

Introduction and Objectives

Disease Burden
Esophageal cancer remains a major global health burden, with more than 600,000 new cases annually and high associated mortality rates. Surgical resection remains the cornerstone of curative therapy, and minimally invasive esophagectomy (MIE) has emerged as the preferred approach due to reduced morbidity, shorter hospital stays, and improved recovery compared to open esophagectomy

Current Literature
Early studies suggest that RAMIE may reduce conversion rates, improve lymph node harvest, and facilitate complex dissections. However, the adoption of robotic platforms has raised concerns regarding cost and resource utilization.

Knowledge Gap
While clinical outcomes of RAMIE have been increasingly studied, its economic impact remains unclear.

Difficulty of studying cost
Understanding and comparing surgical costs within the U.S. healthcare system is inherently complex due to the multifactorial nature of cost calculation and reporting. Standardized cost comparisons remain challenging and may lead to misleading conclusions if patient complexity factors are not considered. Despite variances in cost reporting and comparison, the utilization of robotic platforms for esophageal cancer surgery poses a unknown value proposition and resource allocation in esophageal cancer care.

Study Objective
This study aims to address this gap by comparing direct and total hospitalization costs of RAMIE versus MIE at a single academic institution, using standardized risk-adjusted metrics derived from the Vizient Clinical Database.

Methods

Study Design
A retrospective review was conducted of a prospectively maintained surgical database and Vizient Clinical Database at a large academic medical center between January 2021 and June 2024. All adult patients undergoing RAMIE or MIE for esophageal cancer were included. Patients undergoing hybrid or open procedures were excluded. Intention to treat analysis was performed. Statistical significance was set at p>0.05.

Variable definitions:
Average Direct Cost: Costs directly attributable to patient care (e.g., OR time, supplies, medications). time of surgery through hospital discharge

Average Total Cost: Direct cost, plus allocated overhead, administrative expenses, and facility costs.

MS-DRG: Medicare severity diagnosis related group. Classification system with a numerical relative weight. A weight of 1.0 represents the average resource consumption for all patients. Complex>simple

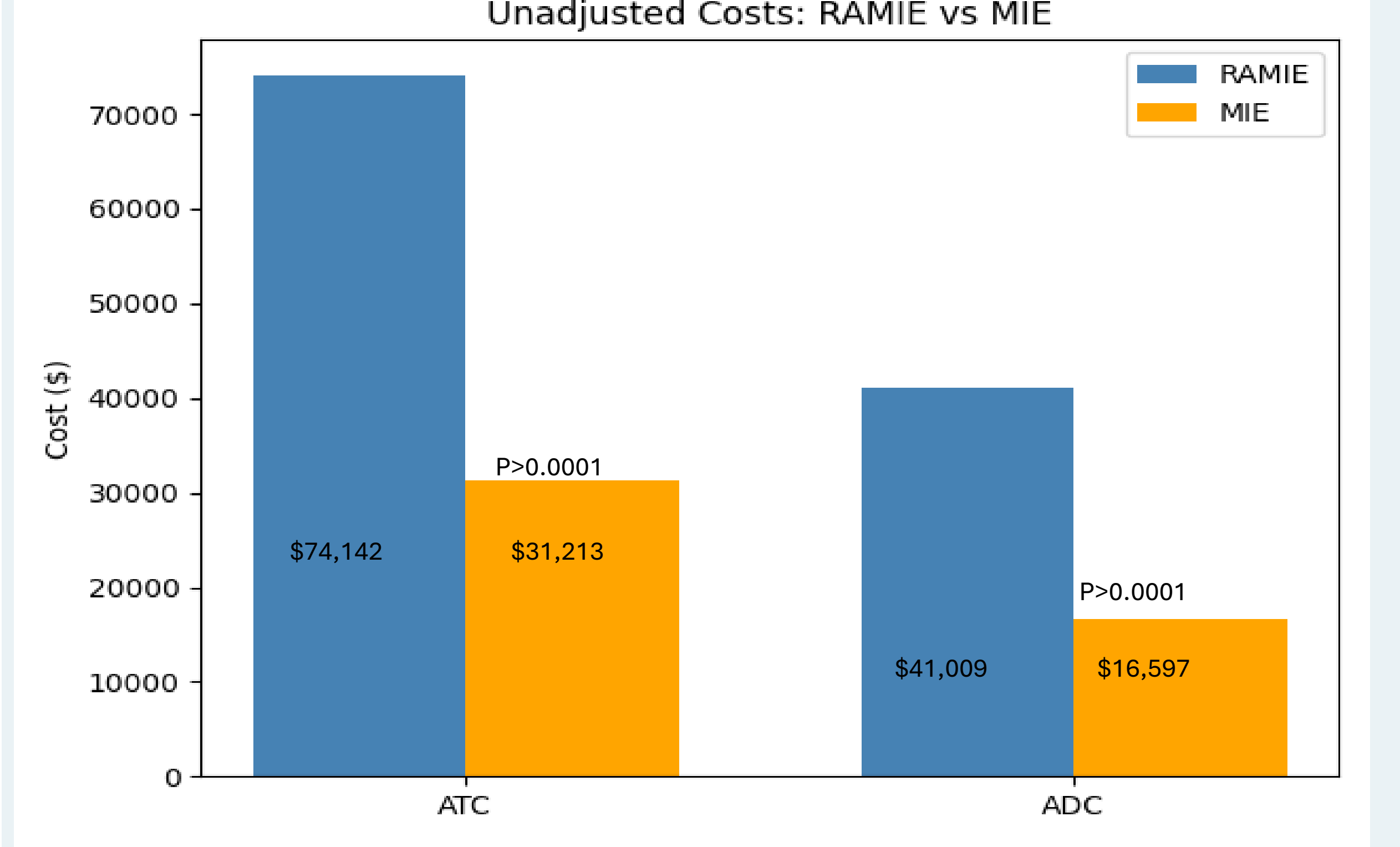
Case Mix Index (CMI): The average relative weight of all patients treated at a hospital over a specific period = MS-DRG/discharges

Risk Adjustment: Risk-adjusted costs were derived by normalizing both ADC and ATC to the Case Mix Index (CMI)

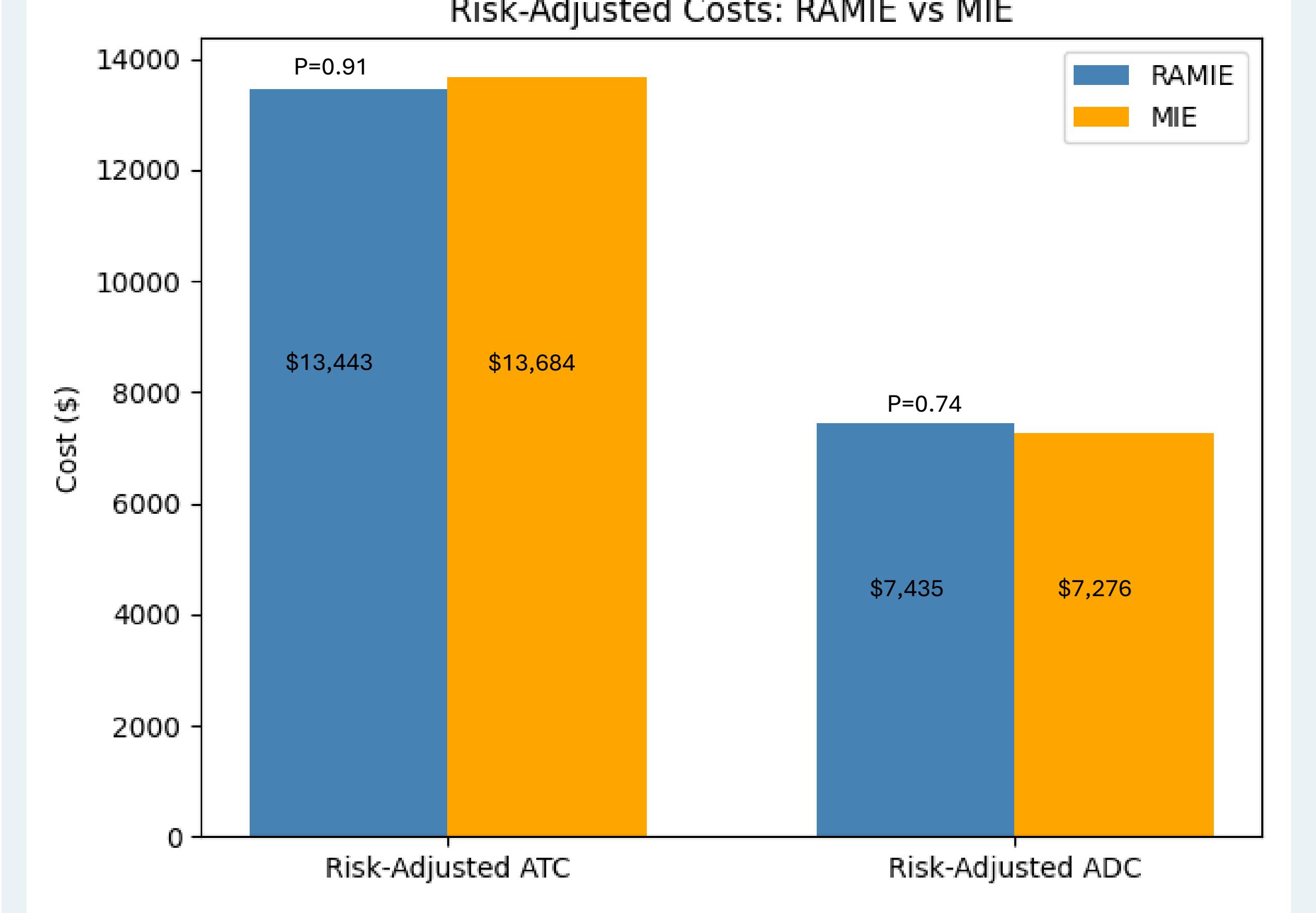
Length-of-stay (LOS) index: Ratio of the observed to expected total number of inpatient days from surgery to discharge. Expected LOS generated through the Vizient model. Predicts hospitalization duration based on patient demographics, comorbidities, case complexity, and national benchmarks.

Direct cost index: ratio of observed average direct cost to this expected value. Expected values generated through Vizient Model. An index less than 1.0 indicated that a case used fewer resources than predicted

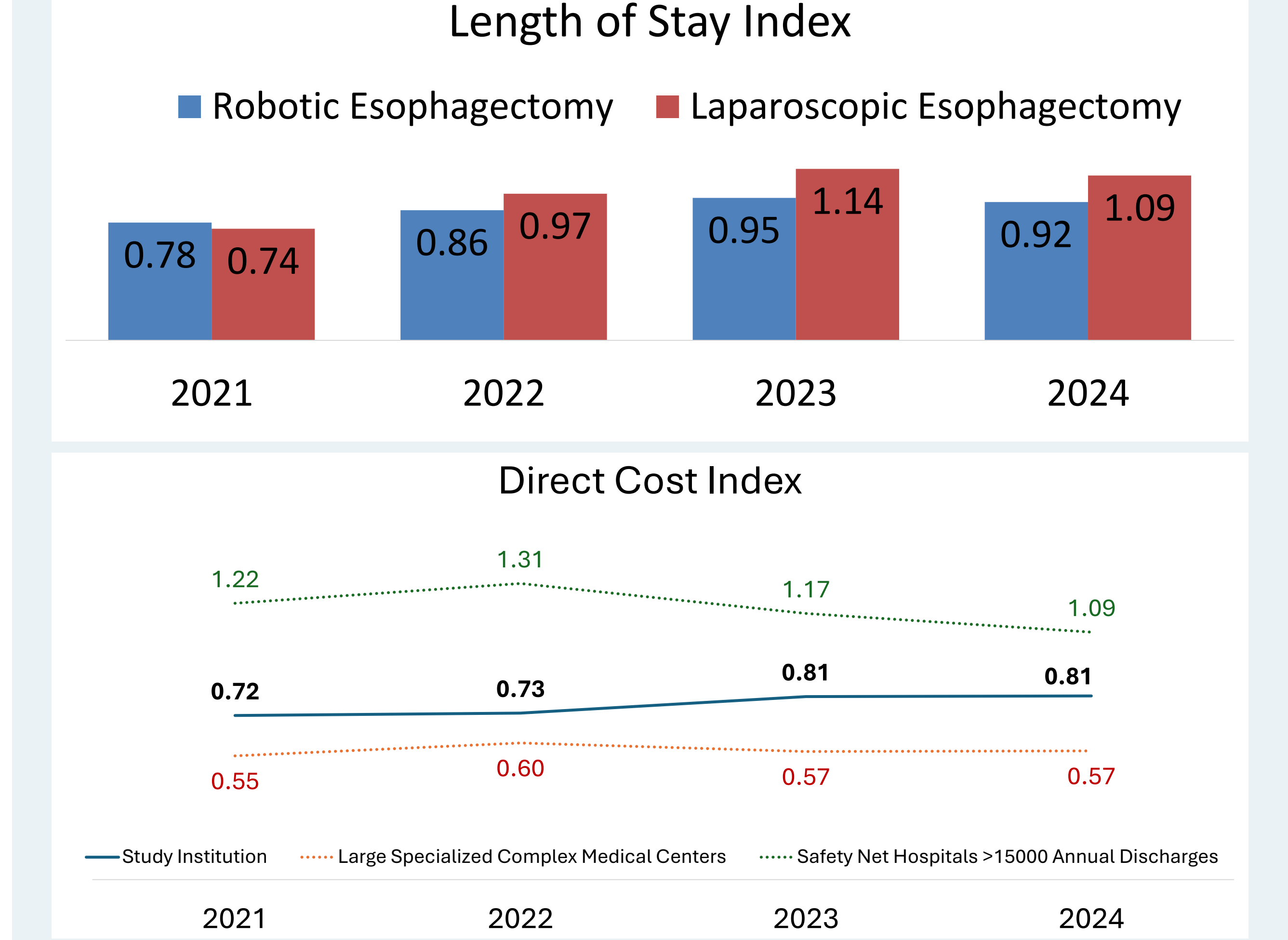
Results



	RAMIE	MIE	p-value
Case Mix Index (CMI)	5.5	2.28	<0.0001
MS-DRG Score	5.00	2.28	<0.0001



Results



Conclusions

This study demonstrates that while RAMIE is associated with significantly higher raw direct and total costs compared to MIE, these differences are neutralized when adjusting for patient complexity.

The higher CMI and MS-DRG scores in the RAMIE group suggest that robotic surgery is preferentially used in more complex patients, which may justify the increased resource utilization.

The Direct Cost Index below 1 in both groups indicates cost efficiency relative to expected benchmarks, suggesting that both RAMIE and MIE are delivered at lower-than-expected costs compared to peer institutions.

Future research should incorporate multicenter data, long-term oncologic outcomes, and patient-reported quality-of-life measures to provide a more comprehensive assessment of cost efficiency