**Development of Unplanned Extubation Prediction Model in Intensive Care Unit**

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**Abstract**

*Unplanned extubation (UE) is an important incidence in the intensive care unit (ICU). UE is the related to patient safety and associated with increased morbidity. The aim of this study is development of UE prediction model in the ICU. Inclusion criteria were admitted in the ICU and underwent intubation cases, between January 1, 2010, and December 31, 2018. Among the 7,190 cases who underwent first extubation in the ICU, the incidence of UE was 249 (3.5%). The input variables of the machine learning algorithm were use of restrains, CAM-ICU, RASS, and glasgow coma scale. The result of AUROC were 0.817 for support vector machine, and 0.813 for random forest. Because of the small occurrence of UE events, multi-center studies are required for validate machine learning algorithm. OMOP-CDM based algorithm extension is expected to improve the quality and safety for patients care.*

**Introduction**

Unplanned Extubation (UE) reported 0.5% to 35.8% in the literature review1. The proper position of the endotracheal tube is essential to maintain the respiratory support. UE is the adverse event in the intensive care unit which is related to the patient safety and morbidity. Several studies have demonstrated that the UE patients are associated with increased complications such as airway injury, aspiration, and hypoxia2. Reintubation causes an increase in pneumonia and failure of reintubation can lead to death, and respiratory failure. In addition, emergency reintubation after UE will result in clinician overload. In previous studies, the risk factor of UE is use of sedative, mental status such as Glasgow Coma Scale (GCS), alert and oriented, and duration of ventilation and physical restraint3,4.

**Method**

A retrospective study was carried out in ICU of an academic tertiary hospital. The study included patients who admitted in the ICU between January 1, 2010, and December 31, 2018. During the study period, 102,178 cases were treated in the ICU, 46,018 cases underwent intubation. Include criteria is the first episode of extubation in ICU and needing invasive mechanical ventilation for at least 24 hours. Patients aged<18 years were excluded. Among 7,189 include cases, 249 cases underwent UE event.

**Result**

During the study period, among the 7,190 cases, 249 underwent UE. The basic patient characteristics are shown in Table 1. Among the unplanned extubation group, 31% underwent reintubation within 1 hour and 55% was within 3 hours. 10% of planned extubation group underwent reintubation within 1 hour. We developed machine learning prediction algorithm using support vector machine, and random forest. The input variables were GCS, CAM-ICU, RASS and use of restrains. ROC curves showing a performance comparison between random forest (AUC: 0.813) and support vector machine (AUC: 0.817). Figure 1 shows AUROC results.

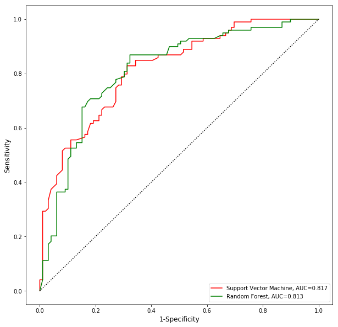
**Table 1.** The basic patient characteristics

Figure 1. Receiver operation characteristic curves of models for predicting unplanned Extubation. Red line represents support vector machine model and green line represents random forest model, respectively.

**Conclusion**

In this study, we development of unplanned Extubation prediction model in ICU, the result of AUROC was 0.817 using support vector machine.

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