

Breast Reconstruction After Mastectomy Among Department of Defense Beneficiaries by Race

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BACKGROUND: Postmastectomy breast reconstruction increased approximately 20% between 1998 and 2008 in the United States and has been found to improve body image, self-esteem, and quality of life. These procedures, however, tend to be less common among minority women, which may be due to variations in health care access. The Department of Defense provides equal health care access, thereby affording an exceptional environment in which to assess whether racial variations persist when access to care is equal. **METHODS:** Linked Department of Defense cancer registry and medical claims data were used. The receipt of reconstruction was compared between white women (n = 2974) and black women (n = 708) who underwent mastectomies to treat incident histologically confirmed breast cancer diagnosed from 1998 through 2007. **RESULTS:** During the study period, postmastectomy reconstruction increased among both black (27.3% to 40.0%) and white (21.8% to 40.6%) female patients with breast cancer. Receipt of reconstruction did not vary significantly by race (odds ratio, 0.93; 95% confidence interval, 0.76-1.15). Reconstruction decreased significantly with increasing age, tumor stage, and receipt of radiotherapy and was significantly more common in more recent years and among active service-women, TRICARE Prime (health maintenance organization) beneficiaries, and women whose sponsor was an officer. **CONCLUSIONS:** The receipt of breast reconstruction did not vary by race within this equal-access health system, indicating that the racial disparities reported in previous studies may have been due in part to variations in access to health care. Additional research to determine why a large percentage of patients with breast cancer do not undergo reconstruction might be beneficial, particularly because these procedures have been associated with noncosmetic benefits. *Cancer* 2014;120:3033-9. Published 2014. This article is a U.S. Government work and is in the public domain in the USA.

KEYWORDS: breast cancer, mastectomy, reconstruction, racial disparities, epidemiology, health care access.

INTRODUCTION

With an estimated 232,340 new breast cancer cases reported in 2013, breast cancer remains the most common cancer diagnosed among women in the United States.¹ Although the surgical management of breast cancer has changed over time to favor breast-conserving procedures (eg, lumpectomy), mastectomies are still common; approximately 40% of women with breast cancer underwent mastectomy annually between 2000 and 2010.²

Mastectomies have been associated with diminished body image, self-esteem, and quality of life; postmastectomy breast reconstruction surgeries have been found to reduce these adverse effects.^{3,4} The noncosmetic benefits of breast reconstruction were recognized by the United States enactment of the Women's Health and Cancer Rights Act (WHCRA) in 1998, which mandated that health insurance plans cover mastectomy-associated reconstruction.⁵ Then, largely in response to the Breast and Cervical Cancer Prevention and Treatment Act of 2000, all 50 states and the District of Columbia expanded Medicaid eligibility to provide breast cancer treatment to certain uninsured women.⁶ Since these laws were passed, postmastectomy reconstructive rates have increased.⁷⁻¹² However, many studies have continued to demonstrate that reconstruction rates are lower among black women than white women.¹⁰⁻¹⁵ The reason for this racial disparity is likely multifactorial but may still be due to variations in health insurance and thereby health care access. For example, nonwhite women in the United States are less likely than white women to have health insurance,^{16,17} and the

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The opinions and assertions expressed in this article represent the private views of the authors and do not reflect the official views of the US Departments of the Army, Navy, or Defense; the National Cancer Institute; or the US government. Nothing in the presentation implies any endorsement by the federal government, Department of Defense, or Department of the Navy.

DOI: 10.1002/cncr.28806, **Received:** February 14, 2014; **Revised:** March 17, 2014; **Accepted:** March 31, 2014, **Published online** June 25, 2014 in Wiley Online Library (wileyonlinelibrary.com)

WHCRA only benefits women who have health insurance. Furthermore, the Breast and Cervical Cancer Prevention and Treatment Act did not result in universal Medicaid coverage for women with breast cancer. Medicaid expansion varies by state and is often dependent on whether the woman's cancer was diagnosed through a screening program.⁶

The Department of Defense (DoD) Military Health System (MHS) provides universal health care to all beneficiaries, regardless of race/ethnicity and socioeconomic status; thus, it provides an extraordinary opportunity to investigate whether racial health disparities exist when the access to care is equal. An identified racial difference in an equal-access environment suggests the potential effects of factors other than health care access. Using the combined DoD cancer registry and medical claims data, the objective of the current study was to determine whether there were variations in the receipt of breast reconstruction after mastectomy between white and black women after adjustment for covariates. A secondary aim was to assess temporal trends in the receipt of postmastectomy breast reconstruction by race.

MATERIALS AND METHODS

This study was based on linked data from the DoD's Central Cancer Registry (CCR) and the MHS Data Repository (MDR), the DoD's medical claims database. The study was approved by the Institutional Review Boards of the Walter Reed National Military Medical Center, TRICARE Management Activity, and the National Institutes of Health's Office of Human Subjects Research Protections. Breast cancer cases were first identified within the CCR, which contains information for all DoD patients with cancer who are diagnosed or treated at military treatment facilities (MTFs), including active-duty and retired military personnel and their dependents. Duplicate records pertaining to the same diagnosis were consolidated following North America Association of Central Cancer Registries guidelines. The CCR includes information regarding demographic variables (eg, age and race), diagnostic factors (eg, diagnostic confirmation and date of diagnosis), tumor characteristics (eg, histology and stage), and cancer treatment (eg, surgery, radiotherapy, chemotherapy, and hormonal therapy). The *International Classification of Diseases for Oncology* codes were used to identify eligible breast cancer cases.^{18,19} The MDR was then accessed to obtain additional data for the identified CCR cases. The MDR includes administrative and medical claims information from the DoD health care program, known as TRICARE, including direct care received at

MTFs and indirect care received at non-MTFs that is paid for by the DoD. The MDR includes information regarding clinical diagnoses, which are coded using the *International Classification of Diseases, Ninth Revision* (ICD-9), and diagnostic and treatment procedures, which are coded using ICD-9, Current Procedural Terminology (CPT), or Healthcare Common Procedure Coding System codes.

The study participants were non-Hispanic white (white) and non-Hispanic black (black) women with histologically confirmed, first primary, malignant breast cancer diagnosed between 1998 and 2007 in the CCR, who were aged 21 years to 75 years and underwent mastectomy (total of 3694 women). There were too few women of Hispanic ethnicity and of other races to include in the analyses. Women were excluded if no data could be linked from the MDR (12 women). The receipt of mastectomy and reconstructive surgery was determined by combining data from the CCR and MDR and was considered "yes" if either database recorded their occurrence. In the CCR, mastectomy was defined as the receipt of total/simple, modified radical, radical, or extended radical mastectomies or mastectomy, not otherwise specified. In the MDR, mastectomy was defined based on CPT or ICD-9 codes. Based on CPT codes, if codes 19180, 19200, 19220, 19240, 19303, or 19305 through 19307 were recorded, the women were then considered to have undergone a mastectomy. If any of these CPT codes were reported with a modifier code of 50 or 09950 then the mastectomy was classified as bilateral. If there was no modifier code reported, the mastectomy was then classified as unilateral. Based on ICD-9 codes, if codes 85.42, 85.44, 85.46, or 85.48 was reported then the mastectomy was classified as bilateral; if codes 85.41, 85.43, 85.45, or 85.47 were reported, the mastectomy was classified as unilateral. If there were indications that a woman had undergone 2 unilateral procedures on 2 different dates then she was classified as having undergone a bilateral mastectomy. To capture both immediate and delayed procedures, receipt of reconstructive surgery within 12 months of mastectomy was defined by CPT codes 19340, 19342, 19350, 19357, 19361, 19364, or 19366 through 19369 or ICD-9 codes 85.33, 85.35, 85.53, 85.54, 85.7x, 85.84, 85.85, 85.93, and 85.95, which is similar to a previous study.⁷

Demographic variables and tumor characteristic data were obtained from the CCR. Tumor stage was defined by the sixth edition of the American Joint Committee on Cancer²⁰ and classified as stages I, II, III, IV, and unknown. Tumor grade (ICD-O) was classified as 1 (well differentiated), 2 (moderately differentiated), 3

TABLE 1. Distribution of Demographics, Tumor and Health Characteristics, and Cancer Treatments Among Women Diagnosed With Breast Cancer Who Underwent a Mastectomy: Military Health System, 1998 to 2007

Characteristic	Race ^a				P ^b
	White (N=2974)		Black (N=708)		
	No.	%	No.	%	
Age, y					
21-49	1104	37.1	399	56.4	<.01
50-64	1312	44.1	239	33.8	
65-75	558	18.8	70	9.9	
Marital status					
Married	2433	81.8	544	76.8	<.01
Not married	480	16.1	142	20.1	
Unknown	61	2.1	22	3.1	
Duty status					
Nonactive duty	2833	95.3	600	84.7	<.01
Active duty	141	4.7	108	15.3	
Beneficiary type					
Prime	2024	68.1	523	73.9	<.01
Not Prime	333	11.2	60	8.5	
Unknown	617	20.7	125	17.7	
Rank of sponsor					
Enlisted	1874	63.0	603	85.2	<.01
Officer	1066	35.8	95	13.4	
Other/unknown	34	1.1	10	1.4	
Year of diagnosis					
1998	381	12.8	77	10.9	.04
1999	388	13.0	81	11.4	
2000	334	11.2	73	10.3	
2001	313	10.5	64	9.0	
2002	338	11.4	71	10.0	
2003	277	9.3	67	9.5	
2004	262	8.8	69	9.7	
2005	259	8.7	67	9.5	
2006	203	6.8	69	9.7	
2007	219	7.4	70	9.9	
AJCC tumor stage					
I	1108	37.3	178	25.1	<.01
II	1196	40.2	311	43.9	
III	432	14.5	153	21.6	
IV	71	2.4	24	3.4	
Unknown	167	5.6	42	5.9	
Tumor grade					
1	509	17.1	78	11.0	<.01
2	1103	37.1	242	34.2	
3-4	984	33.1	311	43.9	
Unknown	378	12.7	77	10.9	
Hormone receptor status					
ER+ and/or PR+	2000	67.2	415	58.6	<.01
ER- and PR-	570	19.2	209	29.5	
Unknown	404	13.6	84	11.9	
Charlson comorbidity index					
0	2385	80.2	568	80.2	.56
1	397	13.3	101	14.3	
>1	192	6.5	39	5.5	
Radiotherapy					
No	1800	60.5	352	49.7	<.01
Yes	1174	39.5	356	50.3	
Chemotherapy					
No	970	32.6	149	21.0	<.01
Yes	2004	67.4	559	79.0	

TABLE 1. Continued

Characteristic	Race ^a				P ^b
	White (N=2974)		Black (N=708)		
	No.	%	No.	%	
Hormonal therapy ^c					
No	728	36.4	181	43.6	.02
Yes	1148	57.4	211	50.8	
Unknown	124	6.2	23	5.5	
Mastectomy					
Unilateral	2662	89.5	657	92.8	<.01
Bilateral	312	10.5	51	7.2	
Reconstruction					
No	2058	69.2	477	67.4	.35
Yes	916	30.8	231	32.6	

Abbreviations: +, positive; -, negative; AJCC, American Joint Committee on Cancer; ER, estrogen receptor; PR, progesterone receptor.

^aAll patients were non-Hispanic.

^bDerived using the chi-square test.

^cAmong women with ER-positive and/or PR-positive tumors.

to 4 (poorly or undifferentiated), and unknown. Hormone receptor status was considered positive if either estrogen receptor or progesterone receptor status was recorded as positive, negative if both estrogen receptor and progesterone receptor were negative, and unknown if neither measure was recorded. Triple-negative status could not be determined because data regarding human epidermal growth factor receptor 2/*neu* expression were not available. Comorbidities were considered to be present if a diagnosis was recorded in the MDR during the 12 months before breast cancer diagnosis. To minimize the possibility of false comorbidity diagnoses, codes had to be recorded in the inpatient data at least once and in the outpatient data at least 3 times. The level of comorbidity present was categorized according to the Charlson comorbidity index,²¹ excluding breast cancer diagnoses. The receipt of breast cancer treatments (radiotherapy, chemotherapy and hormonal therapy) were each considered to be “yes” based on a combination of the CCR and MDR data.

Statistical Analysis

During data analysis, the distributions of demographics, tumor and health characteristics, and cancer treatments were compared between white and black women using chi-square tests. Variables assessed included age at diagnosis, marital status (married, not married, never married, separated, divorced, and unknown), active-duty status, beneficiary type (TRICARE prime: health maintenance organization component, TRICARE nonprime, and unknown), military rank of sponsor (enlisted,

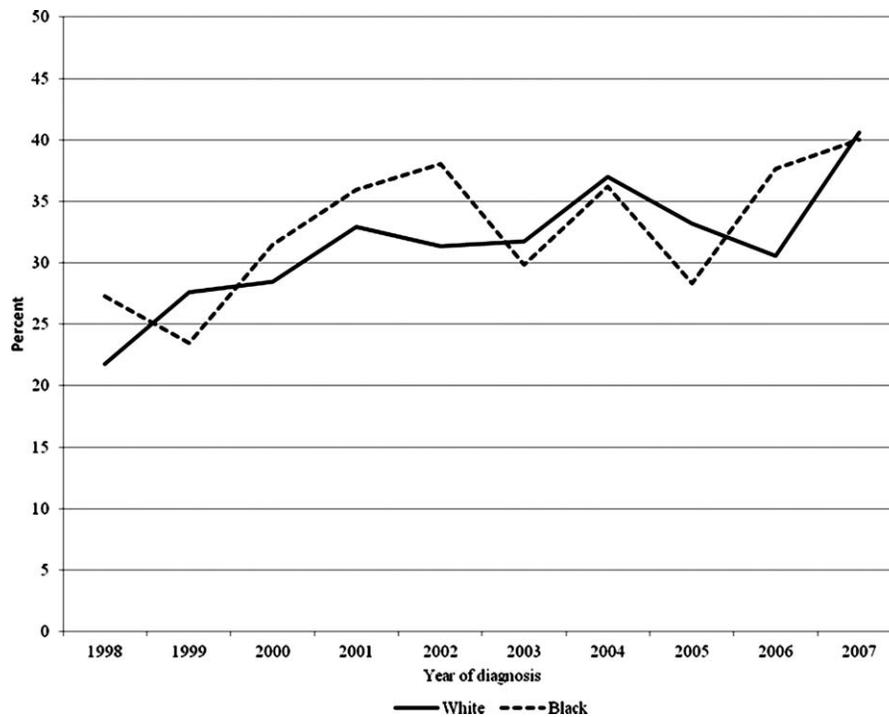


Figure 1. Receipt of reconstructive surgery after mastectomy is shown among women diagnosed with breast cancer in the Military Health System between 1998 and 2007.

officer, and unknown), year of diagnosis, tumor characteristics (stage, grade, and hormone receptor status), Charlson comorbidity index, and cancer treatments (radiotherapy, chemotherapy, and hormonal therapy). Temporal trends in the receipt of reconstructive surgery by race (2007 vs 1998) were explored graphically and via chi-square tests. Chi-square tests were also conducted to determine whether there was a significant racial difference in the receipt of reconstructive surgery for any given diagnosis year. Logistic regression was used to assess receipt of reconstructive surgery by race after adjustment for all variables that were either significant during bivariate analyses and/or were theoretical confounders (eg, comorbidity level). All statistical analyses were performed using SAS statistical software (version 9.3; SAS Institute Inc, Cary, NC); the 2-sided significance level was set at $P < 0.05$.

RESULTS

The distributions of demographics, tumor and health characteristics, and cancer treatments by race are presented in Table 1. In comparison with white patients, black patients were more likely to be younger, not married, active-duty beneficiaries, TRICARE Prime beneficiaries, diagnosed in later years, and to have enlisted

sponsors and more advanced disease ($P < .04$). Black women were more likely to undergo unilateral mastectomies and to receive radiotherapy and chemotherapy compared with white women ($P < .01$). Black women were also less likely to have hormone receptor-positive tumors and to receive hormone therapy than white women ($P < .01$). There was no indication that the receipt of reconstruction varied by race (30.8% for white women vs 32.6% for black women; $P = .35$).

As indicated in Figure 1, from 1998 to 2007 the rate of reconstruction increased among both white women (21.8% to 40.6%) and black women (27.3% to 40.0%). There was no indication of a significant racial difference in the receipt of reconstruction during any of the included calendar years (P values of $> .05$).

Results from multivariate logistic regression, which are presented in Table 2, indicated no significant difference in the receipt of reconstruction between white and black women after adjustment for covariates (odds ratio, 0.93; 95% confidence interval, 0.76-1.15). Furthermore, no racial difference was observed when stratified by age, marital status, beneficiary type, or tumor stage (data not shown); thus, there was no indication of effect modification by these covariates. However, the likelihood of reconstruction did decrease significantly with increasing age

and tumor stage and with receipt of radiotherapy (Table 2). The likelihood of reconstruction was also significantly

TABLE 2. Multivariate Analysis Assessing the Receipt of Reconstructive Surgery Among Women Diagnosed With Breast Cancer Who Underwent a Mastectomy: Military Health System, 1998 to 2007

Characteristic	OR ^a	95% CI
Race		
White	1.00	Referent
Black	0.93	0.76-1.15
Age (continuous)	0.94	0.93-0.95*
Marital status		
Married	1.00	Referent
Not married	0.88	0.70-1.11
Unknown	1.00	0.59-1.70
Charlson comorbidity index		
0	1.00	Referent
1	0.96	0.75-1.21
>1	0.69	0.47-1.01
Duty status		
Nonactive duty	1.00	Referent
Active duty	1.93	1.42-2.63*
Beneficiary type		
Prime	1.00	Referent
Not Prime	0.82	0.60-1.12
Unknown	0.76	0.59-0.98*
Rank of sponsor		
Enlisted	1.00	Referent
Officer	1.40	1.19-1.66*
Other/unknown	0.79	0.36-1.75
Year of diagnosis		
1998	1.00	Referent
1999	1.17	0.84-1.64
2000	1.18	0.83-1.68
2001	1.81	1.27-2.57*
2002	1.59	1.13-2.25*
2003	1.42	0.98-2.05
2004	1.87	1.29-2.72*
2005	1.52	1.04-2.22*
2006	1.66	1.12-2.46*
2007	2.37	1.61-3.47*
AJCC tumor stage		
I	1.00	Referent
II	0.65	0.53-0.79*
III	0.48	0.36-0.65*
IV	0.23	0.12-0.43*
Unknown	0.75	0.52-1.09
Tumor grade		
1	1.00	Referent
2	1.23	0.98-1.54
3-4	0.91	0.71-1.18
Unknown	1.01	0.75-1.37
Hormone receptor status		
ER+ and/or PR+	1.00	Referent
ER- and PR-	0.81	0.65-1.02
Unknown	0.83	0.64-1.06
Radiotherapy		
No	1.00	Referent
Yes	0.49	0.41-0.59*
Chemotherapy		
No	1.00	Referent
Yes	0.90	0.73-1.12
Hormonal therapy		
No	1.00	Referent
Yes	1.08	0.91-1.29
Unknown	1.16	0.82-1.64

TABLE 2. Continued

Characteristic	OR ^a	95% CI
Mastectomy		
Unilateral	1.00	Referent
Bilateral	1.21	0.95-1.55

Abbreviations: +, positive; -, negative; 95% CI, 95% confidence interval; AJCC, American Joint Committee on Cancer; ER, estrogen receptor; OR, odds ratio; PR, progesterone receptor.

^aAdjusted for all listed variables.

*means $p < 0.05$.

higher in more recent years and among active service-women, TRICARE Prime beneficiaries, and beneficiaries with officer sponsors.

DISCUSSION

The rate of breast reconstruction among women undergoing mastectomy was observed to increase during the study period among both white and black women. Although the receipt of reconstruction was found to vary by covariates, there was no indication of racial variation among DoD beneficiaries.

Regardless of race, approximately 40% of the women in the MHS who underwent a mastectomy underwent reconstruction in 2007. In agreement with previous studies,⁷⁻¹² reconstruction rates increased after 1998, which is likely due, at least in part, to the WHCRA. It is difficult to compare reconstruction rates between the current study and other studies, given that the definitions of reconstruction and patient demographics have varied widely across studies. For example, although Albornoz et al⁷ assessed reconstruction rates using the same inpatient claims codes during a very similar time period (1998-2008), this previous study did not consider outpatient claims and included only immediate reconstruction procedures. Therefore, even though the reconstruction rates observed in this previous study (20.8% in 1998 and 37.8% in 2008) appear similar to those from the current study, it is unclear whether the rates would remain similar if differences in the definition of reconstruction and population demographics were taken into account.

The current finding of no racial difference in the receipt of reconstruction is in contrast to previous studies.¹⁰⁻¹⁵ In the United States, black individuals are less likely than white individuals to have health insurance.^{16,17} Therefore, it is plausible that racial differences in health care access were responsible for the previous findings, even though many of the previous studies¹⁰⁻¹² continued to observe racial differences after adjusting for health insurance status. However, given that the previous studies

broadly categorized health insurance status (eg, private, Medicare, and Medicaid), there still may have been residual confounding. In the MHS, breast reconstruction procedures are performed at minimal cost to the patient and access to care is equal between racial groups, which likely accounted for the lack of racial differences observed in the current study. However, it cannot be ruled out that women in the MHS are more homogenous than women in the general population. After all, these women included belong to a very selective group, both directly if the woman was a service member and indirectly if the woman was a dependent of a service member. Similar to previous findings, in the current study older age, later tumor stage, and receipt of radiotherapy were found to be associated with a decreased likelihood of reconstruction. We found that active-duty women were more likely to undergo reconstruction than non-active-duty women, independent of age, and we can only speculate as to why this difference was observed. Therefore, this observation should be explored further.

A main strength of the current study was the ability to assess racial disparities in a setting in which health care access has been equalized. Additional strengths of the current study were the large sample size and the ability to assess and adjust for demographics, tumor characteristics, and comorbidities, which was possible by combining cancer registry data and medical claims data. Finally, in contrast to previous claims-based studies, the current study included both outpatient and inpatient claims data to obtain a more complete assessment of reconstructive procedures. Limitations of the current study included those inherent to using medical administrative databases, such as coding inaccuracies and incomplete data. Claims for health care provided outside of the MHS are not submitted to the DoD if a woman has supplemental health insurance. However, it does not appear that this possible limitation affected our main findings; no racial difference in reconstruction was observed when restricted to women with TRICARE Prime (data not shown), which is a health maintenance organization-like program that includes cost incentives for beneficiaries to obtain all health care services through the DoD. Another limitation was the inability to control for other possible confounders such as geographical location and density of plastic surgeons. However, given that DoD beneficiaries move around more frequently and are cared for within a more contained health care system, we do not believe that variations in these variables could account for the findings of the current study.

In the current study, white and black women were found to have a similar likelihood of receiving postmastec-

tomy reconstruction within an equal-access health care system. However, even with accessible health care, a large percentage of breast cancer patients do not undergo post-mastectomy reconstruction. Additional research to elucidate the reasons why many women do not receive reconstruction might be beneficial, particularly because these procedures have been associated with noncosmetic benefits.

FUNDING SUPPORT

Supported by the John P. Murtha Cancer Center of Walter Reed National Military Cancer Center via the Uniformed Services University of the Health Sciences under the auspices of the Henry M. Jackson Foundation for the Advancement of Military Medicine.

CONFLICT OF INTEREST DISCLOSURES

The authors made no disclosures.

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