

Quality Indicator for Capnometry Parameters

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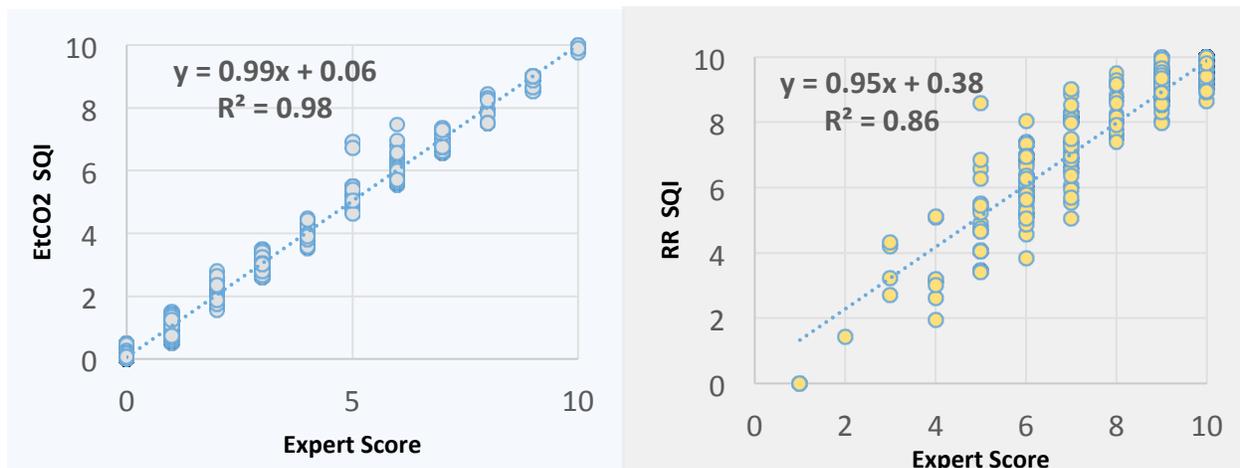
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Background: When a clinician or smart advisory system makes use of capnometry parameters such as respiratory rate and end-tidal carbon dioxide (etCO₂) for decision making, and before these parameters are stored in automated patient records, it is important to first know how reliable the parameters are. Historically, clinicians evaluated the corresponding capnogram for waveform quality before recording the respiratory rate and etCO₂ in a patient record. For example, if cardiogenic oscillations caused a high number of breaths to be detected, the anesthesiologist knew the displayed respiratory rate was too unreliable for use in decision making and the high rate was not recorded.

As capnometry monitoring moves to areas of use outside of the operating room, several challenges are encountered. The clinicians have less capnometry expertise and less time to evaluate the capnogram waveform quality. Meanwhile, the capnogram waveforms are more likely to be unreliable, so a clinician may not know if the reported parameters can be relied upon for decision making. We have developed an automated system that evaluates the expired CO₂ waveform and calculates a quality score to indicate if the respiration rate and etCO₂ measurements from that waveform are reliable for decision making. A quality indicator (SQI) could be displayed next to each parameter to indicate how dependable it is. In addition, we expect that these reliability scores could accompany parameters stored in anesthesia information systems to prevent incorrect conclusions from being reached from these parameters when the patient records are analyzed. We developed and evaluated quality indicators for etCO₂ and respiratory rate parameters.

Methods: An automated system extracts numeric descriptive features from the CO₂ waveform. These descriptive features are the input to a scoring algorithm. Scores of the parameter signal quality for respiratory rate and etCO₂ are in a range of 1-10 for each breath. Algorithm scores and expert opinion were recorded for a set of capnograms which had been recorded from patients in the OR, ICU and during procedural sedation. The algorithm was modified to better match expert opinion and the data were re-evaluated. The automated system scores were compared to the expert scores using linear regression analysis.

Results: Figure 1 shows the linear regression analysis of the quality indicator score and the expert score for the etCO₂ and respiration rate signal quality



indicators.

Figure 1: EtCO₂ and RR SQI vs. Expert score

Discussion: The automated system scores correlated well with the experts' scores in this initial study. We are currently evaluating the automated scoring system in an expanded study.