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Self-Report Versus Ultrasound Measurement of Uterine Fibroid Status

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Abstract

Background: Much of the epidemiologic research on risk factors for fibroids, the leading indication for hysterectomy, relies on self-reported outcome. Self-report is subject to misclassification because many women with fibroids are undiagnosed. The purpose of this analysis was to quantify the extent of misclassification and identify associated factors.

Methods: Self-reported fibroid status was compared to ultrasound screening from 2046 women in Right From The Start (RFTS) and 869 women in the Uterine Fibroid Study (UFS). Log-binomial regression was used to estimate sensitivity (Se) and specificity (Sp) and examine differences by ethnicity, age, education, body mass index, parity, and miscarriage history.

Results: Overall sensitivity was ≤0.50. Sensitivity was higher in blacks than whites (RFTS: 0.34 vs. 0.23; UFS: 0.58 vs. 0.32) and increased with age. Parous women had higher sensitivity than nulliparae, especially in RFTS whites (Se ratio = 2.90; 95% confidence interval [CI]: 1.51, 5.60). Specificity was 0.98 in RFTS and 0.86 in UFS. Modest ethnic differences were seen in UFS (Sp ratio, black vs. white = 0.90; 95% CI: 0.81, 0.99). Parity was inversely associated with specificity, especially among UFS black women (Sp ratio = 0.84; 95% CI: 0.73, 0.97). Among women who reported a previous diagnosis, a shorter time interval between diagnosis and ultrasound was associated with increased agreement between the two measures.

Conclusions: Misclassification of fibroid status can differ by factors of etiologic interest. These findings are useful for assessing (and correcting) bias in studies using self-reported clinical diagnosis as the outcome measure.

Introduction

Uterine leiomyomata (fibroids) are benign neoplasms of uterine smooth muscle tissue that develop in the majority of reproductive-age women.[1] For some women, fibroids can cause menstrual abnormalities, pelvic pain, and pregnancy complications[2] severe enough to require surgical treatment. However, many women with fibroids remain asymptomatic throughout their reproductive years. An estimated 20% to 50% of women with fibroids will experience related symptoms,[3,4] and these women will be more likely to be diagnosed.

The large proportion of women with subclinical fibroids leads to an important methodological challenge for epidemiologic studies. As with any condition with a long preclinical phase, any ascertainment method that does not attempt to identify asymptomatic women will misclassify a proportion of true cases as noncases. This misclassification can be extensive when outcome ascertainment is obtained by self-report. In the Uterine Fibroid Study (UFS), 51% of premenopausal women who reported no previous diagnosis had fibroids upon ultrasound examination.[1]

Incidental detection also affects which women will be clinically diagnosed. Women who are not experiencing fibroid-related symptoms could be diagnosed during a routine pelvic exam or obstetric ultrasound or if seeking care for other gynecologic conditions. The use of self-report could

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therefore result in spurious associations with factors not related to uterine fibroids, reflecting instead an underlying difference in the opportunity for diagnosis. In a large prospective cohort study (Black Women's Health Study) that validated positive self-report among a subsample of women, 55% of cases reported being diagnosed because of fibroid-related symptoms; the remaining 45% were diagnosed incidentally, either during a routine pelvic examination (32%) or while receiving care for another condition (13%).[5]

The purpose of this analysis is to evaluate the validity of self-reported fibroid status and examine possible predictors of reporting quality. It is well-established that fibroid prevalence increases with age and that black women are at higher risk than white women at all ages.[6,7] We therefore used data from two studies with a relatively high proportion of black participants and which, together, included women from 18 to 49 years old.

Materials and Methods

Data sources

Data for this analysis came from two studies in which participants were systematically screened for uterine fibroids using ultrasound. Right From The Start (RFTS) is an ongoing community-based prospective study of early pregnancy conducted since 2000. Women (at least 18 years old) very early in pregnancy or those planning to become pregnant were recruited from the community and clinical care sites via outreach materials and advertisements. Details of methods and study design are described elsewhere.[8,9] Questionnaire data were gathered through computer-assisted telephone interview; information on basic demographics was obtained at enrollment, and questions about medical and reproductive history were asked in a first trimester interview. Weight and height were collected at enrollment and during the first trimester ultrasound.

This analysis is limited to women joining RFTS from 2004 onward, when a question on previous fibroid diagnosis was added to the enrollment interview. Although women were allowed to re-enroll in the study, we only included records from the first time they were asked about previous fibroid diagnoses. Study enrollment was required before 9 completed weeks of gestation. A total of 2411 women enrolled between 2004 and 2008, and 2341 (97%) had both ultrasound and self-report information. We included only women whose self-reported race/ethnicity was non-Hispanic white ($n = 1756$) or non-Hispanic black ($n = 290$) in this analysis.

The UFS was a cross-sectional study conducted between 1996 and 1999 to estimate uterine fibroid prevalence among 35- to 49-year-old women randomly selected from among members of an urban health plan. Details have been described previously.[1] Approximately 88% of the original random sample was contacted by telephone and screened for eligibility and 1430 (80%) of the eligible women participated. Information on demographic characteristics and reproductive and medical history were collected from telephone interviews and self-administered questionnaires. Height and weight were measured at the clinic visit. We excluded 107 women whose reported ethnicity was other than non-Hispanic black or white, 180 postmenopausal women, 152 missing ultrasound, and four with indeterminate ultrasound results. An additional 118 who had a study ultrasound showing a diffuse heterogeneous pattern suggestive of fibroids, but no focal fibroids were excluded[1] because medical practitioners may vary in whether or not they will tell such patients that they have fibroids. The final analysis subset included 363 white and 506 black women.

Self-report of uterine leiomyomata

Both RFTS and the UFS collected information on fibroid diagnosis by telephone interview prior to conducting the study ultrasound. Self-reported fibroid status (yes/no) was based on women's responses to whether a doctor or medical care provider had ever told them they had uterine fibroids. The UFS interview also included a series of follow-up questions (e.g., diagnostic and follow-up examinations, treatment). Fewer than 10 women who responded "yes" to the initial question subsequently indicated that the diagnosis had been incorrect and were classified as having no previous fibroid diagnosis.

Ultrasound detection of uterine leiomyomata

RFTS participants underwent an endovaginal ultrasound as early as 6 weeks of gestation and no later than 13 weeks. Premenopausal participants in the UFS underwent transvaginal (and, if necessary for better imaging, transabdominal) ultrasound examinations within 3 months of study entry. In both studies, examinations were performed by sonographers certified by the American Registry of Diagnostic Medical Sonographers who received additional study training for consistency in identifying, measuring, and recording uterine fibroids.[1,8] RFTS sonographers had three or more years of clinical obstetric-gynecologic experience. UFS examinations were performed by gynecologic sonographers under the direct supervision of a radiologist with fellowship training in ultrasonography. In both studies, any questionable sonograms were examined by study physicians. Sonographers were instructed not to discuss prior knowledge of fibroid status with study participants.

Recorded measurements included the number, location, and size of each tumor. The diameter of each tumor was measured in three perpendicular planes. Because RFTS participants were pregnant, each tumor was measured three times during the exam (with intervening time between measurements) to reduce the chance of misidentifying focal contractions as fibroids, and the mean of these diameter measurements was calculated for each tumor.[8] In the UFS, 170 women who had had a recent pelvic ultrasound were classified as positive or negative for fibroids based on their radiology records.

Fibroid identification was based on the Muram criteria[10] of a mass that is relatively spherical and echogenically different from the surrounding myometrium, but the size criterion was modified to include masses of ≥ 0.5 cm. Women were classified as having uterine fibroids if the results of the ultrasound examination indicated presence of one or more fibroids. Fibroid size was categorized as < 2.00, 2.00–3.99, and ≥ 4.00 cm based on the largest measured diameter for the tumor(s) detected. A total of 23 (3%) UFS and 16 (1%) RFTS participants reported having previous surgery to remove fibroids. For this analysis, these women were classified as having fibroids, even if the study ultrasound did not show evidence of tumors. We assigned fibroid size as ≥ 4.00 cm for women who had fibroid surgery.

Data analysis

The validity of self-reported uterine fibroid status as compared to the ultrasound examination was measured by sensitivity and specificity. Sensitivity was defined as the proportion of women who self-reported a previous fibroid diagnosis among those with ultrasound-confirmed fibroids or prior fibroid surgery. Specificity was defined as the proportion of women who self-reported no previous diagnosis among those with no evidence of fibroids at ultrasound and no previous fibroid surgery. RFTS and UFS data were analyzed separately due to differences in the study populations.

All analyses were carried out with the statistical software package SAS 9.1 (SAS Institute Inc.). Log-binomial regression was used to estimate sensitivity and specificity with 95% confidence intervals (CIs). Prevalence ratios obtained from the regression models are interpreted in this analysis as the sensitivity (or specificity) of self-report in one subgroup compared to that in a reference group. These ratio measures were used to examine differences in self-report validity according to age at interview, education, body mass index (BMI), parity, miscarriage history, and (for sensitivity only) size of the largest fibroid detected at ultrasound.

Univariate analyses were conducted to assess the association of each individual predictor with sensitivity and specificity, respectively. Statistical interaction by ethnicity and age was tested using the Mantel-Haenszel χ^2 test for homogeneity with a $p < 0.10$ significance level. Ethnicity modified the association between sensitivity and parity in RFTS ($p = 0.06$), and sensitivity and fibroid size in UFS ($p < 0.05$). Both overall and ethnicity-stratified estimates are presented here.

Adjusted models included covariates that were associated ($p < 0.10$) with sensitivity (or specificity) in the univariate analyses. Sensitivity ratios were adjusted for parity (any previous birth vs. none) and age as a continuous variable (with a quadratic term in the UFS analysis to accommodate nonlinearity). UFS specificity ratios were adjusted for parity, but no adjustment was made in RFTS due to the small number of women who did not have ultrasound-detected fibroids but reported a previous diagnosis. Linearity of trends for categorical predictors was examined by treating categorical variables as ordinal parameters in the models. Poisson regression with robust error variance was used when log-binomial models did not converge.[11]

Results

Overall, RFTS participants were about 10 years younger than UFS participants (Table 1). On average, black women were 2.8 years younger than white women in RFTS. Black and white women differed with respect to education, BMI, and parity in both study populations. Prevalence of both self-reported and ultrasound-detected fibroids was higher among black women compared to whites in both study populations, but lower in both groups in RFTS compared to UFS. Furthermore, a higher percentage of black than white women had fibroids ≥4 cm in diameter. Among those who had a previous diagnosis in the UFS, the reported age at first diagnosis was 3 years younger in black compared to white women.

Sensitivity (Se) was low among participants of both studies (Supplementary Table S1; Supplementary Data are available online at www.liebertonline.com/jwh). Half of the UFS participants who had fibroids at study ultrasound reported a previous diagnosis (Se: 0.50; 95% CI: 0.45, 0.54). Sensitivity was even lower (Se: 0.27; 95% CI: 0.22, 0.32) in RFTS. As shown in Figs. 1 and 2, black women had higher sensitivity of self-report than did white women; this was more pronounced in the UFS participants (sensitivity ratio [SeR]: 1.73; 95% CI: 1.33, 2.25). Sensitivity was associated with age at interview in both studies (Figs. 1 and 2). In RFTS, overall sensitivity increased from 0.12 (95% CI: 0.07, 0.21) in 18- to 29-year-old women to 0.41 (95% CI: 0.31, 0.53) in 35- to 45-year-olds (p for trend < 0.005). Among UFS participants, sensitivity was higher among black women in their 40s compared to 35- to 39-year-olds, but there were no significant differences by age for white women.

Figure 2 provides sensitivity ratios for additional demographic and reproductive factors. Parity was associated with higher sensitivity of self-report among white women, with the strongest association seen in white RFTS participants (SeR: 2.90; 95% CI: 1.51, 5.60). Among black women, those with postbaccalaureate education had somewhat higher self-report sensitivity than those with less than 4 years of college, but this difference was statistically significant only in the UFS (SeR: 1.27; 95% CI: 1.05, 1.55). Neither BMI nor miscarriage history was a predictor of self-report sensitivity in either study population.

In both studies, women with larger fibroids at the ultrasound examination had significantly higher sensitivity of self-report (Table 2). After adjusting for age and parity, sensitivity was three to four times as high in women with tumors ≥4 cm as in those whose largest tumor was <2 cm in diameter. The exception was among UFS black women for whom the adjusted association with fibroid size was not as strong (SeR for ≥4 vs. <2 cm: 1.88; 95% CI: 1.42, 2.49), despite the women with large fibroids in this group having the highest sensitivity (0.79).

Specificity (Sp)—the proportion of women reporting "no fibroid diagnosis" among those with no ultrasound-detected fibroids—was high in both study populations. In RFTS, overall specificity was 0.98 (95% CI: 0.97, 0.99) compared with 0.86 (95% CI: 0.82, 0.90) in the UFS (Supplementary Table S2). Unlike the sensitivity results, there were few differences in specificity of self-report among the factors considered (Fig. 3). In RFTS, specificity was almost equal between blacks and whites (0.98 and 0.97, respectively). However, specificity for black women in the UFS was lower compared to whites (specificity ratio: 0.90; 95% CI: 0.81, 0.99). As shown in Fig. 1, age at interview was inversely associated with specificity in RFTS (p for trend < 0.01) but not significantly in the UFS (p for trend $= 0.15$). In both study populations, parous women had lower specificity compared to nulliparae, and this was seen among both blacks and whites (Fig. 3). Specificity was unrelated to education, BMI, or miscarriage history.

Overall agreement between self-report and ultrasound fibroid status was 88% in RFTS and 65% in the UFS (data not shown). The combination of differences in sensitivity, specificity, and prevalence of ultrasound-detected fibroids by race and age yielded the highest agreement (93%) in the youngest (ages 18–29 years) white women, and the lowest agreement (47%) in the oldest white women (ages 45–49 years). Among black women, agreement between self-report and ultrasound fibroid status was also highest in the youngest age group and varied from 83% to 60%.

We examined factors since diagnosis—time interval, age at ultrasound, intervening pregnancy—among UFS women

Table 1. Characteristics of Right From The Start (N=2046) and Uterine Fibroid Study (N=869) Analysis Populations, by Race/Ethnicity

	RFTS				*UFS*			
	White (n=*1756*)		*Black* (n=*290*)		*White* (n=*363*)		*Black* (n=*506*)	
	No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
Age at interview								
<20	18	1.0	22	7.6	0		0	
20–24	134	7.6	80	27.6	0		0	
25–29	658	37.5	76	26.2	0		0	
30–34	629	35.8	85	29.3	0		0	
35–39	279	15.9	22	7.6	124	34.2	191	37.7
40–44	38	2.2	5	1.7	122	33.6	178	35.2
45–49	0		0		117	32.2	137	27.1
Mean (SD)[a]	30.2 (4.5)		27.4 (5.6)		41.9 (4.3)		41.4 (4.2)	
Highest education[b]								
High school	124	7.1	74	25.5	12	3.4	104	20.9
Some college	229	13.0	95	32.8	33	9.3	228	45.8
4 years of college	665	37.9	71	24.5	54	15.3	66	13.3
Postbaccalaureate	737	42.0	50	17.2	254	72.0	100	20.1
Missing	1		0		10		8	
BMI (kg/m^2) at enrollment[c]								
<20.00	186	10.6	18	6.2	27	7.4	16	3.2
20.00–24.99	945	53.8	75	25.9	183	50.4	117	23.2
25.00–29.99	374	21.3	78	26.9	91	25.1	155	30.7
≥30.00	251	14.3	119	41.0	62	17.1	217	43.0
Missing	0		0		0		1	
Parity								
0	803	48.3	118	45.2	219	60.3	115	22.7
1	608	36.6	93	35.6	52	14.3	120	23.7
2	198	11.9	35	13.4	75	20.7	159	31.4
3 or more	54	3.2	15	5.7	17	4.7	112	22.1
Missing	93		29		0		0	
No. of miscarriages[d]								
0	669	65.4	120	62.2	147	69.7	317	69.7
1	277	27.1	57	29.5	47	22.3	112	24.6
2 or more	77	7.5	16	8.3	17	8.1	26	5.7
Missing	64		20		0		0	
Previous fibroid diagnosis (self-report)								
No	1,680	95.7	255	87.9	294	81.0	271	53.6
Yes	76	4.3	35	12.1	69	19.0	235	46.4
Mean (SD) age at diagnosis	29.3 (5.2)		28.4 (4.0)		36.2 (5.6)		33.0 (7.2)	
Missing age at diagnosis	15		7		4		14	
Ultrasound-detected fibroids								
No	1,560	88.8	207	71.4	201	55.4	161	31.8
Yes, size of largest tumor	196	11.2	83	28.6	162	44.6	345	68.2
<2.00 cm	96	49.0	38	45.8	62	38.3	78	22.6
2.00–3.99 cm	62	31.6	19	22.9	60	37.0	140	40.6
≥4.00 cm	38	19.4	26	31.3	40	24.7	127	36.8
Mean (SD) age of first diagnosis[e]	31.1 (5.1)		29.1 (4.7)		40.9 (5.9)		36.3 (7.5)	
Missing	15		7		4		14	

[a]SD, standard deviation.
[b]RFTS asked for years of schooling completed and was categorized as follows: ≤12, high school; 13–15, some college; 16, 4 years of college; and >16, postbaccalaureate. The high school category includes some women with less than a high school education: 11 black UFS women, and 19 white and 21 black RFTS women. The postbaccalaureate category includes 197 white and 11 black women in the UFS who reported having a graduate/professional degree.
[c]For RFTS, BMI was based on self-reported prepregnancy height and weight or first trimester clinic measures when missing.
[d]Among 1087 white and 213 black RFTS women with a previous pregnancy (prior to study enrollment); 211 white and 455 black UFS women with a previous pregnancy.
[e]Among all women with fibroids previously diagnosed or newly detected at ultrasound.

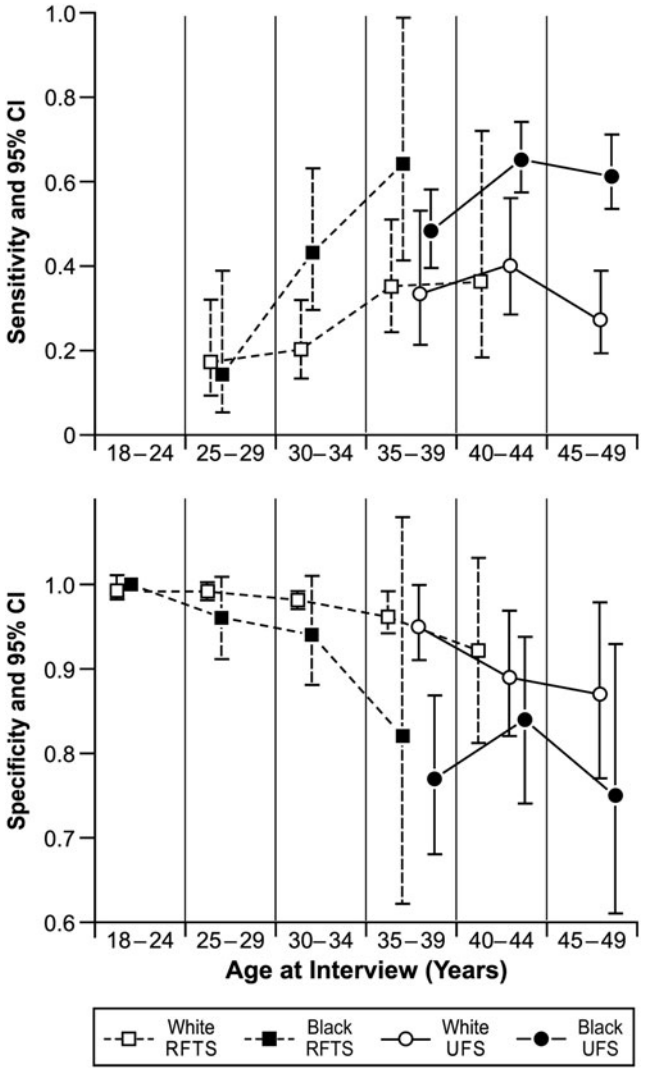

FIG. 1. Self-report sensitivity (upper panel) and specificity (lower panel) by race/ethnicity and age at interview for Right From The Start (RFTS, $n = 2046$) and Uterine Fibroid Study (UFS, $n = 869$) participants. Error bars indicate 95% confidence intervals (CI). Estimates for the following RFTS age groups are excluded because there were fewer than 10 women in each race/age category: sensitivity for women aged 18–24 years and black women over 40 years; specificity for black women aged 40–44 years.

with positive self-report to investigate what might account for their lower specificity (data not shown). Only the UFS black women were examined ($n = 221$) because there were few UFS white women reporting a previous diagnosis who did not have ultrasound-detected fibroids. A short time interval between prior diagnosis and study ultrasound was associated with increased concordance between self-report and ultrasound. Concordance was highest (90.4%) among women who reported a diagnosis within 2 years of the study ultrasound. Excluding women whose reported age at diagnosis was more than 2 years before the ultrasound increased the overall specificity of self-report from 0.86 to 0.98 and eliminated specificity differences by ethnicity, age, and parity. Age at ultrasound was also important, even after controlling for years since diagnosis. Concordance was 23% higher for women 40 years or older relative to that for women 35–39 years old at the time of the ultrasound examination.

Discussion

Much of the published data on risk factors for fibroids is based on self-reported fibroid status.[6] To our knowledge, this is the first detailed assessment of the sensitivity and specificity of this outcome measure. Our results quantify what is generally accepted as a limitation of these data, namely the misclassification of women with (undiagnosed) fibroids as noncases. Overall sensitivity of self-report was quite low: 0.27 in RFTS and 0.50 in the UFS. In addition, results provide evidence that this misclassification can occur differentially with respect to certain factors.

Sensitivity of self-report tended to increase with age and was higher in black women compared with white women. Black women generally have a younger age at onset and larger and more numerous tumors compared with similarly aged whites.[6,12,13] Higher self-report sensitivity could occur if these differences lead to more severe symptoms or easier detection during routine pelvic examination or if there is increased gynecologic surveillance of black women as a "high-risk" group. Ethnic differences in tumor onset and growth may also explain the apparent drop in sensitivity noted in the oldest white women. Among 45- to 49-year-old white women with fibroids, the proportion with large tumors was lower compared to 35- to 44-year-olds (0.22 vs. 0.28, respectively), while the proportion of black women with large tumors increased with age. This may reflect a difference in the natural progression of these tumors, such that fibroids that first develop in white women in their 40's remain small enough to go undetected. In a study that tracked fibroid growth in tumors from 72 premenopausal women, older white women had a lower growth rate than their younger counterparts, while this age difference was not seen in black women.[14]

Parity was associated with higher self-report sensitivity among white women, which may reflect possible ethnic differences in prenatal care and an increased opportunity for diagnosis through pregnancy-related ultrasound examinations. However, we did not find a further association with miscarriage history, which could have increased gynecologic surveillance.

In contrast to the low sensitivity values, specificity was relatively high: 0.98 in RFTS and 0.86 in UFS. Associations with age, ethnicity, and parity were in the opposite direction as the sensitivity results, but relatively weak overall. The principal limitation in interpreting the specificity results lies in the possibility that women who reported having been previously diagnosed could have reported accurately, but fibroid regression after prior diagnosis resulted in no detectable fibroids at subsequent screening ultrasound. Our finding that the proportion of apparent false-positives increased with duration between first diagnosis and ultrasound suggests that specificity may be affected by time since diagnosis as well as age at interview. We demonstrated that limiting the specificity analysis to women who were more recently diagnosed increased specificity in the UFS to levels close to those seen in RFTS. The few studies that have tracked fibroid growth have found a wide variation in growth rates, but spontaneous regression was seen in only a small proportion of tumors.[14–16]

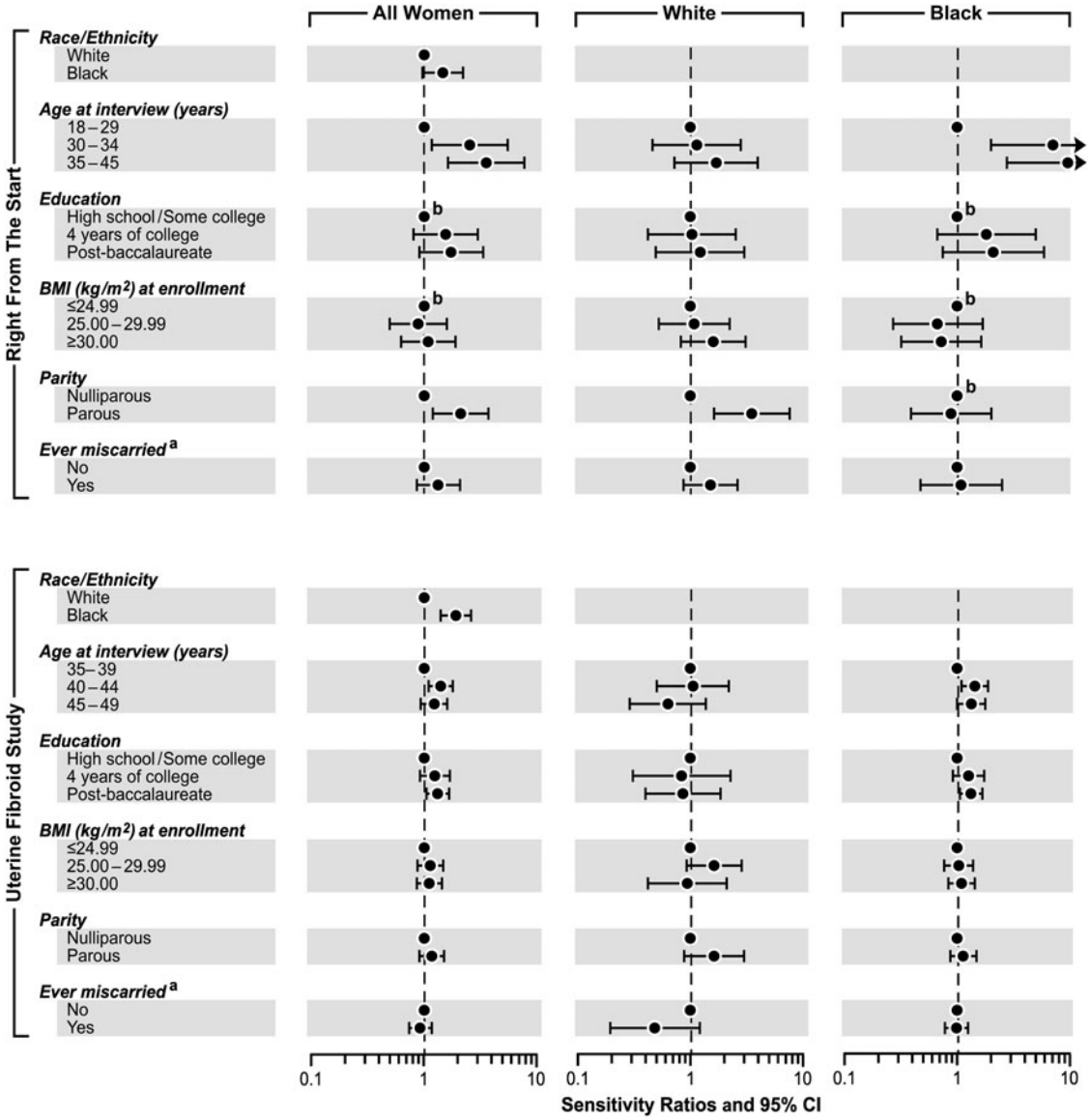

FIG. 2. Association of demographic and reproductive factors with sensitivity of self-reported uterine fibroid status among 279 RFTS and 507 UFS participants with fibroids detected at study ultrasound. Sensitivity ratios (sensitivity in a subgroup of interest compared to sensitivity in the reference group) are adjusted for age (continuous), parity, and (for unstratified estimates) race/ethnicity. A quadratic term was entered for age in the UFS multivariate analysis due to nonlinearity. [a]Among women with a previous pregnancy. [b]Estimates obtained using Poisson regression.

Specificity could also be lower in women who have intervening pregnancies because pregnancy-associated factors have been shown to reduce or eliminate fibroids.[17,18] On the other hand, self-report of previous diagnosis may have been in error. Two prospective cohorts have examined self-report accuracy in validation subsamples and were unable to confirm fibroid diagnosis in 4%–8% of women reporting a diagnosis for whom medical records were obtained.[5,13] We did not have access to complete medical record history to review the validity of earlier diagnoses.

A strength of this analysis was the large sample size, which allowed us to examine both black and white women over a large age range. However, generalizability of our findings to other groups must be considered. Women in RFTS volunteered for the study, and most had planned pregnancies. Compared to the general population, they were more highly educated, less likely to smoke, and more likely to be married.[8] They had achieved the index pregnancy without fertility treatment, so women with fertility problems (possibly due to uterine fibroids) are underrepresented. RFTS was described in recruitment materials as a study of early pregnancy health and not specifically as a study of uterine fibroids, so it is unlikely that participants volunteered because of their concern about fibroids. UFS participants were members of a health plan and therefore had access to health-care services. Self-report from women with limited access to or use of health care might show lower sensitivity than our results. However, the fact that we observed similar results in these two different study populations lends support to our findings.

Table 2. Relationship Between Size of Largest Fibroid Detected at Study Ultrasound and Sensitivity of Self-Report in 279 Right From The Start and 507 Uterine Fibroid Study Participants With Fibroids Detected at Study Ultrasound

	White women						*Black women*					
Mean diameter of largest fibroid	*No. correct*	*Total*	*Se*	*95% CI*	*SeR*[a]	*95% CI*	*No. correct*	*Total*	*Se*	*95% CI*	*SeR*[a]	*95% CI*
RFTS, cm												
<2.00	14	96	0.15	0.09, 0.24	1.00	Referent	5	38	0.13	0.06, 0.30	1.00	Referent
2.00–3.99	12	62	0.19	0.12, 0.32	1.42	0.73, 2.79	8	19	0.42	0.25, 0.71	4.09	1.47, 11.35
≥4.00	20	38	0.53	0.39, 0.71	3.08	1.76, 5.36	15	26	0.58	0.42, 0.80	4.15	1.56, 11.02
UFS, cm												
<2.00	8	62	0.13	0.07, 0.25	1.00	Referent	32	78	0.41	0.31, 0.54	1.00	Referent
2.00–3.99	22	60	0.37	0.26, 0.51	2.93	1.42, 6.02	69	140	0.49	0.42, 0.58	1.19	0.87, 1.62
≥4.00	22	40	0.55	0.42, 0.73	4.26	2.11, 8.60	100	127	0.79	0.72, 0.86	1.88	1.42, 2.49

RFTS, Right From The Start; UFS, Uterine Fibroid Study; Se, sensitivity of self-report; SeR, sensitivity ratio; CI, confidence interval.
[a]Adjusted for age and parity.

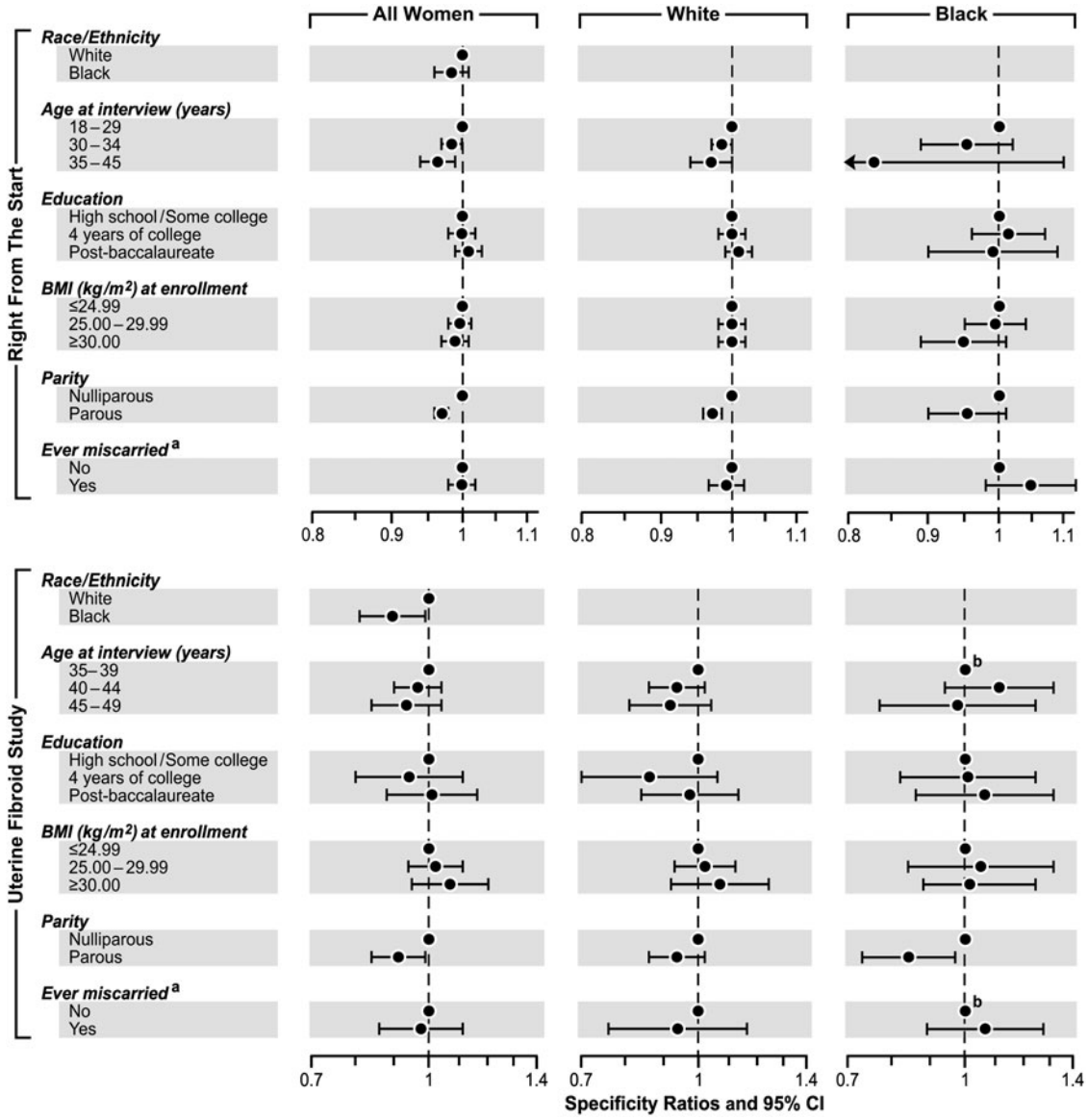

FIG. 3. Association of demographic and reproductive factors with specificity of self-reported uterine fibroid status among 1767 RFTS and 362 UFS participants with no fibroids detected at study ultrasound. Specificity ratios are specificity of self-report in subgroup of interest compared to specificity in the reference group. UFS specificity ratios are adjusted for parity, and (for unstratified estimates) race/ethnicity. RFTS estimates are unadjusted. [a]Among women with a previous pregnancy. [b]Estimates obtained using Poisson regression.

An additional strength of this analysis is use of ultrasound to define "true" fibroid status. Ultrasound has been shown to have high sensitivity (99%) and specificity (91%) when compared to the gold standard histological results.[19] A potential limitation in measuring true fibroid status is that the RFTS population consisted of pregnant women whose fibroids may have grown during early pregnancy, and identification of any resulting newly detectable cases would result in lower sensitivity.[20] However, ultrasound was performed very early in the first trimester, and previous analyses of RFTS data showed no difference in fibroid prevalence by gestational age at ultrasound,[8] so detection is unlikely to be influenced within the narrow time period in which examinations were conducted. Pregnancy may also have affected the validity of the ultrasound results, but study sonographers were specially trained to ensure that focal contractions were not mistaken for fibroid tumors.

Conclusions

In this analysis, between 35% and 90% of women with ultrasound-detected fibroids reported that they had never been diagnosed with fibroids. Previous investigations[21,22] using self-reported fibroid diagnosis have limited analyses to women under 35 years in an attempt to reduce misclassification. Our findings confirm that the high specificity and lower prevalence of fibroids among younger women would result in relatively fewer true cases being misclassified. However, differences in reporting quality with respect to other factors may still lead to biased estimates. For example, higher sensitivity among parous women results in a higher likelihood of reporting a fibroid diagnosis. In the simplest case (i.e., assuming no confounding, other measurement errors, or selection bias), this would lead to parity being an apparent risk factor for uterine fibroids. On the other hand, if women who report a fibroid diagnosis prior to the baseline of a prospective analysis are excluded, then cases would be differentially excluded among parous compared to nulliparous women, and parity would seem to be protective.

Our results provide detailed information that could be used for more accurate assessment of misclassification bias in existing studies. The availability of methods[23–25] that allow for varying sensitivity and specificity according to designated covariate patterns provides an opportunity to calculate point and interval estimates that account for the differential validity of self-reported fibroid diagnosis. However, accurate outcome measurement through ultrasound screening remains critical to clarify the relationships between risk factors that may be important in the onset of fibroids and those that play a role in their growth and detection.

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Author Disclosure Statement

The authors have no conflicts of interest to report.

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