# Prediction of Physiological Deterioration and Mortality in Mechanically Ventilated Patients Admitted to the ICU

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## Introduction/Background

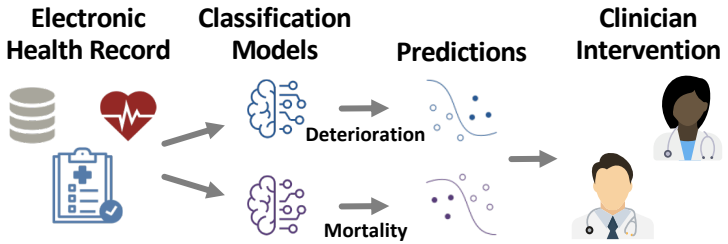
- Mechanical ventilation provides adequate gas exchange and reduces the work of breathing in critically ill patients to maintain respiratory function and blood oxygenation.
- Ventilation itself can cause damage to healthy lungs or exacerbate pathology in previously damaged lungs and has been shown to contribute to end-organ dysfunction.
- Prediction of physiological deterioration and mortality in mechanically ventilated patients in the ICU can greatly assist clinical decision-making.

## Objective

- To build statistical models for predicting physiological deterioration and mortality in ventilated ICU patients.

## Materials and Methods

- Patient data from the Phillips eICU Database were filtered using the following inclusion criteria: age ≥18 years, ICU stay ≥48 hours, pressure- or volume-controlled ventilation, and intubation ≥48 hours.
- Classification methods (logistic regression: LR; random forest: RF; support vector: SVC; XGBoost: XGB) were evaluated with six-fold cross validation.




## Results

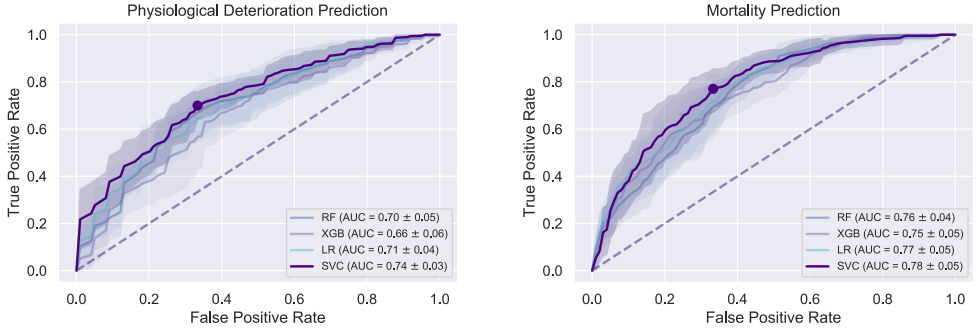



**Figure 1. Overall Physiological Deterioration and Mortality Prediction**
**Left:** Average ROC curves for physiological deterioration prediction. Support vector classification was our highest performing model with an AUC of 0.74 ± 0.03. **Right:** Average ROC curves for mortality prediction. Support vector classification again was our highest performing model with an AUC of 0.78 ± 0.05.

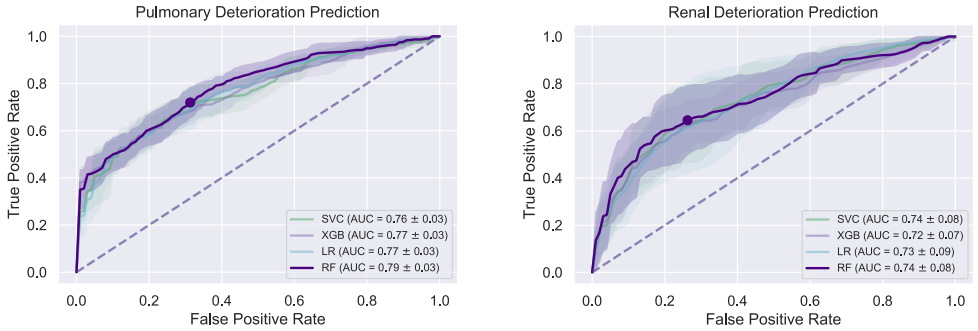



**Figure 2. Organ-Specific Deterioration Prediction**
**Left:** Average ROC curves for pulmonary deterioration prediction. Random forest was our highest performing model with an AUC of 0.79 ± 0.03. **Right:** Average ROC curves for renal deterioration prediction. Random forest again was our highest performing model with an AUC of 0.74 ± 0.08.

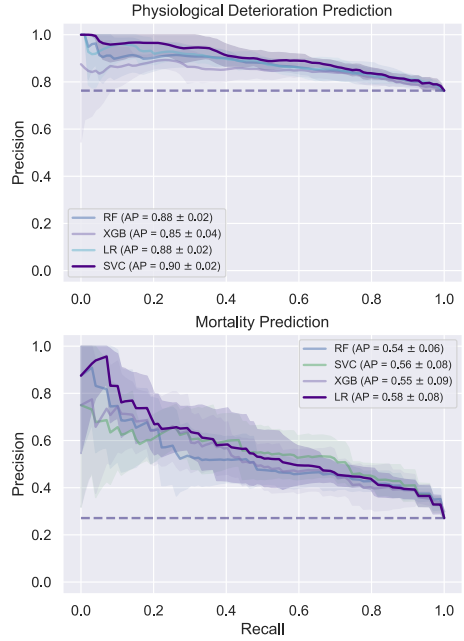



**Figure 3. Predictive Model Precision-Recall (PR) Curves**
**Top:** PR curves for physiological deterioration prediction. SVC had the highest average precision of 0.90 ± 0.02. **Bottom:** PR curves for mortality prediction. LR had the highest average precision of 0.58 ± 0.08.

## Conclusion

- Our results demonstrate promising predictive power for physiological deterioration and mortality using statistical learning models.
- These models have the potential to help prevent and manage end-organ dysfunction associated with mechanical ventilation.