

A Machine Learning Model to Predict Patient Opioid Consumption Following Surgical Discharge Using Comprehensive Perioperative Data

Key Takeaways:

- We have built among the first machine learning models to predict - and identify relevant features associated with - post-discharge opioid consumption.
- Leveraging opioid consumption data can significantly impact surgical opioid prescribing.
- Among opioid-exposed patients, for whom few guidelines exist, predictive modelling may enable safer personalized prescribing practices.

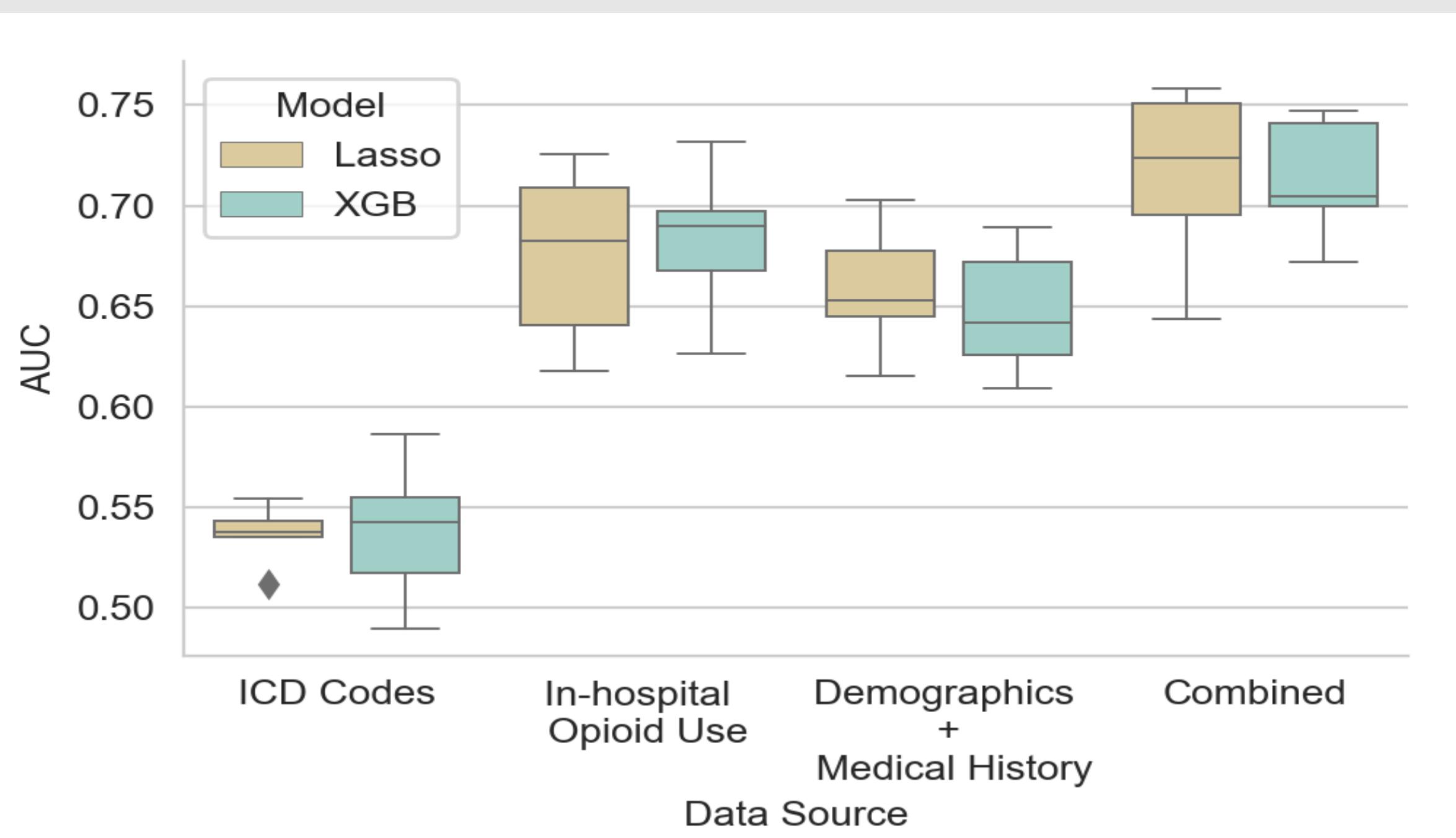


Figure 1: Diagnosis codes, medical history, in-hospital opioid use, and perioperative factors were used as predictors of opioid consumption. Performance was best when all of these data sources were leveraged (AUROC 0.74).

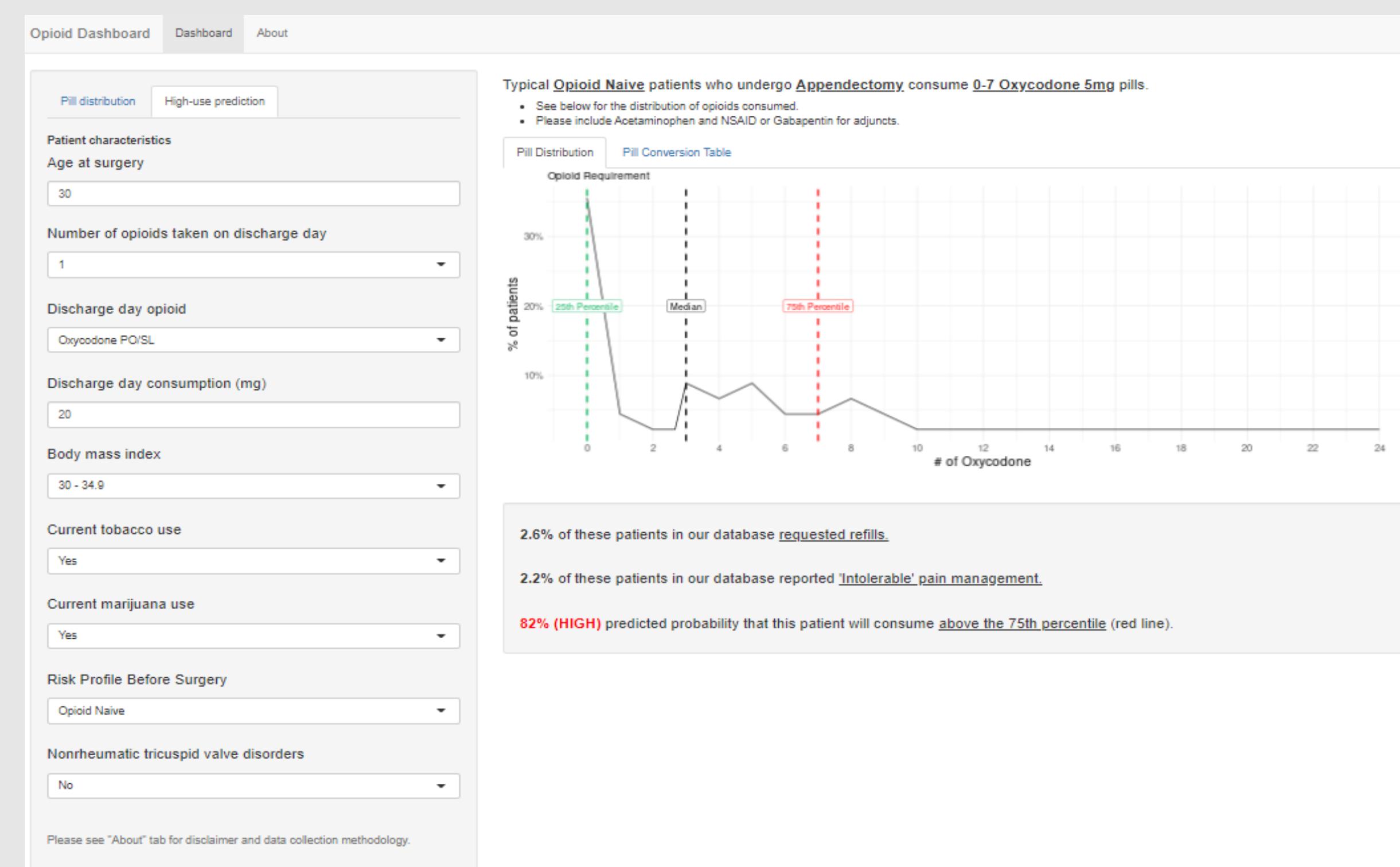


Figure 2: To demonstrate the potential clinical application of our predictive model, we used it to build a web application to help providers identify appropriate prescription sizes for their patients (surgery.bidmc.org/opioids).

Significance: Few evidence-based resources exist to guide personalized post-surgical prescribing, especially for opioid exposed patients. Furthermore, it is largely unclear how perioperative factors are associated with a patient's post-surgical opioid consumption.

Data Source/Population and Results:

- Retrospective cohort study of 1,867 opioid exposed and naïve patients discharged after surgery at 1 institution.
- Patients were called after discharge to collect opioid consumption data.
- Bootstrapped logistic regression analysis identified 6 perioperative predictors of post-discharge opioid consumption. In-hospital opioid consumption was the most important predictor.
- Lasso performed with 33.3% specificity and 89.8% sensitivity (AUC 0.74), and XGB performed with 31.5% specificity and 93.2% sensitivity (AUC 0.74) in predicting post-discharge opioid consumption outlier status.

Lessons Learned

- Comprehensive perioperative data, combined with machine learning techniques, is able to reliably predict a patient's likelihood of being an outlier opioid consumer after surgery.
- In-hospital opioid consumption data is an important heuristic for predicting post-discharge consumption. Accurate tracking of in-hospital opioid consumption may help providers reduce opioid prescription sizes for patients unlikely to benefit from larger prescriptions.

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