

This month's Editor's Choice is a retrospective review by Miller and colleagues, evaluating the modified pulmonary index score (MPIS) in asthma, as a predictor of length of stay (LOS) in the pediatric intensive care unit (PICU) and hospital. They studied records from 143 subjects over 3 years, categorizing MPIS into low, medium and high. MPIS scores predicted LOS in the PICU, hospital LOS, and time on continuous albuterol. Davis provides an accompanying comment espousing the importance of protocols, particularly in face of the current pandemic.

Bedoya et al performed a multicenter retrospective cohort study of unplanned intubations on general floors following respiratory decompensation. The study sought to define subject characteristics associated with unplanned intubations and to analyze medications administered, monitoring strategies, and vital sign trajectories. They found an incidence of 0.42 per 1,000 bed-days suggesting that over 60,000 such events occur in the U.S. annually. Vital signs changes were only seen in half the subjects, bringing into question the utility of continuous monitoring. Vines opines that patients on general floors require additional monitoring and machine learning to identify those at risk.

Marjanovic and others describe the use of high-flow nasal cannula (HFNC) compared to noninvasive ventilation (NIV) in the emergency department in subjects with hypercapnia and cardiogenic pulmonary edema. In a small set of 27 subjects they determined the change in arterial carbon dioxide (PaCO_2) in the first hour and evaluated indices of subjects' respiratory work. Both treatments reduced PaCO_2 and alleviated signs of respiratory distress. These findings are interesting, as NIV provides an increase in minute ventilation while HFNC only reduces the ventilation requirement.

Plotnikow and others performed a bench evaluation of HFNC systems at normal and high flows. They compared 3 heated humidifiers and 7 heated wire circuits. Delivered temperature, relative humidity, and absolute humidity (AH) were measured using flows from 30-100 L/min. Their results show statistically significant differences at high flows, which might have clinical impact.

Lofaso et al evaluated the impact of simulated hypoventilation in a lung model on the response of adaptive pressure modes in home ventilators. The novelty in this study is a simulated reduction in tidal volume (V_T) and breathing frequency. Traditional modes such as average volume-assured pressure support and intelligent volume-assured pressure support typically only adjust pressure support to meet V_T changes, while adaptive servo ventilation (ASV) addresses both V_T and breathing frequency. They found that ASV reduced hypoventilation events without creating hyperpnea.

Sinha et al developed a visualization tool created from data in the electronic health record they named the respiratory support score (RSS). This retrospective cohort study of postoperative pediatric cardiac surgery subjects evaluated 3 million time points to identify the timing and incidence of non-procedural reintubations. The RSS provided a clear visual depiction of respiratory care over time, particularly in subjects with complex ICU courses.

Kim and coworkers evaluated HFNC failure in 1,161 adults in 5 hospitals. Pneumonia was the most frequent diagnosis associated with HFNC use, followed by do-not-resuscitate or do-not-intubate orders. HFNC failure was associated with the resident's decision to initiate therapy, higher breathing frequency, lower initial arterial oxygen saturation, and lower respiratory rate-oxygenation index within 6 h.

Medeiros da Fonseca et al evaluated the impact of inspiratory load on chest wall kinematics, breathing pattern, and respiratory muscle activity in mouth breathing children. They found that the use of inspiratory loads improved breathing pattern and increased lung volume and electrical activity of inspiratory muscles. The nasal interface proved to be more effective when compared to the oral interface.

Bernatzky and others evaluated the impact of the type of the humidifier during ventilation with a T-piece resuscitator. Twelve rabbits received ventilation using a heat and moisture exchanger (HME), heated

humidifier (HH), or no humidity. Measurements of inspired AH were made every 5 min for 20 min. HHs provided the greatest AH followed by the HME; both were far greater than no humidity. They conclude that for short term ventilation in the delivery room, the HME could be used.

Gueret and colleagues prospectively evaluated unplanned extubations in a medical ICU including 2,578 admissions receiving 4,072 ventilation days. There were 53 unplanned extubations for an event rate of 1.3 per 100 days of ventilation. At that time of the event, subjects that self-extubated had a higher Richmond Agitation Severity Scale score, a longer distance from the endotracheal tip to carina on chest x-ray, and a shorter duration of mechanical ventilation. ICU mortality was lower in the self-extubation group despite having a trend towards a higher SAPS II score.

Lokin and others compared transesophageal electrical activity of the diaphragm (tEA_{di}) as used in neurally-adjusted ventilatory assist (NAVA) ventilation to noninvasive surface EA_{di} (sEA_{di}). tEA_{di} detected 3,675 breathing efforts of which 3,162 (86.0%) were also detected by sEA_{di} . They concluded that sEA_{di} was not reliable for breathing effort detection in invasively ventilated subjects compared to tEA_{di} .

Oppersma and others evaluated patient-ventilator synchrony during pressure support ventilation (PSV) and NAVA in 8 subjects with COPD exacerbation. Trigger delay was reduced with NAVA vs PSV, but there were no differences in cycle asynchrony. Higher levels of PSV were associated with neuromechanical asynchrony.

Li et al evaluated the use of pulsed-dose oxygen delivery from a concentrator during NIV in a bench study and in a small group of subjects with COPD exacerbation. They compared pulsed-dose oxygen to continuous flow oxygen, matching flow in L/min to the numerical setting on the concentrator. They concluded that integration of a concentrator with NIV could achieve similar efficacy as continuous flow.

Sheehy and coworkers evaluated double triggering (DT) during NIV in a bench model using two different ventilators. They observed an increase in DT with lower test lung compliance and with lower airway resistance in one device, but not the other. They concluded that simulated-patient and device characteristics influenced the frequency of DT in NIV in a simulated lung model.

John and others tested a bubble NIV device in an infant lung simulator. The system was designed to provide NIV in low resource settings. The fabricated system pressure waveforms and V_T delivery were compared to a commercially available device. The authors concluded that in low resource settings this system could provide ventilation without electricity.

Delorme and others evaluated the impact of HFNC at 20-60 L/min in healthy volunteers. Indices of respiratory effort were evaluated and deadspace was calculated. While work of breathing was not altered, minute volume and breathing frequency were significantly lower. Calculated deadspace was reduced by half at flows > 20 L/min.

Yousif et al evaluated pharmacy claims data to assess adherence to respiratory medications at home. The system allowed graphic depiction of adherence to maintenance medications and use of rescue medications. They conclude that this tracking system could improve medication adherence by sharing data with members of the healthcare team and patients.

Castineira and colleagues evaluated a machine learning approach using continuous vital sign data to predict LOS in the PICU. The combination of vital signs information and static clinical data from the health record resulted in a performance of the prediction model of 90%. The authors conclude that readily available data from bedside monitors can be used for real-time predictive systems.

Nunna and coworkers provide a systematic review of participant retention in survivors of acute respiratory failure. Using 21 studies and over 4,000 subjects they report that optimizing retention rate should become a priority. Santus et al provide a narrative review of targeting the small airways in asthma and COPD, including drug delivery.