

**METHODS**

- Using an ASL5000 lung to simulate obstructive and restrictive patient models, the investigators tested the Maquet SERVO-i**, Dräger Evita Infinity** V500, Covidien Puritan Bennett™ 840, Philips Philips Respironics** V60 and Hamilton-C3 ventilators to determine the number of breaths required to achieve (simulated) patient-ventilator synchrony during increasing (n=6) and decreasing leaks (n=6).
- Obstructive model: inspiratory/expiratory resistance of 10/20 cmH₂O/L/sec, compliance 60 ml/cmH₂O.
- Restrictive model: inspiratory/expiratory resistance of 5/5 cmH₂O/L/sec; compliance 20 ml/cmH₂O.
- Leak levels were: BL (baseline < 0.5 L/min), L1 (4-5L/min), L2 (9-10 L/min) and L3 (26-27 L/min).
- Ventilator settings: invasive ventilation, pressure support (spontaneous mode), PEEP 5 and 10 cmH₂O and pressure support level 12 cmH₂O.

**RESULTS**

- Only the Puritan Bennett 840 and Philips Respironics® V60 ventilators exhibited synchronization following all increasing and decreasing leak scenarios in both obstructive and restrictive models.
- Maquet SERVO-i** did not synchronize at any leak level.
- Dräger Evita Infinity** V500 and Hamilton-C3 ventilators could not synchronize to leak L3.
- Number of breaths to synchronization for increasing leaks differed from decreasing leak with median breaths (25th-75th) of 2 (1, 3) and 0 (0, 0) (p < 0.0001) respectively.
- Significant differences were observed for number of breaths to synchronization between the obstructive 2 (0, 3) and restrictive model 0 (0, 1) (p < 0.0001), and PEEP 5 cmH₂O 0 (0, 2.25) and 10 cmH₂O 1 (0, 2) (p =0.03).
- Puritan Bennett 840 ventilator required fewer breaths than V60 (p < 0.0001) to synchronize to increasing and decreasing leaks in both obstructive and restrictive lung models and with PEEP 5 cmH₂O and 10 cmH₂O.

**CONCLUSIONS**

- Puritan Bennett 840 and Philips Respironics® V60 ventilators were the only ventilators that adapted well to increasing or decreasing leaks.
- Puritan Bennett 840 ventilator required fewer breaths to synchronize under all test conditions. The clinical significance of these differences is unclear.
- In the presence of leaks over 26-27 L/min, most ICU ventilators cannot synchronize even if leak compensation is available.


METHODS
• Using an ASL5000 lung to simulate obstructive and restrictive patient models, the investigators tested the Maquet SERVO-i**, Dräger Evita Infinity** V500, Covidien Puritan Bennett™ 840, Philips Respironics** V60 and Hamilton-C3 ventilators to determine the number of breaths required to achieve (simulated) patient-ventilator synchrony during increasing (n=6) and decreasing (n=6) leaks.
• Obstructive lung model: inspiratory/expiratory resistance of 10/20 cm H₂O/L/sec, compliance 60 ml/cm H₂O.
• Restrictive lung model: inspiratory/expiratory resistance of 5/5 cm H₂O/L/sec; compliance 20 ml/cm H₂O.
• To simulate the leaks expected during noninvasive ventilation, lung model leak levels were: BL (baseline 3-4 L/min), L1 (9-10 L/min), L2 (26-27 L/min) and L3 (35-36 L/min).
• Ventilator settings: noninvasive ventilation, pressure support (spontaneous mode), PEEP 5 and 10 cm H₂O and pressure support level 12 cm H₂O.

RESULTS
• With the exception of the Dräger Evita Infinity®* V500 ventilator, all ventilators exhibited synchronization to increasing and decreasing leaks in both the obstructive and restrictive models.
• The Dräger Evita Infinity** V500 ventilator could not synchronize to leaks L2 (26-27 L/min) and L3 (35-36 L/min).
• Number of breaths to synchronization for increasing leaks differed from the number to synchronization for decreasing leaks with median breaths (25th, 75th) of 2 (1, 3) and 0 (0, 1) (p < 0.0001) respectively.
• Significant differences were observed for number of breaths to synchronization between the obstructive 2 (0, 3) and restrictive model 0 (0, 2) (p < 0.0001) and with PEEP 5 cm H₂O 0 (0, 2) and 10 cm H₂O 1 (0, 3) (p =0.002).
• The Puritan Bennett 840 ventilator required fewer breaths to synchronize to increasing and decreasing leaks in both obstructive and restrictive lung models and with PEEP 5 cm H₂O and 10 cm H₂O compared with all other ventilators (p < 0.0001).

CONCLUSIONS
• The leak compensation in noninvasive ventilation modes can correct partially or completely for leak interference within four breaths, but there are wide variations between ventilators.
• The Dräger Evita Infinity®* V500 ventilator could not synchronize to leaks of 26-36 L/min.
• The Puritan Bennett 840 ventilator required the fewest number of breaths to synchronize under all test conditions.