

Emergency Department Operational Metrics, Measures and Definitions: Results of the Second Performance Measures and Benchmarking Summit

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There is a growing mandate from the public, payers, hospitals, and Centers for Medicare & Medicaid Services (CMS) to measure and improve emergency department (ED) performance. This creates a compelling need for a standard set of definitions about the measurement of ED operational performance. This Concepts article reports the consensus of a summit of emergency medicine experts tasked with the review, expansion, and update of key definitions and metrics for ED operations. Thirty-two emergency medicine leaders convened for the Second Performance Measures and Benchmarking Summit on February 24, 2010. Before arrival, attendees were provided with the original definitions published in 2006 and were surveyed about gaps and limitations in the original work. According to survey responses, a work plan to revise and update the definitions was developed. Published definitions from key stakeholders in emergency medicine and health care were reviewed and circulated. At the summit, attendees discussed and debated key terminology and metrics and work groups were created to draft the revised document. Workgroups communicated online and by teleconference to reach consensus. When possible, definitions were aligned with performance measures and definitions put forth by the CMS, the Emergency Nurses Association Consistent Metrics Document, and the National Quality Forum. The results of this work are presented as a reference document. [Ann Emerg Med. 2010;xx:xxx.]

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INTRODUCTION

Background

The Institute of Medicine has defined 6 domains of quality of care: safe, timely, effective, efficient, equitable, and patient centered.¹ Timeliness and efficiency are core attributes of emergency medicine, yet the details of which processes to measure and how to measure them are still a work in progress.^{2,3} Time metrics (the time it takes for certain processes and subcycles of care) and proportion metrics (percentage of defects) have become de facto markers for quality in the literature. In February 2006, the first Performance Measures and Benchmarking Summit convened key stakeholders in emergency medicine to develop by consensus standards for emergency department (ED) operations and benchmarking terminology.⁴ Much has changed since the publication of the original standards, including new models of ED intake, growing evidence that ED crowding and prolonged length of stay are associated with lower-quality care and worse

outcomes, and an intense national focus on measurement of health care quality.⁵⁻¹¹ Length of stay, door-to-physician time, and left without being seen have been endorsed by the National Quality Forum as quality measures.¹² Additionally, the Centers for Medicare & Medicaid Services (CMS) are testing 2 ED timing measures (length of stay and boarding time) and plan to include them in the hospital pay for reporting program in 2014 and publish results on the Hospital Compare Web site.¹³ Because interest in these metrics and how to improve them will be a growing concern for EDs, the Emergency Department Benchmarking Alliance organized a second summit to review and update critical terminology. The results are presented here.

Importance

As EDs, hospitals, and health systems work to improve the timeliness and efficiency of emergency care, it is critical that they use standard terminology and metrics to measure and benchmark performance. There are 3 compelling reasons to pursue standardization in this area: regulatory burdens, ED operations management, and research. Regulatory bodies, such

*Participants listed in Appendix.

as CMS and The Joint Commission (TJC), are beginning to include ED patient flow standards in their performance measurement and accreditation programs.¹⁴⁻¹⁶ It is imperative that further regulatory requirements use parameters developed by experts from within the specialty who understand its practice and the nuances of ED operations. Many EDs are implementing and testing techniques to improve ED patient flow and processes.¹⁷⁻²² To advance the growing research on ED operations and quality improvement, standardized terminology and methodology are necessary.²³⁻²⁵

Goals

The Second Performance Measures and Benchmarking Summit convened to develop a set of metrics and definitions. The summit addressed the following objectives: (1) to develop a core set of metrics for ED patient flow and operations; (2) to define those metrics clearly, using timestamps, time intervals, and proportions; (3) to standardize the vocabulary relevant to the practice of emergency medicine operations, including operating characteristics, processes, and utilization (service units). The summit participants were tasked with drafting definitions for ED operations while maintaining consistency with previous work in this area. The vision was to standardize the language for industry-wide application.

SUMMIT METHODOLOGY

The summit was organized by the Emergency Department Benchmarking Alliance, a nonprofit organization. It is a collaborative of 367 (EDs) with more than 14 million ED visits annually. The Emergency Department Benchmarking Alliance was founded in 1997 as an alliance of performance-driven EDs. It operates as a quality improvement collaborative and learning community, sharing performance data and operational strategies to identify best practices. The Emergency Department Benchmarking Alliance has developed a benchmarking database and educational programs focusing on ED operations and performance and disseminates new ideas and innovations through conferences and publications.²⁶⁻³²

Participants

Key stakeholders in ED operations practice, policy, and research were identified and invited to attend the summit. The summit attendees included 32 participants, representing leading EDs, hospitals, ED staffing groups, professional societies, and regulatory agencies (Appendix).

Summit Working Model

A survey was circulated before the Benchmarking Summit, asking respondents to comment on the original 2006 document. Criticisms, limitations, omissions, and successful features were all solicited and responses were collated. The agenda for the summit was developed according to the survey responses. During the in-person meeting, a work plan for the project was crafted and workgroups were formed for operating

characteristics, time metrics (timestamps and time intervals), proportion metrics, process definitions, and utilization data. Workgroup leaders were chosen according to their expertise in the area.

Each workgroup leader was provided with instructional materials about running a successful workgroup, objectives, a work plan, and timetable. Workgroup members were provided with background materials. Information sharing took place through the Internet, e-mails, and conference calls. Project support was provided by the Emergency Department Benchmarking Alliance, including a conference call line, assistance with document processing, and project coordination. Each workgroup drafted a summary section. Two authors (S.J.W. and J.S.) collated and integrated the workgroup drafts into a final article, which was circulated numerous times to the workgroup leaders. Specific areas of disagreement were highlighted and addressed through conference calls and threaded e-mail discussions. The final article was then reviewed by the workgroup leaders and the Emergency Department Benchmarking Alliance board of directors.

FINDINGS

Operating Characteristics

To perform comparative analyses, EDs need to benchmark themselves against appropriate counterparts. EDs will use parameters to benchmark themselves, depending on the purpose of the comparison. Parameters currently in use to help EDs in this categorization are defined below:

ED Characteristics.

- ED census: Number of ED encounters tracked annually
- Acuity by Emergency Severity Index (ESI)/Canadian Triage Acuity Scale (CTAS): Patients receiving an ESI/CTAS scale 1 or 2 on arrival are considered high acuity; those with an ESI/CTAS scale 4 and 5, low acuity^{33,34}
- Acuity by evaluation and management codes: Patients receiving codes of level 4 or 5 are high acuity; those receiving codes of 1 or 2, low acuity
- Admission rate: Percentage of ED visitors who are admitted as inpatients
- ICU admission rate: Percentage of ED visitors requiring an ICU bed on admission
- Pediatric rate: Percentage of ED visitors younger than 18 years
- Infant pediatric rate: Percentage of ED visitors younger than 2 years
- Geriatric rate: Percentage of ED visitors older than 65 years
- Transfer rate: Percentage of ED visitors transferred for care at another facility
- Teaching status: Does the ED serve as a training site for resident physicians

Timestamps and Interval Metrics

The workgroups identified and defined a set of key timestamps and time intervals for ED operations. Additionally, subcycle time intervals for critical ED processes such as

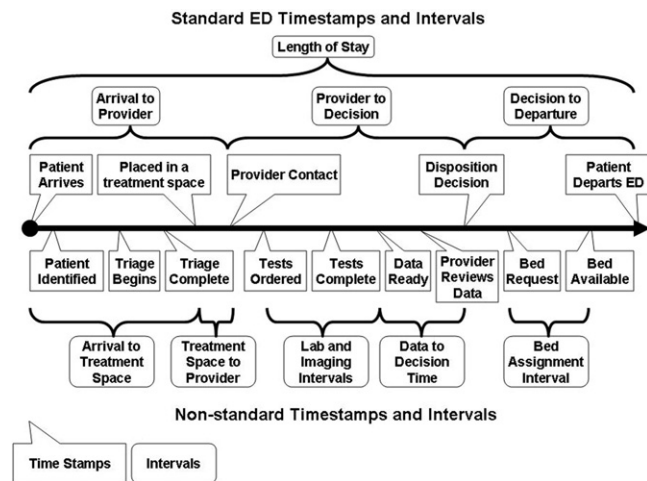


Figure. Timeline of ED timestamps and intervals.

emergency medical services (EMS) offload, laboratory, imaging, and bed management have also been defined. Where possible, they used language from the most recently published consensus document, *Definitions for Consistent Emergency Department Metrics*, developed by the Emergency Nurses Association (ENA) in 2009 and subsequently endorsed by many leading organizations in emergency medicine.³⁵ Timestamps and intervals that are identical to those of the ENA definitions are marked by an asterisk. In addition, the workgroups attempted to maintain consistency with performance measures endorsed by the National Quality Forum. The [Figure](#) is a schematic for the timestamps and intervals as they occur in a typical ED visit. It identifies a core set of standard timestamps that are necessary for ED operations and a more visionary set that an ideal future ED information system could collect.

Timestamps.

- Arrival time: The date and time that the patient first arrives at the institution for the purpose of requesting emergency care should be recorded as the arrival time. This is the first contact and not necessarily registration time or the triage time.*
- EMS offload time: The date and time that the patient is transferred from the EMS stretcher and placed in a treatment space and care is assumed by the ED staff.* This is typically recorded in the EMS run report.
- Treatment space time: The date and time of placement in a treatment space. "Treatment space" is any space the hospital/facility designates as a space to render emergency care and is facility specific.*
- Provider contact time: The date and time of first contact of the physician or the provider (defined as an institutionally credentialed provider) with the patient to initiate the medical screening examination, but specifically not the triage nurse.*
- Data ready time: The date and time when all relevant data (test results, image interpretations, and treatment responses) are available to the provider for decisionmaking about

patient disposition. (This is more forward looking, when information system will enable its capture.)

- Disposition decision time: The date and time that the order about the disposition of the patient (transfer, observe, discharge) is documented.
- Admit decision time: The above applied to admitted patients. The date and time that the admit order is documented by the provider.
- Departure time: The date and time of physical departure of a patient from the ED treatment space. The time most closely represented by leaving the department for all categories of patients, including admitted, discharged, observed, and behavioral health patients.

Time intervals.

- Arrival to provider time (aka "door to doc"): Arrival time to provider contact time
- ED length of stay: Arrival time to departure time.* This is tracked for the following subsets of patients:
 - admitted patients
 - discharged patients
 - observation patients
 - behavioral health patients
- Arrival to treatment space time: Arrival time to treatment space time
- Treatment space to provider time: Treatment space time to provider contact time
- Provider to data-ready time: Provider contact time to data-ready time
- Data-ready to decision time: Data-ready to disposition decision time
- Decision to departure time: Disposition decision time to the actual departure time of the patient
- Admit decision to departure time: The above applied to admitted patients; the admit decision time to the actual departure time of the patient. This is undergoing testing as trial CMS hospital inpatient quality measures

Subcycle intervals. For clarity and consistency, the term *turnaround time* has been replaced with *interval* in the subcycles definitions. Turnaround time was used inconsistently in the literature and in practice and so was abandoned for the new term, keeping the terminology consistent.

- EMS offload interval: Arrival time to EMS offload time*
- Triage interval: The interval from when the rapid or comprehensive triage or intake is initiated by an institutionally credentialed provider to the time when triage is completed*
- Laboratory interval: The time from the placement of an order for laboratory testing until the time the results are available
- ED consultation interval: The time from the placement of an order for an ED consultation until the time the patient is evaluated by the consulting service and the final recommendation is communicated to the ED provider.

- **Imaging interval:** The time from the placement of an order for an imaging test until the time that the results are available. Institutions are recommended to track for each modality:
 - plain radiography
 - computed tomography (CT) scans
 - ultrasonography
 - magnetic resonance imaging (MRI)
- **Bed assignment interval:** The time from the placement of an order/request for an inpatient bed to the time a bed is assigned (empty, clean, and staffed) and the ED receives notification

Proportion Metrics

A number of measures reported as percentages or rates have been used to capture elements of performance in the ED. The proportion metrics are well established in the literature and in hospital operations. Patient complaints and the ultimate complaint, the walk away (referred to collectively in the 2006 document as “Patients Who Left Before They Were Supposed To”) correlate with timeliness and can be thought of as indirect markers for timeliness and efficiency.

- **Left without being seen:** All patients who leave the ED before consulting a provider
- **Left before treatment complete:** All patients who leave the ED after being treated by a provider and before formal disposition is made
- **Against medical advice:** All patients who leave the ED against the advice of the provider and after the risks and benefits of further care have been explained and documented. Against medical advice patients are a subset of left before treatment complete patients.
- **Complaint ratio:** All spontaneous expressions of concern that are written, called in, or spoken and brought to the attention of the ED management or hospital staff. There must be a mechanism for recording these expressions, and the mechanism will be institution specific. Complaint ratios are tracked as complaints per 1,000 ED visits by convention.

Process Definitions

As the specialty identifies best practices, it is beginning to collect data on important ED processes, and these are defined below. Operations research in emergency medicine cannot advance without definitions of key processes.

- **Identification:** The process of collecting sufficient information critical to establishing and recording a unique patient encounter, with at minimum 2 unique identifiers. This is distinct from registration.
- **Triage:** The process of assessing patients who present for care to prioritize access according to the urgency of their need and complexity of the services required. Traditionally performed by a registered nurse, it involves a number of steps and information gathering. One of the most important features is the assignment of triage scale, now most frequently a 5-level ESI/CTAS scale.

- **Intake:** The process of receiving and sorting persons seeking access to acute episodic medical care in the ED. Triage is one intake model. Rapid medical screening, team triage, and physician in triage are other intake models.³⁶
- **Registration:** The process of identifying and recording information to generate a patient-specific record. It includes collecting information pertaining to financial responsibility and sociodemographic statistics, and its main function is related to billing. Registration is distinct from patient identification
- **Medical screening examination:** The assessment by a provider to determine whether an emergency medical condition exists.
- **Discharge:** The process of releasing patients from the ED at the end of the encounter, including the distribution of discharge papers.
- **ED diversion:** ED diversion is a notification to the medical community of a temporary limitation of complete or partial institutional capability to handle medical or surgical conditions, communicated to EMS.
- **Boarding:** The practice of holding patients who have been admitted to the hospital in the ED for prolonged periods. Defined as an interval, it encompasses the admit decision time to the departure time.
- **Overcapacity:** Defined as having more patients than treatment spaces in the ED. It may be measured as time in a 24-hour period spent at overcapacity.

Utilization

Defined as emergency service units and tracked to understand utilization, the following are recommended as service units for tracking. Higher utilization has been correlated with longer length of stay and higher acuity. CMS and payers have become intensely interested in utilization and are developing utilization metrics to be used in public quality programs.³⁷ The emergency service units defined at the summit are listed below.

Emergency Service Units

- **ECGs:** The number of ECGs performed per 100 ED visits
- **Plain radiography studies:** The number of radiographic studies (not images) per 100 ED visits
- **CT studies:** The number of contrasted and noncontrasted CT studies (not images) per 100 ED visits. Includes CT-guided procedures.
- **MRI studies:** The number of MRI studies (not images) per 100 ED visits
- **Ultrasonographic studies:** The number of formal ultrasonographic studies (not images) performed by the radiology department and reported to the ED per 100 ED patients. Bedside ultrasonography is not reported in this measure.
- **Laboratory studies:** The number of patients per 100 ED visits who have any specimen ordered and sent to the

laboratory. (This is a yes/no data point). Point-of-care testing is not reported in this measure.

- Medication dosages: The number of medication doses administered by any route (intravenous, oral, intranasal or intramuscular) per 100 ED visits. These are typically counted as doses from an electronic dispensing system.
- Behavioral health consultations: The number of behavioral health consultations per 100 ED visits as a marker for mental health burden on the ED
- Specialty consultations: The number of medical or surgical specialty consultations arranged through the ED per 100 ED visits

LIMITATIONS

This work has several limitations. First, our methods did not adhere strictly to standardized qualitative research consensus processes such as the Delphi method, which has been used before in this type of work.³⁸ However, the model used here follows many of the same principles, such as an iterative process, with in-person meetings and follow-up calls or e-mail discussions, and it was used successfully by the Emergency Department Benchmarking Alliance in the original Performance Measures Summit and in another Agency for Healthcare Research and Quality (AHRQ)–sponsored summit to develop consensus around particular issues in emergency medicine.³⁹ Second, the group was a purposeful sample whose creation was open to selection bias, yet we solicited representation from leading organizations in emergency medicine and it incorporates existing work by prominent stakeholders. Third, the definitions focus on 2 domains of quality: timeliness and efficiency. Although it is important for future work to define standards for other quality domains in emergency medicine, there is a pressing need for consensus around these domains, as illustrated by the imprecision of the current CMS measures. Finally, this document has not yet been formally endorsed by leading professional organizations, and there has been no pilot testing.

DISCUSSION

In response to the growing demand for measures of ED performance, we convened a summit of key stakeholders. With an iterative team process, time metrics for ED operations were reviewed, revised, and developed by consensus. We present definitions for critical and future ED timestamps, time intervals, and proportion metrics. Additionally, we define key processes and utilization metrics. These standardized definitions should help ED administrators, researchers, and regulators by providing a common language.

As EDs increasingly incorporate information technology into work processes, electronic tracking systems will enable the routine capture of timestamps as part of patient care. The best systems will have timestamping and cueing built into the same computer interaction, minimizing repetition and rework. The most reliable timestamps will be those that also serve a patient flow function. To be operationally useful, timestamps must be

clearly defined and easy to accurately capture, and their capture must be built into clinical workflow and future electronic health records.⁴⁰ Efforts have been made to develop timestamps that may be applied in EDs without electronic tracking systems or information technology support. Though EDs without information technology support will not be able to gather the robust data sets of those with information technology support, critical timestamps and intervals can be measured through logs or hand audits.

The Controversies

Among summit discussions, the timestamp causing the most debate was the admit decision time. The members of the workgroup defining the timestamps and intervals attempted to maintain alignment with work done by ENA and with CMS's definitions.^{35,41} However these definitions were problematic. In particular, the definitions offered by ENA and CMS, titled "decision to admit time," have flawed language embedded in them. "Decision to admit time" is an unfortunate choice of words; the inclusion of "to" connotes an interval, rather than a point in time. Additionally, both organizations differentiated between an admit *decision* time and an admit *order* time because they were concerned that some EDs may face significant delays from the time they decide to admit a patient to the time they are permitted to place an admission order. Recently, the ENA went so far as to say that because the "decision to admit" time is difficult to capture, it should not be used in comparative measures. Because the interval indicated by "admit decision to departure" is currently undergoing feasibility testing and is proposed to become a CMS quality measure of inpatient care in 2014, clarification of the admit decision timestamp is critical.

Summit attendees were concerned that the "decision to admit" is an artificial timestamp that will not be recorded in the normal course of work, leading to inaccurate data entry or gaming the system to improve performance measures. CMS's goal for this measure is to quantify ED boarding and ultimately to ease the burden it places on the ED. To that end, the summit participants believed that the placing of the admit order is the most accurate and reliable proxy for the admit decision time. Using the admit order time to mark this timestamp and using language to clarify that it is a timestamp and not an interval maintains alignment with the goal of CMS definitions while lending more clarity to it.

It can be expected that the tracking of timestamps, intervals, and processes will continue to involve data that are increasingly granular. More subcycle times will be captured in future studies of ED patient flow and will identify delays. Other time measures for ancillary services, such as laboratory interval time, have been included in the subcycle intervals section. The timestamps for each subcycle will be defined at each institution because they depend on varying processes. Where possible, these mirror the measures suggested by National Quality Forum as ED quality measures.¹³ For the sake of consistency and clarity, the authors have abandoned the old jargon of turnaround times for intervals.

Summit participants defined several proportion metrics that are widely reported in the literature as measures of ED operational performance. Measures of patients who left before visit completion are used in ED operations research and have been included on national data sets such as the AHRQ's annual National Healthcare Quality Report.³⁹ Referred to in the 2006 performance measures document as "People Who Left Before They Were Supposed To," this includes left without being seen, left before treatment complete, and against medical advice, which is a subset of left before treatment complete. Leaving against medical advice is perhaps the most widely misapplied. Leaving against medical advice has to do with the patient's decision to leave before all recommendations are given and after a legal warning is rendered. The decision to label a patient's action as against medical advice is largely physician and institution dependent and does not correlate with timestamps. Correctly assigned against medical advice patients are just a fraction of left before treatment complete patients, with left without being seen making up the majority of the walk-away patients. The National Quality Forum has endorsed the tracking of left without being seen as an ED quality measure.

Although discussed at the summit, proportion metrics for revisits (eg, readmissions or other adverse events) have not been included because participants could not come to consensus. Unscheduled return visits have been used in quality improvement work and reported as an outcome of interest in emergency medicine research to identify patients whose diagnosis or management at the initial ED visit was in error or suboptimal. Different time intervals have been used including unscheduled returns at 24, 48, and 72 hours and 1-week intervals. For example, 48 hours is recommended in the American College of Emergency Physicians' book *Continuous Quality Improvement for Emergency Departments*,⁴² whereas an important article by Sklar et al⁴³ examined deaths within 7 days of ED discharge. There are several other complexities to this metric besides setting a standard time interval. The unscheduled return visit rate will be directly influenced by the factors outside of the ED's control, such as availability of follow-up care. Finally, distinguishing between unscheduled returns and appropriate follow-up visits is difficult, and there are no standard validated techniques to do this yet.

Building on the First Summit

This article differs from the original 2006 article in a number of areas. Since the publication of the original article, ED operations have matured and performance measures refined as more organizations are advancing this work. The concepts of meaningful use and pay for quality now are being incorporated into measurement work. Several significant changes deserve discussion. First, the original article proposed a comparison scheme for EDs that did not prove effective. The original comparison scheme was removed and this article simply offers definitions of operating characteristics that will help EDs to find other EDs with similar census and acuity to benchmark against. Second, we have removed terms that did not gain acceptance or

were criticized as ambiguous, including "conversion time" and "ED boarding load." The definitions have been thoroughly revised and vetted, and now each clearly belongs to one of the following categories: operating characteristics, time metrics, proportion metrics, process definitions, and utilization data. Third, since the first summit, utilization has become an area of intense interest and focus by payers. Because little is known about utilization rates in emergency medicine, the specialty needs to begin research in this area and needs the terminology to do so. Finally, the first article was drafted in isolation. This document actively attempts to reconcile the definitions being put forth by the ENA, CMS, and National Quality Forum.

CONCLUSIONS

According to growing evidence that the timeliness of emergency care is associated with quality of care, there is internal and external motivation to improve ED operations. Common definitions of key terms, timestamps, and metrics will improve the comparability of ED operations research and publications. Without consistent definitions, it will be difficult to track, measure, and communicate in a meaningful way. This work provides all of the stakeholders in emergency medicine with the language to begin the important work that lies ahead.

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REFERENCES

1. Institute of Medicine. *Crossing the Quality Chasm: A New Health System for the Twenty-first Century*. Washington, DC: National Academies Press; 2001.
2. Graff L, Stevens C, Spaitte D, et al. Measuring and improving quality in emergency medicine. *Acad Emerg Med*. 2002;9:1091-1107.

3. Lindsay P, Schull M, Bronskill S, et al. The development of indicators to measure the quality of clinical care in EDs following the modified-Delphi approach. *Acad Emerg Med.* 2002;9:1131-1139.
4. Welch SJ, Augustine J, Camargo C, et al. Performance Measures and Benchmarking Summit. *Acad Emerg Med.* 2006;13:1075-1086.
5. Chafin DB, Trzeciak S, Likourezos A, et al. Impact of delayed transfer of critically ill patients from the emergency department to the intensive care unit. *Crit Care Med.* 2007;35:1477-1483.
6. Richardson DB. Increase in patient mortality at 10 days associated with emergency department overcrowding. *Med J Aust.* 2006;184:213-216.
7. Sprivilis PC, DaSilva JA, Jacobs IG, et al. The association between hospital overcrowding and mortality among patients admitted via Western Australian emergency departments. *Med J Aust.* 2006;184:208-212.
8. Carr BG, Kaye AJ, Wiebe DJ, et al. Emergency department length of stay: a major risk factor for pneumonia in intubated blunt trauma patients. *J Trauma.* 2007;63:9-12.
9. Fishman PE, Shofer FS, Robey JL, et al. The impact of trauma activations on the care of emergency department patients with potential acute coronary syndromes. *Ann Emerg Med.* 2006;48:347-353.
10. Pines JM, Localio AR, Hollander JE. The impact of emergency department crowding measures on time to antibiotics for patients with community-acquired pneumonia. *Ann Emerg Med.* 2007;50:510-516.
11. Bernstein SL, Aronsky D, Duseia R, et al. The effect of emergency department crowding on clinically oriented outcomes. *Acad Emerg Med.* 2009;16:1-10.
12. The National Quality Forum. NQF endorses measures to address care coordination and efficiency in hospital emergency departments. Press release, October 8, 2008. Available at: <http://urgentmatters.org/media/file/NQF%20Press%20Release.pdf>. Accessed September 23, 2010.
13. Specifications manual for national hospital inpatient quality measures v 3.2b. Available at: <http://www.qualitynet.org/dcs/BlobServer?blobkey=id&blobnocache=true&blobwhere=1228883796338&blobheader=multipart%2Foctet-stream&blobheadername1=Content-Disposition&blobheadervalue1=attachment%3Bfilename%3DED%2C0.pdf&blobcol=urldata&blobtable=MungoBlobs>. Accessed September 23, 2010.
14. A comprehensive review of development and testing for national implementation of hospital core measures. Available at: <http://www.jcaho.org/pms>. March 2005.
15. Joint Commission Resources. *2009 Comprehensive Accreditation Manual for Hospitals: The Official Handbook*. Oakbrook Terrace, IL: Joint Commission on Accreditation of Healthcare Organizations; 2008.
16. Glickman SW, Schulman KA, Peterson ED, et al. Evidence-based perspectives on pay for performance and quality of patient care and outcomes in emergency medicine. *Ann Emerg Med.* 2008;51:622-631.
17. Beach C, Haley L, Adams J, et al. Clinical operations in academic emergency medicine. *Acad Emerg Med.* 2003;10:806-808.
18. Wiler JL, Gentle C, Halfpenny JM, et al. Optimizing emergency department front-end operations. *Ann Emerg Med.* 2010;55:142-160.
19. Kyriacou DN, et al. A 5-year time study of emergency department patient care efficiency. *Ann Emerg Med.* 1999;34:326-335.
20. Chan TC, Killeen JP, Kelly D, et al. Impact of rapid entry and accelerated care at triage on reducing emergency department patient wait times, lengths of stay and rate of left without being seen. *Ann Emerg Med.* 2005;46:491-497.
21. Thompson DS, Yarnold PR, Williams DR, et al. Effects of actual waiting time, information delivery and expressive quality on patient satisfaction in the emergency department. *Ann Emerg Med.* 1996;28:657-665.
22. Fottler MD, Ford RC. Managing patient waits in hospital emergency departments. *Health Care Manag (Frederick).* 2002;21:46-61.
23. Davidoff F, Batalden P. Toward stronger evidence on quality improvement. Draft publication guidelines: the beginning of a consensus project. *Qual Saf Health Care.* 2005;14:319-325.
24. Berwick DM. Broadening the view of evidence-based medicine. *Qual Saf Health Care.* 2005;14:315-316.
25. Thomson RG. Consensus publication guidelines: the next step in the science of quality improvement? *Qual Saf Health Care.* 2005;14:317-318.
26. Michalke JA, Patel SG, Siler Fisher A, et al. Emergency department size determines the demographics of emergency department patients. *Ann Emerg Med.* 2005;46(3 suppl):39.
27. Siler Fisher A, Hoxhaj S, Patel SG, et al. Predicting patient volume per hour. *Ann Emerg Med.* 2005;46(3 suppl):6-7.
28. Hoxhaj S, Jones LL, Fisher AS, et al. Nurse staffing levels affect the number of emergency department patients that leave without treatment. *Acad Emerg Med.* 2004;11:459-463.
29. Welch S, Jones S. Census, acuity and ED operations by time of day at a level one trauma and tertiary care center. *Jt Comm J Qual Patient Saf.* 2007;33:247-255.
30. Jensen K, Welch S, Mayer T, et al. *Leadership for Smooth Patient Flow. ACHE Management Series*. Chicago, IL: Health Administration Press; 2006.
31. Jones S, Allen TA, Welch S, et al. An independent evaluation of four quantitative emergency department crowding scales. *Acad Emerg Med.* 2006;13:1204-1211.
32. Jones S, Welch S, Allen T, et al. Forecasting daily patient volumes in the emergency department. *Acad Emerg Med.* 2008;15:159-171.
33. Elshove-Bolk J, Mencl F, Van Rijswijck TF, et al. Validation of the Emergency Severity Index (ESI) in self-referred patients in a European emergency department. *Emerg Med J.* 2007;24:170-174.
34. Bullard MJ, Unger B, Spence J, et al. Revisions to the Canadian Emergency Department Triage and Acuity (CTAS) adult guidelines. *CJEM.* 2008;10:136-151.
35. Emergency Nurses Association, ED Metrics Stakeholders Meeting, Consensus Meeting Report. (Unpublished), Presented at: ED Metrics Stakeholders Meeting, July 26, 2010; Washington, DC.
36. Welch SJ, Davidson SD. Exploring new intake models into the emergency department. *Am J Med Qual.* 2010;25:172-180.
37. NQF endorses consensus standards to reduce waste and promote safe and effective use of imaging procedures. Measures address appropriate and efficient use of procedures. Press release, October 8, 2008. Available at: <http://urgentmatters.org/media/file/NQF%20Press%20Release.pdf>. Accessed September 23, 2010.
38. Lindsay P, Schull M, Bronskill S, et al. The development of indicators to measure the quality of clinical care in emergency departments following a modified-Delphi approach. *Acad Emerg Med.* 2002;9:1131-1139.
39. Welch SJ, Savitz L. Strategies to improve emergency department intake. *J Emerg Med.* In press.
40. Davidson SD, Zwemmer F, Nathanson LA, et al. "Where's the Beef?" The promise and the reality of clinical documentation. *Acad Emerg Med.* 2004;11:1127-1134.

41. National Healthcare Quality report. 2009. Available at: <http://www.ahrq.gov/qual/nhq09/Chap4.htm>. Accessed September 23, 2010.
42. Siegel DM, Crocker PJ. *Continuous Quality Improvement for Emergency Departments*. Dallas, TX: ACEP Publishing; 1994.
43. Sklar DP, Crandall CS, Loeliger E, et al. Unanticipated death after discharge home from the emergency department. *Ann Emerg Med*. 2007;49:735-745.

APPENDIX.

Participants in the Second Performance Measures and Benchmarking Summit, Salt Lake City, February 24, 2020

- Nick Jouriles, MD, Past President, American College of Emergency Physicians (ACEP)
 Charles Reese, MD, Chairman, Emergency Department Benchmarking Alliance
 Jedd Roe, MD, MBA, Chairman Emergency Medicine, William Beaumont Medical Center
 Deb Richey, RN, Board Member, Emergency Department Benchmarking Alliance
 Michael Phelan, MD, Emergency Medicine Quality Review Officer, Cleveland Clinic
 Brent Asplin, MD, MPH, Chairman, Emergency Medicine Department, The Mayo Clinic
 Jody Crane, MD, MBA, Institute for Healthcare Improvement (IHI)
 James Augustine, MD, Director Clinical Operations, Emergency Medicine Physicians (EMP)
 Steven Davidson, MD, MBA, Chairman, Maimonides Medical Center
 Jeanne McGrayne, RN, Premier Consulting Services
 John Lyman, MD, CMO, Premier Health Care Services Inc.
 Bruce Janiak, MD, Vice Chairman Emergency Medicine, Medical College of Georgia
 Jeremiah Schuur, MD, Director of ED Quality and Safety, Brigham and Women's Hospital
 Suzanne Stone-Griffith, RN, Vice President HCA Healthcare
 Shari Welch, MD, Fellow, Intermountain Institute for Health Care Delivery Research
 Angela Franklin Esq., Director of Quality and Health IT, ACEP
 Todd Taylor, MD, Physician Executive, Microsoft Corp.

Short abstract for Welch et al, YMEM There is a growing mandate from the public, payers, hospitals, and the Centers for Medicare & Medicaid Services to measure and improve emergency department (ED) performance. This creates a compelling need for a standard set of definitions about the measurement of ED operational performance. We report the consensus of a summit of emergency medicine experts tasked with the review, expansion, and update of key definitions and metrics for ED operations.

- Mark McClelland, MN, RN, GWU–The Center for Health Care Quality
 Pamela Turner, RN, MBA, Rudder Associates Consulting
 Lucy Savitz, PhD, MBA, The Intermountain Institute for Health Care Delivery Research
 Kevin Baumlin, MD, Informatics, Mt Sinai Medical Center
 David Garvey, MD, The T-System
 Randy Pilgrim, MD, President of EDPMA, VP Operations, The Schumacher Group
 Michael Handrigan, MD, Center for Emergency Preparedness, HHS
 Jennifer Wiler, MD, MBA, University of Colorado
 Azita Hamedani, MD, University of Wisconsin, Madison
 Tim Seay, MD, Greater Houston Emergency Physicians
 David Garvey, MD, Physician Executive, The T-System
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 Ian Jones, MD, Director Medical ED, Vanderbilt University
 Ellen Weber, MD, Department of Emergency Medicine, University of California San Francisco
 Sherri Almeida, RN, ENA

Professional Associations of Summit Attendees*

- ACEP
 ENA
 Emergency Department Benchmarking Alliance
 Emergency Department Practice Management Association (EDPMA)
 Institute for Healthcare Improvement (IHI)
 AHRQ
 Society for Academic Emergency Medicine (SAEM)
 TJC
 Emergency Care Coordination Center (ECCC) of HHS
 American College of Health Care Executives (ACHE)
 American Academy of Emergency Medicine (AAEM)
 The Intermountain Institute for Health Care Delivery Research
 The National Quality Forum

*Listing of these organizations does not imply endorsement of this document, but rather shows the diversity of representation at the summit.