

COMPARISON OF LAPAROSCOPIC VS. ROBOTIC CHOLECYSTECTOMY: COST-UTILITY AND SAFETY OUTCOMES

Natalia R. Torres-Acevedo; Corrado P. Marini; Anna Liveris; Srinivas H. Reddy; John McNelis; Department of Surgery, NYCHHC + Hospitals / Jacobi

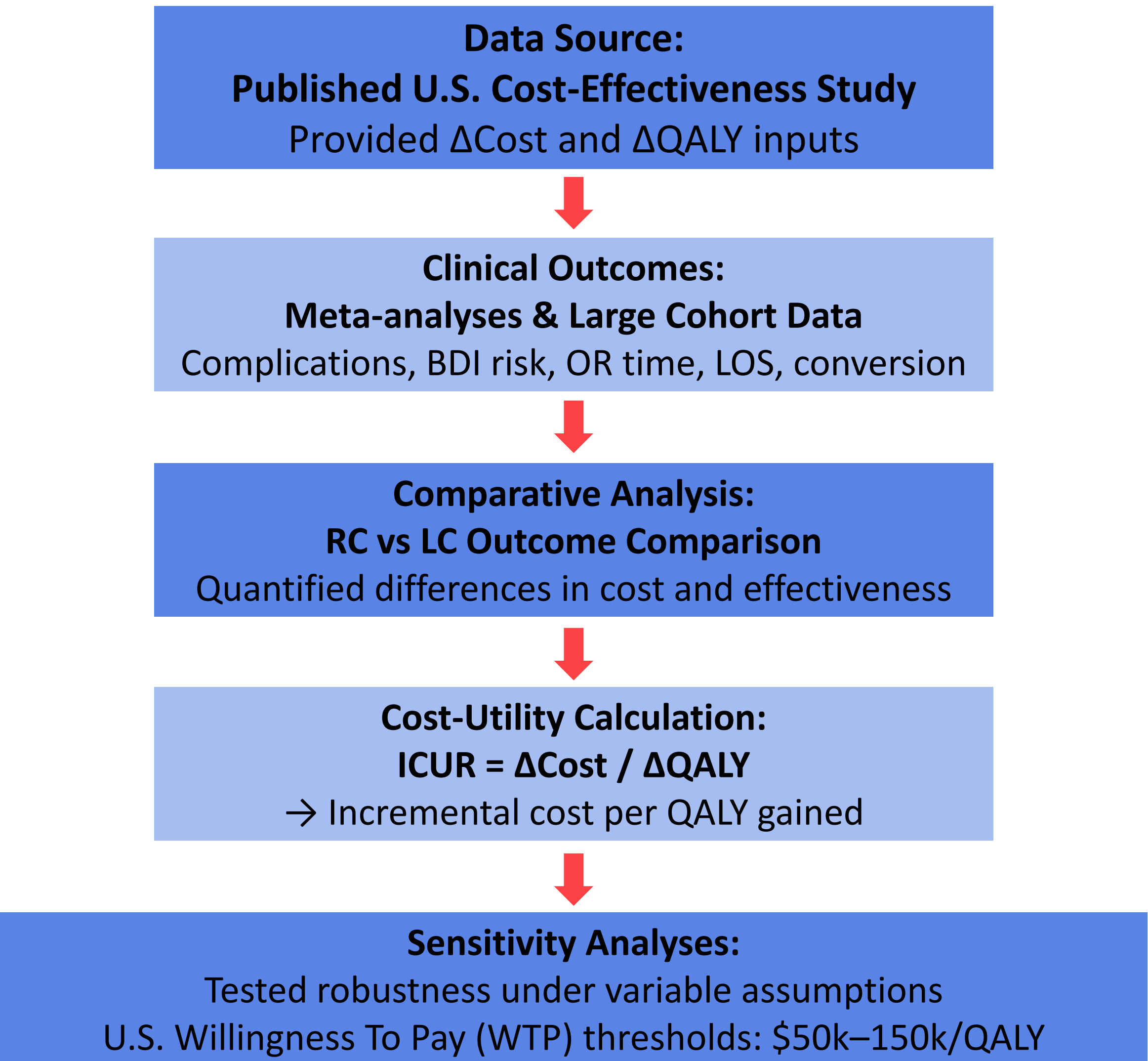
Introduction

- Laparoscopic cholecystectomy (LC) has been the gold standard for the past 30 years
- Robotic cholecystectomy (RC) use is increasing in the U.S.
- Proposed advantages:
 - 3D visualization
 - Wristed instruments
 - Ergonomics
- Concerns:
 - Higher cost
 - Unclear outcome benefit
 - Potential increased bile duct injury (BDI) risk

Objectives

- Compare RC vs LC for benign gallbladder disease from the standpoint of incremental cost utilization ratio (ICUR) and safety
- The variables of interest included:
 - Operative time
 - Conversion to open
 - Bile duct injury (BDI)
 - Length of stay (LOS)
 - Complications in the form of bleeding, infections, and return to the OR
 - Cost-utility (ICUR, ΔCost / ΔQALY)
- Determine if RC adoption is justified

Methods



Incremental Cost Utility Ratio (ICUR)

- Key metric in **health economics** used to evaluate **cost-effectiveness** between two interventions: **RC** vs. **LC**.

$$\text{ICUR} = \frac{\text{Cost}_{RC} - \text{Cost}_{LC}}{\text{QALY}_{RC} - \text{QALY}_{LC}}$$

- Cost = total healthcare cost per patient (equipment, disposables, hospitalization, etc.)
- QALY = *Quality-Adjusted Life Year*, a measure of both quantity and quality of life gained.
- Lower ICUR → more cost-effective
- Higher ICUR → less cost-effective
- Comparison is made against a *willingness-to-pay (WTP) threshold*, commonly:
 - ✓ \$ 50,000–\$150,000 per QALY in the U.S
 - ✓ € 50,000 in Europe

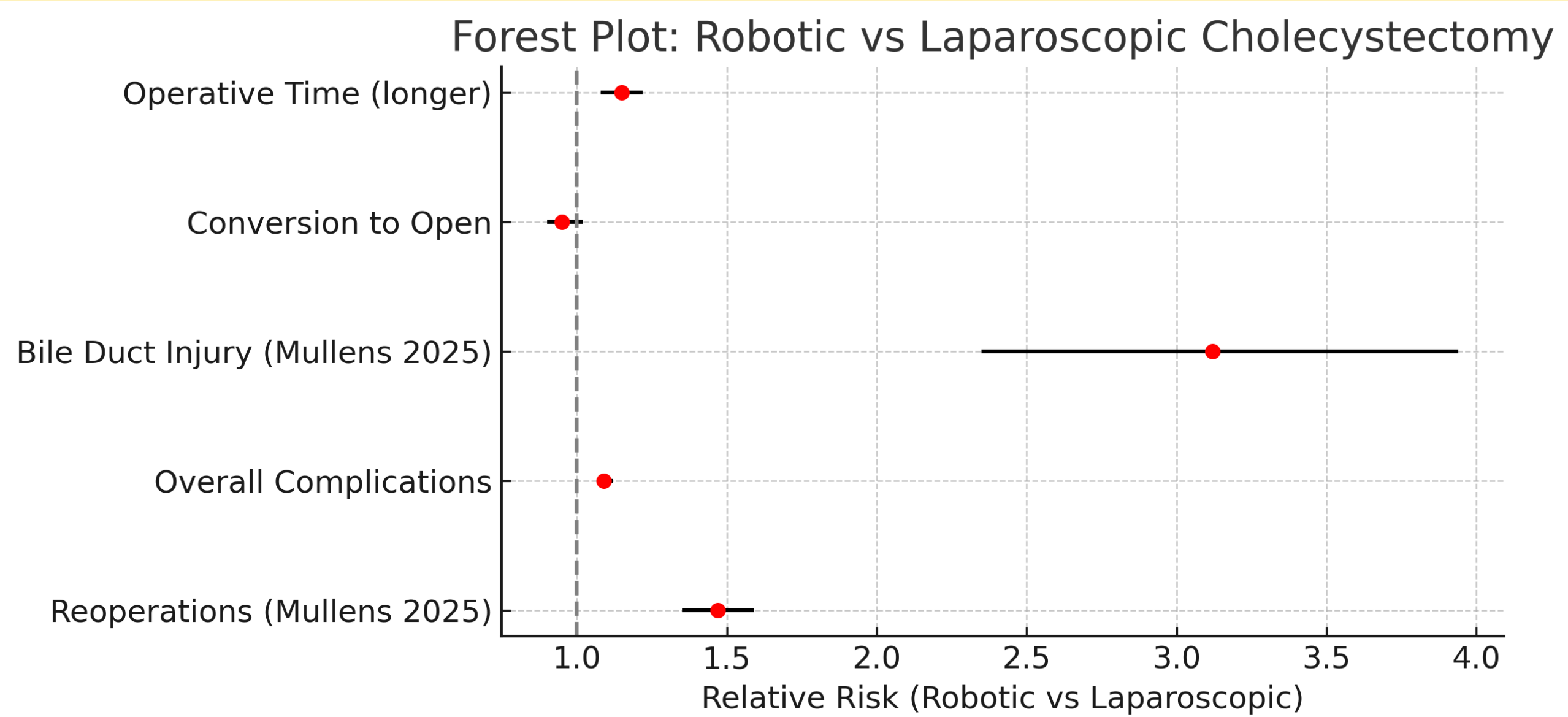
Study Weights and Populations

Study	RR (95% CI)	Total Patients	Weight (%)
Kalata et al. JAMA Surg 2023 (Medicare) BDI	3.16 (2.47-3.75)	1,026,088	64.1
Mullens et al. JAMA Open 2025 BDI	3.12 (2.24 -3.91)	737,908	34.7
Singh et al. TGH 2024 (6 studies) BDI	3.34 (0.85 -13.03)	1,013	1.2
Pooled (RE)	3.15 (2.71 – 3.66)	1,765,009	100

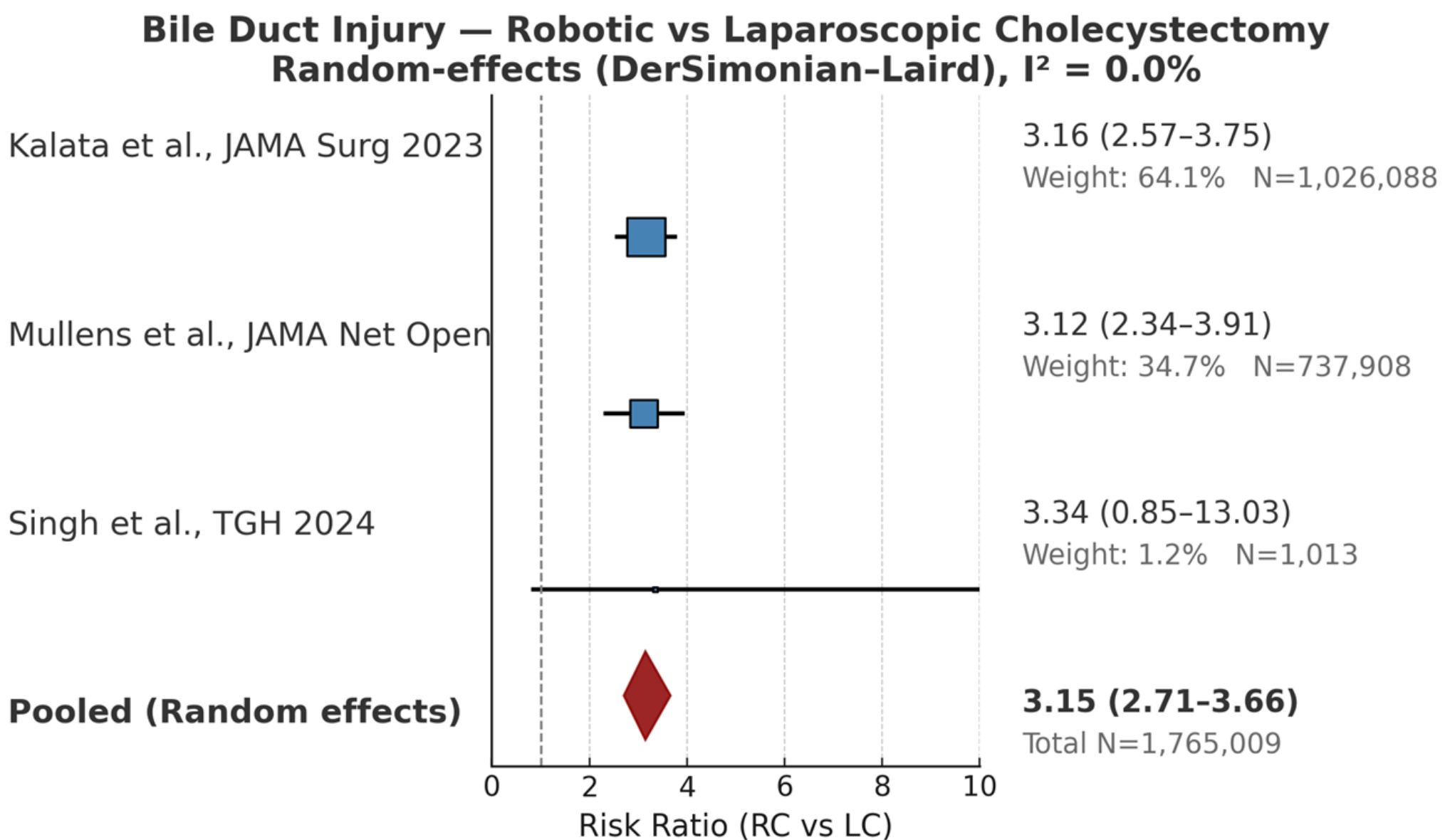
Results

Perioperative Outcomes

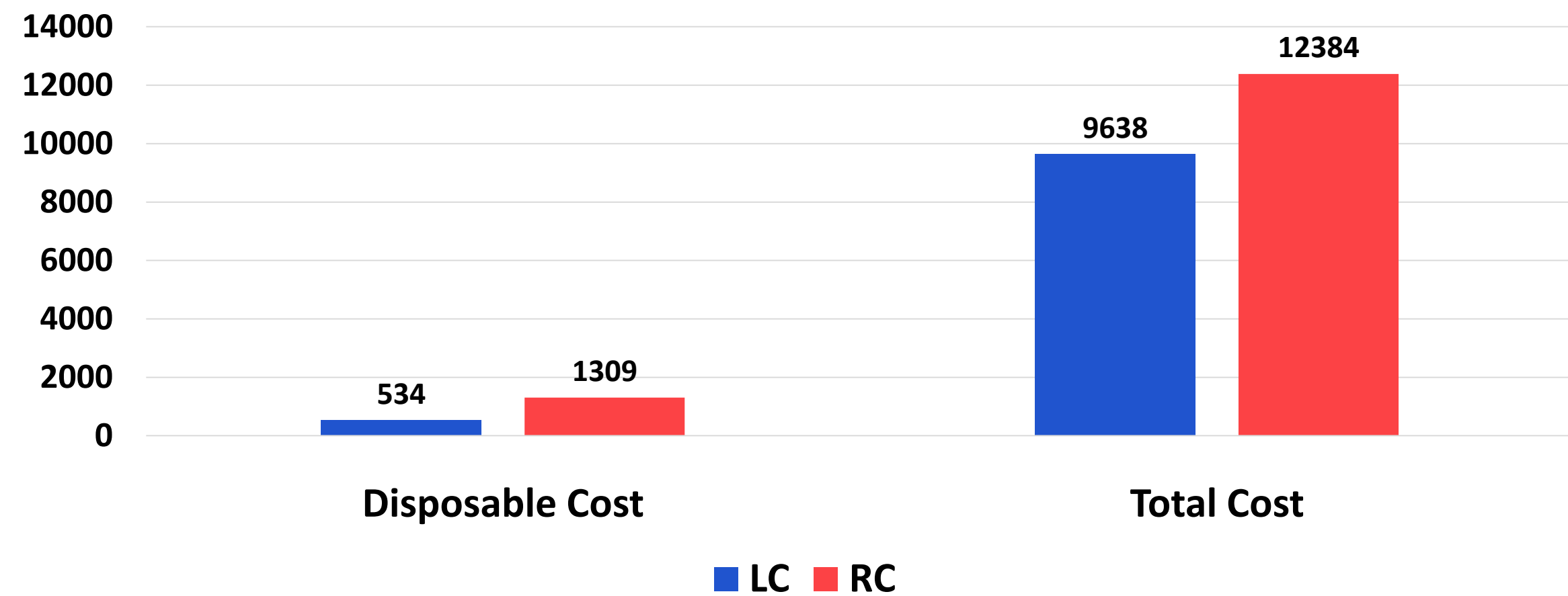
Outcome	Laparoscopic Cholecystectomy	Robotic Cholecystectomy	Key Finding
OR time (min)	30–60	50–90	RC longer
Conversion to open	Low	Low	Similar
Bile Duct Injury	0.2%	0.7%	RC ~3× higher
Length of stay	1.1 d	1.2 d	Similar
Overall complications	Low	Low	No significant difference



Bile Duct Injury: LC vs RC

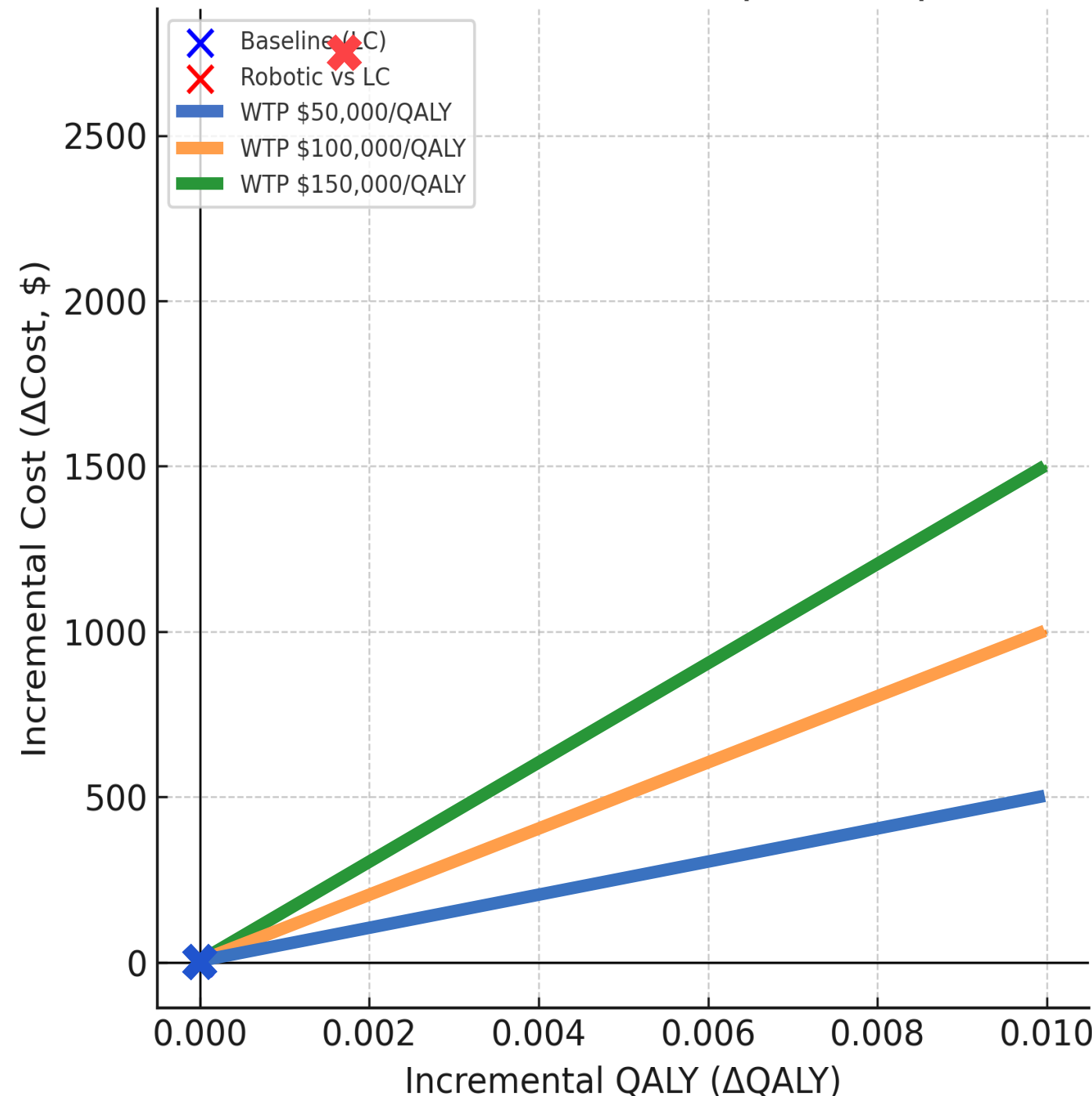


Cost Comparison: LC vs RC



Cost Utility Analysis

Cost-Effectiveness Plane: Robotic vs Laparoscopic Cholecystectomy



- ICUR = \$1,795,735 per QALY
- U.S. WTP threshold: \$50,000–150,000/QALY
- Sensitivity analyses:
RC remained not cost-effective

Conclusions

- RC is costlier than LC and has higher BDI risk (0.7% vs 0.2%)
- ICUR analysis shows RC is not cost-effective for routine benign disease
- LC remains the standard; selective, evidence-driven RC use recommended