

Machine Learning Identifies Higher-Risk Patients Who Meet Traditional Extubation Criteria

Glenview, IL (October 12, 2026) – A machine learning (ML) model identified a group of mechanically ventilated patients who met traditional criteria for extubation but experienced more than twice the reintubation rate and higher mortality compared with patients classified as low risk by the same model.

Extubation failure occurs in 8% to 15% of mechanically ventilated patients and independently doubles mortality. Traditional predictors, including rapid shallow breathing index (RSBI), FiO₂, and PEEP, assess respiratory mechanics but may not capture systemic factors that contribute to reintubation. Researchers developed an ML model to predict extubation failure and identify patients at high risk despite meeting traditional extubation criteria.

Using MIMIC-IV data, researchers studied 23,379 adults who underwent their first extubation following mechanical ventilation. Extubation failure was defined as reintubation within 72 hours and occurred in 8.3% of patients. A gradient boosting machine was trained using 52 pre-extubation features, including ventilator mechanics, hemodynamics, laboratory values, fluid balance, vasopressor status, ventilation duration, and comorbidities. Patients were then classified according to traditional extubation criteria and ML-predicted risk.

The model identified 4,370 patients, or 18.7%, who met all traditional low-risk criteria but were classified as high-risk by ML. These “occult high-risk” patients had a 15.4% reintubation rate and 18.7% mortality rate, compared with 7.3% and 11.1%, respectively, among patients who met traditional criteria and were classified as low risk by the model.

Patients in the occult high-risk group had longer durations of ventilation; higher rates of acute respiratory distress syndrome, pneumonia, congestive heart failure and sepsis; and greater positive fluid balance. The model also classified 39.4% of patients who failed traditional criteria as low risk. These patients had a 4.2% reintubation rate and 4.5% mortality rate, suggesting potential opportunities for earlier extubation.

“Nearly one in five extubated patients meets all traditional weaning criteria but have twice the reintubation and mortality risk, driven by systemic factors like prolonged ventilation, ARDS [acute respiratory distress syndrome], sepsis, and fluid overload, which is not readily reflected in conventional respiratory mechanics-based assessment,” said Jeril Lasington, MD, CHEST 2026 presenting author. “Integrating machine learning risk scores alongside standard weaning parameters could flag these occult high-risk patients for enhanced post-extubation monitoring, prophylactic noninvasive ventilation, or delayed extubation.”

The findings suggest that incorporating systemic factors alongside traditional respiratory mechanics may help identify patients whose risk of extubation failure is not captured by conventional weaning criteria. ML risk assessment may also help identify patients who fail traditional criteria but could be candidates for earlier extubation.

Further results will be presented at the CHEST Annual Meeting 2026 as part of the Mechanical Ventilation Liberation: Diaphragm Phenotyping and Extubation Risk Prediction original investigation presentations titled, *Machine Learning-Based Prediction of Extubation Failure Beyond Traditional Weaning Parameters: A Mimic-IV Analysis*. The [study abstract](#) can be viewed on the CHEST® journal website.