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RESEARCH ARTICLE

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# Racial disparities in low-value surgical care and time to surgery in high-volume hospitals

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## Abstract

**Background:** The objective of this study is to examine racial differences in receipt of low-value surgical care and time to surgery (TTS) among women receiving treatment at high-volume hospitals.

**Methods:** Stage I–III non-Hispanic Black (NHB) and Non-Hispanic White (NHW) breast cancer patients were identified in the National Cancer Database. Low-value care included (1) sentinel lymph node biopsy (SLNB) among T1N0 patients age ≥70 with hormone receptor–positive cancers, (2) axillary lymph node dissection (ALND) in patients meeting ACOSOG Z0011 criteria, and (3) contralateral prophylactic mastectomy (CPM) with unilateral cancer. TTS was days from biopsy to surgery. Bivariate and logistic regression analyses were used to compare the groups.

**Results:** Compared to NHWs, NHBs had lower rates of SLNB among women age ≥70 with small hormone–positive cancers (NHB 58.5% vs. NHW 62.2% $p < .001$) and CPM (NHB 26.3% vs. NHW 36%; $p < .001$). ALND rates for patients meeting ACOSOG Z0011 criteria were similar between both groups ($p = .13$). The odds of surgery >60 days were higher among NHBs (odds ratio, 1.77; 95% confidence interval, 1.64–1.91; NHW ref).

**Conclusions:** NHBs treated at high-volume hospitals have higher rates of surgical delay but are less likely to undergo low-value surgical procedures compared to NHW women.

**KEYWORDS**
breast cancer, disparities, race, surgery, value

## 1 | INTRODUCTION

Advancements in the diagnosis and treatment of breast cancer have resulted in earlier stages of diagnosis and increased survival.[1] Current Surveillance Epidemiology and End Result (SEER) Program data show a 90% 5-year relative survival rate for all breast cancer stages.[2] However, improvements in clinical outcomes such as survival have not extended to non-Hispanic Black (NHB) breast cancer patients. NHB women diagnosed with breast cancer present at younger ages, with more advanced stages and increased rates of aggressive subtypes.[3,4] In addition, they face disparities in dosing and frequency of chemotherapy, endocrine therapy adherence, and surgical delays.[5,6] These differences in treatment are significant as they contribute to worse disease-specific and overall survival.[7,8]

An avenue to mitigate racial disparities in breast cancer outcomes include evaluations of patterns of care. Studies suggest breast cancer patients treated by oncology specialists or by high-volume providers or centers are more likely to receive guideline-concordant

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care and have higher survival rates than patients treated by non-specialists or at low-volume centers.[9–11] A review of the National Cancer Database (NCDB) suggests that treatment at a high-volume center (defined as annual cases ≥298) resulted in an 11% reduction in mortality compared to treatment at low-volume centers.[12] Notably, NHB women in the study did not appear to have any improvement in survival when treated at high-volume centers compared with low-volume centers.[12] In the aforementioned study, hospital volume categories were based on the relationship between annual hospital volume and survival after controlling for potential confounding variables. This approach to defining hospital volume provides a more nuanced understanding of the volume–outcome relationship compared with studies constructing volume categories based on the distribution of cases within a cohort.

To better understand processes of care that contribute to racial disparities in clinical outcomes, the objective of this study was to examine differences in surgical management and time to first definitive surgery between NHB women and Non-Hispanic White (NHW) women receiving treatment in high- volume hospitals in the NCDB. Specifically, we were interested in racial differences in the utilization of low- value surgical care and surgical delays. Low-value surgical procedures are defined as procedures with minimal to no clinical benefit.[13] The motivation behind focusing on these procedures was to better understand racial differences in the quality of surgical care. Surgical delay was evaluated due to its association with increased disease-specific and overall survival.[7] We hypothesized that NHB women were more likely to receive low-value surgical care and experience longer wait times from biopsy-proven diagnosis to first definitive surgery at high-volume hospitals compared to their NHW counterparts. To this end, results from this study could provide additional insight into surgically rooted racial differences in outcomes among patients treated at high-volume centers.

## 2 | METHODS

### 2.1 | Data source

The NCDB prospectively collects cancer cases from 1500 Commission on Cancer (CoC) accredited facilities and represents 70% of newly diagnosed cancers in the United States.[14] The NCDB is jointly managed by the American Cancer Society and the American College of Surgeons.

### 2.2 | Study population

The NCDB was queried for NHB and NHW female breast cancer patients ages 18–90, diagnosed with stage I–III breast cancer between 2010 and 2016, who received treatment at high-volume hospitals (Figure 1). Based on the prior work of Greenup et al.[12] high-volume hospitals were defined as facilities that evaluate/treat ≥298 patients a year. To define hospital volumes, Greenup et al.[12] used a multivariable Cox proportional hazards model with restricted cubic splines to account for the nonlinearity of the relationship between hospital volume and survival. Women with inflammatory breast cancer (T4d) and women who were diagnosed on autopsy were excluded.

### 2.3 | Low value surgical care

This study focused on three established low-value procedures as defined by the Society of Surgical Oncology, the American College of Surgeons, and the American Society of Breast Surgery. The procedures include (1) sentinel lymph node biopsy (SLNB) among patients age ≥70 with clinically T1N0 hormone receptor–positive cancers; (2) axillary lymph node dissection (ALND) among patients with clinically T1-2N0 breast cancer with ≤2 positive sentinel lymph nodes who undergo breast conservation therapy (BCT). Performance of ALND among patients meeting ACOSOG Z0011 criteria was evaluated from 2012 to 2016 as the ACOSOG Z0011 trial was published in 2011[15]; (3) contralateral prophylactic mastectomy (CPM) among women presenting with unilateral breast cancers.[16–18]

Of note, Choose Wisely guidelines for the omission of SLNB among women age ≥70 with small hormone–positive cancers and avoidance of CPM for unilateral cancer were published in 2016.[19,20] Consequently, our study timeframe includes the period before wide public dissemination of the guidelines. Nonetheless, it should be noted that the data supporting the guidelines were available before 2016.

### 2.4 | Time to treatment

Based on the prior work of Bleicher et al,[21] surgical delay was defined as the time from biopsy-proven diagnosis to first definitive surgery of >60 days. Patients who received neoadjuvant chemotherapy as their first definitive treatment were omitted from the time to surgery (TTS) analysis as a receipt of neoadjuvant chemotherapy delays time from biopsy to surgery. All patients who had the date of biopsy and surgery on the same date were also excluded due to concerns these cases were also excisional biopsies.

### 2.5 | Statistical analysis

The study population was dichotomized into NHB women and NHW women. Descriptive analysis of the two groups was conducted with categorical variables calculated as frequencies and continuous variables as medians or means. Sociodemographic, clinical, and treatment characteristics were compared between the two groups using the chi-square test for categorical variables and analysis of variance for continuous variables.

A multivariable logistic regression model was used to evaluate the probability of surgical delay. To account for patients being treated in the same facility we performed clustering at the hospital level.[22] Variables in the model included insurance status (not insured, private

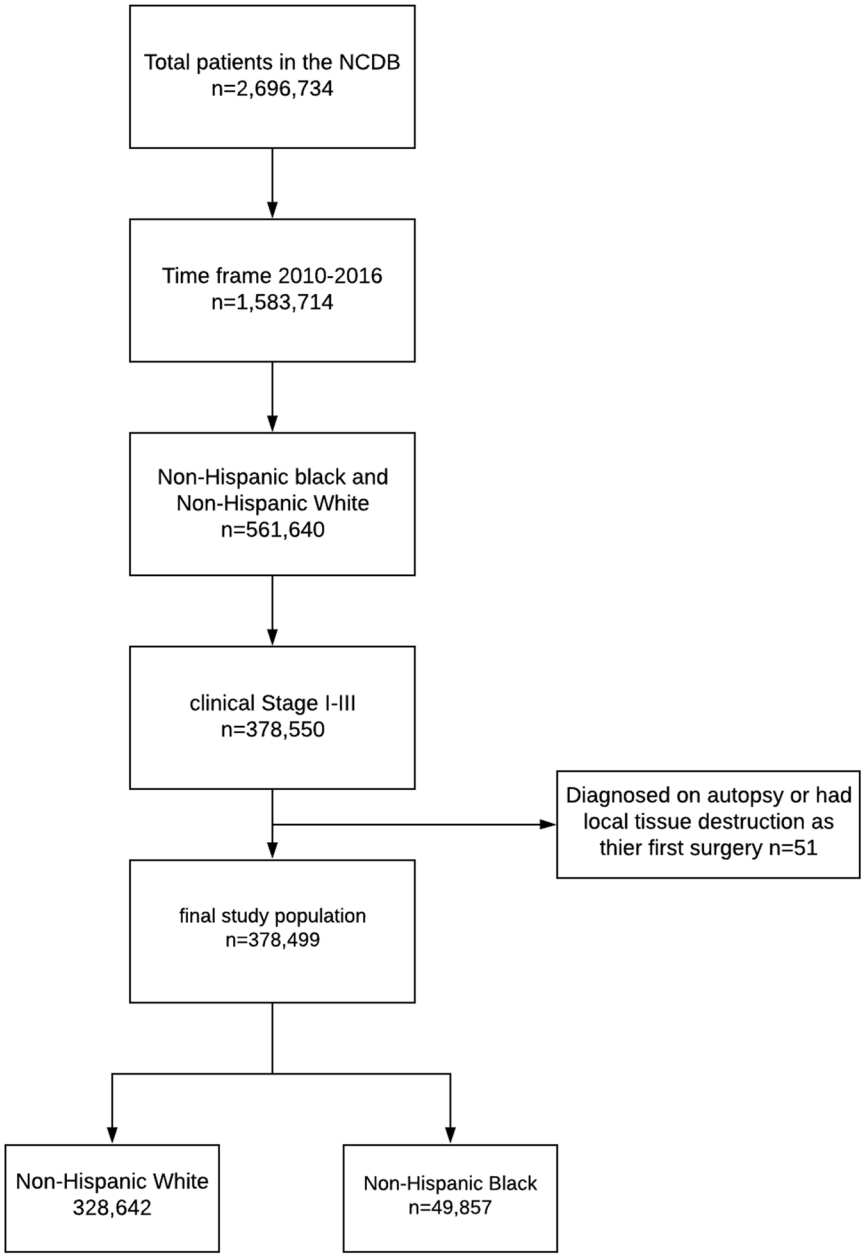


**FIGURE 1** Study population diagram. NCDB, National Cancer Database

insurance/managed care, medicaid, medicare, other government, unknown), age (continuous), race (NHB women, NHW women), year of diagnosis (2010–2016), clinical-stage (I–III), comorbidities (0, 1, ≥2), education (percentage of people in neighborhood with high school degree, ≥21%, 13%–20.9%, 7%–12.9%, or <7%), metropolitan status (metropolitan area of 1M population, metropolitan area of 250K–1M population, metropolitan area of <250K population, urban, or rural), surgery type (breast conservation surgery [BCS] vs. mastectomy), reconstruction (yes vs. no), biopsy and surgery facility, and distance traveled to the surgery facility (miles). Patients who received their biopsy and surgery at the same facility were categorized as same facility. Conversely, patients who had their biopsy and surgery in different facilities were categorized as different facility. Distance to the facility, per the NCDB, was based on the distance from the patient's residence to the hospital in miles.[23] Variables in the model were selected due their potential relationship to treatment delay. [6,24–31] All statistical analyses were performed in Stata software version 16.0 with $p$ values obtained from a two-tailed test. A $p$ value of .05 was considered significant. The Ohio State University Office of Responsible Research Practices deemed this study IRB exempt.

## 3 | RESULTS

### 3.1 | Description of study population

There were 378,499 patients who met the study criteria. Overall, NHB women were significantly younger (mean age 58.2 years ±13.3

vs. 61.4 years ±13.3; $p < .001$), more likely to live in a neighborhood with a low median income (neighborhood income <$38,000, 36.6% 18232/49765 vs. 9.1% 29984/327971; $p < .001$), had lower educational achievement (percent of individuals in neighborhood who did not graduate from high school ≥21%, 29.0% 14455/49799 vs. 8.8% 28729/328198; $p < .001$) and resided in a large metropolitan area (77.5% 38086/49133 vs. 64.4% 205785/319750; $p < .001$) compared with NHW women (Table 1). In addition, a higher percentage of NHB women (11.4% 5902/49857) were on Medicaid than NHW women (3.5% 11676/328642; $p < .001$).

Significantly more NHB women had ($p < .001$) advanced stages of disease at diagnosis compared NHW women (Table 1). Aggressive cancer subtypes such as Triple Negative Breast Cancer (TNBC) and HER 2 + breast cancer were significantly ($p < .001$) more common among NHB compared to NHW women. Consequently, more NHB women received chemotherapy than NHW women (54.9% 26807/48787 vs 40.3% 129749/322161 $p < .001$). However, despite differences in tumor subtype, there were no differences between the groups on pathologic response after chemotherapy ($p = .23$). NHB women were less likely to have surgery compared to NHW (21.4% 10683/49857 vs 18.1% 59383/328642; $p < .001$). On subset analysis the most common reasons for no surgery included 1) not part of the planned first treatment course and 2) it was recommended by the physician but refused by the patients (not shown). The omission of surgery secondary to patient risk factors was similar between the two groups (not shown). There was no difference in the utilization of BCT (BCS + radiation) between NHB and NHW women ($p = .55$).

### 3.2 | TTS and low-value procedures

Median time from biopsy proven diagnosis to first definitive surgery (Table 2) was significantly longer ($p < .001$) for NHB women (43 days [IQR, 28–68]) compared with NHW women (35 days [24–52]). Moreover, 30.6% (9031/29559) of NHB had surgery >60 days after biopsy compared to 18.0% (39692/219888) of NHW women ($p < .001$).

The groups were similar on the performance of ALND among women meeting criteria for ASOCOG Z0011 ($p = .13$). However, NHB women age ≥70 with T1 hormone–positive cancers were less likely to have had an SLNB than NHW women (NHB 58.5% 1428/2442 vs. NHW 62.2% 19614/31547; $p < .001$). Moreover, among patients with unilateral breast cancer NHW had higher rates of CPM (36% 38028/105601) than NHB (26.3% 3822/14512) ($p < .001$). A review of CPM over the study period revealed compared to NHB women, NHW women underwent more CPMs during the entire study period (Figure 2).

### 3.3 | Multivariable analysis

In the multivariable logistic regression analysis, NHB race (odds ratio [OR], 1.77; 95% confidence interval [CI], 1.64–1.91), uninsured status (OR, 1.61; 95% CI, 1.31–1.96), Medicaid insurance (OR, 1.72; 95% CI, 1.59–1.86), mastectomy (OR, 1.62; 95% CI, 1.53–1.73), later stage at diagnosis (Stage II OR, 1.5; 95% CI, 1.39–1.54, Stage III 3.52 95% CI, 3.17-3.91), biopsy and surgery in different facilities (OR, 1.44; 95% CI, 1.33–1.58) and reconstruction (OR, 1.31; 95% CI, 1.21–1.42) were associated with an increased odds of first definitive surgery of >60 days after biopsy compared to NHW race, private insurance, BCS, stage I, biopsy and surgery in the same facility and no reconstruction, respectively (Table 3).

## 4 | DISCUSSION

The results of this study suggest NHB women receiving surgical management at high-volume hospitals are less likely to receive certain low-value breast surgical procedures than NHW women. Specifically, NHB women have lower rates of CPM for unilateral disease and SLNB among women age ≥70 with small hormone–positive cancers. Unfortunately, NHB breast cancer patients face significant delays in TTS compared to their NHW counterparts and are also more likely to have surgical management omitted. Notably, the omission of ALND among patients meeting ACOSOG Z0011 criteria was similar between both groups of women. We anticipate study findings of lower rates of low-value surgical care among NHB women are most likely secondary to established racial disparities in surgical care rather than disparities in the implementation of guidelines.

When viewed through the lens of receipt of guideline-concordant care, study findings of lower rates of low-value procedures among NHB women are meaningful. Historically, NHB breast cancer patients have been less likely to receive guideline-concordant locoregional and systemic management such as BCT or chemotherapy, respectively, and have higher rates of nonadherence to endocrine therapy.[32,33] The omission of low-value procedures is consequential as the performance of these procedures does not change the utilization of adjunct treatment modalities, such as chemotherapy or radiation therapy, nor do they improve outcomes including survival.[34] In addition, the performance of these procedures adds unnecessary surgical complication risks with no discernable clinical benefit.

The results on low-value care should be interpreted with caution as Choose Wisely guidelines concerning SLNB in women age ≥70 with small hormone–positive tumors and CPM for unilateral breast cancer were published toward the end of the study period. We anticipate the lower rates of CPM among NHB women in this study is most likely a reflection of higher BCS rates among the population and lower perceived risk of second cancer compared to NHW women.[35,36] A higher perceived risk of second cancer has been implicated as a factor in decision making for CPM.[36] Other factors that may influence the decision for CPM include lack of physician referrals to reconstructive surgeons and the geographic unavailability of reconstructive surgeons.[37–39] Black race and Medicaid insurance have both been associated with diminished access and utilization of reconstruction.[40] Consequently, we believe the racial differences in

**TABLE 1** Sociodemographic and clinical variables by race*

| Variable | Total *N* = 378,499, *N* (%) | Non-Hispanic *N* = 328,642, *N* (%) | Non-Hispanic *N* = 49,857, *N* (%) | *P* value |
|---|---|---|---|---|
| Age (continuous) years | | | | <.001 |
| Mean (SD) | 61.06 (13.18) | 61.44 (13.13) | 58.52 (13.27) | |
| Age | | | | <.001 |
| ≤40 | 22,419 (5.9) | 18,125 (5.5) | 4294 (8.6) | |
| 41–50 | 64,142 (16.9) | 54,041 (16.4) | 10,101 (20.3) | |
| 51–60 | 94,224 (24.9) | 80,619 (24.5) | 13,605 (27.3) | |
| 61–70 | 104,426 (22.6) | 92,078 (28.0) | 12,348 (24.8) | |
| 71–80 | 64,234 (17.0) | 57,519 (17.5) | 6715 (13.5) | |
| ≥81 | 29,054 (7.7) | 26,260 (8.0) | 2794 (5.6) | |
| Income | | | | <.001 |
| <$38,000 | 48,216 (12.8) | 29,984 (9.1) | 18,232 (36.6) | |
| $38,000–$47,999 | 66,688 (17.7) | 56,200 (17.1) | 10,488 (21.1) | |
| $48,000–$62,999 | 96,120 (25.4) | 85,838 (26.2) | 10,282 (20.7) | |
| $63,000+ | 166,712 (44.1) | 155,949 (47.5) | 10,763 (21.6) | |
| Education (% no. high school degree) | | | | <.001 |
| ≥21% | 43,184 (11.4) | 28,729 (8.8) | 14,455 (29.0) | |
| 13%–20.9% | 80,612 (21.3) | 63,658 (19.4) | 16,954 (34.1) | |
| 7%–12.9% | 122,491 (32.4) | 110,382 (33.6) | 12,109 (24.3) | |
| <7% | 131,546 (34.8) | 125,285 (38.2) | 6,261 (12.6) | |
| Distance to facility (miles) | 30.38 (116.19) | 32.31 (121.20) | 17.67 (73.98) | <.001 |
| Facility type | | | | <.001 |
| Comprehensive community cancer program | 114,293 (31.8) | 102,876 (32.8) | 11,417 (24.7) | |
| Teaching/research | 191,037 (53.1) | 163,577 (52.2) | 27,460 (59.4) | |
| Integrated network | 54,511 (15.1) | 47,171 (15.0) | 7340 (15.9) | |
| Rural/urban | | | | <.001 |
| Metro_1M | 243,871 (66.1) | 205,785 (64.4) | 38,086 (77.5) | |
| Metro 250K–1M | 75,767 (20.5) | 68,350 (21.4) | 7417 (15.1) | |
| Metro <250K | 15,940 (4.3) | 14,348 (4.5) | 1592 (3.2) | |
| Urban | 29,931 (8.1) | 28,114 (8.8) | 1817 (3.7) | |
| Rural | 3354 (0.9) | 3153 (1.0) | 201 (0.4) | |
| Region | | | | <.001 |
| New England | 23,920 (6.6) | 22,712 (7.2) | 1208 (2.6) | |
| Middle Atlantic | 67,035 (18.6) | 57,539 (18.3) | 9496 (20.5) | |
| South Atlantic | 84,497 (23.5) | 69,314 (22.1) | 15,183 (32.9) | |
| East North Central | 61,822 (17.2) | 53,425 (17.0) | 8397 (18.2) | |
| East South Central | 18,939 (5.3) | 15,570 (5.0) | 3369 (7.3) | |
| West North Central | 26,040 (7.2) | 24,477 (7.8) | 1563 (3.4) | |
| West South Central | 29,828 (8.3) | 25,429 (8.1) | 4399 (9.5) | |
| Mountain | 14,067 (3.9) | 13,647 (4.4) | 420 (0.9) | |
| Pacific | 33,693 (9.4) | 31,511 (10.0) | 2182 (4.7) | |
| Year of diagnosis | | | | .048 |
| 2010 | 45,976 (12.1) | 40,074 (12.2) | 5902 (11.8) | |
| 2011 | 49,550 (13.1) | 43,061 (13.1) | 6489 (13.0) | |
| 2012 | 52,116 (13.8) | 45,382 (13.8) | 6734 (13.5) | |
| 2013 | 55,053 (14.5) | 47,721 (14.5) | 7332 (14.7) | |

**TABLE 1** (Continued)

| Variable | Total *N* = 378,499, *N* (%) | Non-Hispanic *N* = 328,642, *N* (%) | Non-Hispanic *N* = 49,857, *N* (%) | *P* value |
|---|---|---|---|---|
| 2014 | 57,229 (15.1) | 49,665 (15.1) | 7564 (15.2) | |
| 2015 | 59,240 (15.7) | 51,369 (15.6) | 7871 (15.8) | |
| 2016 | 59,335 (15.7) | 51,370 (15.6) | 7965 (16.0) | |
| Insurance | | | | <.001 |
| Not insured | 4235 (1.1) | 2934 (0.9) | 1301 (2.6) | |
| Private Insurance/managed care | 205,542 (54.3) | 180,640 (55.0) | 24,902 (49.9) | |
| Medicaid | 17,380 (4.6) | 11,676 (3.6) | 5704 (11.4) | |
| Medicare | 140,059 (37.0) | 123,895 (37.7) | 16,164 (32.4) | |
| Other government | 3555 (0.9) | 2987 (0.9) | 568 (1.1) | |
| Unknown | 7728 (2.0) | 6510 (2.0) | 1218 (2.4) | |
| Median follow-up (days) | 40.25 | 40.67 | 37.62 | <.001 |
| IQR | (22.80–60.90) | (23.16–61.21) | (20.63–58.81) | |
| Clinical stage | | | | <.001 |
| 1 | 234,849 (62.0) | 209,704 (63.8) | 25,145 (50.4) | |
| 2 | 119,516 (31.6) | 100,111 (30.5) | 19,405 (38.9) | |
| 3 | 24,121 (6.4) | 18,817 (5.7) | 5304 (10.6) | |
| Pathologic Stage | | | | <.001 |
| 0 | 13,917 (4.1) | 11,247 (3.8) | 2670 (6.1) | |
| 1 | 193,936 (56.8) | 173,280 (58.1) | 20,656 (47.5) | |
| 2 | 104,146 (30.5) | 88,898 (29.8) | 15,248 (35.1) | |
| 3 | 28,820 (8.4) | 24,060 (8.1) | 4760 (11.0) | |
| 4 | 747 (0.2) | 636 (0.2) | 111 (0.3) | |
| Pathologic response | | | | .230 |
| None | 3,021 (9.8) | 2425 (9.6) | 596 (10.3) | |
| Partial | 15,646 (50.5) | 12,766 (50.6) | 2880 (50.0) | |
| Complete | 12,300 (39.7) | 10,014 (39.7) | 2286 (39.7) | |
| Tumor size (cm) | | | | <.001 |
| ≤2 | 197,524 (52.2) | 175,692 (53.5) | 21,832 (43.8) | |
| 2 to ≤5 | 94,263 (24.9) | 79,374 (24.2) | 14,889 (29.9) | |
| ≥5 | 25,602 (6.8) | 20,786 (6.3) | 4816 (9.7) | |
| Unknown | 61,110 (16.1) | 52,790 (16.1) | 8320 (16.7) | |
| Hormone receptor status | | | | <.001 |
| ER+/PR− or +/HER 2− | 261,489 (76.0) | 233,649(78.0) | 27,840 (62.6) | |
| ER+/PR+/HER 2+ | 25,238 (7.3) | 21,853 (7.3) | 3385 (7.6) | |
| ER−/PR−/HER 2− | 43,343 (12.6) | 32,576 (10.9) | 10,767 (24.2) | |
| ER−/PR−/HER 2+ | 14,064 (4.1) | 11,561 (3.9) | 2503 (5.6) | |
| Grade | | | | <.001 |
| Well differentiated | 80,529 (21.3) | 73,988 (22.5) | 6,541 (13.1) | |
| Moderately differentiated | 164,017 (43.3) | 145,832 (44.4) | 18,185 (36.5) | |
| Poorly differentiated | 111,016 (29.3) | 89,132 (27.1) | 21,884 (43.9) | |
| Undifferentiated, anaplastic | 595 (0.2) | 497 (0.2) | 98 (0.2) | |
| Cell type not determined | 22,342 (5.9) | 19,193 (5.8) | 3149 (6.3) | |
| Histology | | | | <.001 |
| Ductal | 292,982 (77.4) | 252,945 (77.0) | 40,037 (80.3) | |
| Lobular | 39,820 (10.5) | 35,867 (10.9) | 3,953 (7.9) | |
| Mixed (ductal+lobular) | 23,503 (6.2) | 21,282(6.5) | 2,221 (4.5) | |
| Other | 22,194 (5.9) | 18,548 (5.6) | 3,646 (7.3) | |

(Continues)

**TABLE 1** (Continued)

| Variable | Total *N* = 378,499, *N* (%) | Non-Hispanic *N* = 328,642, *N* (%) | Non-Hispanic *N* = 49,857, *N* (%) | *P* value |
|---|---|---|---|---|
| Chemotherapy | | | | <.001 |
| No | 214,392 (57.8) | 192,412 (59.7) | 21,980 (45.1) | |
| Yes | 156,556 (42.2) | 129,749 (40.3) | 26,807 (54.9) | |
| Neoadjuvant chemotherapy | | | | <.001 |
| No | 309,269 (88.3) | 272,543 (89.2) | 36,726 (82.5) | |
| Yes | 40,795 (11.7) | 33,002 (10.8) | 7793 (17.5) | |
| Immunotherapy | | | | <.001 |
| No | 350,558 (92.6) | 304,955 (92.8) | 45,603 (91.5) | |
| Yes | 27,035 (7.1) | 22,940 (7.0) | 4095 (8.2) | |
| Unknown | 906 (0.2) | 747 (0.2) | 159 (0.3) | |
| Radiation | | | | .025 |
| No | 157,572 (41.6) | 136,982 (41.7) | 20,590 (41.3) | |
| Yes | 219,224 (57.9) | 190,213 (57.9) | 29,011 (58.2) | |
| Unknown | 1703 (0.4) | 1447 (0.4) | 256 (0.5) | |
| Breast conservation therapy | | | | .550 |
| No | 30,654 (17.7) | 26,830 (17.7) | 3824 (17.5) | |
| Yes | 142,828 (82.3) | 124,831 (82.3) | 17,997 (82.5) | |
| Surgery | | | | <.001 |
| No surgery | 70,066 (18.5) | 59,383 (18.1) | 10,683 (21.4) | |
| Partial mastectomy | 173,958 (46.0) | 152,100 (46.3) | 21,858 (43.8) | |
| Mastectomy | 134,134 (35.4) | 116,855 (35.6) | 17,279 (34.7) | |
| Unknown | 341 (0.1) | 304 (0.1) | 37 (0.1) | |
| Time to surgery (days) | | | | <.001 |
| Mean (*SD*) | 40.59 (39.30) | 39.30 (37.01) | 50.11 (52.30) | |
| Median (IQR) | 33.00 (21.00–48.00) | 32.00 (21.00–47.00) | 37.00 (22.00–58.00) | |
| Patient treated at more than one CoC facility | | | | <.001 |
| Yes | 83,246 (22.0) | 73,540 (22.4) | 9,706 (19.5) | |
| No | 295,253 (78.0) | 255,102 (77.6) | 40,151 (80.5) | |
| Lymph node surgery | | | | <.001 |
| None (code 0) | 26,296 (11.5) | 22,248 (11.2) | 4048 (13.5) | |
| Sentinel lymph node biopsy (code 2) | 160,733 (70.1) | 142,497(71.5) | 18,236 (61.0) | |
| Axillary lymph node dissection (code 6 and 7) | 42,157 (18.4) | 34,563 (17.3) | 7594 (25.4) | |
| Comorbidities | | | | <.001 |
| 0 | 318,866 (84.2) | 280,038 (85.2) | 38,828 (77.9) | |
| 1 | 46,791 (12.4) | 38,582 (11.7) | 8209 (16.5) | |
| ≥2 | 12,842 (3.4) | 10,022 (3.0) | 2820 (5.7) | |

Abbreviations: CoC, Commission on Cancer; IQR, interquartile range.

*Data may not add up to 100% due to rounding.

CPM noted in this study are most likely driven by an interplay between patient preferences, lack of physician referrals, and access to reconstructive surgeons.

Concerning omission of SLNB in women age ≥70 with small hormone–positive cancers, the most likely explanation is that these results are a reflection of underlying racial disparities in the surgical management of the axilla rather than an earlier implementation of guidelines. Notably, the CALGB 9394 trial that served as the justification for omission of SLNB among women age ≥70 with small hormone–positive tumors was published in 2013.[41] However, without information in the NCDB about physician knowledge or awareness of CALGB 9394 findings, the implications

**TABLE 2** Differences in receipt of low-value surgical care practices by race*

| | Total *N* = 378,499, *N* (%) | Non-Hispanic White *N* = 328,642, *N* (%) | Non-Hispanic Black *N* = 49,857, *N* (%) | *P* value |
|---|---|---|---|---|
| Time from biopsy to surgery (continuous) | 36.00 (24.00–54.00) | 35.00 (24.00–52.00) | 43.00 (29.00–68.00) | <.001 |
| Time from biopsy to surgery | | | | <.001 |
| ≤60 days | 200,724 (80.5%) | 180,196 (81.9%) | 20,528 (69.4%) | |
| >60 days | 48,723 (19.5%) | 39,692 (18.1%) | 9031 (30.6%) | |
| ACOSOG Z0011 Criteria | | | | .13 |
| No | 8493 (79.9%) | 7504 (80.1%) | 989 (78.3%) | |
| Yes | 3133 (20.1%) | 1859 (19.9%) | 274 (21.7%) | |
| Contralateral prophylactic mastectomy | | | | <.001 |
| No | 78,263 (65.2%) | 67,573 (64%) | 10,690 (73.7%) | |
| Yes | 41,850 (34.8%) | 38,028 (36.0%) | 3822 (26.3%) | |
| Sentinel lymph node surgery age ≥70 | | | | <.001 |
| No | 12,947 (38.1%) | 11,933 (37.8%) | 1014 (41.5%) | |
| Yes | 21,042 (61.9%) | 19,614 (62.2%) | 1428 (58.5%) | |

*Data may not add up to 100% due to rounding.

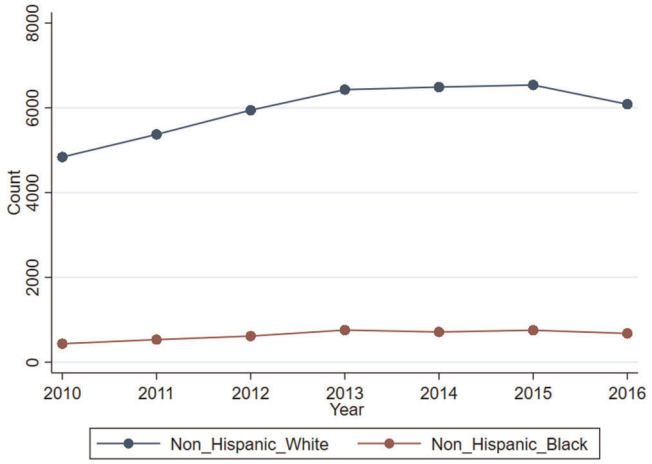


**FIGURE 2** Distribution of contralateral prophylactic mastectomy [Color figure can be viewed at wileyonlinelibrary.com]

of the study results on surgical decision making are difficult to surmise.

Higher rates of surgical delay among NHB patients in this study are consistent with previous studies.[6] Surgical delay is probably attributable to a mixture of institutional and patient-related factors. For example, NHB women receiving treatment at high-volume centers in the NCDB may be experiencing higher rates of transportation issues, financial toxicity, insurance issues, difficulty securing childcare, and lack of time off from work which are all factors that could influence delay.[42,43] In addition, Black patients tend to be less knowledgeable about their disease and are subjected to physician–patient relationships in which communication styles prohibits cultural and linguistically appropriate information sharing

**TABLE 3** Multivariable analysis evaluating time to surgery*

| Variable | Odds ratio | Confidence interval | *P* value |
|---|---|---|---|
| Age, years (continuous) | 0.99 | (0.98–0.99) | <.001 |
| Insurance | | | |
| Not insured | 1.61 | (1.31–1.96) | <.001 |
| Private | Ref | | |
| Medicaid | 1.72 | (1.59–1.86) | <.001 |
| Medicare | 1.00 | (0.95–1.04) | .933 |
| Other government | 1.16 | (1.00–1.35) | .048 |
| Race | | | |
| Non-Hispanic White | Ref | | |
| Non-Hispanic Black | 1.77 | (1.64–1.91) | <.001 |
| Year of diagnosis | | | |
| 2010 | Ref | | |
| 2011 | 1.09 | (1.03–1.16) | .002 |
| 2012 | 1.12 | (1.03–1.20) | .004 |
| 2013 | 1.20 | (1.11–1.29) | <.001 |
| 2014 | 1.26 | (1.16–1.37) | <.001 |
| 2015 | 1.46 | (1.33–1.61) | <.001 |
| 2016 | 1.55 | (1.41–1.71) | <.001 |
| Clinical stage | | | |
| 1 | Ref | | |
| 2 | 1.46 | (1.39–1.54) | <.001 |
| 3 | 3.52 | (3.17–3.91) | <.001 |
| Receptor status | | | |
| ER+/PR− or+/HER 2− | Ref | | |
| ER+/PR+/HER 2+ | 1.32 | (1.24–1.40) | <.001 |
| ER−/PR−/HER 2− | 1.13 | (1.07–1.20) | <.001 |
| ER−/PR−/HER 2 + | 1.38 | (1.27–1.50) | <.001 |

(Continues)

**TABLE 3** (Continued)

| Variable | Odds ratio | Confidence interval | *P* value |
|---|---|---|---|
| Comorbidities | | | |
| 0 | Ref | | |
| 1 | 0.99 | (0.94–1.03) | .627 |
| ≥2 | 1.09 | (1.01–1.17) | .026 |
| % No. high school degree | | | |
| ≥21% | Ref | | |
| 13%–20.9% | 0.92 | (0.86–0.99) | .044 |
| 7%–12.9% | 0.91 | (0.83–0.99) | .044 |
| <7% | 0.84 | (0.76–0.93) | .001 |
| Surgery type | | | |
| Mastectomy | 1.62 | (1.53–1.72) | <.001 |
| Partial mastectomy | Ref | | |
| Reconstruction | | | |
| Yes | 1.31 | (1.21–1.42) | <.001 |
| No | Ref | | |
| Biopsy+surgery facility | | | |
| Same | Ref | | |
| Different | 1.44 | (1.32–1.57) | <.001 |
| Distance traveled (continuous) miles | 1.00 | (0.99–1.00) | .226 |

*This table evaluates the probability of surgical delay (probability of surgery >60 days vs probability ≤60 days).

which diminishes patient self-adovcay.[44,45] This interplay between NHB patient's socioeconomic position and the deficits of the doctor–patient relationship could be adversely affecting the timeliness of care. Nevertheless, these findings are worrisome, as surgical delay >60 days has been implicated in higher overall and disease-specific mortality.[7] Study findings of an association between surgical delay and Medicaid or uninsured status, mastectomy, later stage of diagnosis, reconstruction and biopsy, and surgery in different facilities are consistent with prior studies in the literature.[26,46]

The findings from this study highlight some of the ongoing surgical disparities NHB breast cancer patients face compared to their NHW counterparts when receiving care at high-volume hospitals. Although lower rates of low-value surgery and similarities in receipt of BCT show adherence to guideline-concordant locoregional management, higher rates of surgical delay and omission of surgery are worrisome. Furthermore, when placed within the context of a study timeframe before the publication of some of the low-value guidelines these results underscore persistent racial differences in the management of the breast and axilla. The benefits of study findings of having lower rates of low-value surgical procedures on outcomes, such as mortality or recurrence, are unclear and warrants further investigation.

The limitations of this study include a lack of generalizability of study results beyond CoC accredited hospitals. In addition, receipt of care at high-volume hospitals may not be reflective of receipt of care at all institutions across the United States both within and outside of the NCDB. The NCDB does not collect data on genetic information; therefore, patients who received CPM due to genetic mutations were not identified. As of the writing of this manuscript, the NCDB only has data available until 2016, therefore, part of the study timeframe was before publication and dissemination of some of the low-value surgical procedure guidelines. This data restriction makes it difficult to extrapolate the implications of these results on post-publication practices. The strengths of the study include the large sample size and the fact that the NCDB represents approximately 70% of newly diagnosed cancer cases in the United states.[14]

## 5 | CONCLUSION

Results from this study suggest there are racial disparities in surgical management among patients receiving care at high-volume CoC Centers. These results infer that NHB breast cancer patients receiving care at high-volume facilities face barriers in receiving timely surgical care. Future studies will need to discern if the omission of low-value surgical care is reducing surgical complications rates among NHB women and delineate how this may translate into improved clinical outcomes such as survival in this population. Moreover, more granular studies are needed to better understand the drivers of surgical delay among NHB breast cancer patient receiving care at high-volume hospitals.

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### DISCLOSURES

Destiny Jackson declares that she has no conflict of interest. Yaming Li declares that she has no conflict of interest. Miriam Eskander declares that she has no conflict of interest. Bridget Oppong declares that she has no conflict of interest. Allan Tsung declares that he has no conflict of interest. Oindrila Bhattacharyya declares that she has no conflict of interest. Electra Paskett declares that she has no conflict of interest. Samilia Obeng-Gyasi declares that she has no conflict of interest.

### DATA AVAILABILITY

The National Cancer Database (NCDB) is a joint project of the Commission on Cancer (CoC) of the American College of Surgeons and the American Cancer Society. The CoC's NCDB and the hospitals participating in the CoC's NCDB are the sources of the deidentified

data used herein; they have not verified and are not responsible for the statistical validity of the data analysis or the conclusions derived by the authors.

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