stakeholder will likely use resources differently in each scenario. It is certainly possible that a disaster could overwhelm an already crowded system due to daily crowding, and in that case, both types of measures would be appropriate (i.e. superimposed crowding and preparedness issues would come into play).

Thus, ED boarding, crowding, and diversion all come into play both during routine emergency department crowding and emergency department preparedness scenarios. The ability to measure these conditions in emergency departments and hospitals around the nation is critical to understanding the baseline level of preparedness and potential capacity in our emergency care system, along with how it performs on a routine basis.

¹ Williams, J, Mears, G., et. al. “National Quality Forum Environmental Scan: Regionalized Emergency Medical Care Services.” February 2011.

² Nelson, Christopher, Lurie, Nicole, Wasserman, Jeffrey, and Zakowski, Sarah; “Conceptualizing and Defining Public Health Emergency Preparedness.” Am J Public Health. 2007 April; 97 (Supplement_1): S9-S11.

Objective and Goal

The objective of this environmental scan is to identify measures and measure concepts that are related to emergency department crowding and emergency preparedness. The goal of the project is to use this environmental scan to inform HHS on the readiness of the measurement field in this area and determine whether the timing is appropriate for an endorsement project focused on emergency department crowding and emergency preparedness.

Approach

This environmental scan has included a variety of primary and secondary sources to identify existing measures and measure concepts related to emergency preparedness in the prioritized areas. Specifically, a focused literature search strategy has been complemented by focused outreach to key organizations and opinion leaders to ensure capture of existing performance measures and measure concepts that pertain to emergency preparedness (Figure 1). An emergency medicine physician from Brigham and Women's and Massachusetts General Hospitals, Arjun Venkatesh, MD, MBA, provided clinical context and outreach to key informants in the emergency medicine field. Jesse Pines, MD, MBA, MSCE, FACEP, NQF Consultant and Director, Center for Health Care Quality, Department of Health Policy, George Washington University provided additional input.

Deliverable

Attached to this summary is a spreadsheet catalog of existing emergency preparedness measures and measure concepts. Measures and measure concepts are presented on separate tabs of the spreadsheet. NQF sought to include the following information for measures and measure concepts, where available:

- Measure/concept title and description
- Data source
- Target population
- Timeframe for measure development
- Potential measure developers
- Mapping of each measure to Domain 1 (Capability, Capacity, and Access) of the NQF REMCS framework. The subdomains include the following:
 - 1.1 Public Health Initiatives
 - 1.2 Pre-hospital capabilities
 - 1.3 Real-time capacity information (this includes both “real-time” capacity measures and retrospective flow measures)
 - 1.4 Categorization of participating agencies, organizations, and facilities
 - 1.5 Preparedness, monitoring, and data sharing
 - 1.6 Enabling legal and regulatory framework

Measure concepts were also mapped to ASPR's priority areas of boarding, crowding, and diversion. This mapping allows for the identification of potential gaps in emergency preparedness measurement. The measure concepts were further mapped against the Input-Throughput-Output conceptual model of Emergency Room crowding.³ The input part of the model broadly includes conditions, events or

³ Asplin BR, Magid DJ, Rhodes KV, Solberg LI, Lurie N, Camargo CA Jr.. A conceptual model of emergency department crowding. *Ann Emerg Med.* 2003 Aug;42(2):173-80.

system characteristics that contribute to demand for ED services. Throughput examines processes within the ED that contribute to crowding, and output focuses on factors related to moving patients out of the ED and into other care settings.

Findings

Measures

The environmental scan yielded 81 measures. The majority of these measures have federal sources with focus on responder safety and timing, medical material distribution, and local health department collaborations. The identified measures mapped to the following subdomains of the NQF REMCS Framework:

- 2 measures mapped to REMCS area 1.1: Public Health Initiatives
- 7 measures mapped to REMCS area 1.2: Prehospital Capabilities
- 10 measures mapped to REMCS area 1.3: Real-Time Capacity Information
- 4 measures mapped to REMCS area 1.4: Categorization of Participating Agencies, organizations, and facilities
- 54 measures mapped to REMCS area 1.5- Preparedness, monitoring and data sharing

Condition-specific measures related to cardiac care, stroke, trauma and pediatrics were previously identified in the [Regionalized Emergency Medical Care Services Environmental Scan](#) from the first phase of the project. NQF has endorsed additional emergency care services measures as part of a project focused on [additional outpatient measures in 2010](#).

Measure concepts:

The environmental scan did not yield any specified and tested measures in the ASPR priority areas of crowding, boarding and diversion. However, a number of promising measure concepts used in research studies or local public health efforts were identified through literature review and key informants. The breakdown of the types of concepts identified in the 3 priority areas is as follows:

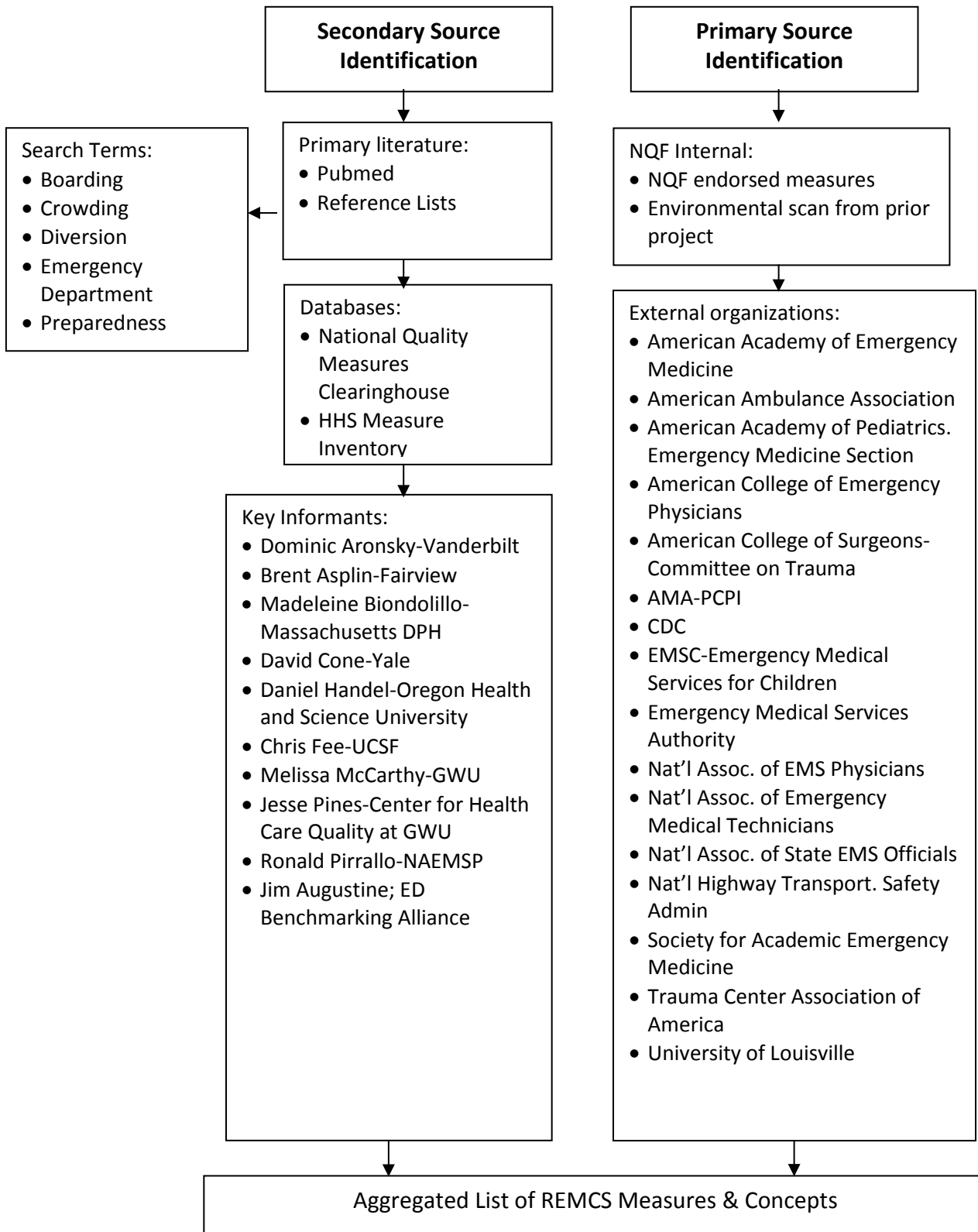
- 9 Boarding measure concepts
- 53 Crowding measure concepts
- 3 Diversion measure concepts

Given that measures specific to boarding and crowding have earned NQF endorsement (e.g., emergency department length of stay for admitted and discharged patients), it seems likely that some of the more developed measure concepts could be translated into fully specified measures for accountability.

Next steps

This focused scan yielded many full measures from federal sources related to overall preparedness, but only measure concepts in ASPR's other priority areas of crowding, diversion and boarding. As noted above, the ability to measure these concepts in emergency departments around the nation is critical to understanding the baseline level of preparedness and potential capacity in our emergency care system. There is general agreement that grounding these measures geographically—at the hospital, health system, community and regional level—would be a key enabler, but defining that geography remains an open question. NQF would be happy to continue working with ASPR to use the work in this scan as a foundation for exploring the broader question of regionalized measurement of emergency services and identifying gaps in measurement.

Figure 1: Environmental Scan Search Strategy



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Regionalized Emergency Medicine Care Services (REMCS): Measures and Concepts

Measures

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|---|---|---|---|--|-----------|--|----------|
| CDC | Medical and public health surge outcome | Percentage of volunteers trained to provide mass prophylaxis (e.g. mass vaccinations or mass antibiotic distribution in the event of a public health emergency) | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |
| HRSA | surge capacity: beds | Number of additional beds for which a recipient could make patient care available within 24 hours | | Hospital, Clinic | | 1.3 - Real-time capacity information | Boarding |
| EMSC- Emergency Medical Services for Children | Performance Measure 73(formerly PM 66b) | The percent of patient care units in the state/territory that have essential pediatric equipment and supplies as outlined in national guidelines. NUMERATOR (BLS (basic life support) patient care units): Number of BLS patient care units that have the essential pediatric equipment and supplies according to the data collected. DENOMINATOR (BLS patient care units): Total number of BLS patient care units for which data was collected. NUMERATOR (ALS-Advanced life support- patient care units): Number of ALS patient care units that have the essential pediatric equipment and supplies according to the data collected. DENOMINATOR (ALS patient care units): Total number of ALS patient care units for which data was collected. | All EMSC grantees (including 49 states and 6 territories) | Hospital, Pediatric, All EMSC grantees | Specified | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|---|--|---|---|--|-----------|--------------------------------------|----------|
| EMSC- Emergency Medical Services for Children | Performance Measure 74(formerly PM 66c medical) | The percent of hospitals recognized through a statewide, territorial, or regional standardized system that are able to stabilize and/or manage pediatric medical emergencies. NUMERATOR: Number of hospitals with an ED that are recognized through a statewide, territorial or regional standardized system that are able to stabilize and/or manage pediatric medical emergencies. DENOMINATOR: Total number of hospitals with an ED in the State/Territory. | All EMSC grantees (including 49 states and 6 territories) | Hospital, Pediatric, All EMSC grantees | Specified | 1.3 - Real-time capacity information | Access |
| EMSC- Emergency Medical Services for Children | Performance Measure 75(formerly PM 66c trauma) | The percent of hospitals recognized through a statewide, territorial, or regional standardized system that are able to stabilize and/or manage pediatric traumatic emergencies. NUMERATOR: Number of hospitals with an ED that are recognized through a statewide, territorial or regional standardized system that are able to stabilize and/or manage pediatric traumatic emergencies. DENOMINATOR: Total number of hospitals with an ED in the State/Territory. | All EMSC grantees (including 49 states and 6 territories) | Hospital, Pediatric, All EMSC grantees | Specified | 1.3 - Real-time capacity information | Access |
| University of Louisville | Emergency Medical Services | Composite: Average Response Time, Number of available hospital/clinic beds, Number of medical personnel (per thousand population) | | EMS, Hospital | | 1.3 - Real-time capacity information | Boarding |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|--|---|-------------------------------|--|-----------|--|-------|
| CDC | Pre-identified staff notified to fill all eight Incident Command System (ICS) core functional roles due to a drill, exercise, or real incident | The intent of this performance measure is to demonstrate the capability to rapidly notify staff with incident management functional responsibilities that the EOC (Emergency Operations Center) is being activated (see Activations below). States and localities are required to report details on a minimum of two notification drills, exercises, or real incidents. States and localities can report an unlimited number of drills, exercises, or real incidents, but can only provide details for a maximum of 12 for the entire year (a maximum of six for each of the two reporting periods within the entire year). This CDC report provides information on the detailed notification drills, exercises, or incidents. States and localities may have conducted additional notifications. | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Pre-identified staff acknowledged notification within the target time of 60 minutes | This performance measure, related to the measure above, considers the time for staff with public health agency ICS functional responsibilities to acknowledge the notification. | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Conducted at least one unannounced notification outside of normal business hours | States and localities must be able to demonstrate that all eight core ICS functional roles can be staffed rapidly outside of normal business hours without advance warning. | | | | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|--|---|-------------------------------|--|-----------|--|-------|
| CDC | Public health EOC (Emergency Operations Center) activated as part of a drill, exercise, or real incident | The intent of this performance measure is to demonstrate the capability for all eight staff having core ICS functional responsibilities to report for duty at the public health EOC. States and localities are required to report a minimum of two activations. States and localities can report an unlimited number of activations, but can only provide details for a maximum of 12 for the entire year (a maximum of six for each of the two reporting periods within the entire year). This CDC report provides information on the detailed activations. States and localities may have conducted additional activations. | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Pre-identified staff reported to the public health EOC within the target time of 2.5 hours | This performance measure, related to the measure above, considers the time for staff with public health agency Incident Command System functional responsibilities to report for duty at the public health agency's EOC. | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Conducted at least one unannounced activation | States and localities must be able to demonstrate that all eight core ICS functional role scan be staffed rapidly outside of normal business hours without advance warning. | | | | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|--|--|-------------------------------|--|-----------|--|-------|
| CDC | AAR/IPs developed following an exercise or real incident. After Action Reports/Improvement Plans (ARR/IPs) | The intent of this performance measure is to demonstrate the capability to analyze response actions, describe needed improvements, and prepare a plan for making improvements. States and localities are required to report details on a minimum of two AAR/IPs. States and localities can report an unlimited number of AAR/IPs, but can only provide details for a maximum of 12 for the entire year (a maximum of six for each of the two reporting periods within the entire year). This CDC report provides information on the detailed AAR/IPs. States and localities may have developed additional AAR/IPs. | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | AAR/IPs developed within target time of 60 days | Development of an AAR/IP within 60 days is calculated using the date following the end of the exercise or public health emergency response operations as determined by the incident commander, and the date the draft AAR/IP was submitted for clearance within the public health agency. | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Re-evaluated response capabilities following approval and completion of corrective actions identified in AAR/Ips | The systematic reevaluation of response capabilities is critical for providing evidence that planned corrective actions have been effective in improving response. | | | | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|--|---|-------------------------------|--|-----------|--|-------|
| CDC | Time for pre-identified staff covering activated public health agency incident management lead roles (or equivalent lead roles) to report for immediate duty. Performance Target: 60 minutes or less | Activate public health emergency operations | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Production of the approved Incident Action Plan before the start of the second operational period | Develop incident response strategy | | | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Time to complete a draft of an After Action Report and Improvement Plan | Demobilize and evaluate public health emergency operations | | | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Time to issue a risk communication message for dissemination to the public | Issue public information, alerts, warnings, and notifications | | Public Health Agency | | 1.1 - Public Health initiatives | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|--|--|-------------------------------|--|-----------|--|-------|
| CDC | Composite performance indicator from the Division of Strategic National Stockpile in CDC's Office of Public Health Preparedness and Response | Activate dispensing modalities | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Composite performance indicator from the Division of Strategic National Stockpile in CDC's Office of Public Health Preparedness and Response | Dispense medical countermeasures to identified population | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Composite performance indicator from the Division of Strategic National Stockpile in CDC's Office of Public Health Preparedness and Response | Direct and activate medical material management and distribution | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|--|--|-------------------------------|--|-----------|--|-------|
| CDC | Composite performance indicator from the Division of Strategic National Stockpile in CDC's Office of Public Health Preparedness and Response | Acquire medical material | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Composite performance indicator from the Division of Strategic National Stockpile in CDC's Office of Public Health Preparedness and Response | Maintain updated inventory management and reporting system | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Composite performance indicator from the Division of Strategic National Stockpile in CDC's Office of Public Health Preparedness and Response | Establish and maintain security | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|--|--|---|--|-----------|--|--------------|
| CDC | Composite performance indicator from the Division of Strategic National Stockpile in CDC's Office of Public Health Preparedness and Response | Distribute medical material | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Composite performance indicator from the Division of Strategic National Stockpile in CDC's Office of Public Health Preparedness and Response | Recover medical material and demobilize distribution operations | | Public Health Agency | | 1.5 - Preparedness, monitoring, and data sharing | |
| Premier, Inc. | Risk-Adjusted Average Length of Inpatient Hospital Stay | Percentage of inpatient & outpatients with excessive in-hospital days. Numerator: Number of excess in-hospital days in a given inpatient population. Denominator: Patients admitted to a hospital. Patient population can be aggregated as any grouping of patients (e.g., by hospital, physician, diagnosis code, procedure, DRG, etc.) | Electronic Clinical Data : Electronic Health Record | | Specified | 1.3 - Real-time capacity information | NQF endorsed |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|---|---|-------------------------------|--|-----------|--------------------------------------|--------------|
| United Health Group | Inpatient Hospital Average Length of Stay (risk adjusted) | <p>Overall inpatient hospital average length of stay (ALOS) and ALOS by medical service category. Numerator: Total number of inpatient days of care for the admissions in the denominator. Denominator:</p> <ul style="list-style-type: none"> •Denominator 1: Total number of inpatient admissions during the reporting period. •Denominator 2: Total number of inpatient admissions for the selected APR-DRG or DRG service category during the reporting period. <p>oAPR-DRG and DRG service categories: medical, surgical, neonatal intensive care unit, mental health, substance abuse, obstetrics, and transplants (see Table 1 for DRG statistics and service categories).</p> | Administrative claims | Hospital, Clinic | Specified | 1.3 - Real-time capacity information | NQF endorsed |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|---|--|-------------------------------|--|-----------|--|-----------------|
| Leapfrog Group | Severity- Standardized Average Length of Stay -- Routine Care (risk adjusted) | Standardized average length of hospital stay (ALOS) for routine inpatient care (i.e., care provided outside of intensive care units). Numerator: Number of accommodation days in Routine Care hospital units for discharges in the denominator. Denominator: Number of inpatient hospital discharges (for respective condition) Inclusions: 1. Global time period = Cases with discharge dates falling within six-month measurement time period 2. Cases meeting global Clinical Criteria for Acute Myocardial Infarction (AMI), Coronary Artery Bypass Graft (CABG), Percutaneous Coronary Intervention (PCI), or Pneumonia, respectively 3. Patients aged 18-64 years at admission 4. Primary source of payment = private/commercial health insurance plan 5. Cases with Routine Care accommodation Days 0 or more, whole number values, defined by UB-92 revenue codes | Administrati ve claims | Adult/Elderly Care | Specified | 1.3 - Real-time capacity information | NQF endorsed |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|---|------------------------------|-------------------------------|--|-----------|--|-------|
| CDC | Time for sentinel clinical laboratories to acknowledge receipt of an urgent message from the CDC Public Health Emergency Preparedness (PHEP)-funded Laboratory Response Network biological (LRN-B) laboratory | Manage laboratory activities | | Laboratories | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Time for initial laboratorian to report for duty at the CDC PHEP-funded laboratory | Manage laboratory activities | | Laboratories | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Percentage of Laboratory Response Network (LRN) clinical specimens without any adverse quality assurance events received at the CDC PHEP-funded LRN-B laboratory for confirmation or rule-out testing from sentinel clinical laboratories | Perform sample management | | Laboratories | | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|---|--|-------------------------------|--|-----------|--|-------|
| CDC | Percentage of LRN non-clinical samples without any adverse quality assurance events received at the CDC PHEP-funded LRN-B laboratory for confirmation or rule-out testing from first responders | Perform sample management | | Laboratories | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Ability of the CDC PHEP-funded Laboratory Response Network chemical (LRN-C) laboratories to collect relevant samples for clinical chemical analysis, package, and ship those samples | Perform sample management | | Laboratories | | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Measure 1: Proportion of reports of selected reportable diseases received by a public health agency within the jurisdiction required time frame ²⁸⁸ | <ul style="list-style-type: none"> – Numerator: Number of reports of selected reportable disease received by a public health agency within the jurisdiction-required time frame – Denominator: Number of reports of selected reportable disease received by a public health agency | | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|--|--|-------------------------------|--|-----------|---|-------|
| CDC | Measure 1: Percentage of infectious disease outbreak investigations ³⁰² that generate reports | – Numerator: Number of infectious disease outbreak investigation reports generated Denominator: Number of infectious disease outbreak investigation reports investigated | | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Measure 2: Percentage of infectious disease outbreak investigation reports that contain all minimal elements ³⁰³ | – Numerator: Number of infectious disease outbreak investigation reports generated containing all minimal elements Denominator: Total number of infectious disease outbreak investigation reports generated | | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Measure 3: Percentage of acute environmental exposure ³⁰⁴ investigations that generate reports | – Numerator: Number of acute environmental exposure investigation reports generated Denominator: Number of acute environmental exposures investigated | | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Measure 4: Percentage of acute environmental exposure reports that contain all minimal elements | – Numerator: Number of acute environmental exposure reports generated containing all minimal elements Denominator: Number of acute environmental exposure investigation reports generated | | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|---|---|-------------------------------|--|-----------|---|-------|
| CDC | Measure 1: Proportion of reports of selected reportable diseases for which initial public health control measure(s) were initiated within the appropriate time frame ³⁰⁹ | – Numerator: Number of reports of selected reportable diseases for which public health control measure(s) were initiated within an appropriate time frame Denominator: Number of reports of selected reportable diseases received by a public health agency | | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC-NIOSH | Safety Climate: Overall Performance Measure: Develop and evaluate a set of new best practices or recommended performance measures to improve the organization of emergency response activities and to promote a pro- active crew-based safety climate. Reduce exposures, illnesses, or injuries attributable to improvements in safety climate | Strategic Goal: Reduce injuries and enhance the health, safety, and resilience of emergency responders by improving the organization of emergency response work. Discussion: Improved preparation, better organization, and more consistent adherence to best practices during emergency operations will minimize exposures, prevent consequent injuries and illnesses, and promote workforce resilience. The overall safety climate in an emergency setting is influenced by many factors, including the nature of the hazards, management practices, crew-based collaboration, communication, preparation, and training, that address all phases of a response, from pre-event preparation to after-action review and treatment. | | EMS | | 1.2 - Prehospital capabilities | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|--|---|-------------------------------|--|-----------|--------------------------------------|-------|
| CDC-NIOSH | Personal Protective Equipment(PPE): Overall Performance Measure: Reduce the number of injuries and illnesses to first responders as a result of improper selection or use (or non-use) of PPE. | Strategic Goal: Emergency response organizations with responsibilities associated with hazardous materials response will reduce exposures to inhalation and dermal hazards. Discussion: During the earliest phases of response operations, before technical expertise can be brought to bear or supplemental safety equipment can be located, responders and safety managers need guidelines, checklists, or other decision-making tools to assist in developing appropriate initial and reevaluated protection strategies. | | EMS | | 1.2 - Prehospital capabilities | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|---|--|-------------------------------|--|-----------|--------------------------------------|-------|
| CDC-NIOSH | Surveillance: Overall performance measure: Reduce the development of illnesses or injuries attributable to occupational exposure during disaster response through the use of prevention tools developed from information from short and long-term surveillance reporting systems. | Strategic Goal: Emergency response organizations will use the results from analyses of data from a surveillance system(s) developed by NIOSH to improve emergency responder safety and health. The surveillance system will identify problems for corrective action through the systematic collection, analysis, and interpretation of exposure, hazard, injury, and illness data. Discussion: The systematic collection, analysis, and interpretation of health and exposure data can give decision makers valuable information for improving the safety and health of those called upon during disasters. Surveillance data can also be useful to identify subgroups at risk of exposure to specific hazards so that appropriate prevention can be implemented, follow-up can be planned, and possible intervention can be implemented. For example, the rapid identification of specific respiratory illnesses among emergency responders may allow for monitoring of other workers and facilitate the introduction of controls and risk management at the site, as well as for long-term surveillance of affected workers. | | EMS | | 1.2 - Prehospital capabilities | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|---|---|-------------------------------|--|-----------|--------------------------------------|-------|
| CDC-NIOSH | Characterization/Assessment of Potential Hazards: Overall Performance Goal: Reduce the incidence and severity of injuries and illnesses through improved and more rapid characterization/assessment of potential hazards. | Develop new methods for identifying environmental contamination in case of a terror event. These methods would reduce the number of workers exposed and injured since more rapid identification of the terror agent would occur and the appropriate protection, workplace controls would be instituted. | | EMS | | 1.2 - Prehospital capabilities | |
| CDC-NIOSH | Engineering/Technological Interventions and Controls: Overall Performance Measure: Reduce exposure through improved engineering/technological interventions and controls. | Strategic Goal: As appropriate and feasible, improve engineering controls, technology, and tools to reduce responder's exposures to or hazards associated with CBRN, toxic industrial compounds, and other hazardous materials. Discussion: Poor integration of engineering controls during structural design and procedural development usually results in almost total dependence on PPE to minimize exposures or hazards during emergency response operations. Engineering control interventions should be evaluated and implemented, even though complete control of CBRN, toxic industrial compounds, and hazardous exposures may not be possible by engineering controls alone. | | EMS | | 1.2 - Prehospital capabilities | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|--|---|-------------------------------|--|-----------|--------------------------------------|-------|
| CDC-NIOSH | Environmental Microbiology: Overall Performance Goal: Improve the ability to evaluate, understand risk of infection, and improve risk reduction strategies for biological threat agents. | Strategic Goal: Emergency response organizations will improve their understanding of environmental microbiology threat agents, including environmental factors that influence the introduction, spread, and control of these agents. Emergency responders will enhance their capability to respond to a biological threat, whether naturally occurring or deliberately introduced. Discussion: Critical gaps exist in our knowledge about environmental microbiology, and these disparities impede the ability of public health responders to take appropriate action in emergency situations that involve microbial agents. Microbial agents are considered to include bioterrorism agents, emerging infectious pathogens, and non-select agents. Establishing the presence and level of threat agents in the environment ideally would be supported by validated and effective sampling, detection, and quantification of the target agents, as well as specific identification of pathogens and their antimicrobial susceptibilities. It is also critical to have the capacity to estimate risk of infection to human populations using data such as number and viability of organisms in an environment, persistence of agents in the environment, dose-infection relationships through various environmental media, and antimicrobial resistance patterns. | | EMS | | 1.2 - Prehospital capabilities | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
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| | | Finally, it is important to develop and understand the effectiveness of a range of risk reduction strategies for contaminated environments, including environmental controls; personal protective equipment; disinfection strategies; and, when Available and indicated, medical countermeasures like immunization or antimicrobial prophylaxis. | | | | | |
| CDC-NIOSH | Biological Monitoring of Terrorism Agents develop new methods for evaluating internal doses following a terror event. | These methods would reduce the number of workers affected since more rapid and accurate identification of those with significant absorption of the terror agent would occur, and appropriate treatment would be instituted for those who need it. In addition, such methods would permit better monitoring of the effectiveness of exposure protections and more precise identification of those needing further medical follow-up or monitoring. Strategic Goal: Emergency response and remediation workers will reduce the potential impact of exposures to terror agents by utilizing improved biological monitoring methods. Discussion: When a terror event occurs, the causative agent, whether chemical, biological, or radiologic/nuclear, needs to be quickly identified and exposures assessed. At times, the terror event may entail multiple agents released either simultaneously or sequentially. | | EMS | | 1.2 - Prehospital capabilities | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
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| | | <p>Better methods to identify absorbed chemical or biological agents and to quantify internal exposure are needed. In particular, rapid methods for measuring what or how much agent is actually absorbed into the body using various biomonitoring techniques would be beneficial, especially when clinical evaluation is needed. Cumulative exposures to chemical agents (and perhaps some biological agents) at levels insufficient to produce acute symptoms or illness may over time lead to frank disease or other adverse health effects, and biomonitoring is an important tool for early identification and monitoring of such exposures. Additionally, vaccination can augment protection against some biothreat agents. Successful vaccination results in measurable antibody titers. Exposure to biothreat agents also can induce natural immunity, which can serve as a biological marker of remote or recent exposure. Critical gaps exist in the efficient measurement of antibodies to numerous biothreat agents, as existing methods can measure only one analyze per assay.</p> | | | | | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|---|---|--|--|-----------|--|------------------------|
| CDC | CP – Identification of key organizations Annual | Median number of community sectors in which local health departments (LHDs) identified key organizations to participate in public health, medical, and/or mental/behavioral health-related emergency preparedness efforts. Measurement Specifications: When the numbers of community sectors engaged by each participating LHD are arranged from highest to lowest [maximum is 11, minimum is zero], the median is the midpoint number where half of the LHDs engaged a number of sectors at or above the midpoint and the other half of the LHDs engaged a number of sectors at or below it. | Self-reported data from local health departments | Public Health Agency | Specified | 1.4 - Categorization of participating agencies, organizations and facilities | |
| CDC | CP – Community engagement in risk identification Annual | Median number of community sectors that LHDs engaged in using hazards, and vulnerabilities assessment (HVA) data to determine local hazards, vulnerabilities, and risks that may impact public health, medical, and/or mental/behavioral health systems and services. Measurement Specifications: When the numbers of community sectors that each LHD engaged to determine local hazards, vulnerabilities, and risks are arranged from highest to lowest [maximum is 11, minimum is zero], the median is the midpoint number where half of the LHDs engaged a number of sectors at or above the midpoint and the other half of the LHDs engaged a number of sectors at or below it. | Self-reported data from local health departments | Public Health Agency | Specified | 1.4 - Categorization of participating agencies, organizations and facilities | Boarding and/or Access |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|---|---|--|--|-----------|--|-------|
| CDC | CP – Community engagement in public health preparedness activities Annual | Proportion of key organizations that LHDs engaged in a significant public health emergency preparedness activity. Measurement Specifications: Numerator: Number of key organizations that LHDs engaged in one or more of the following significant public health emergency preparedness activities: Development of key organizations’ emergency operations or response plans related to public health, medical, and/or mental/behavioral health Exercises containing objectives or challenges (e.g. injects) related to public health, medical, and/or mental/behavioral health. Competency-based training related to public health, medical, and/or mental/behavioral health emergency preparedness and response. Denominator: Total number of key organizations identified by LHDs (as specified in data element #2 for CP 1) | Self-reported data from local health departments | Public Health Agency | Specified | 1.4 - Categorization of participating agencies, organizations and facilities | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
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| CDC | CP – Community engagement in recovery planning Annual | Median number of community sectors that LHDs engaged in developing and/or reviewing a community recovery plan related to the restoration and recovery of public health, medical, and/or mental/behavioral health systems and services. Measurement Specifications: When the numbers of community sectors that each LHD engaged in developing and/or reviewing their community recovery plan are arranged from highest to lowest [maximum is 11, minimum is zero], the median is the midpoint number where half of the LHDs engaged a number of sectors at or above the midpoint and the other half of the LHDs engaged a number of sectors at or below it. | Self-reported data from local health departments | Public Health Agency | Specified | 1.4 - Categorization of participating agencies, organizations and facilities | |
| CDC | EOC – Staff Assembly Annual | Time for pre-identified staff covering activated public health agency incident management lead roles (or equivalent lead roles) to report for immediate duty. Measurement Specification: Start time: Date and time that a designated official began notifying staff to report for immediate duty to cover activated incident management lead roles. Stop time: Date and time that the last staff person notified to cover an activated IM lead role reported for immediate duty. | health department. Self-reported data on exercises or real incidents. | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|---|---|---|--|-----------|--|-------|
| CDC | EOC – Priority Goal (50 states only) Annual | Time for pre-identified staff covering activated public health agency incident management lead roles (or equivalent lead roles) to report for immediate duty. Performance Target: 60 minutes. Measurement Specification: Start time: Date and time that a designated official began notifying staff to report for immediate duty to cover activated IM lead roles. Stop time: Date and time that the last staff person notified to cover an activated IM lead role reported for immediate duty. | health department. Self-reported data on exercises or real incidents. | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | EOC - IAP | Production of the approved Incident Action Plan (IAP) before the start of the second operational period. Measurement Specifications: Was a written IAP approved before the start of the second operational period [Yes/No]? | health department. Self-reported data on exercises or real incidents. | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | EOC - AAR and IP Annual | Time to complete a draft of an After Action Report (AAR) and Improvement Plan (IP). Measurement Specifications: Start time: Date exercise or public health emergency operation completed (may be prior to or during current BP). Stop time: Date the draft AAR and IP were submitted for clearance within the public health agency. | health department. Self-reported data on exercises or real incidents. | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|--|---|---|--|-----------|--|-------|
| CDC | EPIW - Public Message Dissemination | Time to issue a risk communication message for dissemination to the public. Measurement Specifications: Start time: Date and time that a designated official requested that the first risk communication message be developed. Stop time: Date and time that a designated official approved the first risk communication message for dissemination. | health department. Self-reported data on exercises or real incidents. | Public Health Agency | Specified | 1.1 - Public Health initiatives | |
| CDC | Communication between PHEP-funded Laboratory and Sentinel Clinical Laboratories Bio Only | Time for sentinel clinical laboratories to acknowledge receipt of an urgent message from PHEP-funded laboratory. Measurement Specifications: Start time: Time PHEP-funded laboratory sends urgent message to first sentinel clinical laboratory. Intermediate stop time 1: Time at least 50% of sentinel clinical laboratories acknowledged receipt of urgent message. Intermediate stop time 2: Time at least 90% of sentinel clinical laboratories acknowledged receipt of urgent message. Stop time: Time last sentinel clinical laboratory acknowledged receipt of urgent message | self-reported data from real incidents or exercises | Laboratories | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Laboratorian Reporting Bio & Chem | Time for initial laboratorian to report for duty at the PHEP-funded laboratory. Measurement Specifications: Start Time: Date and time that a public health designated official began notifying on-call laboratorian(s) to report for duty at the PHEP-funded LRN laboratory. Stop Time: Date and time that the first laboratorian reported for duty at the PHEP-funded LRN laboratory | self-reported data from real incidents or exercises | Laboratories | Specified | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|---|---|--|--|-----------|--|-------|
| CDC | LRN-EPI 24/7 Emergency Contact Drill Bio & Chem Annual | Time to complete notification between CDC, on-call laboratorian, and on-call epidemiologist Performance Target: 45 minutes. Measurement Specifications: Start Time: Date and time that CDC Emergency Operations Center official began notification to on-call laboratorian. [In BP11, this applies only to LRN-B in this direction.] Stop Time: Date and time on-call epidemiologist (after receiving notification from on-call laboratorian) notifies CDC Emergency Operations Center that notification drill is complete. | CDC-initiated drills and CDC EOC, DSLR (Division of State and Local Readiness) | Laboratories | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | LRN-EPI 24/7 Emergency Contact Drill Bio & Chem Annual | Time to complete notification between CDC, on-call epidemiologist, and on-call laboratorian Performance Target: 45 minutes. Measurement Specifications: Start Time: Date and time that CDC Emergency Operations Center official began notification to on-call epidemiologist. Stop Time: Date and time on-call laboratorian (after receiving notification from on-call epidemiologist) notifies CDC Emergency Operations Center that notification drill is complete. [In BP11, this applies only to LRN-C in this direction.] | CDC-initiated drills and CDC EOC, DSLR (Division of State and Local Readiness) | Laboratories | Specified | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|---|--|--|--|-----------|--|-------|
| CDC | LRN Emergency Response Pop Proficiency Test (PopPT) Exercise Chem Only Annual | Ability of PHEP-funded LRN-C Level 1 and/or Level 2 laboratories to detect and quantify biomarkers of chemical agents in clinical samples during the LRN Emergency Response Pop Proficiency Test (PopPT) Exercise. Measurement Specifications: Numerator: Number of biomarkers of chemical agents detected by Level 1 and/or Level 2 laboratories. Denominator: Number of biomarkers of chemical agents in the exercise. | Data are collected internally by the LRN-C program. Results will be shared with DSLR. | Laboratories | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Notification Drill associated with Proficiency Testing Bio Only Annual | Ability of PHEP-funded LRN-B reference laboratory to contact the CDC Emergency Operations Center within 2 hours during LRN notification drill. Measurement Specifications: Notification drill results [Passed/did not pass/did not participate] | Data will be collected by LRN-B program. Results will be shared with DSLR. Notification drill data must be validated in PERFORMS by the awardee's preparedness office. | Laboratories | Specified | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|--|--|--|--|-----------|--|-------|
| CDC | Notification to Partners Bio & Chem Annual | Time for PHEP-funded laboratory to notify public health partners of significant laboratory results. Measurement Specifications: Start time: Time PHEP-funded laboratory obtains a significant laboratory result. Stop time: Time PHEP-funded laboratory completes notification of public health partners of significant laboratory results (i.e., time when last public health partner was notified, if partners were not simultaneously notified) | self-reported data from real incidents or exercises | Laboratories | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Proficiency Testing Bio Only Annual | Proportion of LRN-B proficiency tests successfully passed by PHEP-funded laboratories. Measurement Specifications: Numerator: Number of LRN-B proficiency tests successfully passed by PHEP-funded laboratory(ies). Denominator: Total number of LRN-B proficiency tests participated in by PHEP-funded laboratory(ies) | Data are collected internally by the LRN-B program. Awardees will submit information for Reported Data Element 4. Results will be shared with DSLR. Proficiency testing data must be validated in PERFORMS by the awardee's preparedness office. | Laboratories | Specified | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|--|---|--|--|-----------|---|-------|
| CDC | Proficiency Testing - Chemical Additional Chem Only Annual | Proportion of LRN-C proficiency tests (additional methods) successfully passed by PHEP-funded laboratory. Measurement Specifications: Numerator: Number of LRN-C additional methods successfully proficiency tested by the PHEP-funded laboratory. Denominator: Total number of LRN-C additional methods for which the PHEP- funded laboratory is qualified to test | Reported Data Elements 1-4 are collected internally by the LRN-C program. Awardees will submit information for Reported Data Element 5. Results will be shared with DSLR. | Laboratories | Specified | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|--|--|--|--|-----------|--|-------|
| CDC | Proficiency Testing - Chemical Core Chem Only Annual | Proportion of LRN-C proficiency tests (core methods) successfully passed by PHEP-funded laboratory. Measurement Specifications: Numerator: Number of LRN-C core methods successfully proficiency tested by the PHEP-funded laboratory. Denominator: Total number of LRN-C core methods (9) | Reported Data Elements 1-4 are collected internally by the LRN-C program. Awardees will submit information for Reported Data Element 5. Results will be shared with the Division of State and Local Readiness. | Laboratories | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Sample Collection, Packing, and Shipping (SCPaS) Chem Only Annual | Ability of PHEP-funded LRN-C laboratory to collect, package, and ship samples properly during LRN exercise. Measurement Specifications: SCPaS Exercise Results [Passed/Did not pass] | Data are collected internally by the LRN-C program office at CDC. Results will be shared with DSLR. | Laboratories | Specified | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|---|--|--|--|-----------|--|-------|
| CDC | Sample Quality-First Responders Bio Only Annual | Percentage of LRN nonclinical samples received at the PHEP-funded laboratory for confirmation or rule-out testing from first responders without any adverse quality assurance events. Measurement Specifications: Numerator: Number of LRN nonclinical samples received at the PHEP-funded laboratory for confirmation or rule-out testing from first responders without any adverse quality assurance events. Denominator: Total number of LRN nonclinical samples received at the PHEP-funded laboratory for confirmation or rule-out testing from first responders | Self-Reported. Data are to be reported on the quality of LRN nonclinical samples received from first responders on a day-to-day basis (i.e., not via exercises). | Laboratories | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | Specimen Quality-Sentinel Clinical Laboratories Bio Only Annual | Percentage of LRN clinical specimens received at PHEP-funded laboratory for confirmation or rule-out testing from sentinel clinical laboratories without any adverse quality assurance events. Measurement Specifications: Numerator: Number of LRN clinical specimens received at PHEP-funded laboratory for confirmation or rule-out testing from sentinel clinical laboratories without any adverse quality assurance events. Denominator: Total number of LRN clinical specimens received at CDC PHEP-funded laboratory for confirmation or rule-out testing from sentinel clinical laboratories | Self-Reported. Data are to be reported on the quality of LRN nonclinical samples received from first responders on a day-to-day basis (i.e., not via exercises). | Laboratories | Specified | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|--|---|---|--|-----------|--|-------|
| CDC | Surge Capacity Exercise Chem Only Annual | Ability of each PHEP-funded LRN-C Level 1 laboratory to process and report results to CDC for 500 samples during the LRN Surge Capacity Exercise. Measurement Specifications: Start Time: Date and time of delivery of 500 samples to LRN-C Level 1 laboratory. Stop Time: Date and time result from last sample was reported to CDC | Data are collected internally by the LRN-C program. Results will be shared with DSLR. | Laboratories | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | SURV – Disease Reporting Annual | Proportion of reports of selected reportable diseases received by a public health agency within the awardee-required timeframe. Measurement Specifications: Numerator: Number of reports of selected reportable disease received by a public health agency within the awardee-required timeframe. Denominator: Number of reports of selected reportable disease received by a public health agency | Self-reported data from local health departments | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | SURV – Disease Control Annual | Proportion of reports of selected reportable diseases for which initial public health control measure(s) were initiated within the appropriate timeframe. Measurement Specifications: Numerator: Number of reports of selected reportable diseases for which public health control measure(s) were initiated within an appropriate timeframe. Denominator: Number of reports of selected reportable diseases received by a public health agency | Self-reported data from local health departments | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-------------------------------|--|---|---|---|------------------|--|--------------|
| CDC | El – Outbreak Investigation Reports Annual | Percentage of infectious disease outbreak investigations that generate reports. Measurement Specifications: Numerator: Number of infectious disease outbreak investigation reports generated. Denominator: Number of infectious disease outbreaks investigated | Self-reported data from local health departments from real reports, not exercises | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | El – Outbreak Reports with Minimal Elements Annual | Percentage of infectious disease outbreak investigation reports that contain all minimal elements. Measurement Specifications: Numerator: Number of infectious disease outbreak investigation reports containing all minimal elements. Denominator: Number of infectious disease outbreak reports generated | Self-reported data from local health departments from real reports, not exercises | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | El – Exposure Investigation Reports Annual | Percentage of EI of acute environmental exposures that generate reports. Measurement Specifications: Numerator: Number of EI reports of acute environmental exposures generated. Denominator: Number of EI of acute environmental exposures | Self-reported data from local health departments from real reports, not exercises | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CDC | El – Exposure Reports with Minimal Elements Annual | Percentage of EI reports of acute environmental exposures that contain all minimal elements. Measurement Specifications: Numerator: Number of EI reports of acute environmental exposures containing all minimal elements. Denominator: Number of EI reports of acute environmental exposures generated | Self-reported data from local health departments from real reports, not exercises | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |

| Developer/ Steward | Measure Title | Measure Description | Data Source (If Available) | Target Population (If Available) | Specified | Mapping To NQF REMCS Framework | Notes |
|-----------------------|---|---|---|--|-----------|--|--------------|
| HHS-OASH | Ensure that State and District of Columbia health departments establish training, plans, and protocols and conduct annual multi-institutional exercises to prepare for response to natural and technological disasters. | Topic or Condition: Population Sub-Topic or Sub-Condition: Environmental Health Domain: Process Care Setting: Health System Numerator: Number of States including District of Columbia that have established preparedness plans and scheduled exercises Denominator: Not applicable Explanation If No Numerator/Denominator: Number, not a rate | Association of State and Territorial Health Officials (ASTHO); CDC, Division of State and Local Readiness (DSLRL) | Public Health Agency | Specified | 1.5 - Preparedness, monitoring, and data sharing | |
| CMS | Median time from ED arrival to ED departure for Discharged ED patients | Median time from emergency department arrival to time of departure from the emergency room for patients discharged from the emergency department | Electronic Clinical Data; Paper Medical Records | Hospital | Specified | 1.3 - Real-time capacity information | NQF endorsed |
| CMS | Admit decision time to ED departure time for admitted patients | Median time from admit decision time to time of departure from the emergency department for emergency department patients admitted to inpatient status | Electronic Clinical Data; Paper Medical Records | Hospital | Specified | 1.3 - Real-time capacity information | NQF endorsed |
| CMS | Median time from ED arrival to ED departure for admitted ED patients | Median time from emergency department arrival to time of departure from the emergency room for patients admitted to the facility from the emergency department | Electronic Clinical Data; Paper Medical Records | Hospital | Specified | 1.3 - Real-time capacity information | NQF endorsed |

Concepts

| Measure Concept Description | Domain | Input, Throughput, Output, Or Staffing | Mapping To NQF REMCS Framework, Part 1 |
|--|--------------------------------|--|--|
| ED beds at capacity > 6 hours or hallways filled > 6 hours | Boarding | Output | 1.3 - Real-time capacity information |
| No. of full rooms | Boarding | Output | 1.3 - Real-time capacity information |
| No., mean no., or % of boarders | Boarding | Output | 1.3 - Real-time capacity information |
| Boarding time | Boarding | Output | 1.3 - Real-time capacity information |
| Boarding time components | Boarding | Output | 1.3 - Real-time capacity information |
| Inpatient occupancy level | Boarding | Output | 1.3 - Real-time capacity information |
| ED volume / inpatient bed capacity | Boarding | Output | 1.3 - Real-time capacity information |
| Number of staffed acute care beds | Boarding | Output | 1.3 - Real-time capacity information |
| Alternate level of care bed availability | Boarding | Output | 1.3 - Real-time capacity information |
| Percentage of open appointments in ambulatory care clinics | Crowding | Input; Output | 1.3 - Real-time capacity information |
| Staff Present | Crowding | Staffing | 1.3 - Real-time capacity information |
| ED workload Rate (# of daily ED visits x mean LOS / number of ED beds available) | Crowding | Throughput | 1.3 - Real-time capacity information |
| Physicians feel rushed | Crowding; Clinician Opinion | Throughput | 1.3 - Real-time capacity information |
| Clinician opinion of crowding | Crowding; Clinician Opinion | Throughput | 1.3 - Real-time capacity information |
| Emergency Physician satisfaction | Crowding; Clinician Opinion | Staffing | 1.3 - Real-time capacity information |
| Waiting time | Crowding; Input | Throughput | 1.3 - Real-time capacity information |
| Waiting room filled > 6 hours / day | Crowding; Input | Throughput | 1.3 - Real-time capacity information |
| Time to physician | Crowding; Input | Throughput | 1.3 - Real-time capacity information |
| No. of ED arrivals | Crowding; Input | Input | 1.3 - Real-time capacity information |
| No. of pts in ED waiting room | Crowding; Input | Input | 1.3 - Real-time capacity information |
| No. of pts registered | Crowding; Input | Input | 1.3 - Real-time capacity information |
| No. or % of ambulance patients registered | Crowding; Input | Input | 1.3 - Real-time capacity information |

| Measure Concept Description | Domain | Input, Throughput, Output, Or Staffing | Mapping To NQF REMCS Framework, Part 1 |
|--|-------------------------|---|---|
| No. of pts awaiting triage | Crowding; Input | Input | 1.3 - Real-time capacity information |
| No. of low-complexity pts | Crowding; Input | Input | 1.3 - Real-time capacity information |
| No. of pts at each acuity level | Crowding; Input | Input | 1.3 - Real-time capacity information |
| Average triage acuity level | Crowding; Input | Throughput | 1.3 - Real-time capacity information |
| No. of new pts by usual care | Crowding; Input | Input | 1.3 - Real-time capacity information |
| LWBS (Left Without Being Seen)/reneging | Crowding; Input | Input | 1.3 - Real-time capacity information |
| Average or % of pts who leave without treatment complete | Crowding; Input | Input | 1.3 - Real-time capacity information |
| Average EMS waiting time | Crowding; Input | Throughput | 1.3 - Real-time capacity information |
| No. or % of admissions | Crowding; Output | Throughput | 1.3 - Real-time capacity information |
| ED Observation unit census | Crowding; Output | Output | 1.3 - Real-time capacity information |
| No. of pts waiting discharge ambulance pick-up | Crowding; Output | Output | 1.3 - Real-time capacity information |
| ED admission transfer rate | Crowding; Output | Output | 1.3 - Real-time capacity information |
| Hospital admission source | Crowding; Output | Output | 1.3 - Real-time capacity information |
| Hospital supply / demand forecast | Crowding; Output | Output | 1.3 - Real-time capacity information |
| No. of inpatients ready for discharge | Crowding; Output | Output | 1.3 - Real-time capacity information |
| Inpatient processing times | Crowding; Output | Output | 1.3 - Real-time capacity information |
| Inpatient laboratory, radiology, CT orders | Crowding; Output | Output | 1.3 - Real-time capacity information |
| Time from request to bed assignment | Crowding; Output | Throughput | 1.3 - Real-time capacity information |
| Time from bed ready to ward transfer | Crowding; Output | Throughput | 1.3 - Real-time capacity information |
| Agency nursing expenditures | Crowding; Output | Staffing | 1.3 - Real-time capacity information |
| Local home care service availability | Crowding; Output | Output | 1.3 - Real-time capacity information |
| Percentage of time ED > or = to stated capacity | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |
| Total no. of pts in ED | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |
| ED occupancy rate | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |

| Measure Concept Description | Domain | Input, Throughput, Output, Or Staffing | Mapping To NQF REMCS Framework, Part 1 |
|---|-------------------------|---|---|
| No. of hallway pts | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |
| No. of resuscitations in past 4 hours | Crowding; Throughput | Input | 1.3 - Real-time capacity information |
| No. of pts being treated | Crowding; Throughput | Input | 1.3 - Real-time capacity information |
| No. of pts waiting for specialty consult or disposition by consultant > 4 hours | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |
| No. of ED diagnostic orders | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |
| No. of pts waiting test results | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |
| No. of nurses working | Crowding; Throughput | Staffing | 1.3 - Real-time capacity information |
| Pts treated by acuity per bed hours | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |
| No. of pts per nurse or physician | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |
| No. of pts admitted or discharged per physician | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |
| Sum of pt care time per shift | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |
| ED ancillary service turnaround time | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |
| Time to consultation | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |
| Time to room placement | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |
| ED treatment time | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |
| ED LOS | Crowding; Throughput | Throughput | 1.3 - Real-time capacity information |
| Ambulance diversion episodes | Diversion | Input | 1.3 - Real-time capacity information |
| Nearby EDs diverting ambulances | Diversion | Input | 1.3 - Real-time capacity information |
| Hours on ambulance diversion | Diversion | Input | 1.3 - Real-time capacity information |

Appendix B: Project Expert Panel and NQF Staff

EXPERT PANEL

Stephen Pitts, MD, MPH (Co-Chair)

Emory University School of Medicine, Atlanta, GA

Suzanne Stone-Griffith, RN, MSN, CNAA (Co-Chair)

HCA Healthcare, Nashville, TN

Terry Adirim, MD, MPH

Health Services Research Agency (HRSA/HHS), Washington, DC

Brent Asplin, MD, MPH, FACEP

Fairview Medical Group, Minneapolis, MN

Emily Carrier, MD, MSc

Center for Studying Health System Change, Washington, DC

Brendan Carr, MD, MA, MS

University of Pennsylvania School of Medicine, Philadelphia, PA

William Wesley Fields, MD, FACEP

Emergency Medicine Action Fund, Laguna Niguel, CA

Edward Gabriel, MPA, EMT-P, CEM, CBCP

Assistant Secretary for Preparedness and Response (ASPR/HHS), Washington, DC

David Levine, MD, FACEP

University Healthcare Consortium (UHC), Chicago, IL

Anthony Macintyre, MD

Department of Emergency Medicine at The George Washington University, Washington, DC

David Marcozzi, MD, MHS-CL, FACEP

Assistant Secretary for Preparedness and Response (ASPR/HHS), Washington, DC

Gregg Margolis, PhD, NREMT-P

Assistant Secretary for Preparedness and Response (ASPR/HHS), Washington, DC

Linda McCaig, MPH

Centers for Disease Control and Prevention (CDC/HHS), Hyattsville, MD

Melissa McCarthy, ScD, MS

George Washington University, Washington, DC

Ryan Mutter, PhD

Agency for Healthcare Research and Quality (AHRQ/CDOM/HHS), Washington, DC

AnnMarie Papa, DNP, RN, CEN, NE-BC, FAEN
University of Pennsylvania, Philadelphia, PA

Sally Phillips, RN, PhD
Office of Health Affairs, Department of Homeland Security, Washington, DC

Michael Rapp, MD, JD
Centers for Medicare and Medicaid Services (CMS/HHS), Baltimore, MD

Kathy Robinson, RN
National Association of State EMS Officials, Bloomsburg, PA

Jeremiah Schuur, MD, MHS
Brigham and Women's Hospital, Boston, MA

Manish Shah, MD, MPH
University of Rochester Medical Center, Rochester, NY

Michael Stoto, PhD
Georgetown University, Washington, DC

Shelly D. Timmons, MD, PhD
Geisinger Health System, Danville, PA

Arjun Venkatesh, MD, MBA
Yale University School of Medicine, New Haven, CT

Ellen Weber, MD
University of California San Francisco Medical Center, San Francisco, CA

Leonard Weireter, Jr., MD, FACS
Eastern Virginia Medical School and Sentara Norfolk General Hospital, Norfolk, VA

NQF STAFF

Helen Burstin, MD, MPH
Senior Vice President
Performance Measures

Heidi Bossley, MSN, MBA
Vice President
Performance Measures

Jesse M. Pines, MD, MBA, MSCE
NQF Consultant

Angela Franklin, JD
Senior Director
Performance Measures

Adeela Khan, MPH

Project Analyst
Performance Measures

Akinluwa A. Demehin, MPH

Administrative Director
Performance Measures

Eugene Cunningham, MS

Project Manager
Performance Measures

National Quality Forum
1030 15th St NW, Suite 800
Washington, DC 20005
<http://www.qualityforum.org>

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