

# POTTER-ICU: An Artificial-Intelligence Interpretable Tool To Predict Need For ICU Admission After Emergency Surgery



Anthony Gebran, MD,<sup>1</sup> Annita Vapsi, BS, MBAn,<sup>2</sup> Lydia R. Maurer, MD, MPH,<sup>1</sup> Mohamad El Moheb, MD,<sup>1</sup> Leon Naar, MD,<sup>1</sup> Sumiran S. Thakur, BS, MBAn,<sup>2</sup> Dania Daye, MD, PhD,<sup>3</sup> George C. Velmahos, MD, PhD,<sup>1</sup> Dimitris Bertsimas, PhD,<sup>2</sup> Haytham M.A. Kaafarani, MD, MPH<sup>1</sup>

1. Department of Surgery, Division of Trauma Emergency Surgery Surgical Critical Care, Massachusetts General Hospital & Harvard Medical School, Boston, MA. 2. Massachusetts Institute of Technology, Cambridge, MA 3. Division of Interventional Radiology, Massachusetts General Hospital, Boston, MA

## INTRODUCTION

- Delays in identifying and admitting high-risk emergency surgery (ES) patients to the intensive care unit (ICU) result in higher mortality and increased healthcare costs.(1)
- Alternatively, unnecessary admissions to the ICU waste valuable resources.
- We sought to use machine learning methodologies to create artificial-intelligence (AI) based algorithms to preoperatively predict the need for post-operative ICU care in ES patients.

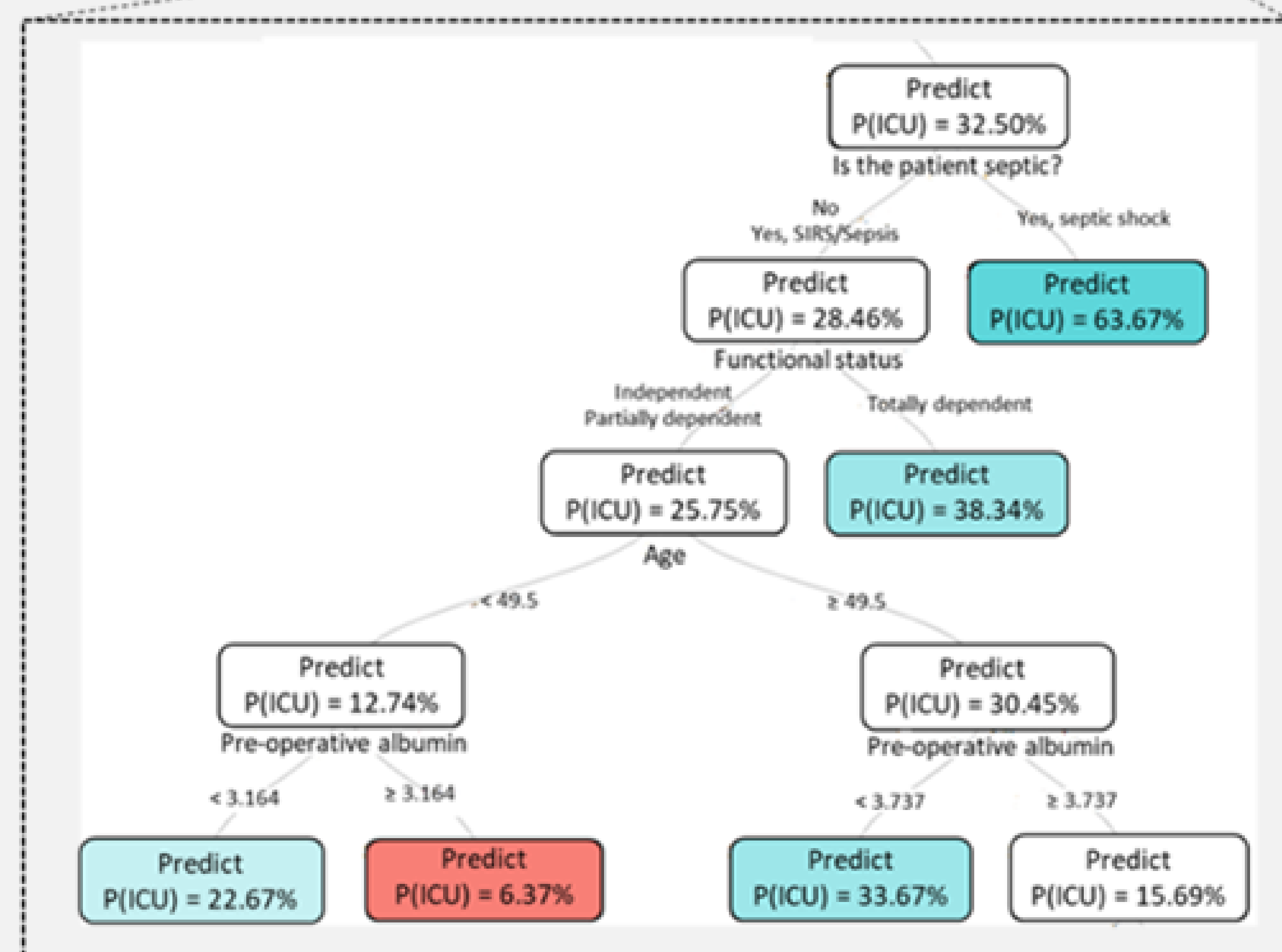
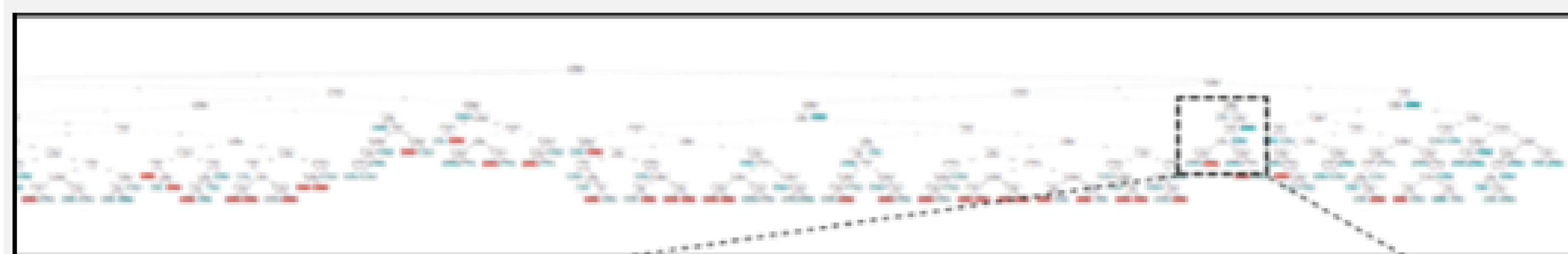


Figure 1. Optimal Classification Tree.

## PATIENTS & METHODS

- An interpretable AI technology called Optimal Classification Trees (OCTs) (2–4) was leveraged in an 80:20 train:test split of adult ES patients in the 2007-2017 ACS-NSQIP database.
- Demographics, comorbidities, and laboratory values were used to develop, train, and validate OCT algorithms to predict the need for post-operative ICU admission.
- The latter was defined as occurrence of any of the following:

- Post-operative death
- Unplanned intubation
- Ventilator requirement for more than 48h
- Cardiac arrest requiring cardiopulmonary resuscitation (CPR)
- Septic shock

- An interactive and user-friendly application was created.
- C-statistics were used to measure performance.

## RESULTS

- A total of 464,861 patients were included.
- Mean age 55 years; 48% male; 11% developed severe post-operative complications warranting critical care.
- Comprehensive OCT algorithms were derived [Figure 1], and the Predictive OpTimal Trees in Emergency Surgery Risk ICU (POTTER-ICU) application was created [Figure 2].
- The number of questions (i.e., tree depths) needed to predict ICU admission ranged from 2 to 11.
- POTTER-ICU had excellent discrimination for predicting the need for ICU admission (c-statistics: 0.89 train, 0.88 test).

## CONCLUSION

- We have thus developed POTTER-ICU as an accurate, AI-based tool for predicting severe complications warranting ICU admission after ES.
- POTTER-ICU can prove useful to appropriately triage ICU patients and to decrease failure to rescue in ES patients.

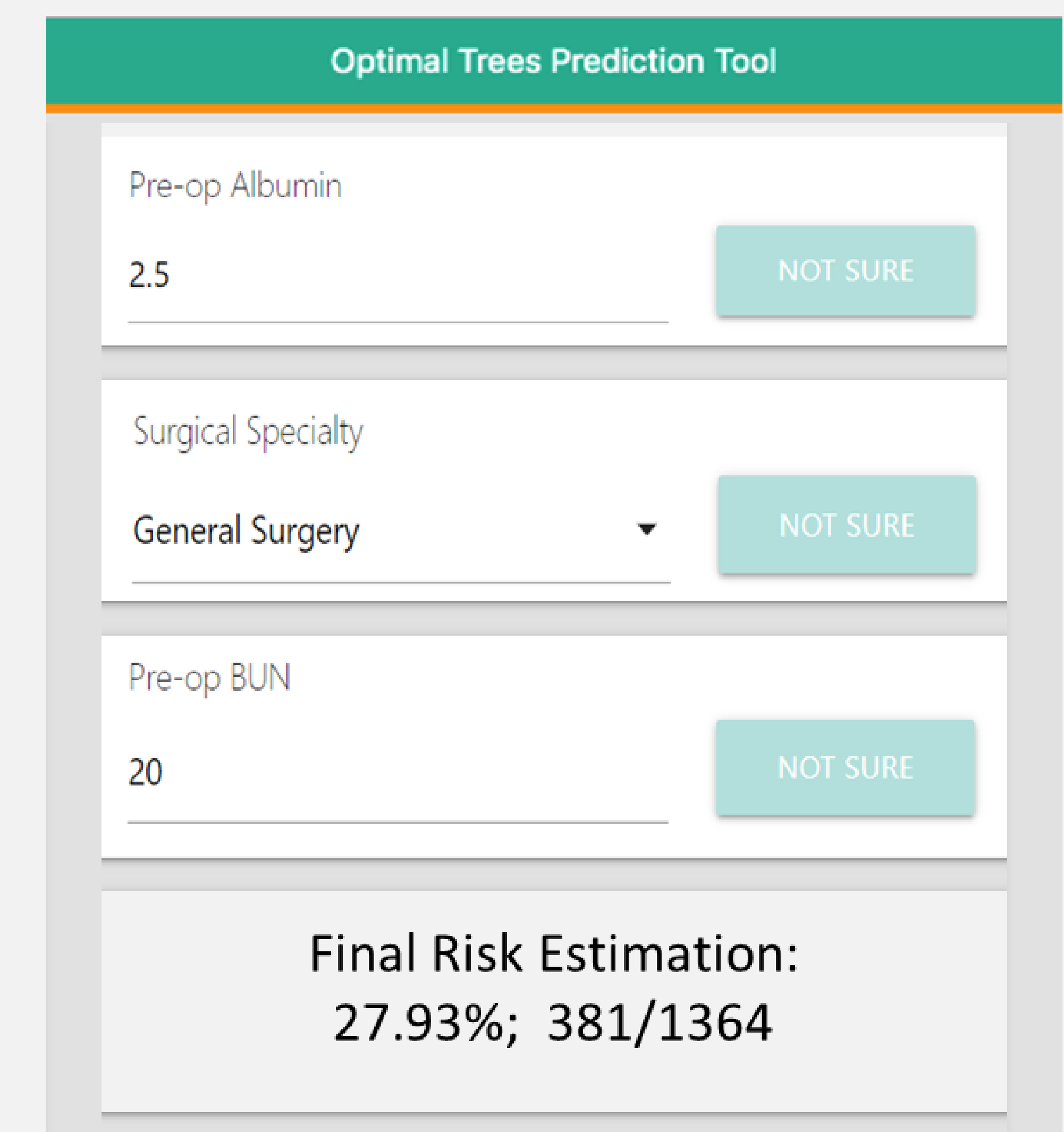


Figure 2. Example screen shot of Predictive OpTimal Trees in Emergency Surgery Risk Intensive Care Unit (POTTER ICU) smartphone application.

## REFERENCES

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