RES-129

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Explainable Machine Learning for Predicting CLABSI in Severe Burn Patients : A 10–Year Time-Series Analysis

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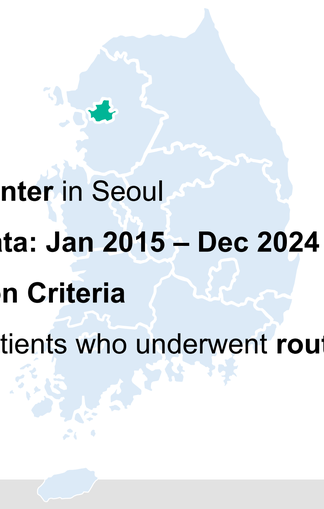
1 Backgrounds

- **Patients with severe burns** are at a **high risk** for central line–associated bloodstream infections (**CLABSI**)
- **Aim of Study: Identify risk factors** for CLABSI in severe burn patients using time–series data
  , analyze via a **machine learning** (ML) model with **explainable AI** (XAI)

2 Methods

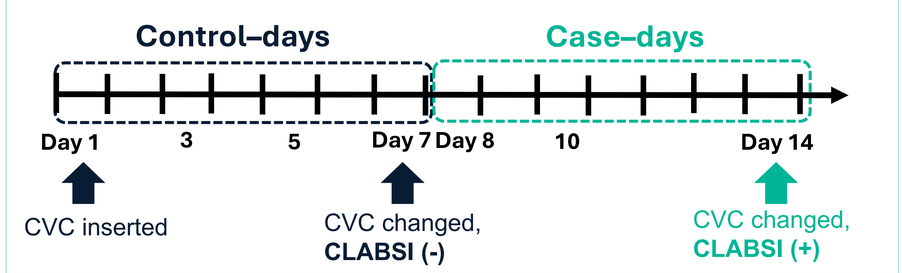


Burn center in Seoul

Daily data: Jan 2015 – Dec 2024

Inclusion Criteria

: ICU patients who underwent **routine CVC changes**



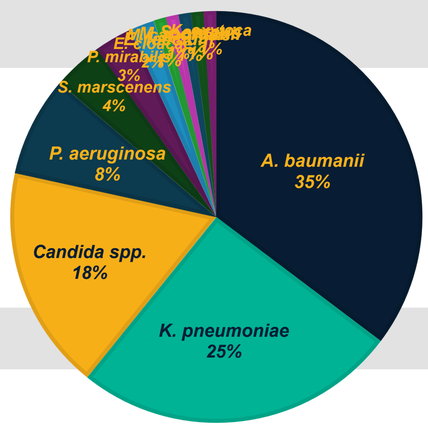
- **Training Set: Test Set = 8:2, 5-fold cross validation**
- **ML method: XGBoost**
- **SHAP : ensured ML model interpretability**

73 Features	
Daily laboratory tests	CBC, chemistry, microbiology.. etc.
Daily vital signs	BT, BP, M.A.P, HR ...etc.
Burn index	TBSA(%), 3rd degree (%)...etc.
Demographics	Age, Sex, BMI, past history..etc.
Procedures	Femoral catheterization, transfusion...etc.

Recursive Feature Elimination: Select key features

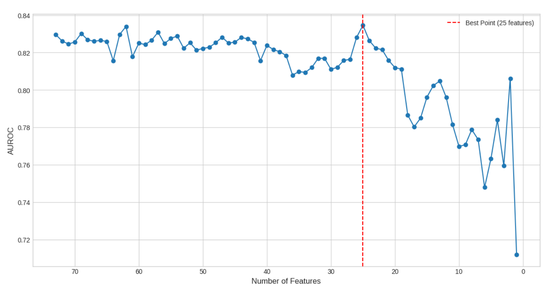
3 Results – CLABSI

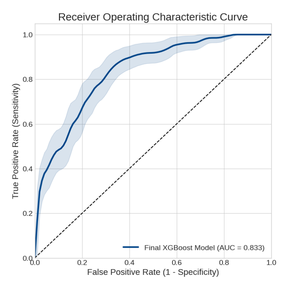
- **6,378 line–days** from 860 CVCs in 286 patients were were analyzed
- **CLABSI rate**:15.99 per 1,000 line–days
- **Most common** pathogens: *A.baumanii* (35.3%), *K.pneumoniae* (25.4%), and *Candida* spp. (17.6%)



4 Results – CLABSI prediction ML model

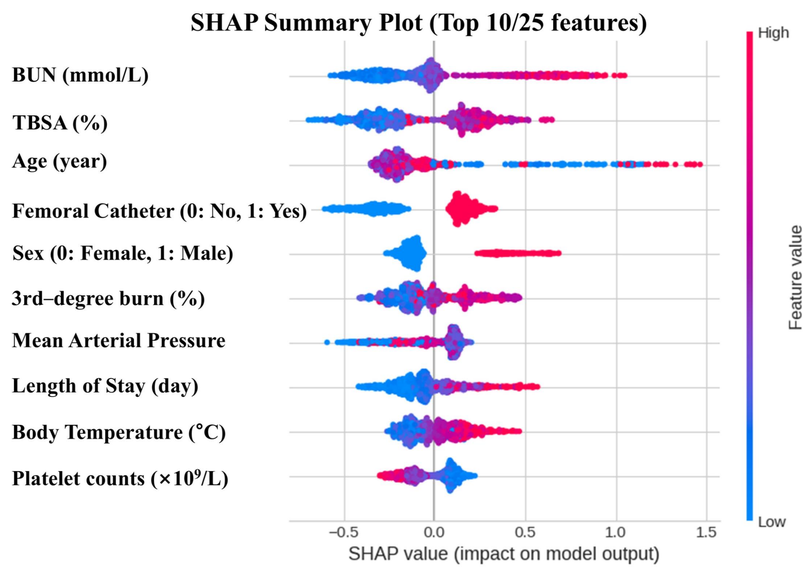
Recursive Feature Elimination with XGBoost model





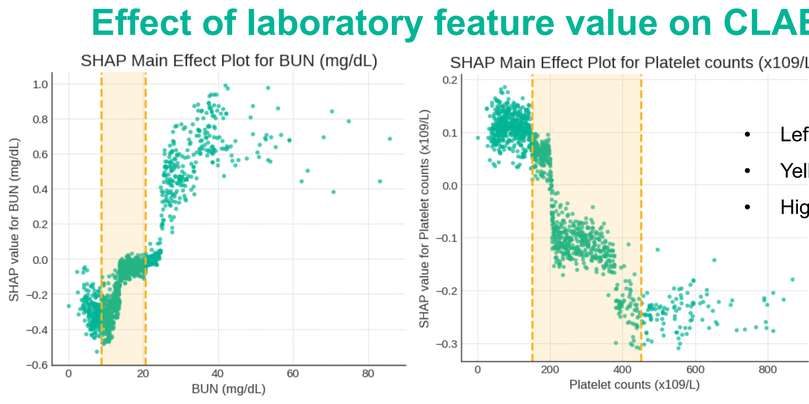
- **25 Features** showed highest **AUROC of 0.833** (95% CI: 0.798–0.868)

Key features on CLABSI prediction



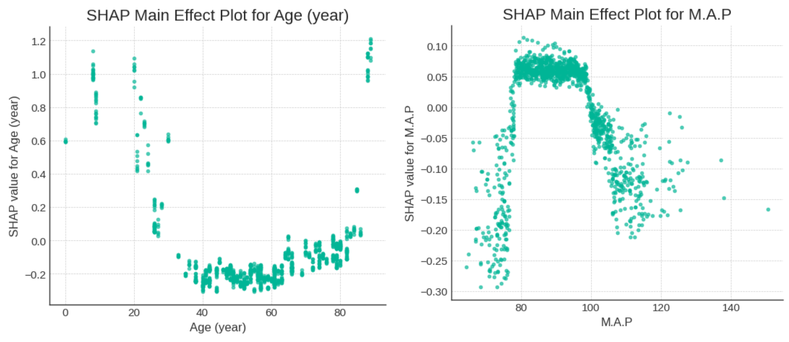
- Each dot correspond to an individual
- The colors represent feature values for numeric features: red for larger values, and blue for smaller
- A negative SHAP value (extending to the left) indicates reduced CLABSI risk,
  while a positive one (extending to the right) indicates increased CLABSI risk

Effect of laboratory feature value on CLABSI risk



- Left: BUN, Right: Platelet counts
- Yellow shaded region: Reference interval
- Higher SHAP value: Higher CLABSI risk

ML model captured non-linear relationships with CLABSI risk



- Left: Age, Right: mean arterial pressure
- Higher SHAP value: Higher CLABSI risk
- **Age** exhibited a **U-shaped relationship** and
  M.A.P an **inverted U-shaped relationship** with CLABSI prediction

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5 Conclusions

- ML model demonstrated excellent performance, and XAI revealed complex relationships between CLABSI risk and features
- Daily laboratory tests and vital signs were critical, showing that integrating time-series data with baseline characteristics enhances predictive accuracy