Original Research

Ethnoracial Differences in Premenopausal Hysterectomy

The Role of Symptom Severity

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OBJECTIVE: To evaluate whether greater symptom severity can explain higher hysterectomy rates among premenopausal non-Hispanic Black compared with White patients in the U.S. South rather than potential overtreatment of Black patients.

METHODS: Using electronic health record data from 1,703 patients who underwent hysterectomy in a large health care system in the U.S. South between 2014 and 2017, we assessed symptom severity to account for differences in hysterectomy rates for noncancerous conditions among premenopausal non-Hispanic Black, non-Hispanic White, and Hispanic patients. We used Poisson generalized linear mixed modeling to estimate symptom severity (greater than the 75th percentile on composite symptom severity scores of bleeding, bulk, or pelvic pain) as a function of race–ethnicity. We calculated prevalence ratios (PRs). We controlled for factors both contra-indicating and contributing to hysterectomy.

RESULTS: The overall median age of non-Hispanic White (n=1,050), non-Hispanic Black (n=565), and Hispanic (n=158) patients was 40 years. The White and Black patients were mostly insured (insured greater than 95%), whereas the Hispanic patients were often uninsured (insured 58.9%). White and Black patients were mostly treated outside academic medical centers (nonmedical center: 63.7% and 58.4%, respectively); the opposite was true for Hispanic patients (nonmedical center: 34.2%). Black patients had higher bleeding severity

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scores compared with Hispanic and White patients (median 8, 7, and 4 respectively) and higher bulk scores (median 3, 1, and 0, respectively), but pain scores differed (median 3, 5, and 4, respectively). Black and Hispanic patients were disproportionately likely to have severe symptoms documented on two or more symptoms (referent: not severe on any symptoms) (adjusted PR [Black vs White] 3.02, 95% CI 2.29–3.99; adjusted PR [Hispanic vs White] 2.61, 95% CI 1.78–3.83). Although Black and Hispanic patients were more likely to experience severe symptoms, we found no racial and ethnic differences in the number of alternative treatments attempted before hysterectomy.

CONCLUSION: We did not find evidence of overtreatment of Black patients. Our findings suggest potential undertreatment of Black and Hispanic patients with uterine-sparing alternatives earlier in their disease progression.

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Rates of hysterectomy before menopause remain disproportionately high among U.S. Black populations and in U.S. territories such as Puerto Rico.[1–6] Hysterectomy, an effective treatment for gynecologic conditions such as uterine leiomyomas (fibroids) and dysmenorrhea,[7] is also sterilizing. Overtreatment with sterilizing procedures remains a concern among marginalized communities, given state-sponsored eugenics programs in the 20th century and the even longer history of gynecologic abuse of Black women.[8–10] However, in the past 20 years, few quantitative studies have investigated potentially racialized overtreatment with hysterectomy.[11–14] Research has focused on clinical outcomes or surgical route rather than treatment decision making.[15–17]

One barrier to investigating overtreatment with hysterectomy is the difficulty of defining "overtreatment." Recommendations for premenopausal hysterectomy decision making center on impairment of patient quality of life from symptoms such as pelvic pain, heavy or unexpected uterine bleeding, or pressure from large leiomyomas.[7] Unfortunately, neither quality-of-life measures nor symptom severity are captured in the insurance claims databases often used in health services research.[18]

To overcome these methodologic challenges, we compared patient symptom severity across race–ethnicity categories in a case series of patients who underwent hysterectomy. If Black patients were being overtreated with hysterectomy, we would expect to observe lower symptom severity among Black patients than non-Hispanic White patients. Using electronic health record (EHR) data from 1,703 patients treated in a large health care system in the U.S. South[19] between 2014 and 2017,[20] we evaluated symptom severity as a potential mechanism for differences in hysterectomy rates among premenopausal non-Hispanic Black, non-Hispanic White, and Hispanic patients.

METHODS

We identified eligible patients using a health care system "data warehouse" that leverages structured EHR data, such as self-reported race–ethnicity, procedure and diagnostic codes, age, and hospital, among other fields. We supplemented these eligibility data with other data-warehouse–derived data, such as laboratory values and prescriptions. Further, professional abstractors collected data from surgical notes as well as imaging and other records related to patients' gynecologic symptoms for at least 180 days before patients' surgeries.[21–23] They did not collect data on patient race or ethnicity, nor was this information in the REDCap abstraction tool or EHR tabs reviewed. For quality control, 100 records were randomly selected for independent re-abstraction.[20] This study was approved by the University of North Carolina IRB (17-2728.)

We assembled a study population to meet the following eligibility criteria: North Carolina residents aged 18–44 years who underwent hysterectomy for noncancerous, non–pregnancy-related indications between October 2, 2014, and December 31, 2017, at 1 of 10 hospitals in a large health system in the U.S. South that had used the health system's EHR platform for at least 180 days. To determine eligibility, we first queried the health system's structured EHR data (see Appendix 1, available online at http://links.lww.com/AOG/D190, for diagnostic codes used). Of 2,839 patients aged 18–44 years who underwent hysterectomy, 668 were ineligible because their hospital had been using the system's EHR for 180 days or less at the time of their hysterectomy, which complicates the collection of adequate presurgical data on symptom severity. Of the 2,171 remaining patients, 314 were excluded for ineligibility due to residence, evidence of cancer or pregnancy, or incomplete abstraction records (see Fig. 1). Of the 1,857 patients remaining, we excluded 104 patients who were not non-Hispanic White, non-Hispanic Black, or Hispanic or Latina (race–ethnicity described in more detail below). Finally, 50 patients were excluded because of missing covariate data on body mass index (BMI, calculated as weight in kilograms divided by height in meters squared) (n=37), previous laparotomy (n=10), or

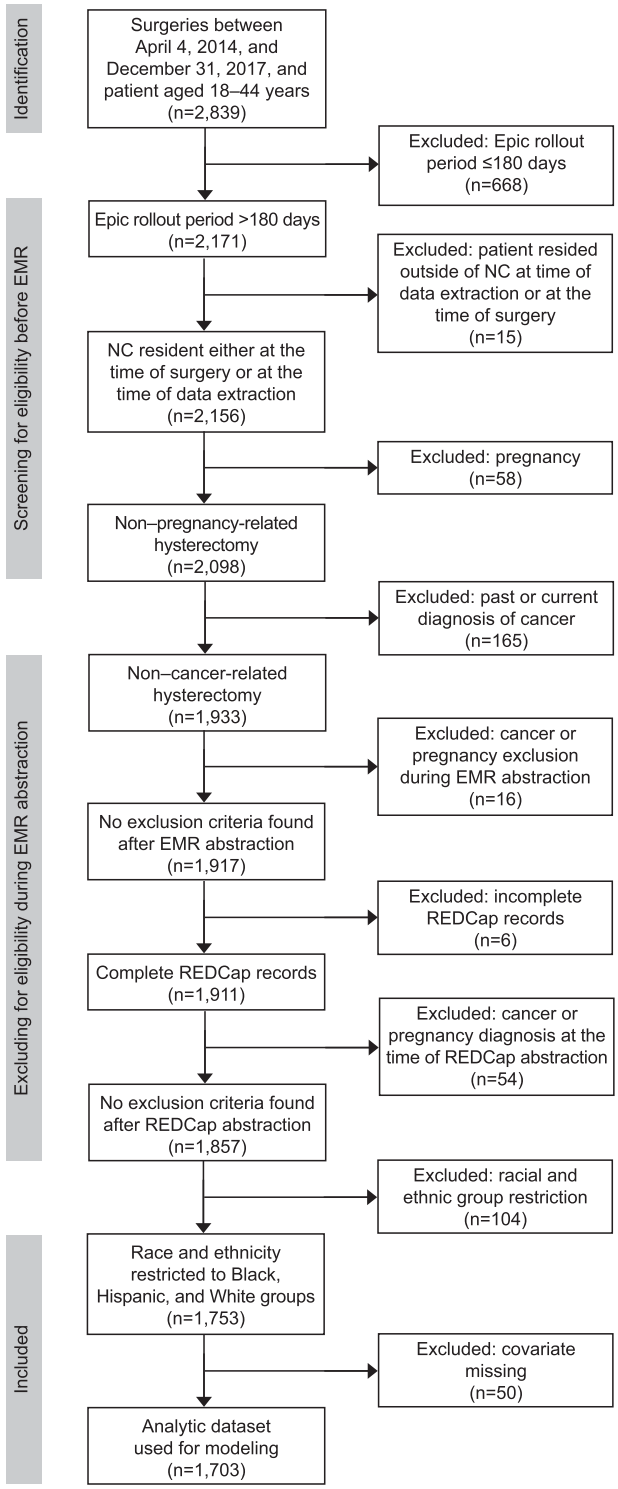

Fig. 1. Flow chart showing inclusion and exclusion criteria to obtain the analytic data set for the population of patients who underwent hysterectomy, aged 18–44 years. NC, North Carolina; EMR, electronic medical record.

Robinson. Racial and Ethnic Differences in Hysterectomy. Obstet Gynecol 2023.

both (n=3). The final analytic sample consisted of 1,703 patients.

The independent variable of interest was three-level race–ethnicity: non-Hispanic Black; Hispanic of any race; and non-Hispanic White, the referent group. This composite race–ethnicity variable was derived from two EHR variables that are legally required to be self-reported[24]: six-level race (White, Black, Asian, Native, Other, Refused or Unknown) and dichotomous Hispanic ethnicity. Any patient classified as Hispanic on the ethnicity variable was coded as Hispanic. Where patients had multiple values for the EHR's race variable (always White plus another non-White value), we classified them as the non-White value in our collapsed race–ethnicity variable to err on the side of being more inclusive of the experience of non-White patients, who are often underrepresented in gynecologic research.[25] Further, we conceptualized these U.S. racial and ethnic categories as social constructs that reflect differential exposure to systemic and institutional racism as well as other social determinants of health, especially for any deviations from Whiteness.[26,27] We restricted multivariable analyses to non-Hispanic Black, Hispanic, and non-Hispanic White patients because of nonconvergence of models due to small sample sizes for other racial and ethnic groups.

We scored each patient on severity of their gynecologic symptoms on three domains: bulk, vaginal bleeding, and pelvic pain.[2–6] The construction and validation of the severity scores are described in detail elsewhere.[20] Our dichotomous outcomes were Yes/No to being in the top 25th percentile of bulk, pelvic pain, or bleeding symptom severity scores. Because symptom data from EHR notes are often missing, we focused on the high end of the score range. Although low scores may miscategorize missing data as low symptom severity, high scores are likely to be a specific indicator of high symptom severity. We also fit two "combined severity" models for being in the highest 25th percentile 1) for any of the three constructs or 2) two of the three constructs, each compared with not being in top 25th percentile on any construct.

We controlled for other factors that influence the decision to perform hysterectomy, either those that are relatively contra-indicating against hysterectomy or those that would support the decision to perform hysterectomy (contributing). We expected contra-indicating factors to be associated with greater symptom severity at the time of hysterectomy, whereas

contributing factors would be associated with lower symptom severity. Relatively contra-indicating factors include younger age, high BMI (eg, higher than 40),[7,8] comorbidities (Charlson Comorbidity Index based on the hysterectomy's hospital-billed diagnostic codes), and previous abdominal surgeries (Yes/No). *Previous abdominal surgery* (Yes/No) was defined as laparotomy for gynecologic indication and other abdominal surgery (excluding cesarean deliveries, due to high prevalence [greater than 30.0%]). The contributing indications were ovarian cysts, pelvic masses, number of alternative treatments attempted before hysterectomy (zero, one, two or more), and previous completed pregnancies. Presence of ovarian cysts (Yes/Absent from the record) or cervical dysplasia (Yes/Absent) was obtained from EHR progress and preoperative notes. Previous treatments considered were oral contraceptives, vaginal ring, hormonal patch, oral progestins, Depo Provera, contraceptive implants (Implanon and Nexplanon), Lysteda (tranexamic acid), LupronDepot or gonadotropin-releasing hormone agonist, hormonal intrauterine device, uterine artery embolization, uterine ablation, myomectomy, hysteroscopy, laparoscopy for gynecologic indication, and laparotomy for gynecologic indication. Another contributing indication for surgery is achievement of desired childbearing. Because there was not a direct measure of this in the EHR, we examined number of previous deliveries (continuous) as a covariate in supplemental analyses. Because missingness was high on this variable (25.5%), we did not include it in the main analyses.

Descriptive statistics are presented by race and Hispanic ethnicity. Medians and interquartile ranges are reported for continuous variables, and frequencies and percentages are reported for categorical variables. Robust Poisson models, which allow for calculation of each outcome's prevalence ratio (PR), were fit for the combined symptom severity outcome (one or more vs zero, two or more vs zero) and for each of the symptom severity outcomes. The simplest models presented here included race–ethnicity, age at time of hysterectomy, a fixed effect for hospital type (academic medical center vs other community hospitals), and lead surgeon (the attending or billing surgeon of record; n=115) as a random effect to account for patient clinical mix (a priori test for inclusion: intraclass correlation greater than 75.0% total variance). The fully adjusted models included the following additional covariates: categorized BMI, cervical dysplasia, ovarian cyst or pelvic mass, previous laparotomy, previous treatment count, and Charlson Comorbidity Index.

We performed several supplemental analyses to understand possible contributors to racial differences in symptom differences. First, we ran five fully adjusted models among subsets of the data stratified by common diagnoses treated with hysterectomy, with the model outcomes chosen to correspond to symptom scores related to that diagnosis: leiomyoma diagnosis (bulk and bleeding severity outcomes), abnormal uterine bleeding or menorrhagia diagnosis (bleeding severity), chronic pelvic pain diagnosis (pain severity) and endometriosis diagnosis (pain). The diagnoses were considered present if any preoperative or progress notes listed them as a main indication for surgery or even as a relevant or suspected gynecologic diagnosis.

Second, in the full analytic sample, we added number of deliveries (variable has high missingness) as a covariate in fully adjusted models of each symptom severity score. Third, in another series of models of symptom severity scores, to assess modification of the race–ethnicity association with symptom threshold, we added interaction terms between race–ethnicity and the following contributing factors for hysterectomy: 1) ovarian cyst or pelvic mass and 2) cervical dysplasia (overall F-test $\alpha=0.20$). Finally, we described the distribution of number of prior treatments by race–ethnicity and symptom severity. Specifically, we examined the distributions graphically and evaluated differences in the medians of race–ethnicity–specific distributions of number of prior treatments (Kruskal-Wallis tests, $\alpha=0.05$). In addition, in adjusted regression models, we added interaction terms between race–ethnicity and prior treatments (F-test $\alpha=.20$).

RESULTS

To contextualize the sample, Table 1 shows patient characteristics before the sample was restricted by race–ethnicity (N=1,857). This study analyzed data on the subsample (n=1,703) of non-Hispanic White (n=1,050), non-Hispanic Black (n=565), and Hispanic (n=158) patients. The median age at the time of surgery was 40 years. The Hispanic patients were most likely to be uninsured (41.1% vs less than 5.0% among White and Black patients). The Hispanic patient sample was mostly treated at academic medical centers (65.8%), whereas White and Black patients were more often treated at community hospitals in this sample (63.7% and 58.4%, respectively). Black patients in this sample had higher median bleeding severity scores (8) compared with their White (4) and Hispanic (7) counterparts. On the bulk score, the Black patient sample had higher median

Table 1. Descriptive Characteristics of Patients Who Underwent Hysterectomy in 2014–2017, Aged 18–44 Years, by Racial and Ethnic Group Before Restriction of Data Sets to Hispanic, Black, and White Patients

		Racial and Ethnic Groups Included in the Analytic Data Set			Racial and Ethnic Groups Excluded From the Analytic Data Set			
Characteristic	All (N=1,857)	Black (n=565)	Hispanic (n=158)	White (n=1,030)	Asian (n=22)	Native American (n=17)	Other (n=31)*	Refused or Unknown (n=34)
Age at hysterectomy (y)	40.1 (36.5, 42.8)	40.8 (37.4, 42.9)	40.8 (38.0, 43.2)	39.6 (35.6, 42.4)	41.9 (37.5, 44.0)	38.9 (37.8, 42.7)	42.4 (37.9, 44.1)	40.5 (38.4, 42.7)
BMI, categorized (kg/m2)								
25.0 or lower	332 (18.9)	54 (9.6)	24 (15.2)	254 (24.7)	8 (36.4)	<5	<5	6 (17.7)
Higher than 25.0–30.0	450 (25.7)	110 (19.7)	54 (34.2)	286 (27.8)	9 (40.9)	<5	<5	5 (14.7)
Higher than 30.0–35.0	397 (22.7)	148 (26.2)	41 (25.9)	208 (20.2)	<5	<5	6 (19.4)	6 (17.7)
Higher than 35.0–40.0	276 (15.7)	118 (20.9)	21 (13.3)	137 (13.3)	<5	5 (29.4)	5 (16.1)	9 (26.5)
Higher than 40.0	258 (14.7)	124 (21.9)	14 (8.9)	120 (11.7)	<5	<5	<5	6 (17.7)
Missing	40 (2.3)	11 (1.9)	<5	25 (2.4)	<5	<5	<5	<5
BMI (kg/m^2)†	30.8 (25.9, 36.6)	33.8 (28.9, 39.4)	29.9 (26.1, 34.7)	29.2 (24.9, 35.1)	26.5 (23.1, 27.8)	36.1 (26.7, 39.9)	29.2 (25.1, 34.7)	33.9 (26.5, 38.3)
Hysterectomy hospital site								
Academic medical center	713 (40.7)	235 (41.6)	104 (65.8)	374 (36.3)	13 (59.1)	13 (76.5)	15 (48.4)	30 (88.2)
Nonacademic medical center	1,040 (59.3)	330 (58.4)	54 (34.2)	656 (63.7)	9 (40.9)	<5	16 (51.6)	<5
Common diagnoses present in preoperative notes‡								
Leiomyomas	943 (53.8)	457 (80.8)	102 (64.6)	384 (37.8)	13 (59.1)	6 (35.3)	20 (64.5)	18 (52.3)
Chronic pelvic pain	486 (27.7)	112 (19.8)	42 (26.6)	332 (32.2)	<5	<5	7 (22.6)	8 (23.5)
Endometriosis	319 (18.2)	62 (11.0)	18 (11.4)	239 (23.2)	6 (27.3)	5 (29.4)	7 (22.6)	7 (20.6)
Menorrhagia or AUB	1,310 (74.7)	479 (84.8)	122 (77.2)	709 (68.8)	12 (54.6)	11 (64.7)	16 (51.6)	23 (67.6)
No. of previous gynecologic treatments§	1.0 (0, 2.0)	1.0 (0, 2.0)	1.0 (0, 2.0)	1.0 (0, 2.0)	1.0 (0, 1.0)	1.0 (1.0, 3.0)	1.0 (0, 2.0)	1.0 (0, 3.0)
Patient insurance type at the time of surgery‖								
Private	1,315 (75.0)	426 (75.4)	75 (47.5)	814 (79.0)	19 (86.4)	9 (52.9)	25 (80.7)	25 (73.5)
Public	303 (17.3)	111 (19.6)	18 (11.4)	174 (16.9)	<5	6 (35.3)	<5	6 (17.7)
Uninsured	135 (7.7)	28 (5.0)	65 (41.1)	42 (4.1)	<5	<5	<5	<5
No. of previous deliveries	2.0 (2.0, 3.0)	2.0 (1.0, 3.0)	2.5 (2.0, 3.0)	2.0 (2.0, 3.0)	2.0 (1.0, 2.0)	2.0 (2.0, 4.0)	2.0 (2.0, 3.0)	2.0 (1.0, 3.0)
Missing	447	120	16	282	7	<5	6	14
Previous laparotomy¶								
Yes	340 (19.4)	86 (15.2)	16 (10.1)	238 (23.1)	<5	<5	8 (25.8)	7 (20.6)
Missing	7 (0.4)	<5	<5	<5	<5	<5	<5	<5
CCI	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 0)	0 (0, 1.0)	0 (0, 0)	0 (0, 0)
Cervical dysplasia‡	219 (12.5)	43(7.6)	17 (10.8)	159 (15.4)	<5	<5	<5	<5
Ovarian cyst or pelvic mass‡	568 (32.4)	160 (28.3)	55 (34.8)	353 (34.3)	9 (40.9)	<5	8 (25.8)	12 (35.3)

(*continued*)

Table 1. Descriptive Characteristics of Patients Who Underwent Hysterectomy in 2014–2017, Aged 18–44 Years, by Racial and Ethnic Group Before Restriction of Data Sets to Hispanic, Black, and White Patients (*continued*)

		Racial and Ethnic Groups Included in the Analytic Data Set			Racial and Ethnic Groups Excluded From the Analytic Data Set			
Characteristic	All (N=1,857)	Black (n=565)	Hispanic (n=158)	White (n=1,030)	Asian (n=22)	Native American (n=17)	Other (n=31)*	Refused or Unknown (n=34)
Bleeding score	5.0 (2.0, 10.0)	8.0 (4.0, 13.0)	7.0 (3.0, 15.0)	4.0 (2.0, 8.0)	4.0 (2.0, 7.0)	5.0, (3.0, 10.0)	3.0 (0, 15.0)	5.0 (2.0, 11.0)
Top 25th percentile	441 (23.7)	194 (34.3)	61 (38.6)	163 (15.8)	<5	<5	9 (29.0)	9 (26.5)
Pain score	4.0 (1.0, 8.0)	3.0 (0, 7.0)	5.0 (2.0, 8.0)	4.0 (1.0, 8.0)	1.5 (1.0, 5.0)	6.0 (2.0, 9.0)	1.0 (0, 6.0)	3.0 (0, 7.0)
Top 25th percentile	422 (22.7)	116 (20.5)	36 (22.8)	253 (24.6)	<5	<5	<5	6 (17.6)
Bulk score	1.0 (0, 4.0)	3.0 (1.0, 5.0)	1.0 (0, 4.0)	0 (0, 1.0)	1.0 (0, 4.0)	1.0 (0, 4.0)	1.0 (0, 4)	1.0 (0, 5.0)
Top 25th percentile	491 (26.4)	277 (49.0)	53 (33.5)	126 (12.2)	9 (40.9)	<5	9 (29.0)	12 (35.3)

BMI, body mass index; AUB, abnormal uterine bleeding; CCI, Charlson Comorbidity Index.
Continuous data are shown as median (25th percentile, 75th percentile) and categorical data as n (%).
* Includes those patients who selected "Other" for the electronic health record's six-level racial categorization system but did not select Hispanic ethnicity.
† Three study participants with BMIs higher than 100 were excluded, and an additional 40 study participants had missing BMIs.
‡ Derived from electronic health record preoperative progress notes. A patient may have multiple gynecologic diagnoses mentioned in preoperative progress notes.
§ Previous treatments include oral contraceptive, vaginal ring, or hormonal patch use; oral progestins; Depo Provera; implants; Lysteda (tranexamic acid); LupronDepot or gonadotropin-releasing hormone agonist; hormonal intrauterine device; uterine artery embolization; uterine ablation; myomectomy; hysteroscopy; laparoscopy for gynecologic indication; and laparotomy for gynecologic indication.
‖ Private includes patients with private insurance or Tricare, coverage provided to military service members and their families. Public includes patients with insurance from Medicare, Medicaid, or the state women's prison. Uninsured includes patients who were indicated as "self-pay," either partially (n≤5) or wholly (n=141).
¶ Laparotomy for gynecologic indication and other abdominal surgery and cesarean delivery.

scores (3) than White (0) and Hispanic (1) patients. The pain severity median scores were as follows: Hispanic 5, White 4, Black 3. In this sample, the most commonly noted diagnoses for Black patients in the EHR progress or preoperative notes were menorrhagia (84.8%) and leiomyomas (80.8%). These diagnoses were also common among the Hispanic and White patients in this sample, who had menorrhagia noted 77.2% and 68.8% of the time, respectively, and leiomyomas noted 64.6% and 37.8% of the time, respectively.

In analyses of overall symptom severity, we did not find evidence that young Black women were being overtreated with hysterectomy in this health system (Table 2). Black patients were more likely than White patients to have documentation of high symptom severity. For instance, in the fully adjusted model (Table 2), Black patients had 35.0% greater risk of being in the top 25.0% of at least one symptom construct. Black patients were disproportionately more likely to have severe symptoms documented on two or three symptoms (fully adjusted PR [Black vs White] 3.02, 95% CI 2.29–3.99) (Table 2). Results for Hispanic patients tended to be similar to those for Black patients but less pronounced. For instance, the fully adjusted association of Hispanic race–ethnicity with at least one severe symptom was 1.21 (95% CI 0.90–1.62) compared with White patients; the increased likelihood of two or more severe symptoms compared with White patients was more than double (fully adjusted PR [Hispanic vs White] 2.61, 95% CI 1.78–3.83).

To more precisely characterize racial differences in symptom severity, we ran models separately for each of the three symptom constructs (Table 3). The models for severe bleeding and bulk were consistent with the models for overall composite severity (described above) but with more pronounced racial and ethnic differences. For instance, Black patients were almost twice as likely as White patients to be in the highest quartile of bleeding symptoms (fully adjusted PR 1.83, 95% CI 1.46–2.30; see Table 3) and more than three times as likely to be in the highest quartile of severe bulk (PR 3.61, 95% CI 2.88–

Table 2. Multivariable-Adjusted Models Calculating the Prevalence Ratios of Patients Being in the Top 25th Percentile of at Least One Symptom Severity Score or Two or Three Symptom Severity Scores*

	Top 25th Percentile of at Least 1 Symptom Severity Score vs None		Top 25th Percentile of 2 or 3 Symptom Severity Scores vs None	
	Simple Model (n=1,404)†	Fully Adjusted Model (n=1,404)‡	Simple Model (n=1,092)†	Fully Adjusted Model (n=1,092)‡
Racial and Ethnic Group				
Black	1.38 (1.16–1.64)	1.35 (1.12–1.62)	3.37 (2.58–4.41)	3.02 (2.29–3.99)
Hispanic	1.18 (0.88–1.57)	1.21 (0.90–1.62)	2.62 (1.80–3.82)	2.61 (1.78–3.83)
White (ref)	1.00	1.00	1.00	1.00

ref, referent.
Data are prevalence ratio (95% CI).
* Referent: not in the top 25th percentile on any symptoms.
† Adjusted for age at the time of hysterectomy. Lead surgeon was included as a random effect.
‡ Adjusted for the following covariates: age at the time of hysterectomy, cervical dysplasia, ovarian cyst or pelvic mass, number of previous gynecologic treatments, categorized body mass index, previous laparotomy, Charlson Comorbidity Index, and hysterectomy hospital site. Lead surgeon was included as a random effect.

4.53). Similarly, Hispanic patients were twice as likely to be in the highest quartiles of severe bleeding (fully adjusted PR 2.03, 95% CI 1.48, 2.77) or bulk (PR 2.26, 95% CI 1.61–3.16). For pain severity, patterns of racial and ethnic difference were markedly different than for bleeding and bulk. For pain, there were no statistically significant differences (α=.05) in likelihood of severe pain prevalence by race–ethnicity (Table 3).

First, in the five fully adjusted models stratified by four common diagnoses (leiomyomas, abnormal uterine bleeding or menorrhagia, chronic pelvic pain, and endometriosis), Black and Hispanic prevalence of high symptom severity compared with White patients was generally similar to that in analyses not stratified by diagnosis (Appendix 2, available online at http://links.lww.com/AOG/D190). Second, adding number of deliveries as a covariate did not substantially

Table 3. Prevalence Ratios From Multivariable-Adjusted Models of Being in the Top 25th Percentile of Bulk, Bleeding, or Pain Severity Scores, Patients Aged 18–44 Years Who Underwent Hysterectomy, 2014–2017

	Simple Model (n=1,703)*	Fully Adjusted Model (n=1,703)†
Bulk score		
Racial and ethnic group		
Black	3.78 (3.04–4.71)	3.61 (2.88–4.53)
Hispanic	2.40 (1.72–3.36)	2.26 (1.61–3.16)
White (ref)	1.00	1.00
Bleeding score		
Racial and ethnic group		
Black	2.03 (1.64–2.52)	1.83 (1.46–2.30)
Hispanic	2.03 (1.49–2.77)	2.03 (1.48–2.77)
White (ref)	1.00	1.00
Pain score		
Racial and ethnic group		
Black	0.84 (0.67–1.06)	0.85 (0.68–1.08)
Hispanic	0.77 (0.54–1.11)	0.91 (0.63–1.31)
White (ref)	1.00	1.00

ref, referent.
Data are prevalence ratio (95% CI).
* Adjusted for age at the time of hysterectomy. Lead surgeon was included as a random effect.
† Adjusted for the following covariates: age at the time of hysterectomy, cervical dysplasia, ovarian cyst or pelvic mass, number of previous gynecologic treatments, categorized body mass index, previous laparotomy, Charlson Comorbidity Index, and hysterectomy hospital site. Lead surgeon was included as a random effect.

change estimates (Appendix 3, available online at http://links.lww.com/AOG/D190). Third, interactions with race–ethnicity and ovarian cyst or pelvic mass or cervical dysplasia were not statistically significant (Appendices 4 and 5, available online at http://links.lww.com/AOG/D190).

Overall, 30.0% of patients in the high symptom severity quartile had no documentation of previous uterine-sparing treatments. For bleeding, there was evidence that greater number of prior treatments was more associated with greater bleeding severity among White patients than among Black or Hispanic patients (P=.09; PR for two or more treatments 2.20 for White patients; PR 1.25 and 1.53 for Black and Hispanic patients, respectively). Notably, the prevalence of severe bleeding symptoms before hysterectomy was greater among Black patients with no documentation of previous treatments (48/120, 40.0%) than among White patients who had tried two or more previous treatments (86/309, 28.0%). For bulk and pain, there was little evidence of statistical modification of racial differences in symptom severity by number of prior treatments (F-test P>.20) (Appendix 6, available online at http://links.lww.com/AOG/D190).

DISCUSSION

We did not find evidence that premenopausal Black or Hispanic patients were systematically overtreated with hysterectomy for their gynecologic symptoms. Instead, our findings point to potential undertreatment of Black and Hispanic patients earlier in their disease processes. Undertreatment can involve multiple potential pathways, including patient–physician interactions, but also systemic health care barriers to diagnosis and treatment as well as patient preferences about treatment options.[28–30] The majority of patients had a bleeding- or bulk-related primary indication for surgery. However, Black and Hispanic patients who underwent hysterectomy had more severe bulk and bleeding symptoms compared with their White counterparts. Despite greater symptom burden, Black and Hispanic patients had received a similar number of prior uterine-sparing treatments before hysterectomy as White patients. The fact that Black and Hispanic patients had worse symptoms but no evidence of escalated uterine-sparing treatments indicates potential undertreatment of severe bleeding and leiomyoma-related bulk in Black and Hispanic patients before progression to hysterectomy. This discrepancy is particularly notable for severe bleeding, which was the symptom most amenable to uterine-sparing treatments.

The similarity of results, particularly for bleeding, across the Black and Hispanic patients in this analysis casts doubt on the idea that innate biological factors specific to people of African ancestry drive Black patients' high prevalence of severe symptoms or faster disease progression.[31] The reproductive-aged Hispanic population in the catchment area of this North Carolina study is distinct from the Black population: heavily first-generation immigrants from Mexico and Central America, as well as being culturally and genetically distinct from the Black population in this region.[32] Instead, what is common between these populations may be systemic factors in the ways that these economically and socially marginalized populations are treated by health care systems and cultural factors shaped by environments in which marginalization is much more common than among White populations.

The results for pain were notably different from the results for the bleeding and bulk symptoms. These results may reflect a true racial and ethnic difference in the burden of gynecologic pain or treatment of gynecologic pain with hysterectomy. Alternatively, the results may reflect systematic racial and ethnic bias in pain appraisal and treatment by health care professionals in the United States.[33–35] The symptom severity score for pain here relied on physician documentation and previous treatments administered, such as opioids prescribed for gynecologic pain or emergency department admissions.[20] Previously, we have documented that barriers to diagnosis with pain-related conditions such as endometriosis are most pronounced for Black and Hispanic patients, especially patients with low socioeconomic status, in North Carolina.[36] Finally, pain can co-occur with severe bulk and bleeding. Given a complex symptom profile, barriers to comprehensive diagnosis, and racialized understandings of gynecologic health,[37,38] health care professionals may default to ascribing a constellation of symptoms in a Black or Hispanic patient to bulk or abnormal uterine bleeding–related symptoms rather than the gynecologic pain they may also be experiencing.

Anchoring this investigation to symptom severity rather than diagnoses is an important strength of this work. We used previously developed indices of symptom severity derived from free text in the EHR, in addition to diagnostic and procedure codes.[20] For instance, 80% or more of the population of Black patients who underwent hysterectomy had diagnoses of dysmenorrhea or abnormal uterine bleeding associated with their surgeries. Differentiating the population by symptom severity rather than diagnosis allowed us to better differentiate potential disparity in

surgery. Finally, we expanded on limited research on the gynecologic health of Hispanic populations in the U.S. South, a region with a growing population of first- and second-generation immigrants from Mexico and Central America.[39]

Our findings should be interpreted in the context of the following limitations. The case series design does not include those who were successful with less invasive treatments, which limits inference. Investigations of earlier symptom and treatment progression could clarify mechanisms by which racial and ethnic differences in symptom severity arise among patients who undergo hysterectomy. Further, health care–based study designs do not account for people who self-manage care or who never receive care despite burdensome disease. Additionally, our EHR data did not include reliable data on access to, or patient decisions to forgo, conservative alternative treatments. However, our use of EHR data is more inclusive of patients with no insurance and those with Medicaid insurance than most claims-based analyses. Another limitation of EHR data is gaps in documentation. Acknowledging that missing data could underestimate symptom severity, we focused on the quartile of greatest symptom severity, which we expect to be a highly specific measure of severe symptoms.[20]

In one large health care system in the U.S. South, a region with high rates of premenopausal hysterectomy,[4,5,14,40] we found little evidence of overtreatment of non-Hispanic Black and Hispanic patients given their levels of symptom burden. However, there was evidence of a disproportionately high burden of severe symptoms among Black and Hispanic patients without a corresponding level of previous uterine-sparing treatments attempted. Undertreatment of initial symptoms may contribute to faster disease progression and arrival at greater symptom severity among Black and Hispanic patients before hysterectomy.[41]

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