Supplemental Table: Detail Explanations of Different ED Crowding Tools used in the study

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| Variables | Definition |
| NEDOCS = 85.8T + 600B + 5.64W + 0.93L + 13.4C -20 | |
| T | The total number of ED patients collected divided by the number of licensed beds at the time score is calculated |
| B | The number of admitted patients/number of hospital beds at the time score is calculated |
| W | Waiting room wait time for last patient called (In hours) |
| L | Longest time in hours since registration among boarding patients at the time score is calculated |
| C | Number of critical care patients at the time score is calculated, typically this is a site-specific variable which usually refers to patient that requires one to one nurse care. In study ED, critical care patients define as ICU patients /ICU consulted patients including but not limited to patients receiving ventilations, tPA, septic shock, critical trauma level 1 patients, and patients requiring conscious sedation at the time score is calculated, etc. |
| CEDOCS=3A+0.53B+1.16C+20.66D+0.00126E-30.39-V | |
| A | Number of critical care patients at the time score is calculated |
| B | Longest time (in hours) for an admitted patient waiting in the ED since admission at the time score is calculated |
| C | Number of patients in the waiting room at the time score is calculated |
| D | Number of ED patients to number of ED licensed beds ratio at the time score is calculated |
| E | ED visit/year |
| V | ED volume adjust constant=(1.11e-12)xPmax(E-18811,0)^3 + (8.23e-12)xPmax (E-43012, 0)^3 – (8.20e-12)x Pmax (E-49466,0)^3 + (1.08e-12) x Pmax (E-67273, 0)^3 |
| SONET=43.2W + 27A +540V + 53E + 18 | |
| W | Waiting room Index=Number of high acuity level patients (ESI 1, 2, and 3) in the waiting room divided by the number of ED licensed beds at the time score is calculated |
| A | Acuity Index=Number of high acuity level patients (ESI 1, and 2) occupying an ED bed exclude critical patients divided by the number of licensed beds at the time score is calculated |
| V | V-Index=Number of critical care patients at ED (same as the critical patients in NEDOCS) divided by the number of licensed beds at the time score is calculated |
| E | Total ED patient index defines as the total number of ED patients collected divided by the number of licensed beds at the time score is calculated |