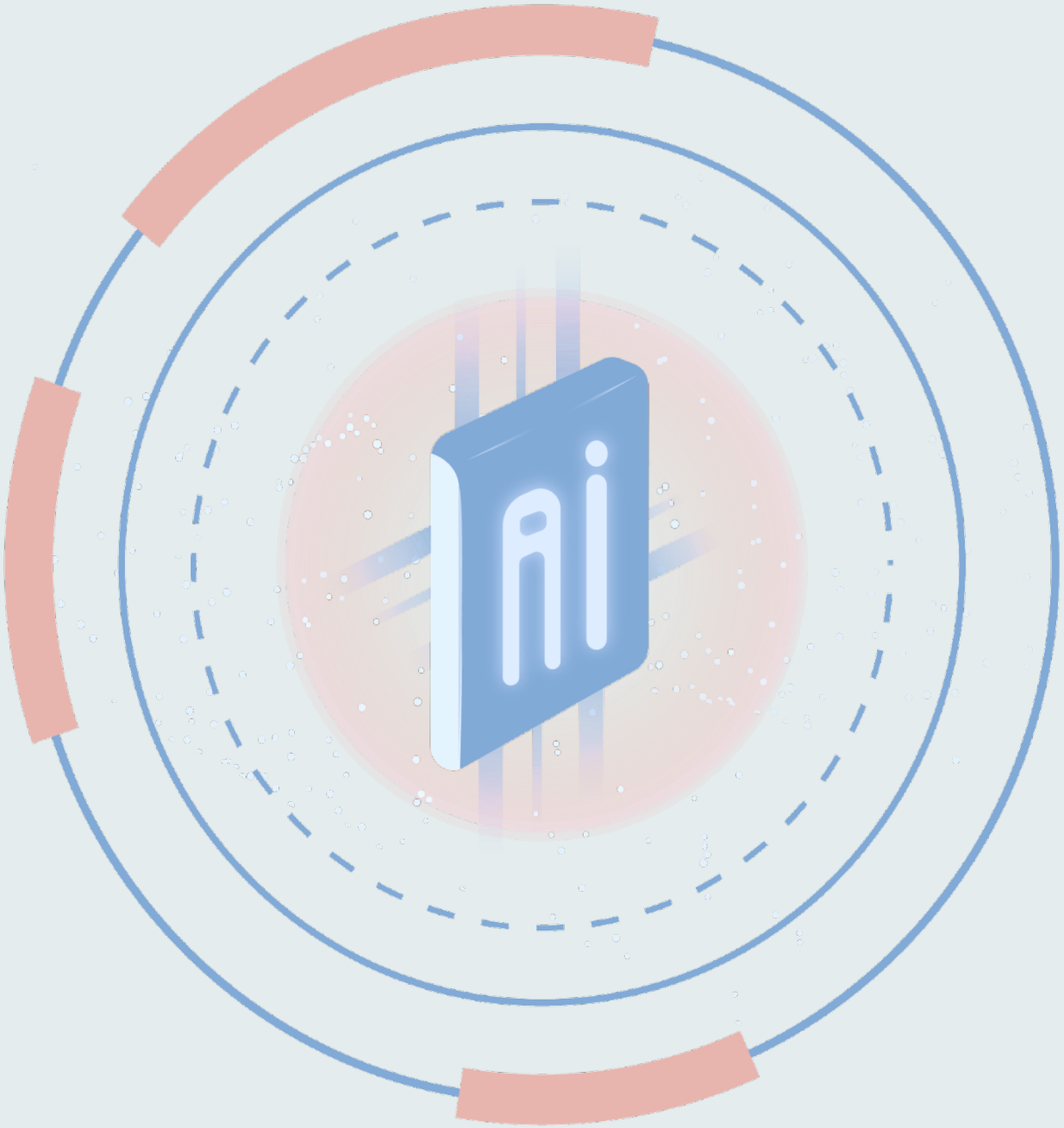
APAC Scientific Forum

July 4, 2024

Agenda

- AI-based Prediction for Post-Surgical Complications in Patients Undergoing Elective Surgery by Singapore A*STAR



AI-based Prediction for Post-Surgical Complications Risk in Patients Undergoing Elective Surgery

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Data Manager, A*STAR

PROBLEM

300 million surgeries per year around world

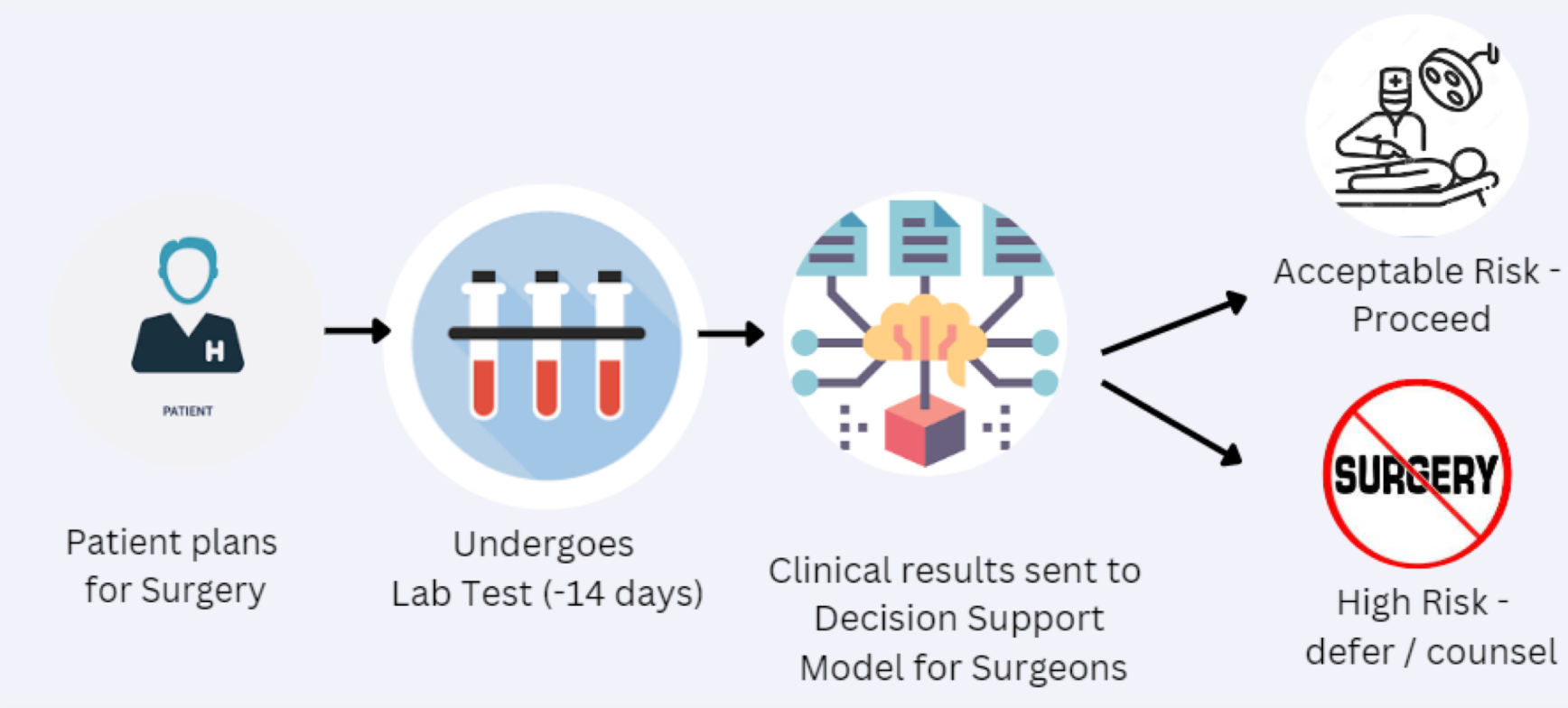
~ 5% post-operative mortality

~ 15% post-operative complications

Reference:
1. Magnitude of post-operative mortality and associated factors among patients who underwent surgery in Wolaita Sodo teaching and referral hospital, SNNPR region, Ethiopia: https://bit.ly/3B7t8xw
2. Postoperative complications and implications on patient-centered outcomes : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3637983/

SOLUTION

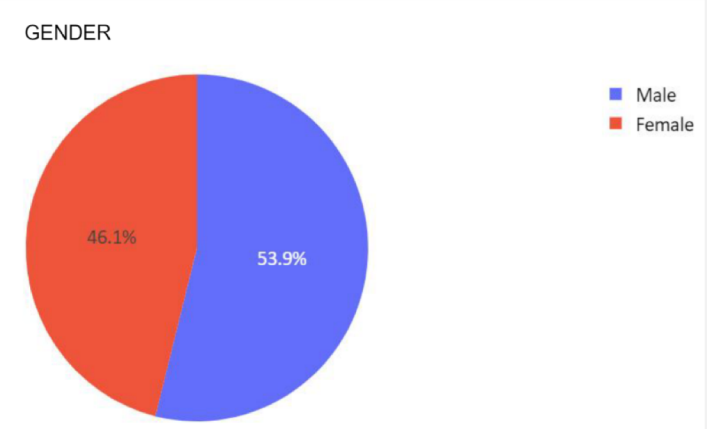
A decision support tool for surgeons to predict post surgery complications of elective surgery patients using pre-operative clinical risk factors



DATA OVERVIEW

VitalDB

- The VitalDB (Vital Signs DataBase) for surgical patients.
- Routine operation at Seoul National University Hospital, Seoul, Korea.
- 4,221 patients with non-emergency surgery performed (elective surgery).



Age							
n	Mean	Std	Min	25%	50%	75%	Max
4221	58.6	14.2	0.6	50.0	60.0	69.0	90.0

No. of Cases in VitalDB

N = 6,388

→

Non-emergency Cases

N = 5,606

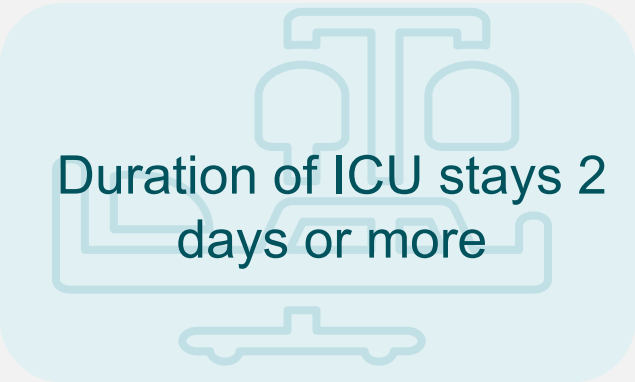
→

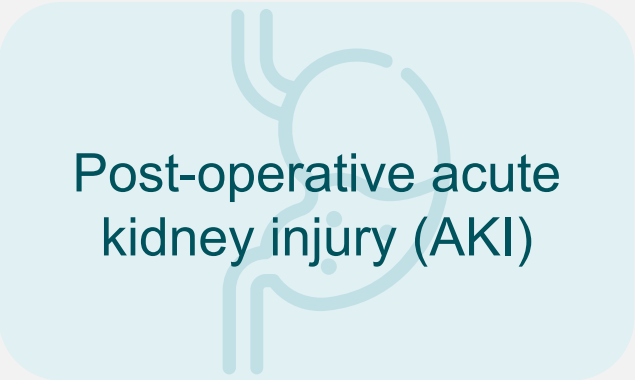
Cases with pre- and post-operative lab biomarker data

N = 4,221

AIM

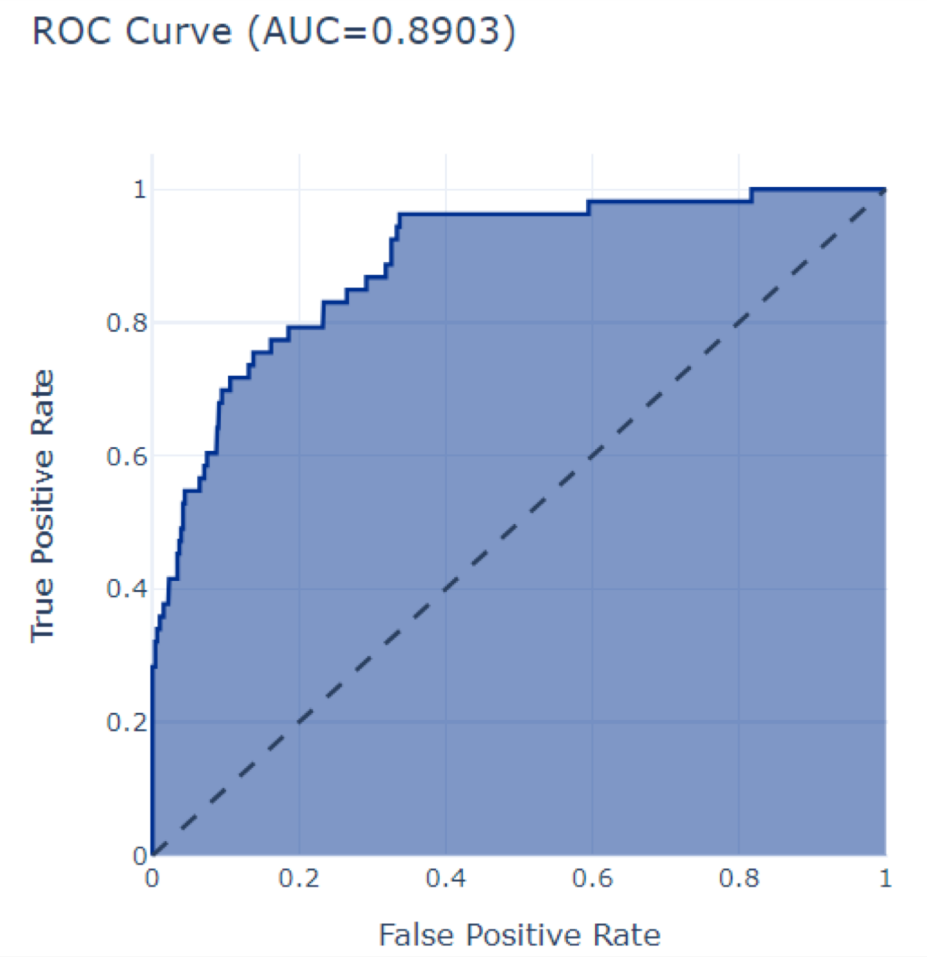
- To predict post-surgical risk complications, our study defines these complications as :





MODEL RESULTS - FROM XGBOOST FEATURE SELECTION MODEL

XGBoost Gradient Boosting Classifier

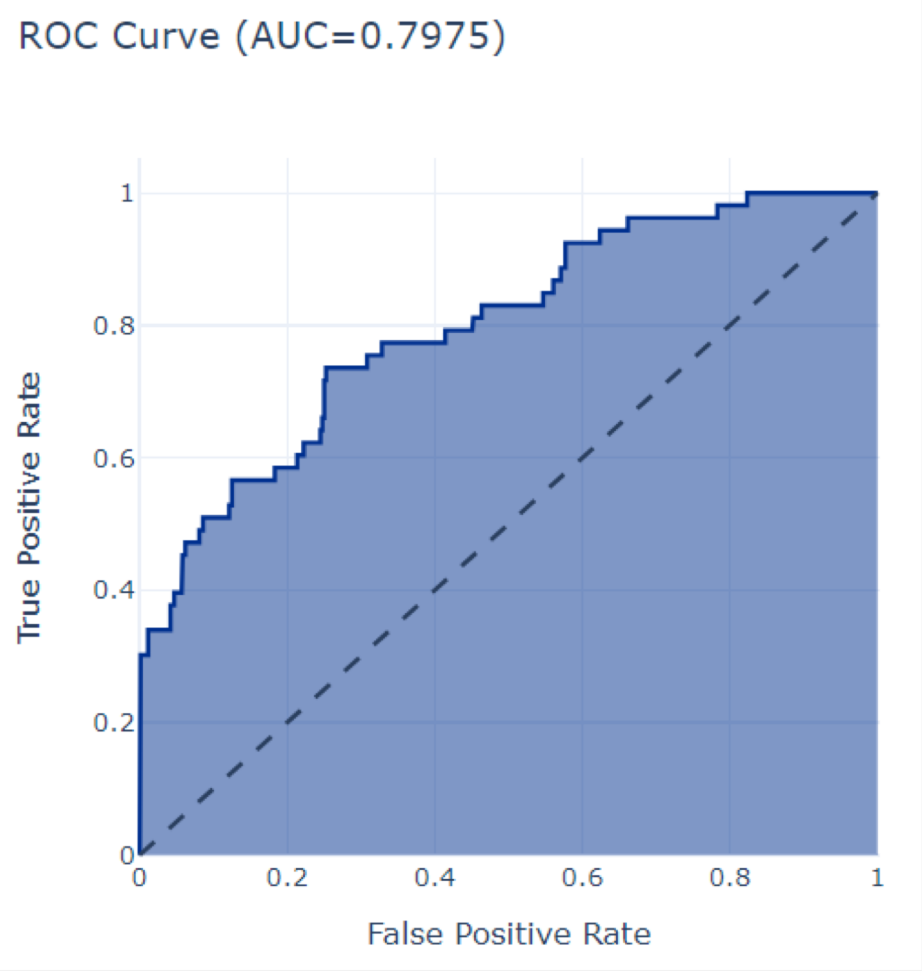


Top 3 Risk Predictors

- Any Transplantation
- Perioperative C-reactive Protein
- Perioperative Platelet Count

OPTIMUM MODEL RESULTS -
SEQUENTIALLY CONSTRUCTED USING TOP PREDICTORS

First Tier Model



4 Features for Predictors of Post-Surgical Risk

- Any Transplantation
- Perioperative C-reactive Protein (High)
- Perioperative Platelet Count (High)
- Perioperative Fibrinogen (Low)

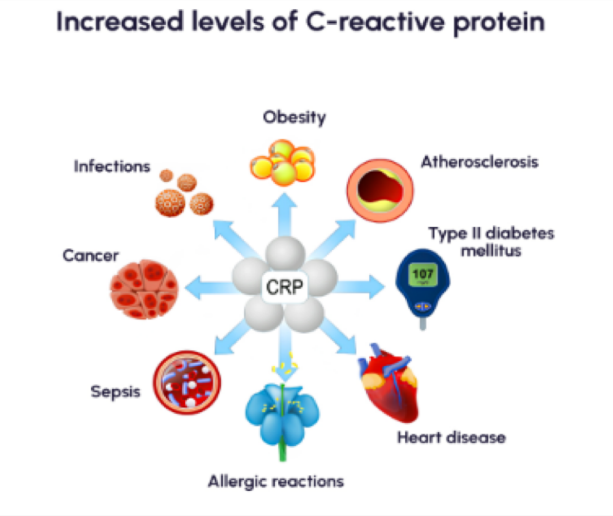
OPTIMUM MODEL RESULTS - FIRST TIER MODEL

4 Features for Predictors of Post-Surgical Risk

Transplantation Surgery

- Increase the risk of Surgical Site Infections
- Entails longer hospital durations

Perioperative C-reactive Protein (CRP)



- CRP serves as a well-established marker of inflammation
- High CRP indicates presence of inflammatory response
- Leads to complications such as infections, cardio events and prolonged hospital stays

Reference:
1. Prolonged Operative Duration Increases Risk of Surgical Site Infections: https://pubmed.ncbi.nlm.nih.gov/28832271/
2. High CRP Levels After Critical Illness are Associated With an Increased Risk of Rehospitalization: https://pubmed.ncbi.nlm.nih.gov/29438222/

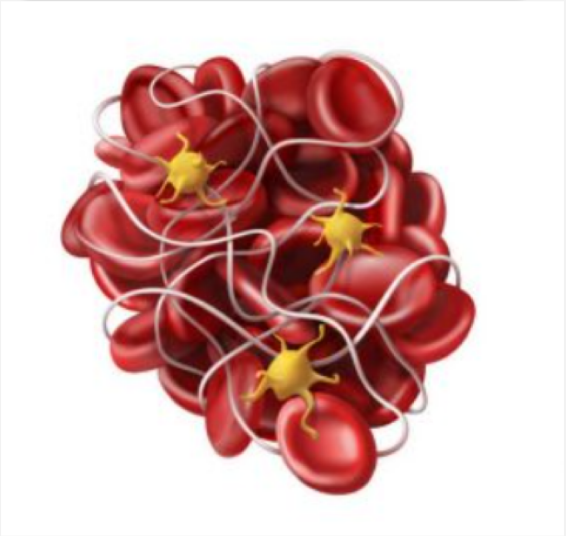
OPTIMUM MODEL RESULTS - FIRST TIER MODEL

4 Features for Predictors of Post-Surgical Risk

Perioperative Platelet Count

- Platelets are cells that helps the blood clot
- High preoperative platelet count:
  - > Increases the likelihood of thrombotic events
  - > Can be worsened by surgery

Perioperative Fibrinogen

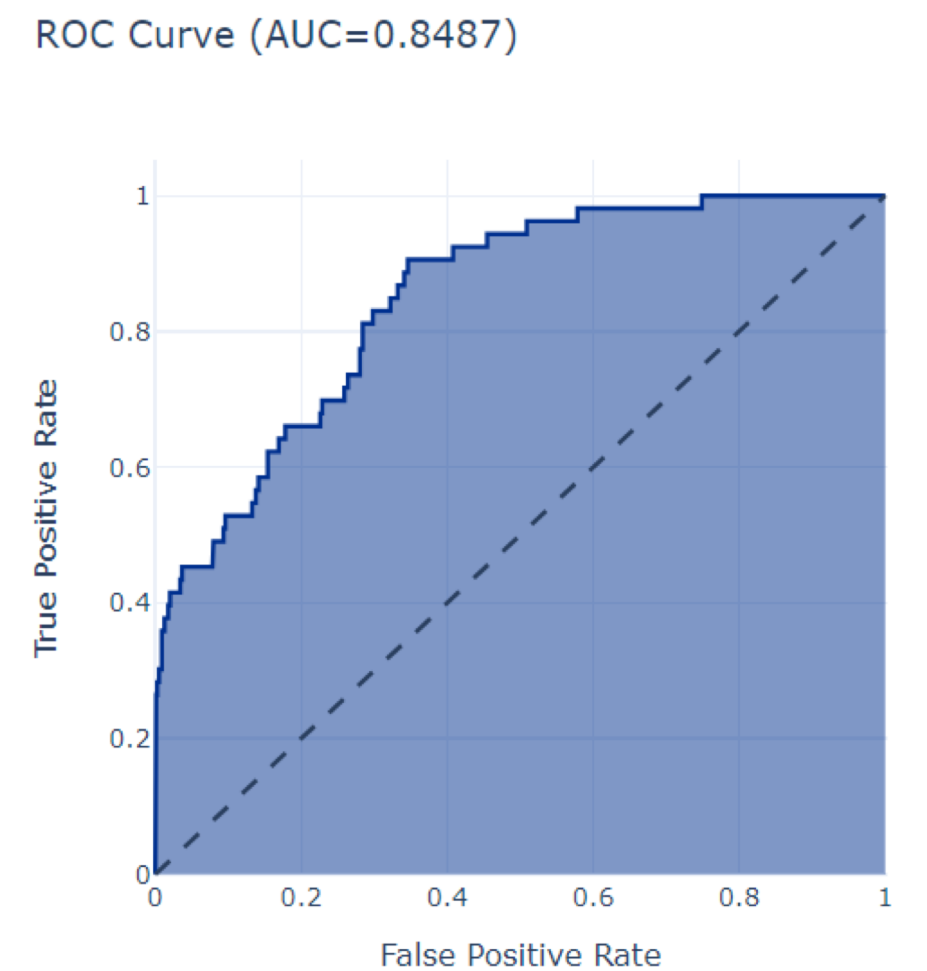


- Fibrinogen is a protein that helps to stop bleeding and support wound healing
- Low levels of fibrinogen:
  - > Leads to uncontrollable bleeding
  - > Increase the risk of AKI, indicating hepatic dysfunction

Reference:
1. Surgical Complications in Myeloproliferative Neoplasm Patient with Essential Thrombocythemia : https://pubmed.ncbi.nlm.nih.gov/36120702/
2. Predictive Utility of Fibrinogen in Acute Kidney Injury in Living Donor Liver Transplantation: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8177619/

OPTIMUM MODEL RESULTS - SEQUENTIALLY CONSTRUCTED USING TOP PREDICTORS

Second Tier Model



17 Features for Predictors of Post-Surgical Risk

- Any Transplantation
- Perioperative C-reactive Protein
- Perioperative Platelet Count
- Perioperative Fibrinogen
- Age
- Perioperative Sodium
- Perioperative Glucose
- Perioperative White Blood Cells
- Perioperative Haematocrit
- Perioperative Glomerular Filtration Rate
- Body Mass Index (BMI)
- Perioperative prothrombin percentage time
- Perioperative Alanine Transferase
- American Society of Anaesthesiologists Physical Status Classification Grade 2
- Perioperative Total Protein
- Perioperative Creatinine
- Perioperative Blood Urea Nitrogen

OHDSI APAC SYMPOSIUM/DATATHON 2024

To perform ML validation with 4 external datasets:

1. Singapore Perioperative Dataset, Singapore General Hospital, Singapore
2. INSPIRE, publicly available research dataset in preoperative medicine, Seoul National University Hospital, Seoul, South Korea
3. OHDSI Thailand's Electronic Health Records with Perioperative Data (in discussion with Max)
4. OHDSI Data partners

PLANS TO MOVE FORWARD

ML Development

- ML paper on development of Asian predictive model (A*STAR/NUS/NUH collaboration) at the SHADE'22 Datathon

ML Validation

- ML validation with external datasets at the OHDSI APAC Symposium 2024

ML Validation

- ML validation with MOH TRUST (Whole of Singapore EHR) in 2025


SHADE '22
SG HEALTHCARE DATATHON & EXPO
Lead the change in healthcare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OBSERVATIONAL HEALTH DATA SCIENCES AND INFORMATICS

Thank you!