System For High Intensity Evaluation During Radiation Therapy (SHIELD-RT): A Prospective Randomized Study Of Machine Learning-Directed Clinical Evaluations During Outpatient Cancer Radiation And Chemoradiation

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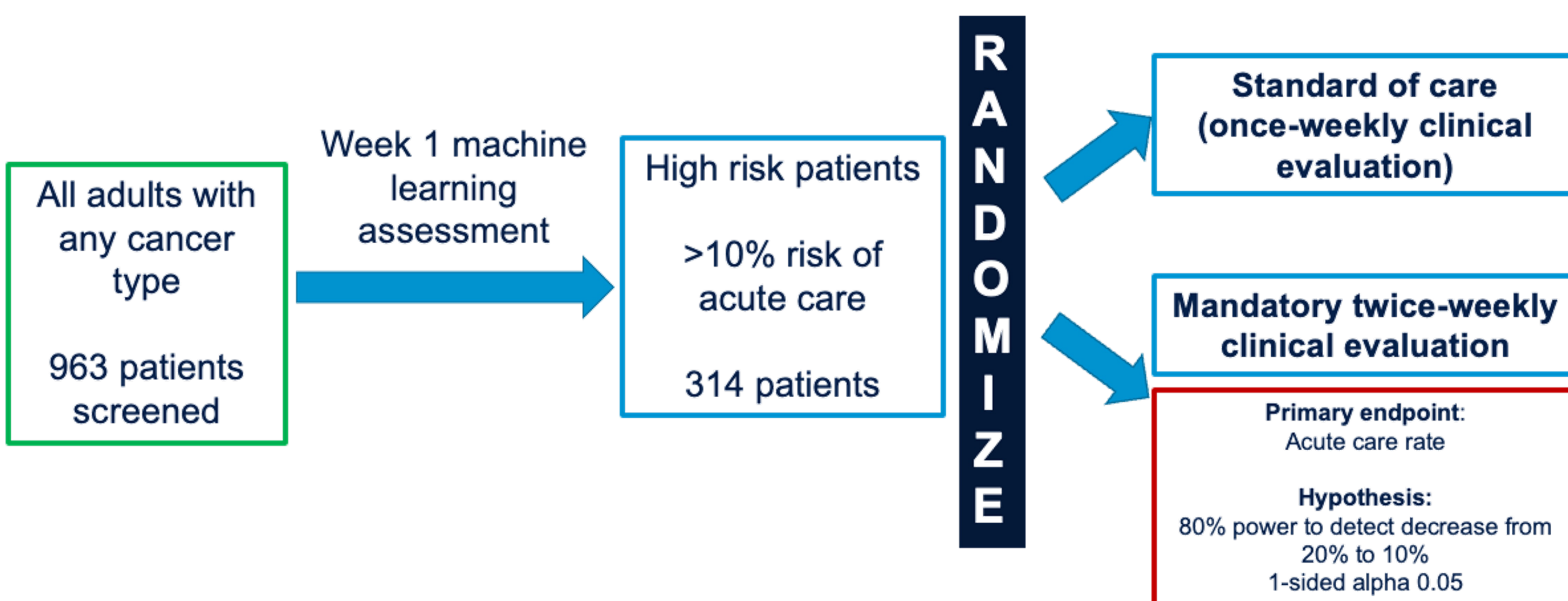
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Purpose/Objective

- Patients undergoing outpatient radiotherapy (RT) or chemoradiation (CRT) for cancer frequently require acute care (emergency department evaluation or hospitalization). This impacts outcomes, patient quality of life, and costs.

- There are limited randomized controlled trials (RCTs) investigating the clinical benefit of healthcare machine learning (ML) in healthcare.

- The objective of this randomized quality improvement study (NCT04277650) was to determine whether electronic health record (EHR)-based ML could identify high risk patients and direct mandatory twice-weekly clinical evaluation to reduce acute care during treatment.

Methods

- Gradient boosted tree model based on EHR and oncology information system data trained on 8,134 courses of RT from January 2013-December 2016.[1]

- 311 courses identified by ML as high risk (>10% risk of acute care) randomized to standard once-weekly or mandatory twice-weekly evaluation.

- Additional ad hoc evaluations per clinician allowed on both arms.

Results

Machine learning performance for non-interventional courses

Receiver operating characteristic curve

Calibration plot

Clinical outcomes

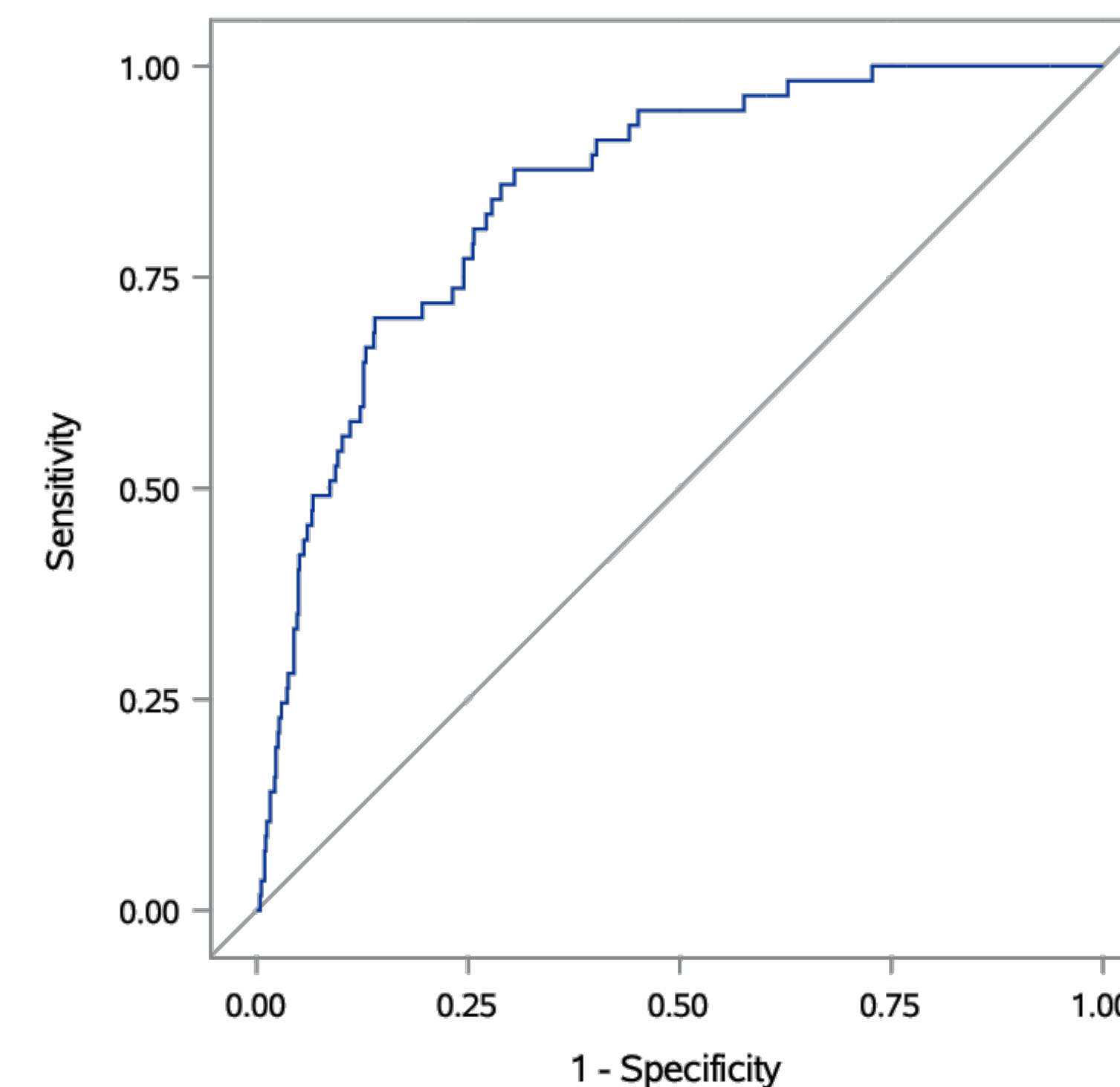**Acute care rates**
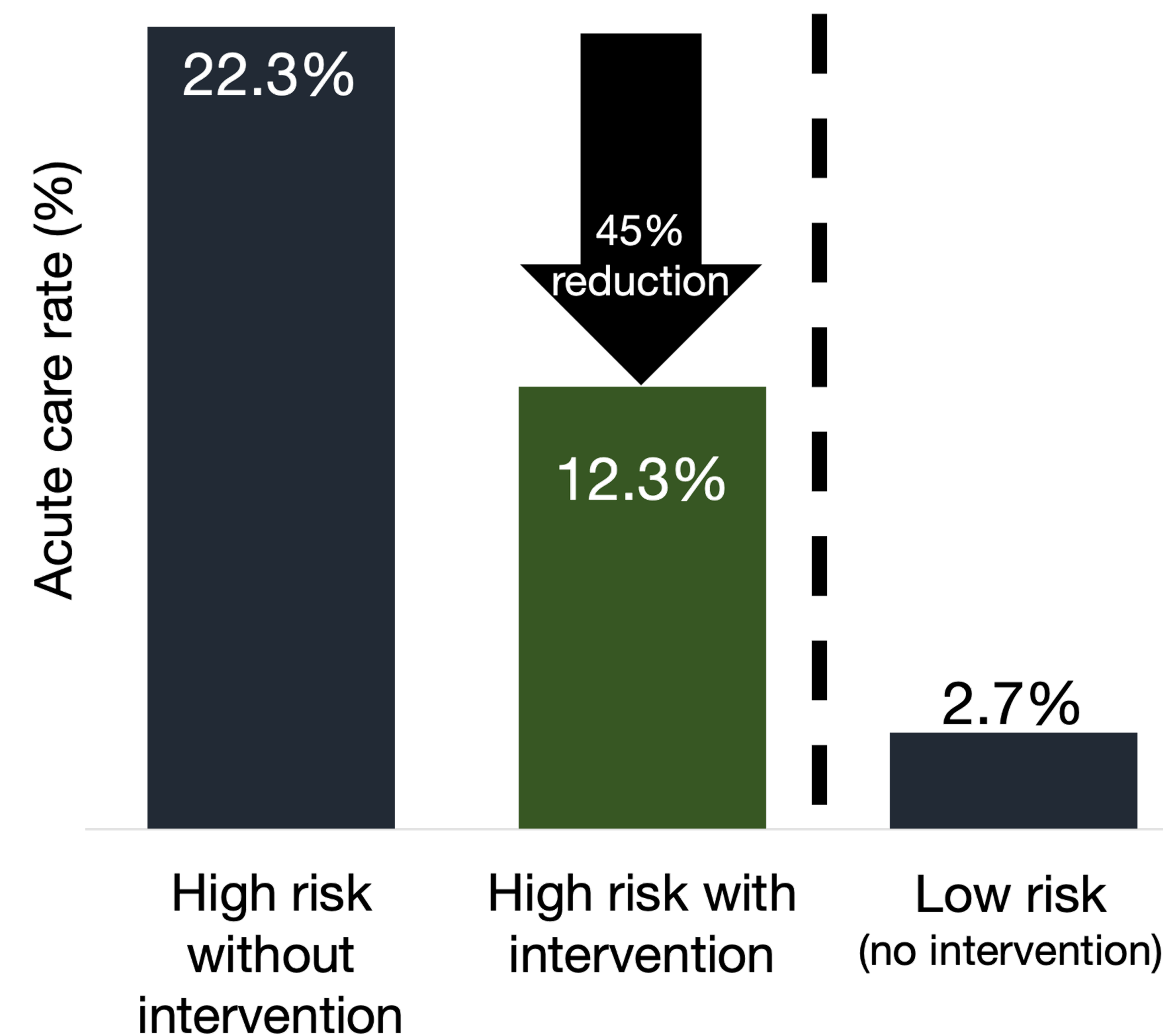
Cost savings

Conclusions

- In this randomized controlled study, ML accurately triaged patients undergoing RT and CRT, directing clinical management with reduced acute care rates and costs.
- Next steps
  - Generalizability across indication and institution
  - Wearables data on cooperative group trial NRGF-001 trial
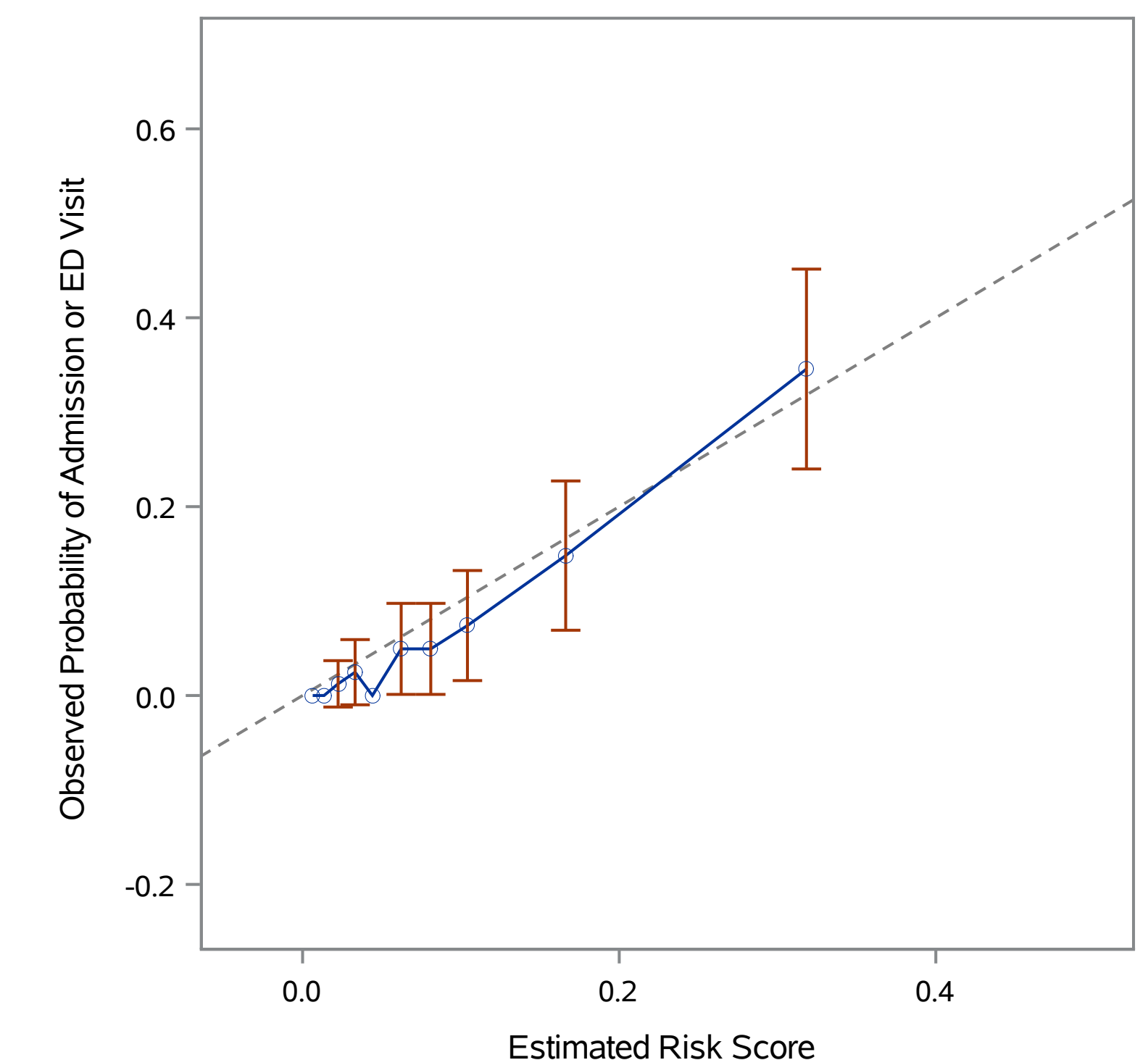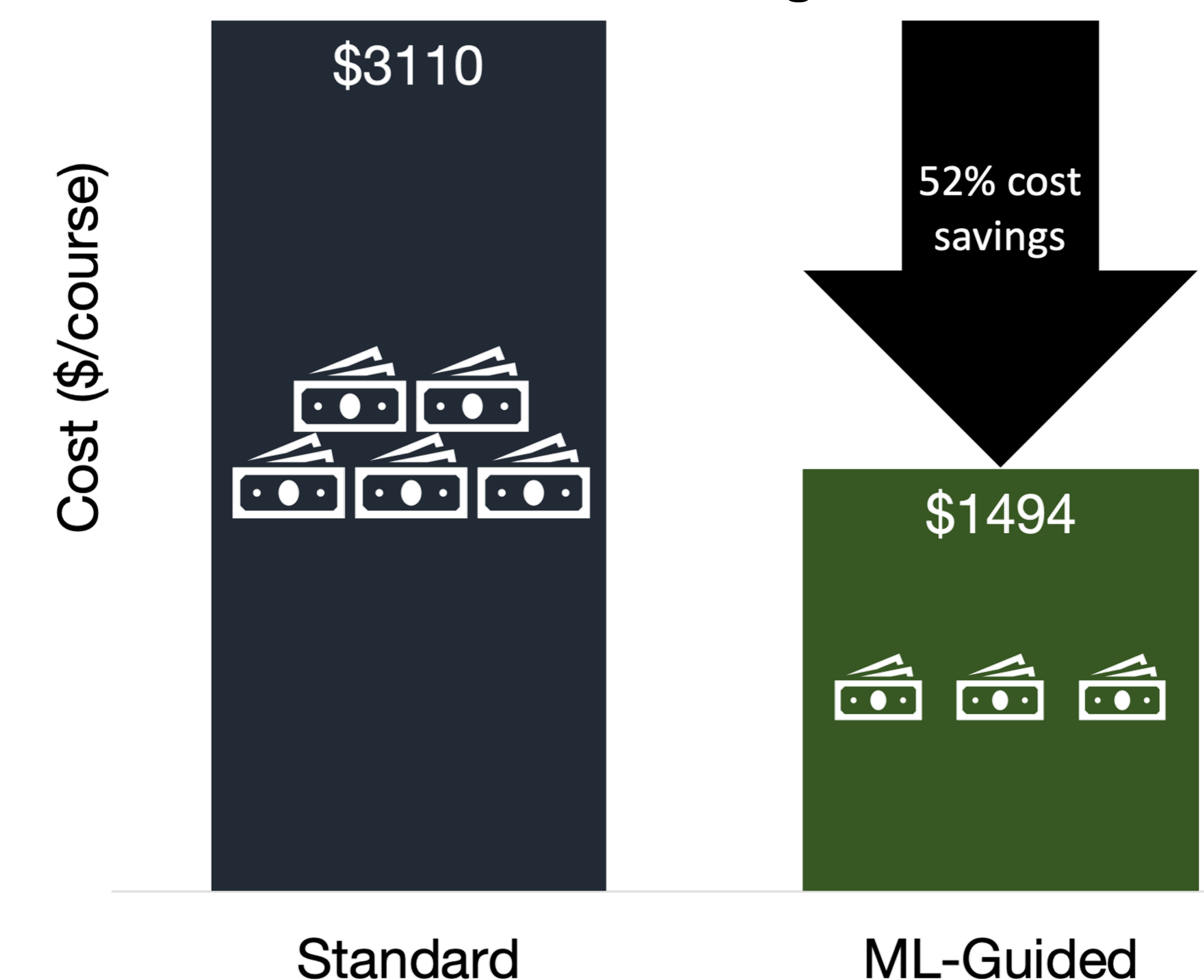 - Natural language processing integration

Acknowledgments

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References

1. Hong JC, Niedzwiecki D, Palta M, et al: Predicting emergency visits and hospital admissions during radiation and chemoradiation: An internally validated pretreatment machine learning algorithm. JCO Clin Cancer Inform 2018.

2. Hong JC, Eclov NCW, Dalal NH, et al: System for High System for High-Intensity Evaluation During Radiation Therapy (SHIELD-RT): A Prospective Randomized Study of Machine Learning–Directed Clinical Evaluations During Radiation and Chemoradiation. J Clin Oncol 2020.