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Burden of Gastrointestinal, Liver, and Pancreatic Diseases in the United States

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Abstract

Background & Aims—Gastrointestinal (GI), liver, and pancreatic diseases are a source of substantial morbidity, mortality, and cost in the United States (US). Quantification and statistical analyses of the burden of these diseases are important for researchers, clinicians, policy makers, and public health professionals. We gathered data from national databases to estimate the burden and cost of GI and liver disease in the US.

Methods—We collected statistics on healthcare utilization in the ambulatory and inpatient setting along with data on cancers and mortality from 2007 through 2012. We included trends in utilization and charges. The most recent data were obtained from the Centers for Disease Control and Prevention, the Agency for Healthcare Research and Quality, and the National Cancer Institute.

Results—There were 7 million diagnoses of gastroesophageal reflux and almost 4 million diagnoses of hemorrhoids in the ambulatory setting in a year. Functional and motility disorders resulted in nearly 1 million emergency department visits in 2012; most of these visits were for constipation. GI hemorrhage was the most common diagnosis leading to hospitalization, with more than 500,000 discharges in 2012 at a cost of nearly $5 billion dollars. Hospitalizations and associated charges for inflammatory bowel disease, Clostridium difficile infection, and chronic liver disease have increased over the last 20 years. In 2011, there were more than 1 million people in the US living with colorectal cancer. The leading GI cause of death was colorectal cancer, followed by pancreatic and hepatobiliary neoplasms.

Conclusions—GI and liver diseases are a source of substantial burden and cost in the US.

Keywords

Abdominal pain; gastrointestinal hemorrhage; GERD; IBS; population

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Introduction

Gastrointestinal (GI) and liver diseases are highly prevalent, costly and lead to substantial health care utilization in the United States. Many of these diseases also affect patients' quality of life and productivity.[1] Given this burden of disease, the National Institutes of Health plans to devote an estimated $1.6 billion dollars to GI research and another $619 million dollars to liver disease research in 2015.[2]

Statistics quantifying the burden of GI and liver diseases are valuable in public health research, decision-making, priority-setting, and resource allocation. Reports describing the epidemiology of GI and liver diseases have been published and are commonly referenced for these reasons.[1,3–8] We took advantage of recently available statistics to provide an update to our previous report.[1]

The objective of this work was to create a complete and accurate report detailing the current state of GI and liver morbidity, mortality, and cost in adults in the United States. We gathered data from several complementary national databases to achieve this objective.

Methods

We compiled the most recently available statistics from several publicly available databases. We utilized material available in the public domain or limited data sets with no direct patient identifiers. The methods used to collect the data from the source databases are detailed below.

Symptoms and Diagnoses across Ambulatory Settings

We tabulated the leading GI symptoms and diagnoses in the United States from the National Ambulatory Medical Care Survey (NAMCS) for office-based outpatient visits and the National Hospital Ambulatory Medical Care Survey (NHAMCS) for emergency department and hospital-based outpatient visits for 2010. NAMCS and NHAMCS are annual national surveys sponsored by the US Centers for Disease Control and Prevention (CDC) to provide reliable information about the provision and use of ambulatory medical care services in the United States (http://www.cdc.gov/nchs/ahcd.htm). The NAMCS collects data on visits to non-federal employed office-based physicians or non-physician clinicians who are primarily engaged in direct patient care. The NHAMCS collects data on visits to emergency department and hospital-based outpatient visits exclusive of Federal, military, and Veterans Administration hospitals.

To perform our analyses, we downloaded the public use data files from the CDC website. Both NAMCS and NHAMCS collect data on patient-reported symptoms. We used the patients' most important complaint (variable RFV1) for the visit in our analyses. We combined related symptoms (Appendix 1) and we totaled and ranked data from office visits, emergency department and hospital outpatient departments. Physician and non-physician clinician diagnoses were categorized into relevant disease categories based on clinical expertise using International Classification of Diseases, 9th Revision, Clinical Modification

(ICD-9-CM). We used the primary diagnosis code only. After combining the related diagnoses into clinically meaningful disease groups, we created a rank order list. NAMCS and NHAMCS are based on probability samples. Therefore, sampling weights were applied to all analyses in order to generate national estimates. These analyses were conducted using SAS v9.3 (Cary, NC).

Emergency Department Visits

We compiled the most common and selected other emergency department (ED) GI and liver *principal* visit discharge diagnoses from the 2012 Nationwide Emergency Department Sample (NEDS) (http://hcup.ahrq.gov/hcupnet.jsp). The NEDS was developed by the Agency for Healthcare Research and Quality and is part of the Healthcare Cost and Utilization Project (HCUP). The NEDS includes discharge data for emergency department visits from 950 hospitals located in 30 States and is the largest all-payer database in the United States.

To perform our analyses, we utilized the 'National Statistics on All ED Visits' link on the HCUP website. We first created a list of the most common GI diagnoses in 2012. To do this, we queried the NEDS to generate a list of the top 100 principal diagnoses and then limited our list to GI and hepatology diagnoses only. We combined related diagnosis codes. We then performed a query for each individual ICD-9-CM code (or group of codes) to determine the total number of visits, number of visits per 100,000 people, the total number of patients admitted to the same hospital from the emergency department (ED) with that diagnosis and proportion of deaths either in the hospital or the ED. We also performed a temporal analysis to determine admission trends between the year 2006 (first year available in NEDS) and 2012. Finally, we created a list of select emergency department GI and liver principal discharge diagnoses that were not among the top 100 discharge diagnoses with methods similar to those detailed above.

Hospitalizations

The most common inpatient GI and hepatology discharge diagnoses were compiled from the Nationwide Inpatient Sample (NIS), one of the databases in the Healthcare Cost and Utilization Project (HCUP) (http://hcup.ahrq.gov/hcupnet.jsp). The 2012 NIS contains a 20 percent sample of discharges from 4,378 community hospitals participating in HCUP across 44 states. The sampling frame for the 2012 NIS comprises approximately 95 percent of the U.S. population, and includes more than 94 percent of discharges from U.S. community hospitals. The NIS is the only national hospital database containing hospital charges for all patients, regardless of payer, including persons covered by Medicare, Medicaid, private insurance, and the uninsured.

To perform our analyses, we utilized the 'National Statistics on All Stays' link on the HCUP website. We queried the 2012 database for the top principal discharge diagnoses for all patients in all hospitals. From the top 100 diagnoses, we identified the GI and hepatology diagnoses and then rank-ordered then after combining related diagnosis codes. We then performed a separate query for each individual ICD-9-CM code (or group of codes) to acquire data on mean and median length of stay (LOS), median charges and costs, aggregate

charges and aggregate costs, and number of inpatient deaths associated with each diagnosis or diagnosis group. We calculated the change in the number of admissions for the top principal GI diagnoses between the year 2003 and 2012 to identify relevant trends over the 10 year period. The total length of stay (LOS) was estimated by the product of the mean LOS and the number of discharges for each diagnosis. Total charges were converted to costs by HCUP using cost-to-charge ratios based on hospital accounting reports from the Centers for Medicare and Medicaid Services (CMS). Cost data are presented rather than charges, as costs tend to reflect actual expenditures, while charges represent what the hospital billed for the case. In diagnosis categories represented by multiple ICD-9-CM codes, median LOS and median costs are presented for most common ICD-9-CM code in these categories. Rate of visits, admissions and deaths represent the sum from all codes. Total hospital days per year for all persons with each diagnosis were estimated from the product of the number of discharges and mean LOS.

Finally, we reviewed the 10-year trend data and based on these numbers chose to perform temporal analyses for the number of admissions and associated costs for *Clostridium difficile*, inflammatory bowel disease, and liver disease between the year 1993 and 2012. For charge trends, we graphed the actual charges per calendar year, as well as inflation-adjusted charges (2012 dollars) using the Consumer Price Index published by the US Bureau of Labor Statistics (www.bls.gov). Linear regression was used to determine statistical significance of trends over time.

Cancer

We collected GI and liver cancer statistics from the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute (www.seer.cancer.gov).[9] The SEER program collects and publishes cancer statistics from a collection of population-based cancer registries and represents approximately 28 percent of the United States population. We gathered the most recent version of the SEER estimates available from the SEER Cancer Statistics Review.[9] Incidence rates were age adjusted and based on 2007–2011 cases. New cases were estimated for 2014. Prevalence was estimated for 2011. Lifetime risk was based on 2009–2011 data.

Mortality

We generated a list of the most common GI and liver causes of death using data from the Centers for Disease Control Wide-ranging Online Data for Epidemiologic Research (CDC WONDER) (http://wonder.cdc.gov). CDC WONDER is a publically available database provided by the Centers for Disease Controls. The CDC maintains county-level, national mortality of children and adults collected and reported by state registries. Underlying and contributing causes of death are derived from death certificates and are classified by International Classification of Diseases, 10^{th} edition (ICD-10). The underlying cause of death is defined as the disease that initiated the sequence of morbid events leading directly to death. Contributing cause of death statistics include all deaths with the disease of interest as either the underlying cause or any of 20 additional diseases leading to death.

To perform our analyses, we downloaded the 2012 public use data files for underlying cause of death and multiple cause of death from the CDC website. Using ICD-10 codes, the 20 most common GI and liver causes of death were ranked. Diagnoses were combined to create clinically meaningful categories. The crude rate per 100,000 deaths was calculated by dividing the number of deaths listed as an underlying cause by the total U.S. population in the United States in 2012 (314,112,078 from the U.S. Census Bureau)[10] then multiplying by 100,000. Results include children and adults. These analyses were conducted using Stata MP v13.0 (College Station, Texas).

Results

Symptoms and Diagnoses across Ambulatory Settings

The leading GI symptoms prompting a visit in 2010 are shown in Table 1. Abdominal pain was responsible for more than 27 million total visits, followed by diarrhea, vomiting, nausea, and bleeding. Constipation and anorectal symptoms accounted for 3.0 and 2.6 million visits, respectively.

Abdominal pain is also the most frequent diagnosis (Table 2) with nearly 17 million annual visits. There were more than 7 million visits with GERD and reflux esophagitis. Hemorrhoids accounted for nearly 4 million visits.

Emergency department visits

The most common GI discharge diagnoses from the emergency department in the U.S. in 2012 as captured by the NEDS are detailed in Table 3. Abdominal pain was the most frequent visit diagnosis with an estimated 5.7 million visits. This diagnosis was rarely associated with admission to the hospital or death. GI hemorrhage was also a common discharge diagnosis almost 800,000 visits. More than half of these visits resulted in a hospital admission. Mortality from GI hemorrhage is substantial (10,393 deaths, 1.3% visits). Constipation was also common with nearly 800,000 visits and the number of ED visits for constipation has increased 60% since 2006.

Select GI and liver discharge diagnoses are detailed in Table 3. Functional and motility disorders had close to a million visits and increased by 39% since 2006. The majority of these visits were for constipation, as per Table 3. ED visits for liver disease and inflammatory bowel disease have both increased since 2006, and both disorders result in hospital admission in a majority of cases.

Hospitalizations

The most common GI and liver discharge diagnoses from hospital admissions are detailed in Table 4. GI hemorrhage was the most frequent discharge diagnosis with more than 500,000 discharges in 2012 at a cost of nearly $5 billion dollars. Hospitalizations for *Clostridium difficile* infection and associated charges continue to increase as illustrated in Figure 1A and Figure 1B. Regardless of inflation, the increases in spending are statistically significant ($p<0.0001$). There are higher aggregate costs for chronic GI conditions, such as inflammatory bowel disease, motility disorders, and chronic liver disease, despite fewer

number of total hospital days. Hospitalizations and charges for inflammatory bowel disease and chronic liver disease in particular have increased over the last twenty years as seen in Figures 1C–F. These increases in spending are also statistically significant, regardless of inflation ($p<0.0001$). These charges are also detailed in table format in Appendix 2. Chronic liver disease had the highest inpatient mortality (5.8%, with roughly 14,000 annual hospital deaths).

Some GI diagnoses were not among the "top 100" diagnoses overall, but do contribute to the burden of GI diseases. For example, chronic pancreatitis, with only 14,195 discharges, is very expensive (aggregate cost ~$150 million). Eating disorders, though an uncommon reason for hospitalization (n=5,865) are associated with long hospital stays (mean length of stay 12 days), high median charges ($51,847) and aggregate costs ($90,356,190).

Cancer

GI and liver cancer incidence, prevalence, and survival are detailed in Table 5. Using SEER data, the National Cancer Institute estimated that in 2011 there were more than a million people in the United States living with a diagnosis of colorectal cancer. They also estimated 136,830 new cases of colorectal cancer each year with a 65% 5-year survival. The estimated lifetime risk of developing colorectal cancer in the United States is 4.7%. Pancreatic, gastric and esophageal cancers remain common and highly lethal GI malignancies, all of which are associated with <30% 5-year survival.

Mortality

The leading causes of death from GI and liver disease are presented in Table 6. The top three causes of death from GI and liver disease remain colorectal cancer followed by pancreatic, liver and intrahepatic bile duct cancers. All-cause cirrhosis contributed to 34,251 deaths in the U.S.. *Clostridium difficile* continues to be a source of substantial significant mortality, accounting for 7,739 deaths in the U.S. in 2012.

Discussion

We have compiled the most recently available statistics from several complementary national databases to create a complete and accurate report detailing the current state of GI and liver morbidity, mortality, and cost in adults in the United States. GI and liver diseases account for substantial utilization of health care resources and cost in the United States. This report demonstrates several trends in the data worthy of highlighting.

The U.S population is growing older.[11] This demographic is driven by the cohort of Americans born during the post-World War II baby boom (1945–1965). In 2011, the first baby boomers turned 65. This change in demographics is manifest in changes in liver disease in the U.S. Baby boomers are five times more likely to have chronic hepatitis C compared with adults born in other years.[12] An estimated 2.7 million Americans have chronic HCV infection and most of those infected (75%) were born between 1945–1965.[12–14] We found a 176% increase in hepatitis C related emergency department visits between 2006 and 2012 and a 225% increase in hepatitis C admissions between 2003 and 2012. In-hospital mortality was nearly 6%. Moreover, rates of new liver cancers are rising

and many of these cancers are attributable to chronic hepatitis C infection.[15, 16] The incidence of end stage liver disease from chronic hepatitis C infection is predicted to increase until the year 2030.[17]

Other GI diagnoses associated with age are also increasing. There are an increasing number of anorectal symptoms reported by patients and physicians in the ambulatory setting commonly diagnose hemorrhoids. Between 2006 and 2012, there has been an increase in the number of patients seen for constipation and lower GI bleeding in the emergency department. Hospital admissions for acute diverticulitis and *C. difficile* are increasing. By 2030, an estimated one in five Americans will be 65 or older. Even if the epidemiology of these conditions remains stable on an age-adjusted basis, we can expect increased numbers of cases and therefore increased utilization of health care and costs for these diseases.

The incidence of colorectal cancer and death rate from colorectal cancer in the United States continues to decrease and is in part attributable to screening and removal of adenomatous polyps.[18–21] While this trend is encouraging, a substantial number of Americans are still diagnosed with and die from colorectal cancer every year. In 2014, an estimated 136,830 people were diagnosed with colorectal cancer. In 2012, 51,139 people died from colorectal cancer. Despite the effectiveness of screening, in 2010 only 58% of adults aged 50 to 75 years had received colorectal cancer screening based on U.S. Preventative Services Task Force guidelines.[22] A new initiative from the National Colorectal Cancer Roundtable aims to increase colorectal screening in the United States to 80% by 2018, which would have the predicted benefit of preventing 280,000 cases of colorectal cancer and 200,000 deaths within 20 years.[23, 24]

Hospitalizations account for a large portion of the economic burden of IBD. Over the last twenty years in the United States, despite advances in therapy, hospital admissions and associated charges for inflammatory bowel diseases have increased. This is congruent with earlier trends using the National Hospital Discharge Survey.[7, 25, 26] Emergency department visits are also rising.

This report has important strengths. We have gathered data from several complementary national databases each designed specifically to assess utilization. Since our last report[1] we have obtained data from the NHAMCS. Adding NHAMCS provides a more comprehensive picture of GI symptoms and diagnoses in the ambulatory setting with more than a third of visits occurring in hospital-based clinics and emergency departments. We have also added statistics from the NEDS and for the first time present data for emergency department visits from two sources with different methods to assess visits. Despite differences in methodology, the estimates generated from these two sources appear to be similar, increasing our confidence in their accuracy.

There are important limitations imposed with the use of administrative data and ICD codes. The fidelity of coding data to clinical information is imperfect. Some trends may reflect coding changes occurring during the observed time period (e.g. codes for ascites changed in 2007). For most of our sources, data are coded by visit, and not by person, so a single patient could be represented by multiple visits or discharges. The methodology used in our data

sources can change over time. For instance, the NIS utilized a new sampling strategy for the 2012 data. With this change, the estimated overall trends in discharge counts declined by about 4.3 percent, overall trends in average length-of-stay declined by about 1.5 percent, overall trends in total charges declined by about 0.5 percent, and overall trends in hospital mortality declined by about 2.0 percent. Costs are estimates calculated from charges based on Medicare cost-to-charge ratio. Our estimates do not include federal health care delivery sites. The National Vital Statistics System accounts for all deaths in the US but depends on the accuracy of the death certificates and therefore may underestimate mortality.[27, 28]

More than 16 million uninsured Americans have gained health insurance coverage since the Affordable Care Act's provisions took effect. This sweeping legislation can be expected to change the landscape of care for GI illnesses. As health care access expands, and the financing of these services changes, researchers, clinicians, policy makers, and public health professionals now more than ever need a clear understanding of which conditions affect large portions of the populations and the costs inherent in the care of them. GI and liver diseases continue to account for substantial burden and cost in the United States.

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Appendix 1

Symptom Groupings from NAMCS/NHAMCS

RFV1	LABEL	COUNT	PERCENT		
15451	'Abdominal pain, cramps, spasms, NOS'	9435447	22.1691855	Abdominal pain	15028011
15453	'Upper abdominal pain, cramps, spasms'	1136576	2.6704579		
15452	'Lower abdominal pain, cramps, spasms,'	1010634	2.3745491		
15450	Stomach and abdominal pain, cramps and spasms	3445354 15028011	8.0950793		
15950	'Diarrhea'	4454522	10.466184	Diarrhea	4454522
15300	'Vomiting'	2681315	6.2999209	Vomiting	2681315
15900	'Constipation'	2472469	5.8092239	Constipation	2472469
15250	'Nausea'	2343409	5.5059892	Nausea	2343409
16052	'Anal-rectal bleeding'	1664572	3.9110183	Bleeding	2691658
15801	'Blood in stool (melena)'	753950	1.7714537		
15800	'Gastrointestinal bleeding'	232363	0.5459517		
15802	'Vomiting blood (hematemesis)'	40773 2691658			
16051	'Anal-rectal pain'	1445408	3.3960784	Anorectal symptoms	2446210
16054	'Anal-rectal itching'	335186	0.7875409		
16053	'Anal-rectal swelling or mass'	179550	0.4218642		

RFV1	LABEL	COUNT	PERCENT		
16050	'Symptoms referable to anus-rectum'	447253	1.0508495		
16004	'Incontinence of stool'	38813 2446210	0.0911936		
15350	'Heartburn and indigestion (dyspepsia)'	1355288	3.1843357	Heartburn and indigestion	1355288
16150	Other and unspecified symptoms referable to the digestive systemic	1324906	3.1129513	Other GI symptoms, unspecified	1324906
15702	'Decreased appetite'	837473	1.9676963	Decreased appetite	837473
15200	'Difficulty in swallowing (dysphagia)'	808250	1.899035	Dysphagia	808250
16000	Other symptoms or changes in bowel function	722827	1.6983282	Other changes in bowel function	1307775
16003	Changes in size, color, shape, or odor	584948 1307775	1.3743727		
15850	'Flatulence'	582303	1.3681581	Flatulence	582303
16100	Symptoms of liver, gallbladder, and biliary tract	188353	0.4425474	Symptoms related to the liver and biliary system	411063
16102	'Jaundice'	222710 411063	0.5232714		
15651	'Abdominal distention, fullness, NOS'	291507	0.6849143	Abdominal distention	373732
15653	'Abdominal swelling, NOS'	70454	0.1655362		
15650	'Change in abdominal size'	11771 373732	0.0276567		
15050	'Symptoms referable to lips'	566403	1.3308		
15001	'Toothache'	504037	1.1842671		
15652	'Abdominal mass or tumor'	400400	0.9407654		
15100	'Symptoms referable to mouth'	336032	0.7895287		
15104	'Mouth ulcer, sore'	321258	0.7548162		
15150	'Symptoms referable to tongue'	296148	0.6958186		
15053	'Cold sore'	225644	0.530165		
15051	'Cracked, bleeding, dry lips'	116390	0.2734657		
15103	'Mouth dryness'	114517	0.269065		
15701	'Excessive appetite'	98399	0.2311947		
15151	'Tongue pain'	93304	0.2192237		
15750	'Difficulty eating'	90538	0.2127248		
15011	'Symptoms of the jaw, swelling'	78977	0.1855615		
15400	'Gastrointestinal infection'	77764	0.1827115		
15101	'Mouth pain, burning, soreness'	46531	0.1093276		
15802	'Vomiting blood (hematemesis)'	40773	0.0957988		
15012	'Symptoms of the jaw, lump or mass'	35988	0.0845561		
15000	'Symptoms of teeth and gums'	20218	0.0475035		
15102	'Mouth bleeding'	20158	0.0473625		

Appendix 2

Inflation-adjusted charges for GI hospitalizations

Annual charges for C. diff-related hospitalizations, 1993 through 2012, National Inpatient Sample

Year	Mean charges	Actual aggregate charges	Inflation - adjusted charges (2012 dollars)
1993	$11,548	$273,595,216	$434,711,557
1994	$11,309	$288,051,539	$446,254,420
1995	$11,719	$286,588,145	$431,751,434
1996	$12,011	$277,021,704	$405,369,797
1997	$13,119	$317,230,539	$453,795,815
1998	$13,301	$334,599,956	$471,301,486
1999	$14,316	$417,783,828	$575,754,263
2000	$15,810	$502,473,420	$669,947,052
2001	$18,372	$652,867,392	$846,861,220
2002	$20,646	$931,650,750	$1,189,001,792
2003	$24,040	$1,139,399,840	$1,421,735,689
2004	$24,535	$1,431,224,690	$1,739,547,917
2005	$26,809	$1,973,437,299	$2,319,966,018
2006	$27,789	$2,405,860,464	$2,739,936,148
2007	$31,499	$3,154,089,367	$3,492,587,098
2008	$33,331	$3,620,479,882	$3,860,793,663
2009	$33,779	$3,560,948,401	$3,810,868,928
2010	$34,174	$3,663,179,408	$3,857,026,956
2011	$35,334	$4,194,039,798	$4,280,833,352
2012	$35,214	$4,201,558,410	$4,201,558,410

Annual charges for IBD-related hospitalizations (combined UC and Crohn’s), 1993 through 2012, National Inpatient Sample

Year	Mean charges	Actual aggregate charges	Inflation-adjusted charges (2012 dollars)
1993	$12,805	$751,423,010	$1,193,925,360
1994	$13,521	$806,879,196	$1,250,031,188
1995	$13,448	$802,805,256	$1,209,444,029
1996	$13,659	$865,680,102	$1,266,761,997
1997	$14,090	$920,401,070	$1,316,626,562
1998	$14,888	$974,315,384	$1,372,374,026
1999	$14,796	$1,053,874,692	$1,452,360,781
2000	$16,760	$1,194,971,240	$1,593,253,350
2001	$18,288	$1,408,761,216	$1,827,362,275
2002	$20,318	$1,604,309,280	$2,047,469,621
2003	$22,545	$1,907,442,270	$2,380,094,024

Year	Mean charges	Actual aggregate charges	Inflation-adjusted charges (2012 dollars)
2004	$23,690	$2,110,542,100	$2,565,208,062
2005	$25,355	$2,229,744,055	$2,621,279,347
2006	$25,981	$2,236,444,480	$2,546,995,208
2007	$28,299	$2,443,194,165	$2,705,398,429
2008	$32,631	$3,257,356,944	$3,473,567,996
2009	$32,872	$3,181,878,112	$3,405,194,084
2010	$34,277	$3,331,313,076	$3,507,598,974
2011	$35,679	$3,566,936,667	$3,640,752,636
2012	$37,049	$3,673,037,860	$3,673,037,860

Annual charges for liver disease-related hospitalizations, 1993 through 2012, National Inpatient Sample

Year	Mean charges	Actual aggregate charges	Inflation-adjusted charges (2012 dollars)
1993	$16,177	$2,401,632,255	$3,815,919,418
1994	$18,094	$2,756,797,142	$4,270,877,753
1995	$17,304	$2,633,399,391	$3,967,274,933
1996	$17,722	$2,799,163,282	$4,096,055,415
1997	$18,202	$2,893,893,178	$4,139,691,653
1998	$17,673	$2,920,518,969	$4,113,703,265
1999	$23,113	$3,896,558,485	$5,369,906,655
2000	$21,669	$3,839,816,809	$5,119,621,954
2001	$22,847	$4,115,772,745	$5,338,738,574
2002	$25,504	$4,752,736,726	$6,065,591,083
2003	$31,002	$6,205,607,440	$7,743,316,492
2004	$29,434	$6,006,104,668	$7,299,976,682
2005	$33,114	$6,680,995,303	$7,854,154,816
2006	$32,355	$6,684,530,895	$7,612,739,019
2007	$37,094	$7,698,349,247	$8,524,538,188
2008	$43,984	$9,770,589,440	$10,419,124,266
2009	$45,558	$10,120,566,475	$10,830,865,255
2010	$46,466	$10,780,950,651	$11,351,455,292
2011	$48,599	$11,388,653,380	$11,624,335,861
2012	$49,611	$12,063,851,846	$12,063,851,846

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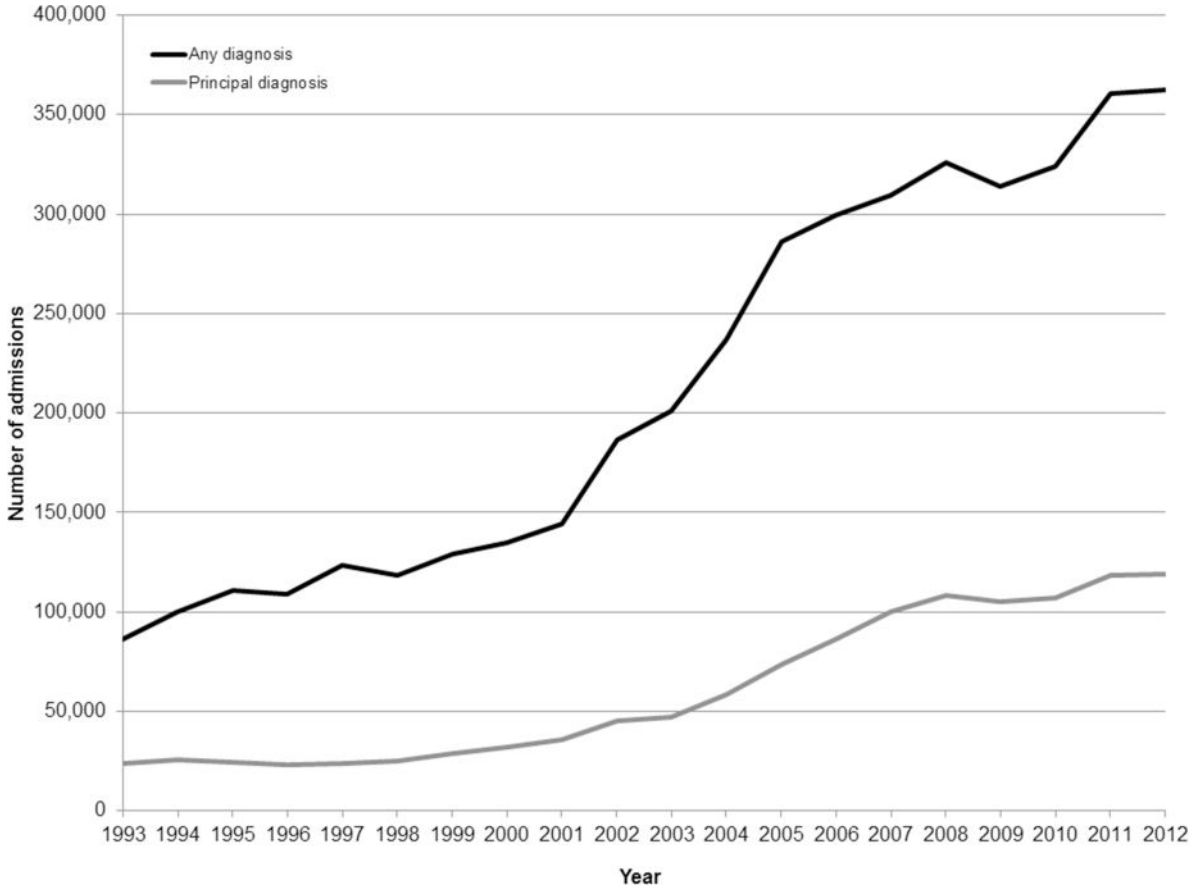

FIGURE 1A.

Rising number of hospitalizations with associated or principal *Clostridium difficile* infection diagnoses

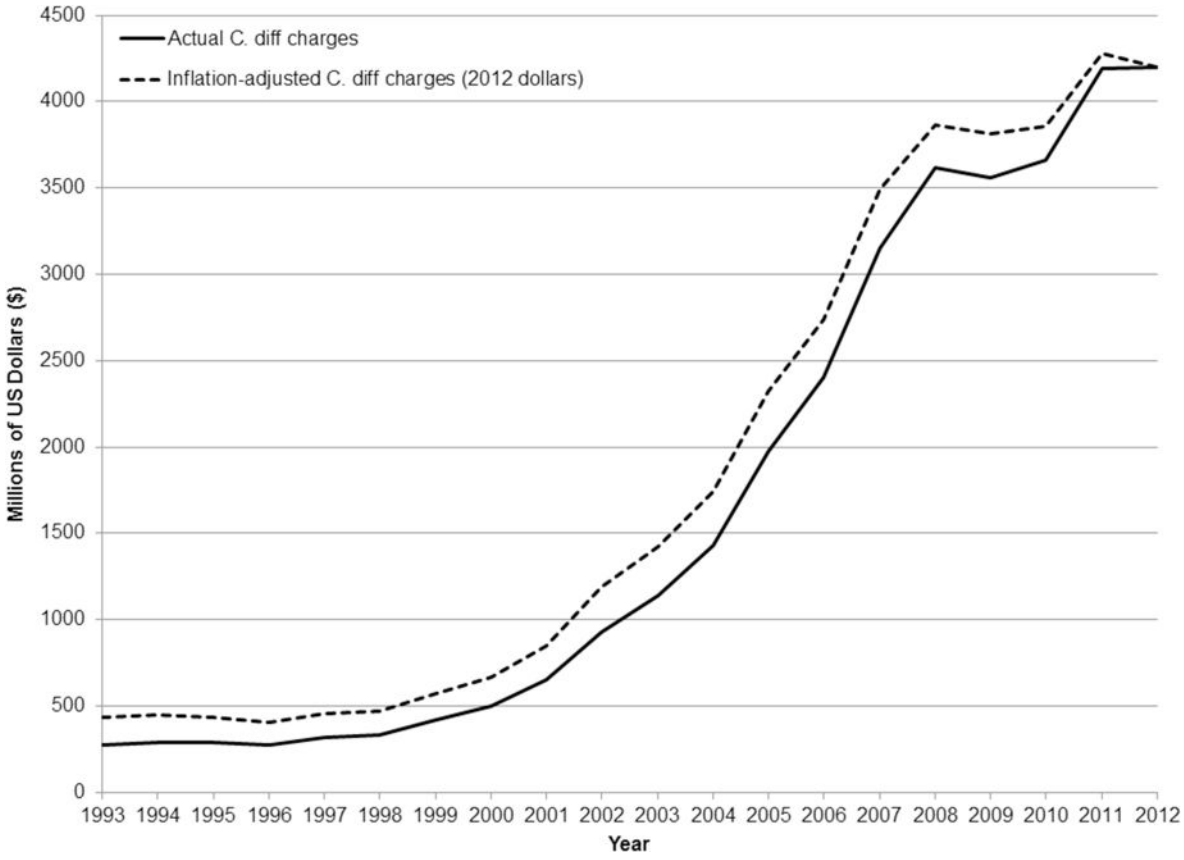

FIGURE 1B.

Rising charges for hospitalizations with principal *Clostridium difficile* infection diagnoses

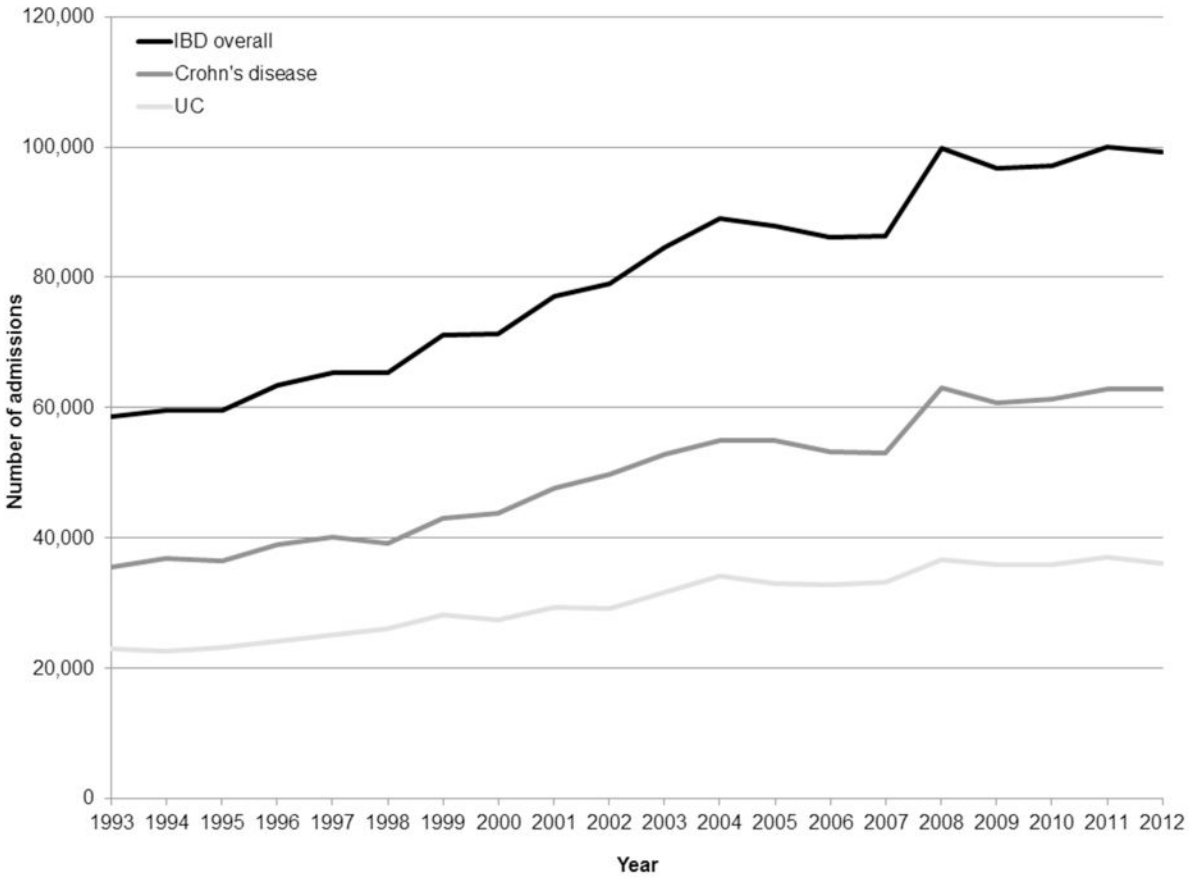

FIGURE 1C.

Rising number of hospitalizations with principal diagnosis of inflammatory bowel disease, including Crohn's disease or ulcerative colitis

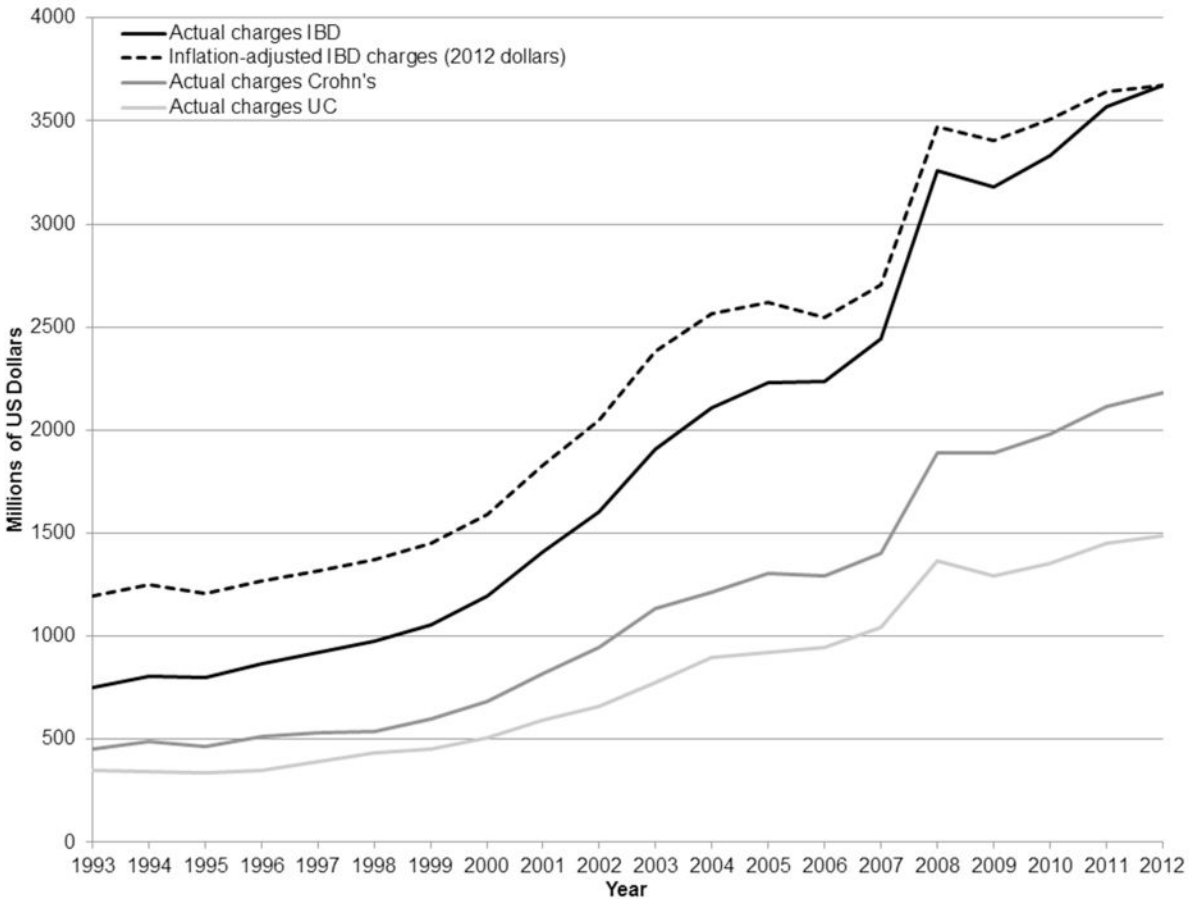

FIGURE 1D.

Rising charges for hospitalizations for inflammatory bowel disease, including Crohn's disease or ulcerative colitis

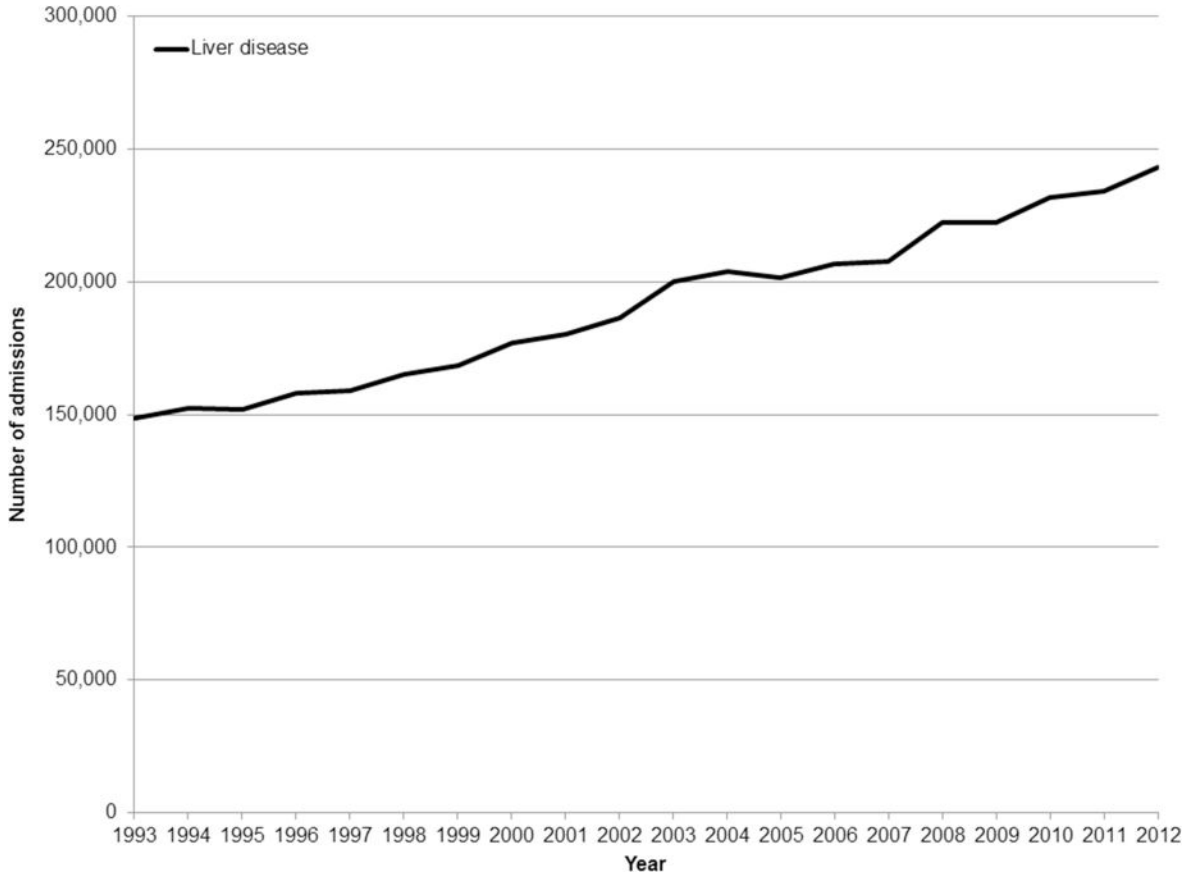

FIGURE 1E.
Rising number of hospitalizations with principal diagnosis of liver disease

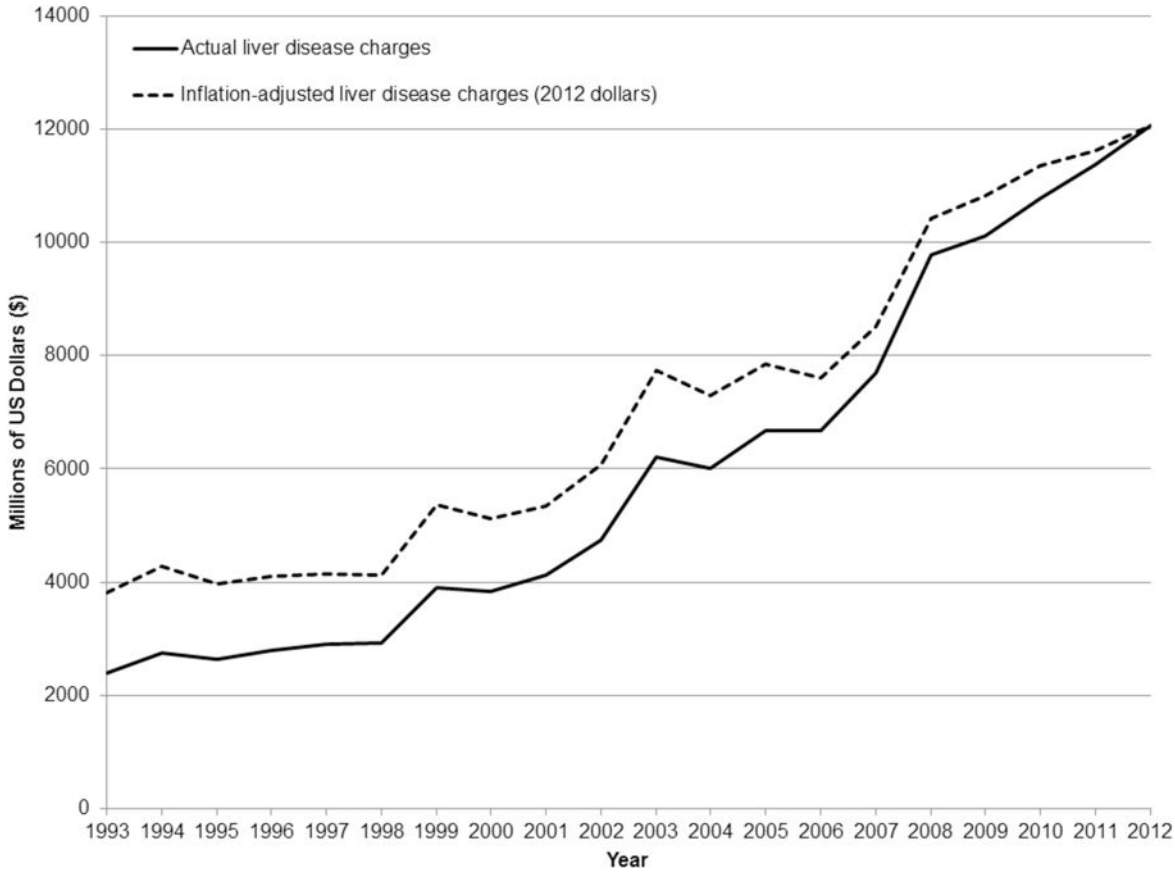

FIGURE 1F.
Rising charges for hospitalizations for principal diagnosis of liver disease

Table 1

Leading Gastrointestinal Symptoms Prompting an Ambulatory Visit, 2010

			Emergency Visits		
Rank	**Symptom**	**Office Visits**	**Emergency Department**	**Hospital Outpatient Department**	**Total**
1	Abdominal pain	15,028,011	10,416,899	1,655,073	27,099,983
2	Diarrhea	4,454,522	795,543	379,173	5,629,238
3	Vomiting	2,681,315	2,459,103	351,709	5,492,127
4	Nausea	2,343,409	2,187,272	184,238	4,714,919
5	Bleeding	2,691,658	672,402	279,969	3,644,029
6	Constipation	2,472,469	321,964	220,748	3,015,181
7	Anorectal symptoms	2,446,210	106,766	33,698	2,586,674
8	Other GI symptoms, unspecified	1,324,906	123,740	104,072	1,552,718
9	Heartburn and indigestion	1,355,288	81,831	23,515	1,460,634
10	Changes in bowel function	1,307,775	28,767	21,872	1,358,414
11	Dysphagia	808,250	118,465	115,399	1,042,114
12	Decreased appetite	837,473	114,282	52,136	1,003,891
13	Flatulence	582,303	4,817	1,706	588,826
14	Abdominal distention	373,732	98,256	57,828	529,816
15	Symptoms related to the liver and biliary system	411,063	28,449	83,755	523,267

Source: National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey (http://www.cdc.gov/nchs/ahcd.htm)

Table 2

Leading Diagnoses in the Ambulatory Setting for Gastrointestinal, Liver and Pancreatic Disorders in the United States, 2010

		Estimated Visits				
Rank	**Diagnosis**	**Office Visits**	**Emergency Department**	**Hospital Outpatient Department**	**Total**	**ICD-9-CM Codes**
1	Abdominal pain	9,232,817	6,475,136	970,318	16,678,271	789.00
2	Gastroesophageal reflux and reflux esophagitis	6,222,275	294,942	549,992	7,067,209	530.11,530.81
3	Hemorrhoids	3,592,943	20,128	226,505	3,939,576	455
4	Constipation	2,905,705	530,827	280,129	3,716,661	564.0
5	Nausea and vomiting	1,404,564	1,969,949	215,701	3,590,214	787.0
6	Abdominal wall and inguinal hernia	2,852,677	204,375	422,937	3,479,989	550, 553.0, 553.1, 553.2, 553.9
7	Malignant neoplasm of the colon or rectum	2,420,463	2,420	386,783	2,809,666	153, 154
8	Diverticular disease	2,275,438	262,910	195,771	2,734,119	562.1
9	Diarrhea	1,943,572	533,181	197,071	2,673,824	787.91
10	Gastritis and dyspepsia	1,902,993	472,165	234,836	2,609,994	535, 536.8
11	Irritable bowel syndrome	2,290,460	24,121	89,170	2,403,751	564.1
12	Crohn’s disease	1,722,664	44,641	121,256	1,888,561	555
13	Cholelithiasis	872,040	355,504	119,166	1,346,710	574
14	Dysphagia	1,021,034	38,264	113,664	1,172,962	787.2
15	Rectal bleeding	648,827	176,160	61,772	886,759	569.3
16	Benign neoplasm of colon and rectum	726,675		144,775	871,450	211.3, 211.4
17	Pancreatitis	409,862	320,418	91,492	821,772	577, 577.1
18	Ulcerative colitis	633,445	17,166	72,763	723,374	556
19	Hepatitis C infection	563,442	19,496	90,334	673,272	070.41, 070.44, 070.51, 070.54, 070.7
20	Appendicitis	317,374	195,150	128,524	641,048	540, 541, 542
21	Hepatitis, unspecified	554,749	3,212	9,573	567,534	573.3
22	Chronic liver disease and cirrhosis	438,914	30,084	78,957	547,955	571
23	Barrett’s esophagus	369,739		47,083	416,822	530.85
24	Celiac disease	23,521		4,472	27,993	579.0

Source: National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey (http://www.cdc.gov/nchs/ahcd.htm)

Table 3

Most Common Gastrointestinal and Pancreatic Principal Diagnoses From Emergency Department Visits, 2012

Rank	Diagnosis[a]	Visits	Change from 2006 (%)	Rate of visits per 100,000 persons	Hospitalized from Emergency Department (%)	Death (%)[a]	ICD-9-CM Codes
1	Abdominal pain	5,733,676	+27	1,827	124,840 (2.2)	834 (0.01)	789.0, 789.6
2	Nausea and vomiting	1,937,744	+35	617	36,755 (1.9)	364 (0.02)	787.0
3	Noninfectious gastroenteritis/colitis	1,200,159	−24	382	118,863 (9.9)	314 (0.03)	558.9
4	Gastrointestinal hemorrhage	796,323	+10	254	435,072 (54.6)	10,393 (1.3)	456.0, 456.20, 530.21, 530.7, 530.82, 531.0, 531.2, 531.4, 531.6, 532.0, 532.2, 532.4, 532.6, 533.0, 533.2, 533.4, 533.6, 534.0, 534.2, 534.4, 534.6, 535.01, 535.11, 535.21, 535.31, 535.41, 535.51, 535.61, 535.71, 537.83, 562.02, 562.03, 562.12, 562.13, 569.85, 569.86, 569.3, 578, 772.4
5	Constipation	799,614	+61	255	50,587 (6.3)	507 (0.06)	564.00, 564.09, 560.32
6	Cholelithiasis and cholecystitis	651,829	+31	208	309,436 (47.5)	1,285 (0.20)	574, 575.0 – 575.2
7	Gastritis/duodenitis	603,407	+17	192	65,560 (10.9)	99 (0.02)	535.00, 535.10, 535.20, 535.30, 535.40, 535.50, 535.60, 535.70
8	Diarrhea	534,870	+28	170	22,061 (4.1)	161 (0.03)	009.2, 009.3, 564.5, 787.91
9	Gastrointestinal infection[b]	372,466	+5	119	105,079 (28.2)	240 (0.06)	001, 002, 003, 004, 005, 006, 007, 009, 008.00–008.44, 008.46–008.8
10	Appendicitis	358,208	+8	114	224,956 (62.8)	164 (0.05)	540–542
11	Diverticulitis without hemorrhage	333,464	+31	106	157,562 (47.3)	830 (0.3)	562.11
12	Acute pancreatitis	330,561	+12	105	239,839 (72.6)	1,695 (0.5)	577.0
13	Gastroesophageal reflux	324,359	+4	103	43,296 (13.3)	20 (0.01)	530.81, 530.11, 787.1

Selected Gastrointestinal and Liver Principal Diagnoses From Emergency Department Visits, 2012

Diagnosis	Visits	Change from 2006 (%)	Rate of visits per 100,000 persons	Hospitalized from Emergency Department (%)	Death (%)[a]	ICD-9-CM Codes
Functional/motility disorders[b]	941,202	+39	300	88,351 (9.4)	377 (0.04)	530.0, 530.5, 536.2, 536.3, 536.8, 536.9, 564, 306.4

Selected Gastrointestinal and Liver Principal Diagnoses From Emergency Department Visits, 2012

Diagnosis	Visits	Change from 2006 (%)	Rate of visits per 100,000 persons	Hospitalized from Emergency Department (%)	Death (%)[a]	ICD-9-CM Codes
Liver disease and viral hepatitis	288,678	+24	92	187,938 (65.1)	9501 (3.3)	070, 570–573, 789.5, 789.59, 567.23, 456.1, 456.21
Alcoholic liver disease	64,912	−0.5	21	51,572 (79.5)	2259 (3.5)	571.0–571.3
Hepatitis C	33,237	+176	11	26,906 (80.9)	1046 (3.5)	070.7,070.41, 070.44, 070.51, 070.54
Hepatitis B	4,477	+29	1	3,672 (82.0)	149 (3.3)	070.2, 070.3
Ascites or spontaneous bacterial peritonitis	48,346	+87	15	12,215 (25.3)	418 (0.9)	789.5, 789.59, 567.23
Hepatic encephalopathy	50,446	+18	16	43,065 (85.4)	2569 (5.09)	572.2
GI disorders during pregnancy[c]	254,190	+19	81	13,357 (5.3)	–	643, 646.7
Upper GI bleeding[d,e]	226,580	−5	72	180,767 (79.8)	3,739 (1.7)	456.0, 456.20, 530.21,530.7, 530.82, 531.0, 531.2, 531.4, 531.6, 532.0, 532.2, 532.4, 532.6, 533.0, 533.2, 533.4, 533.6, 534.0, 534.2, 534.4, 534.6, 535.01, 535.11, 535.21, 535.31, 535.41, 535.51, 535.61, 535.71, 537.83, 569.86, 578.0
Lower GI bleeding[e]	342,102	+17	109	13 7,288 (40.1)	2,086 (0.6)	562.02, 562.03, 562.12, 562.13, 569.85, 569.3, 578.1
Foreign body in intestinal tract	184,503	+18	59	11,703 (6.3)	45 (0.02)	935.1–938
C. difficile infection	118,834	+51	38	103,773 (87.3)	2321 (2.0)	008.45
Inflammatory bowel diseases	125,755	+38	40	71,609 (56.9)	186 (0.2)	555, 556
Crohn’s disease	86,652	+38	28	45,881 (52.9)	28 (0.03)	555
Ulcerative Colitis	39,103	+40	13	25,728 (65.8)	146 (0.4)	556
Dysphagia	71,042	+18	23	8,353 (11.8)	105 (0.2)	787.2
Chronic pancreatitis	35,695	+2	11	10,609 (29.7)	39 (0.1)	787.2
Eating Disorders	4,564	+14	2	1,421 (13.1)	–	307.51, 307.1, 307.50, 307.59

[a] Includes deaths in ED and in hospital deaths for patients admitted from ED with corresponding diagnoses

[b] Does not include Clostridium difficile infections

Source: HCUP Nationwide Emergency Department Sample (http://www.hcup-us.ahrq.gov/nedsoverview.jsp)

[a] Includes deaths in ED and in hospital deaths for patients admitted from ED with corresponding diagnoses

[b] Includes esophageal (e.g. achalasia), gastric (e.g. dyspepsia), and intestinal (e.g. irritable bowel syndrome) functional/motility syndromes. Also includes some constipation and diarrhea codes from Table 3

[c] Too few deaths to generate an estimate

[d] Does not include codes for bleeding varices, which are included in the "gastrointestinal hemorrhage" category.

[e] Does not include "Gastrointestinal hemorrhage NOS (578.9). Upper and lower GI bleeding are subcategories of "gastrointestinal hemorrhage" category.

Source: HCUP Nationwide Emergency Department Sample (http://www.hcup-us.ahrq.gov/nedsoverview.jsp)

Table 4

Most Common Gastrointestinal, Liver and Pancreatic Principal Diagnoses From Hospital Admissions, 2012

Rank	Diagnosis	Admissions	Change from 2003 (%)	Median Length of Stay (days)	Total Hospital Days	Median Costs (US dollars)	Aggregate Costs (US dollars)	In Hospital Death (%)	ICD-9-CM Codes
1	Gastrointestinal hemorrhage	507,440	−1	3.0	2,131,248	6,700	4,853,663,600	11,065 (2.2)	456.0, 456.20, 530.21, 530.7, 530.82, 531.0, 531.2, 531.4, 531.6, 532.0, 532.2, 532.4, 532.6, 533.0, 533.2, 533.4, 533.6, 534.0, 534.2, 534.4, 534.6, 535.01, 535.11, 535.21, 535.31, 535.41, 535.51, 535.61, 535.71, 537.83, 562.02, 562.03, 562.12, 562.13, 569.85, 569.86, 569.3, 578, 772.4
2	Cholelithiasis with cholecystitis	389,180	−5	3.0	1,478,884	9,148	4,420,306,440	1,960 (0.5)	574, 575.0–575.2
3	Acute pancreatitis	275,170	+15	3.0	1,293,299	6,279	2,632,268,998	2,135 (0.8)	577.0
4	Intestinal obstruction	256,775	+38	3.0	1,463,618	5,237	2,919,447,015	267 (0.1)	560.9, 560.89, 560.81
5	Appendicitis	248,080	−13	1.0	694,624	7,287	2,405,135,600	270 (0.1)	540–542
6	Chronic liver disease and viral hepatitis	243,170	+21	5.7	1,386,069	49,611	3,314,650,270	13,990 (5.8)	070, 570 – 573, 789.5, 567.23, 456.1, 456.21
	Alcoholic liver disease	61,670	−4	5.9	363,853	50,316	848,147,510	3,140 (5.1)	571.0–571.3
	Hepatitis C	34,360	+225	5.4	185,544	54,629	493,821,920	1,660 (4.8)	070.7, 070.41, 070.44, 070.51, 070.54
	Hepatitis B	4,600	+31	5.3	24,380	50,210	61,506,600	220 (4.8)	070.2, 070.3
	Ascites or Spontaneous Bacterial Peritonitis	15,675	+172	5.2	81,510	38,223	173,052,000	550 (3.5)	789.5, 789.59, 567.23
	Hepatic encephalopathy	52,840	+36	5.4	285,336	38,485	559,258,560	3,275 (6.2)	572.2
7	Diverticulitis without hemorrhage	216,560	+21	4.0	2,181,992	6,333	2,178,031,586	1,005 (0.5)	562.11
8	Noninfectious gastroenteritis/colitis	133,420	−12	2.0	413,602	4,656	779,973,320	345 (0.3)	558.9
9	Obesity	125,625	+12	2.0	263,813	11,606	1,650,838,125	105 (0.08)	278.00, 278.01
10	Clostridium difficile infection	119,315	+151	5.0	715,890	6,871	1,170,881,881	2,630 (2.2)	008.45

Rank	Diagnosis	Admissions	Change from 2003 (%)	Median Length of Stay (days)	Total Hospital Days	Median Costs (US dollars)	Aggregate Costs (US dollars)	In Hospital Death (%)	ICD-9-CM Codes
11	Gastrointestinal infection[a]	117,450	+11	2.0	364,095	4,070	685,203,300	245 (0.2)	001, 002, 003, 004, 005, 006, 007, 009, 008.00–008.44, 008.46–008.8
12	Functional/motility disorders[b]	115,975	+17	3.8	440,705	25,739	844,877,875	395 (0.3)	530.0, 530.5, 536.2, 536.3, 536.8, 536.9, 564, 306.4
13	Inflammatory bowel diseases	99,140	+17	5.3	525,442	37,049	1,045,629,580	295 (0.3)	555, 556
	Crohn’s disease	62,965	+19	5.0	314,825	34,676	627,698,085	105 (0.2)	555
	Ulcerative colitis	36,175	+14	5.7	206,198	41,186	417,965,950	190 (0.5)	556

[a] Does not include Clostridium difficile infections

[b] Includes esophageal (e.g. achalasia), gastric (e.g. dyspepsia), and intestinal (e.g. irritable bowel syndrome) functional/motility syndromes.

Source: HCUP Nationwide Inpatient Sample (http://www.hcup-us.ahrq.gov/db/nation/nis/nisdbdocumentation.jsp)

Table 5

Gastrointestinal, Liver and Pancreatic Cancer Statistics

Cancer Site	Incidence Rate (new cases/100,000)[a]	New case estimate (per year)[b]	Prevalence[c]	Lifetime Risk of Developing Cancer	% Surviving 5 Years
Colon and Rectum	43.7	136,830	1,162,426	4.7%	65%
Pancreas	12.3	46,420	43,538	1.5%	7%
Liver and Intrahepatic Bile Ducts	7.9	33,190	45,942	0.9%	17%
Stomach	7.5	22,220	74,035	0.9%	28%
Esophagus[e]	4.4	18,170	34,551	0.5%	18%
Small Intestine	2.1	9,160	–	0.2%	65%

[a] Age adjusted and based on 2007–2011 cases

[b] Estimated for 2014

[c] Estimated for 2011

[e] Prevalence estimate not available

Source: Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute (http://seer.cancer.gov)

Table 6

Causes of Death from Gastrointestinal, Liver and Pancreatic Diseases in the United States, 2012

Rank	Cause of Death	Deaths (underlying cause)	Deaths (contributing cause)	Crude Rate (per 100,000)	ICD-10 Codes
1	Colorectal cancer	51,139	58,816	16.6	C18.0-21.0
2	Pancreatic Cancer	38,797	40,301	12.4	C25.0-C25.9
3	Malignant neoplasms of the liver and intrahepatic bile ducts	22,973	24,771	7.3	C22.0-C22.9
4	Hepatic Fibrosis/Cirrhosis (all-cause)	17,495	34,251	5.6	K74.0-K74.6
5	Alcoholic Liver Disease	17,419	22,851	5.5	K70.0-K70.9
6	Esophageal Cancer	14,649	15,789	4.7	C15.3-C15.9
7	Gastric Cancer	11,191	12,057	3.6	C16.0-C16.9
8	Vascular Disorders of the Intestine	7,846	14,466	2.5	K55.0-K55.9
9	*Clostridium difficile* colitis	7,739	12,050	2.5	A04.7
10	Gastrointestinal hemorrhage, unspecified	7,721	27,732	2.5	K92.2
11	Chronic hepatitis C	7,292	17,788	2.3	B18.2
12	Paralytic ileus and intestinal obstruction	6,074	15,592	1.9	K56.0-K56.7
13	Hepatic failure (acute and chronic)	4,117	24,227	1.3	K72.0-K72.9
14	Ulcers (gastric/duodenal/peptic)	2,892	5,850	0.9	K25-K28
15	Acute pancreatitis	2,844	5,392	0.9	K85.0-K85.9
16	Diverticular disease	2,773	4,567	0.9	K57.0-K57.9
17	Perforation of Intestine (non-traumatic)	2,121	5,491	0.7	K63.1
18	Malignant neoplasms of gallbladder	2,102	2,227	0.7	C23
19	Cholecystitis	2,043	3,239	0.7	K81.0-K81.9
20	Fatty change of liver-not elsewhere specified	1,241	2,593	0.4	K76.0

Source: Centers for Disease Control Wide-ranging Online Data for Epidemiologic Research (http://wonder.cdc.gov)