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**Is this Emergency Department Crowded? A Real-Time Implementation of the Emergency Department Crowding Scale (EDCS)**

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**Objective:** There exists no consistent method for defining periods of ED crowding (EDC). The goal of this study was to derive an EDC scale (EDCS) consistent with ED provider perspectives and able to predict 4 consensus adverse outcomes commonly associated with EDC: increased ED length of stay (LOS), boarding times, leaving without being seen (LWBS) rates, and diversion episodes (Divert).

**Methods:** Data were collected in prospective, observational manner at 8 academic EDs. Patient and hospital-level operational data were aggregated by consecutive 6-hour period. In each period, one staff MD and one charge nurse rated the level of EDC using an existing 5-point scale. An ordinal probit model was fit to identify variables that correlated with provider ratings. Estimates from this model were then used to weight each variable's contribution to a normalized 100-point EDCS. We used site-specific, fixed-effect regressions to test the EDCS's correlation with the 4 adverse outcomes. This scale was then interfaced with existing patient tracking databases to provide a real-time assessment of the operational state of a level one trauma center.

**Results:** After controlling for the number of staffed ED and hospital beds, and for the number of ED staff MDs, the number of boarders ( $p<.001$ ), the total number of ED patients ( $p=.002$ ), and the number of critical care ED patients ( $p=.007$ ) were independently associated with provider ratings of EDC. The normalized EDCS was significantly correlated with ED LOS ( $R^2=.48$ ), boarding ( $R^2=.77$ ), LWBS (Gen. $R^2=.48$ ), and divert (Gen. $R^2=.99$ ).

**Conclusion:** Using physician and nurse ratings of EDC as a reference standard, the number of boarders, the total number of ED patients, and the number of critical care ED patients are consistently identified across multiple sites as the most important determinants of EDC. The relative weights of these variables were used to create a 100-point EDCS, which positively correlates with adverse outcomes commonly associated with ED crowding. When made available in real-time, the EDCS provides valuable information to decision makers. If independently validated, the EDCS may be a useful tool for both multi-center studies and real-time operational decisions.