



Influence of race, insurance status, and geographic access to plastic surgeons on immediate breast reconstruction rates



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ABSTRACT

Background: This study evaluates the rates of immediate breast reconstruction (IBR) among racial and insurance status subgroups, in the setting of a changing plastic surgeon workforce.

Methods: Using state level inpatient and ambulatory surgery data, we identified discharges for adult women who underwent mastectomy for breast cancer. This information was supplemented with plastic surgeon workforce data and aggregated to the health service area-level (HSA). Hierarchical linear models were used to risk standardized IBR rates for 8 race-payer subgroups.

Results: The final cohort included 65,246 women treated across 67 HSAs. The plastic surgeon density per 100,000 population directly related to the IBR rate. While all subgroups saw a modest increase in IBR rates, Caucasian women with private insurance realized the largest absolute increase (46%) while African-American and Asian women with public insurance saw the smallest increase (6%).

Conclusion: Significant disparities persist in the provision of IBR according to the form of insurance a patient possesses. Of heightened concern is the novel finding that even within privately insured patients, women of color have significantly lower IBR rates compared to Caucasian women.

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1. Introduction

Post mastectomy breast reconstruction for cancer is now universally recognized as an important component of the comprehensive breast cancer treatment. It has been well documented that breast reconstruction following mastectomy can improve a woman's psychosocial well-being after oncologic surgery.^{1,2} Since 1998, the Women's Health and Cancer Rights Act, and subsequent state driven legislation, has mandated third party health care payers to cover breast reconstructive procedures at a level commensurate with that of the patient's mastectomy and adjuvant oncologic care.^{3,4} Despite this coverage mandate, only 45% of women surgically treated for breast cancer will undergo breast reconstruction nationwide.⁵

Several studies have evaluated factors associated with patients that do not receive breast reconstruction and have found that advanced cancer stage and presence of significant comorbidities to be negatively correlated.^{6–8} These clinical etiologies seem

relatively easy to rationalize; however, there is growing concern that sociodemographic factors such as race and payer status are also related to the likelihood of a woman undergoing breast reconstruction after mastectomy.^{5,6,9,10}

Racial disparities in the delivery of health care have been widely reported including within the field of plastic and reconstructive surgery. It has been well documented that women of color are found to undergo breast reconstruction less frequently than their Caucasian counterparts.^{5,9,11,12} Additionally, the impact of payer status can be seen in the variation of reported reconstruction rates when different payer groups are studied.^{4,6} It is not surprising to find that in these studies patients with insurance have the highest reconstruction rates, while those that are uninsured have the lowest.

Another factor that has garnered heightened interest is the clinical impact of geographic access to a plastic surgeon on a given population. There is growing evidence, substantiating prior conjecture, that geographic access to a plastic surgeon plays a role in whether a woman will undergo post mastectomy breast reconstruction. These studies demonstrate that women residing in areas in relatively close proximity to a plastic surgeon are significantly more likely to undergo reconstruction than those living in more remote locations.¹³

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When the topic of racial disparities in breast reconstruction has been presented nationally, there has often been the argument that the disparity likely exists because these minority communities have lower rates of insurance and tend to live in areas of lower plastic surgeon density. We hypothesized that the higher rates of breast reconstruction found with an increase in plastic surgeon density may not be realized by all women equally, and that disparities may be seen between women of different racial groups as well as based on the type of insurance (private vs. public), not just the presence of it. Therefore, we conducted this study to evaluate the relationship between rates of immediate breast reconstruction (IBR) among racial and types of insurance subgroups in the setting of a changing plastic surgeon workforce.

2. Methods

We performed a retrospective analysis of the 2008–2012 California (CA), Florida (FL), and New York (NY) state inpatient and ambulatory surgery databases. These databases are available through the Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project.¹⁴ The inpatient data is a census of hospital discharges from acute care, non-federal, community hospitals, whereas the ambulatory surgery data is drawn from free-standing, ambulatory surgery centers and hospital-based, outpatient departments. These specific state databases were selected for analysis due to their geographic diversity and large populations, which accounted for approximately 24% of the United States adult population in 2010.¹⁵ In addition, these states provide encrypted patient identifiers which allow a longitudinal analysis of healthcare over time and across settings.

2.1. Patient selection and classification

From the 2009–2011 state inpatient and ambulatory surgery databases, we identified discharges for women at least 18 years of age who underwent mastectomy (ICD-9-CM 85.4x, 85.33–85.36; CPT 19303, 19305, 19306, 19307) for a diagnosis of breast cancer (ICD-9-CM 233.0, 174.x) with or without concurrent breast reconstruction (ICD-9-CM 85.33, 85.35, 85.5x, 85.6x, 85.7x, 85.8x, 85.95; CPT 19340, 19342, 19357, 19324, 19361, 19364, 19367, 19368, 19369). We defined the immediate breast reconstruction rate as the percentage of women who underwent breast reconstruction during the same admission where mastectomy was performed.

Patients were then grouped for subsequent analysis according to race and ethnicity and anticipated primary payer. The available race and ethnicity information is provided in a single variable with the following, mutually exclusive levels: Caucasian, African-American, Hispanic, Asian or Pacific Islander, Native American, Other, or missing. Because of low cell counts and for the purposes of this study, we combined the Asian, Pacific Islander, and Native American (APINA) categories and excluded patients with a race or ethnicity reported as "other" or "missing." Anticipated primary payer was then defined as public (i.e., Medicare and Medicaid) versus private forms of insurance. This resulted in 4 race and ethnicity and 2 primary payer categories for 8 total patient groups overall.

2.2. Defining geographic access to plastic surgeons

Geographic healthcare data was obtained from the 2013–2014 Area Health Resource File (AHRF). This file is a compilation of multiple sources that provide population and healthcare workforce data at the county-level. From this file, we determined plastic surgeon density as the total number of plastic surgeons per 100,000 population in each U.S. county. The numerator in this ratio was the

total number of plastic surgeons in each county as reported in the AHRF via the American Medical Association's Masterfile while the denominator represented the total population within each county according to the U.S. Census (2010). This information was merged with the clinical data based on the county where the treating hospital was located.

2.3. Aggregation of data to health service areas

We aggregated all data from the county-level to the National Cancer Institute's (NCI) Health Service Area (HSA)-level using crosswalk files available from the NCI. HSAs were originally defined by the National Center for Health Statistics as a single county, or cluster of counties, which are "self-contained" in respect to hospital care. The NCI subsequently modified these areas by dividing HSAs that straddled state lines so that all HSAs are contained within a single state's boundaries. The use of HSAs to describe population and physician characteristics at a national level is well-established.

2.4. Covariates for risk-standardization

We defined several patient variables for subsequent risk-standardization that may impact the ability of providers to offer immediate reconstruction. This included a patient's age, diagnosis (in-situ disease, invasive cancer, or metastatic cancer), whether a lymph node procedure was completed (none, sentinel node, or axillary dissection), and degree of medical comorbidity as defined by the enhanced-Elixhauser algorithm described by Quan. For each of the 31 medical conditions, we considered a condition to be present if it was a listed diagnosis during the hospitalization for mastectomy with reconstruction or at any hospital admission in the 12 months preceding surgery. In a similar manner, we assessed whether the patient had a history of tobacco use (ICD-9-CM 305.1). The Elixhauser index score was then calculated for each patient based on prior research. In the current databases, no information on post-mastectomy radiation therapy was available.

2.5. Statistical analysis

First, we compared patient characteristics and reconstruction rates across race and ethnicity groups (Caucasian, African American, Hispanic, Asian/Pacific Islander/Native American) using chi-squared and t-tests for categorical and continuous variables, respectively. Next, we created a patient-level, logistic regression model to quantify the relationship between immediate breast reconstruction (*dependent variable*) and race/ethnicity-payer subgroups while controlling for the covariates described above. Results are reported as adjusted odds ratios with 95% confidence intervals. Finally, we evaluated the relationship between a patient's race/ethnicity-payer subgroup and plastic surgeon density. To do this, we calculated risk-standardized, immediate breast reconstruction rates at the HSA-level using a two-level (patient and HSA), hierarchical generalized linear model. In this model, breast reconstruction was the binary outcome and the independent variables are those described above. The model also included HSA random intercepts to account for clustering of patients within HSAs and permit separation within and between HSA variation in breast reconstruction rates after accounting for patient characteristics. The predicted-to-estimated ratio obtained from these models was then multiplied by the mean, unadjusted breast reconstruction rate among all HSAs included in the study to yield the risk standardized rates. To assess the relationship between plastic surgeon density and the risk standardized, breast reconstruction rates, we calculated volume-weighted correlation coefficients.

All analyses were conducted using SAS version 9.4 (SAS

Institute, Cary, North Carolina). All p-values were two sided and considered significant at the <0.05 level. Because this study used publicly available data that does not include patient identifiers, it was considered exempt from review by the Institutional Review Board of the Hospital of the University of Pennsylvania.

3. Results

The final sample included 65,246 women with breast cancer who underwent mastectomy during an inpatient hospitalization or outpatient encounter (Table 1).

3.1. Relationship between plastic surgeon density and immediate breast reconstruction

The average health service area had 2.2 plastic surgeons per 100,000 population and a risk standardized breast reconstruction rate of 43.6%. The plastic surgeon density per 100,000 population was directly related to the risk standardized breast reconstruction rate (correlation coefficient = 0.69, p value < 0.001). For example, in areas with <1.0 plastic surgeons/100,000, the breast reconstruction rate was only 23% vs. 60% in areas with >3.0 plastic surgeons/100,000. (Table 1).

3.2. Relationship between anticipated primary payer and immediate breast reconstruction

When controlling for breast cancer stage, presence of comorbidities, and type of oncologic procedure performed, privately insured patients had significantly higher rates of breast reconstruction than patients with public insurance (Medicaid and Medicare) (p < 0.001) (Fig. 1). Privately insured patients received breast reconstruction in ~60% of cases, while publicly insured patients received breast reconstruction in ~20% of cases. This was found to be the case regardless of race and ethnicity.

3.3. Relationship between race, type of insurance, and plastic surgeon density on breast reconstruction

All racial subgroups had improved IBR rates with increased plastic surgeon density, however even in the areas of highest surgeon propensity, Caucasian women had greater IBR rates (59%) than Hispanic (47%), African-American (42%), and APINA (41%) women (p < 0.001) (Fig. 2). When looking specifically at publicly insured patients, surgeon propensity yielded higher IBR rates, however not equitably among all racial groups. Caucasian women with public insurance residing in areas with the highest plastic surgeon density had a higher IBR rate of (34%), compared with Hispanic (28%), African-American (24%), and APINA (24%) women (p < 0.001) (Fig. 3). Upon focused assessment of the privately insured patients, surgeon propensity again yielded higher IBR rates. Notably, the gains were dramatically disparate according to race. Caucasian women with private insurance residing in areas with the highest plastic surgeon density had a significantly higher IBR rate of (84%), compared with Hispanic (65%), African-American (60%), and APINA (58%) women (p < 0.001) (Fig. 4). While all subgroups saw at least a modest increase in IBR rates with an increase in plastic surgeon density, Caucasian women with private insurance realized the largest absolute increase (46%) while African-American and Asian women with public insurance saw the smallest increase (6%) (p < 0.001) (Table 2).

4. Discussion

Disparities in breast reconstruction according to race and ethnicity remain a perverse and insistent surgical health care disparity nationwide. The etiology of this disparity is undoubtedly complex and multi-factorial. Historical examinations of this issue have pointed to the impact of insurance and economic status^{4,16}; inconsistency in physician referral patterns influenced by overt or implicit bias^{7,9,17–20}; health literacy regarding breast reconstruction options^{6,7}; cultural beliefs and preferences²¹; and most recently,

Table 1

Description of 65,246 women who underwent mastectomy for breast cancer between January 1, 2008 and December 31, 2012 in California, Florida, or New York stratified by race.

	Caucasian	African-American	Hispanic	Asian, Pacific Islander, or Native American	p-value
Patients, N	44,241	6505	8059	6441	–
Age in years, mean (STD)	61.0	57.9	57.1	56.6	<0.001
Private insurance, %	53.0	43.1	43.9	54.7	<0.001
Plastic surgeons per 100,000 population where treated					<0.001
<1.00	4.0	1.9	4.0	2.5	
1.00–1.99	14.2	11.4	13.6	8.6	
2.00–2.99	27.5	18.4	12.5	12.8	
>3.00	54.3	68.3	69.9	76.2	
Diagnosis, %					<0.001
In situ disease	14.5	14.4	12.7	17.4	
Invasive cancer, node negative	61.3	60.1	61.1	59.3	
Invasive cancer, node positive	21.8	22.6	23.7	21.5	
Metastatic disease	2.3	3.0	2.5	1.8	
Elixhauser index score	6.9	7.2	7.0	6.6	<0.001
Medical comorbidity, %					
Cardiovascular disease other than hypertension	10.5	8.3	6.0	5.1	<0.001
Hypertension	36.7	54.5	38.9	37.2	<0.001
Chronic obstructive pulmonary disease	11.9	11.7	9.1	7.5	<0.001
Diabetes	10.6	21.6	18.3	15.3	<0.001
Hypothyroidism	12.7	5.8	7.7	7.2	<0.001
Mental health diagnoses	9.2	6.2	6.9	4.4	<0.001
Obesity	7.0	12.5	9.8	4.6	<0.001
Smoker	6.6	5.6	3.6	1.9	<0.001
Surgical treatment					
Axillary dissection	43.8	56.1	55.3	48.0	<0.001
Bilateral procedure	26.5	15.1	16.8	17.2	<0.001
Immediate breast reconstruction, %	43.7	33.9	37.0	37.6	<0.001

IMMEDIATE BREAST RECONSTRUCTION RATES STRATIFIED BY RACE AND PAYER

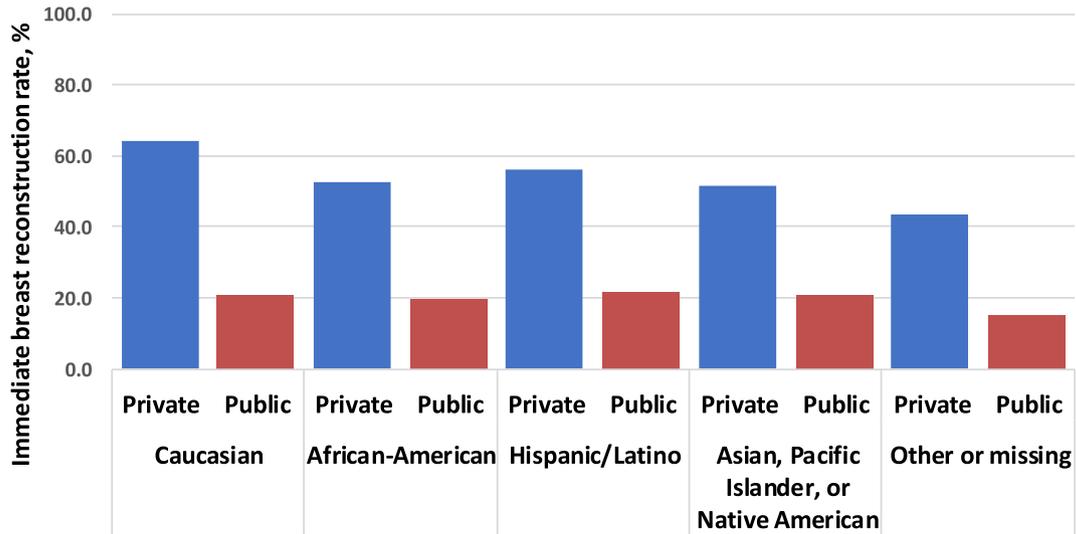


Fig. 1. Immediate breast reconstruction rates stratified by race and payer.

geographic access to plastic and reconstructive surgeons.^{13,22,23} The findings in this study are novel because it is the first to combine the use of a large and diverse population, control for access to a plastic surgeon, and control for the anticipated primary payer, while still revealing disparate care in immediate breast reconstruction according to the patient's race and ethnicity.

4.1. Geographic access to a plastic and reconstructive surgeon

It has been estimated that ~25 million people in the US have limited to no geographic access to a plastic and reconstructive surgeon, with another 29 million living in areas with less than one plastic surgeon per 100,000 population.²⁴ There has been growing support within the plastic surgery community for lobbying efforts

to increase the plastic surgeon workforce to meet the needs of this ever-expanding population especially in the face of the impending retirement of surgeons born in the baby boom era.^{25,26}

There have been some recently published findings on the impact of distance traveled on breast reconstruction rates. They have determined that breast reconstruction patients must travel significantly further than patients undergoing mastectomy alone, and that there is a statistically significant linear correlation between travel distance and reconstruction rates.^{13,22} In that same vein, there is new evidence of a direct positive correlation between plastic surgeon density and the likelihood of a woman receiving breast reconstruction.²³ These aforementioned studies' ability to confirm the positive impact of improved access to plastic and reconstructive surgeons on the likelihood of a woman receiving this

BREAST RECONSTRUCTION RATES FOR ALL INSURED WOMEN AS PLASTIC SURGEON DENSITY INCREASES, STRATIFIED BY RACE

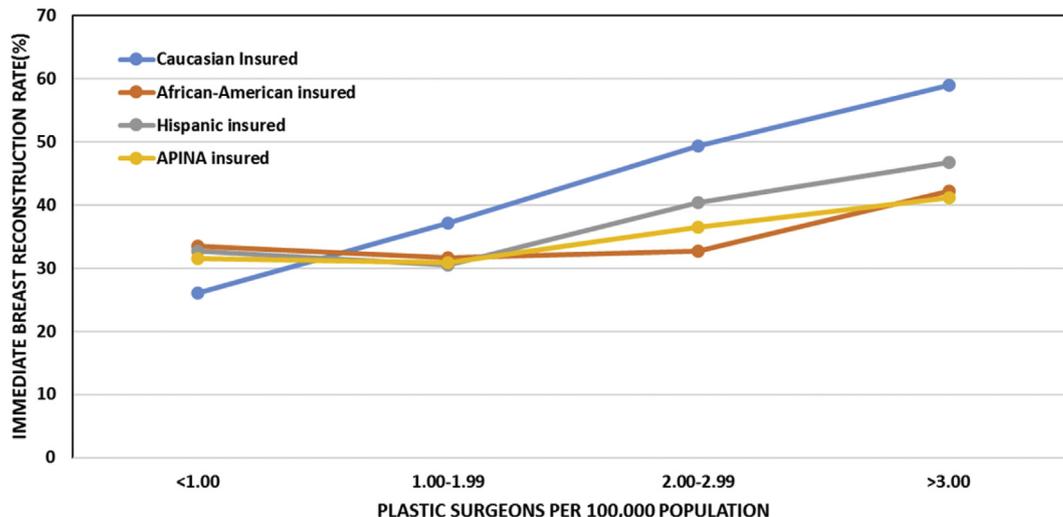


Fig. 2. Breast reconstruction rates for all insured women as plastic surgeon density increases, stratified by race.

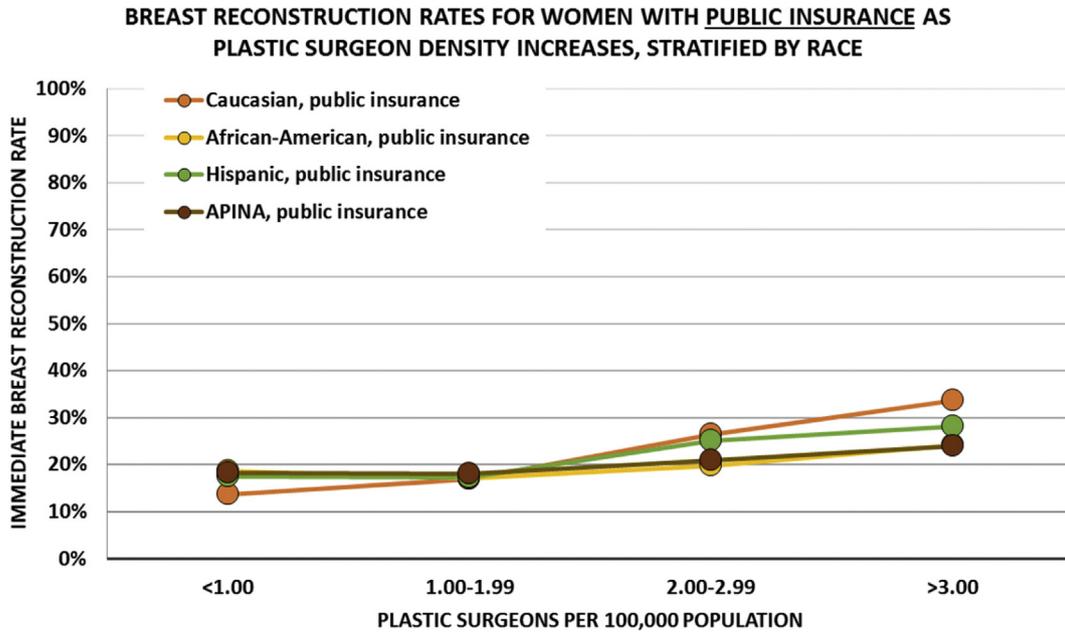


Fig. 3. Breast reconstruction rates for women with public insurance as plastic surgeon density increases, stratified by race.

widely encouraged and arguably necessary care, suggests that mechanisms need to be adopted to either increase the number of plastic surgeons, improve the geographic distribution of plastic surgeons, or likely both.

4.2. Impact of insurance type

Several historical studies have documented a correlation between insurance status and receipt of timely oncologic treatment in a wide array of cancer modalities, including breast cancer care^{27–30}

and breast reconstruction after mastectomy. Having insurance is positively correlated with higher breast reconstruction rates.^{4,7,31} A recent study looking specifically at California was able to further elucidate this association by delineating differences in breast reconstruction rates between publicly and privately insured patients. They found that privately insured Californians were 10 times more likely to receive post mastectomy breast reconstruction than their publicly insured counterparts.³² Our study reveals that this disparity among private and public insurance is not unique to California. Through the assessment of data for three of the largest

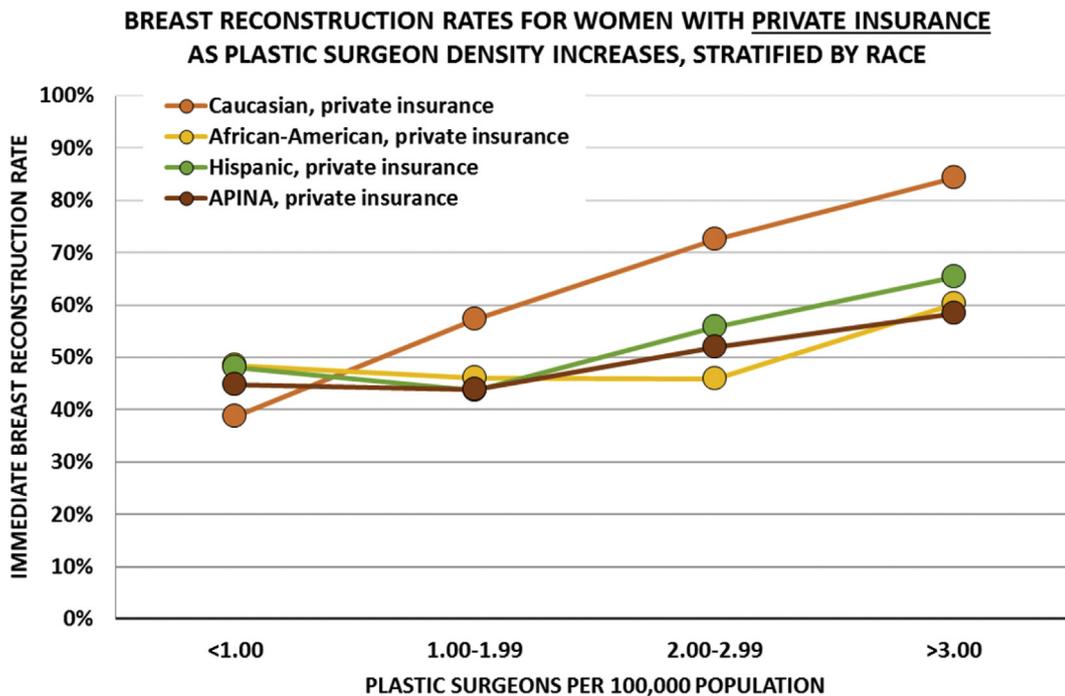


Fig. 4. Breast reconstruction rates for women with private insurance as plastic surgeon density increases, stratified by race.

Table 2
Model of immediate breast reconstruction.

	Odds Ratio	Lower Confidence Interval	Upper Confidence Interval
Age	0.95	0.94	0.95
Diagnosis, %			
In situ disease	Reference		
Invasive cancer, node negative	0.61	0.58	0.64
Invasive cancer, node positive	0.50	0.47	0.54
Metastatic disease	0.36	0.31	0.41
Medical comorbidity, %			
Cardiovascular disease other than hypertension	0.95	0.88	1.02
Hypertension	0.84	0.80	0.87
Chronic obstructive pulmonary disease	0.90	0.84	0.96
Diabetes	0.67	0.62	0.71
Hypothyroidism	1.21	1.13	1.29
Mental health diagnoses	1.08	1.01	1.16
Obesity	0.69	0.64	0.74
Smoker	0.57	0.53	0.62
Lymph node procedure			
No node procedure	Reference		
Lymph node biopsy	1.46	1.39	1.54
Lymph node dissection	0.76	0.73	0.81
Bilateral procedure	2.87	2.73	3.01
Subgroup			
Caucasian, private insurance	Reference		
Caucasian, public insurance	0.42	0.40	0.44
African-American, private insurance	0.74	0.68	0.81
African-American, public insurance	0.31	0.28	0.34
Hispanic, private insurance	0.73	0.68	0.79
Hispanic, public insurance	0.32	0.29	0.35
APINA, private insurance	0.58	0.54	0.63
APINA, public insurance	0.28	0.26	0.32

c-statistic = 0.829.

and most diverse states in the US (inclusive of California), we provide sufficient evidence that this disparity is very likely a systemic problem that spans the entire national health care system.

The often-maligned Patient Protection and Affordable Care Act was implemented with the intent to improve the health of the nation by reducing the number of uninsured and subsequently improving access to care.³³ While we respect and recognize the potential benefit, this study suggests that further thought and consideration must be given to the form of insurance that is obtained, how to optimize its utilization by its owners, and how to better ensure its acceptance by health care systems and their providers.

4.3. Impact of race and ethnicity

The etiology of racial and ethnic health care disparities is incredibly convoluted and the challenges facing breast reconstruction are no different. All prior contributions to the literature that have explored this issue call for additional studies to elucidate why these differences according to race and ethnicity exist. Frequently it has been suggested that insurance status, socioeconomic status, and geographic access to reconstructive plastic surgeons were the most likely culprits. While this may be in part true, our study points to something inherent to race and ethnicity that surpasses a patient's financial means or geographic residence. It should be universally alarming that women of color with private insurance and living in regions of high plastic surgeon density have breast reconstruction rates that are ~25% lower than their Caucasian counterparts. Such a statistic should compel us to examine and address other factors that inevitably contribute to this disparity, such as health literacy among minority populations^{4,6}; variability in referral patterns by general surgeons and surgical oncologists^{9,18,19}; willingness and availability of plastic surgeons to provide this service equitably to women⁷; and patients' cultural preferences.²¹

4.4. Strategies for improvement

4.4.1. Outreach

If there is to be a true commitment to alleviate racial disparities in breast reconstruction, then there must be further investments made into educating these underserved communities about breast reconstructive options. There is a historical distrust of the US health care system by minority communities dating back to the Tuskegee syphilis study.³⁴ Although most would argue that our country has made great strides since that era, recent studies have revealed persistence of this distrust and its inevitable impact on cancer outcomes.³⁵ Engaging underserved communities in the conversation regarding breast reconstruction through targeted outreach should yield dividends. The concept of Shared Decision Making, specifically for racial/ethnic minority patients, is gaining traction in other disciplines and should be considered for breast cancer and breast reconstruction care as well.³⁶ Cultural and personal preferences will dictate much of what is agreed upon by a patient; however, ensuring that every woman is armed with the knowledge regarding her reconstruction options should be the ultimate goal.

4.4.2. Consistent and equitable referrals

Although an increasing number of women are using the internet to find their microsurgeon,³⁷ referral by general surgeons and surgical oncologist remains the primary means by which breast cancer patients are referred to plastic surgeons for potential reconstruction.³⁸ While there has been limited information published on national referral rates for breast reconstruction, one regional study found that 40% of surveyed surgeons did not refer the majority of their patients for breast reconstruction.³⁹ Another study surveying general surgeons in two large cities (Detroit and Los Angeles) found that only 24% of its respondents referred >75% of their patients to plastic surgeons prior to mastectomy.⁴⁰ Compared with high-referral surgeons, low-referral surgeons reported

perceiving more access barriers (availability of plastic surgeons and costs) and lower patient priority for reconstruction as reasons for not referring for potential reconstruction.

Many studies have proven the benefits of breast reconstruction and consistently demonstrated the procedures' safety across all ages, races, and ethnic backgrounds.^{1,5,20,41} In addition to improving our educational outreach to underserved communities, the medical community must also be educated on breast reconstruction's evolution to a heightened status as a standard of care (in most clinical scenarios).

4.4.3. Commitment of plastic surgeons and insurance providers

Like most medical subspecialties, plastic surgeons are subject to market forces and must obtain a profit to remain in practice. Thus, it should not be a surprise, nor yield disparaging judgment, that the historically low reimbursement rates from Medicare and Medicaid impact a plastic surgeon's willingness to carryout breast reconstruction. Alderman et al. found a mere 13.0% collection rate for surgeon fees and 20.4% collection rate for facility fees from Medicaid for breast reconstruction procedures. This was compared to significantly higher surgeon and facility collection rates for Medicare (37.0% and 33.5%) and private insurance (40.0% and 63.4%), respectively.⁴² There has been the argument that although the Women's Health and Cancer Rights Act of 1998 mandated breast reconstruction coverage from third party payers, it failed to set standard regarding the reimbursement of these frequently labor and time intensive procedures.⁴³ As a result, health care systems and/or surgeons that do not find the procedures to be profitable are not obligated, nor inclined, to perform them. Inevitably, there will have to be some common ground agreed upon between the plastic surgery community and these public insurance agencies. While plastic surgeons will likely have to temper their expectations, the insurance providers will need to enhance their reimbursement rates to further incentivize plastic surgeons to offer more patients their expert care. The public is growing increasingly aware as was evident from a recent New York Times article.⁴⁴ As patients and

the dataset without further detail provided. Because the data is collected by several agencies that operate in different states, the method of race and ethnicity data collection may not be standardized. Additionally, the data provided is mutually exclusive of one another meaning that patients from multi-racial families or patients who identify as both a given racial group and ethnicity would be required to select one option. Either scenario could lead to a misclassification of race and ethnicity.

5. Conclusion

Although general rates of IBR are steadily increasing nationally, there are significant disparities in the provision of breast reconstruction according race and ethnicity as well as the form of insurance a patient possesses. Of heightened concern is the finding that even within privately insured women residing in areas of high plastic surgeon density, African-American, Hispanic, and Asian/Pacific Islander/Native American patients have significantly lower rates of breast reconstruction compared to Caucasians. Identifying these inequalities suggest the need for heightened dedication to local, regional and national initiatives to help mitigate this glaring health care disparity.

Disclaimers

The views expressed in this article are those of the authors and do not reflect the official policy of the United States Air Force, Department of Defense, or the U.S. Government.

Financial disclosure

No financial disclosures.

Appendix 1

Appendix 1: Coding appendix

	ICD-9-CM diagnostic codes	ICD-9-CM procedural codes	CPT-4
Diagnoses			
Breast cancer	233.0, 174.x		
Metastatic disease	197.x, 198.x, 199.1		
Smoking history	305.1		
Procedures			
Lumpectomy		85.2, 85.20–85.25	19110, 19120, 19125, 19126, 19160, 19162, 19301, 19302
Mastectomy		85.4x, 85.33–85.36	19303, 19305, 19306, 19307
Direct-to-implant reconstruction		85.5x, 85.33, 85.35	19325, 19340, 19342
Tissue expander reconstruction		85.95	19357
Autologous tissue reconstruction		85.6x, 85.7x, 85.8x, 85.33, 85.35, 85.84, 85.85, 85.89	19324, 19361, 19364, 19367, 19368, 19369
Axillary lymph node procedures		40.2x, 40.1x, '85.43, 85.45, 85.46, 85.47, 85.48, 40.59, 40.50, 40.5,	19302, 19305, 19306, 19307, 38740, 38745, 35825, 38500

their advocates begin to demand more from the health care system, it will inevitably lead to these necessary negotiations between hospitals, surgeons and public insurance agencies.

4.5. Limitations

This study should be reviewed in the context of several important limitations. First, race and ethnicity data is a defined variable in

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