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

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BACKGROUND & AIMS: Gastrointestinal (GI), liver, and pancreatic diseases are a source of substantial morbidity, mortality, and cost in the United States. 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 United States. **METHODS:** We collected statistics on health care 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 >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 during the last 20 years. In 2011, there were >1 million people in the United States 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 United States.

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 to GI research and another $619 million 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 used material available in the public domain or limited datasets with no direct patient identifiers. The methods used to collect the data from the source databases are detailed here.

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 (ED) 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 nonphysician clinicians who are primarily engaged in direct patient care. The NHAMCS collects data on visits to ED and hospital-based outpatient visits exclusive of federal, military, and Veterans Affairs hospitals.

To perform our analyses, we downloaded the public use data files from the CDC website. Both NAMCS and NHAMCS

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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 (Supplementary Table 1) and we totaled and ranked data from office visits, EDs, and hospital outpatient departments. Physician and nonphysician 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 Software, version 9.3 (SAS Institute, Cary, NC).

Emergency Department Visits

We compiled the most common and selected other 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 ED visits from 950 hospitals located in 30 states and is the largest all-payer database in the United States.

To perform our analyses, we used 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 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 ED GI and liver principal discharge diagnoses that were not among the top 100 discharge diagnoses with methods similar to those detailed here.

Hospitalizations

The most common inpatient GI and hepatology discharge diagnoses were compiled from the Nationwide Inpatient Sample (NIS), one of the databases in the HCUP (http://hcup.ahrq.gov/hcupnet.jsp). The 2012 NIS contains a 20% sample of discharges from 4378 community hospitals participating in HCUP across 44 states. The sampling frame for the 2012 NIS comprises approximately 95% of the US population, and includes >94% of discharges from US 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 used 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 during the 10-year period. The total 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. 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% of the US 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 CDC Wide-Ranging Online Data for Epidemiologic Research (http://wonder.cdc.gov), which is a publically available database provided by CDC. 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, 10th edition. 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