Combination of Easily Measurable Real Time Variables to Predict ED Crowding

*Clouston R.V., **Howlett M.**, Fraser J., Atkinson P., Stoica G.*

Introduction
Quality suffers in crowded emergency departments (ED), however crowding is difficult to measure with precision. The most widely used tool to measure crowding is NEDOCS. A local tool based on NEDOCS (LOCAL) is used at Saint John Regional Hospital, a tertiary hospital with 57,000 visits per year. We compared real time variables to determine if a simple tool may predict ED crowding as well as more complex models.

Methods
Over two weeks we recorded crowding variables and calculated NEDOCS and LOCAL scores compared to a standard Physician Visual Analog Scale assessment. Five numeric variables performed well under univariate analysis: i) Total ED Patients; ii) Patients in ED beds + Waiting Room; iii) Boarded Patients; iv) Waiting Room Patients; v) Patients in beds To Be Seen. These underwent multivariate, log regression with stratification and bootstrapping to account for incomplete data and seasonal and daily effect.

Results
143 out of a possible 168 observations were made. Two combinations of 3 variables outperformed NEDOCS and LOCAL. The most powerful combination was: Boarded Patients plus Waiting Room Patients plus Patients in beds To Be Seen (Sensitivity 81%, Specificity 76%, r=0.844, β=0.712, p<0.0001, strong positive correlation). This compared favourably with NEDOCS and LOCAL, (Sensitivity 71%, Specificity 64%, r=0.545 and r=0.640). For crowding VAS, Cohen's kappa demonstrated moderate agreement (k=0.424).

Conclusion
A combination of 3 easily measurable ED variables (Boarded Patients; plus Waiting Room Patients; plus Patients in beds To Be Seen) performed better than NEDOCS and a NEDOCS-derived LOCAL Score at predicting ED crowding when compared against clinicians' visual analog scale impression. These indicators will be used to design and validate a simple tool to predict crowding in real time across multiple departments. Such a tool may facilitate early identification and interventions.