

## ASPR TRACIE Technical Assistance Request

**Requestor:** [REDACTED]  
**Requestor Phone:**  
**Requestor Email:**  
**Request Receipt Date (by ASPR TRACIE):** 27 July 2015  
**Type of TTA Request:** Standard

### Request:

[REDACTED] is investigating mechanisms to establish more objective measures for their local hospitals to assess and report patient surge prior to necessity of entering into a diversion status. In doing research on systems that use objective scoring to help capture current patient volume and throughput, they came upon the National Emergency Department Overcrowding Scale (NEDOCS) system developed out of the University of New Mexico. [REDACTED] question is whether there are other alternative scoring systems that are widely used to reduce the facility-to-facility variance in structure and practice when defining status.

### Response:

The ASPR TRACIE team looked into various journal articles that compared scales or methods for qualitatively determining or predicting emergency department (ED) crowding. The research showed that there are six primary tools/ scales/ methods used by EDs to quantitatively determine crowding (more information on each provided in Section I below):

1. National Emergency Department Overcrowding Scale (NEDOCS)
2. Emergency Department Work Index (EDWIN)
3. Real-Time Emergency Analysis of Demand Indicators (READI)
4. Emergency Department Crowding Scale (EDCS)
5. Work Score
6. Emergency Department Occupancy Rate

A one-page comparison and calculations of these six crowding scales can be found at <http://www.hindawi.com/journals/emi/2012/838610/tab1/>.

Additional ED overcrowding/ saturation score tools/ scales are included in Section II.

The ASPR TRACIE team also consulted with one of our Expert Practitioners/ Subject Matter Experts (through the ASPR TRACIE SME Cadre) to provide his comments/ recommendations on this topic area. The response from [REDACTED], is found in Section III.

#### I. General Research

- In 2006, an article in the Academic Emergency Medicine Journal compared the **National Emergency Department Overcrowding Scale (NEDOCS)** with the **Emergency**

**Department Work Index (EDWIN)**<sup>1</sup> to determine which tool most accurately quantified emergency department crowding. The authors of the article noted that these were the only two scales presently available in predicting overcrowding. They concluded that while both scales had high area under the receiver operating characteristic curve (AUCs), correlated well with each other, and showed good discrimination for predicting ED overcrowding, NEDOCS was the favored scale because the data it uses is more readily available.

- Also in 2006, a study was done comparing four quantitative scales for ED crowding: **Real-Time Emergency Analysis of Demand Indicators (READI)**, EDWIN, NEDOCS, and the **Emergency Department Crowding Scale (EDCS)**<sup>2</sup>. The authors found that all of the scales lack scalability and do not perform as designed in EDs where crowding is not the norm. However, NEDOCS, EDWIN, and READI's bed ratio subscale yielded good predictive power of perceived ED crowding. The authors noted that these results suggest that these scales can be used effectively after a period of site-specific celebration at EDs where crowding is a frequent occurrence.
- In 2007, a published study showed results of using EDWIN, NEDOCS, the Demand Value of READI, and the **Work Score**<sup>3</sup> to quantify the potential for monitoring current and near-future ED crowding. This study. The authors found that EDWIN, NEDOCS, and the Work Score show high discrimination of ED crowding, however, none of the measures provided substantial advance warning before crowding at low rates of false alarms.
- In 2008, a study compared EDWIN to the **Emergency Department Occupancy Rate** to measure crowding<sup>4</sup>. Results found that the both tools classified leaving without being seen and ambulance diversion hours with moderate accuracy. The authors noted that the simplicity of capturing ED occupancy rates makes the real-time assessment of crowding more feasible for facilities.

## II. Other Tools/ Scales

1. **Basic Saturation Scoring Tool**- developed by EMSsystems<sup>5</sup>, this basic tool uses key inputs related to the ED to measure its total capacity, including capacity, volume, and acuity of patients in the ED. This commercially available computer program tracks the diversion status of all local hospitals. The saturation score that is calculated is a standardized score that measures the percentage of total capacity for an ED.
  - To calculate a score, the system asks for responses to eight queries (number of ED beds occupied, patients in lobby, ambulance patients en route or waiting, general

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<sup>1</sup> Weiss SJ, Ernst AA, Nick TG. Comparison of the National Emergency Department Overcrowding Scale and the Emergency Department Work Index for quantifying emergency department crowding. *Acad Emerg Med*. 2006 May;13(5):513-8. Full text available at: <http://onlinelibrary.wiley.com/doi/10.1197/j.aem.2005.12.009/epdf>

<sup>2</sup> Jones SS, Allen TL, Flottemesch TJ, et al. An independent evaluation of four quantitative emergency department crowding scales. *Acad Emerg Med*. 2006;13:1204-1211. Full text available at: <http://onlinelibrary.wiley.com/doi/10.1197/j.aem.2006.05.021/epdf>

<sup>3</sup> Hoot NR, Zhou C, Jones I, Aronsky D. Measuring and forecasting emergency department crowding in real time. *Ann Emerg Med*. 2007 Jun;49(6):747-55. Abstract only: <http://www.ncbi.nlm.nih.gov/pubmed/17391809>

<sup>4</sup> McCarthy ML, Aronsky D, et al. The emergency department occupancy rate: a simple measure of emergency department crowding? *Ann Emerg Med*. 2008 Jan;51(1):15-24. Full text available at: [http://californiaacep.org/wp-content/uploads/The\\_Emergency\\_Department\\_Occupancy\\_Rate\\_A-Simple\\_Measure\\_of\\_.pdf](http://californiaacep.org/wp-content/uploads/The_Emergency_Department_Occupancy_Rate_A-Simple_Measure_of_.pdf)

<sup>5</sup> EMSsystems. Saturation Scoring.

[https://emresource.emssystem.com/resource/onlinehelp/Setup/StatusesAdmin/Saturation\\_Scoring.htm#ScaleB](https://emresource.emssystem.com/resource/onlinehelp/Setup/StatusesAdmin/Saturation_Scoring.htm#ScaleB). Accessed 31 July 2015.

admits, ICU admits, patients requiring 1:1 care, RNs short staffed, ED beds assigned, and reasonable lobby capacity). The system will then provide a saturation score for each hospital in the region.

- Scale is as follows: 0% saturation score- ED is unoccupied; 50% saturation score- ED is running at about half of its total capacity; 100% saturation score- ED is running at capacity; >100% saturation score- ED is running above capacity.
  - Tool is described and show here:  
[https://emresource.emsystem.com/resource/onlinehelp/Setup/StatusesAdmin/Saturation\\_Scoring.htm#ScaleB](https://emresource.emsystem.com/resource/onlinehelp/Setup/StatusesAdmin/Saturation_Scoring.htm#ScaleB)
  - Local uses of the tool can be found in the following links:
    - Florida: [http://www.floridahealth.gov/programs-and-services/emergency-preparedness-and-response/healthcare-system-preparedness/em-systems-patient-tracking/\\_documents/saturation-scoring-help.pdf](http://www.floridahealth.gov/programs-and-services/emergency-preparedness-and-response/healthcare-system-preparedness/em-systems-patient-tracking/_documents/saturation-scoring-help.pdf)
    - Phoenix: [http://www.jenonline.org/article/S0099-1767\(02\)00038-7/fulltext](http://www.jenonline.org/article/S0099-1767(02)00038-7/fulltext)
2. **CALDOCs**- a computer based program that calculates resource saturation in the ED using length of stay, lobby waiting, throughput, and other variables. It tracks and trends crowding causes, solutions and results of actions taken. A full description of this tool and how it was implemented at Dignity Health (San Francisco), including implementation, timeline, cost/ benefit analysis, lessons learned, and administrative policies and guidelines:  
<https://smhs.gwu.edu/urgentmatters/sites/urgentmatters/files/CALDOC.DignityHealth.pdf>
3. **ForecastED**<sup>6</sup>- tool developed that provides a discrete event simulation that uses patient flow to predict near-future ED operational measures. The developers of the tool believe that it may be used to forecast the values of various ED crowding measurements at points in the near future. They found that the discriminatory power for ambulance diversion remained consistently high up to 8 hours into the future.
- First published in 2008:  
[http://www.researchgate.net/publication/5464248\\_Forecasting\\_Emergency\\_Department\\_Crowding\\_A\\_Discrete\\_Event\\_Simulation](http://www.researchgate.net/publication/5464248_Forecasting_Emergency_Department_Crowding_A_Discrete_Event_Simulation)
  - A follow-up report<sup>7</sup> was published in 2009 that discusses the tool being deployed:  
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2732235/>

### III. ASPR TRACIE Expert Practitioner Comments

Diversion is a complex issue with few good solutions. Patients, EMS, and hospitals all dislike diversion for different reasons, but it persists in many forms in many EMS systems. Metrics can help recognize the need for system changes and document and compare conditions when diversion is declared. NEDOCS is one of the best validated scores that may help an EMS system provide quantitative data as to the conditions that exist when hospitals declare diversion status. Also, hospitals may find NEDOCS and other scoring systems helpful in declaring ‘internal

<sup>6</sup> Hoot N, LeBlanc LJ, et al. Forecasting emergency department crowding: a discrete event simulation. *Annals of emergency medicine* 05/2008; 52(2):116-25.

<sup>7</sup> Hoot N, LeBlanc LJ, et al. Forecasting emergency department crowding: A prospective, real-time evaluation. *J Am Med Inform Assoc.* 2009 May-Jun; 16(3): 338–345.

capacity alerts' or similar conditions that may prompt changes in staffing and admissions processes. Hospitals and EMS systems are encouraged to examine the goals for a formal system, what the utility of the data will be (i.e., what changes or actions will be prompted by the data analysis), who will use the data and for what means, and what the burden of the data collection will be versus the return on that investment of time. Choosing a simple and commonly used system is probably the most important component in developing a useful process.