

# Letters

## RESEARCH LETTER

### Health Care Use and Adverse Events After Sleeve Gastrectomy and Gastric Bypass Among Adolescents With Severe Obesity Insured by Medicaid

Prospective observational studies have found that sleeve gastrectomy and gastric bypass resulted in significant weight loss and low complication rates in adolescents with severe obesity (body mass index [calculated as weight in kilograms divided by height in meters squared]  $\geq 40$ ).<sup>1</sup> Although Medicaid is the single largest insurer of adolescents in the US, the comparative outcomes (which may help inform coverage policy and decision-making) of these 2 procedures have yet to be described in this population.<sup>2</sup> Therefore, we evaluated comparative health care use and adverse events up to 5 years after bariatric surgery in adolescents insured by Medicaid.

**Methods** | We used national Medicaid claims to identify adolescents (aged  $\leq 19$  years) with severe obesity who underwent

laparoscopic sleeve gastrectomy or Roux-en-Y gastric bypass between January 1, 2012, and December 31, 2018. Outcomes were based on similar research in adults and included mortality, complications, hospitalization, emergency department (ED) use, reoperation, and revision.<sup>3</sup> Inpatient splenic, hemorrhagic, anastomotic, wound-related, obstruction-related, pulmonary, cardiac, neurological, genitourinary, thromboembolic, and shock-related complications during or after the index admission were included. Reoperation included any abdominal operation potentially related to the index procedure, including biliary procedures and abdominal wall, internal, and paraesophageal hernia repair. Revision included any operation that directly modified the index procedure. Health care use included all-cause ED use and hospitalization, and was identified using a previously described revenue center code algorithm.<sup>4</sup> Covariates included age, sex, race and ethnicity, year of operation, type of operation, and Elixhauser comorbidities.

Outcomes were evaluated up to 5 years after the date of the surgical procedure. We used Cox proportional hazards

**Table. Patient Characteristics by Receipt of Sleeve Gastrectomy or Gastric Bypass Among Adolescents With Severe Obesity Insured by Medicaid**

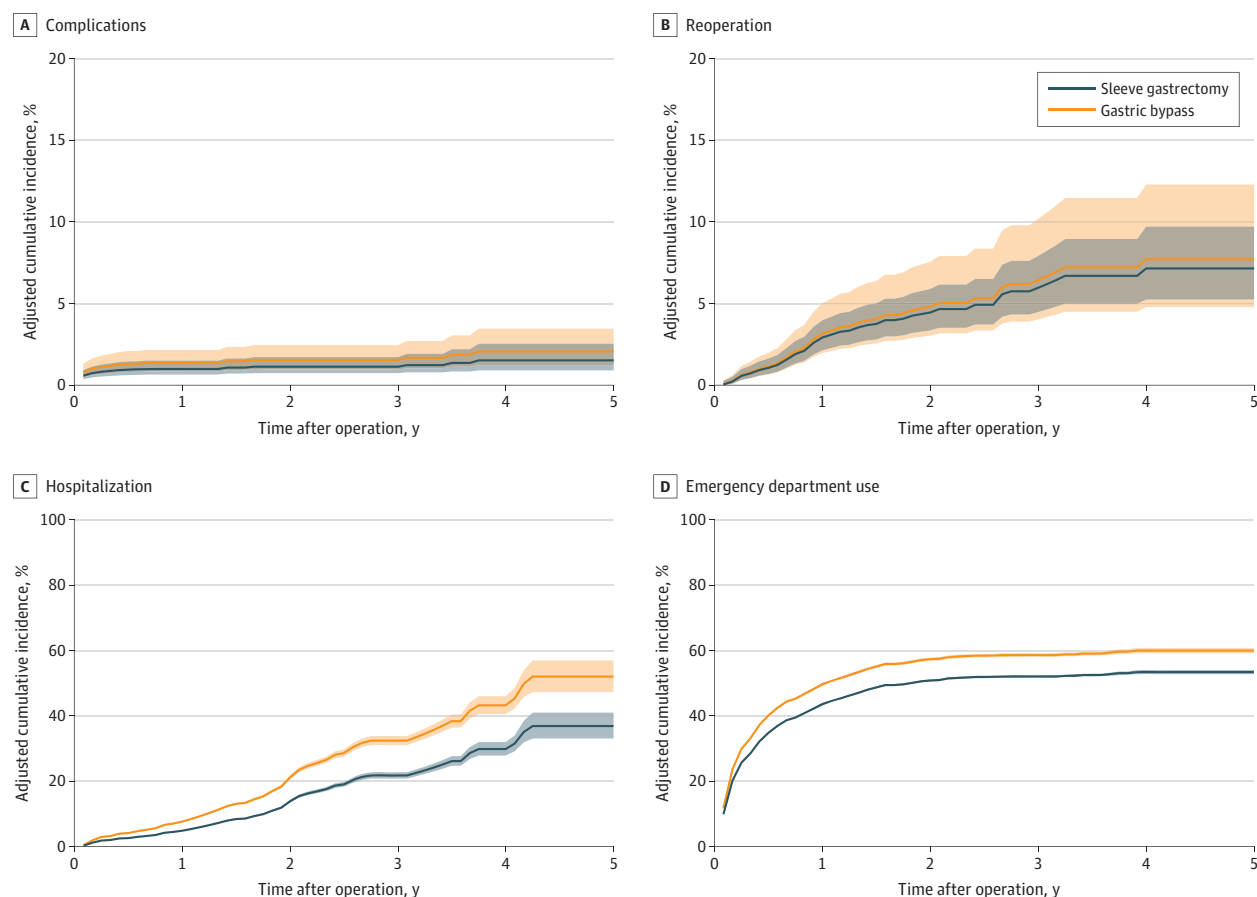
	Sleeve gastrectomy (n = 855) <sup>a</sup>	Roux-en-Y gastric bypass (n = 277) <sup>a</sup>	P value
Age, mean (SD), y	18.58 (0.49)	18.70 (0.46)	<.001
Sex			
Female	641 (75.0)	221 (79.8)	.10
Male	214 (25.0)	56 (20.2)	.10
Race and ethnicity <sup>b</sup>			
Black	196 (22.9)	49 (17.7)	.18
Hispanic	285 (33.3)	101 (36.5)	
White	374 (43.7)	127 (45.9)	
Year of operation			
2012	39 (4.6)	41 (14.8)	<.001
2013	86 (10.1)	60 (21.7)	
2014	106 (12.4)	46 (16.6)	
2015	103 (12.1)	27 (9.8)	
2016	155 (18.1)	36 (13.0)	
2017	200 (23.4)	32 (11.6)	
2018	166 (19.4)	35 (12.6)	
Comorbidities			
Chronic pulmonary disease	196 (22.9)	64 (23.1)	.95
Deficiency anemias	38 (4.4)	15 (5.4)	.51
Depression	95 (11.1)	45 (16.3)	.02
Diabetes without long-term complications	98 (11.5)	39 (14.1)	.25
Hypertension	148 (17.3)	49 (17.7)	.89
Hypothyroidism	37 (4.3)	12 (4.3)	.99
Liver disease	124 (14.5)	36 (13.0)	.53
Mental health diagnosis	23 (2.7)	<sup>c</sup>	.41

<sup>a</sup> Data are expressed as No. (%) unless otherwise indicated.

<sup>b</sup> Identified using classifications defined in Medicaid claims data. Included in this study given the evidence that outcomes after bariatric surgery differ by race.

<sup>c</sup> Per the US Centers for Medicare & Medicaid Services data use policy, categories with 10 or fewer patients were censored.

Figure. Adjusted Cumulative Incidence of Complications, Reoperation, All-Cause Hospitalization, and Emergency Department Use



The adjusted cumulative incidence was estimated using Cox proportional hazards models that included the covariates of age, sex, race and ethnicity, year of operation, type of operation, and Elixhauser comorbidities. Reoperations included any abdominal operation potentially related to the index bariatric

procedure, including biliary procedures and abdominal wall, internal, and paraesophageal hernia repair, but not operations that directly modified the index bariatric procedure, which were classified as revision. Shaded areas indicate 95% CIs.

models that included all covariates to estimate the 5-year cumulative incidence for each outcome while adjusting for between-group differences. Mortality and revision could not be modeled due to extremely low outcome rates. Patients were censored if they died, disenrolled from Medicaid, or reached the end of the follow-up period (December 31, 2019).

All statistical tests were performed using SAS version 9.4 (SAS Institute Inc). Tests were 2-sided and significance was set at  $P < .05$ . This study was exempted from review by the University of Michigan institutional review board.

**Results** | A total of 855 patients who underwent sleeve gastrectomy (mean age, 18.6 years [SD, 0.5 years] and 641 [75.0%] were female) and 277 patients who underwent gastric bypass (mean age, 18.7 years [SD, 0.5 years] and 221 [79.8%] were female) were identified (Table). The median follow-up time was 575 days (IQR, 277-928 days). The annual percentage of sleeve gastrectomy relative to gastric bypass increased from 48.8% in 2012 to 82.6% in 2018.

Sleeve gastrectomy was associated with a significantly lower 5-year risk of ED use compared with gastric bypass (53.3% [95% CI, 52.6%-53.9%] vs 59.9% [95% CI, 59.1%-60.7%];  $P = .01$ ) and hospitalization (36.9% [95% CI, 33.1%-41.0%] vs 52.1% [95% CI, 47.3%-57.0%];  $P = .001$ ), but no significant difference in complications (1.5% [95% CI, 0.9%-2.5%] vs 2.1% [95% CI, 1.2%-3.5%];  $P = .31$ ) or reoperation (7.2% [95% CI, 5.3%-9.7%] vs 7.7% [95% CI, 4.8%-12.3%];  $P = .78$ ) (Figure). There was also no difference between sleeve gastrectomy and gastric bypass in observed rates of death (2 [0.2%] vs 0;  $P = .42$ ) or revision (9 [1.1%] vs 2 [0.7%];  $P = .63$ ).

**Discussion** | In this US study of adolescents with severe obesity and insured by Medicaid, sleeve gastrectomy was significantly associated with lower rates of ED use and hospitalization, but similar rates of death, complications, reoperation, and revision compared with gastric bypass. The low rates of death, complications, and reoperation are consistent with previous studies with different designs and

populations. One of the studies reported an in-hospital complication rate of 2.6% and another reported a 3-year reoperation rate of 13%.<sup>1,5</sup> Only 1132 patients were identified over 7 years, suggesting that this treatment is infrequently used in this population, possibly due to access issues or controversies over the use of bariatric surgery in young patients.<sup>5,6</sup>

This study is subject to selection bias because patient characteristics may influence the choice of procedure, although appropriate statistical adjustment was used. Other limitations include the small sample size, which increases the possibility of type II error; the relatively short follow-up period; and the inability to directly attribute outcomes to the index procedure. These results may help inform the treatment of severe obesity in adolescents insured by Medicaid, although future studies should also evaluate long-term weight loss and comorbid-ity resolution in this population.

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## Primary Care Physician Supply by County-Level Characteristics, 2010-2019

In the US, many communities face systemic barriers accessing health care in part due to primary care physician (PCP) shortages.<sup>1</sup> Recent federal investments such as the 2011 Community Health Center Fund, which was established through the Affordable Care Act and provided more than \$11 billion in funding, aimed to expand the primary care workforce in underserved communities.<sup>2</sup> Changes in PCP supply since the implementation of these initiatives remain unclear. Therefore, we evaluated trends in per-capita PCP supply by county-level racial and ethnic minority concentration, poverty, rurality, and region and how the differences changed between 2010 and 2019.

**Methods |** The characteristics and number of PCPs in all US counties (N = 3142) from 2010 to 2019 were obtained from the Area Health Resources File. Primary care physicians included all nonfederal physicians younger than 75 years of age who were not hospital residents and whose major professional activity was outpatient care in general practice, family medicine, general internal medicine, or general pediatrics. Counties with a high proportion of racial and ethnic minority populations (high-proportion minority) were defined as those in the top decile by proportion of Black and Hispanic individuals in 2019. County-level poverty was measured by quartile rank of the proportion of persons with incomes below the federal poverty level each year. The 2013 Rural-Urban Continuum Codes were used to classify counties as urban (1-3) or rural (4-9).

We calculated county-level PCP supply per 100 000 population for each year, then examined trends by county-level characteristics. Generalized estimating equations with robust SEs and a compound symmetry structure were used to assess differences in PCP supply between high-proportion minority counties and other counties in 2010 and 2019, after adjusting for poverty quartile, rurality, and region. Models included a high-proportion minority status × year (2010 vs 2019) interaction term to evaluate whether differences in PCP supply between these counties changed over time. We then repeated analyses by other county-level characteristics (poverty level, rurality, and region). Analyses were