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ORIGINAL RESEARCH—CLINICAL

The Association of Race, Ethnicity, and Insurance Status With Outcomes in Hospitalized Patients With Ulcerative Colitis

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BACKGROUND AND AIMS: The impact of sociodemographic factors on outcomes in patients with ulcerative colitis (UC) is not well studied. We characterized the association of race/ethnicity and insurance status with procedures, length of stay (LOS), mortality, and cost of care in a cohort of hospitalized patients with UC. **METHODS:** Data from the National Inpatient Sample from 2016 to 2018 were used. Outcomes were analyzed using generalized estimating equations. All models included age, sex, income quartile, hospital diagnosis, hospital characteristics, and Elixhauser Comorbidity Index as well as the primary predictors. **RESULTS:** A total of 34,814 patients were included. Black (adjusted odds ratio [aOR] 0.46, 95% confidence interval [0.39–0.55]) or Hispanic (aOR 0.74, [0.64–0.86]) patients had lower odds of colectomy than White patients. Patients with Medicare (aOR 0.54, [0.48–0.62), Medicaid (aOR 0.51, [0.45–0.58]), or no insurance (aOR 0.42, [0.35–0.50]) had lower odds of colectomy than privately insured patients. Black patients had higher mortality than White patients (aOR 1.38, [1.07–1.78]). Patients with Medicare or Medicaid had 5% ([1.01–1.09]) and 9% longer LOS ([1.05–1.13]), respectively, than privately insured patients, while uninsured patients had a 6% shorter LOS ([0.90–0.97]). Hispanic or Asian/Native American patients had 11% ([1.06–1.15]) and 13% ([1.07–1.20]) higher costs, respectively, than White patients. Uninsured patients had 11% lower hospitalization costs than privately insured patients ([0.85–0.94]). **CONCLUSION:** Hospitalized patients with UC differed significantly in rates of colectomy, mortality, LOS, and costs based on race/ethnicity and insurance status. Further research is needed to understand the cause of these differences and develop targeted solutions to reduce these inequities.

Keywords: Disparities; Race; Health Equity; Health Outcomes

Introduction

Inflammatory bowel disease (IBD), which includes ulcerative colitis (UC) and Crohn's disease, is a major source of morbidity and mortality in the United States. While many clinicians still consider IBD to be a disease that predominantly affects White patients, one recent study suggests that the incidence of IBD increased by 39% in White patients and 134% in minority patients between 1970 and 2010.[1] IBD, and more specifically UC, has also become increasingly prevalent in developing nations over the last several decades.[2–4] UC typically presents as mild to moderate disease on diagnosis, but 10% of patients present with severe symptoms, including life-threatening complications such as hemorrhage, bowel perforation, toxic megacolon, and colorectal cancer, leading to worse outcomes.[2,5]

Despite these changing demographics and important clinical outcomes, there are relatively few studies that examine race and ethnicity in patients with IBD.[6] As race and ethnicity are social constructs, both interpersonal and structural racism have powerful effects on health and health care. Indeed, race-based disparities in medical care and clinical outcomes for other gastrointestinal diseases have been documented.[7–9] Studies examining IBD suggest that White and Asian patients with IBD are more likely to have private insurance than Black and Hispanic patients, who are more likely to have public or no insurance and, therefore, experience increased challenges in accessing care.[10] Among patients with UC specifically, Black patients are less likely to be under the care of a gastroenterologist and have more frequent emergency department visits than their White counterparts, as well as longer times to colectomy.[11–13]

The adverse outcomes in UC associated with minority race or ethnicity are multifactorial and likely related to the interplay of interpersonal and structural racism and its consequences, including access to care.[14] Health outcomes also vary by insurance status or type, another proxy for barriers to care, with underinsured or uninsured patients having worse health outcomes as compared to privately insured patients.[15] However, to our knowledge, there are no nationally representative

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Abbreviations used in this paper: **aOR, adjusted odds ratio; IBD, inflammatory bowel disease; LOS, length of stay; NIS, National Inpatient Sample; UC, ulcerative colitis.**

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large-scale studies utilizing all payer data in patients with UC that address the association of race/ethnicity or insurance status with hospitalizations and in-hospital outcomes.

It is essential to study the racial and socioeconomic disparities that exist in the care of patients with UC, so focused efforts can be made to address these inequities. Therefore, we examined the association of race/ethnicity and insurance status with admitting diagnoses, in-hospital procedures, specifically partial or total colonic resection and endoscopy, length of stay (LOS), in-hospital mortality, and cost of care in hospitalized patients with UC.

Materials and Methods

Data Source and Study Sample

Data from the National Inpatient Sample (NIS) from 2016 to 2018 were used. The NIS is the largest all-payer database in the United States. It contains data from all states participating in the Healthcare Cost and Utilization Project, which covers more than 97% of the US population. It represents approximately 20% of all hospitalizations nationwide, excluding rehabilitation and long-term acute care hospitals. Hospital administrative data began using International Classification of Diseases, Tenth Revision, (ICD-10) codes in October 2015, so data were limited to 2016 onwards.[16]

A data set was created from the NIS that identified individuals aged 18 years and older with a primary or secondary diagnosis of UC (K51.x) between January 1, 2016, and December 31, 2018. In patients with a secondary diagnosis of UC, ICD-10 codes were used to filter for admissions that were likely to be related to the UC based on the primary diagnosis (Table A1).

To determine the distribution of specific diagnoses present in the cohort, primary and secondary ICD-10 codes were used to obtain the number of patients with gastrointestinal hemorrhage/coagulopathy, infection/abscess, colitis without complication, malignancy, obstruction, ostomy complication, and perforation/fistula (Table A1). These diagnoses were chosen because they encompassed both acute and chronic complications seen in patients with UC.[5]

Demographic data including age, sex, Elixhauser comorbidities, median income, insurance status, and hospital characteristics were extracted from the NIS. Admissions missing key data elements including insurance status (n = 116), race (n = 2715), median income (n = 1158), discharge location (n = 249), discharge condition (n = 51), sex (n = 32), LOS (n = 4), transfer in (n = 288), and total charges (n = 791) were excluded, as were patients with missing age or age <18 years (n = 2742). Admissions who were transferred to a different hospital or were missing this information were also excluded to avoid double-counting hospitalizations, as the NIS does not link hospitalizations for each patient (n = 1629). However, admissions initiated by a hospital transfer were retained in the data set, as these generally represent transfer to a higher level of care where procedures might occur and where clinical outcomes can be ascertained.

Predictors and Covariates

The primary predictors evaluated in this study were race/ethnicity (White, Black, Hispanic, or Native American/Asian/other) and insurance status (Medicare, Medicaid, private insurance, or uninsured/no charge/other). Race/ethnicity was defined by individual hospitals in their data submissions to Healthcare Cost and Utilization Project and, therefore, may reflect patient report or ascertainment by an admission clerk or administrator. Additional control variables included age, sex, hospital region (Northeast, Midwest, South, and West), patient location (urban, town, rural), median income by patient zip code (top 3 quartiles, lowest quartile), Elixhauser Comorbidity Index, and hospital diagnoses by the groupings outlined above.[17,18]

Outcomes

The primary outcome was mortality in hospitalized patients with UC. Secondary outcomes included receipt of endoscopy or partial or total colonic resection during the hospitalization, total LOS, and total cost of stay. The cohorts that received endoscopy or partial or total colonic resection were extracted using specific procedure codes, which are embedded within the NIS data set (Table A1).

Analyses

First, demographics including age, sex, race/ethnicity, insurance status, income quartile, hospital region, patient location, and comorbidities defined by the Elixhauser method among the entire population were summarized and compared across groups including race and insurance status using chi-square tests and t-tests as appropriate.

The distribution of patients within each hospital diagnosis group (gastrointestinal hemorrhage/coagulopathy, infection/abscess, colitis without complication, malignancy, obstruction, ostomy complication, and perforation/fistula) was also summarized and compared across race/ethnicity and insurance status using chi-square tests.

Receipt of in-hospital procedures, specifically endoscopy or colectomy, based on race/ethnicity and insurance status was analyzed, using logistic regression models that included the covariates listed above. Similar analyses were done for LOS using negative binomial distribution, in-hospital mortality using logistic regression, and cost of stay using gamma distribution. The models also included each patient's admission diagnosis group as a covariate to account for differences in outcomes due to differences in admissions (eg, hemorrhage vs infection). All models were fit using generalized estimating equations clustering on hospital-year to account for within hospital-year correlation. As a result, all odds ratios and rates represent population-averaged results.

All multivariate regression analyses were conducted using SAS (version 9.4). The remainder of the analyses were conducted using R (version 4.1). We considered a P value $< .05$ to be statistically significant. This study was considered nonhuman subjects research by the Washington University Office of Human Research Protection due to the deidentified nature of the data (IRB no. 202103093).

Results

Sample, Patient, and Hospital Characteristics

There were 34,814 hospitalizations for UC that met inclusion criteria between January 1, 2016, and December 31,

Table 1. Demographics of Patients With Ulcerative Colitis in the NIS From 2016 to 2018

	N (%)
Age	
18–34	8379 (24.1%)
35–54	9822 (28.2%)
55–64	5555 (16.0%)
65–74	5310 (15.3%)
>74	5784 (16.6%)
Race/ethnicity	
White	25,820 (74.2%)
Black	3643 (10.5%)
Hispanic	3477 (10.0%)
Asian/Native American/other	1874 (5.4%)
Insurance status	
Private	14,493 (41.6%)
Medicare	12,514 (35.9%)
Medicaid	5113 (14.7%)
Uninsured/no charge/other	2694 (7.7%)
Income percentile	
76–100	8876 (25.5%)
51–75	9036 (26.0%)
26–50	8627 (24.8%)
0–25	8275 (23.8%)
Sex	
Male	16,219 (46.6%)
Female	18,595 (53.4%)
Degree of rurality	
Urban	20,645 (59.3%)
Town	9846 (28.3%)
Rural	4323 (12.4%)
Hospital region	
Northeast	7867 (22.6%)
Miswest	7294 (21.0%)
South	12,747 (36.6%)
West	6906 (19.8%)
Selected comorbidities	
Fluid and Electrolyte disorders	15,905 (45.7%)
Hypertension (uncontrolled)	9575 (27.5%)
Weight loss	5619 (16.1%)
Chronic lung disease	5090 (14.6%)
Cardiac arrythmias	4903 (14.1%)
Depression	4404 (12.7%)
Hypertension (controlled)	3337 (9.6%)
Hypothyroidism	3137 (9.0%)
Obesity	2936 (8.4%)
Renal failure	2825 (8.1%)
Weighted Elixhauser Score	
Mean Agency for Healthcare Research and Quality score	8.12

2018, (Table 1). The majority of hospitalizations were in patients aged 18–34 years (24.1%) and 35–54 years (28.2%), while patients aged 55–64 years (16%), 65–74 years (15.3%), and >74 years (16.6%) represented a smaller proportion of hospitalizations. White patients (74.2%) were the most common race/ethnicity represented in the sample, while Black (10.5%), Hispanic (10%), and Asian/Native American/other (5.4%) were less common. Most patients were privately insured (41.6%) or were insured by Medicare (35.9%), while a minority of patients were insured by Medicaid (14.7%) or were uninsured/no charge/other (7.7%). The patients were evenly distributed across the income quartile. The hospitals in our sample were distributed among the South (36.6%), Northeast (22.6%), Midwest (21%), and West (19.8%) regions of the United States. The majority (59.3%) of patients lived in urban settings, 28.3% in towns, and 12.4% in rural areas. Selected comorbidities and mean weighted Elixhauser score are shown in Table 1. The same demographic data broken down by the primary predictors of race/ethnicity and insurance status are shown in Tables A2 and A3.

The distribution of specific diagnoses in hospitalized patients with UC, broken down by race/ethnicity and insurance status, is shown in Figure. Gastrointestinal hemorrhage or coagulopathy was the most common reason for admission in all subgroups except for the Medicare group, in which infection or abscess was the most common presentation (Figure).

In-Hospital Procedures

After adjusting for age, sex, hospital region, patient location, income status, medical comorbidities, and hospital diagnosis, as well as the primary predictors of race/ethnicity and insurance status, patients who were Black (4.42%, adjusted odds ratio [aOR] 0.46, 95% confidence interval [0.39–0.55]) or Hispanic (6.87%, aOR 0.74, [0.64–0.86]) had lower odds of partial or total colonic resection than White patients (10.51%). There was no significant difference in receipt of colectomy between Asian/Native American/other patients and White patients. Patients with Medicare (5.83%, aOR 0.54, [0.48–0.62]), Medicaid (6.79%, aOR 0.51, [0.45–0.58]), or no insurance (5.61%, aOR 0.42, [0.35–0.50]) had lower odds of colectomy than privately insured patients (14.24%) (Table 2). There was no significant association between race/ethnicity or insurance status and receipt of endoscopy while hospitalized (Table 3).

In-Hospital Mortality

Black patients with UC had higher mortality than White patients (2.33% vs 2.28%, aOR 1.38, [1.07–1.78], $P = .01$). There were no significant differences in mortality in Hispanic and Asian/Native American patients compared to White patients. There were no significant differences in mortality by insurance status (Table 2).

Length of Stay

There was no significant difference in LOS among patients of different races/ethnicities. Patients with Medicare had a 5% longer LOS on average (6.41 days, [1.01–1.09]) than patients with private insurance while patients with Medicaid had a 9% longer LOS on average (5.90 days, [1.05–1.13]) than patients with private insurance (5.35 days). Patients who were uninsured/no charge/other had a 6% shorter LOS on average (4.87 days, [0.90–0.97]) than privately insured patients (Table 2).

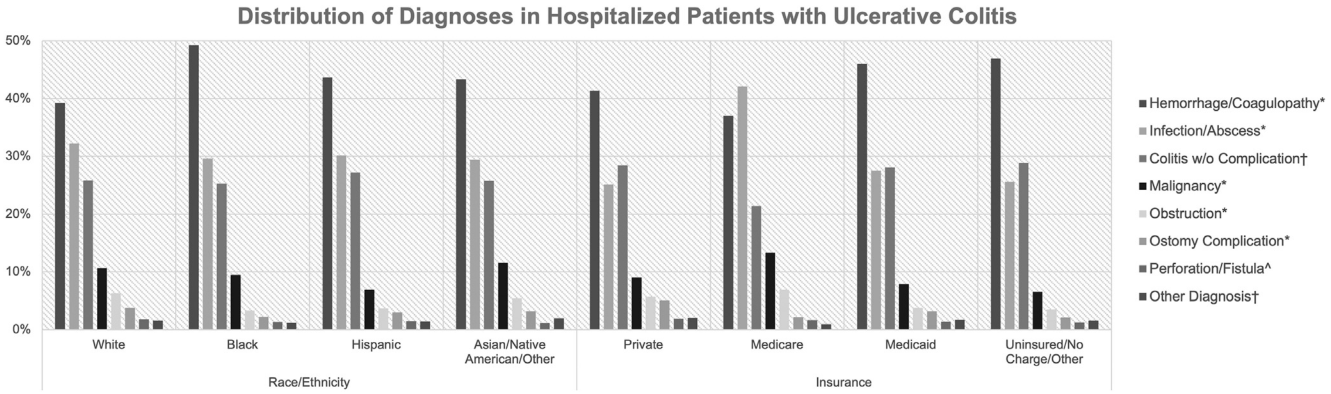

Figure. Distribution of diagnoses in hospitalized patients with ulcerative colitis. Note: the most common "other diagnosis" was UC with other or unspecified complication. *$P < .001$ by race/ethnicity and insurance status. †P values not significant by race/ethnicity, $P < .001$ by insurance status. ˆ$P < .05$ by race/ethnicity and insurance status.

Cost of Stay

Black patients did not have significantly different hospitalization costs compared to White patients. Hispanic patients had 11% higher hospitalization costs ($63,200, [1.06–1.15]) than White patients, and Asian/Native American patients had 13% higher hospitalization costs ($69,200, [1.07–1.20]) than White patients ($55,500). There was no significant difference in cost of care between patients insured by Medicaid or Medicare and privately insured patients. Patients who were uninsured/no charge/other had hospitalization costs that were 11% lower than those of patients with private insurance ($45,600 vs $53,800, [0.85–0.94]) (Table 2).

Discussion

In this nationally representative cohort, we found that race/ethnicity and insurance status were associated with differences in receipt of colonic resection in hospitalized patients with UC, specifically in Black and Hispanic patients and patients without private insurance. Black patients also had a higher mortality rate than their White counterparts.

There were clear differences in the odds of colectomy between the patient cohorts. Around 30% of patients with UC will undergo some form of colectomy in their lifetime, for either fulminant or refractory disease or malignancy.[19] Resection of the diseased portion of the colon can be curative for UC, and patients who receive surgery have been shown to have good quality of life following the procedure.[20–22] In this study, Black and Hispanic patients as well as uninsured patients and patients insured with Medicaid or Medicare had significantly lower rates of colectomy than White patients and privately insured patients. One other study, analyzing data from 1998 to 2003, has shown similar findings in racial minorities, also noting that Black patients had a longer interval between hospital admission and surgery.[11]

While investigating the reasons for these disparities is beyond the scope of administrative data, it is possible that

Table 2. Association of Race/Ethnicity and Insurance Status on Length of Stay, Mortality, and Cost of Stay in Patients With Ulcerative Colitis

	Length of stay			Mortality				Cost of stay		
	Mean (d)	aRate	CI	Rate	aOR	P	CI	Mean ($)	aRate	CI
Race/Ethnicity										
White[a]	5.77			2.28%				55,500		
Black	6.03	1.03	0.99–1.08	2.33%	1.38	.01	1.07–1.78	57,800	1.01	0.96–1.06
Hispanic	5.35	0.98	0.95–1.02	1.75%	1.10	.50	0.83–1.46	63,200	1.11	1.06–1.15
Asian/Native American/other	6.08	1.05	0.98–1.11	2.29%	1.28	.14	0.92–1.78	69,200	1.13	1.07–1.20
Insurance										
Private[a]	5.35			0.95%				53,800		
Medicare	6.41	1.05	1.01–1.09	4.39%	1.31	.05	1.00–1.72	63,500	1.03	0.98–1.08
Medicaid	5.90	1.09	1.05–1.13	1.21%	1.34	.07	0.98–1.85	57,900	0.96	0.92–1.00
Uninsured/no charge/other	4.87	0.94	0.90–0.97	1.08%	1.20	.41	0.78–1.83	45,600	0.89	0.85–0.94

All regressions controlled for age, sex, income status, hospital characteristics, comorbidities using weighted Elixhauser index, and hospital diagnosis by group as well as the primary predictors of race/ethnicity and insurance status.
aRate, adjusted rate; CI, confidence interval.
[a] Reference group.

Table 3. Association of Race/Ethnicity and Insurance Status on Resection and Endoscopy in Patients With Ulcerative Colitis

	Resection		Endoscopy	
	Rate	aOR (CI)	Rate	aOR (CI)
Race/ethnicity				
White[a]	10.51%		6.00%	
Black	4.42%	0.46 (0.39–0.55)	6.09%	0.99 (0.85–1.16)
Hispanic	6.87%	0.74 (0.64–0.86)	5.84%	0.97 (0.83–1.14)
Asian/Native American/other	9.55%	0.92 (0.78–1.09)	5.28%	0.86 (0.70–1.07)
Insurance				
Private[a]	14.24%		5.86%	
Medicare	5.83%	0.54 (0.48–0.62)	6.25%	1.24 (1.06–1.45)
Medicaid	6.79%	0.51 (0.45–0.58)	6.06%	1.07 (0.93–1.23)
Uninsured/no charge/other	5.61%	0.42 (0.35–0.50)	4.83%	0.82 (0.68–1.00)

All regressions controlled for age, sex, income status, hospital characteristics, comorbidities using weighted Elixhauser index, and hospital diagnosis by group as well as the primary predictors of race/ethnicity and insurance status.
CI, confidence interval.
[a] Reference group.

racial bias is present among both physicians and risk-algorithms when identifying and treating patients with severe UC.[23,24] It is also possible that hospitals are less likely to perform a procedure knowing their reimbursement may be lower in patients with public insurance than in those with private insurance. Additionally, due to greater difficulty in accessing outpatient care, publicly insured or uninsured patients may be started on biologics during admission as an attempt at rescue therapy, while privately insured patients may be admitted for definitive surgical therapy. There is also data that show there are racial differences in the number of emergency department visits, access to outpatient gastroenterologists, and biologic or steroid use among patients with IBD which could be contributing to the differences in rates of colectomy when inpatient.[25,26] Finally, it is possible that Black patients had fewer indications for surgery although their higher mortality rate would suggest that lower disease severity overall is unlikely or that they were less likely to want surgery, possibly due to well-founded mistrust of the medical system in the context of its longstanding interpersonal and structural racism.[27]

There was no significant difference in LOS among patients of different races/ethnicities. However, patients with Medicaid and Medicare had longer LOS than patients with private insurance, and patients who had no insurance had a shorter LOS. This trend has been seen in other patient populations as well.[28,29] It is possible that care for patients with public insurance may be less efficient than care for privately insured patients. The longer LOS also may be due to a higher rate of post-acute care use among publicly insured patients, which can delay discharge or may represent unmeasured differences in severity of illness between the groups. Additionally, due to the potential differences in treatment by insurance as discussed above, LOS may be impacted by initiation of biologics vs definitive surgical therapy. On the other hand, uninsured patients may be hospitalized for shorter periods of time due to concerns related to external stressors like maintaining a job, housing, or caring for family members. Hospitals may also be quicker to discharge uninsured patients due to their inability to pay.

Patients who were Black had higher mortality than White patients who were hospitalized with UC between 2016 and 2018, after adjusting for patient characteristics and comorbidities. Black patients may have presented with more severe disease, particularly if they had decreased access to outpatient care and chronic disease management. Other studies have shown that differences in medical treatment for UC are present based on race, with Black patients less likely to receive steroids, and thus, it is possible that mortality is affected by variations in treatment.[30] It is also possible that Black patients are presenting to hospitals that have fewer resources or specialists, leading to differences in outcomes.[31]

Hispanic patients and patients identified as Asian, Native American, or another race/ethnicity had hospitalization costs that were higher than those of White patients, and patients who had no insurance had hospitalization costs that were lower than those of patients with private insurance. Other studies have also shown that Hispanic and Asian patients experience higher hospitalization charges than White patients although the reasons behind this association remain unclear.[32] In this setting, it is also difficult to know whether lower or higher costs are appropriate. Low costs may reflect a lack of access to procedures such as endoscopy or colectomy; high costs may represent complications or poor-quality care or unmeasured disease severity.

Despite being one of the least prevalent gastrointestinal disorders, IBD is among the most costly for patients and hospitals.[33] Furthermore, the incidence of both UC and Crohn's disease has been increasing in recent years, and more so in minority populations.[1,34] Thus, there recently has been significant interest in the effect of various social, demographic, and economic factors in outcomes in patients with IBD. Other studies have shown that racial and social disparities exist among patients with IBD, but these studies were limited by small sample size, low mortality rates, and lack of adjustment for income level.[32,35] Few studies have taken a closer look at the impact of race/ethnicity and insurance status on UC specifically, and this study attempts to understand the health disparities that exist among this population.[35] Several factors may contribute to the inequities in outcomes among minority and publicly insured patients such as access to care, environmental differences, and differences in disease perception and management.[6] It will be important to elucidate the cause of these disparities in future studies by investigating racial and insurance-based differences in administration of steroid or biologic therapy in outpatient and inpatient settings, access to subspecialist care in the outpatient setting, treatment recommendations by providers for colectomy, and patients' perspectives on medical vs surgical treatments for their UC.

There are limitations to this study. Since the NIS only includes inpatient hospitalizations and relies on diagnosis codes from billing, this study was only able to assess inpatient outcomes and lacked detailed clinical data such as disease severity on presentation and prior outpatient treatments for risk adjustment, relying instead on a comorbidity index. We also lacked clinical data regarding patients' eligibility for procedures such as colectomy, both in terms of indications and contraindications. Furthermore, pharmaceutical data are not available through the NIS, and therefore, the interplay between inpatient treatment such as biologics and steroids and in-hospital outcomes cannot be analyzed. Additionally, the patient cohort was created by including all patients with a primary diagnosis of UC and patients with a secondary diagnosis of UC if they had a specific primary diagnosis that was felt to be related to their UC. While this method allowed for a larger data set and for the inclusion of complications that would not have been captured otherwise, it is possible that certain hospitalizations were not related to the UC based on misclassification in ICD-10 codes. Lastly, race/ethnicity is being used in this study as a proxy for racism, both individual and structural, which is a significant limitation. Race/ethnicity was hospital-reported and not patient-reported, and because of a limited sample size, this study categorized individuals as other if they were not identified as Black, White, or Hispanic. As a result, the analysis did not adequately evaluate other ethnicities or those with multiracial backgrounds. It is also possible that demographic data were not collected accurately, thereby affecting the analysis. While there is a lack of data specifically regarding misclassification rates of race/ethnicity in the NIS as a whole, state-specific data from California, which is submitted to Healthcare Cost and Utilization Project, have shown around 86% agreement between patient-reported and hospital-reported race/ethnicity.[36] There is also data from the Veterans Affairs that show that percent agreement between hospital-reported and patient-reported race is 70%–98% for most races, but as low as 20% for Native Americans, and data from a Medicare database show racial misclassification rates between 4.2% and 7.5%, with particular underidentification of Hispanic, Asian, Pacific Islander, and Native American patients.[37,38] Despite these limitations, these findings provide important information on outcomes in adults hospitalized with UC.

Conclusions

Hospitalized patients with UC differed significantly in diagnoses, in-hospital procedures, LOS, mortality, and costs based on race/ethnicity and insurance status. Importantly, Black, Hispanic, and publicly insured patients were less likely to receive colectomy than their White and privately insured counterparts, and Black patients had higher mortality. As rates of UC continue to rise, it will be important to investigate the reasons for these disparities and focus efforts to developing targeted strategies to reduce the inequities in IBD outcomes.

Supplementary Materials

Material associated with this article can be found in the online version at https://doi.org/10.1016/j.gastha.2022.07.016.

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

Data Transparency Statement:
The data used for this study are available from the Healthcare Cost and Utilization Project (https://www.hcup-us.ahrq.gov/) under appropriate data use agreements. The investigators are not authorized to share data independently.