Published in final edited form as:

Clin Gastroenterol Hepatol. 2019 January ; 17(1): 90–97.e3. doi:10.1016/j.cgh.2018.04.039.

Rates of Hospital Readmission Among Medicare Beneficiaries With Gastrointestinal Bleeding Vary Based on Etiology and Comorbidities

Shazia Mehmood Siddique, MD,

Division of Gastroenterology, University of Pennsylvania Perelman School of Medicine

Associate Fellow, Leonard Davis Institute of Health Economics

Shivan J. Mehta, MD MBA,

Division of Gastroenterology, University of Pennsylvania Perelman School of Medicine

James Lewis, MD MSCE,

Division of Gastroenterology, University of Pennsylvania Perelman School of Medicine

Center for Epidemiology and Biostatistics, University of Pennsylvania Perelman School of Medicine

Mark D. Neuman, MD MS, and

Department of Anesthesiology and Critical Care, University of Pennsylvania School of Medicine

Senior Fellow, Leonard Davis Institute of Health Economics

Rachel M. Werner, MD PhD

Division of General Internal Medicine, University of Pennsylvania Perelman School of Medicine

Crescenz VA Medical Center, Philadelphia PA

Senior Fellow, Leonard Davis Institute of Health Economics

Abstract

Corresponding Author: Shazia Mehmood Siddique, MD, 3400 Civic Center Blvd. 7th Floor Gastroenterology, Philadelphia, PA 19104, Shazia.siddique@uphs.upenn.edu, (w) 215-873-9108. (c) 848-391-8469.

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Disclosures: All authors certify that there are no relevant financial, personal, or professional conflicts of interest relevant to this manuscript to disclose.

Author contributions:

Siddique: study concept and design; acquisition of data; analysis and interpretation of data; drafting of the manuscript; critical revision of the manuscript for important intellectual content; statistical analysis; obtained funding; study supervision

Mehta: study concept and design; analysis and interpretation of data; drafting of the manuscript; critical revision of the manuscript for important intellectual content; study supervision

Lewis: critical revision of the manuscript for important intellectual content; study supervision

Neuman: critical revision of the manuscript for important intellectual content; study supervision

Werner: study concept and design; analysis and interpretation of data; drafting of the manuscript; critical revision of the manuscript for important intellectual content; study supervision

Background & Aims—Gastrointestinal bleeding results in significant morbidity, mortality, and healthcare costs in the United States. The Center for Medicare and Medicaid Services' payment reform programs assess quality and value based on rates of hospital readmission for patients with gastrointestinal bleeding, but they identify these patients using Medicare Severity Diagnosis Related Groups (MS-DRGs), which include many types of gastrointestinal bleeding and do not account for the clinical heterogeneity among these patients. We aimed to characterize heterogeneity in outcomes of subgroups of patients with gastrointestinal bleeding.

Methods—We performed a cross-sectional, claims-based retrospective analysis of Medicare fee for service beneficiaries hospitalized for gastrointestinal bleeding in 2014 (159,000 hospitalizations). The primary outcome was unplanned readmission within 30 days of discharge from the hospital (30-day readmission). Secondary outcomes included length of stay, inpatient mortality, and death within 30 days of admission to the hospital (30-day mortality). Analyses were adjusted for age, sex, race, and Elixhauser comorbidities using logistic and Poisson regression, adjusting for clustering within hospitals.

Results—The 30-day readmission rate was 16.0%. Readmission rates varied among patients with different types of gastrointestinal bleeding, ranging from 13.5% for diverticular bleeding to 18.6% for small bowel bleeding. The mean length of stay was 4.2 days and 30-day mortality was 6.9% (ranging from 3.4% for diverticular bleeding to 12.1% for upper gastrointestinal bleeding not otherwise specified). When hospitalizations were stratified by MS-DRGs, the main source of variation in rates of readmission and mortality was MS-DRGs.

Conclusion—In a retrospective analysis of Medicare fee for service beneficiaries hospitalized for gastrointestinal bleeding, we found that 16% of these patients are readmitted to the hospital. Rates of hospital readmission, length of stay, and mortality vary with type of gastrointestinal bleeding, but MS-DRGs account for the largest source of variation. Policies focused on quality and value should account for this heterogeneity.

Keywords

GIB; quality metrics; re-hospitalization; quality of care

Introduction

Gastrointestinal bleeding leads to over 500,000 hospital admissions annually in the United States and is associated with substantial morbidity, mortality, and health care costs (1–3). Among patients hospitalized with gastrointestinal bleeding, outcomes vary based on type of bleeding. For example, upper gastrointestinal bleeding is associated with higher inpatient mortality, healthcare utilization, and costs than lower gastrointestinal bleeding (4–7). However, far less is known about readmission rates or length of stay among patients hospitalized for gastrointestinal bleeding, particularly among subtypes of bleeding. High readmission rates and prolonged length of stay may reflect gaps in quality of care, including high rates of complications, nosocomial infections, or poor coordination of post-discharge care. In other clinical conditions, such as heart failure, focusing on readmissions data has driven successful efforts to reduce readmissions, including partnerships with local hospitals, close outpatient follow-up, and medication reconciliation programs (8). These outcomes are

also becoming increasingly important as hospitals are held accountable through newer payment models for readmission rates and care that is delivered in the post-hospitalization period.

The focus on readmission rates for patients with gastrointestinal bleeding has arisen in the setting of new policies, including the Center for Medicare and Medicaid's (CMS) Bundled Payment Care Initiative (BPCI) and the Inpatient Quality Reporting programs (9,10). These programs hold hospitals accountable for unplanned 30-day readmissions; however little data are available regarding the application of this metric in this population. Of notable concern is that both BPCI and the Inpatient Quality Reporting program define the population of patients with gastrointestinal bleeding using Medicare Severity Diagnosis Related Groups (MS-DRGs) which encompass many types of gastrointestinal bleeding, and do not account for the clinical heterogeneity by type of bleeding. Additionally, the three MS-DRGs vary based on presence of comorbidities or complications associated with the gastrointestinal bleeding hospitalization, but for quality metric reporting, they are grouped together and reported as a larger gastrointestinal bleeding population (11). Finally, by characterizing the population by MS-DRGs, the cohort is not comprehensive of all causes of gastrointestinal bleeding; specifically, variceal bleeding is excluded, as it is characterized under a different MS-DRG for esophageal disorders. Therefore, in order to better understand the potential impact of these new policies, we sought to characterize readmission rates, length of stay, and mortality among patients hospitalized with gastrointestinal bleeding, accounting for heterogeneity within this population in terms of different types of bleeding, and stratifying across different MS-DRGs in a Medicare population.

Methods

We conducted a cross-sectional, claims-based retrospective analysis describing hospitalizations and outcomes among fee-for-service Medicare beneficiaries hospitalized for gastrointestinal bleeding in the United States during 2014.

Data source

We used the 100% MedPAR data for 2014, containing inpatient claims, and the 100% 2014 Medicare Beneficiary Summary File, containing beneficiary enrollment information. This study was approved by the Institutional Review Board at the University of Pennsylvania, which waived the requirement for participant informed consent.

Study population

Hospitalizations for gastrointestinal bleeding were identified based on MS-DRGs, following the definition used in prior studies, as well as in Medicare payment policies (9–10, 12). All hospitalizations for gastrointestinal bleeding, even if it were a repeat admission within the same year, were included given that the specifications of this Medicare measure do not differentiate the admissions. Specifically, we included all acute care hospitalizations for any of the three MS-DRGs for gastrointestinal bleeding (377 – with major comorbidity or complication, 378 – with comorbidity or complication, 379 – without comorbidity or complication) (11). Beneficiaries must have been enrolled in fee-for-service Medicare for 12

months prior to their hospitalization, and were excluded if they were enrolled in Medicare Advantage during the month of their hospitalization or during the month after. Patients less than age 66 were excluded, as this subset of Medicare patients are a unique, less representative portion of the Medicare population.

Dependent Variables (outcomes)

The primary outcome was unplanned readmission within 30 days of hospital discharge. An unplanned readmission was defined as an admission to an acute-care hospital that occurred within 30 days of hospital discharge, and the reason for readmission was not maintenance chemotherapy, bone marrow transplant, solid organ transplant, rehabilitation, or a potentially planned procedure (13). Potentially planned procedures were defined based on the technical specifications of CMS' hospital-wide readmission measure and are identified based on the following three principles: (1) some types of care are always considered planned (obstetrical delivery, transplant surgery, maintenance chemotherapy, rehabilitation); (2) otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and (3) admissions for acute illness or for complications of care are never planned (13). Secondary outcomes included mortality, defined by death from any cause during the inpatient hospitalization and within 30 days of hospital admission, and inpatient length of stay.

Independent Variables

Within the study population defined by MS-DRGs, as specified above, we characterized subgroups of gastrointestinal bleeding using primary ICD-9 codes. Using prior characterizations, we divided patients into those three groups based on location of gastrointestinal bleeding: upper, lower, and not otherwise specified bleeding (2). We then further subdivided into clinical conditions. These clinical conditions were determined based on consensus from two gastroenterologists (SMS and SJM): 1. peptic ulcer disease, 2. non-peptic ulcer disease upper GI bleed (e.g., gastritis, arteriovenous malformations (AVMs) in stomach or duodenum), 3. upper GI bleed – not otherwise specified (NOS) (includes one code for hematemesis), 4. small bowel bleeding (includes small bowel diverticulosis and small bowel AVMs), 5. colonic diverticulosis with bleeding, 6. lower GI bleed – NOS (includes bleeding of the rectum or anus), and 7. GI Bleed – NOS (includes codes for blood in stool and NOS codes) (Appendix Table 1). Of note, the Medicare definition of gastrointestinal bleeding is characterized using these DRGs, but does not encompass all forms of gastrointestinal bleeding, as codes for liver-related sources of gastrointestinal bleeding, such as portal hypertensive gastropathy and variceal bleeding, were not found in this population.

Statistical Analysis

To compute risk-adjusted readmission rates, mortality rates, and length of stay, we utilized regression models, adjusting the outcome for age, race, sex, and Elixhauser comorbidities, based on all reported ICD-9 codes during the current admission (12). Additional covariates, such as hospital type, initial hospital length of stay, presence of hospital transfer, and patient disposition after initial hospitalization, were added to the regression models which were rerun, to determine if any influenced differences in readmission rates. Logistic regression was

performed for binary outcomes (mortality and readmission), and Poisson regression for length of stay. All standard errors were adjusted for clustering within hospital. Analyses were performed for the total cohort and separately for each clinical condition specified above.

Subgroup analyses were performed for each of the three MS-DRGs described above in order to determine if there was heterogeneity in patient outcomes within MS-DRGs. Additionally, in order to determine if differences in outcomes were determined by liver disease-related complications such as variceal bleeding or portal hypertensive gastropathy, that were instead coded as hematemesis, patients with liver disease were excluded from the cohort and the same regression models were conducted. Similarly, a sensitivity analysis was performed after excluding GIB-NOS patients, and running the same regression models.

All statistical analyses were conducted using Stata, Version 14 (Stata Corp LP, College Station, Texas).

Results

Our initial sample included 326,827 hospitalizations for gastrointestinal bleeding during 2014, and after applying exclusion criteria, the final cohort included 159,000 hospitalizations (Figure 1). Of these, 84.9% of Medicare beneficiaries were hospitalized once during 2014 for gastrointestinal bleeding; 6.8% were hospitalized twice; 6.8% were hospitalized three times; 1.03% were hospitalized four times; the remaining 648 (0.4%) patients were hospitalized 5 or more times.

In our cohort, patients hospitalized with gastrointestinal bleeding had a mean age of 80.2 years, were predominantly female (55.2%) and white (82.1%; Table 1). The most prevalent diagnosis was anemia (87.2%). Other related comorbidities include liver disease (4.3%) and coagulopathy (6.3%). Patient characteristics were also described among MS-DRG groups, with similar trends (Appendix Table 2).

30.8% of patients were hospitalized with an upper gastrointestinal bleed, with the majority of those hospitalized for peptic ulcer disease (17.1% of total; Table 2). 27.9% were hospitalized with lower gastrointestinal bleeding, with the most cases due to colonic diverticular bleed. A large proportion of patients hospitalized (41.2%) had gastrointestinal bleeding NOS.

The prevalence of liver disease was higher in patients hospitalized with non-PUD UGIB (7.4%) and UGIB-NOS (6.6%) compared to the full cohort (4.4%).

30-day unplanned readmission rate

In the full cohort, risk-adjusted 30-day unplanned readmission rates ranged from 13.5% in those with diverticular bleeding to 18.6% in those with small bowel bleeding (Table 2). Readmission rates were significantly higher in those hospitalized with upper gastrointestinal bleeding (16.9%) than with lower gastrointestinal bleeding (14.6%) ($p < 0.0001$). In terms of specific types or sources of bleed, the 30-day readmission rate for patients hospitalized with diverticular bleeding was lower than those hospitalized with PUD (13.5% vs. 16.0%,

$p<0.0001$). Patients with non-PUD bleeding, which includes arteriovenous malformations in the stomach/duodenum, Dieulafoy lesions, gastritis and duodenitis, and those with small bowel bleeding had higher readmission rates than those with PUD (18.1% and 18.6% vs. 16.0%, $p<0.0001$ for both comparisons). There was no significant difference in readmission rates between those hospitalized with PUD (16.0%) and those hospitalized with UGIB-NOS, which was coded as hematemesis, (16.4%, $p=0.51$), LGIB-NOS, which was coded as rectal or anal hemorrhage (15.1%, $p=0.07$), and GIB-NOS (16.2%, $p=0.41$).

When additional covariates (adjusting for initial hospital length of stay, beneficiary zip code, presence of hospital transfer, and patient disposition after initial hospitalization) were added to this model, these the results did not change appreciably (Appendix Table 3).

Length of stay

The mean length of stay was 4.2 days, ranging from 3.6–4.6 days among different sources of gastrointestinal bleeding (Table 2). All types of GI bleeding had a statistically significant shorter length of stay than PUD ($p<0.003$ for all comparisons). The three conditions with the shortest length of stay were LGIB-NOS (3.6 days), UGIB-NOS (3.7 days), and GIB-NOS (4.0 days). Hospitalizations for PUD (4.6 days) and small bowel bleeding (4.4 days) had the longest lengths of stay.

Mortality

There is notable heterogeneity in inpatient mortality rates among types of gastrointestinal bleeding, with rates ranging from 0.7% (colonic diverticular bleeding) to 4.4% (UGIB-NOS) (Table 2). Patients hospitalized with UGIB-NOS had a significantly higher inpatient mortality rate than those hospitalized with PUD (4.4% vs. 2.9%, $p<0.0001$), whereas those with all other types of gastrointestinal bleeding had lower inpatient mortality rates ($p<0.0001$ for all comparisons) except for GIB-NOS which was not statistically different ($p=0.48$).

30-day mortality rates for patients with gastrointestinal bleeding followed similar patterns as inpatient mortality, but were approximately 3-fold higher (Table 2). These rates ranged from 3.4% (diverticular bleeding) to 12.1% (UGIB-NOS). There were lower rates of 30-day mortality for patients with non-PUD bleeding, small bowel bleeding, and diverticular bleeding, compared to those with PUD ($p<0.0001$ for all comparisons), while patients with UGIB-NOS and GIB-NOS had higher rates of 30d mortality ($p<0.02$ for both comparisons). There was no statistical difference in 30-day mortality rates for LGIB-NOS compared with PUD ($p=0.82$). Sensitivity analyses demonstrated nearly identical results as the primary analyses (see Supplementary Material).

MS-DRG characterization

To assess the impact of case mix based on MS-DRG, the analysis was repeated stratified by MS-DRG (Table 3). In terms of case-mix, the sicker populations (including all of those with comorbidities and complications, or MS-DRG 377 and 378) included more patients with UGIB compared to LGIB, whereas patients without complications or comorbidities (MS-DRG 379) included more patients with LGIB compared to UGIB. Readmission rate,

mortality, and length of stay varied significantly across the three gastrointestinal bleeding MS-DRGs ($p < 0.0001$ for all outcomes, and comparisons between MS-DRG 377 vs. 378 and 379). Those without comorbidity or complication (MS-DRG 379) had the lowest readmission rates, shortest length of stay, and lowest mortality rates, and those with major comorbidity or complication (MS-DRG 377) had the highest rates (Table 3). Within each MS-DRG, the pattern of patient outcomes across clinical conditions mirrored the differences in outcomes in the non-stratified cohort (in Table 2).

Across hospitals, there was substantial variation in MS-DRG case mix. The 159,000 hospitalizations for gastrointestinal bleeding during 2014 were from 3253 hospitals. Hospitalizations coded as MS-DRG 377 (with major comorbidity or complication) comprised a median of 19.3% of hospitalizations for gastrointestinal bleeding at a given hospital, with a wide interquartile range (IQR) 11.3–25.7% across hospitals. Hospitalizations coded as MS-DRG 378 (with comorbidity or complication) comprised a median of 64.7% (IQR 55.8%–72.2%), and those coded as MS-DRG 379 (without comorbidity or complication) had a median of 13.2% (IQR 7.3–21.9%). In our cohort, there were hospitals that did not have any hospitalizations in one of the three MS-DRGs, as well as hospitals that had all of their hospitalizations for gastrointestinal bleeding under only one MS-DRG (Figure 2).

Discussion

In this study of Medicare hospitalizations for gastrointestinal bleeding, we found substantial differences in readmission rates, length of hospital stay, and mortality between different types of gastrointestinal bleeding, defined by source of bleed, and among MS-DRGs. This variability found in Medicare's defined gastrointestinal bleeding cohort raises concerns regarding the application and interpretation of readmission rates in this population. In some subgroups, including those with small bowel bleeding and non-PUD bleeding, 30-day readmission rates were as high as 19% (Table 2). In contrast, patients with diverticular bleeding had lower 30-day readmission rates (13.5%), inpatient mortality (0.7%) and 30-day mortality (3.4%), but similar lengths of stay (4.1 days).

Notably, patients with UGIB-NOS had similar readmission rates and length of stay compared to PUD, but a higher mortality rate (12.1% vs 7.7% at 30 days). We speculated that patients coded as having hematemesis may have had cirrhosis-related bleeding, given that the ICD-9 codes for portal hypertensive gastropathy and variceal bleeding are categorized into other DRGs (for esophageal and stomach disorders) that are less specific for bleeding. However, after excluding patients with liver disease similar results were observed (Appendix Table 2). Therefore, it is possible that patients coded as UGIB-NOS were more likely to be receiving palliative care and as such less likely to undergo formal testing to establish a definitive cause for the bleeding. Future studies could examine this patient population in more detail, including procedure utilization, to better understand drivers of these outcomes.

Given that readmission rates, length of stay, and mortality vary across clinical conditions, readmission reduction efforts could target specific clinical conditions more effectively than

targeting a larger gastrointestinal bleeding population, particularly since clinical management differs based on the source of bleed (15–17). A potential targetable population is patients with small bowel bleeding (3.7% of all patients with gastrointestinal bleeding), who had the highest 30-day readmission rate (18.6%), but the second lowest 30-day mortality (3.%). Prior studies have shown that patients with suspected small bowel bleeding warrant an upper and lower endoscopy prior to a video capsule endoscopy, and this need for increased number of procedures may result in longer hospitalizations (18). In our data, however, patients with small bowel bleeding did not have a statistically significant longer length of stay than those with PUD. However, the high readmission rate suggests that bleeding may be persistent despite these interventions. Further research is warranted to determine reasons for high readmission rates in this patient population, such as recurrent bleeding, and given the low mortality rate, whether patients could receive some care as an outpatient instead.

Our readmissions data fill an important gap in the literature for gastrointestinal bleeding. We found high readmission rates, 16.0% in the full cohort, and in hospitalizations associated with major comorbidities or complications (MS-DRG 377), those rates were as high as 25%. The readmission rates for gastrointestinal bleeding are similar to those of other populations, such as pneumonia, stroke, and acute myocardial infarction, which are currently the focus of numerous readmission reduction efforts (9, 19–21). A prior study of Medicare beneficiaries hospitalized in New Haven and Boston hospitals from 1987–1989 found that readmission rates for patients with gastrointestinal bleeding ranged from 20–65% within a six month interval after the index admission (13). However, 30-day readmission rates were not provided and hospital-wide readmission rates have dropped significantly since that time. More recently, a study of Swedish patients with acute upper gastrointestinal bleeding were found to have an unplanned 30-day readmission rate of 16.5% (22), which is similar to the range in our cohort (16.0%–18.1%). Another recent study of patients with lower gastrointestinal bleeding at a single center found a 30-day readmission rate of 21% (15). However, this study was limited by small sample size, lack of generalizability to other patient populations, and lack of data for hospitalizations at other institutions. Our data showed readmission rates for patients with lower gastrointestinal bleeding ranged from 13.5–18.6% in a large, recent, national sample of Medicare beneficiaries (Table 2).

Notably, we also found significant variation in risk-adjusted outcomes between MS-DRGs (Table 3). Readmission rates were higher, length of stay was longer, and mortality was higher in MS-DRG 377 (hospitalizations with major comorbidity or complications) compared to MS-DRG 378 (with comorbidity or complication) and compared to MS-DRG 379 (without comorbidity or complication). Although there is variation within DRG by clinical condition similar to the full cohort, the main source of variation was between MS-DRGs. Additionally, we found variation in MS-DRG distribution across hospitals.

In terms of policy implications, our data suggests that grouping all three MS-DRGs for gastrointestinal bleeding together to report readmission rates, which is the current method for CMS' BPCI and quality reporting programs, may not reflect quality of care appropriately, particularly when some hospitals care for sicker patients than others. In this case, grouping MS-DRGs together does not account for the clinical heterogeneity of the

patient population across hospitals (Figure 2). Instead, future policies could stratify patients by type of MS-DRG and additionally based on clinical conditions, defined by ICD codes, when reporting readmission rates. Another option would be to narrow the targeted patient population; for example, a policy focusing on only those with PUD, where there is more evidence-based management, while stratifying by MS-DRGs, could more appropriately incentivize hospitals to target clinical care pathways to improve transitions of care and readmissions efforts for this cohort. This would allow for a more granular assessment of this patient population to account for clinical heterogeneity. Otherwise, payment models could unintentionally incentivize hospitalize to cherry-pick lower risk patients, a phenomenon that has been described in response to changes in reimbursement (23–25). Although acute gastrointestinal bleeding is often an emergency and patients present to the nearest hospital, if a hospital does not provide services such as advanced endoscopic techniques to evaluate for small bowel bleeding for example, they may transfer patients elsewhere or refer them as an outpatient to a tertiary care center, thereby shifting risk. Such shifts in population are important to study as payment models are implemented, in order to ensure access to care for high-risk patients does not worsen.

Limitations to this study include lack of generalizability to younger or commercially insured populations, given the study population of Medicare beneficiaries who are 65-years or older. However, this population is directly applicable to the cohort of patients included in Medicare-specific programs such as BPCI and Inpatient Quality Reporting. Also, this study included only data from 2014 and does not provide longitudinal data to examine trends over time. Additionally, there was a large proportion of patients hospitalized with gastrointestinal bleeding that were coded as blood in stool or GIB-NOS. However this is a coding limitation that impacts CMS' application of the data as well, and our sensitivity analysis did not show a difference in trends when excluding this group. Another limitation is the accuracy of Medicare claims data for GI bleed diagnoses.

Overall this study provides an important first step to understanding outcomes and utilization for patients hospitalized for gastrointestinal bleeding. This is the first study to our knowledge to report 30-day readmission rates for patients with gastrointestinal bleeding in a national cohort, and additionally, define quality metrics for this population, accounting for clinical heterogeneity. Our study shows that readmission rates, length of stay, and mortality vary by type of gastrointestinal bleeding, but far greater variability is explained by MS-DRGs. Future studies should examine reasons for readmissions in this patient population, and determine whether clinical care pathways can impact and improve quality metrics. Additionally, further research on readmissions at the hospital level can help further inform the potential impact of proposed policies on hospitals, and assess their effects on patient outcomes. Future policies focused on quality and value should use risk stratification accounting for clinical heterogeneity, and stratifying across MS-DRGs.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Grant support:

Siddique – NIH T32 grant (T32-DK007740)

Werner – NIH K24 grant (K24-AG047908)

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Background & Context

New Medicare payment reform policies assess readmission rates for patients with gastrointestinal bleeding. However, Medicare currently classifies patients with gastrointestinal bleeding as one large patient population, and does not account for clinical heterogeneity (e.g. peptic ulcer disease, diverticulosis) within this group.

Findings

The overall 30-day readmission rate for patients with gastrointestinal bleeding is significant (16.0%). Importantly, our study also found substantial variability in readmission rates, length of stay, and mortality among Medicare beneficiaries with different types of gastrointestinal bleeding and by Medicare Severity Diagnosis Related Group.

Implications for patient care

Since Medicare's classification does not account for this clinical heterogeneity, our study sheds light on the need for further efforts to redefine the gastrointestinal bleeding population in order to avoid penalizing hospitals based on case mix. Also, the higher readmission rates seen in some populations (e.g. 18.7% for small bowel bleeding) may be targets for future quality improvement initiatives.

Figure 1.

Figure 2.

Table 1
Patient Characteristics

Patient characteristics for 2014 Medicare hospitalizations for gastrointestinal bleeding.

Demographics	Frequency (%)
Age *	80.2 (8.1)
Sex	
Female	87,818 (55.2%)
Male	71,182 (44.8%)
Race	
White	130,650 (82.1%)
Black	19,892 (12.6%)
Asian	2,371 (1.5%)
Hispanic	2,630 (1.7%)
North American Native	783 (0.5%)
Other	2,100 (1.3%)
Unknown	574 (0.4%)
Elixhauser Comorbidities	
<u>Most Common Diagnoses:</u>	
Congestive heart failure	41,209 (26.0%)
Chronic Obstructive Pulmonary Disease	43,019 (27.1%)
Diabetes without chronic complications	44,837 (28.2%)
Electrolyte abnormality	47,607 (29.9%)
Hypertension	84,314 (53.0%)
Hypertension with complication	32,464 (26.7%)
Hypothyroidism	31,668 (19.9%)
Renal Failure	45,364 (28.5%)
Valvular Disease	22,345 (14.1%)
<u>Gastrointestinal bleeding related diagnoses:</u>	
Anemia secondary to blood loss or iron deficiency	138,750 (87.2%)
Coagulopathy	9,947 (6.3%)
Liver disease	6,788 (4.3%)
Composite score **	4 (3–6)

* mean and standard deviation are reported

** median and interquartile range are reported

Table 2
Risk-adjusted patient-level outcomes among different types of gastrointestinal bleeding

Outcomes for gastrointestinal bleeding patients are risk-adjusted for age, sex, race, and Elixhauser comorbidities.

Type of GI bleed	Frequency (%)	30d Unplanned Readmission Rate		Length of Stay		Mortality		
		Rate	p-value *	mean	p-value *	Inpatient	30-day	
PUD	27,184 (17.1%)	16.0%	ref	4.6	ref	Rate	Rate	p-value *
Non-PUD	16,707 (10.5%)	18.1%	<0.0001	4.3	<0.0001	2.9%	7.7%	ref
UGIB NOS	5,072 (3.2%)	16.4%	0.51	3.7	<0.0001	1.3%	5.0%	<0.0001
Small bowel	5,870 (3.7%)	18.6%	<0.0001	4.4	0.003	4.4%	12.1%	<0.0001
Colonic diverticular	31,228 (19.6%)	13.5%	<0.0001	4.1	<0.0001	0.9%	3.6%	<0.0001
LGIB-NOS	7,504 (4.7%)	15.1%	0.07	3.6	<0.0001	0.7%	3.4%	<0.0001
GIB NOS	65,435 (41.2%)	16.2%	0.41	4.0	<0.0001	1.9%	7.6%	0.82
Total	159,000 (100%)	16.0%		4.2		2.8%	8.2%	0.01
						2.2%	6.9%	

* P-values compare each type of gastrointestinal (GI) bleed with a reference category of PUD.

Abbreviations: PUD = peptic ulcer disease; UGIB = upper gastrointestinal bleed; NOS = not otherwise specified; LGIB = lower gastrointestinal bleed; GIB = gastrointestinal bleed

Table 3

Risk-adjusted patient level outcomes within MS-DRG

Outcomes for gastrointestinal bleeding patients within different Medicare Severity-Diagnosis Related Groups (MS-DRGs). Outcomes are risk-adjusted for age, sex, race, and Elixhauser comorbidities.

Type of GI bleed	Frequency	30d Unplanned Readmission Rate		Length of Stay		Mortality		
		Rate	p-value *	Mean	p-value *	Inpatient		30-day p-value *
						Rate	p-value *	
MS-DRG 377: GI hemorrhage with major complication or comorbidity								
PUD	6,490 (18.8%)	23.3%	ref	6.8	ref	7.2%	ref	17.0%
Non-PUD	4,795 (13.9%)	24.6%	0.17	6.0	<0.0001	4.3%	<0.0001	11.9%
UGIB NOS	1,371 (3.9%)	21.0%	0.09	5.4	<0.0001	10.6%	<0.0001	25.1%
Small bowel	1,412 (4.1%)	24.6%	0.31	6.5	0.06	3.6%	<0.0001	9.9%
Colonic diverticular	4,059 (11.8%)	20.8%	<0.01	6.2	<0.0001	3.5%	<0.001	10.3%
LGIB NOS	1,271 (3.7%)	21.0%	0.08	5.4	<0.0001	6.4%	0.22	19.1%
GIB NOS	15,055 (43.7%)	23.0%	0.68	5.9	<0.0001	7.9%	0.11	19.1%
Total	34,453 (100%)		22.9%		6.1		5.9%	12.9%
MS-DRG 378: GI hemorrhage with complication or comorbidity								
PUD	18,393 (17.9%)	14.3%	ref	4.0	ref	1.4%	ref	4.5%
Non-PUD	10,251 (10.0%)	17.0%	<0.0001	3.9	<0.0001	0.2%	<0.0001	3.0%
UGIB NOS	2,901 (2.8%)	16.3%	0.005	3.5	<0.0001	2.5%	<0.0001	8.5%
Small bowel	3,890 (3.8%)	17.5%	<0.0001	4.0	0.65	0.1%	<0.0001	2.1%
Colonic diverticular	21,037 (20.5%)	12.8%	<0.0001	3.8	<0.0001	0.2%	<0.0001	2.0%
LGIB NOS	4,546 (4.4%)	14.9%	0.40	3.4	<0.0001	1.0%	0.024	5.5%
GIB NOS	41,876 (40.7%)	15.2%	0.01	3.7	<0.0001	1.3%	0.342	5.3%
Total	102,894 (100%)		15.4%		3.8		1.2%	5.0%
MS-DRG 379: GI hemorrhage without complication or comorbidity								
PUD	2,301 (10.6%)	10.8%	ref	2.8	ref	1.0%	ref	2.9%
Non-PUD	1,661 (7.7%)	10.5%	0.78	2.7	0.08	0.1%	0.012	1.1%
UGIB NOS	800 (3.7%)	9.5%	0.35	2.3	<0.0001	1.2%	0.798	3.5%
								0.47

Type of GI bleed	Frequency	30d Unplanned Readmission Rate		Length of Stay		Mortality			
		Rate	p-value *	Mean	p-value *	Inpatient		30-day	
						Rate	p-value *	Rate	p-value *
Small bowel	568 (2.6%)	14.5%	0.02	2.9	0.14	0.2%	0.161	0.8%	0.01
Colonic diverticular	6,132 (28.3%)	8.6%	0.01	2.7	0.08	0.1%	<0.0001	0.8%	<0.0001
LGIB NOS	1,687 (7.8%)	9.5%	0.35	2.5	<0.0001	0.3%	0.023	1.7%	0.04
GBIB NOS	8,504 (39.3%)	10.2%	0.54	2.6	<0.001	1.1%	0.790	3.0%	0.87
Total	21,653 (100%)	10.0%		2.7		0.3%		1.8%	

* P-values compare each type of gastrointestinal (GI) bleed with a reference category of PUD.

Abbreviations: PUD = peptic ulcer disease; UGIB = upper gastrointestinal bleed; NOS = not otherwise specified; LGIB = lower gastrointestinal bleed; GIB = gastrointestinal bleed