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Background & Objectives

- Gastroenteritis is among the most frequently diagnosed conditions in emergency departments across the country
- Symptoms of gastroenteritis often begin mildly, with fever, diarrhea, abdominal pain, and vomiting. However, without prompt treatment, these symptoms can worsen, leading to more severe conditions that affect individuals of all ages
- In this study, we aim to predict 7-day 1) ER revisits, 2) ICU admissions, and 3) mortality, to assess the severity of gastroenteritis
- By identifying patients in high risk for disease prognosis, it enables quick triage and timely treatment, ultimately improving outcomes and reducing transmission

Methods

Data sources

- Ajou University School of Medicine (AUSOM) database
 - Electronic health records (1994.01 ~ 2024.02)
 - OMOP-CDM v5.3.4

Study population

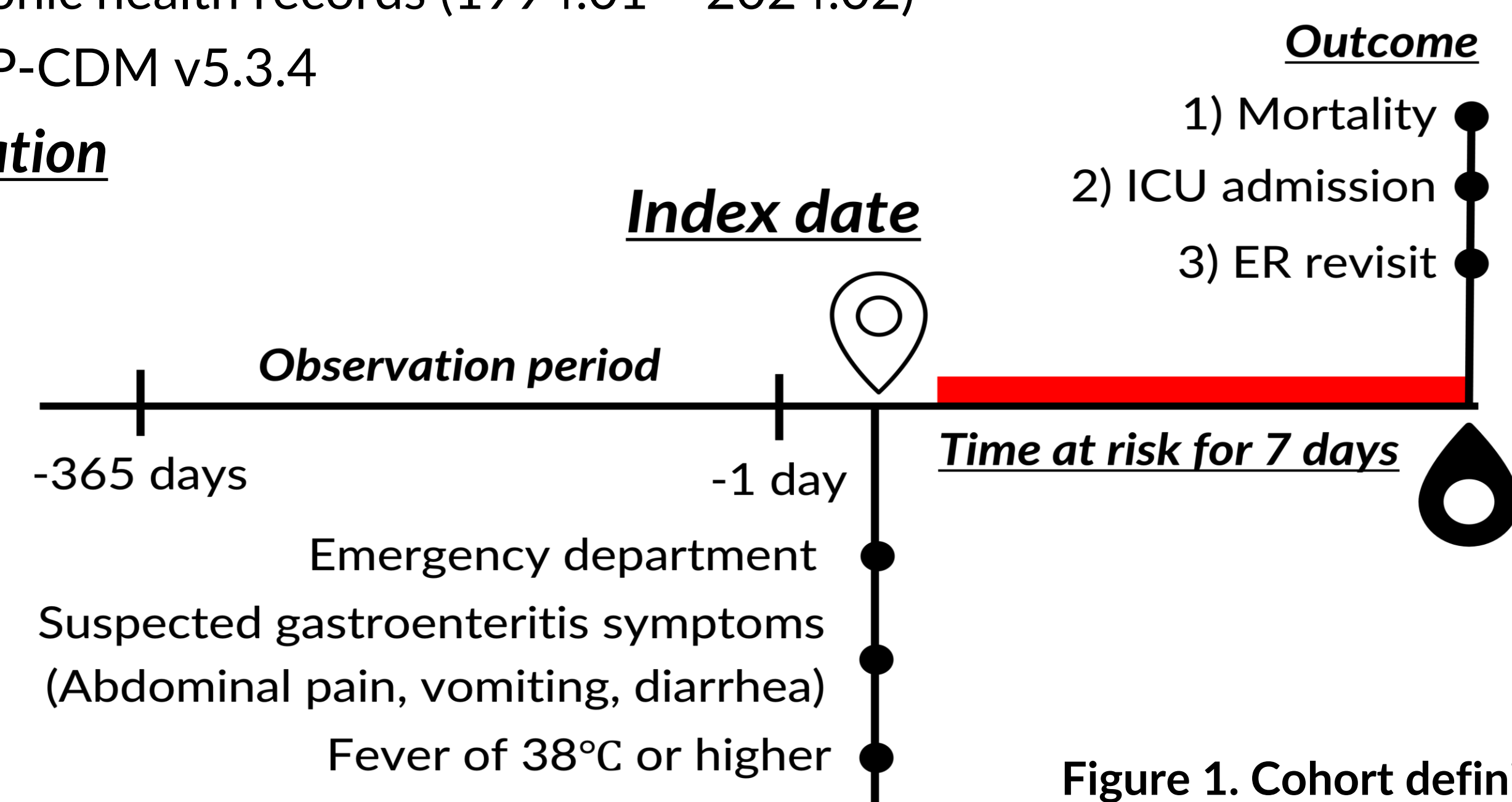


Figure 1. Cohort definition

Model development and evaluation

- Machine learning Algorithms:
 - Gradient boosting model (GBM) & Least absolute shrinkage and selection operator (LASSO)
- Covariates
 - Demographics, condition, drug, measurement and visit
 - Time frames : Long-term (-365 days) and Short term (-1 day) prior to the index date
 - The short-term period was chosen to capture recent conditions crucial for predicting the severity and treatment response of the patient
- Data split: Split into the train (75%) and test set (25%) in 3-fold cross validation
- Model performance
 - The area under the receiver operating curve (AUROC)
 - Youden index to determine threshold for high and low risk groups

Survival Analysis for ICU admission

- To assess the association between the risk of ICU admission and the incidence of 7-day mortality through the survival analyses
- Cox proportional model: for calculating the hazard ratio
- Kaplan-Meier method: for plotting the survival curve

Results

- GBM outperformed LASSO in AUROC for predicting ER revisits, ICU admissions, and mortality (0.758 vs. 0.679, 0.964 vs. 0.947, and 0.990 vs. 0.980, respectively)

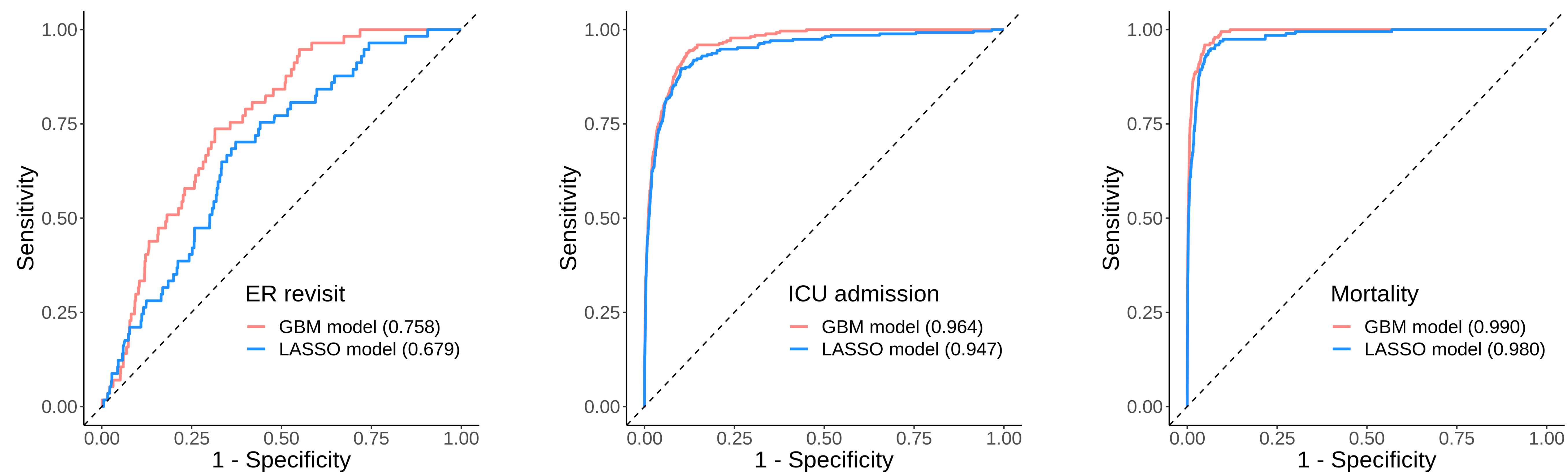


Figure 2. Model Performance for severity of gastroenteritis; (a) Prediction for ER revisit, (b) Prediction for ICU admission, (c) Prediction for mortality

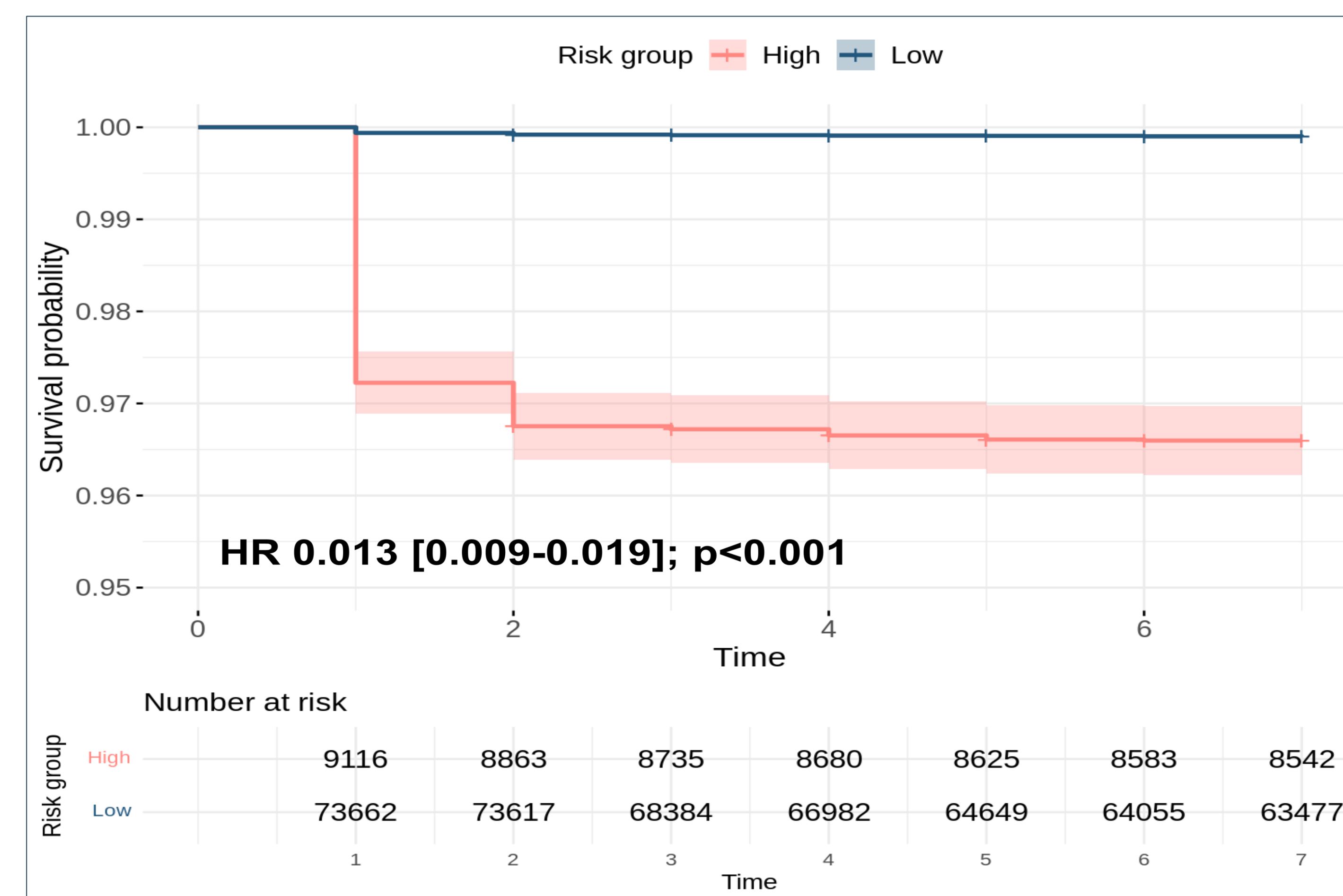


Figure 3. Kaplan-Meier survival analysis of Gradient boosting machine for ICU admission

- Based on the predicted results (Youden index: 0.005) by GBM prediction model in ICU admission, the low-risk group had a significantly lower hazard ratio for 7-day mortality (HR 0.013, 95% CI [0.009–0.019], $p < 0.001$)

Conclusions

- We developed CDM-based prediction models to assess the severity of gastroenteritis outcomes, including ER revisits, ICU admissions, and mortality
- These models demonstrated moderate accuracy in predicting severity and distinguishing high-risk patients, aiding in timely treatment and improving patient outcomes

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