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RESEARCH ARTICLE

Racial and Ethnic Disparities in Cervical Cancer Screening From Three U.S. Healthcare Settings

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Introduction: This study sought to characterize racial and ethnic disparities in cervical cancer screening and follow-up of abnormal findings across 3 U.S. healthcare settings.

Methods: Data were from 2016 to 2019 and were analyzed in 2022, reflecting sites within the Multilevel Optimization of the Cervical Cancer Screening Process in Diverse Settings & Populations Research Center, part of the Population-based Research to Optimize the Screening Process consortium, including a safety-net system in the southwestern U.S., a northwestern mixed-model system, and a northeastern integrated healthcare system. Screening uptake was evaluated among average-risk patients (i.e., no previous abnormalities) by race and ethnicity as captured in the electronic health record, using chi-square tests. Among patients with abnormal findings requiring follow-up, the proportion receiving colposcopy or biopsy within 6 months was reported. Multivariable regression was conducted to assess how clinical, socioeconomic, and structural characteristics mediate observed differences.

Results: Among 188,415 eligible patients, 62.8% received cervical cancer screening during the 3-year study period. Screening use was lower among non-Hispanic Black patients (53.2%) and higher among Hispanic (65.4%,) and Asian/Pacific Islander (66.5%) than among non-Hispanic White patients (63.5%, all $p<0.001$). Most differences were explained by the distribution of patients across sites and differences in insurance. Hispanic patients remained more likely to screen after controlling for a variety of clinical and sociodemographic factors (risk ratio=1.14, CI=1.12, 1.16). Among those receiving any screening test, Black and Hispanic patients were more likely to receive Pap-only testing (versus receiving co-testing). Follow-up from abnormal results was low for all groups (72.5%) but highest among Hispanic participants (78.8%, $p<0.001$).

Conclusions: In a large cohort receiving care across 3 diverse healthcare settings, cervical cancer screening and follow-up were below 80% coverage targets. Lower screening for Black patients was attenuated by controlling for insurance and site of care, underscoring the role of systemic inequity. In addition, it is crucial to improve follow-up after abnormalities are identified, which was low for all populations.

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INTRODUCTION

Racial disparities in cervical cancer incidence and mortality across the U.S. are large, with Black women 30% more likely to develop and 60% more likely to die from cervical cancer than non-Hispanic White women.[1,2] Hispanic women have a 51% higher age-adjusted incidence of cervical cancer than non-Hispanic White women. Despite better survival after diagnosis, their mortality rates are around 20% higher.[1,2] These racial and ethnic disparities have been persistent over time[3] and have been attributed to unequal care access in prevention, early detection, and treatment.[4−7]

Timely cervical cancer screening, through Pap tests, human papillomavirus (HPV) tests, or both (cotests), is a powerful yet underutilized tool for prevention and early detection, with an estimated 70%−80% of eligible individuals up-to-date with recommended screening.[8,9] Previous studies assessing racial or ethnic differences in self-reported screening use show mixed results.[7,10,11] However, self-reported cervical cancer screening has been shown to not only overestimate screening use relative to matched health record data but also produce a differential misclassification by race, resulting in underestimates of disparities.[11,12] Furthermore, single-site studies using health record data may miss important patterns across sites of care. Numerous studies have characterized a history of racist policies in the U.S. leading to highly concentrated care for racially minoritized populations, including a higher percentage of Black and Hispanic populations receiving care from safety-net health systems.[13−16]

To improve equity in cancer prevention, it is essential to better characterize racial and ethnic differences in screening across multiple healthcare settings to identify the factors that may account for observed differences.[17] This study uses electronic health record (EHR) and administrative data across 3 U.S. healthcare settings to evaluate racial and ethnic disparities in cervical cancer screening use and timely follow-up among those with abnormal results.

METHODS

Study Population

This retrospective study was conducted within the Multi-level Optimization of the Cervical Cancer Screening Process in Diverse Settings & Populations (METRICS) Research Center, part of the Population-based Research to Optimize the Screening PRocess (PROSPR) consortium.[18] METRICS includes 3 sites: (Site A) an integrated safety-net healthcare system in the southwestern U.S., with data reported by their academic partner; (Site B) a mixed-model healthcare system providing health insurance and care in the northwestern U.S.; and (Site C) an integrated healthcare system in the northeastern U.S., including multiple affiliated primary care networks.

The METRICS cohort included female patients aged 18−89 years. Sites A and C included patients with at least 1 visit to a primary care or women's health clinic at any time between January 1, 2010 and December 31, 2019. Site B included patients who were enrolled in the health plan and who were selected, were assigned, or were attributed to a Site B primary care provider during this time. All sites collected and harmonized comprehensive cervical cancer screening process data on their cohorts from the EHR and administrative databases.[19] This work was approved by the IRBs of each participating site (Kaiser Permanente Washington, University of Texas Southwestern, Brigham and Women's Hospital, and Massachusetts General Hospital). Analyses were conducted in 2022.

The analysis identified METRICS cohort members who were part of the cohort from June 1, 2016 to May 31, 2019 (3-year study period; Appendix Figure 1, available online). Screening use was evaluated among those who were age eligible per the U.S. Preventive Services Task Force guidelines,[20] removing the first and last year of eligibility ages to reduce the impact of these transition periods (i.e., participants were aged 22−64 years on June 1, 2016). Analysis excluded those without a cervix, living with HIV, or on a cervical cancer surveillance protocol (i.e., a history of cervical abnormality or cancer). For patients who were cohort members for some or all the 2 years before the study period, the analysis excluded those with a documented cotest during the 2 years before (June 1, 2014 to May 31, 2016) because they would not be due for screening during the study period (Appendix Table 1, available online).

Measures

This study evaluated the receipt of any cervical cancer screening test (HPV, Pap, or both) within the 3-year study window. During this period, the U.S. Preventive Services Task Force recommended a Pap alone every 3 years for individuals with a cervix aged 21−30 years and equivalently recommended Pap alone every 3 years or co-testing every 5 years for those aged 30−65 years.[20] To understand differences in screening modality uptake, the study also compared receipt of co-testing with cytology alone among those in this age range.

The second outcome, *timely follow-up*, was defined as receipt of a colposcopy, biopsy, or excisional procedure within 6 months after a high-grade abnormal screening result. The analysis included only patients with an abnormal screening result per American Society for Colposcopy and Cervical Pathology 2012 management guidelines[21] (i.e., NILM/HPV 16/18+, ASC-US/HPV+, or worse results) during the 3 years of the study period in

the analysis of this outcome.[17] To allow for 6 months of follow-up for all patients, the analysis included follow-up procedures through December 31, 2019.

To compare outcomes by race and ethnicity, patients were grouped to include non-Hispanic White, non-Hispanic Black, Hispanic, Asian/Pacific Islander, multiracial, other race (including Native American), or unknown race/ethnicity according to available data in the EHR. Individuals reporting Hispanic ethnicity were classified as Hispanic, regardless of the race(s) reported.

Covariates were calculated as of June 1, 2016. Health insurance coverage was grouped into mutually exclusive categories: Medicare only, Medicaid only, commercial insurance only, uninsured (including those on medical assistance through the safety-net system), multiple sources of insurance, and other source of insurance (including government insurance other than Medicare and Medicaid). Smoking status was categorized as never, former, current, and unknown. Sites used the International Classification of Diseases, Ninth Revision and ICD-10 codes in both inpatient and outpatient visits during 2016 to evaluate comorbidities using an adapted version of the Charlson comorbidity index,[22,23] which were then categorized as a score of 0, 1–3, or 4. The number of primary care visits in the two years before the study period as well as whether participants had a documented pregnancy during the study period were both identified from METRICS data.

Statistical Analysis

Analysis first described the study population, overall and by racial and ethnic groups. The team calculated the proportions of the study population receiving any screening within 3 years, receiving a cotest within 3 years (among those screened and aged 30–64 years), and receiving follow-up within 6 months of an abnormal screening result, by race/ethnicity, both overall and by site, comparing differences by chi-square tests.

Using a modified Poisson regression,[24] for each racial and ethnic group, the study team estimated the RRs and 95% CIs of receiving any screening in 3 years, receiving an abnormal screening result, and receiving follow-up within 6 months of an abnormal screening result. Consistent with best practices for race-based analysis,[25,26] race was conceptualized as a social construct, with differences reflecting the impact of racism rather than the impact of race itself. The study team calculated three models to examine how the estimate between race/ethnicity and the outcomes changed with each; each model provides distinct implications. First, the total disparity was estimated using an unadjusted model (Model 1). A clinically adjusted model adjusted for age, pregnancy status, BMI, comorbidity score, and smoking status (Model 2). Finally, a fully adjusted model estimated the residual effect (i.e., the expected difference by race if included clinical and socioeconomic variables were equalized across racial and ethnic groups), including insurance coverage type, number of visits documented in the two years before the study window, and an indicator for site of care (Model 3).[26]

RESULTS

Of 1,027,128 METRICS cohort members across the three sites, 188,415 (18.3%) met all study eligibility criteria (Appendix Table 1, available online). Across sites, the study population was 44.7% non-Hispanic White, 12.4% non-Hispanic Black, 32.5% Hispanic, 6.7% Asian or Pacific Islander, 2.1% multiracial or other race (including Native American and Alaskan Native), and 1.6% of an unknown race or ethnicity (Table 1).

The racial and ethnic distribution of patients varied by site, with Black and Hispanic patients most likely to receive care at Site A (63.7% of Black patients; 81.8% of Hispanic patients) (Table 1), whereas non-Hispanic White patients were most likely to receive care at Site B (61.1%). Insurance type varied by race and ethnicity, with Black and Hispanic patients more likely to be uninsured (26.0% and 37.8%, respectively) or on Medicaid (26.2% and 19.7%, respectively) than non-Hispanic White patients (2.4% uninsured and 9.2% Medicaid, $p<0.001$) or Asian/Pacific Islander patients (7.6% uninsured and 10.5% Medicaid). Only 2.8% of eligible non-Hispanic White patients had a documented pregnancy during the 3-year study period, compared with 9.3% of Black patients and 21.8% of Hispanic patients ($p<0.001$).

In bivariate analyses (Table 2), 62.8% of patients across sites received cervical cancer screening over 3 years, with the highest screening uptake at Site C (71.1%) and the lowest at Site A (58.6%). Across sites, screening uptake was highest among Asian/Pacific Islander patients (66.0%) and Hispanic patients (65.4%); screening uptake was lowest among Black patients (53.2%) and those with unknown race and ethnicity (49.6%, all $p<0.001$ versus non-Hispanic White; 63.5%). Within each site, Black patients had higher screening uptake or screening uptake equivalent to that of non-Hispanic White patients, but overall, screening uptake was lower, owing to the higher proportion of Black patients at the site with the lowest overall screening uptake. Hispanic patients had higher screening use than non-Hispanic Whites across all sites, with the largest difference observed at Site A (64.6% vs 40.0%, respectively, $p<0.001$). Those with unknown race and ethnicity consistently had the lowest screening uptake at each site.

Among those screened during the study period, 3.5% had abnormal test results for which follow-up is recommended by current guidelines, with a higher prevalence of abnormalities observed among Black (4.1%) and Hispanic (3.7%) patients than among non-Hispanic White (3.3%, both $p<0.001$) or Asian patients (2.7%, $p=0.01$). Of those with abnormal results warranting follow-up, 72.5% received a biopsy or colposcopy within 6 months, with patients at Site B less likely to receive follow-up within 6 months (65.6%) than those at Site C (77.0%, $p<0.001$) or Site A (77.2%, $p<0.001$). The only significant difference in screening follow-up was a higher

probability of 6-month follow-up among Hispanic patients than among non-Hispanic White (78.8% vs 69.8, $p<0.001$)

Receipt of cotest (among those aged 30−64 years) varied greatly by site, with only 12.7% of screened patients at Site A receiving a cotest compared with 84.8% of those at Site C and 68.7% of those at Site B. Within sites, differences in co-testing proportions by race and ethnicity were generally small, but Hispanic patients were significantly less likely to receive a cotest within each site than non-Hispanic White patients, and both Black and Hispanic patients were much less likely to receive a cotest when comparing across sites (Black, 44.0%; Hispanic, 22.2% vs non-Hispanic White, 73.6%; both $p<0.001$).

In multivariable models adjusting first for clinical and then for socioeconomic characteristics (Figure 1 and Appendix Table 2, available online), clinical variables reversed the direction of association for Hispanic patients. Hispanic patients had 2% lower screening rates than non-Hispanic White patients (Model 2: RR=0.98 [95% CI=0.97, 0.99]). The direction reversed again when adding insurance, visits, and site: Hispanic patients after adjusting for site of care, clinical characteristics, and insurance had 18% higher screening rates than non-Hispanic Whites (RR=1.18 [95% CI=1.16, 1.20]).

In contrast, Black patients were still less likely to receive screening than non-Hispanic White patients after adjustment for clinical covariates (Model 2: RR=0.86 [95% CI=0.84, 0.88]), but these differences were attenuated in the fully adjusted model (Model 3: RR=1.00 [95% CI=0.98, 1.03]). The higher screening rate observed for Asian/Pacific Islander patients was no longer statistically significant after adjusting for clinical variables (RR=1.02 [95% CI=1.00, 1.04]), and no significant differences were seen for multiracial/other race patients.

Screened Black and Hispanic patients were more likely to have an abnormal test result than non-Hispanic White patients, even after adjustment for all covariates (Figure 2A and Appendix Table 3, available online). Black patients with at least 1 screening test during the study period and Hispanic patients were, respectively, 26% more likely (RR=1.26 [95% CI=1.12, 1.41]) and 18% more likely (RR=1.18 [95% CI=1.06, 1.31]) to have a detected abnormality than non-Hispanic White patients. In adjusted models, Asian patients were slightly but consistently less likely to have an abnormal finding than non-Hispanic Whites. A higher probability of follow-up from abnormal testing among Hispanic patients (than among non-Hispanic White patients) was no longer significant after adjusting for insurance type and location of care (Figure 2B and Appendix Table 4, available online).

DISCUSSION

Using data from 3 large healthcare settings, this study found that Black patients were significantly less likely than non-Hispanic White patients to receive timely cervical cancer screening, a difference only fully attenuated when accounting for insurance and site of care. In contrast, Hispanic patients were more likely to receive cervical cancer screening than non-Hispanic White patients, a difference that widened when accounting for insurance and site of care. More up-to-date screening among Hispanic populations (versus non-Hispanic) is consistent with many[27−29] but not all[7,30] national estimates of screening. Both Black and Hispanic patients were more likely than non-Hispanic White patients to have a screen-detected abnormality, which persisted after adjustment. Timely follow-up within 6 months of a screen-detected abnormality was low, with only 73% of patients returning for follow-up within 6 months, but lowest for Black patients (65%) and highest for Hispanic patients (79%).

Assessing disparities in cervical cancer screening is met with numerous challenges. National surveys can enumerate screening uptake in a representative sample but are subject to recall and social desirability bias.[12] Using health records provides greater internal validity with more reliable screening documentation but may miss key systemic drivers of inequity if representing only a single setting. This multisite study provides valuable comparisons both within and across sites, but these conclusions are inherently driven by the selected sites and their patient composition. Site was a primary driver of the differences observed; nearly 64% of Black patients and three quarters of Hispanic patients were seen at the participating safety-net health system, which had the lowest prevalence of screening (58.6%), whereas the site that saw the smallest proportion of Black and Hispanic patients had the highest (71.1%). Site was the largest predictor of screening, even when controlling for insurance and other patient characteristics. Differences in racial and ethnic composition of patients by site are consistent with the distribution of care nationally,[13,15,16] including that Black and Hispanic individuals are 2−3 times more likely to receive care at a federally qualified health center than non-Hispanic White individuals.[14,29] Although these data do not provide an estimate of national-level disparities, the inclusion of settings with different care delivery models in the study provides some insight into existing racial and ethnic disparities, which persist even among individuals receiving regular primary care.

Table 1. Sociodemographic and Clinical Characteristics of the Study Population by Race and Ethnicity

Characteristic	White, non-Hispanic 84,133 (44.7%) *n* (%)	Black, non-Hispanic 23,447 (12.4%) *n* (%)	Hispanic 61,262 (32.5%) *n* (%)	Asian/Pacific Islander 12,642 (6.7%) *n* (%)	Multi/other 3,886 (2.1%) *n* (%)	Unknown 3,045 (1.6%) *n* (%)	Total 188,415 (100%) *n* (%)
Site		***	***	***	***	***	
Site A	4,112 (4.9%)	**14,926 (63.7%)**	**50,137 (81.8%)**	**1,862 (14.7%)**	**163 (4.2%)**	**152 (5.0%)**	71,352 (37.9%)
Site B	28,600 (34.0%)	**2,178 (9.3%)**	**2,706 (4.4%)**	**5,911 (46.8%)**	**2,272 (58.5%)**	**1,383 (45.4%)**	43,050 (22.8%)
Site C	51,421 (61.1%)	**6,343 (27.1%)**	**8,419 (13.7%)**	**4,869 (38.5%)**	**1,451 (37.3%)**	**1,510 (49.6%)**	74,013 (39.3%)
Age (years)		***	***	***	***	***	
22–29	13,041 (15.5%)	**3,979 (17.0%)**	**14,133 (23.1%)**	**1,910 (15.1%)**	**869 (22.4%)**	**496 (16.3%)**	34,428 (18.3%)
30–39	16,101 (19.1%)	**5,109 (21.8%)**	**20,279 (33.1%)**	**3,012 (23.8%)**	**984 (25.3%)**	**645 (21.2%)**	46,130 (24.5%)
40–49	18,767 (22.3%)	**5,196 (22.2%)**	**14,843 (24.2%)**	**3,299 (26.1%)**	**832 (21.4%)**	**772 (25.4%)**	43,709 (23.2%)
50–64	36,224 (43.1%)	**9,163 (39.1%)**	**12,007 (19.6%)**	**4,421 (35.0%)**	**1,201 (30.9%)**	**1,132 (37.2%)**	64,148 (34.0%)
Insurance type		***	***	***	***		
Commercial	69,970 (83.2%)	**6,986 (29.8%)**	**7,263 (11.9%)**	**9,692 (76.7%)**	**2,911 (74.9%)**	2,492 (81.8%)	99,314 (52.7%)
Medicare	1,431 (1.7%)	**1,440 (6.1%)**	**649 (1.1%)**	**77 (0.6%)**	**67 (1.7%)**	43 (1.4%)	3,707 (2.0%)
Medicaid	7,769 (9.2%)	**6,153 (26.2%)**	**12,071 (19.7%)**	**1,329 (10.5%)**	**671 (17.3%)**	318 (10.4%)	28,311 (15.0%)
Uninsured/medical assistance	2,055 (2.4%)	**6,097 (26.0%)**	**23,129 (37.8%)**	**964 (7.6%)**	**67 (1.7%)**	66 (2.2%)	32,378 (17.2%)
Multiple insurance	2,233 (2.7%)	**1,074 (4.6%)**	**5,875 (9.6%)**	**364 (2.9%)**	**132 (3.4%)**	95 (3.1%)	9,773 (5.2%)
Other government/insurance	403 (0.5%)	**588 (2.5%)**	**6,319 (10.3%)**	**109 (0.9%)**	**23 (0.6%)**	17 (0.6%)	7,459 (4.0%)
Unknown	272 (0.3%)	**1,109 (4.7%)**	**5,956 (9.7%)**	**107 (0.8%)**	**15 (0.4%)**	14 (0.5%)	7,473 (4.0%)
BMI (kg/m^2)		***	***	***	***	***	
<18.5	1,374 (1.6%)	**184 (0.8%)**	**220 (0.4%)**	**391 (3.1%)**	**55 (1.4%)**	**46 (1.5%)**	2,270 (1.2%)
18.5–24.9	32,824 (39.0%)	**3,231 (13.8%)**	**8,327 (13.6%)**	**6,350 (50.2%)**	**1,116 (28.7%)**	**972 (31.9%)**	52,820 (28.0%)
25.0–29.9	21,549 (25.6%)	**4,968 (21.2%)**	**15,867 (25.9%)**	**3,202 (25.3%)**	**1,005 (25.9%)**	**722 (23.7%)**	47,313 (25.1%)
30.0–34.9	12,064 (14.3%)	**4,650 (19.8%)**	**12,814 (20.9%)**	**1,169 (9.2%)**	**716 (18.4%)**	**353 (11.6%)**	31,766 (16.9%)
35.0–39.9	6,495 (7.7%)	**3,140 (13.4%)**	**6,503 (10.6%)**	**392 (3.1%)**	**387 (10.0%)**	**202 (6.6%)**	17,119 (9.1%)
40+	5,503 (6.5%)	**3,625 (15.5%)**	**4,526 (7.4%)**	**246 (1.9%)**	**376 (9.7%)**	**141 (4.6%)**	14,417 (7.7%)
Missing	4,324 (5.1%)	**3,649 (15.6%)**	**13,005 (21.2%)**	**892 (7.1%)**	**231 (5.9%)**	**609 (20.0%)**	22,710 (12.1%)
Smoking status		***	***	***	***	***	
Never	53,509 (63.6%)	**12,815 (54.7%)**	**41,223 (67.3%)**	**10,417 (82.4%)**	**2,557 (65.8%)**	**1,794 (58.9%)**	122,315 (64.9%)
Former	17,941 (21.3%)	**3,210 (13.7%)**	**4,668 (7.6%)**	**915 (7.2%)**	**687 (17.7%)**	**411 (13.5%)**	27,832 (14.8%)
Current	7,295 (8.7%)	**3,694 (15.8%)**	**2,378 (3.9%)**	**389 (3.1%)**	**376 (9.7%)**	**178 (5.8%)**	14,310 (7.6%)
Unknown	5,388 (6.4%)	**3,728 (15.9%)**	**12,993 (21.2%)**	**921 (7.3%)**	**266 (6.8%)**	**662 (21.7%)**	23,958 (12.7%)
Charlson score		***	***	***		***	
0	55,028 (65.4%)	**12,805 (54.6%)**	**42,726 (69.7%)**	**8,759 (69.3%)**	2,528 (65.1%)	**2,375 (78.0%)**	124,221 (65.9%)
1–3	26,536 (31.5%)	**8,971 (38.3%)**	**16,661 (27.2%)**	**3,558 (28.1%)**	1,226 (31.5%)	**638 (21.0%)**	57,590 (30.6%)
4+	2,569 (3.1%)	**1,671 (7.1%)**	**1,875 (3.1%)**	**325 (2.6%)**	132 (3.4%)	**32 (1.1%)**	6,604 (3.5%)

(*continued on next page*)

Table 1. Sociodemographic and Clinical Characteristics of the Study Population by Race and Ethnicity (*continued*)

Characteristic	White, non-Hispanic	Black, non-Hispanic	Hispanic	Asian/Pacific Islander	Multi/other	Unknown	Total
	84,133 (44.7%) *n* (%)	**23,447 (12.4%)** *n* (%)	**61,262 (32.5%)** *n* (%)	**12,642 (6.7%)** *n* (%)	**3,886 (2.1%)** *n* (%)	**3,045 (1.6%)** *n* (%)	**188,415 (100%)** *n* (%)
Ever pregnant during the study period		***	***	***	***		
No	81,795 (97.2%)	**21,275 (90.7%)**	**47,884 (78.2%)**	**11,928 (94.4%)**	**3,710 (95.5%)**	2,960 (97.2%)	169,552 (90.0%)
Yes	2,338 (2.8%)	**2,172 (9.3%)**	**13,378 (21.8%)**	**714 (5.6%)**	**176 (4.5%)**	85 (2.8%)	18,863 (10.0%)
Number of PCP visits during 2 years before the study period		***	***	***	***	***	
0	9,348 (11.1%)	**3,631 (15.5%)**	**10,220 (16.7%)**	**1,604 (12.7%)**	**472 (12.1%)**	**755 (24.8%)**	26,030 (13.8%)
1–2	31,129 (37.0%)	**6,700 (28.6%)**	**17,292 (28.2%)**	**4,712 (37.3%)**	**1,245 (32.0%)**	**1,098 (36.1%)**	62,176 (33.0%)
3–6	32,171 (38.2%)	**8,657 (36.9%)**	**20,371 (33.3%)**	**4,676 (37.0%)**	**1,416 (36.4%)**	**880 (28.9%)**	68,171 (36.2%)
7+	11,485 (13.7%)	**4,459 (19.0%)**	**13,379 (21.8%)**	**1,650 (13.1%)**	**753 (19.4%)**	**312 (10.2%)**	32,038 (17.0%)

Note: Boldface indicates statistical significance (*$p<0.05$, **$p<0.01$, and ***$p<0.001$).
p-values show comparisons with Non-Hispanic White.
PCP, primary care provider.

Site also drove the low prevalence of co-testing among Hispanic and Black individuals screening in the study population, specifically through infrequent co-testing at Site A. Recent cervical cancer screening guidelines include primary HPV testing as an option,[31] a lower-cost alternative to co-testing that could be performed from self-collected samples once Food and Drug Administration approved, potentially increasing test accessibility.[32–34] However, unequal roll out of primary HPV testing may delay improvement in or exacerbate screening disparities. Therefore, it is important to understand the barriers to the implementation of HPV testing at safety-net and other healthcare settings that provide care for patients from historically and contemporarily marginalized groups.

The few studies that have tracked diagnostic evaluation after abnormal screening results have reported follow-up completion of 78% from self-report or 65% from EHR data,[11,35] comparable with this study's estimates of 72.5% across all sites. Because follow-up is essential for cervical cancer screening to reduce cancer incidence or mortality,[36] it is crucial that healthcare systems address low follow-up using patient navigation or other interventions to help all patients complete the entire screening process.[37–40]

Limitations

Patients may have received care outside the system to which they were attributed (before or during the study window) and therefore could have been misclassified as unscreened. Requiring 3 years of data improves the internal validity of the estimates but may introduce selection bias by including only those enrolled during this period. There are other potential mediators of disparities that the study could not evaluate, including measures of structural and interpersonal racism.[41] In addition, it is impossible to separate the sites from the local and state contexts in which they operate, meaning that the estimates of site effect likely reflect characteristics both within and outside of the healthcare setting. The analysis classified patient race and ethnicity on the basis of information in the EHR, which is known to misclassify some patients and to result in 1.5% having an unknown race or ethnicity.[42,43] Owing to small numbers, results were not reported separately for Native Americans and Alaska Natives, a group with a high cervical cancer burden and historically lower access to care.[44] In addition, there was no way to disaggregate the heterogenous populations within each of these larger groups, including Asian,[45,46] Hispanic,[47,48] and Black populations,[49,50] which may obscure important variation within these groups.[45–47]

Table 2. Prevalence of Screening, Abnormal Screening Result, Follow-Up, and Test Modality by Race/Ethnicity and Site

Site	Site A	Site B	Site C	Total
Population	71,352 (37.9%)	43,050 (22.8%)	74,013 (39.3%)	188,415 (100%)
Percentage receiving at least 1 screening test within 3 years[a]				
Overall	58.6% (41,846/71,352)	71.1% (30,598/43,050)	61.9% (45,847/74,013)	62.8% (118,291/188,415)
White, non-Hispanic	40.0% (1,644/4,112)	71.2% (20,370/28,600)	61.0% (31,373/51,421)	63.5% (53,387/84,133)
Black, non-Hispanic	**46.2%*** (6,889/14,926)**	71.4% (1,555/2,178)	**63.4%*** (4,024/6,343)**	**53.2%*** (12,468/23,447)**
Hispanic	**64.6%*** (32,401/50,137)**	**74.8%*** (2,023/2,706)**	**66.7%*** (5,613/8,419)**	**65.4%*** (40,037/61,262)**
Asian/Pacific Islander	42.6% (794/1,862)	**75.5%*** (4,463/5,911)**	**63.4%** (3,088/4,869)**	**66.0%*** (8,345/12,642)**
Multi/other	45.4% (74/163)	**69.0%* (1,568/2,272)**	62.2% (902/1,451)	**65.5%* (2,544/3,886)**
Unknown	**28.9%** (44/152)**	**44.8%*** (619/1,383)**	**56.1%*** (847/1,510)**	**49.6%*** (1,510/3,045)**
Percentage with abnormal results for the first screening test in study window[b]				
Overall	3.6% (1,501/41,846)	3.0% (928/30,598)	3.7% (1,681/45,847)	3.5% (4,110/118,291)
White, non-Hispanic	4.4% (73/1,644)	2.9% (585/20,370)	3.5% (1,087/31,373)	3.3% (1,745/53,387)
Black, non-Hispanic	4.2% (286/6,889)	3.7% (58/1,555)	4.0% (161/4,024)	**4.1%*** (505/12,468)**
Hispanic	**3.5%* (1,125/32,401)**	3.4% (69/2,023)	**5.2%*** (291/5,613)**	**3.7%*** (1,485/40,037)**
Asian/Pacific Islander	**1.9%* (15/794)**	2.8% (125/4,463)	2.8% (88/3,088)	**2.7%** (228/8,345)**
Multi/other	1.4% (1/74)	**4.1%** (65/1,568)**	**4.0%* (36/902)**	**4.0%* (102/2,544)**
Unknown	2.3% (1/44)	4.2% (26/619)	**2.1%* (18/847)**	3.0% (45/1,510)
Percentage receiving biopsy or colposcopy within 6 months of abnormal finding[c]				
Overall	77.2% (1,147/1,485)	77.0% (705/916)	65.6% (1,068/1,627)	72.5% (2,920/4,028)
White, non-Hispanic	70.8% (51/72)	79.7% (459/576)	64.3% (678/1,055)	69.8% (1,188/1,703)
Black, non-Hispanic	67.8% (192/283)	**63.2%** (36/57)**	61.4% (97/158)	65.3% (325/498)
Hispanic	**80.5%* (897/1,114)**	76.8% (53/69)	**72.6%** (204/281)**	**78.8%*** (1,154/1,464)**
Asian/Pacific Islander	**42.9%* (6/14)**	72.6% (90/124)	64.7% (55/85)	67.7% (151/223)
Multi/other	–[d]	73.8% (48/65)	71.9% (23/32)	72.4% (71/98)
Unknown	–[d]	76.0% (19/25)	68.8% (11/16)	73.8% (31/42)
Percentage of screened patients receiving HPV cotest[e]				
Overall	12.7% (5,318/41,846)	84.8% (25,944/30,598)	68.7% (31,483/45,847)	53.0% (62,745/118,291)
White, non-Hispanic	20.3% (334/1,644)	85.2% (17,362/20,370)	68.9% (21,609/31,373)	73.6% (39,305/53,387)
Black, non-Hispanic	19.5% (1,341/6,889)	84.6% (1,315/1,555)	70.3% (2,827/4,024)	**44.0%*** (5,483/12,468)**
Hispanic	**10.8%*** (3,495/32,401)**	**83.0%* (1,679/2,023)**	**65.8%*** (3,696/5,613)**	**22.2%*** (8,870/40,037)**

(*continued on next page*)

Table 2. Prevalence of Screening, Abnormal Screening Result, Follow-Up, and Test Modality by Race/Ethnicity and Site (*continued*)

Site	Site A	Site B	Site C	Total
Asian/Pacific Islander	**16.4%* (130/794)**	**87.5%* (3,907/4,463)**	**71.6%** (2,211/3,088)**	**74.9%* (6,248/8,345)**
Multi/other	**10.8%* (8/74)**	**78.1%* (1,225/1,568)**	**63.4%*** (572/902)**	**71.0%** (1,805/2,544)**
Unknown	22.7% (10/44)	**73.7%* (456/619)**	67.1% (568/847)	**68.5%*** (1,034/1,510)**

Note: Boldface indicates statistical significance (*$p<0.05$, **$p<0.01$, and ***$p<0.001$).
p-values show comparisons with Non-Hispanic White.
[a]Pap and/or HPV test; 3-year study window was June 1, 2016–May 31, 2019.
[b]Test results that warrant diagnostic evaluation or treatment as per ASCCP 2012 management guidelines.[21,40]
[c]Eligible follow-up procedures include colposcopy (with or without biopsy) or excisional procedures; removes individuals who received a diagnostic evaluation procedure on the same day as a cytology or HPV test (n=82).
[d]Fewer than 5 observations; data suppressed.
[e]Among patients aged 30–64 year who received any screening test.
ASCCP, American Society for Colposcopy and Cervical Pathology; HPV, human papillomavirus.

Figure 1. Estimated RR (95% CIs) for any screening within 3 years by race and ethnicity.
RRs and 95% CIs for each race or ethnic group using the non-Hispanic White group as the reference are estimated from logistic regression models with Poisson log-link. Covariates are added progressively: M1 includes the main independent variable (race/ethnicity) only; M2 adjusts for age, pregnancy, smoking, Charlson comorbidity score, and BMI; and M3 additionally adjusts for insurance type, number of primary care provider visits in 2 years before the study period, and site of care. Full regression results are available in Appendix Table 2 (available online).
M1, Model 1; M2, Model 2; M3, Model 3.

CONCLUSIONS

This multisite study population provides insights into screening uptake by race and ethnicity, including the observation that Black patients have higher cervical cancer screening use within each site but lower screening when comparing across sites, driven by patient distribution. Although it is important to directly address lower screening rates for Black individuals and in safety-net settings, these findings underscore the need to also address a larger root cause of these disparities: systemic racism resulting in inequitable policies, under-resourced healthcare settings, and differences in care access.[41,51,52] The study also found that Hispanic patients were more likely to receive any screening than non-Hispanic patients but were around one third as likely to receive a cotest. Future work should adopt an asset-based approach to understand why Hispanic patients were more likely to be up-to-date with screening across all sites as well as explore the reasons for the observed cross-site variation in screening and follow-up. Finally, these results suggest that any screening interventions should also focus on ensuring timely follow-up of abnormal findings because only around 73% of patients with abnormalities received further workup within 6 months.

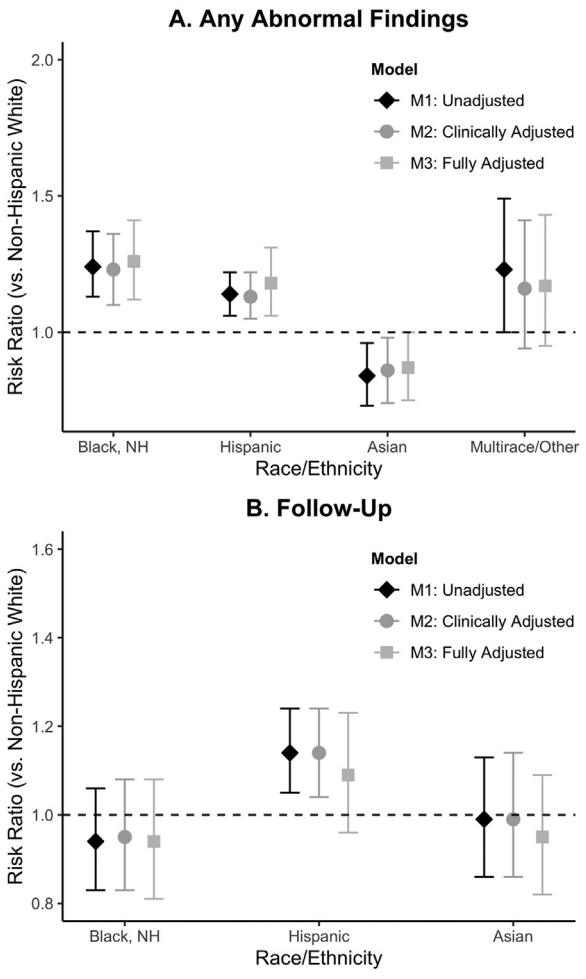

Figure 2. Estimated RR (95% CIs) for screen-detected abnormality and 6-month follow-up among those with abnormalities by race or ethnicity.

RRs and 95% CIs for each race or ethnic group using the non-Hispanic White group as the reference are estimated from logistic regression models with Poisson log-link. Covariates are added progressively: M1 includes the main independent variable (race/ethnicity) only; M2 adjusts for age, pregnancy, smoking, Charlson comorbidity score, and BMI; and M3 additionally adjusts for insurance type, number of primary care provider visits in 2 years before the study period, and site of care. Full regression results are available in Appendix Tables 4 and 5 (available online).

M1, Model 1; M2, Model 2; M3, Model 3.

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SUPPLEMENTAL MATERIAL

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