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## Persistent disparities in breast cancer surgical outcomes among hispanic and African American patients



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### ABSTRACT

**Background:** Racial disparities among patients who receive breast mastectomy and reconstruction have not been well characterized.

**Methods:** Records of patients undergoing breast extirpative and reconstructive surgery at a high-volume university-affiliated hospital over 5 consecutive years were reviewed. Patient demographics, breast cancer profiles, reconstructive modality, and outcomes were compared by race.

**Results:** A total of 1045 patients underwent 1678 breast reconstructions during the five-year period. Mean age and standard deviation was  $49.8 \pm 10.6$  years with a BMI of  $27.9 \pm 6.5$ . Hispanic and African American patients had significantly higher BMIs ( $p < 0.001$ ), higher rates of ASA class III or IV ( $p = 0.025$ ), obesity, diabetes, hypertension ( $p < 0.001$  for these three comparisons), and smoking ( $p = 0.003$ ), and had more prior abdominal surgeries ( $p = 0.007$ ). Comparing oncologic characteristics, this population subset had higher rates of neoadjuvant chemotherapy ( $p = 0.036$ ), history of radiation ( $p = 0.016$ ), and were more likely to undergo modified radical mastectomy ( $p = 0.002$ ) over nipple-sparing mastectomy ( $p = 0.035$ ). Reconstructive complications revealed a higher overall complication rate ( $p = 0.023$ ), higher rates of partial mastectomy flap necrosis ( $p = 0.043$ ), as well as arterial ( $p = 0.009$ ) and venous insufficiency ( $p = 0.026$ ) during microvascular reconstruction among Hispanic and African American patients. **Conclusions:** Compared to other patients, the present study identifies higher comorbidity burdens, higher rates of prior radiation and neoadjuvant chemotherapy, and higher post-surgical complication rates among Hispanic and African American patients with breast cancer.

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### Introduction

Affecting 12% of women in the United States [1], breast cancer treatment requires mastectomy in nearly 40% of patients [2]. Post-mastectomy breast reconstruction rates range from 36% to 79% [3–9]. Despite passage of the Women's Health and Cancer Rights Act in 1998 mandating that all insurers provide coverage for post-mastectomy breast reconstruction, racial disparities for receiving any breast reconstruction persist [10]. Compared to non-Hispanic white women, women of color are less likely to receive breast reconstruction [3,8,11–20], and are more likely to receive delayed reconstruction [15,21–24].

While there has been much focus on barriers for access to care, limited evidence exists regarding outcomes across race when these barriers are overcome. Quantifying how delayed breast cancer presentation impacts on breast cancer treatment among underserved populations has not been well elucidated. Clarifying whether there are differences in peri-operative outcomes across race can guide pre-operative counseling as well as identify areas for continued improvement beyond initial access.

The present study aims to evaluate patient comorbidity profiles, breast cancer characteristics, extirpative modalities, and reconstructive outcomes by race over five consecutive years of surgical outcomes at an academic medical center.

### Methods

#### Patient population

With institutional review board approval, records of all patients

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who underwent mastectomy with reconstruction at Yale New Haven Hospital between 2013 and 2017 were reviewed. Variables directly abstracted from patients' electronic medical records included patient demographics, comorbidities, operative variables, payer status, socioeconomic factors, and postoperative adverse outcomes. Demographic variables included age, BMI, race/ethnicity, insurance status, and zip code. Additional variables included were mastectomy type, reconstructive modality, diabetes, hypertension, psychiatric history, smoking history, history of abdominal surgery, history of chemotherapy, history of radiation, individual breast and plastic surgeon, and complications.

#### Treatment details

Patients routinely underwent tissue expander placement and rapid expansion prior to initiating radiotherapy. In cases that included adjuvant chemotherapy, patients would undergo tissue expander exchange between the conclusion of chemotherapy and initiation of radiotherapy. In cases where radiation therapy occurred first, tissue expander exchange was delayed 6–12 months following completion of radiation therapy. In bilateral cases, the contralateral side is completely deflated for radiation therapy if there are tissue expanders.

Specific radiation and chemotherapy protocols were not available for all the patient records. Patients were broadly identified as having undergone adjuvant or neoadjuvant chemotherapy, adjuvant radiation therapy, or a history of previous radiation therapy.

#### Analysis

Any patients with incomplete information were excluded. Statistics were analyzed using SPSS version 27.0 (IBM, Inc, Armonk, NY). All variables collected were stratified by patient race and compared. Demographics, comorbidities, reconstructive modalities, mastectomy type, complications, and treatment factors were compared across races using Chi-squared tests. Two-tailed t-tests were used to analyze continuous variables across races.

To evaluate the effect of race on comorbidities, separate multivariate logistic regression analyses were created for each comorbidity that differed significantly between races. For comorbidities not defined using demographic variables, adjusted analyses controlled for age, BMI, and ASA class. Unadjusted models only included race and the demographic variable of interest.

Similarly, to determine the effect of race on adverse events, individual multivariate logistic regression analyses were created for each adverse event that differed significantly between races. Adjusted models controlled for all demographics (age, BMI, and ASA class), as well as all comorbidities that differed significantly between races. Unadjusted regressions included only race and the complication of interest.

Adjusted and unadjusted odds ratios and 95% confidence intervals were reported for all regression models. For all analyses, statistical significance was established at  $p < 0.05$ .

## Results

#### Demographics

Mastectomy with reconstruction was performed in 1678 breasts in 1045 patients from 2013 to 2017. Of the 1678 breasts, 79.0% were in Caucasian patients, 7.6% were in Hispanic patients, 9.5% were in African-American patients, 2.9% were in Asian patients, and 1.0% were in patients of other races. Of the 1045 patients, 728 patients (78.6%) were Caucasian, 75 patients (8.1%) were Hispanic, 88 (9.5%) were African American, 26 (2.8%) were Asian, and 9 (1.0%) were of

other races.

Mean patient age was  $49.8 \pm 10.6$  years, and mean BMI was  $27.9 \pm 6.5$ . The majority of patients were ASA II (63.7%) with 3.3% ASA I, 32.9% ASA III, and 0.1% ASA IV. Complete patient demographics by race are in [Table 1](#).

With respect to concomitant comorbidities, 32.9% of patients were obese, 10.0% had diabetes, 22.3% had hypertension, 16.4% had a psychiatric diagnosis, and 39.7% had a history of prior open abdominal surgery. The majority of patients were non-smokers with 5.1% active smokers and an additional 31.6% former smokers. Patient comorbidities by race are in [Table 1](#).

#### Extirpative and reconstructive modalities

Regarding extirpative procedures, 10.1% were modified radical mastectomies, 70.7% were skin-sparing mastectomies, 16.3% were nipple-sparing mastectomies, and 2.8% involved oncoplastic procedures.

Post-mastectomy breast reconstruction was nearly evenly divided between tissue expanders (43.0%) and autologous reconstruction (41.4%). An additional 10.3% underwent direct-to-implant reconstruction, 1.0% had a latissimus flap with a tissue expander, 1.1% underwent primary fat-grafting, 0.3% had a latissimus flap only, 1.7% underwent oncoplastic reductions, and 0.4% had multimodal reconstruction types. Extirpative and reconstructive surgery types are in [Table 2](#).

A minority of reconstructions were delayed (8.6%) or in patients with prior breast irradiation (6.4%) (see [Table 3](#)). Adjuvant radiation therapy and chemotherapy rates were 17.2% and 30.0%, respectively. The neoadjuvant chemotherapy rate was 22.7% ([Table 2](#)).

#### Reconstructive complications

After surgery, minor and major complications occurred in 479 reconstructions (28.5%). Partial and complete mastectomy flap necrosis rates were 2.8% and 1.8%. Eighty-nine (5.3%) patients had infection requiring intravenous antibiotics. Breast hematoma and seroma rates were each 4.3%. A small proportion of patients had post-operative DVT (1.1%).

With regards to patients who underwent microvascular autologous reconstruction, arterial insufficiency occurred in 0.9%, venous insufficiency in 1.6%, and complete flap failure in 1.9%.

For the abdominal donor site, abdominal dehiscence occurred in 4.9%. Operative repair of a hernia was required in 3.2% of autologous reconstructions. Abdominal hematoma and seroma rates were 0.4% and 1.0%, respectively. Overall, the thirty-day reoperation rate was 8.2%.

#### Demographic outcomes by race

In comparing patient comorbidities by race, significant differences exist with respect to age, BMI, and ASA class ( $p < 0.007$  for all three comparisons). Hispanic and African-American patients had significantly higher BMIs ( $p \leq 0.001$ ) and higher ASA class ( $p = 0.025$ ). Hispanic and African-American patients also had higher rates of obesity, diabetes, and hypertension ( $p < 0.001$  for all three comparisons) as well as higher rates of smokers ( $p = 0.003$ ) and prior open abdominal surgery ( $p = 0.007$ ). There were no differences in rates of stage 3 or 4 cancer ( $p = 0.443$ ).

In multivariate logistic regressions controlling for demographic variables (age, sex, BMI) when not a component of the outcome variables, Hispanic or African American race was significantly positively associated with obesity (adjusted odds ratio [aOR] 2.6, 95% confidence interval [CI] 2.0–3.4,  $p < 0.001$ ), hypertension (aOR 2.7, 95% CI 2.0–3.8,  $p < 0.001$ ), diabetes (aOR 2.8, 95% CI 1.9–4.1,

**Table 1**  
Patient demographics by race.

Variable	Total		Hispanic & African-American		All Other		p*
	n = 1678		n = 287 (17.1%)		n = 1391 (82.9%)		
	n	%	n	%	n	%	
Age, y (mean ± SD)	49.8 ± 10.6		47.9 ± 10.0		50.2 ± 10.6		<b>0.001</b>
BMI (mean ± SD)	27.9 ± 6.5		30.9 ± 6.1		27.3 ± 6.4		<b>&lt;0.001</b>
< 25	625	37.3%	48	16.8%	577	41.5%	
25–30	499	29.8%	92	32.3%	407	29.3%	
30–35	320	19.1%	74	26.0%	246	17.7%	
≥ 35	230	13.7%	71	24.9%	159	11.4%	
ASA							0.129
I	56	3.3%	8	2.8%	48	3.5%	
II	1068	63.6%	168	58.5%	900	64.7%	
III	552	32.9%	111	38.7%	441	31.7%	
IV	2	0.1%	0	0.0%	2	0.1%	
<b>Comorbidities</b>							
ASA III or IV	554	33.0%	111	38.7%	443	31.8%	<b>0.025</b>
Obesity	550	32.9%	145	50.9%	406	29.2%	<b>&lt; 0.001</b>
Diabetes	166	10.0%	59	20.8%	107	7.8%	<b>&lt; 0.001</b>
Hypertension	371	22.3%	106	37.5%	265	19.2%	<b>&lt; 0.001</b>
Psychiatric Diagnosis	264	16.4%	48	17.8%	216	16.1%	0.480
Previous Abdominal Surgery	659	39.7%	132	47.0%	527	38.3%	<b>0.007</b>
Cancer Stage 3+	119	12.8%	22	15%	97	12.5%	0.443
<b>Smoking Status</b>							
Current Smoker	86	5.1%	20	7.0%	66	4.8%	<b>0.003</b>
Former Smoker	527	31.6%	67	23.4%	460	33.2%	
Nonsmoker	1057	63.3%	199	69.6%	858	62.8%	

n refers to number of reconstructions of individual breasts.

\*Chi-squared test comparing incidence of comorbidity by race. Bolding indicates statistical significance at  $p < 0.05$ .

†ANOVA comparing patients across races. Bolding indicates statistical significance at  $p < 0.05$ .

$p < 0.001$ ), and prior abdominal surgery (aOR 1.4, 95% CI 1.0–1.8,  $p = 0.026$ ) (Table 4). Conversely, Hispanic or African-American race was associated with a lower likelihood of smoking (aOR 0.7, 95% CI 0.5–0.9,  $p = 0.009$ ). Race was not associated with higher ASA class (aOR 1.1, 95% CI 0.8–1.5,  $p = 0.445$ ).

#### Oncologic and extirpative modalities by race

When comparing extirpative modalities, Hispanic and African American patients had higher rates of modified radical mastectomy ( $p = 0.002$ ) and lower rates of nipple-sparing mastectomy ( $p = 0.035$ ). Although adjuvant radiation and chemotherapy rates were comparable by race, Hispanic and African-American patients had higher rates of prior radiation therapy ( $p = 0.016$ ) and neoadjuvant chemotherapy ( $p = 0.036$ ).

#### Reconstruction type by race

Asian patients underwent direct-to-implant reconstruction at significantly higher rates than other races ( $p = 0.035$ ), while Hispanic and African-American patients underwent oncoplastic reduction at higher rates ( $p = 0.041$ ). Rates of other reconstructive modalities did not differ across races ( $p > 0.10$  for the remaining six comparisons). On multivariate logistic regression, Asian race was a significant predictor of direct-to-implant reconstruction (OR 2.4, 95% CI 1.1–5.1,  $p = 0.029$ ).

#### Reconstructive complications by race

Hispanic and African-American patients had higher rates of any complication (34.1% vs. 27.4%,  $p = 0.021$ ). More specifically, Hispanic and African American patients had higher rates of partial mastectomy flap necrosis rates compared to the remaining population ( $p = 0.043$ ). Within microvascular reconstruction, Hispanic and African American patients had significantly higher rates of arterial insufficiency ( $p = 0.009$ ) and venous insufficiency ( $p = 0.026$ ) (Fig. 1).

In multivariate logistic regressions controlling for age, BMI, ASA class, and comorbidities that differed significantly between races, Hispanic or African American race was significantly associated with arterial insufficiency (aOR 22.1, 95% CI 2.2–206.3,  $p = 0.007$ ) and venous insufficiency (aOR 7.0, 95% CI 2.2–21.9,  $p = 0.001$ ), but not any type of complication (aOR 1.3, 95% CI 1.0–1.8,  $p = 0.052$ ) or partial mastectomy flap necrosis (aOR 1.6, 95% CI 0.8–3.2,  $p = 0.211$ ) (Table 5).

#### Discussion

Racial disparities for timely breast cancer extirpative surgery and lower rates of reconstruction have been well documented [3,8,11–24]. However, while Hispanic and African American patients have been shown to have later presentation for breast cancer and lower rates of reconstruction, differences in outcomes among patients that ultimately undergo mastectomy and reconstruction

**Table 2**  
Treatment details by race.

Surgery	Total		Hispanic & African-American		All Other		p <sup>a</sup>
	n = 1678		n = 287 (17.1%)		n = 1391 (82.9%)		
	n	%	n	%	n	%	
<i>Extirpative Modality</i>							
Modified Radical Mastectomy	154	10.1%	39	15.9%	115	9.3%	<b>0.002</b>
Simple/Skin-Sparing Mastectomy	1075	70.7%	177	72.0%	898	72.9%	0.748
Nipple-Sparing Mastectomy	248	16.3%	30	12.2%	216	17.7%	<b>0.035</b>
Breast-Conserving Therapy	43	2.8%	11	4.3%	32	2.5%	0.124
<i>Reconstruction</i>							
Tissue Expander	711	43.0%	113	40.4%	598	43.6%	0.325
Microvascular	685	41.4%	117	41.8%	568	41.4%	0.897
Direct-to-Implant	170	10.3%	32	11.4%	138	10.1%	0.489
Pedicled	5	0.3%	0	0.0%	5	0.4%	0.312
Pedicled + Tissue Expander	16	1.0%	5	1.8%	11	0.8%	0.125
Fat Grafting	18	1.1%	4	1.4%	14	1.0%	0.528
Oncoplastic Reduction	28	1.7%	9	3.2%	19	1.4%	<b>0.041</b>
Multimodal Reconstruction	7	0.4%	0	0.0%	7	0.5%	0.610
<i>Treatment Details</i>							
Delayed Reconstruction	137	8.6%	20	7.4%	117	8.9%	0.451
<i>Radiation</i>							
Prior	105	6.4%	27	9.6%	78	5.8%	<b>0.016</b>
Adjuvant	279	17.2%	58	18.8%	227	16.8%	0.437
<i>Chemotherapy</i>							
Neoadjuvant	369	22.7%	76	27.5%	293	21.7%	<b>0.036</b>
Adjuvant	487	30.0%	74	26.7%	413	30.7%	0.192

n refers to number of reconstructions of individual breasts.

<sup>a</sup> Chi-squared test comparing incidence of comorbidity by race. Bolding indicates statistical significance at p < 0.05.**Table 3**  
Postoperative complications by race.

Complication	Total		Hispanic & African-American		All Other		p <sup>a</sup>
	n = 1678		n = 287 (17.1%)		n = 1391 (82.9%)		
	n	%	n	%	n	%	
Any Complication	479	28.5%	98	34.1%	381	27.4%	<b>0.021</b>
Venous Thromboembolism (DVT/PE)	19	1.1%	4	1.4%	15	1.1%	0.637
<i>Mastectomy Flap Necrosis</i>							
Partial	46	2.8%	13	4.5%	33	2.4%	<b>0.043</b>
Complete	30	1.8%	6	2.1%	24	1.7%	0.679
Fat Necrosis	192	11.8%	42	15.2%	150	11.1%	0.059
Infection Requiring IV Antibiotics	89	5.3%	13	4.5%	76	5.5%	0.509
Breast Hematoma	72	4.3%	10	3.5%	62	4.5%	0.450
Breast Seroma	72	4.3%	9	3.2%	63	4.6%	0.301
Return to OR in 30 Days	133	8.2%	27	9.8%	106	7.9%	0.308
Explantation (TE)	29	4.1%	3	2.7%	26	4.4%	0.603
<i>Microvascular Complications</i>							
Reconstructive Failure	13	1.9%	3	2.6%	10	1.8%	0.470
Abdominal Hematoma	3	0.4%	0	0.0%	3	0.5%	0.999
Abdominal Seroma	7	1.0%	0	0.0%	7	1.2%	0.609
<i>Insufficiency</i>							
Arterial	6	0.9%	4	3.4%	2	0.4%	<b>0.009</b>
Venous	11	1.6%	5	4.3%	6	1.1%	<b>0.026</b>
Abdominal Dehiscence	33	4.9%	8	6.9%	25	4.4%	0.243
Operative Hernia Repair	22	3.2%	6	5.2%	16	2.8%	0.242

n refers to number of reconstructions of individual breasts.

<sup>a</sup> Chi-squared test comparing incidence of comorbidity by race. Bolding indicates statistical significance at p < 0.05.

**Table 4**  
Adjusted & unadjusted odds ratios for comorbidities differing significantly by race.

Adverse Event	Race	Unadjusted		Adjusted	
		OR (95% CI)	p <sup>a</sup>	aOR (95% CI)	p <sup>b</sup>
ASA III or IV	Hispanic & African-American	<b>1.3 (1.0–1.8)</b>	<b>0.025</b>	1.1 (0.8–1.5)	0.445 <sup>c</sup>
	All Other	Referent		Referent	
Obesity	Hispanic & African-American	<b>2.5 (1.9–3.3)</b>	<b>&lt; 0.001</b>	<b>2.6 (2.0–3.4)</b>	<b>&lt; 0.001<sup>d</sup></b>
	All Other	Referent		Referent	
Hypertension	Hispanic & African-American	<b>2.5 (1.9–3.3)</b>	<b>&lt; 0.001</b>	<b>2.7 (2.0–3.8)</b>	<b>&lt; 0.001</b>
	All Other	Referent		Referent	
Diabetes	Hispanic & African-American	<b>3.1 (2.2–4.3)</b>	<b>&lt; 0.001</b>	<b>2.8 (1.9–4.1)</b>	<b>&lt; 0.001</b>
	All Other	Referent		Referent	
Previous Abdominal Surgery	Hispanic & African-American	<b>1.4 (1.1–1.8)</b>	<b>0.008</b>	<b>1.4 (1.0–1.8)</b>	<b>0.026</b>
	All Other	Referent		Referent	
Any Smoking History	Hispanic & African-American	<b>0.7 (0.5–0.9)</b>	<b>0.016</b>	<b>0.7 (0.5–0.9)</b>	<b>0.009</b>
	All Other	Referent		Referent	

OR = Odds Ratio, aOR = Adjusted Odds Ratio, CI = Confidence Interval.

<sup>a</sup> Individual uncontrolled multivariate logistic regressions. Bolding indicates statistical significance at p < 0.05.

<sup>b</sup> Individual multivariate logistic regressions controlling for age, BMI, and ASA class. Bolding indicates statistical significance at p < 0.05.

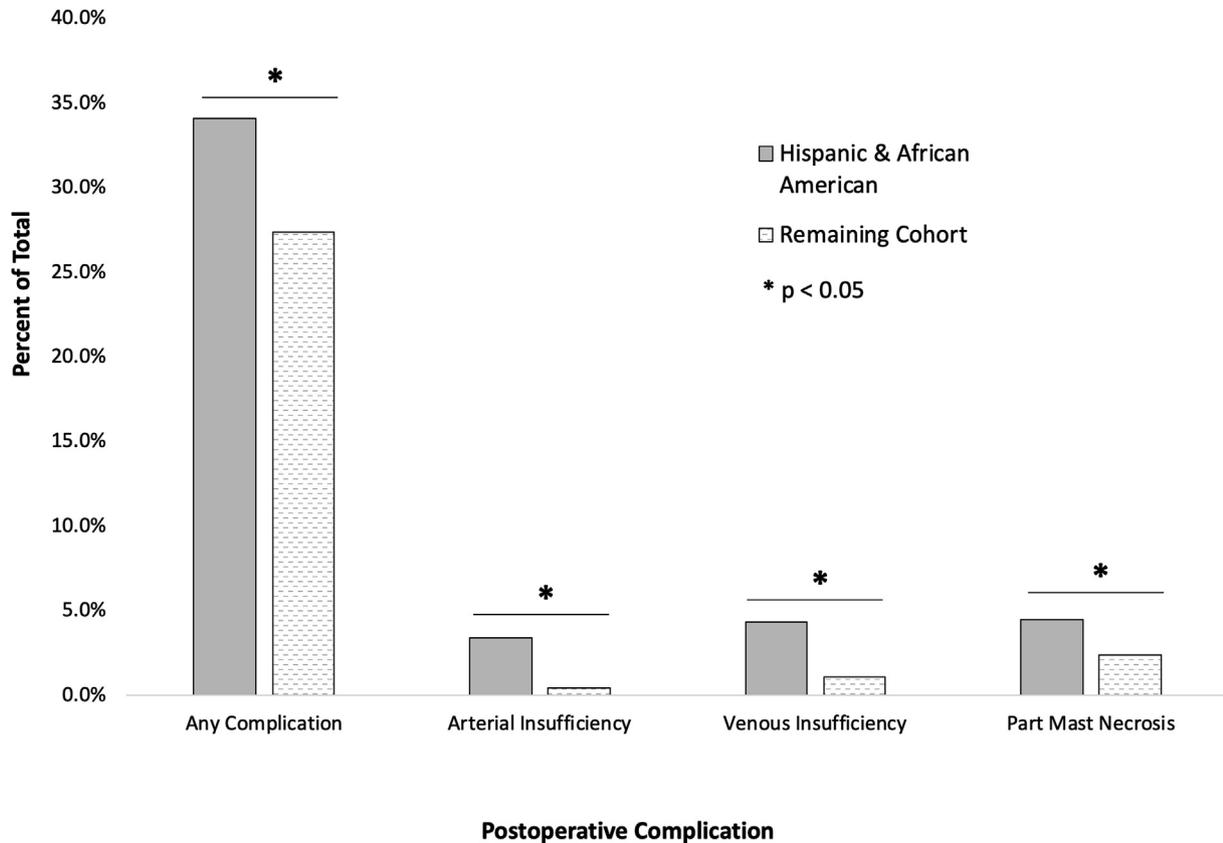
<sup>c</sup> Because of collinearity, this regression does not control for ASA class.

<sup>d</sup> Because obesity is defined using BMI, to limit collinearity, BMI was not included in this regression.

have not been well defined. In analyzing breast cancer mastectomy and reconstruction outcomes for 5 consecutive years at a high-volume academic medical center, significant racial disparities persist for patients receiving comparable, comprehensive care at a dedicated breast center. Patients who are Hispanic and African

American have significantly more pre-operative comorbidities, more aggressive oncologic treatment, and worse reconstructive outcomes.

Our study findings underscored the significantly worse baseline comorbidities in Hispanic and African American patients [25].



**Fig. 1.** Comparison of complication rates between African American and Hispanic patients relative to the remaining cohort.

**Table 5**  
Adjusted & unadjusted odds ratios for adverse events differing significantly by race.

Adverse Event	Race	Unadjusted		Adjusted	
		OR (95% CI)	p <sup>a</sup>	aOR (95% CI)	p <sup>b</sup>
Any Complication	Hispanic & African-American	<b>1.4 (1.0–1.8)</b>	<b>0.021</b>	1.3 (1.0–1.8)	0.052
	All Other	Referent		Referent	
Arterial Insufficiency	Hispanic & African-American	<b>24.5 (2.9–210.9)</b>	<b>0.004</b>	<b>22.1 (2.4–206.3)</b>	<b>0.007</b>
	All Other	Referent		Referent	
Venous Insufficiency	Hispanic & African-American	<b>4.9 (1.7–14.1)</b>	<b>0.003</b>	<b>7.0 (2.2–21.9)</b>	<b>0.001</b>
	All Other	Referent		Referent	
Partial Mastectomy Flap Necrosis	Hispanic & African-American	<b>2.0 (1.0–3.8)</b>	<b>0.045</b>	1.6 (0.8–3.2)	0.211
	All Other	Referent		Referent	

OR = Odds Ratio, aOR = Adjusted Odds Ratio, CI = Confidence Interval.

<sup>a</sup> Individual uncontrolled multivariate logistic regressions. Bolding indicates statistical significance at  $p < 0.05$ .

<sup>b</sup> Individual multivariate logistic regressions controlling for age, BMI, ASA class, and comorbidities differing significantly between races. Bolding indicates statistical significance at  $p < 0.05$ .

Specifically, our study found that Hispanic and African American races were independently predictive of obesity, hypertension, diabetes, and a history of abdominal surgery. Previous studies have also reported increased rates of several of these comorbidities among Hispanic and African American patients [26–33], though other studies report lower rates of hypertension among Hispanic patients [34–36].

In addition, underserved minority populations often present with more advanced breast cancer [37]. Consistent with prior literature, our study revealed higher rates of neoadjuvant chemotherapy, higher rates of prior breast irradiation, and significantly more modified radical mastectomies among Hispanic and African American patients.

Despite more aggressive breast cancers and unfavorable comorbidity profiles, encouragingly patients at the same academic breast center receive comparable types of reconstruction. The major difference of higher rates of direct-to-implant reconstruction in Asian patients is likely related to favorable anatomy. Direct-to-implant reconstruction is best applied in smaller breasted, less ptotic patients. With a mean BMI of 23.2, Asian breast size and anatomy is more often suitable for direct-to-implant reconstruction [38].

Prior studies have noted both higher rates of autologous reconstruction in African Americans and Hispanics as well as higher rates of implant reconstruction among African Americans [38–42]. Unlike prior published literature, our study did not involve multiple, heterogeneous medical centers with variable resources and technical capabilities. Uniquely, all patients in this longitudinal 5-year study received care at the same academic medical center. While practice patterns may differ depending on the surgical preferences or capabilities at different hospitals, it is encouraging that there are few differences in reconstructive modality between races with comparable resources.

However, Hispanic and African American patients still had significantly greater peri-operative complications. Potentially, less favorable pre-operative baseline health status and more aggressive oncologic therapies contributed to higher rates of mastectomy flap necrosis and microvascular complications. A history of prior breast irradiation is a known risk factor for post-operative healing complications [43–45], of which Hispanic and African American patients had higher rates. While Hispanic and African American patients in our study had higher rates of neoadjuvant chemotherapy, previous studies have shown a neutral or negative association [46–52]. A smaller study noted fewer complications among

Hispanic patients [53]. Our institution's high volume of autologous breast reconstruction may have provided a more powered patient sample size to reveal these differences in microvascular complications [39,53,54].

Despite comparable resources and clinical care, Hispanic and African American patients have increased post-operative morbidity as a likely result of the greater number of pre-operative risk factors. In a continued effort to reduce disparities in medical care, underserved populations should be appropriately counseled of the greater rates of peri-operative complications. Although our study was performed at a single center to control for the heterogeneous resources between hospitals, significant differences by race persisted. In order to achieve comparable peri-operative outcomes across race, access to comprehensive breast cancer care is not sufficient alone. Improvements at the primary care and general health maintenance levels are necessary to address comorbidities such as obesity, diabetes, hypertension, and smoking.

Limitations of this study include that results are limited to the experience at a high-volume academic breast center. The rates of autologous microvascular reconstruction are higher than the national average and reflect a bias towards more autologous reconstruction as seen at most academic institutions nationally.

In conclusion, compared to others undergoing mastectomy and reconstruction at the same institution, Hispanic and African American patients have higher comorbidity burdens and increased oncologic aggressiveness that translate to significantly higher overall complication rates. The study results can be used to appropriately counsel and address racial disparities in the breast cancer population.

#### Declarations of interest

None.

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#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ejso.2019.01.016>.

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