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ORIGINAL RESEARCH—CLINICAL

Healthcare Utilization Among Patients Hospitalized With Gastrointestinal Diseases in the United States

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BACKGROUND AND AIMS: Gastrointestinal (GI) disorders represent a significant burden on United States healthcare, but research assessing the relative contribution of individual GI disorders is lacking. We aimed to determine the relative impact of various GI conditions, as compared to non-GI conditions, on US hospital-related healthcare utilization. **METHODS:** Hospitalization data from 2016 to 2018 were obtained from the Nationwide Readmissions Database. Outcomes included length of stay, hospital charges, 30-day readmissions, and death. Multivariable regression models evaluated each outcome, while adjusting for patient and hospital characteristics. Patients hospitalized for each GI indication were compared to individuals hospitalized for non-GI conditions. **RESULTS:** 5,344,145 patients with GI and 68,901,595 patients with non-GI indications for hospitalization were included in our study. All GI indications were associated with increased odds for 30-day readmission compared to non-GI indications, with the highest being gastroparesis (adjusted odds ratio, 2.15; 95% confidence interval [CI], 2.09–2.22). Upper GI cancer had the highest relative increase in length of stay (2.31 days, 95% CI 2.20–2.42) and total charges ($23,441, 95% CI $21,296–25,587). Upper GI cancer, pancreatic cancer, and gallbladder/biliary cancer were associated with the highest odds of death. **CONCLUSION:** GI malignancies contributed significantly to utilization and death, possibly from advanced stage at hospitalization and systemic effects of malignancy. The high GI-specific readmission rates highlight the chronicity of GI conditions and the importance of optimizing digestive health to prevent recurrent admission.

Keywords: Cost; Outcomes; Utilization

Introduction

Gastrointestinal (GI) disorders contributed significantly to spending in the United States with recent total healthcare expenditures for GI conditions totaling over $119 billion annually.[1] Hospitalizations in particular make up a significant proportion of this, with 3.9 million hospitalizations for primary GI diagnoses in 2018, and estimated costs of $47 billion.[1] While prior cross-sectional studies from Peery et al, Everhart et al, and Shaheen et al, have allowed for estimation of utilization among a variety of conditions in the inpatient, emergency department, and outpatient settings,[1–3] there are limited data comparing relative hospitalization-related resource utilization across GI disorders while controlling for potential covariates, including patient and hospital characteristics. Controlling for these potential covariates with more up-to-date data would allow for additional insights into specific GI conditions that contribute most to healthcare utilization. Prior data from Nguyen et al[4] have identified characteristics of patients with high utilization among several GI disorders, including lower income, Medicare/Medicaid insurance, and hospital location; however, their study focused on a select group of conditions that did not include GI neoplasms or infectious colitis. Additionally, their study did not compare the overall impact of hospitalizations for GI conditions with hospitalizations for non-GI indications—the insights offered by this comparison would help guide 1) further research to assess factors common to GI conditions that may be driving utilization, and 2) policy to mitigate excess healthcare utilization.

Using a nationwide database of hospital admission data, our study aimed to assess various measures of healthcare utilization, including number of hospitalizations, length of stay (LOS), total hospital charges, 30-day readmissions, and deaths in patients hospitalized for a variety of GI disorders compared to those hospitalized for non-GI disorders.

Methods

In this nationwide, retrospective cohort study, we queried the Nationwide Readmissions Database (NRD) between 2016 and 2018 using International Classification of Diseases 10th

Abbreviations used in this paper: **aOR, adjusted odds ratio; CI, confidence interval; GI, gastrointestinal; IBD, inflammatory bowel disease; IBS, irritable bowel syndrome; ICD-10, International Classification of Diseases 10th Revision; LOS, length of stay; NRD, Nationwide Readmissions Database; PSC, primary sclerosing cholangitis.**

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Revision (ICD-10) to identify patients hospitalized for the following GI disorders: diverticular disease, irritable bowel syndrome (IBS), inflammatory bowel disease (IBD), chronic pancreatitis, esophageal disorders, gallbladder disease, gastroparesis, celiac disease, acute pancreatitis, functional GI disease, infectious gastroenteritis, noninfectious colitis, colorectal cancer, cholangitis, *Clostridioides difficile* infection, gallbladder/biliary cancer, GI bleed, upper GI cancer, and pancreatic cancer (Table A1). GI disorders were selected based on general classifications of commonly hospitalized discrete GI diagnoses. As this study focused on GI conditions, primary liver pathologies were not included. The NRD is a national database developed for the Healthcare Cost and Utilization Project that contains data from approximately 35 million discharges annually, while incorporating a complex sampling design that permits nationally representative estimates.[4] The NRD uniquely allows for patient linkage to identify all hospitalizations for an individual patient across a given calendar year, but not across multiple calendar years. To provide adequate time for evaluation of 30-day readmission, discharge dates for index hospitalizations had to occur before December to be included in the study.

To ensure hospitalized individuals were admitted for a GI-specific diagnosis, only admissions with ICD-10 codes for GI diagnoses listed in the first 3 diagnosis positions were included. The comparison group of non-GI hospitalizations was composed of all individuals without a GI indication in the first 3 diagnosis positions. Hospitalizations with multiple GI conditions were counted separately for each condition. For each subject, the following patient-specific characteristics were also collected: age (grouped into 4 cohorts: age 0–20, 21–40, 41–60, and greater than 60 years), sex, Charlson-Deyo comorbidity index, primary payer (Medicare, Medicaid, private insurance, self-pay, no charge, other), and zip code income quartile. The Charlson-Deyo comorbidity index is a composite score of predefined comorbidities used as a representation of overall disease burden, which may influence outcomes.[5] Hospital-specific characteristics included hospital bed size (small, medium, large) and hospital location/teaching status (urban teaching, urban nonteaching, rural). These variables were incorporated into regression models as covariates.

Outcomes included LOS, hospital charges, 30-day all-cause readmission after index hospitalization, and inhospital death during index hospitalization. Hospital charges were estimated for the index hospitalization. Readmission excluded inhospital death or transfers. The annual number of patients hospitalized for each GI indication was estimated using weighted frequencies that provided nationally representative values. Multivariable linear regression was used to evaluate the outcomes of LOS and total hospital charges for each patient hospitalized for GI vs non-GI indications, while adjusting for age, sex, Charlson comorbidity index, payer source, zip code income quartile, hospital bed size, and hospital location/teaching status. Multivariable logistic regression was used to evaluate the outcomes of 30-day readmission and death for individual GI indications, as compared to non-GI indications collectively, adjusting for the same covariates. Statistical significance was defined with a threshold of 0.05. All analyses were performed using SAS version 9.4 (SAS Institute, Cary, North Carolina).

The University of California at Los Angeles Institutional Review Board deemed the study exempt due to de-identified population-level data obtained from the NRD (IRB #19-001212).

Results

Population/Hospitalization Characteristics

A total of 5,344,145 patients hospitalized with GI indications and 68,901,595 patients hospitalized without GI indications from 2016 to 2018 were included in our study. 54.1% of patients were female (Table 1). Patients above 60 years of age composed the largest age group (38.8%) and a majority of patients had a Charlson-Deyo comorbidity index of 0 (57.0%). The most common primary payer was Medicare and there was a relatively even breakdown in income quartiles in both groups, though the first income quartile had the largest proportion of patients (28.7%). The majority of hospitals included in this study were large (55.3%), urban nonteaching (68.1%) hospitals.

Figure 1 outlines the average annual number of patients hospitalized for each included GI indication from 2016 to 2018. The most common indications for hospitalization were GI bleed, gallbladder disease, diverticular disease, functional GI disease, acute pancreatitis, infectious gastroenteritis, and noninfectious colitis. On average, the least common GI indications for hospitalization were celiac disease, cholangitis, gallbladder/biliary cancer, chronic pancreatitis, and esophageal disease.

Length of Stay

Figure 2 displays the outcome of adjusted relative LOS for each GI indication for hospitalization, compared to non-GI indications. Upper GI cancer was the condition with the largest adjusted relative difference in LOS (2.31 days, 95% confidence interval [CI] 2.20–2.42), followed by *C difficile* infection (1.91 days, 95% CI 1.84–1.98), functional GI disease (1.23 days, 95% CI 1.18–1.28), and gallbladder/biliary cancer (1.05 days, 95% CI 0.93–1.18). The mean LOS for these conditions were 8.47 days (95% CI 8.34–8.60), 6.64 days (95% CI 6.56–6.73), 5.83 days (95% CI 5.76–5.89), and 7.11 days (95% CI 6.97–7.26), respectively (Table 2). Other GI indications associated with increased adjusted LOS compared to non-GI indications were colorectal cancer, pancreatic cancer, IBD, cholangitis, and gastroparesis. Noninfectious colitis (−0.80 days, 95% CI −0.83 to −0.76), esophageal disorders (−0.74 days, 95% CI −0.80 to −0.68), IBS (−0.58 days, 95% CI −0.62 to −0.54), and chronic pancreatitis (−0.47 days, 95% CI −0.54 to −0.40) were the GI conditions associated with the shortest adjusted LOS with means of 3.54 days (95% CI 3.50–3.59), 3.96 days (95% CI 3.89–4.02), 3.60 days (95% CI 3.56–3.65), and 4.40 days (95% CI 4.32–4.48), respectively.

Hospital Charges

Figure 3 outlines the adjusted relative differences in hospital charges between various GI indications for hospitalization, as compared to non-GI indications. Malignancies, specifically upper GI ($23,441, 95% CI $21,296–25,587), colorectal ($11,628, 95% CI $10,723–12,532), and gallbladder/biliary ($10,644, 95% CI $8460–12,828) made up

Table 1. Patient and Hospital Characteristics for All Patients Hospitalized From 2016 to 2018

Patient characteristics	All hospitalizations (% of total)	GI indications (% of total)	Non-GI indications (% of total)
Total	74,245,740 (100)	5,344,145 (7.2)	68,901,595 (92.8)
Sex			
Female	43,028,564 (58.0)	2,893,711 (3.9)	40,134,854 (54.1)
Male	31,217,175 (42.0)	2,450,434 (3.3)	28,766,741 (38.7)
Age group			
0–20 y	14,954,219 (20.1)	270,397 (0.4)	14,683,822 (19.8)
21–40 y	16,066,354 (21.6)	810,333 (1.1)	15,256,021 (20.5)
41–60 y	14,433,066 (19.4)	1,572,581 (2.1)	12,860,485 (17.3)
>60 y	28,792,099 (38.8)	2,690,833 (3.6)	26,101,266 (35.2)
Charslon-Deyo comorbidity index			
0	42,309,381 (57.0)	2,503,776 (3.4)	39,805,604 (53.6)
1–2	21,326,377 (28.7)	1,870,664 (2.5)	19,455,714 (26.2)
>2	10,609,982 (14.3)	969,705 (1.3)	9,640,277 (13.0)
Payor			
Medicare	27,021,341 (36.4)	2,469,500 (3.3)	24,551,841 (33.1)
Medicaid	17,375,108 (23.4)	812,855 (1.1)	16,562,253 (22.3)
Private insurance	24,303,869 (32.8)	1,633,848 (2.2)	22,670,021 (30.6)
Self-pay	2,812,856 (3.8)	244,990 (0.3)	2,567,866 (3.5)
No charge	297,881 (0.4)	32,310 (0.04)	265,571 (0.36)
Other	2,322,338 (3.1)	142,699 (0.2)	2,179,639 (3.0)
Zipcode income, %			
Quartile 1	21,089,340 (28.7)	1,523,407 (2.1)	19,565,933 (26.7)
Quartile 2	20,018,979 (27.3)	1,454,303 (2.0)	18,564,676 (25.3)
Quartile 3	18,184,680 (24.8)	1,291,832 (1.8)	16,892,848 (23.0)
Quartile 4	14,067,361 (19.2)	1,003,605 (1.4)	13,063,756 (17.8)
Hospital characteristics			
Bed size			
Small	12,582,821 (17.0)	956,843 (1.3)	11,625,978 (15.7)
Medium	20,641,024 (27.8)	1,493,312 (2.0)	19,147,711 (25.8)
Large	41,021,896 (55.3)	2,893,990 (3.9)	38,127,906 (51.4)
Location			
Rural	16,823,121 (22.7)	1,309,044 (1.8)	15,514,077 (20.9)
Urban nonteaching	50,563,022 (68.1)	3,519,777 (4.7)	47,043,245 (63.4)
Urban teaching	6,859,597 (9.2)	515,324 (0.7)	6,344,273 (8.5)

the group with the highest adjusted relative hospital charges. Upper GI, colorectal, and gallbladder/biliary malignancies had mean hospital charges of $100,895 (95% CI $97,444–104,346), $83,760 (95% CI $81,847–$85,674), and $86,984 (95% CI $83,554–$90,415), respectively (Table 2). The GI conditions with the lowest relative adjusted hospital charges were noninfectious colitis (−$15,438, 95% CI −$15,954 to −$14,921), infectious gastroenteritis (−$12,658, 95% CI −$13,193 to −$12,122), chronic pancreatitis (−$10,986, 95% CI −$11,941 to −$10,031), and diverticular disease (−$10,839, 95% CI −$11,266 to −$10,411).

Readmission

Comparing the adjusted odds ratio (aOR) for 30-day readmissions for various GI indications to those for non-GI conditions, every GI indication was associated with increased odds of readmission (Figure 4). Gastroparesis (aOR 2.15, 95% CI 2.09–2.22), gallbladder/biliary cancer (aOR 2.08, 95% CI 2.00–2.16), IBD (OR 2.07, 95% CI 2.03–2.11), and cholangitis (aOR 2.04, 95% CI 1.95–2.14) were the indications with the greatest odds of 30-day readmission compared to non-GI indications. Table 2 shows that for gastroparesis, gallbladder/biliary cancer, IBD, and cholangitis, 30-day readmissions comprised 14.8%, 22.0%, 12.0%, and 15.9% of total admissions for each respective indication.

Deaths

As shown in Figure 5, the only GI indications associated with significantly higher odds of death compared to non-GI indications were upper GI cancer (aOR 1.20, 95% CI 1.13–1.27) and pancreatic cancer (aOR 1.16, 95% CI 1.08–1.24). Inhospital mortality rates for patients hospitalized with these conditions during index hospitalization were 5.0% and 5.1%, respectively. All other GI indications, with the exception of gallbladder/biliary cancer, were associated with lower adjusted odds of death when compared to non-GI indications. Diagnoses with the lowest odds of death were IBD (aOR 0.276, 95% CI 0.253– 0.301), diverticular

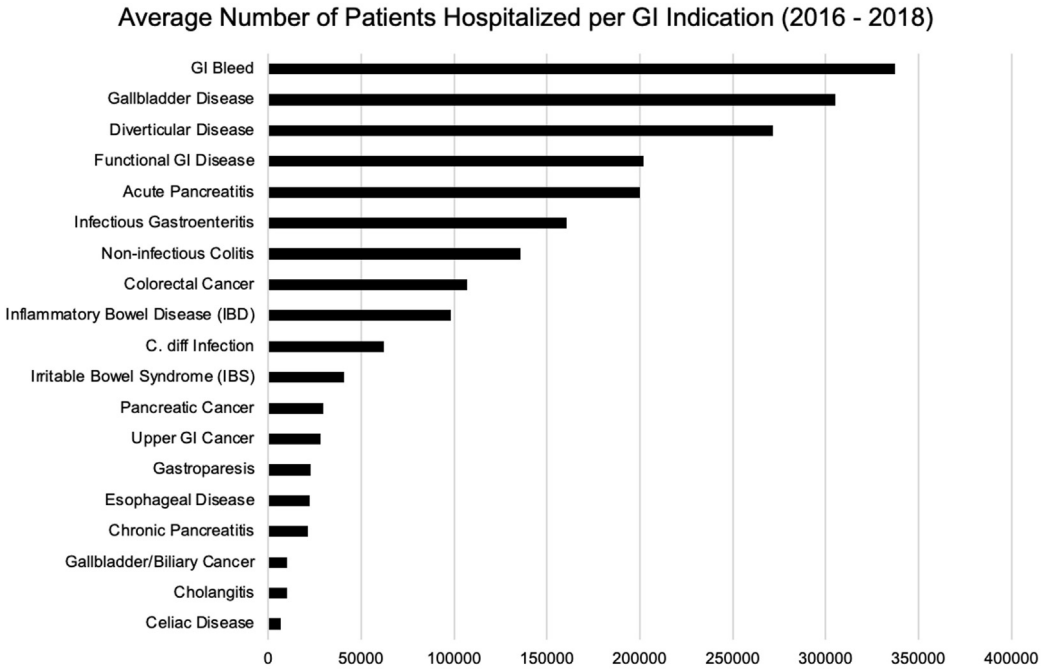

Figure 1. Average annual number of patients hospitalized per GI indication from 2016 to 2018.

disease (aOR 0.297, 95% CI 0.285– 0.310), and IBS (aOR 0.302, 95% CI 0.270– 0.338). Inhospital mortality rates for patients hospitalized with these conditions were 0.3%, 0.5%, and 0.4%, respectively.

Discussion

In this nationwide analysis, we compared healthcare utilization metrics between patients hospitalized for specific GI indications and those collectively hospitalized for non-GI indications. We found that GI bleed, gallbladder disease, and diverticular disease were the most common indications for hospitalization, while celiac disease, cholangitis, and gallbladder/biliary cancer were the least common. Conditions associated with increased relative adjusted LOS were upper GI cancer, *C difficile* infection, functional GI disorders, gallbladder/biliary cancer, colorectal cancer, pancreatic cancer, IBD, cholangitis, and gastroparesis. Upper GI, colorectal, and gallbladder/biliary cancer along with functional GI disorders, gallbladder disease, and cholangitis were associated with increased adjusted hospital charges. All GI indications were associated with increased adjusted odds of 30-day readmission, and the GI indications associated with the highest adjusted odds for readmission were gastroparesis,

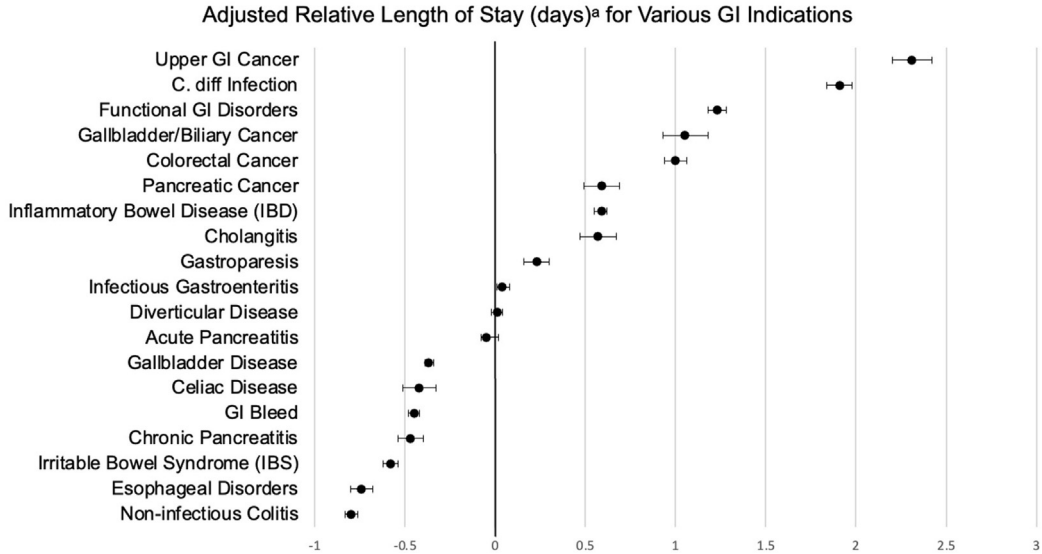

Figure 2. Adjusted relative length of stay (LOS) for GI indications compared to non-GI indications. [a]Adjusted for age, sex, primary payer, Charlson-Deyo comorbidity index, zip code income quartile, hospital size, and hospital location.

Table 2. Unadjusted Healthcare Utilization Metrics for GI Indications From 2016 to 2018

	Length of stay	Hospital charges	30 d readmissions	Deaths
GI disorders	Mean, d (95% CI)	Mean, dollars per patient (95% CI)	Weighted frequency, number of patients (%)	Weighted frequency, number of patients (%)
Esophageal disorders	3.96 (3.89–4.02)	51,777 (49,861–53,694)	5920 (8.8)	434 (0.6)
GI bleeds	4.55 (4.51–4.60)	48,499 (46,969–50,029)	113,345 (11.2)	20,257 (2.0)
Gastroparesis	4.68 (4.59–4.76)	46,849 (44,792–46,665)	10,020 (14.8)	342 (0.5)
Inflammatory bowel disease (IBD)	4.63 (4.59–4.68)	44,599 (42,934–46,263)	35,332 (12.0)	874 (0.3)
Diverticular disease	4.35 (4.33–4.38)	43,455 (41,876–45,034)	75,939 (9.3)	4399 (0.5)
Irritable bowel syndrome (IBS)	3.60 (3.56–3.65)	41,363 (39,735–42,991)	9201 (7.5)	513 (0.4)
Functional GI disorders	5.83 (5.76–5.89)	56,275 (54,656–57,894)	59,693 (9.9)	4815 (0.8)
Gallbladder disease	3.84 (3.82–3.86)	54,849 (53,262–56,437)	69,619 (7.6)	4649 (0.5)
Cholangitis	5.46 (5.35–5.57)	63,958 (60,787–67,130)	4764 (15.9)	476 (1.6)
Acute pancreatitis	4.48 (4.44–4.51)	41,849 (40,279–43,402)	55,811 (9.3)	4524 (0.8)
Chronic pancreatitis	4.40 (4.32–4.48)	41,759 (39,778–43,741)	9241 (14.8)	356 (0.6)
Celiac disease	3.67 (3.57–3.77)	39,197 (37,078–41,316)	1548 (7.5)	76 (0.4)
C diff infection	6.64 (6.56–6.73)	52,802 (50,866–54,737)	25,696 (13.8)	2849 (1.5)
Noninfectious colitis	3.54 (3.50–3.59)	32,956 (31,301–34,611)	36,307 (8.9)	2114 (0.5)
Infectious gastroenteritis	4.53 (4.48–4.57)	37,138 (35,535–38,741)	46,642 (9.7)	3734 (0.8)
Upper GI cancer	8.47 (8.34–8.60)	100,895 (97,444–104,346)	15,090 (17.8)	4282 (5.0)
Colorectal cancer	6.80 (6.74–6.87)	83,760 (81,847–85,674)	40,458 (12.6)	7055 (2.2)
Gallbladder/Biliary cancer	7.11 (6.97–7.26)	86,984 (83,554–90,415)	6698 (22.0)	1367 (4.5)
Pancreatic cancer	6.73 (6.61–6.86)	76,990 (74,225–79,725)	17,892 (20.0)	4511 (5.1)

gallbladder/biliary cancer, IBD, and cholangitis. Increased odds of adjusted inhospital mortality were found in upper GI cancer and pancreatic cancer.

Our findings have important implications for researchers, policy makers, and healthcare providers. Our finding that all GI indications were associated with increased odds of 30-day readmission when compared to non-GI indications collectively is novel and may guide future systems-based research. While prior research has identified risk factors for readmissions for individual diseases, it is unclear what is driving this readmission trend common to all GI disorders. Previously identified risk factors for individual disorders include lack of endoscopy on hospitalization and depression for ulcerative colitis, as well as

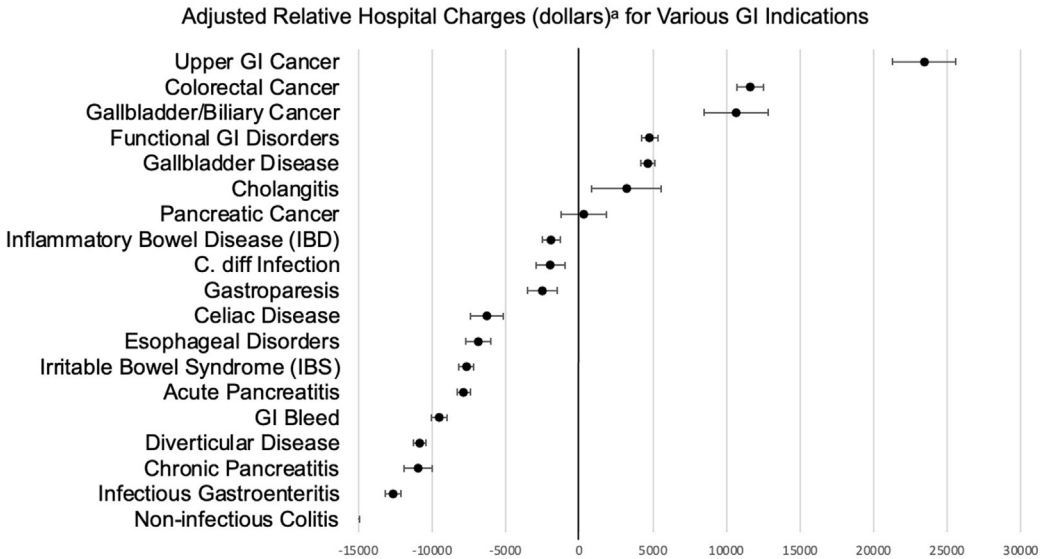

Figure 3. Adjusted relative hospital charges for GI indications compared to non-GI indications. [a]Adjusted for age, sex, primary payer, Charlson-Deyo comorbidity index, zip code income quartile, hospital size, and hospital location.

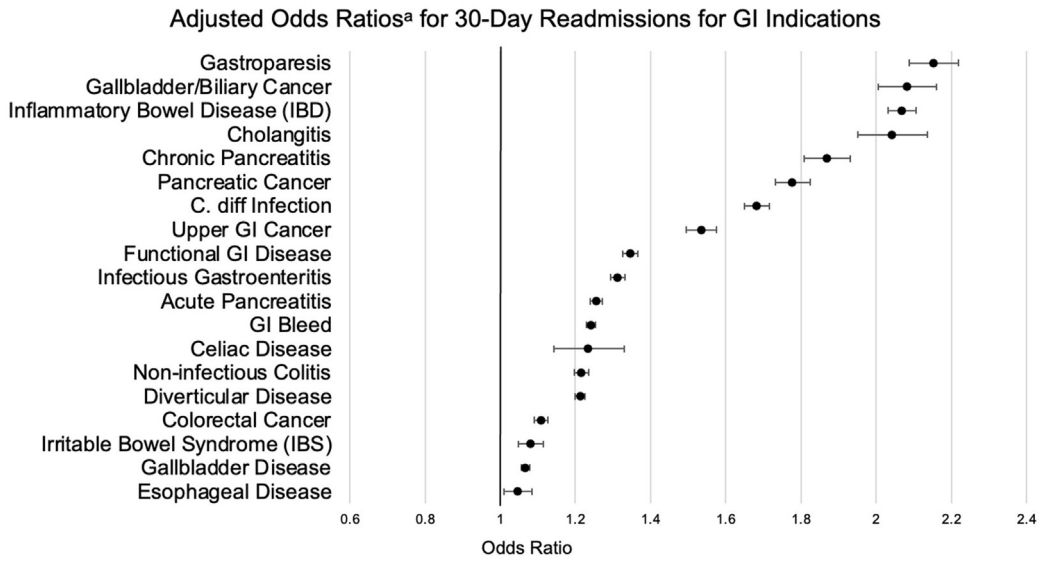

Figure 4. Adjusted odds ratio for 30-day readmissions for GI indications compared to non-GI indications. [a]Adjusted for age, sex, primary payer, Charlson-Deyo comorbidity index, zip code income quartile, hospital size, and hospital location.

polysubstance use, pancreatic neoplasms, or coexisting mental health disorders in acute and chronic pancreatitis.[6,7] The presence of any neoplasm is a risk factor for readmission for all hospitalized internal medicine patients.[8] For gastroparesis, a condition associated with multiple metrics of increased healthcare utilization in our study, prior research has demonstrated that post-discharge care fragmentation is a key driver of readmissions, LOS, and hospitalization costs for gastroparesis, an issue that may be driving utilization for other GI disorders as well.[9] Patients with GI disorders may also struggle with follow-up care due to limited availability of GI subspecialty care. Causes common to all GI disorders, including systemic causes such as poor post-discharge follow-up require further investigation.

Another consideration is the chronic nature of GI conditions that may lead to increased risk of readmission. Between 2005 and 2018, the most common discharge diagnoses were septicemia, heart failure, osteoarthritis, childbirth complications, and pneumonia.[10] Apart from osteoarthritis, these conditions have acute or acute-on-chronic presentations that may have lower risk of admission than the GI conditions in our study, many of which are chronic, recurrent diseases that may have increased likelihood of readmission. As noted previously, the chronic, recurrent nature of GI disorders may explain why post-discharge care fragmentation may affect utilization among GI conditions more than non-GI conditions. This highlights the need for future research into various patient-specific,

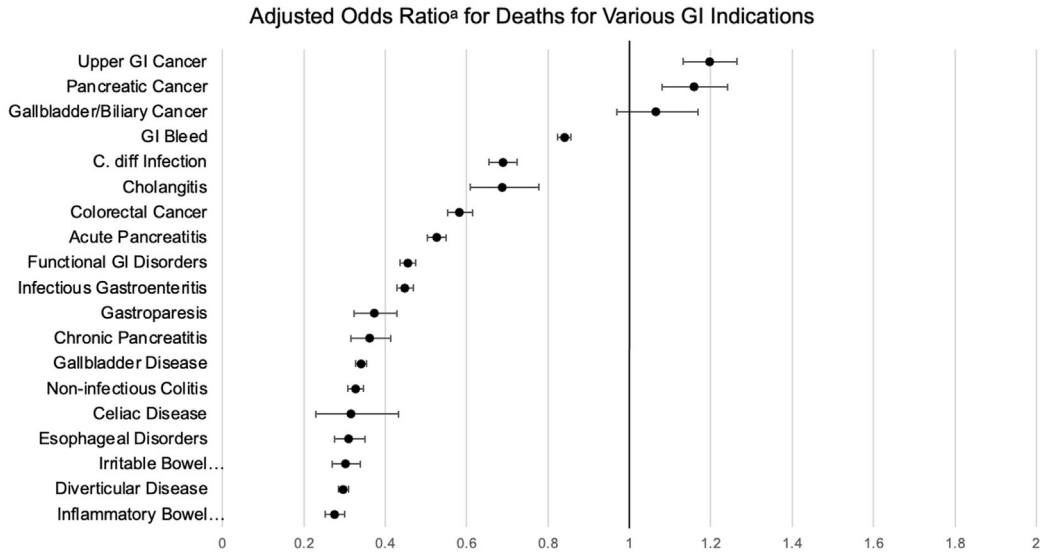

Figure 5. Adjusted odds ratio for deaths for various GI indications compared to non-GI indications. [a]Adjusted for age, sex, primary payer, Charlson-Deyo comorbidity index, zip code income quartile, hospital size, and hospital location.

GI-specific, and systems-level factors that predict hospital admission for all GI conditions.

Our study highlights several individual conditions associated with high healthcare utilization for which research should be done to identify interventions that may decrease utilization burden. For gastric cancer (part of upper GI cancer), 5-year survival remains below 30% for all cases and below 5% for those diagnosed with metastatic disease.[11] Our study demonstrates that patients with gastric cancer still have increased LOS, hospitalization costs, and readmission risk relative to patients with non-GI indications. There are no US screening guidelines for gastric cancer, and current American Gastroenterological Association guidelines for surveillance of premalignant gastric cancer are reported to be based on very low quality of evidence.[12] Future research is warranted into screening and surveillance programs despite the low incidence of gastric cancer given the ongoing resource burden demonstrated.

Cholangitis was also associated with increased healthcare utilization across multiple metrics, specifically LOS, total charges, and readmissions, though was infrequently an indication for hospitalization. The ICD-10 coding in our study (Table A1) defines cholangitis as bacterial or primary sclerosing cholangitis (PSC). For patients with PSC, the lack of effective medical therapies and long-term complications of cirrhosis, biliary strictures, and cholangiocarcinoma likely contribute to the significant healthcare burden seen in our study.[13] To our knowledge, there are no studies addressing utilization patterns of bacterial cholangitis or PSC. Our findings demonstrate that cholangitis, although an uncommon indication for hospitalization, remains a significant contributor to healthcare utilization, the drivers of which warrant future research.

Using our study, policy makers may be able to concentrate their efforts on changes to reduce the resource burden among the conditions with the highest utilization metrics. Intraluminal GI malignancies (upper GI and colorectal cancer) were associated with increased utilization burden across multiple metrics. Despite existing American Gastroenterological Association screening guidelines[14] for esophageal pre-malignant lesions, 37% of patients are diagnosed with metastatic esophageal cancer (part of upper GI cancer) at initial diagnosis.[15] Adherence to existing guidelines for Barrett's esophagus is improving, but remains relatively low overall, especially in community practice settings.[16] Prior studies have shown an association with lower socioeconomic status and decreased adherence to screening guidelines, suggesting limitations in access to care.[17] Policy changes addressing potential access to endoscopy as well as increased incentives, potentially through changes in payment structure, for providers who adhere to existing Barrett's screening guidelines may reduce the late-stage presentation of esophageal cancer and associated costs.

With improvement in colon cancer screening, US incidence has been decreasing over the past 3 decades with diagnosis at earlier stages of disease.[18] Despite this, there exist significant racial disparities in costs for colon cancer, with Black colorectal cancer patients having higher costs during every phase of care compared to White patients.[19] This may be a result of persistently low rates of colorectal cancer screening among Black populations due to patient, provider, and systems-level barriers.[20] While we were unable to stratify by race or ethnicity due to limitations in the NRD, policy changes addressing these barriers may help mitigate ongoing hospital-related healthcare costs demonstrated in this study.

For individual gastroenterology providers, our study has important implications for clinical practice. In particular, focusing on non-luminal GI cancers (pancreatic, gallbladder/biliary) our study demonstrated increased healthcare utilization across most utilization metrics. Five-year survival rates for gallbladder, biliary, and pancreatic cancer are poor, at 19%, 9%, and 9% respectively, with over 40% of cases presenting with distant disease at diagnosis.[21–23] There are limited data assessing the burden of gallbladder and biliary cancer, but recent studies have demonstrated that medical costs associated with pancreatic cancer have been rising, driven primarily by treatment of advanced cancer along with inpatient costs, which have nearly tripled over the last decade.[24,25] For gallbladder, biliary, and pancreatic cancer, the lack of effective screening measures, presence of advanced stage at diagnosis, and poor prognostic outcomes of these diseases highlight the importance of palliative care interventions to reduce healthcare utilization burden. It is well-established that palliative care leads to higher quality of life and lower costs for patients with poor-prognosis cancer.[26] Among pancreatic, gallbladder, and extrahepatic cholangiocarcinoma, there are low rates of palliative care consults (<15%), but there are significant reductions in cost of care in those who do engage with palliative care.[27–30] These data suggest timely referral and use of palliative care in the appropriate clinical setting may serve as a way to both improve patient-centered outcomes such as quality of life while also reducing healthcare utilization.

Our study has several strengths. The NRD allowed for weighted estimates of all hospitalizations throughout the United States, which allows for generalizability of our findings to a variety of different practice settings, geographic locations, ages, and socioeconomic backgrounds. Another strength of our study was its novelty as the first to compare relative inhospital utilization metrics between GI indications and non-GI indications. By controlling for various characteristics, including hospital, patient, and socioeconomic characteristics, we were able to make more generalizable conclusions that may be important in guiding future policy and research.

Limitations of this study included its retrospective and observational nature, with the inability to determine causation. Another limitation included the inability to track patients over multiple calendar years, which may lead to multiple hospitalizations counted for an individual patient over multiple years. However, given that the measure of utilization in our study is patients hospitalized

per year, this would not be expected to significantly alter our conclusions. There is a possibility that despite a GI indication listed as one of the first 3 diagnosis positions, a patient may have been hospitalized for a primarily non-GI related concern depending on the coding leading to overrepresentation of certain indications. Given the large number of possible GI conditions, we had to group related conditions into categories (eg, esophageal disorders). This action invariably led to some loss of granularity and introduced the risk of combining 2 or more GI conditions with differing impact on healthcare utilization. Another limitation of our study is that it did not include outpatient measures of healthcare utilization—however, given that hospitalizations comprise a significant portion of healthcare costs, our results still provide important data to guide policy, funding, and resource management. Prior research has additionally demonstrated disparities in utilization between malignancies, however, the NRD did not allow for analysis of race or ethnicity data, and future research should address these disparities. Given the use of a nationwide database, our study was limited by the lack of certain granular data such as disease severity, cancer subtypes, and presence of metastatic disease, which would be helpful in targeting future efforts.

Conclusion

Our study provides novel insights into the relative impact of GI disorders on healthcare utilization as compared to a collective of non-GI disorders. The high healthcare utilization among GI disorders highlights the importance of assessing GI-specific patient, provider, or systems-level issues that may be contributing to increased hospital-related utilization. Our study highlighted individual disorders with increased utilization across multiple metrics, such as upper GI cancer and cholangitis—additional research may be beneficial in understanding the factors at play that contribute to utilization burden of these conditions. Our findings highlight the importance of early detection and screening for eligible cancers, along with appropriate palliative care referrals for poor-prognosis cancers. As evidenced by the findings of our study, a better understanding of the contributions of GI conditions individually and collectively to healthcare utilization is required to guide future research, policy, and institutional resource management.

Supplementary Materials

Material associated with this article can be found in the online version at https://doi.org/10.1016/j.gastha.2023.01.002.

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Ethical Statement:
The corresponding author, on behalf of all authors, jointly and severally, certifies that their institution has approved the protocol for any investigation involving humans or animals and that all experimentation was conducted in conformity with ethical and humane principles of research.

Data Transparency Statement:
Data, analytic methods, and study materials will not be made available to other researchers.

Reporting Guidelines:
SAGER, STROBE.