

RESEARCH NOTE OPEN ACCESS

Left-Digit Bias in Surgical Management of Chronic Rhinosinusitis in Young Adults

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1 | Introduction

Previous concerns about the effects of endoscopic sinus surgery (ESS) on facial development, which have subsequently been disproven, may lead to withholding of surgical therapy in teens [1–3]. This potential withholding of surgery may be further compounded by a phenomenon known as left-digit bias (LDB).

LDB is a psychological phenomenon in which people tend to focus on the leftmost digit of a number [4]. Previous work has shown LDB impacting clinical decision-making in many fields, but there are no studies assessing LDB in the surgical management of chronic rhinosinusitis (CRS) [5–7]. Therefore, this study seeks to describe the impact of LDB on ESS rates in teens and young adults with CRS.

2 | Material and Methods

The Merative MarketScan Commercial Claims & Encounters Database Outpatient Services Table (CCEOST) is a collection of deidentified US commercial insurance claims for medical services provided in an outpatient facility for individuals not eligible for Medicare.

We compiled all claims with a primary diagnosis of CRS, as defined by ICD-10-CM codes. For all patients in a given year, only the earliest claim in which the primary diagnosis was ICD-10-CM

Summary

- Left-digit bias (LDB) is a cognitive bias where people focus on the leftmost digit of a number.
- Twenty-year-olds had 35% more surgeries for CRS than 19-year-olds, after covariate adjustment.
- LDB may cause arbitrary delays in surgical treatment for CRS, despite clinical indication.

codes J32.0 (chronic maxillary sinusitis), J32.1 (chronic frontal sinusitis), J32.2 (chronic ethmoidal sinusitis), J32.3 (chronic sphenoidal sinusitis), J32.4 (chronic pansinusitis), J32.8 (other chronic sinusitis), and J32.9 (chronic unspecified sinusitis) was included in our analytic sample. We calculated patients' Charlson comorbidity index (CCI) using a modified version of the code created by Beyrer et al. [8]. Initial screening and CCI calculation were performed in SAS Software Version 9.4 (SAS Institute Inc.).

After this initial screen, we only included claims with a primary procedure code in level 1 of the Healthcare Common Procedure Coding System (HCPCS), which includes codes in the Current Procedural Terminology (CPT). Patients were categorized as receiving ESS if their primary procedure code was one of the codes in Table S1. Using a regression discontinuity design, we analyzed the difference in rates of ESS for CRS by age, while adjusting for sex, comorbidities CCI, and primary diagnosis. Secondary

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Alexander Z. Wang and Ringo K. Leung contributed equally to this study.

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TABLE 1 | Cohort characteristics by endoscopic sinus surgery (ESS) status.

	Did not receive ESS (<i>n</i> = 1,462,640)	Received ESS (<i>n</i> = 20,523)
Age (mean ± SD)	39.6 ± 17.1	42.3 ± 14.6
Sex		
Male, <i>n</i> (%)	564,348 (38.6)	9946 (48.5)
Female, <i>n</i> (%)	898,292 (61.4)	10,577 (51.5)
Charlson comorbidity index (mean ± SD)	0.19 ± 0.61	0.19 ± 0.66
Primary diagnosis by sinus		
Maxillary, <i>n</i> (%)	207,682 (14.2)	6461 (31.5)
Frontal, <i>n</i> (%)	41,511 (2.8)	2280 (11.1)
Ethmoidal, <i>n</i> (%)	42,093 (2.9)	2585 (12.6)
Sphenoidal, <i>n</i> (%)	7364 (0.5)	492 (2.4)
Pansinusitis, <i>n</i> (%)	88,940 (6.1)	3371 (16.4)
Other, <i>n</i> (%)	76,984 (5.3)	2341 (11.4)
Unspecified, <i>n</i> (%)	998,066 (68.2)	2993 (14.6)

screening and analysis were conducted in Stata Version 18 (StataCorp).

3 | Results

Our analytic sample included 1,483,163 claims. Note that 38.7% (*n* = 574,294) of patients were male. Patients spanned all ages from 0 to 65 (mean: 39.7). The most common diagnosis was chronic unspecified sinusitis (*n* = 1,001,059), followed by chronic maxillary sinusitis (*n* = 214,143). The average CCI for the entire cohort was 0.19 (range: 0–15). Note that 20,523 patients received ESS for CRS (1.38%). Patients diagnosed with chronic

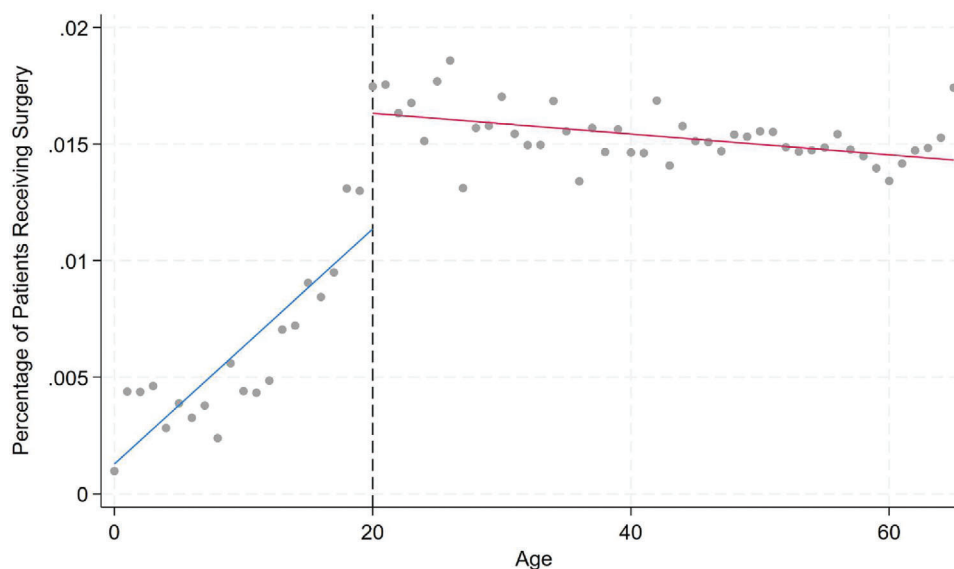
unspecified sinusitis received surgery at the lowest rate (0.30%), whereas those with chronic sphenoidal sinusitis received surgery at the highest rate (6.26%). Table 1 summarizes our cohort characteristics, stratified by patients that did and did not receive ESS.

Regression discontinuity showed that 20-year-olds were 35% more likely to receive surgery than 19-year-olds, even after adjusting for sex, CCI, and primary diagnosis (*p* = 0.02). Two procedures accounted for the majority of increased surgeries: submucosal resection of the inferior turbinate (CPT code 30140) and nasal/sinus endoscopy with biopsy, polypectomy, or debridement (CPT code 3137). This increased rate of surgery was sustained for all patients who were older than 20 years, with a consistent and gradual decline in rate of ESS (Figure 1). As sensitivity analyses, we checked whether discontinuities existed at surrounding cutoff points (18, 19, 21) and found no significant discontinuities (18: *p* = 0.09, 19: *p* = 0.412, 21: *p* = 0.167).

4 | Discussion

This is the first study to assess LDB in surgical CRS management. Our findings suggest that cognitive biases like LDB may lead to arbitrary delays in surgical treatment for CRS symptoms, despite clinical indication. If clinicians hesitate to consider patients as surgical candidates due to LDB, they may similarly downplay surgical treatment as an option while counseling patients. Thus, the impact of LDB may be two-pronged: restricting access to ESS and indirectly decreasing patient satisfaction in those who do receive ESS by delaying pre-operative counseling and expectation-setting. Standardizing treatment guidelines should be a priority to mitigate the effects of LDB in this patient population.

In addition to physician decision-making, there are several factors from the patient's perspective that must be considered. Patient preference and life-events (i.e., patient's transition from high school to college/work) may contribute to decreased willingness

**FIGURE 1** | Regression discontinuity plot of ESS by age with cut off at 20 years old.

to pursue ESS at 19 years of age; however, previous research found that patients may rely on counseling from otolaryngologists when deciding to pursue surgery for CRS, suggesting that physicians can still play a key role in mitigating LDB [9]. Another consideration is transition of care from pediatric to adult otolaryngologists. Pediatric otolaryngologists may have a higher threshold for surgery than adult otolaryngologists. Conversely, adult otolaryngologists may opt to retry medical management, delaying surgery until the patient attained 20 years of age. While transition of care may be a factor, previous research found that 46% of pediatric otolaryngologists transfer care when patients are of 21+ years, suggesting that practice pattern differences between subspecialties may not ultimately be the driving factor for the disparity in surgery between 19- and 20-year-olds found in our analysis [10].

Our study has some limitations. Notably, the MarketScan dataset does not include information on race, ethnicity, or disease severity, which may confound our findings. Nonetheless, the use of a large, nationwide dataset enhances the reliability of our results.

5 | Conclusion

In addition to other factors, LDB may impact the decision to pursue ESS for CRS in young adults. This highlights the importance of being aware of cognitive biases in clinical decision-making.

Disclosure

The authors have nothing to report.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.