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Introduction

Capacity limitations prevent all patients from receiving palliative care (PC) shortly after diagnosis. We evaluated whether a prognostic machine learning (ML) system could promote early PC given existing capacity.

Methods

Using population-level administrative data in Ontario, Canada, we assembled a cohort of patients with incurable cancer who received palliative-intent systemic therapy.

	Development Cohort	Testing Cohort
Timeframe	2014/07/01–2017/06/30	2017/07/01 – 2019/12/30
Sessions	454,011	223,024
Patients	31,448	23,187

We developed a ML system that predicted death within one year of each treatment using

- demographics
- cancer characteristics
- treatments
- symptoms
- laboratory values
- history of acute care admissions

Reference

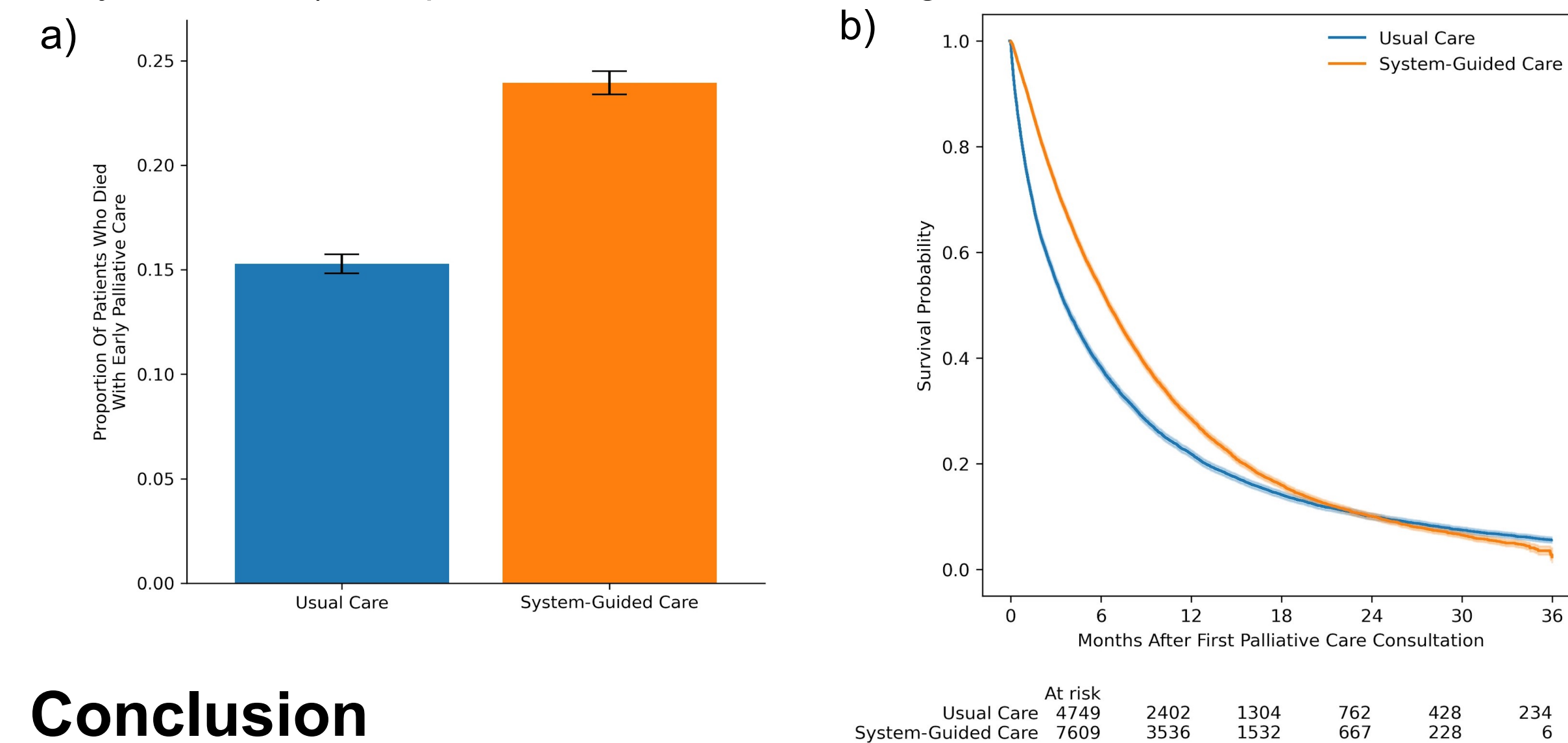
¹Hui D, Mori M, Watanabe SM, et al: Referral criteria for outpatient specialty palliative cancer care: an international consensus. *Lancet Oncol* 17:e552–e559, 2016.

Results

When system recommended the same number of PC consultations as observed in usual care:

System Evaluation	Metric	Utility Evaluation	Metric
Warning Rate	9.9%	Increase in Early PC (6 months before death ¹)	8.6%
Positive Predictive Value	69.8%	Increase in Early PC among patients who live 6 months beyond their first treatment	15.5%
Outcome-level Sensitivity	74.3%	Increase in PC for patients whose prognosis exceeds 2 years ¹	<0.1%

Figure 2. Usual care vs system-guided care. a) The proportion of patients who received early PC, and b) a Kaplan-Meier curve comparing survival after the first PC consultation.



Conclusion

ML systems could optimize early PC despite capacity constraints and should be prospectively deployed and evaluated in clinical care.

Figure 1. System performance. a) Receiver operating characteristic curve. b) Precision-recall curve.

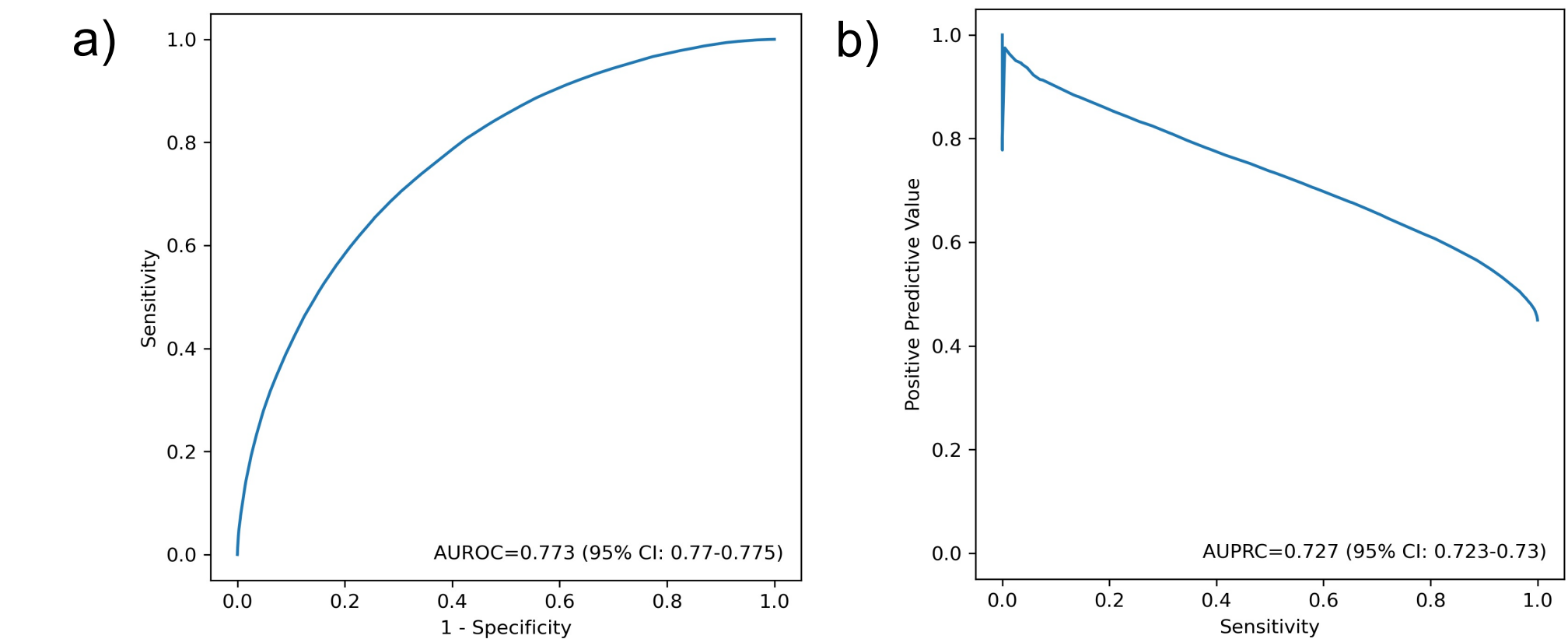


Figure 3. Bias evaluation comparing 1) urban vs rural subgroups b) recent immigrant vs long-term resident subgroups.

