

The National Utilization of Immediate and Early Delayed Breast Reconstruction and the Effect of Sociodemographic Factors

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The purpose of this study was to identify important sociodemographic factors affecting the utilization of immediate and early delayed postmastectomy breast reconstruction in the United States. Using the Surveillance, Epidemiology, and End Results (SEER) program, all cases of mastectomy-treated breast cancer that were reported to a SEER registry in 1998 were identified. Data were limited to reconstructions within the first 4 months postmastectomy, and logistic regression was used to analyze the effects of sociodemographic variables on reconstruction rates. Of the 10,406 mastectomy-treated breast cancer patients, 1607 (15 percent) underwent reconstruction within the first 4 months postmastectomy. Compared with women 45 to 54 years old, those 35 to 44 years old were significantly more likely to have breast reconstruction (OR = 1.52, $p < 0.001$), but women 55 to 64, 65 to 74, and 75 years and older were significantly less likely to have reconstruction (OR = 0.42, $p < 0.001$; OR = 0.16, $p < 0.001$; OR = 0.04, $p < 0.001$, respectively). Compared with Caucasian women, African American, Hispanic, and Asian women were significantly less likely to have reconstruction (OR = 0.48, $p < 0.001$; OR = 0.45, $p < 0.001$; OR = 0.29, $p < 0.001$, respectively). In addition, a four-fold difference in reconstruction rates existed in high-use versus low-use regions. With regard to the type of reconstruction, patients younger than 35 and 65 to 74 years old were significantly less likely to receive autogenous tissue reconstruction compared with women 45 to 54 years old (OR = 0.47, $p = 0.047$; OR = 0.61, $p = 0.031$, respectively). However, African Americans were significantly more likely to receive autogenous tissue reconstructions compared with Caucasians (OR = 2.03, $p = 0.021$). According to these data, the utilization of immediate and early delayed breast reconstruction in the United States is low and is significantly influenced by patients' age, race, and geographic location. Further research is needed to evaluate the impact of provider bias, patient preference, and barriers to care on the utilization of breast reconstruction in

the United States. (*Plast. Reconstr. Surg.* 111: 695, 2003.)

Breast cancer is a concern to every American woman, regardless of race or socioeconomic status. Fortunately, progress is occurring in the detection and treatment of the disease and in postmastectomy reconstruction. More than three decades have passed since the introduction of silicone implants for breast reconstruction in 1971, which many surgeons mark as the beginning of the modern era of breast reconstruction.¹ Since then, immediate breast reconstructions with either autogenous tissue or expander/implants have proved to be safe procedures associated with high patient satisfaction and improved psychosocial well being.²⁻⁴ Immediate and early delayed reconstructions have also gained popularity in the surgical community, especially as the risks of masking a cancer recurrence with reconstruction have proved to be minimal.² However, despite the benefits and safety of reconstruction, the national rates of immediate and early delayed breast reconstruction in the postmastectomy population are unknown. Because breast cancer is the most common cancer affecting American women, the use of postmastectomy breast reconstruction and its distribution among women with different sociodemographic back-

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grounds is highly relevant to current U.S. health services research.⁵

The purpose of our study was to describe the national utilization of immediate and early delayed breast reconstruction in the postmastectomy population. To enrich the study, we also evaluated the impact of sociodemographic factors on reconstruction rates while controlling for disease severity. Identifying disparities in the delivery of health care resources is the first step toward ensuring equality in the health of the population.

METHODS

Database Characteristics

The Surveillance, Epidemiology, and End Results (SEER) program of the National Cancer Institute is one of the most comprehensive sources of information on cancer incidence in the United States. SEER incorporates epidemiologically significant population subgroups into the sample population, focusing on income and education parameters, which enhances the generalizability of the sample to the general U.S. population.⁶ The SEER database includes 11 national registries that represent approximately 14 percent of the U.S. population.⁶ The registries include San Francisco, Connecticut, Metro Detroit, Hawaii, Iowa, New Mexico, Seattle (Puget Sound), Utah, Metro Atlanta, San Jose-Monterey, and Los Angeles. Patients from all types of health care systems and insurance carriers are included.

Study Population

From the SEER public-use data file, we obtained data on all 1998 mastectomy-treated breast cancer cases reported to a SEER registry. Our target population, women with breast cancer, was identified using the International Classification of Diseases for Oncology (ICD-O) diagnostic codes. Men with breast cancer were excluded from the analyses. The cases included were intraductal carcinoma (ICD-O 8500), lobular carcinoma (ICD-O 8520), infiltrating ductal carcinoma (ICD-O 8521), intraductal and lobular carcinoma (ICD-O 8522), Paget disease (ICD-O 8540), Paget disease and infiltrating duct carcinoma (ICD-O 8541), and Paget disease and intraductal carcinoma (ICD-O 8543). Patients with inflammatory carcinoma of the breast were excluded, since the majority of these women do not undergo reconstruction because of the severity of the dis-

ease; this should not be considered underutilization of reconstructive surgery. Cases were selected if one of the following procedures had been performed: simple mastectomy, modified radical mastectomy, radical mastectomy, extended radical mastectomy, or mastectomy not otherwise specified. We excluded patients undergoing partial and subcutaneous mastectomies, because these procedures are not generally considered standard therapies for breast cancer and partial mastectomies do not routinely require reconstruction. The inclusion of partial mastectomies would underestimate the use of reconstruction. The data on reconstruction were limited to the first course of reconstruction performed within 4 months of the mastectomy.

Data Analysis

Two logistic regression models were analyzed. In one, the primary dependent variable of interest was receipt of immediate breast reconstruction (yes/no). In the second model, the type of reconstruction was analyzed and the primary dependent variable was receipt of an autogenous tissue reconstruction (yes/no). Patients were considered to have an autogenous tissue reconstruction if a muscle flap was used in the reconstruction, regardless of whether or not an implant was used in addition. In this model, we were analyzing factors that affected the aggressiveness of reconstruction, with autogenous tissue reconstructions representing a more aggressive treatment method than implants because of the longer operative time and hospitalization associated with autogenous tissue reconstructions. Therefore, we combined patients who had autogenous tissue-only reconstructions with those who had muscle flap procedures augmented with implants, because the addition of implants does not significantly affect the postoperative course. In both models, the effects of patient age, race, marital status, and geographic treatment location on the two dependent variables were evaluated while controlling for the stage of disease and the use of adjuvant radiotherapy.

Race was broadly defined in the database and encompassed many different categories. To create a more complete race variable, we combined white Hispanics with black Hispanics to form a general Hispanic category; Chinese, Japanese, Filipino, and Hawaiians were combined into an Asian category; and American Indians, a very small population, were combined with cases coded in the "other" category.

SEER used the American Joint Committee on Cancer Third Edition coding system for disease staging, with patients categorized as stages I through IV. We dichotomized the marital status variable by combining the single, divorced, separated, and widowed cases into an unmarried category; and we dichotomized radiotherapy by combining beam, radioactive implants, radioisotopes, and unspecified radiotherapy into a general radiotherapy category.

In the regressions, women 45 to 54 years old, Caucasian race, and stage II disease were chosen as reference groups because the majority of breast cancer cases were in these categories. San Francisco, which had the most representative racial distribution, was chosen as the registry reference group because it also had midrange reconstruction rates compared with the other registries. We also had no reason to expect any particular registry to display significant variations in practice compared with the other registries. All analyses were performed with Stata (College Station, Texas) version 6.0 statistical software package, and statistical significance was set at $p \leq 0.05$.

RESULTS

For 1998, the 11 national SEER registries had data on 10,404 mastectomy-treated breast cancer cases. Of these patients, 1607 (15.4 percent) received breast reconstruction within the first 4 months postmastectomy. Table I summarizes the sociodemographic characteristics of the study population. The mean ages of patients with and without breast reconstruction were 50.3 and 63.1 years, respectively. In all age groups, the majority of patients did not have reconstruction, even in the group younger than age 35. As age or stage of disease increased, the proportion of patients undergoing reconstruction declined. Furthermore, the SEER registries displayed varying rates of reconstruction. Atlanta reported the highest rate of immediate reconstruction (33.6 percent of mastectomy patients), and Hawaii had the lowest rate (7.6 percent)—a four-fold difference in rates.

Table II displays the results of the first logistic regression model, which evaluated the effects of sociodemographic variables on receipt of immediate and early delayed postmastectomy breast reconstruction. Patient age was a significant predictor of reconstruction. Compared with women between 45 and 54 years of age (and controlling for other variables in the

TABLE I
1998 SEER Mastectomy-Treated Breast Cancer
Population Characteristics*

	Reconstruction (%)	No Reconstruction (%)	Total
<i>n</i>	15.4	84.5	10406
Age (yrs)			
< 35	26.7	73.3	221
35-44	33.6	66.4	1233
45-54	27.4	72.6	2323
55-64	14.8	85.2	2114
65-74	6.4	93.6	2260
≥ 75	1.7	98.3	2255
Race			
Caucasian	16.7	83.4	7801
African American	16.1	83.9	791
Hispanic	11.1	88.9	736
Asian/other	7.7	92.3	961
Marital status			
Married	18.2	81.8	5756
Not married	12.0	88.0	4650
Stage of disease			
In situ	32.1	67.9	1022
Stage I	14.9	85.1	3152
Stage II	13.9	86.1	4031
Stage III	9.6	90.4	857
Stage IV	9.1	90.9	230
Adjuvant radiotherapy	12.7	87.3	1548
SEER registry†			
San Francisco	16.7	83.3	1226
Connecticut	9.2	90.8	963
Metro Detroit	22.9	77.1	1332
Hawaii	7.6	92.4	367
Iowa	8.8	91.2	1310
New Mexico	14.4	85.7	446
Seattle (Puget Sound)	11.6	88.4	907
Utah	17.1	82.9	461
Metro Atlanta	33.6	66.4	643
San Jose-Monterey	17.2	82.8	727
Los Angeles	13.6	86.4	2024

* SEER, Surveillance, Epidemiology, and End Results.

† The rate is calculated by dividing the number of patients who underwent reconstruction by the total number of mastectomy-treated breast cancer patients in that registry.

model), those in the younger age category, 35 to 44 years old, were significantly more likely to receive reconstruction (OR = 1.52, $p < 0.001$). However, in the older age groups, reconstruction rates were significantly lower. Compared with the odds of reconstruction for women 45 to 54 years old (and controlling for the covariates in the model), the odds of reconstruction were 0.42 for women between 55 and 64 years, (OR = 0.42, $p < 0.001$), and the odds of reconstruction were even less in those between 65 and 74 and 75 years and older (OR = 0.16, $p < 0.001$; OR = 0.04, $p < 0.001$, respectively).

Race was also a significant predictor of reconstruction. Compared with the odds of reconstruction for Caucasians and controlling for the other variables in the model, the odds of reconstruction for African Americans, His-

TABLE II
A Logistic Regression of the Predictors of Immediate and Early Delayed Breast Reconstruction in the 1998 SEER Population*

Independent Variable	Adjusted OR	95% CI	<i>p</i>
Age (yrs)			
< 35	1.24	0.86, 1.79	0.246
35-44	1.52	1.28, 1.80	< 0.001
45-54†	-	-	-
55-64	0.42	0.35, 0.49	< 0.001
65-74	0.16	0.13, 0.19	< 0.001
> 75	0.04	0.03, 0.06	< 0.001
Race			
African American	0.51	0.40, 0.65	< 0.001
Hispanic	0.47	0.36, 0.62	< 0.001
Asian/other	0.30	0.23, 0.40	< 0.001
Caucasian†	-	-	-
Marital status‡	0.91	0.80, 1.04	0.18
Registry			
San Francisco†	-	-	-
Connecticut	0.37	0.28, 0.51	< 0.001
Metro Detroit	1.36	1.08, 1.71	0.009
Hawaii	0.56	0.34, 0.91	0.020
Iowa	0.47	0.36, 0.62	< 0.001
New Mexico	0.76	0.53, 1.09	0.134
Seattle (Puget Sound)	0.57	0.43, 0.77	< 0.001
Utah	0.75	0.54, 1.04	0.087
Metro Atlanta	2.49	1.90, 3.27	< 0.001
San Jose-Monterey	1.05	0.80, 1.39	0.713
Los Angeles	0.84	0.66, 1.05	0.125
Stage of disease			
In situ	2.44	2.03, 2.94	< 0.001
Stage I	1.25	1.07, 1.45	0.005
Stage II†	-	-	-
Stage III	0.63	0.49, 0.83	0.001
Stage IV	0.61	0.37, 1.01	0.056
Adjuvant radiotherapy*§	0.71	0.58, 0.86	0.001

* SEER, Surveillance, Epidemiology, and End Results; OR, odds ratio; CI, confidence interval.

† Reference group.

‡ Married patients comprise the reference group.

§ Patients who received radiotherapy comprise the reference group.

panics, and Asians significantly decreased (OR = 0.51, $p < 0.001$; OR = 0.47, $p < 0.001$, OR = 0.30, $p < 0.001$, respectively). In addition, the geographic treatment location significantly affected a woman's chance of reconstruction. Compared with San Francisco, six of the 10 registries had significantly different reconstruction rates. For example, while controlling for the other covariates, a Detroit woman's odds of reconstruction increased to 1.36 (OR = 1.36, $p = 0.009$), but the odds of reconstruction for an Iowa woman decreased to 0.47 (OR = 0.47, $p < 0.001$) compared with the odds of reconstruction for a woman living in San Francisco. However, marital status did not seem to significantly affect the odds of reconstruction.

Clinical factors—stage of disease and radiotherapy—also significantly influenced reconstruction rates. Compared with stage II cases, in situ and stage I cases were significantly more

likely to receive breast reconstruction (OR = 2.44, $p < 0.001$; OR = 1.25, $p = 0.005$, respectively); however, stage III cases were significantly less likely to receive reconstruction (OR = 0.63, $p = 0.001$), with a similar trend with stage IV cases (OR = 0.61, $p = 0.056$). As expected, patients who received adjuvant radiotherapy were significantly less likely to have immediately reconstruction (OR = 0.71, $p = 0.001$).

Of the 1607 immediate and early delayed postmastectomy breast reconstructions reported, 672 (41.8 percent) were autogenous tissue (muscle flap) reconstructions, 386 (24.0 percent) were implants, and 185 (11.5 percent) were combined flap/implant procedures (Table III). Combining the combined flap/implant cases with the autogenous reconstruction group provides a 2:1 incidence of autogenous versus implant reconstructions for 1998. Table IV displays the sociodemographic and clinical characteristics of the implant and autogenous tissue reconstruction groups. Proportionately fewer cases received autogenous tissue reconstruction in the younger and older age categories; however, compared with other race categories, African Americans received proportionately more autogenous tissue reconstructions. Furthermore, the proportion of patients undergoing reconstruction with autogenous tissue seemed to differ by geographic treatment location because 83.6 percent of Seattle's and 83.2 percent of Atlanta's cases had autogenous tissue reconstructions compared with 53.7 percent of Iowa's and 53.5 percent of San Jose-Monterey's cases.

Table V shows the results of the second logistic regression model, which evaluated the predictors of the receipt of autogenous tissue reconstruction. While controlling for the other variables, women younger than 35 and those

TABLE III
Distribution of the Types of Immediate and Early Delayed Breast Reconstruction in the SEER Population for 1998*

Type of Reconstruction	<i>n</i>	%
Implant reconstruction	386	24.0
Reconstruction with flap	222	13.8
Latissimus dorsi flap reconstruction	43	2.7
TRAM reconstruction	407	25.3
Flap (type unspecified) with implant reconstruction	92	5.7
Latissimus dorsi flap with implant reconstruction	49	3.0
TRAM flap with implant reconstruction	44	2.7
Reconstruction, type unspecified	364	22.7

* SEER, Surveillance, Epidemiology, and End Results; TRAM, transverse rectus abdominis musculocutaneous.

TABLE IV
Sociodemographic Distribution of the Mastectomy-Treated Breast Cancer SEER Population by Type of Breast Reconstruction in 1998*

	Implant Reconstruction (%)	Autogenous Tissue Reconstruction† (%)	Total
<i>n</i> ‡	31.1	69.9	1243
Age (yrs)			
< 35	40.9	59.1	44
35-44	27.8	72.2	324
45-54	30.0	70.0	487
55-64	28.3	71.7	240
65-74	42.6	57.4	115
≥ 75	45.5	54.5	33
Race			
Caucasian	32.5	67.5	987
African American	15.7	84.3	102
Hispanic	29.2	70.8	72
Asian/other	33.9	66.1	65
Marital status			
Married	30.5	69.5	802
Not married	32.0	68.0	441
SEER registry			
San Francisco	30.5	69.5	164
Connecticut	29.5	70.5	44
Metro Detroit	30.4	69.9	237
Hawaii	33.3	66.7	21
Iowa	46.3	53.7	67
New Mexico	34.6	65.4	55
Seattle (Puget Sound)	16.4	83.6	55
Utah	26.3	73.7	57
Metro Atlanta	17.7	82.3	192
San Jose-Monterey	46.5	53.5	114
Los Angeles	35.0	65.0	237
Stage of disease			
In situ	36.5	63.5	271
Stage I	34.7	65.3	343
Stage II	25.6	74.4	450
Stage III	31.2	68.8	61
Stage IV	31.6	68.4	19
Adjuvant radiotherapy	26.9	73.1	160

* SEER, Surveillance, Epidemiology, and End Results.

† Includes muscle flap reconstructions with and without the additional use of implants.

‡ A total of 364 unspecified types of reconstruction.

65 to 74 years old were significantly less likely to receive an autogenous tissue reconstruction compared with those 45 to 54 years old (OR = 0.47, *p* = 0.047; OR = 0.61, *p* = 0.031, respectively). However, African Americans were significantly more likely to receive an autogenous tissue reconstruction compared with Caucasians (OR = 2.03, *p* = 0.021). Marital status did not seem to be a significant predictor of the type of reconstruction, and geographic treatment location seemed to have only a mild effect, because only two of the 10 registries had significantly different autogenous tissue reconstruction rates compared with the San Francisco registry.

Clinical factors seemed to have less predic-

tive power over the type of reconstruction compared with the receipt of reconstruction. Women with in situ or stage I disease were significantly less likely to receive an autogenous tissue reconstruction compared with stage II cases (OR = 0.58, *p* = 0.002; OR = 0.67, *p* = 0.020). However, no statistically significant difference in the type of reconstruction was seen in stage III or IV cases or in cases that received radiotherapy.

DISCUSSION

In the United States, at least one woman in nine can expect to fall victim to breast cancer during her lifetime.⁵ As noted in the SEER database, mastectomy is still a frequently used treatment option. For women undergoing mastectomy, recent advances in both implant and

TABLE V
A Logistic Regression of the Predictors of Immediate and Early Delayed Autogenous Tissue Breast Reconstruction in the 1998 SEER Population (*n* = 857)*

Independent Variable	Adjusted OR	95% CI	<i>p</i>
Age (yrs)			
< 35	0.47	0.22, 0.99	0.047
35-44	1.03	0.74, 1.45	0.844
45-54†	-	-	-
55-64	1.17	0.80, 1.70	0.417
65-74	0.61	0.38, 0.95	0.031
≥ 75	0.51	0.22, 1.16	0.109
Race			
African American	2.03	1.11, 3.68	0.021
Hispanic	1.24	0.70, 2.20	0.456
Asian/other	0.96	0.52, 1.77	0.896
Caucasian‡	-	-	-
Marital status‡	0.85	0.64, 1.13	0.261
Registry			
San Francisco‡	-	-	-
Connecticut	0.87	0.40, 1.90	0.733
Metro Detroit	0.88	0.55, 1.40	0.586
Hawaii	0.77	0.25, 2.33	0.645
Iowa	0.44	0.23, 0.82	0.010
New Mexico	0.67	0.33, 1.35	0.263
Seattle (Puget Sound)	2.38	0.98, 5.77	0.056
Utah	1.33	0.63, 2.82	0.460
Metro Atlanta	1.61	0.95, 2.76	0.079
San Jose-Monterey	0.53	0.31, 0.88	0.015
Los Angeles	0.74	0.46, 1.17	0.195
Stage of disease			
In situ	0.58	0.40, 0.82	0.002
Stage I	0.67	0.48, 0.94	0.020
Stage II†	-	-	-
Stage III	0.87	0.46, 1.62	0.653
Stage IV	0.64	0.21, 1.90	0.422
Adjuvant radiotherapy§	1.37	0.87, 2.13	0.172

* Flap procedures included those with and without the use of implant devices.

† Reference group.

‡ Married patients comprise the reference group.

§ Patients who received radiotherapy comprise the reference group.

SEER, Surveillance, Epidemiology, and End Results; OR, odds ratio; CI, confidence interval.

autogenous tissue techniques provide safe reconstructive options with significant quality-of-life benefits.^{4,7-9} In the past decade, practice patterns have undergone a gradual shift away from delayed reconstructions and toward more immediate techniques. Many surgeons no longer believe that a woman must temporarily live with her deformity to appreciate her eventual reconstruction.^{2,10} However, the rate for the utilization of immediate and early delayed breast reconstruction in the United States is relatively unknown, because data have been limited to the statewide level.¹¹

In 1998, 15.4 percent of the SEER population received immediate and early delayed breast reconstruction, which is similar to a previous statewide estimate of 15.6 percent.¹¹ The appropriateness of this rate of reconstruction—too high, too low, or appropriate—needs further exploration. Patient knowledge, health status, and preferences must be investigated as possible explanations.¹² The other participants in the current health-care decision-making process—providers and payers—are also likely to have a significant impact on reconstructive choices. Until we have studied these and other factors affecting women's reconstruction decisions, we will be unable to determine what an "appropriate" rate for breast reconstruction might be. Because these procedures have demonstrated psychosocial benefits for recovering mastectomy patients, defining the "right" rate for breast reconstruction has clear policy implications for women's health.

The impact of sociodemographic factors on the rate of reconstructive breast surgery is of concern. Since the Whitehall study in the 1960s, researchers continue to find examples of the disturbing relationship between social class and health status.¹³ Race, sex, age, and socioeconomic status are important determinants of health in America's society.¹⁴ Apparently, access to breast reconstruction is no exception. An underlying cultural assumption exists that breast reconstruction is for the young and sexually active.¹⁴ Cultural bias can influence physicians' referral patterns or can be internalized by older patients, affecting the decision-making process for reconstructive surgery. The effect of age on breast reconstruction in the SEER population was striking, especially in women 55 to 64 years old, whose odds of reconstruction decreased to 0.42 compared with the odds of reconstruction for women 45

to 54 years old. In addition, 43.4 percent of breast cancer cases were in the 65 to 74 and 75 years and older age groups, but the odds of reconstruction for these women was significantly low (OR = 0.16 and OR = 0.04, respectively). The reason for this age effect on reconstruction is unclear. Our research, in addition to other researchers' findings, has supported the safety of reconstruction in older women.¹⁵⁻¹⁷ However, the attitudes of referring physicians and reconstructive surgeons toward breast reconstruction in the older population and the reconstructive preferences of older patients have not been studied. Older women tend to be more passive health-care consumers and give physicians greater power in the decision-making process, making these women "susceptible" to physician biases.¹⁸ On the other hand, older women may have different priorities and different perceptions of mortality, which may influence their decision with regard to reconstructive surgery.¹⁴

Disparities in utilization of health care resources between racial/ethnic minorities and whites have been well documented in many areas of medicine. Compared with Caucasians, African Americans often receive less medical care, receive less aggressive treatment interventions, and are diagnosed at later stages of disease.¹⁹⁻²² Economic status may confound the effect of race on receipt of reconstruction and, unfortunately, the SEER database does not contain socioeconomic data. However, even Asian women, who in our experience often receive health care services similar to those received by Caucasians, were significantly less likely to receive breast reconstruction compared with Caucasians. On the other hand, the cultural value of women's breasts may differ across ethnicity. Nevertheless, the difference in reconstruction rates by race is dramatic and needs further investigation.

The impact of treatment location on breast reconstruction is consistent with previous research that demonstrated large variations in reconstruction rates across the country.²³ However, why an Iowa woman's odds of reconstruction decrease to 0.47 compared with the odds of reconstruction for a San Francisco woman is unclear. Furthermore, Seattle had one of the lowest reconstruction rates compared with the other national registries but the highest use of autogenous compared with implant reconstructions. Regional referral patterns, availability of reconstructive surgeons, financial incen-

tives, and patient preferences should be explored as potential sources for this geographic variation in the utilization of breast reconstruction.²⁴

In addition to sociodemographic variables, the severity of the breast cancer significantly affected reconstruction rates. During the early years of reconstructive breast surgery, surgeons were more conservative in offering reconstruction to women in the later stages of breast cancer because of a fear of masking a cancer recurrence. As the natural history of the disease has been more clearly defined, it seems that cancer recurrences tend to be more systemic, and local recurrences are mostly superficial and not hidden by the reconstructions.²⁵ Therefore, many surgeons are advocating breast reconstruction in the later stages of the disease because of the significant gains in quality of life for these women.²⁵ However, we found immediate and early delayed reconstruction rates to be significantly affected by the woman's stage of disease. Women with stage III breast cancer were significantly less likely to receive reconstruction compared with women with stage II disease. Whether patients' priorities change with the higher mortality risks associated with advanced stages of disease or if physicians act more conservatively in this patient population is unclear. In addition to disease stage, the receipt of adjuvant radiotherapy significantly decreased a woman's odds of having reconstruction in the early postmastectomy period. Some surgeons advocate delaying reconstruction if radiotherapy is required because of the potential for compromised wound healing. This concern may explain the lower immediate and early reconstruction rates in this group.^{10,25}

The utilization of the different types of breast reconstruction in the SEER population, with autogenous tissue reconstructions outnumbering implant procedures almost 2:1, was not unexpected. The popularity of autogenous tissue reconstructions has increased since the Food and Drug Administration's ban on silicone breast implants.²⁵ Furthermore, as we have reported, autogenous tissue reconstructions compared with implant techniques are associated with higher levels of patient satisfaction and aesthetically superior results.^{15,26} However, it is unclear why a patient's age and race have such a significant impact on the type of reconstruction performed. The two extremes of age, women younger than 35 years and those

65 to 74 years old, were significantly less likely to have autogenous tissue reconstructions. Compared with implant procedures, muscle flaps are more physically demanding on patients and require longer hospital courses, which may explain the lower rates of these procedures in the older population. The effect of race on the type of reconstruction is more perplexing. Most of the health care literature on race has described a general practice of less aggressive care in African Americans compared with Caucasians. However, in the SEER population, the odds of an African American woman receiving an autogenous tissue reconstruction increased to 2.03 compared with the odds of a Caucasian woman receiving autogenous tissue reconstruction, which entails a larger, longer operation than most implant techniques. The travel distance between the physician and the patient may be a confounding factor. If African Americans live farther from health care centers or have difficulty obtaining transportation, expander/implant procedures that require multiple visits may be less appealing. In addition, the African American culture has historically been distrustful of the traditional health care system, which may lead to greater concerns about implant safety.

With regard to the effects of disease severity on the type of breast reconstruction performed, some of the findings from the SEER population were expected. The significantly lower odds of autogenous tissue reconstructions in women with in situ or stage I disease are probably a result of skin-sparing mastectomies. However, we did expect the receipt of adjuvant radiotherapy to influence the type of reconstruction performed, because radiotherapy may complicate implant reconstructions. Although a trend existed, women who received radiotherapy were not significantly more likely to receive muscle flap reconstructions in the early postmastectomy period.

Although national databases aid in the generalizability of study results, limitations still exist. Because the sample population was not randomized, the potential for unmeasured variables to affect the outcome of interest is possible. Although we controlled for some sociodemographic variables and disease severity in the regression models, variables such as income, education, body mass index, health status, and receipt of chemotherapy may have an effect on reconstruction rates and the types of reconstructions performed. Furthermore, 22.7

percent of the reconstruction cases did not specify the type of reconstruction performed, which could potentially impact the results of the regression model. The database also did not contain information on reconstruction after 4 months postmastectomy, which would have provided more comprehensive information on the utilization of breast reconstruction in this patient population. However, SEER provides one of the most representative databases for the breast cancer population on a national level, and the large impact of sociodemographic variables on breast reconstruction deserves further investigation.

CONCLUSIONS

In the SEER population, 15.4 percent of postmastectomy breast cancer patients underwent immediate and early delayed breast reconstruction in 1998, and of those who underwent reconstruction, 69.9 percent received an autogenous tissue procedure. The odds of reconstruction were significantly lower with advancing age, non-Caucasian race, and increasing severity of disease. Significant predictors of the type of reconstruction were age, race, and stage of disease. The odds of having an implant procedure significantly increased for women in the younger and older age groups and in women with earlier stages of disease. However, African American women were significantly more likely to have autogenous tissue reconstructions compared with Caucasian women. Finally, breast reconstruction differed across the SEER registries, with greater variation in the overall use of reconstructive surgery than in the type of procedures performed.

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