# Cost-Effectiveness of Metabolic and Bariatric Surgery in Adolescents: A 10-Year Analysis

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## OBJECTIVE

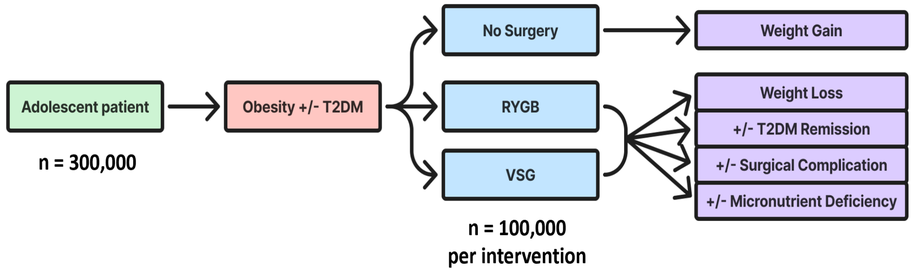
To evaluate the **10-year cost-effectiveness** of **metabolic and bariatric surgery (MBS) compared to non-surgical management** of **severe obesity in adolescents**.

## BACKGROUND

- **Severe obesity affects 20% of U.S. children** at an **estimated annual medical cost** of **$1.3 billion**[1,2]
- **First-line treatments**, including behavioral and pharmacologic, have **limited long-term effectiveness** in adolescents with severe obesity[3]
- **MBS provides durable benefits**, including an average reduction in BMI of 21% and average remission rate of obesity-related comorbidities of 50-60% up to 10 years postoperatively[4]
- Despite these benefits, **adoption of MBS in adolescents with severe obesity remains low**, in part due to **concerns regarding cost**[5]

## METHODS

- **Model Type:** Patient-level, health-state transition model over 10-year time horizon, with 1-month cycle length
  - ***Base case participant:*** Age 17, initial BMI of 52.1 kg/m$^2$, 75% female




Abbreviations: VSG, vertical sleeve gastrectomy; RYGB, Roux-en-Y gastric bypass; T2DM, Type 2 diabetes mellitus

- **Model Input Sources:**
  - ***Surgical Cohort Data***: Teen-Longitudinal Assessment of Bariatric Surgery (Teen-LABS) study
  - ***Non-Surgical Cohort Data***: Cincinnati Children's Hospital's Pediatric Weight Management (PWM) program
- **Costs:**
  - Annual total direct healthcare costs based on age, sex, T2DM status, and BMI for all participants, adjusted to 2022 U.S. Dollars
  - Additional costs included up-front cost of surgery, early (<1 month) and late (>1 month) complications, and long-term monitoring and management of micronutrient deficiencies
- **Utility & Disutility Values**
  - Quality-of-life based on surgical complications, BMI, and T2DM status
- **Endpoints**
  - (1) Total costs, (2) Quality-adjusted life years (QALYs), and (3) Incremental cost-effectiveness ratios (ICERs)
  - Cost-effective if ICER below willingness-to-pay threshold of $100,000 per QALY gained

**QALY = (period of time) x (utility value*)**
***utility value ranges from 0 (lowest possible health state) to 1 (perfect health)**

$$\text{ICER} = \frac{\Delta\ cost}{\Delta\ QALY}$$

**Table 1. Model Inputs**

| Parameter | Value |
|---|---|
| Change in BMI, % (10 y) | |
| No Surgery | 10.3 |
| RYGB | -20.7 |
| VSG | -18.8 |
| Surgery Complications, % | |
| 30-day Mortality | |
| RYGB | 0.2 |
| VSG | 0.1 |
| Early Complications (1 mo) | |
| Minor | |
| RYGB | 16.8 |
| VSG | 11.9 |
| Major | |
| RYGB | 9.3 |
| VSG | 4.5 |
| Late Complications (5 y) | |
| Minor | |
| RYGB | 10.9 |
| VSG | 10.7 |
| Major | |
| RYGB | 15.1 |
| VSG | 8.3 |
| T2D Remission, % (10 y) | |
| RYGB | 58 |
| SG | 41 |
| Micronutrient Deficiency (10 y) | |
| Low Ferritin | |
| RYGB | 44 |
| VSG | 43 |
| Low Vitamin B12 | |
| RYGB | 9 |
| VSG | 3 |
| Low Vitamin D | |
| RYGB | 48 |
| VSG | 52 |
| Utilities | |
| Initial utility, obesity | 0.737 |
| Initial utility, obesity + T2D | 0.654 |
| Surgery (6 wk), RYGB and SG | -0.220 |
| Minor complications (4 wk), RYGB and SG | -0.110 |
| Major complications (6 wk), RYGB and SG | -0.360 |
| 1 unit of BMI reduction | 0.006 |
| T2D Remission | 0.083 |
| Costs, 2022 US dollars | |
| Surgery | |
| RYGB | 26,404 |
| VSG | 24,970 |
| Early Complications | |
| Minor, RYGB and SG | 1,224 |
| Major, RYGB and SG | 39,897 |
| Late Complications | |
| Minor, RYGB and SG | 767 |
| Major, RYGB and SG | 43,928 |
| Micronutrient Screening, RYGB and SG | 186 |
| Ferrous Sulfate, 325 mg, monthly | 1.05 |
| Vitamin B12, 1000 mcg, monthly | 1.30 |
| Vitamin B12 Injection | 58 |
| Vitamin D, 50,000 IU, monthly | 3.27 |
| Multivitamin, monthly | 0.70 |
| Healthcare costs | Stratified by sex, body mass index, and T2D |

Abbreviations: BMI, body mass index; VSG, vertical sleeve gastrectomy; RYGB, Roux-en-Y gastric bypass

## RESULTS

**Total Costs & QALYs**

| | No Surgery | Vertical Sleeve Gastrectomy | Roux-en-Y Gastric Bypass |
|---|---|---|---|
| Total Cost | $40,882 | $72,048 | $79,626 |
| QALYs | 6.117 | 6.875 | 6.888 |

**ICERs: No surgery vs. VSG & RYGB**

| | No Surgery | Vertical Sleeve Gastrectomy | Roux-en-Y Gastric Bypass |
|---|---|---|---|
| | | COST-EFFECTIVE | NOT COST-EFFECTIVE |
| ICER ($/QALY gained) | REFERENCE | $41,164 | $557,751 |

**ICERs: No surgery vs. RYGB**

| | No Surgery | Vertical Sleeve Gastrectomy | Roux-en-Y Gastric Bypass |
|---|---|---|---|
| | | | COST-EFFECTIVE |
| ICER ($/QALY gained) | REFERENCE | UNAVAILABLE | $50,271 |

- **No surgery least costly** with ***lowest QALYs***
- **VSG cost-effective** compared to no surgery
- **RYGB not cost-effective** compared to no surgery, when VSG available
- **RYGB becomes cost-effective** compared to no surgery, ***when VSG unavailable***

## LIMITATIONS

- Generalizability (non-matched surgical and non-surgical cohorts)
- Unmodeled indirect costs
- Some model inputs derived from adult studies (late surgical complication rates/costs and quality-of-life with diabetes)

## CONCLUSION

**Over 10-year time horizon, vertical sleeve gastrectomy is the cost-effective strategy for adolescents with severe obesity.**

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The authors have no disclosures related to this project.
Funding for Teen-LABS was provided by the National Institutes of Health (NIH) (U01DK072493 / UM1 DK072493 to T.H.I.) (UM1 DK095710 to C.X., T.M.J.) and the National Center for Research Resources and the National Center for Advancing Translational Sciences, NIH (8UL1TR000077). Support also came from National Center for Research Resources and the National Center for Advancing Translational Sciences, NIH, (UL1TR000114). ClinicalTrials.gov number: NCT00474318

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