Comparative Validation of CCI, ASA, and LACE Indices for Predicting Postoperative Outcomes in Lumbar Interbody Fusion

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Introduction

- Comorbidity indices are widely used for surgical risk stratification and preoperative planning.
- The Charlson Comorbidity Index (CCI) predicts long-term mortality.
- The American Society of Anesthesiologists (ASA) classification predicts perioperative morbidity and mortality.
- The LACE index predicts 30-day readmission and mortality risk.
- Objective: To determine which of these indices, whether alone or combined, provides the greatest predictive value for postoperative outcomes in lumbar interbody fusion beyond their original validation scopes.

Materials and Methods

- **Design:** Retrospective cohort (2015–2023).
- **Population:** 2200 adults (18–89) undergoing 360°, ALIF, TLIF, or DLIF at a single institution.
- **Analysis:** Univariate logistic regression.
- **Inpatient outcomes:** High opioid use (>50 MME/day), any complication, early ambulation (POD0), discharge disposition.
- **Post-discharge outcomes:** 30-day readmission, ED visit, EQ-5D MCID at 1 year, ODI MCID at 1 year.
- **Performance metrics:** Odds ratio, p-value, and AUC.

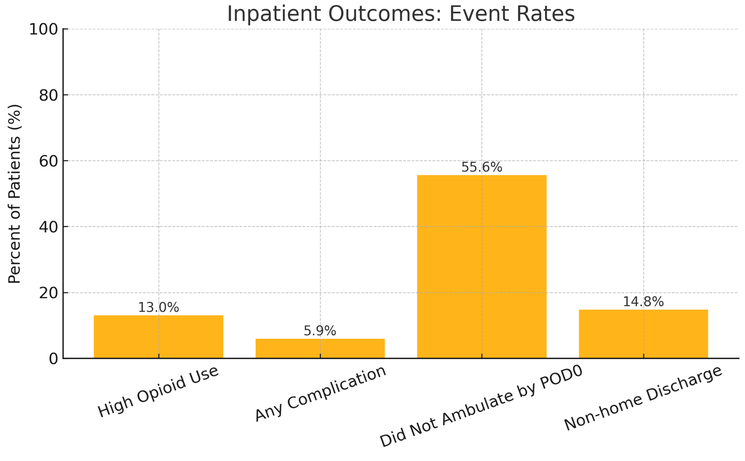
Results

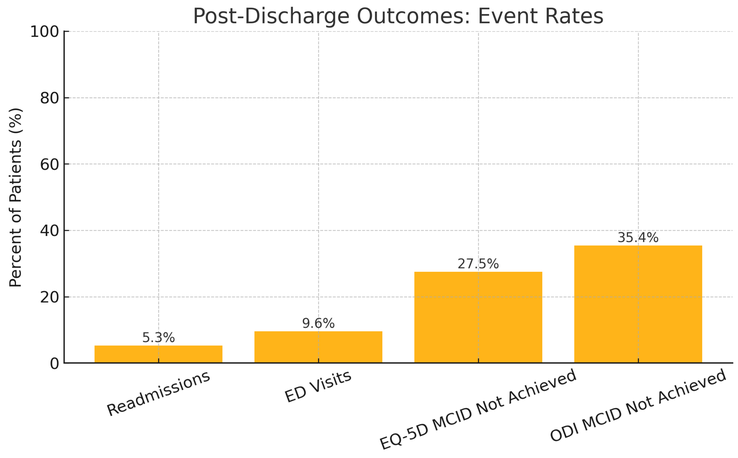
Inpatient Outcomes

- CCI was significantly associated with high opioid use (OR = 0.61, p < 0.001; AUC = 0.676) and non-home discharge (OR = 0.64, p < 0.001; AUC = 0.306).
- ASA correlated with postoperative complications (OR = 2.04, p < 0.001; AUC = 0.589) but demonstrated limited discrimination for other inpatient endpoints, including opioid use (AUC = 0.518) and ambulation (AUC = 0.498).
- Neither index showed meaningful discrimination for early ambulation (CCI = 0.496; ASA = 0.498).

Post-Discharge Outcomes

- LACE demonstrated the strongest discrimination for 30-day readmissions (AUC = 0.623, p < 0.001) and ED visits (AUC = 0.589, p < 0.001).
- ASA modestly predicted 30-day readmission (AUC = 0.570, p = 0.001).
- CCI and ASA provided limited discrimination for functional recovery (EQ-5D MCID AUC = 0.542–0.513; ODI MCID AUC = 0.582–0.510).
- No single index demonstrated consistent superiority across all outcomes.



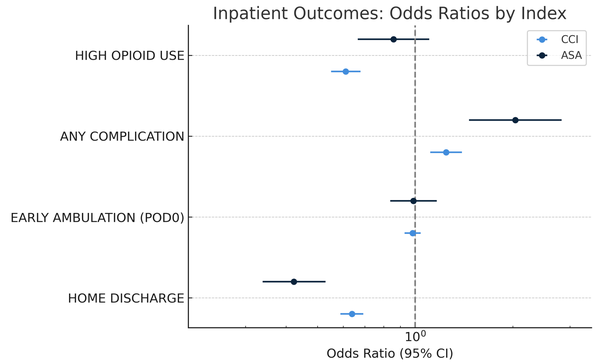


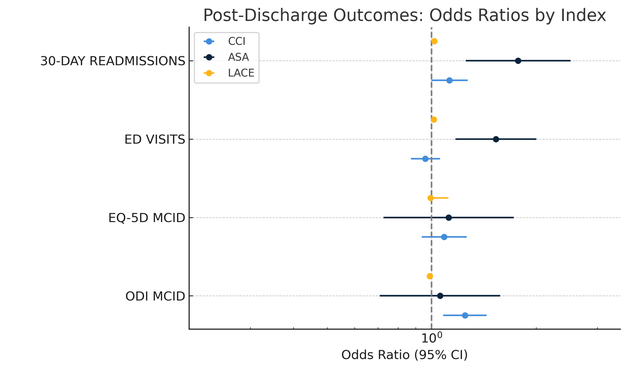
Comparative Predictive Performance of CCI and ASA Across Inpatient Surgical Outcomes

Outcome	Index	Effect Size (OR)	p-value	AUC
High Opioid Use Any Day	CCI	0.611	<0.001	0.676
	ASA	0.858	0.236	0.518
Any Complication	CCI	1.246	<0.001	0.590
	ASA	2.038	<0.001	0.589
Failed Early Ambulation	CCI	0.983	0.565	0.496
	ASA	0.989	0.894	0.498
Non-Home Discharge	CCI	0.639	<0.001	0.306
	ASA	0.423	<0.001	0.392

Comparative Predictive Performance of CCI, ASA, and LACE Across Post-Discharge Surgical Outcomes

Outcome	Index	Effect Size (OR)	p-value	AUC
30-Day Readmission	CCI	1.126	0.056	0.546
	ASA	1.775	0.001	0.570
	LACE	1.018	<0.001	0.623
ED Visits	CCI	0.959	0.399	0.522
	ASA	1.532	0.002	0.547
	LACE	1.014	<0.001	0.589
Failed EQ-5D MCID	CCI	1.087	0.272	0.458
	ASA	1.119	0.612	0.487
	LACE	0.992	0.173	0.441
Failed ODI MCID	CCI	1.247	0.003	0.458
	ASA	1.057	0.787	0.490
	LACE	0.987	0.024	0.400





Discussion

- ASA best predicted short-term complications (AUC = 0.589).
- LACE demonstrated strongest discrimination for 30-day readmissions (AUC = 0.623) and ED visits (AUC = 0.589).
- CCI correlated with high opioid use (AUC = 0.676), and also non-home discharge but with very poor discrimination (AUC = 0.306).
- All indices demonstrated limited discrimination for long-term functional recovery (EQ-5D and ODI).
- Each index displayed domain-specific strengths rather than universal predictive power.
- Findings support ASA for perioperative risk and LACE for post-discharge outcomes.

Future Directions

- Apply multivariate regression to combine CCI, ASA, and LACE with key demographic and clinical covariates.
- Evaluate whether integrated models enhance predictive capabilities.

Acknowledgements

This work was supported in part by the following sources from Frank H. Netter School of Medicine and Saint Francis Hospital:
Connecticut Joint Replacement Institute (CJRI)
Dr. Richard Feinn, PhD

References