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Emergency Department Utilization for Inflammatory Bowel Disease in the United States from 2006–2014

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Abstract

Background—Despite advances in treatment, patients with inflammatory bowel disease (IBD) frequently require emergency department (ED) visits and hospitalizations.

Aims—To analyze trends in ED visits and subsequent hospitalizations for IBD in the United States (US).

Methods—Data were analyzed from the Nationwide Emergency Department Sample (NEDS) years 2006–2014. The NEDS is the largest all-payer ED database in the US, weighted to represent 135 million visits/year. IBD was identified using ICD-9 codes for Crohn's disease (CD) or ulcerative colitis (UC). Surgeries were identified using procedure codes.

Results—The frequency of IBD-ED visits increased 51.8%, from 90,846 visits in 2006 to 137,946 in 2014, which was statistically significant in linear regression. For comparison, all-case ED use between 2006–2014 increased 14.8%. Inpatient hospitalizations from the ED decreased 12.1% for IBD (from 64.7% rate of hospitalization from the ED in 2006 to 52.6% in 2014), with a UC:CD ratio of 1.2:1 in 2006 and 1.3:1 in 2014. Chi-square analysis revealed that this was a significant decrease. Surgery rates also showed a statistically significant decrease. The mean ED charge per patient rose 102.5% and the aggregate national cost of IBD-ED visits increased 207.5%. CD accounted for over twice as many visits as UC in both years. UC, age, male sex, highest income quartile, private insurance, Medicaid/Medicare, and tobacco use were associated with inpatient admissions.

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Conclusions—The number of ED visits due to IBD and associated charges have continued to rise, while the rates of inpatient hospitalizations referred from the ED and surgeries have decreased.

Keywords

Inflammatory Bowel Disease; Crohn's Disease; Ulcerative Colitis; Healthcare Utilization

Introduction

Inflammatory Bowel Disease (IBD), including ulcerative colitis (UC) and Crohn's disease (CD), are chronic, gastrointestinal conditions associated with significant morbidity and healthcare utilization^{1–3}. By recent estimates, IBD accounts for approximately 1.89 million outpatient visits per year and is the 8th leading physician diagnosis for gastrointestinal disorders in outpatient clinics in the United States (including primary, secondary, and tertiary care)^{4–6}. Given the chronic, relapsing and remitting nature of both UC and CD, these illnesses are associated with high rates of emergency department (ED) visits, hospitalizations, and surgeries^{7,8}. As a result, with over 1.6 million Americans affected by IBD, the public health burden of these conditions is significant and estimated total annual direct health care costs are as high as \$6.3 billion in the United States (US) alone^{9,10}.

The ED represents an important, but costly, healthcare resource for patients with IBD, especially in the setting of acute disease flares or complications. One study using an administrative database of approximately 19,400 IBD patients, reported that the mean number of excess ED visits (i.e. number exceeding the mean for healthy controls) between 2003–2004 was 20.1 for CD patients and 10.3 for UC patients per 100 persons¹¹. Female sex, younger age, and Medicaid insurance were associated with more frequent visits to the ED¹¹. Studies have also shown an overall increase in the trend of IBD-related ED visits between 1994 and 2005, with an overrepresentation of young, self-paying patients with CD presenting to the ED⁶.

Most of the available information on healthcare costs and utilization associated with IBD have come from data collected in the 1990s and early 2000s. Since that time, the use of biologic agents has expanded significantly, which may affect the above-mentioned costs and statistics related to IBD. For example, recent single-center studies have reported a decrease in IBD related ED visits, surgeries and hospitalizations with use of anti-tumor-necrosis factor agents^{12,13}. One study using data from the National Emergency Department Sample (NEDS) from 2009–2011 reported an increase in ED visits, a decrease in IBD-related hospitalizations, and stable IBD-related ED charges, despite an increase in overall ED charges in those years¹⁴.

The current study aims to provide trends in ED visits and ED-associated costs for patients presenting with a primary diagnosis of IBD between 2006 and 2014 using the NEDS. Secondary aims include comparing trends between CD and UC, and evaluating clinical, demographic, and lifestyle variables as predictors of hospital admission following IBD-related ED visits.

Methods

This study evaluated trends in IBD presentation to the ED from 2006 to 2014 by identifying ED visits with primary diagnosis of IBD using ICD-9 codes for CD (550.0-555.9) and UC (556.0-556.9) in the NEDS database, available from the Healthcare Utilization Project (HCUP) maintained by the Agency for Healthcare Research and Quality^{15,16}. The NEDS is the largest accessible all-payer emergency department database in the US that is available to the public, providing national ED information regarding patient and hospital demographics, including hospital region, patient age, and primary payer. Summary statistics for these data are available with HCUPnet, a free online service provided by AHRQ. The NEDS contains data that approximates ED statistics from roughly 20 percent of annual ED visits each year in the US (the 2006 NEDS surveyed 955 hospitals; the 2014 surveyed 945 hospitals). The data is then weighted to provide nationally representative estimates.

Study Variables

Diagnoses (ICD-9 codes)—The codes for CD (ICD-9-CM diagnosis codes 555.0-555.9) and UC (ICD-9-CM diagnosis codes 556.0-556.9) were combined to evaluate total IBD ED visits. These codes were also analyzed individually in order to determine the relative frequency of CD- and UC-related ED visits. Data were only used if an ICD-9 CM code of UC or CD was listed as the primary diagnosis, as this is most likely to reflect the primary reason for the ED visit. After establishing a database of IBD ED visits, a search was performed using the code for tobacco use/abuse disorder (ICD-9-CM code 305.1) in order to evaluate smoking-related differences in ED utilization and hospitalization among IBD patients.

Inpatient surgeries (ICD-9) codes—Surgeries during inpatient hospitalization were identified using the following ICD-9 codes: 1) Incision, excision, and anastomosis of intestine (45.0x, 45.33, 45.5x, 45.6x, 45.9x); 2) Large intestinal resection (45.7x, 45.8, 45.92, 45.93, 45.94, 45.95); 3) Rectal, perianal, rectosigmoid surgery (48.x, 49.01, 49.02, 49.03, 49.04, 49.11, 49.12); 4) Stoma surgery (46.1, 46.2); and 5) other operations on the intestine (46.3–46.9).

Demographic variables—Demographic data were retrieved according to predefined categories set by HCUP such as age, sex, charge (both ED and inpatient), primary payer (Medicare, Medicaid, private – including HMO, and other – including self-pay and no-charge), and hospital region (Northeast, Midwest, South, and West)

Statistical Analysis

Statistical analysis was performed using STATA/SE 14.1 using the source files for the 2006 and 2014 NEDS. All charge data reported were inflation adjusted to 2017 dollars using the Consumer Price Index (CPI) inflation calculator¹⁷. Total charge data were obtained by multiplying the mean charge in a year by the total number of visits for a year.

Descriptive data (number of visits; percentage of visits) were obtained through HCUP. The rates of IBD, CD, and UC ED visits per 100,000 visits were calculated for all patient and

hospital characteristics by dividing the number of IBD, CD, and UC ED visits in each category by the total number of ED visits within that respective category, then multiplying by 100,000. Chi square analysis was used to compare frequencies of surgeries and hospitalizations from the ED in 2006 and 2014. Linear regression models were used to assess the statistical significance of trends in ED visit rates per 100,000 ED visits between 2006–2014.

The demographic/lifestyle variables presented in table 1 were entered into univariate analyses to predict inpatient admissions from the ED: age, gender, primary payer, highest/lowest income quartiles, tobacco use, and IBD diagnosis. Multivariable logistic regression was then used to predict inpatient admissions for the variables that were significant in univariate regression.

Results

ED Rates and Charges

From 2006 to 2014, ED visits with a primary diagnosis of IBD rose by 51.8%, from 90,846 in 2006 to 137,946 in 2014 (Table 1), with IBD constituting 0.07% of all ED visits in 2006 and 0.1% in 2014. By comparison, for all diseases in the US there were an estimated 120,033,750 total visits to EDs in 2006 and 137,807,901 total ED visits in 2014, an increase in total ED visits by 14.8%. The rate of IBD ED visits per 100,000 total ED visits rose significantly, from 75.7 per 100,000 in 2006 to 100.1 per 100,000 in 2014, a 32.2% increase ($p<0.001$ for 9-year trend, Figure 1). CD accounted for more than twice as many ED visits as UC in both 2006 (63,000 vs 27,846) and 2014 (93,277 vs 44,669).

ED visits with a primary diagnosis of IBD had a substantial increase in charges from 2006 to 2014. The aggregate national charge (in 2016 dollars) of IBD ED visits increased by 207.5%, from \$194,773,824 in 2006 to \$598,961,532 in 2014. The mean charge of a single ED visit for IBD grew by 102.5%, from \$2,144 in 2006 to \$4,342 in 2014. The total charges associated with CD ED visits rose 196% from \$140,805,000 in 2006 to \$416,854,913 and the mean charge of a single CD ED visit rose 100% from \$2,235 to \$4,469. Similarly, total ED charges for UC rose 239% from \$53,492,166 to \$181,222,133 and single UC visit charges rose 111% from \$1,921 to \$4,057 (table 1).

Demographics

Age—A significant increase in IBD ED visit rates per 100,000 ED visits was observed across all age groups from 2006 to 2014. The group with the greatest increase in ED visit rate was the 18–44 age group with a 41.7% increase, followed by the 45–64 age group, which increased 16.7%. The group with the smallest increase in rate was the 85+ age group with a 3% increase (table 2). In both 2006 and 2014, 18–44 year olds had the highest rate of CD ED visits per 100,000 ED visits, with the second highest rate seen in 45–64 year olds (Table 2). In UC, however, the 65–84 year olds had the highest rate of ED visits per 100,000 in 2006, while in 2014, the highest rate was seen among 18–44 year olds.

Gender—Men and women visited the ED with a primary diagnosis of IBD at similar rates in 2006 and 2014, with men comprising 44.2% of the visits in 2006 and 45.9% in 2014

(table 1). Both male and female IBD ED visits rates per 100,000 increased, but at different rates from 2006 and 2014, with male visits increasing by 40.9% and female visits by 25.5%, (Table 2).

In 2006, women visited the ED with a primary diagnosis of CD at a rate of 54.2 per 100,000, while men with a primary diagnosis of CD visited the ED at a rate of 50.4 per 100,000. These rates increased by 21.4% for women and 38.9% for men in 2014. In 2006, women visited the ED with a primary diagnosis of UC at a rate of 23.5 per 100,000, while men with UC visited the ED at a rate of 22.9 per 100,000. From 2006 to 2014, male visits to the ED with UC increased by 45.4% and female visits increased by 34.9%.

Location—In 2006, the Northeast had the highest rate of IBD ED visits per 100,000 (90.7 per 100,000) while the South had the lowest rate (68.7 per 100,000). In 2014, the Midwest had the highest rate of IBD ED visits per 100,000 (104.8) and the West had the lowest rate (85.7). The South experienced the greatest percentage increase in rate (48.5%) between years (Table 2). Regional trends in ED visits related to CD and UC specifically are shown in Tables 1 and 2.

Payment—Private insurance paid for the highest percentage of IBD ED visits in 2006 (48.3%), and had the highest rate per 100,000 ED visits with private insurance (105 per 100,000). Medicaid was the payer with the lowest percentage of visits (14.6%) and lowest rate of visits (49.7 per 100,000). In 2014, the rate of visits per 100,000 increased in each category of payer, however both Medicaid and Other/self-pay/Uninsured increased at the higher rates 62.0% and 52.6% respectively) compared to private insurance and Medicaid (Table 1 and Table 2).

The pattern seen in payer distribution for IBD-related ED visits in terms of both number (Table 1) and rate per 100,000 (Table 2) also applies to CD and UC individually. In both cases, the greatest percent increase in rate between years was in Medicaid (51.8% and 93.4% respectively) and Other/Uninsured (44.3% and 66.9% respectively) (Figure 2). Additional information on primary payer for CD and UC can be found in Table 1.

Surgeries after admission from the ED—The rates of surgery in IBD patients admitted to the hospital from the ED decreased from 9.1% of all ED visits in 2006 to 5.6% of all ED visits in 2014. Chi-square revealed that this was a significant difference ($p<0.001$).

UC patients admitted to the hospital from the ED had a higher rate of surgery than CD patients in both years. In 2006, 13.4% of all ED visits for UC underwent surgery compared to 7.2% of all ED visits for CD. In 2014, 7.8% of all ED visits for UC had surgical procedures compared to 4.5% of all ED visits for CD (Table 1).

Predictors of IBD inpatient admissions from the ED

Overall, the rate of IBD-related inpatient admissions from the ED decreased 12.1% in the study period (from 64.7% in 2006 to 52.6% in 2014), table 1. Chi-square analysis revealed that this was a significant decrease ($p<0.001$). In univariate analysis, all variables in table 1 were significant at $p<0.001$ and, thus, were entered into multivariable analyses for each year.

Due to collinearity, region was not entered into the multivariable model. In both years in univariate analysis, patients from the Northeast were significantly more likely to be admitted from the ED (OR 2006=1.44 and 2014=1.23) while patients from the Midwest (OR 2006=0.95 and 2014=0.89) and West (OR 2006=0.86 and 2014=0.84) were less likely to be admitted from the ED. In 2006, patients from the South were significantly less likely to be admitted (OR=0.87), while in 2014 they were more likely to be admitted from the ED (OR=1.03).

In multivariable analysis, patients with Crohn's disease were significantly less likely to be admitted to the hospital from the ED than patients with UC in both 2006 and 2014 (POR 2006 CD= 0.60 and 2014 CD = 0.62, both $p < 0.001$). Other factors that were significantly associated with IBD inpatient admissions from the ED in both 2006 and 2014 included age (2006 POR =1.03; 2014 POR=1.02, both $p < 0.001$), being a current or former smoker (2006 POR =2.77; 2014 POR=1.30, both $p < 0.001$), having private insurance (2006 POR =1.73; 2014 POR=1.23, both $p < 0.001$), and living in the highest income quartile (2006 POR =1.31; 2014 POR=1.19, both $p < 0.001$). Factors associated with not being admitted to the hospital included being female (2006 POR =0.88; 2014 POR=0.91, both $p < 0.001$), and living in the lowest income quartile (2006 POR =0.92; 2014 POR=0.96, both $p < 0.001$) (table 3). Table 4 describes these factors by year and by IBD subtype. The multivariable model in 2006 produced an area under the receiver operating characteristic of 0.66 and the 2014 model produced an area under the curve of 0.70.

Discussion

The results of this study show several important trends using a nationally representative sample of IBD-related visits to the ED from 2006–2014 in the US. Overall, the number of ED visits with a primary diagnosis of IBD rose 51.8% between 2006 and 2014, with CD accounting for over twice as many ED visits compared to UC. This is in contrast to the overall number of all-case ED visits, which increased by just 14.8% during the same period. Interestingly, the rate of IBD-related inpatient admissions from the ED decreased 12.1% and the rate of inpatient surgeries referred from the ED decreased 3.4%. Although there were lower rates of UC ED visits than CD ED visits, patients with UC were significantly more likely to be admitted to the hospital compared to patients with CD. The total charges for IBD ED visits also increased between 2006–2014, from over \$194 million in 2006 to more than \$598 million in 2014 (208% increase).

Our observed increase in IBD ED visits between 2006–2014 is lower than the previously reported 165% increase in ED visits due to IBD from 1994–1996 to 2003–2005⁶ and is similar to a recent report documenting GI, Liver, and Pancreatic diseases in the US, which found a 38% increase in ED visits for IBD from 2006–2012¹⁸. Better utilization of ambulatory and urgent care services, introduction of biologics in the late 1990s, more aggressive treatment goals of mucosal healing and deep remission, and increased access to maintenance healthcare could explain the decrease in the rate of ED visits over the last 2 decades. For example, between 2007–2015, the proportions of patients using biologics, which have been associated with improved medical outcomes¹⁹, increased from 22%-44% in CD and 5%-16% in UC²⁰. However, despite the lower rate of increase of ED visits due to

IBD in recent years, the overall number of ED visits due to IBD continues to rise, which may be attributable to a variety of factors. Though increased access to healthcare might explain the lower rate of increase in ED visits for IBD, high healthcare costs may simultaneously contribute to the continued increase in rate of IBD ED visits. In addition, despite the improvement in medical management of IBD, the rate of prescription of narcotics in these patients has not significantly changed between 2003 and 2011 and opiate use has been shown to be an independent predictor of ED utilization among IBD patients^{21,22}.

The incidence of IBD appears to be rising worldwide^{23–25}. In the US, data from The Rochester Epidemiology Project has demonstrated a rising incidence of IBD in a population-based cohort of Olmsted County, Minnesota since 1940, with a 41% increase for CD between 2000–2010 and a 34% increase for UC in that same time period^{26,27}. One study evaluating claims data from approximately 12 million commercially insured Americans from 2004–2009 found a 10% increase in CD and a 6% increase in UC in those 5 years. Interestingly, IBD-related ambulatory care visits in the United States appear to have leveled since the year 2000^{6,28}. As such, the 51.8% increase in ED visits for IBD from 2006–2014 demonstrated in this study appears to be higher than the reported increase in incidence of IBD in similar time periods and does not follow reported trends in outpatient care utilization for IBD.

In the current study, the 18–44 year age group had the highest rate of IBD-related ED visits in both 2006 and 2014, a finding consistent with other studies⁷. This disproportionate trend may be explained, in part, by the fact that younger patients are more likely to have newer diagnoses and potentially more severe disease compared with older individuals^{7,8}. Indeed, it has previously been shown that patients who have had IBD for less than five years have the highest rates of utilization of healthcare resources compared to people who have had IBD for a longer time and those without IBD⁷. Younger patients with IBD are also more likely to be non-adherent to treatment regimens compared to older patients which could also contribute to higher ED visits²⁹.

All forms of payment showed increases for IBD-related ED visits with Medicaid showing the largest change over time, with an increase of 62% from 2006 to 2014 in IBD-related visits to the ED. Uninsured patients, self-pay, or patients with ‘other’ insurance also showed a significantly higher increase in IBD-related ED visits of about 52% over the study period. This pattern was the same when looking at CD and UC separately. Kappelman et al also showed that despite similar numbers of outpatient visits, IBD patients with Medicaid insurance were more likely to visit an ED than those with commercial insurance¹¹, which may be due to perceived barriers to outpatient services rather than differences in patient-perceived acuity³⁰. Improving outpatient access and minimizing barrier to ambulatory healthcare for Medicaid patients might minimize the health care burden due to ED visits among these patients.

There were also significant regional differences in IBD ED visits, with the Northeast accounting for the most visits per 100,000 in 2006 and the second most in 2014 (trailing the Midwest). Interestingly, this finding does not match the trends reported for all ED visits in

the United States, where the Northeast accounted for the smallest percentage of all ED visits in 2014 (18.58%) and the third smallest percentage in 2006 (19.62%)³¹. However our finding closely reflects the regional variation of IBD prevalence in the United States, with the highest prevalence of IBD being reported in the Northeast followed by the Midwest^{32,33}. One recent study has suggested that lower UV exposure may be associated with increased hospitalizations and surgeries for IBD³⁴, which may partially explain the regional differences found here.

During 2006 and 2014, the rate of hospitalization after ED visits decreased by 12% for IBD patients and the rate of surgery decreased 3.4%. Previously, Gajendran et al showed that between 2009 and 2011, there was a 3% decrease in the rate of hospitalization from IBD visits to the ED¹⁴. Severe IBD flare and related complications such as intra-abdominal abscess typically warrant inpatient admission and surgery. Thus, it is possible that despite an increase in IBD ED visits, the rate of inpatient admissions and surgeries are decreasing because patients are experiencing fewer medical complications.

We found several significant demographic and lifestyle predictors of IBD-related inpatient admissions from the ED including ulcerative colitis, older age, male gender, history of smoking, having private insurance, and living in the highest income quartile. Our findings are consistent with previous research indicating that patients with UC have higher hospitalization rates¹⁴, and that although a higher proportion of female and younger patients typically present to the ED for IBD care¹¹, they are less likely to be hospitalized after those visits when compared to males and older patients¹⁴. Reasons for higher hospitalization rates in UC are likely multifactorial and warrant further research. Our findings are consistent with the finding that UC patients admitted from the ED had higher surgery rates than CD patients admitted from the ED, which may indicate that the patients with UC presented to the ED with more severe disease or more complications compared to CD patients in the ED.

Finally, we found that IBD patients in the ED with a secondary diagnosis of tobacco use were significantly more likely to be admitted to the hospital in both 2006 and in 2014, which held true for both CD and for UC patients. This is interesting in light of research regarding the opposing effects of smoking on CD compared to UC, where smoking is detrimental to patients with CD but can be protective in those with UC^{35–37}. In the current study, the likelihood of inpatient admission in those with secondary diagnosis of tobacco use decreased for both CD and UC from 2006–2014, though the odds ratios were higher for CD compared to UC in both years. One recent study reported reduced corticosteroid utilization among smokers with UC, but no reductions in surgery or hospitalization rates³⁸. It is possible that tobacco use is associated with other comorbidities, which could impact likelihood of inpatient admissions, even among those with UC. Additional inquiry is warranted in this area.

There are several important limitations to this study. First, we do not include the ambulatory trends or hospitalization-related costs for IBD-related care, and thus cannot make comparisons with the rise in ED visits and costs. Second, the data set utilized here includes data from 950 hospitals, and coding/reimbursement practices may vary among each institution and/or by region. Third, this study included only ED visits in which IBD was the

primary diagnosis, and may underestimate the number of ED visits if there were visits in which IBD was not the primary discharge diagnosis. Fourth, the area under the ROC for our predictive models did not suggest an ideal fit for our data. This was not unexpected, however, as our model was based on lifestyle and demographic factors available through this database and was not comprehensive. Finally, this data set includes years in which the Affordable Care Act was implemented, which may have affected the trends seen here. Future studies should evaluate medical comorbidities of IBD in the ED and should seek to compare ED with ambulatory care data.

Conclusion

The number and associated charges of ED visits related to IBD (and to CD and UC individually) have increased substantially between 2006 and 2014. However, the rates of inpatient admissions from the ED and surgeries for IBD have declined. Future studies are needed to assess ways that patients frequently seeking ED care can be more effectively managed.

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Figure 1.
IBD-related ED visits per 100,000 ED visits between 2006–2014
Emergency Department (ED) visits with a primary diagnosis of IBD in the United States from 2006–2014. Data are presented as number of IBD visits to the ED per 100,000 ED visits.

Figure 2.

IBD per 100,000 ED visits by payer in 2006 and 2014

Healthcare coverage for Emergency Department (ED) visits with a primary diagnosis of IBD in 2006 and 2014 in the United States. Data are presented as number of IBD visits to the ED per 100,000 ED visits.

Table 1

ED visits with a primary diagnosis of IBD in 2006 and 2014

	2006 IBD N	2014 IBD N	2006 CD N	2014 CD N	2006 UC N	2014 UC N
Number of ED Visits N [% of ED visits]						
	90,846 [100]	137,946 [100]	63,000 [100]	93,277 [100]	27,846 [100]	44,669 [100]
Mean Cost of ED Visit N (95% CI)	\$2,144 (2,124–2,164)	\$4,342 (4,313–4,373)	\$2,235 (2,211–2,259)	\$4,469 (4,433–4,505)	\$1,921 (1,886–1,956)	\$4,057 (4,001–4,114)
Total Cost of ED Visits N (95% CI)	\$194,773,824 (192,956,904 – 196,590,744)	\$598,961,532 (597,961,098 – 603,237,858)	\$140,805,000 (139,293,000 – 142,317,000)	\$416,854,913 (413,496,941 – 420,212,885)	\$53,492,166 (52,517,556 – 54,466,776)	\$181,222,133 (178,720,669 – 183,768,266)
Number admitted to inpatient N [% ED visits]	58,777 [64.7]	72,559 [52.6]	38,651 [61.4]	45,070 [48.3]	20,509 [73.7]	27,488 [61.53]
Inpatient surgeries admitted from ED N [% of ED visits]	8,274 [9.11]	7,721 [5.60]	4,537 [7.20]	4,218 [4.52]	3,737 [13.42]	3,503 [7.84]
Mean Age N (95% CI)	40.8 (40.7 – 40.9)	40.4 (40.3 – 40.5)	39.0 (38.7 – 39.3)	39.1 (38.8 – 39.3)	45.1 (44.8 – 45.3)	43.1 (42.9 – 43.3)
Age years N [% ED visits]						
1–17	4,499 [4.9]	5,113 [3.7]	2,921 [4.6]	3,275 [3.5]	1,563 [5.6]	1,838 [4.1]
18–44	53,221 [58.6]	84,250 [61.1]	39,873 [63.3]	60,394 [64.8]	13,348 [48.0]	23,857 [53.4]
45–64	22,217 [24.5]	33,789 [24.5]	15,065 [23.9]	22,059 [23.7]	7,152 [25.7]	11,729 [26.3]
65–84	9,558 [10.5]	12,998 [9.4]	4,628 [7.4]	6,789 [7.3]	4,930 [17.7]	6,208 [13.9]
85+	1,352 [1.5]	1,760 [1.3]	510 [0.8]	742 [0.8]	841 [3.0]	1,018 [2.3]
Sex N [% ED visits]						
Male	40,118 [44.2]	63,355 [45.9]	27,596 [43.8]	42,930 [46.0]	12,519 [45.0]	20,425 [45.7]
Female	50,728 [55.8]	74,586 [54.1]	35,396 [56.2]	50,342 [54.0]	15,321 [55.0]	24,244 [54.3]
Payer N [% ED visits]						
Medicare	18,419 [20.3]	28,044 [20.3]	11,570 [18.4]	19,108 [20.5]	6,848 [24.5]	8,936 [20.0]
Medicaid	13,184 [14.6]	35,524 [25.8]	9,965 [15.8]	25,191 [27.0]	3,220 [11.6]	10,333 [23.1]
Private Insurance	43,738 [48.3]	53,424 [38.7]	30,216 [48.0]	34,469 [37.0]	13,522 [48.6]	18,955 [42.4]
Other	15,252 [16.8]	20,954 [15.2]	11,061 [17.6]	14,387 [15.4]	4,256 [15.3]	6,406 [14.3]
Median Income						
Low	21,799 [24.4]	39,991 [29.6]	15,608 [24.8]	27,986 [30.0]	6,191 [22.2]	12,004 [26.9]
Not Low	67,267 [75.6]	95,359 [70.5]	46,317 [73.5]	63,594 [68.2]	20,950 [75.2]	31,765 [71.1]

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	2014 IBD N	2006 IBD N	2014 CD N	2006 CD N	2014 UC N	2006 UC N	2014 UC N
N [% ED visits]							
Region							
N [% ED visits]							
Northeast	21,361 [23.5]	26,792 [19.4]	14,742 [23.4]	17,465 [18.7]	6,619 [23.8]	9,327 [20.9]	
Midwest	21,894 [24.1]	32,707 [23.7]	15,603 [24.8]	23,358 [25.0]	6,291 [22.6]	9,350 [20.9]	
South	32,224 [35.5]	56,399 [40.9]	23,154 [36.8]	39,753 [42.6]	9,070 [32.6]	16,646 [37.3]	
West	15,366 [16.9]	22,048 [16.0]	9,501 [15.1]	12,702 [13.6]	5,866 [21.0]	9,346 [20.9]	
Tobacco use/abuse							
N [% ED visits]	12,118 [13.4]	25,917 [18.8]	10,090 [16.0]	20,846 [22.4]	2,027 [7.3]	5,071 [11.35]	

Table 2

ED visits with primary diagnosis of IBD per 100,000 ED visits in 2006 and 2014

		IBD ED Visits per 100,000 Visits in 2006	IBD ED Visits per 100,000 Visits in 2014	CD ED Visits per 100,000 Visits in 2006	CD ED Visits per 100,000 Visits in 2014	UC ED Visits per 100,000 Visits in 2006	UC ED Visits per 100,000 Visits in 2014
Number of ED Visits		75.7	100.1	52.5	67.7	23.2	32.4
Age	<i>1-17</i>	19.7	22.1	12.8	14.1	6.8	7.9
	<i>18-44</i>	109.6	155.3	82.1	111.4	27.5	44.0
	<i>45-64</i>	89.4	104.3	60.6	68.1	28.8	36.2
	<i>65-84</i>	60.6	67.2	29.3	35.1	31.2	32.1
	<i>85+</i>	30.6	31.7	11.5	13.4	19.0	18.3
Sex	<i>Male</i>	73.3	103.3	50.4	70.0	22.9	33.3
	<i>Female</i>	77.7	97.5	54.2	65.8	23.5	31.7
Payer	<i>Medicare</i>	75.9	90.0	47.7	61.3	28.2	28.7
	<i>Medicaid</i>	49.7	80.5	37.6	57.1	12.1	23.4
	<i>Private Insurance</i>	105.2	142.9	72.7	92.2	32.5	50.7
	<i>Other</i>	55.1	84.1	40.0	57.7	15.4	25.7
Median Income	<i>Low</i>	59.6	84.3	42.7	59.0	16.9	25.3
	<i>Not Low</i>	83.3	109.0	57.3	72.7	25.9	36.3
Region	<i>Northeast</i>	90.7	104.6	62.6	68.2	28.1	36.4
	<i>Midwest</i>	78.7	104.8	56.1	74.8	22.6	30.0
	<i>South</i>	68.7	102.0	49.4	71.9	19.3	30.1
	<i>West</i>	70.6	85.7	43.7	49.4	27.0	36.3

Table 3

Multivariable analysis of Factors associated with inpatient admissions after an ED visit for IBD the U.S. Population in 2006 and 2014.

Predictor variables	2006		2014	
	POR	P [95% CI]	POR	P [95% CI]
Age	1.03	p<0.001 [1.02,1.03]	1.02	p<0.001 [1.02,1.02]
Female	0.88	p<0.001 [0.85,0.91]	0.90	p<0.001 [0.88,0.92]
Smoker	2.58	p<0.001 [2.46,2.70]	1.31	p<0.001 [1.26,1.34]
Crohn's	0.60	p<0.001 [0.58,0.62]	0.61	p<0.001 [0.60,0.63]
Private insurance	1.84	p<0.001 [1.77–1.91]	1.55	p<0.001 [1.50,1.60]
Medicare/Medicaid	1.42	p<0.001 [1.36–1.48]	1.37	p<0.001 [1.33,1.42]
Lowest income quartile	0.87	p<0.001 [0.85–0.91]	0.95	p<0.001 [0.93,0.98]
Highest income quartile	1.32	p<0.001 [1.27–1.37]	1.18	p<0.001 [1.15,1.22]

Table 4

Multivariable analysis of factors associated with inpatient admissions after an ED visit for CD or UC the U.S. population in 2006 and 2014.

	UC 2006		UC 2014	
	OR	p [95% CI]	OR	p [95% CI]
Age	1.02	p<0.001 [1.02,1.03]	1.02	p<0.001 [1.02,1.02]
Female	0.95	NS [0.89,1.00]	0.86	p<0.001 [0.82,0.89]
Smoker	1.70	p<0.001 [1.51,1.90]	1.19	p<0.001 [1.11,1.26]
Lowest income quartile	0.76	p<0.001 [0.71,0.81]	1.03	NS [0.98,1.08]
Highest income quartile	1.32	p<0.001 [1.24,1.42]	1.27	p<0.001 [1.21,1.34]
Private insurance	1.34	p<0.001 [1.25,1.45]	1.32	p<0.001 [1.25,1.40]
Medicare/Medicaid	1.76	p<0.001 [1.62,1.92]	1.27	p<0.001 [1.20,1.35]
	CD 2006		CD 2014	
	OR	p [95% CI]	OR	p [95% CI]
Age	1.02	p<0.001 [1.02,1.03]	1.02	p<0.001 [1.02,1.02]
Female	0.86	p<0.001 [0.83,0.87]	0.92	p<0.001 [0.89,0.94]
Smoker	2.82	p<0.001 [2.67,2.96]	1.34	p<0.001 [1.30,1.39]
Lowest income quartile	0.92	p<0.001 [0.88,0.96]	0.92	p<0.001 [0.90,0.95]
Highest income quartile	1.31	p<0.001 [1.26,1.37]	1.14	p<0.001 [1.10,1.18]
Private insurance	2.07	p<0.001 [1.98,2.17]	1.67	p<0.001 [1.61,1.74]
Medicare/Medicaid	1.34	p<0.001 [1.27,1.40]	1.43	p<0.001 [1.37,1.49]