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# Exploring regional variability in utilization of antireflux surgery in children



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## ABSTRACT

**Background:** There is significant variation surrounding the indications, surgical approaches, and outcomes for children undergoing antireflux procedures (ARPs) resulting in geographic variation of care. Our purpose was to quantify this geographic variation in the utilization of ARPs in children.

**Methods:** A cross-sectional analysis of the 2009 Kid's Inpatient Database was performed to identify patients with gastroesophageal reflux disease or associated diagnoses. Regional surgical utilization rates were determined, and a mixed effects model was used to identify factors associated with the use of ARPs.

**Results:** Of the 148,959 patients with a diagnosis of interest, 4848 (3.3%) underwent an ARP with 2376 (49%) undergoing a laparoscopic procedure. The Northeast (2.0%) and Midwest (2.2%) had the lowest overall utilization of surgery, compared with the South (3.3%) and West (3.4%). After adjustment for age, case-mix, and surgical approach, variation persisted with the West and the South demonstrating almost two times the odds of undergoing an ARP compared with the Northeast. Surgical utilization rates are independent of state-level volume with some of the highest case volume states having surgical utilization rates below the national rate. In the West, the use of laparoscopy correlated with overall utilization of surgery, whereas surgical approach was not correlated with ARP use in the South.

**Conclusions:** Significant regional variation in ARP utilization exists that cannot be explained entirely by differences in patient age, race/ethnicity, case-mix, and surgical approach. In order to decrease variation in care, further research is warranted to establish consensus guidelines regarding indications for the use ARPs for children.

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## Introduction

Gastroesophageal reflux is the normal physiological passage of gastric contents into the esophagus that can occur several times a day in infants and children.<sup>1</sup> Most of these cases resolve spontaneously by 18 mo of life and do not cause any symptoms or complications.<sup>2</sup> However, physiological reflux can progress to gastroesophageal reflux disease (GERD) and result in numerous pathologies that can negatively impact a child's well-being. Medical management, specifically the use of proton pump inhibitors, is the mainstay of treatment for symptomatic reflux; however, antireflux procedures (ARPs) remain an option for children whose symptoms do not respond to medical management.

Although there appear to be obvious benefits to the surgical treatment of GERD, there is significant variation in the

indications, preoperative evaluation, surgical approach, and outcomes for children undergoing ARPs.<sup>3–5</sup> Nusrat and Bielefeldt demonstrated a fivefold variation in regional ARP utilization rates in the United States for the treatment of GERD in adults.<sup>6</sup> In addition, there was a marked increase in the use of ARPs for treatment of GERD in adults with the widespread introduction of laparoscopy in the 1990s.<sup>7–9</sup> National surgical utilization rates declined steadily from 1999 to 2003<sup>10</sup>; however, the volume of elective adult ARPs has remained relatively stable since about 2005.<sup>11</sup> Surprisingly, when a pediatric population was examined between 1996 and 2003, no similar trends were identified.<sup>12</sup> The purpose of this study was to examine contemporary regional and state-level variability in utilization of ARPs to treat children with GERD and its complications. We hypothesized that regional and state level rates of surgical utilization would correlate with use of laparoscopy.

**Table 1 – Demographics (age, race, and comorbidities), including all diagnoses with proportion that underwent ARPs.**

	All patients	Antireflux surgery	
		Yes	No
Total N	148,969*	4230 (2.8%)	144,739 (97.2%)
Mean number of total diagnoses (SD) <sup>†</sup>	7.672 (4.82)	9.752 (6.284)	7.611 (4.759)
Female, N (%) <sup>‡</sup>	71,089 (47.7%)	1939 (45.8%)	69,150 (47.8%)
Age, N (%) <sup>§</sup>			
<1 y	69,938 (46.9%)	2009 (47.5%)	67,929 (46.9%)
Between 1 and 10 y	39,147 (26.3%)	1565 (37.0%)	37,582 (26.0%)
>10 y	39,468 (26.5%)	636 (15.0%)	38,832 (26.8%)
Race, N (%) <sup>  </sup>			
White	71,025 (47.7%)	2065 (48.8%)	68,960 (47.6%)
Black	21,201 (14.2%)	624 (14.8%)	20,577 (14.2%)
Hispanic	23,623 (15.9%)	668 (15.8%)	22,955 (15.9%)
Other	10,503 (7.1%)	332 (7.8%)	10,171 (7.0%)
Region, N (%)			
Northeast	26,028 (17.5%)	508 (12.0%)	25,520 (17.6%)
Midwest	34,800 (23.4%)	763 (18.0%)	34,037 (23.5%)
South	56,457 (37.9%)	1884 (44.5%)	54,573 (37.7%)
West	31,684 (21.3%)	1075 (25.4%)	30,609 (21.1%)
Contributing diagnoses (more than one may apply), N (%)			
Esophagitis, N (%)	4300 (2.9%)	184 (4.3%)	4116 (2.8%)
Esophageal stricture, N (%)	828 (0.6%)	54 (1.3%)	774 (0.5%)
Dysphagia, N (%)	11,793 (7.9%)	553 (13.1%)	11,240 (7.8%)
Aspiration, N (%)	10,994 (7.4%)	414 (9.8%)	10,580 (7.3%)
Apnea, N (%)	8987 (6.0%)	143 (3.4%)	8844 (6.1%)
Failure to thrive, N (%)	27,156 (18.2%)	1366 (32.3%)	25,790 (17.8%)
Barrett's esophagus, N (%)	123 (0.1%)	23 (0.5%)	100 (0.1%)
Paraesophageal hernia/hiatal hernia, N (%)	2820 (1.9%)	597 (14.1%)	2223 (1.5%)
Esophageal reflux, N (%)	105,265 (70.7%)	3840 (90.8%)	101,425 (70.1%)
Esophageal ulcer, N (%)	445 (0.3%)	13 (0.3%)	432 (0.3%)

\* Of the 148,969 patients, 22,904 patients (15.4%) are missing either age or race.

† Number of diagnoses range from 1 to 35 and may contain other diagnoses not associated with ARP.

‡ Gender is missing for 278 patients (0.2%).

§ Age is missing for 416 patients (0.3%).

|| Race is missing for 22,617 patients (15.2%), this includes all patients from Ohio, North Carolina, West Virginia, and Minnesota.

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