The prevalence of adult obesity (Body Mass Index (BMI) ≥ 30) in the US has grown significantly over the last two decades and encompasses over 1/3 of the national population. Obese patients are considered to have a greater risk of post-surgical respiratory complications. Postoperative opioid use, one of the leading causes of postoperative respiratory compromise, is especially challenging in obese patients because of physiologic and anthropomorphic differences. Currently, no technology provides continuous, non-invasive, real-time measurements of respiratory competence in intubated patients. Current respiratory monitoring utilizes subjective clinical assessment and oxygen saturation which decreases only after significant respiratory compromise, leading to a delay in interventions. This underscores the importance of adequate monitoring of ventilation, especially in a population that is considered to be at greater risk. A novel non-invasive Respiratory Volume Monitor (RVM) has been developed to provide continuous, real-time measurements of minute ventilation (MV), tidal volume (TV) and respiratory rate (RR). This study evaluates the utility of the RVM in the obese population.

### Methods

After written informed, 35 obese (BMI ≥ 35 kg/m²) patients (66 visits, 1740 tests, aged 19 – 79 years, BMI 35.0 – 60.5 kg/m²) were studied using a bio-impedance based RVM (ExSpiron, Respiratory Motion, Inc., Waltham, MA) from thoracic electrodes (Figure 1). Respiratory traces were collected simultaneously with spirometry data during normal, deep, and shallow breathing and compared to evaluate accuracy and precision of RVM measurements of MV, TV and RR. For each patient a single normal breathing trial was used for calibration and performance was evaluated on the remaining trials.

### Results

RVM data correlated strongly with spirometric volume data, with median correlation across all subjects of r=0.97. Across all subjects, the average MV and TV measurement accuracy was 12.6%±3.9% and 12.3%±4.1%, respectively (mean ± SEM) and the RR accuracy was 2.4%±0.9%. The measurement bias in all three values was less than 1% on average. After individual calibration, less than 2% of all trials had measurement error greater than 20% and no trials had measurement error above 25% (Table 1). Bland-Altman plots of the subject average measurements of TV, MV and RR are shown in Figure 2. Figure 3 shows the correlation between the RVM and spirometry.

### Conclusions

- Continuous non-invasive RVM monitoring can accurately measure and track MV, TV, and RR in the obese population.
- RVM provides quantitative data of respiratory status, otherwise unavailable in non-intubated patients.
- RVM data can be used for post-operative patient monitoring to assist with opioid dosing, especially in populations with an increased risk of respiratory complications.
- RVM has the potential to become a new standard of care, and improve patient safety in this at-risk population.
- Additional data in a post-operative cohort has shown that OSA is not predictive of POA or OIRD.