



Evaluation of racial/ethnic disparities in surgical outcomes after rectal cancer resection: An ACS-NSQIP analysis

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ABSTRACT

Background: Disparities exist in the management of rectal cancer. We sought to evaluate short-term surgical outcomes among different racial/ethnic groups following rectal cancer resection.

Materials and Methods: National Surgical Quality Improvement Program (NSQIP) database (2016–2019) was queried. Patients undergoing rectal cancer resection were categorized by race/ethnicity. Circumferential resection margin positivity rate and postoperative outcomes were evaluated. 1:1 Propensity score matching (PSM) was used.

Results: Of 1,753 patients, 80.2 % were White, 7.6 % Black, 8.5 % Asian and 3.7 % Hispanic. On unadjusted analysis, Hispanic patients presented longer operative time ($p = 0.029$), and Black patients higher postoperative ileus ($p = 0.003$) and readmission ($p = 0.023$) rates. After PSM, Hispanics had a significantly higher circumferential resection margin positivity rate ($p = 0.032$), Black patients higher postoperative ileus rate ($p = 0.014$) and longer LOS ($p = 0.0118$) when compared to White counterparts.

Conclusion: Racial disparities were found in short-term postoperative outcomes. Hispanic patients presented higher margin positivity rate and Black patients worst 30-day postoperative outcomes. Comparative studies evaluating trends and a higher number of minority patients included in databases are warranted.

Introduction

In the 2020 Census approximately one third of the US population self-identified as being something other than non-Hispanic Whites (comprising 59.7 % of the population); Hispanic or Latino was the second largest racial/ethnic group (18.7 %), followed by non-Hispanic Black or African American (12.1 %) and Asians (5.9 %) [1]. Trends show that the proportion of racial minorities will continue to rise; after 2045, non-Hispanic Whites will make up less than 50 % of the US population [2]. Importantly, per the American Cancer Society, racial/ethnic minorities are more likely to develop and die from cancer.

Studies have shown disparities in the incidence and mortality of minorities diagnosed with rectal cancer; patient related factors (e.g., education level, income status, type of insurance) or health care delivery related factors (e.g., provider characteristics, quality of delivered care) can be drivers of the gap in care [3,4]. Black patients have been found to have more advanced disease stage at presentation, decreased rates of neoadjuvant therapy, increased rates of postoperative complications, and lower overall survival [5–7]. Studies have shown that surgical

outcomes appear to be favorable or better in Asians when compared to Whites [8,9]. Mixed evidence exists regarding Hispanic population; some data has demonstrated higher postoperative surgical complications and mortality [10], while other evidencing the opposite [11].

A vast proportion of the studies assessing racial disparities in rectal cancer evaluate White and Black patients or combine multiple races/ethnicities into a single group. Racial/ethnic minorities should not be viewed as a monolithic group, but as different populations since multiple factors can impact the natural history of the disease in each group. There is paucity of studies evaluating post-operative outcomes in minority patients with rectal cancer following oncologic resection. This is an area that warrants attention to identify factors in need of further investigation and intervention to mitigate disparities in care. In this study, we sought to evaluate short-term surgical outcomes among different racial/ethnic groups following low anterior resection (LAR) or abdominoperineal resection (APR) for rectal cancer.

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Materials and methods

Study design

A retrospective cohort study was performed using the American College of Surgeons - National Surgical Quality Improvement Program (ACS-NSQIP) participant user files (PUF) and merged with the targeted proctectomy data between 2016 and 2019. The International Classification of Disease 9 and 10 (ICD-9/ICD-10) diagnosis codes for rectal cancer were used (ICD-9: 154.1/ICD-10: C20). Current procedural terminology (CPT) codes were used to identify surgical procedures comprising APR (45,110, 45,395) and LAR (45,111, 45,112, 45,113, 45,119, 44,145, 45,397). Patients ≥ 18 years of age were included. Patients who underwent emergent resection, with metastatic disease, unknown clinical stage, unknown circumferential or distal resection margin status, unknown race/ethnicity, race/ethnicity other than White, Black, Asian, or Hispanic, and surgeries performed by specialties coded as other than general surgery were excluded.

As a primary outcome we evaluated circumferential resection margin (CRM) positivity rate between racial/ethnic groups. Secondly, we evaluated surgical and 30-day postoperative outcomes as well as composite postoperative morbidity (CPM). CMP, designed as metric to identify postoperative morbidity, was defined as one or more of the following events in the first 30 postoperative days: organ/space SSI, anastomotic leak, reoperation related to index procedure, sepsis/septic shock, pulmonary embolism, stroke or cerebrovascular accident, myocardial infarction, index length of stay longer than 90th percentile, or death.

Data collection

Baseline characteristics included age, sex, Body Mass Index (BMI), American Society of Anesthesiology (ASA) class, comorbidities (history of severe COPD, diabetes mellitus (DM) with oral agents or insulin, hypertension (HTN) requiring medication, bleeding disorder, and smoker defined as current smoker within one year), and steroid use. Race/ethnicity was classified as White (Non-Hispanic White), Black (Non-Hispanic Black), Asian (Non-Hispanic Asian), and Hispanic (Hispanic-White). Oncologic characteristics included tumor location, clinical TNM stage (coded based on the AJCC 8th edition), and if the patient received preoperative neoadjuvant therapy. The tumor location in the rectum was defined according to its distance to the anal verge and classified as following: lower third (<5 cm from the anal verge), middle third (5–10 cm from the anal verge), and upper third (>10 cm from the anal verge). Operative and oncologic characteristics comprised type of surgery (LAR or APR), surgical approach (open, laparoscopic, or robotic), wound classification, operative time, pathologic TNM stage, number of lymph nodes evaluated, positive CRM (circumferential resection margin), and positive DRM (distal resection margin).

Thirty-day postoperative complications included surgical site infection (SSI), anastomotic leak, postoperative ileus, urinary tract infection (UTI), pneumonia, pulmonary embolism (PE), deep vein thrombosis (DVT), acute renal failure, stroke, myocardial infarction (MI), sepsis, bleeding (as defined by needing at least 1 unit of packed or whole red blood cells from the surgical start to 72 h postoperatively), length of stay (LOS), readmission rate, and reoperation rate.

Statistical analysis

Statistical analysis was performed using STATA 17 (StataCorp. 2021. Stata Statistical Software: Release 17. College Station, TX: StataCorp LLC.). Propensity score matching (PSM) without replacement was used. Subjects were selected randomly and matched 1:1 to their nearest neighbor using a caliper width of 0.2. White patients were used as controls and matched to those from a different race/ethnicity (Black, Asian, and Hispanic). Covariates known to impact surgical outcomes

were used in the score matching, and included: age, sex, BMI, ASA class, DM, tobacco use, surgical approach (open, laparoscopic, robotic), type of surgery (LAR, APR), clinical stage, tumor location and use of neoadjuvant therapy. Surgical and 30-day postoperative outcomes were compared between races/ethnicities after PSM. Continuous variables were expressed as medians and interquartile range (IQR), and categorical data as number of patients and percentages. Univariable analyses were performed using Chi-Square test for categorical variables and Kruskal-Wallis test for continuous variables. All tests were two-sided with significance set at $p < 0.05$.

Results

A total of 1753 patients who underwent resection for rectal cancer and met inclusion criteria were identified from the ACS-NSQIP targeted proctectomy database from 2016 to 2019. Of these, 1406 (80.2 %) were White, 133 (7.6 %) Black, 149 (8.5 %) Asian, and 65 (3.7 %) Hispanic. Significant differences in baseline characteristics existed between groups (Table 1). For example, Hispanic patients were younger at the time of surgery (55 years, $p < 0.001$). The median BMI of Asian patients was lower (24 kg/m², $p < 0.001$). Black patients had a higher proportion of DM (28.4 %, $p = 0.017$) and HTN (58.7 %, $p = 0.001$). More Asian patients had an ASA class 2 (57.1 %, $p < 0.001$), while more Black patients a class 3 (72.9 %, $p < 0.001$).

Oncologic and operative characteristics are described in Table 2. Notably, there were significant differences in the surgical approach and type of surgery between racial/ethnic groups. Asian patients had more LARs (57.1 %, $p < 0.001$), fewer open surgeries (18.1 %, $p < 0.001$), and more robotic procedures (42.3 %, $p = 0.001$) when compared to the other groups. Tumor location, clinical TNM stage, and use of neoadjuvant therapy were comparable.

There were 1502 (85.7 %) patients with locally advanced rectal cancer (LARC), defined as a clinical stage II (T3 or T4 node negative) or III (node positive), of which only 73.6 % received neoadjuvant therapy. The use of neoadjuvant therapy in patients with LARC between races/ethnicities was comparable – 74.3 % White, 76.8 % Black, 67.9 % Asian,

Table 1
Baseline characteristics by race/ethnicity.

	White (n = 1406)	Black (n = 133)	Asian (n = 149)	Hispanic (n = 65)	p-value
Age (years), median (IQR)	62 (25–90)	60 (31–82)	62 (40–85)	55 (37–71)	<0.001
Sex, n (%)					0.572
Female	558 (39.7)	50 (37.6)	58 (38.9)	20 (30.8)	
Male	848 (60.3)	83 (62.4)	91 (61.1)	45 (69.2)	
BMI (kg/m ²), median (IQR)	28 (16–53)	28 (19–43)	24 (18–35)	28 (22–38)	<0.001
COPD, n (%)	56 (3.9)	1 (0.8)	2 (1.3)	1 (1.5)	0.077
Diabetes Mellitus, n (%)	223 (14.2)	42 (28.4)	29 (18.1)	14 (18.9)	0.017
Hypertension, n (%)	612 (43.5)	78 (58.7)	71 (47.7)	21 (32.3)	0.001
Bleeding disorder, n (%)	39 (2.7)	2 (1.5)	6 (4.0)	1 (1.5)	0.562
Smoker, n (%)	247 (17.6)	33 (24.8)	21 (14.1)	11 (16.9)	0.114
Steroid use, n (%)	29 (2.1)	6 (4.5)	2 (1.3)	1 (1.5)	0.249
ASA ^a class, n (%)					
1	21 (1.5)	2 (1.4)	2 (1.3)	2 (3.1)	0.748
2	530 (37.7)	31 (23.3)	85 (57.1)	31 (47.7)	<0.001
3	824 (58.6)	97 (72.9)	62 (41.6)	31 (47.7)	<0.001
4	31 (2.2)	3 (2.3)	0 (0)	1 (1.5)	0.326

^a ASA: American Society of Anesthesiologists.

Table 2
Oncologic and operative characteristics by race/ethnicity.

	White (n = 1406)	Black (n = 133)	Asian (n = 149)	Hispanic (n = 65)	p-value
Tumor location, n (%)					
Lower third	745 (56.2)	75 (59.5)	77 (53.9)	38 (62.3)	0.273
Middle third	450 (33.9)	37 (29.4)	55 (38.5)	20 (32.7)	0.303
Upper third	130 (9.8)	14 (11.1)	11 (7.7)	3 (4.9)	0.419
Unknown	81 (5.7)	7(5.3)	6 (4.0)	4 (6.2)	0.841
Clinical TNM stage, n (%)					
I	210 (15.6)	9 (6.8)	23 (15.4)	9 (13.9)	0.079
II	611 (43.5)	62 (46.6)	64 (42.9)	23 (35.4)	0.518
III	585 (41.6)	62 (46.6)	62 (41.6)	33 (50.7)	0.358
LARC ^a , n (%)	1196 (85.1)	124 (93.2)	126 (84.6)	56 (86.2)	0.079
Chemoradiotherapy, n (%)	946 (67)	101 (75.9)	91 (61.5)	39 (60)	0.053
Radiotherapy, n (%)	892 (63.4)	92 (69.2)	90 (60.4)	37 (56.8)	0.426
Surgery, n (%)					
LAR ^b	554 (39.4)	52 (39.1)	85 (57.1)	23 (35.4)	< 0.001
APR ^c	852 (60.6)	81 (60.9)	64 (42.9)	42 (64.6)	< 0.001
Surgical approach, n (%)					
Open	495 (35.2)	58 (43.6)	27 (18.1)	19 (29.2)	< 0.001
Laparoscopic	506 (35.9)	42 (31.6)	39.6 (59)	21 (32.3)	0.507
Robotic	405 (28.8)	33 (24.8)	63 (42.3)	25 (38.5)	0.001
Wound classification, n (%)					
Clean	3 (0.2)	1 (0.8)	0 (0)	1 (1.5)	0.152
Clean/contaminated	1186 (84.4)	107 (80.4)	129 (86.6)	47 (72.3)	0.035
Contaminated	193 (13.7)	22 (16.5)	15 (10.1)	15 (23.1)	0.067
Dirty/infected	24 (1.7)	3 (2.3)	5 (3.4)	2 (3.1)	0.478

^a LARC: Locally Advanced Rectal Cancer.
^b LAR: Low Anterior Resection.
^c APR: Abdominoperineal Resection.

and 63.8 % Hispanics ($p = 0.167$) (Fig. 1).

CPM outcomes are described in Table 3. Black patients were found to have worst postoperative morbidity (27.8 %) when compared to White (15.2 %), Asian (15.4 %) and Hispanic (12.3 %) patients ($p = 0.002$).

The overall margin positivity rate was 6.9 %. When evaluating by race/ethnic group, following adjusted analysis, Hispanic patients presented with a significantly higher positive CRM rate when compared to their White counterparts (13.9 % vs 6.0 %, $p = 0.032$) (Fig. 2).

Table 4 details the unadjusted and adjusted surgical and 30-day postoperative outcomes following PSM. On unadjusted analysis, operative time was longer in Hispanic patients (313 min) compared to White (278 min), Black (310 min), and Asian (310 min) patients ($p = 0.029$). The rate of postoperative ileus was significantly higher in Black patients (28.6 %) when compared to other racial/ethnic groups (White 16.3 %, Asian 15.4 %, Hispanic 14.1 %) ($p = 0.003$). Furthermore, black patients presented a reoperation rate of 9.8 %, significantly higher than Whites (4.3 %), Asians (4.0 %) and Hispanics (4.6 %) ($p = 0.038$).

After PSM analysis, operative time remained statistically significant higher in all racial/ethnic groups when compared to their White counterparts – Black ($p = 0.032$), Asian ($p = 0.031$), Hispanics ($p = 0.002$). The rate of postoperative ileus remained significantly higher in Black

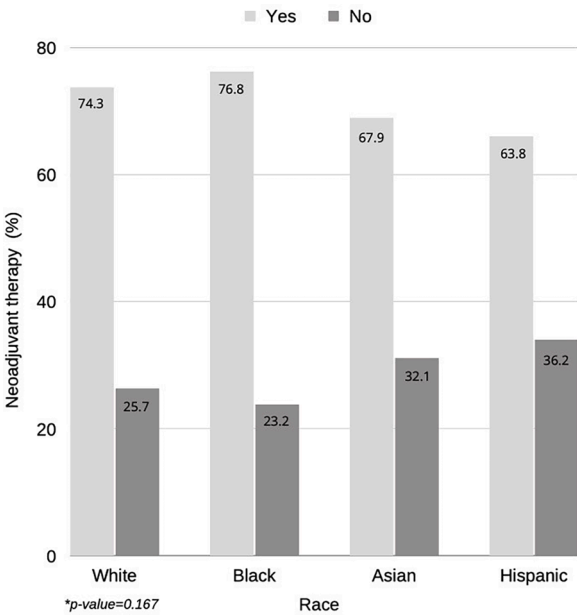


Fig. 1. Neoadjuvant therapy in locally advanced rectal cancer by race/ethnicity.

Table 3
Composite postoperative morbidity (CPM) by race/ethnicity.

Variables included in CPM	White	Black	Asian	Hispanic	p-value
Organ/space SSI, n (%)	67 (4.8)	7 (5.3)	9 (6.0)	1 (1.5)	0.010
Anastomotic Leak, n (%)	18 (1.3)	1 (0.8)	6 (4.0)	1 (1.5)	0.998
Reoperation, n (%)	60 (4.3)	13 (9.8)	6 (4.0)	3 (4.6)	0.038
Sepsis/Septic Shock, n (%)	23 (1.6)	3 (2.3)	8 (5.4)	2 (3.1)	0.021
Pulmonary Embolism, n (%)	9 (0.6)	1 (0.8)	0 (0)	1 (1.5)	0.606
Stroke or CVA ^a , n (%)	7 (0.5)	0 (0)	0 (0)	0 (0)	0.629
Myocardial Infarction, n (%)	6 (0.4)	0 (0)	0 (0)	1 (1.5)	0.351
Length of Stay >12 Days (90th Percentile, n (%))	112 (7.9)	26 (19.6)	12 (8.1)	5 (7.7)	< 0.001
Death, n (%)	2 (0.1)	1 (0.8)	0 (0)	0 (0)	0.382
CPM	214 (15.2)	37 (27.8)	23 (15.4)	8 (12.3)	0.002

^a CVA: Cerebrovascular Accident.

patients when compared to White patients (28.6 % vs 16.3 %, $p = 0.014$). Furthermore, reoperation rate was significantly lower in Asian patients (4.0 % vs 4.3 %, $p = 0.001$). Black patients were found to have longer LOS when compared to White patients (6 vs 5 days, $p = 0.018$). Asian patients had more superficial SSI (6 % vs 4.3 %, $p = 0.044$) when compared to their white counterparts. Additionally, Asians had a lower rate of postoperative pneumonia (0.7 % vs 1.0 %, $p = 0.003$). Hispanic patients a higher rate of PE (1.5 % vs 0.6 %, $p = 0.005$) when compared to Whites. Moreover, Hispanics had fewer superficial SSI (3.1 % vs 4.3 %, $p = 0.001$) and organ SSI (1.5 % vs 4.8 %, $p = 0.10$). No significant differences were found in outcomes such as number of lymph nodes evaluated, rate of anastomotic leak, UTI, bleeding, and readmission rate.

Discussion

In this retrospective cohort study, using ACS-NSQIP data from 2016 to 2019, we evaluated the short-term outcomes among racial/ethnic

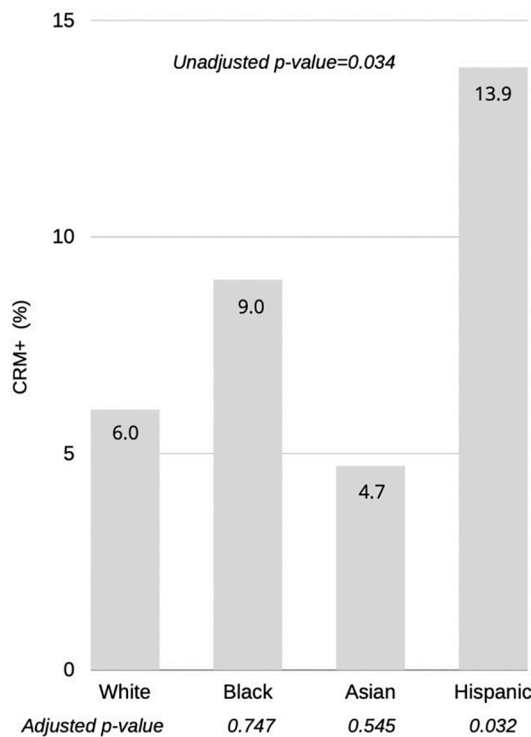


Fig. 2. Circumferential resection margin positivity rates by race/ethnicity.

groups with rectal cancer who underwent surgical resection. Primarily, we identified that Hispanic patients showed a significantly higher CRM positivity rate. The primary goal of surgical resection of a malignant solid tumor is to achieve negative margins, one of the main hallmarks of a successful operation. Studies have demonstrated the importance of CRM as an independent prognostic factor for local cancer recurrence as well as survival [12–14].

We found an overall CRM positivity rate 6.9 %; Hispanic patients were found to have 13.9 %. Similarly, in their study evaluating margin positivity rates in patients with locally advanced rectal cancer, Ore et al. found a 7.4 % positive CRM rate [15]. Mois et al. prospectively evaluates 192 patients with rectal cancer undergoing resection and found a 3.6 % rate of CRM positivity; a positive CRM was found to be a risk factor for local recurrence ($p = 0.031$) and decreased overall survival ($p = 0.001$) [16]. Rickles and colleagues evaluated positive CRM in patients with rectal cancer (stage I–III) who underwent resection using the NCDB database and found positive CRM rate of 17.2 %; total proctectomy had a 30 % increased risk of positive CRM when compared to partial proctectomy (OR 1.293, 95 % CI 1.185–1.411); laparoscopic approach was associated to 22 % decreased risk of positive CRM when compared to open surgery (OR 0.882, 95 % CI 0.790–0.985) [17].

Additionally, Hispanic patients had fewer superficial and organ SSIs and a lower rate of postoperative PE when compared to White patients. In 1986 Kyriakos Markides described the term “the Hispanic paradox” to the epidemiologic mystery of why, despite having lower healthcare access and socioeconomic status, Hispanics lived longer than their White counterparts in the US [18]. However, multiple studies have reported mixed data on the postoperative outcomes in the Hispanic population [10,11]. For instance, Eguia et al. showed that Hispanics had higher odds risk of postoperative complications, in hospital and 30-day mortality [10].

Racial minorities had longer median operative time. When compared to White patients, Black patients had a longer median operative time of 32 min, Asians of 21 min, and Hispanics of 35 min. Longer operative duration is associated with an increased risk of postoperative complications. A recent meta-analysis by Cheng and colleagues showed a 14 % increase in likelihood of complications for every 30 min of additional operating time [19].

Black patients presented a higher risk of composite postoperative morbidity, longer LOS, and higher rate of post-operative ileus, in correlation with previous studies showing worst postoperative outcomes in Black patients. In their nationwide study evaluating racial disparities in length of stay following elective colorectal surgery, Giglia et al. reported Black race as a significant predictor of longer postoperative LOS when

Table 4

Unadjusted and adjusted surgical and 30-Day postoperative outcomes by race.

	White (n = 1406)	Black (n = 133)	Asian (n = 149)	Hispanic (n = 65)	p-value	PSM ^a adjusted p-value		
						Black	Asian	Hispanic
DRM ^b +, n (%)	10 (0.7)	2 (1.5)	2 (1.3)	0 (0)	0.562	0.347	0.800	N/A
Operative time (min), median (IQR)	278 (89–780)	310 (110–670)	299 (128–695)	313 (173–516)	0.029	0.032	0.031	0.002
Number of lymph nodes evaluated, median (IQR)	15 (1–65)	16 (3–40)	15 (4–37)	15 (7–34)	0.793	0.998	0.949	0.479
SSI ^c , n (%)								
Superficial	60 (4.3)	4 (3.0)	9 (6.0)	2 (3.1)	0.597	0.702	0.044	0.001
Deep	17 (1.2)	0 (0)	1 (0.7)	1 (1.5)	0.567	N/A	0.445	0.697
Organ/space	67 (4.8)	7 (5.3)	9 (6.0)	1 (1.5)	0.555	0.700	0.160	0.010
Anastomotic leak, n (%)	18 (1.3)	1 (0.8)	6 (4.0)	1 (1.5)	0.058	0.797	0.649	0.998
Ileus, n (%)	229 (16.3)	38 (28.6)	23 (15.4)	9 (14.1)	0.003	0.014	0.675	0.739
Urinary tract infection, n (%)	34 (2.4)	3 (2.3)	6 (4.0)	2 (3.1)	0.679	0.793	0.811	0.391
Pneumonia, n (%)	14 (1.0)	4 (3.0)	1 (0.7)	0 (0)	0.130	0.122	0.003	N/A
Pulmonary embolism, n (%)	9 (0.6)	0.8 (1)	0 (0)	1 (1.5)	0.606	0.914	N/A	0.005
Deep vein thrombosis, n (%)	7 (0.5)	2 (1.5)	0 (0)	0 (0)	0.300	0.173	N/A	N/A
Acute renal failure, n (%)	4 (0.3)	1 (0.8)	1 (0.7)	0 (0)	0.685	0.327	0.485	N/A
Stroke or CVA ^d , n (%)	7 (0.5)	0 (0)	0 (0)	0 (0)	0.629	N/A	N/A	N/A
Myocardial infarction, n (%)	6 (0.4)	0 (0)	0 (0)	1 (1.5)	0.351	N/A	N/A	0.063
Sepsis/septic shock, n (%)	23 (1.6)	3 (2.3)	8 (5.4)	2 (3.1)	0.021	0.748	0.268	0.870
Bleeding, n (%)	102 (7.3)	14 (10.5)	12 (8.1)	5 (7.7)	0.592	0.302	0.830	0.360
Length of stay (days), median (IQR)	5 (1–39)	6 (2–28)	5 (3–20)	5 (2–15)	0.059	0.018	0.808	0.974
Reoperation rate, n (%)	60 (4.3)	13 (9.8)	6 (4.0)	3 (4.6)	0.038	0.053	0.001	0.369
Readmission rate, n (%)	203 (14.4)	28 (21.1)	23 (15.4)	6 (9.2)	0.116	0.533	0.423	0.966
Multiple readmissions, n (%)	16 (1.1)	3 (2.3)	1 (0.7)	1 (1.5)	0.634	0.362	0.587	0.285

^a PSM: Propensity Score Matching.

^b DRM +: positive Distal Resection Margin.

^c SSI: Surgical Site Infection.

^d CVA: Cerebrovascular Accident.

compared to White (9 % longer, IRR:1.09, $p < 0.001$), Hispanic (7 % longer, IRR: 1.07, $p = 0.001$) and Asian (6 % longer, IRR:1.06, $p = 0.006$) [20]. Additionally, Black patients had higher rates of postoperative ileus. In previous studies, Black race has been independently associated with increased risk of postoperative ileus, a source of increased length of hospital admission and higher costs of care [21].

Mulhern et al. evaluated the association of Asian American ethnicity and colorectal cancer surgical outcomes. Interestingly, they found Asian Americans to have a shorter LOS and lower rates of complications related to ileus, respiratory and renal complications [22]. Multiple studies have described postoperative and survival outcomes in Asian patients to be superior to White patients [8,9]. In the present study, Asian patients displayed lower rate of postoperative pneumonia and reoperation. Additionally, they presented with a higher rate of superficial SSI when compared to White patients.

The rates of anastomotic leak, bleeding and readmission were comparable between racial/ethnic groups. For instance, Suding and colleagues evaluated risk factors for anastomotic leaks in colorectal surgeries and did not find race as a significant risk factor; significant factors included low preoperative albumin level, steroid use, male sex, and increased operative time [23]. Regarding readmission rates, studies have shown that among minorities, insurance coverage plays a big role in the rate of readmissions, with lower rates among uninsured minorities [24].

In the present study, from the patients with LARC, only 73.6 % received neoadjuvant therapy; there was not a statistically significant difference among the different racial/ethnic groups. This shows that all patients, regardless of race, are not getting adequate neoadjuvant treatment. LARC has a high metastatic potential, conferring a poorer prognosis. The use of neoadjuvant therapy has been associated with an improvement in the complete pathologic complete response rate and survival [25].

The present study has several limitations. Among them, the retrospective nature of its design; nonetheless, ACS-NSQIP is a robust national database that has been previously validated. Additionally, there are low numbers of minority patients reported in the database, conferring a smaller sample size which can ultimately affect the power of the analysis. This could be one of the reasons behind studies merging minority racial/ethnic groups for comparisons. In the present study we compared racial/ethnic groups individually since there are patient-specific factors in each group that may impact care and ultimately outcomes. Moreover, we were limited by the variables available in the database for analysis.

The Institute of Medicine's study *Unequal Treatment* establish that racial disparities in healthcare have multi factorial roots—patient, provider, and systemic factors. A robust amount of research focusing on surgical outcomes disparities, focusing on the interplay among race, gender, income, insurance status, and comorbidities, has raised the believe that racial disparities may be, not merely a reflection of the natural history of the disease, but highly influenced by pre-existing inequities based on insurance and socioeconomic status [26,27].

Conclusion

In a PSM study using national data, racial/ethnic disparities were found in oncologic and short-term postoperative outcomes. Particularly, Hispanic patients presented worst oncologic outcomes and Black patients worst 30-day postoperative outcomes. Comparative studies evaluating trends over time and a higher number of minority patients included in large databases are warranted to better identify and characterize disparities between different racial/ethnic groups, and understand how patient, provider and systemic factors influence minority outcomes in rectal cancer to develop interventions to mitigate gaps and optimize care.

CRediT authorship contribution statement

Carolina Vigna: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ana Sofia Ore:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Anne Fabrizio:** Writing – review & editing, Validation, Supervision, Project administration, Methodology, Investigation, Conceptualization. **Evangelos Messaris:** Writing – review & editing, Validation, Supervision, Methodology, Investigation, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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