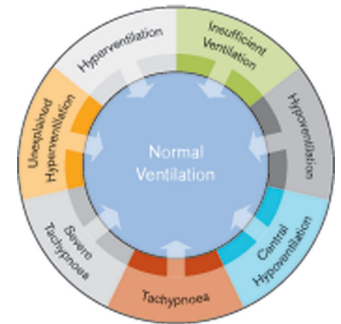


# Automated Weaning: Workflow and Cost Saving Advantages for the ICU

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## ISSUE

Mechanical ventilation is a highly complex process that is routinely conducted in intensive care units. Nonetheless, there are still no uniform evidence-based guidelines for the weaning process. Each delay to weaning patients from mechanical ventilation increases both the cost of care and the risk of adverse events such as VILI or VAE, among many others. Generally speaking, the clinician must first determine what patient may tolerate weaning, and initiate a screening test. The purpose of the screening test is to decide whether or not to wean by predicting whether the patient will tolerate reduction of ventilatory support during the weaning process. Perhaps the most reliable screening test for this decision is the rapid shallow breathing index.<sup>1</sup>

Clinicians are challenged with issues related to information overload, multiple high-priority tasks, and practice variability. Even when adequately explicit protocols are available, adherence to them is uncertain for a variety of practical reasons.<sup>2</sup> When utilizing closed-loop control systems, computerized protocols may lead to a higher degree of uniform clinician decision making. Unlike human beings, a computer is vigilant 24 hours a day, 7 days a week. With the right application, these advances offer the chance to further improve therapeutic quality and efficacy.<sup>3</sup>

**Mechanical ventilation is associated with significantly higher daily costs for patients receiving treatment in the intensive care unit throughout their entire intensive care unit stay. Interventions that result in reduced intensive care unit length of stay and/or duration of mechanical ventilation could lead to substantial reductions in total inpatient cost.<sup>4</sup>**

## COST OF ICU CARE

While factors such as age, acuity, gender, diagnosis can play a role in costs, in general terms, the average cost per day for a patient to be cared for in an ICU is approximately \$3000.00 USD. Mechanical ventilation will cost an additional \$1500.00 daily.<sup>4</sup> Intensive care unit costs are highest during the first two days of admission, stabilizing at a lower level thereafter. Mechanical ventilation is associated with significantly higher daily costs for patients receiving treatment in the intensive care unit throughout their entire intensive care unit stay. Interventions that result in reduced intensive care unit length of stay and/or duration of mechanical ventilation could lead to substantial reductions in total inpatient cost.<sup>4</sup>

## SUPPORTIVE STUDIES/EVIDENCE

The Canadian Wean Earlier and Automatically with New Technology (WEAN study) compared a standardized weaning protocol with automated weaning within an interdisciplinary team which included a Physician, Respiratory Therapist, and ICU Nurse.<sup>5</sup> This study showed that both the mean time to the first successful breathing trial and extubation were significantly shorter in those patients treated under the automated weaning arm. Noted were fewer episodes of extended ventilation and resultant need for tracheostomies.

In a 2014 Cochrane Review, when comparing to automated protocols to the standard weaning practices without protocols, the average total time spent on the ventilator was reduced by 26%. The duration of weaning was reduced by 70% and length of stay in the ICU reduced by 11%. The use of automated protocols did not result in any additional harmful effects. Findings included: considerable variation in the types of protocols used, the criteria for considering when to start weaning, the medical conditions of the patients and usual practice in weaning.<sup>6</sup>

## WORKLOAD REDUCTION

Current workforce shortages within Respiratory Care already exist in a 2006 survey. Since automated weaning has been shown to decrease the number of ventilator manipulations in the weaning process, this should translate into a reduction in workload for an already-overburdened staff.<sup>7</sup> The staffing shortage, increasing number of patients requiring mechanical ventilation, and mandated staff/patient ratios may be the most compelling argument for automated weaning.<sup>7</sup>

## SMARTCARE/PS™

SmartCare/PS is an integrated automated clinical protocol that is designed to stabilize the patient's spontaneous breathing in a comfortable zone of normal ventilation and automatically adjust the inspiratory support level.

After a clinician determines a patient is ready to be considered for weaning (ie: hemodynamically stable, adequate oxygenation, airway protected) the three monitored parameters to define the zone of respiratory comfort are: spontaneous respiratory rate, spontaneous tidal volume, and end-tidal CO<sub>2</sub>.

Based on the monitored parameters, the patient is classified into a condition of normal ventilation, insufficient ventilation, hypoventilation, hyperventilation, unexplained hyperventilation, tachypnea, or severe tachypnea.

The SmartCare/PS program will supervise the weaning process and based on the defined parameters will either adopt to the patient's changing clinical requirements, maintain current support, or continue to observe and suggest separation. When the "Consider Separation" notice appears, the clinician must evaluate the patient and

consider the appropriate course of action (ie: extubation or continue mechanical ventilation).

## CONCLUSION

Decision making support and automated algorithms can support respiratory workflow and provide a uniform approach to ventilator weaning and may in some cases improve outcomes. However, the patient populations selected for its use must be appropriate; issues related to subjective physical assessment (ie: physical appearance/exam, ecg, and hemodynamics) must be determined by the clinician at the bedside.

## Questions?

For questions or more information, please contact:  
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## References

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