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Breast

Association of Insurance Status with the Use of Immediate Breast Reconstruction in Women with Breast Cancer

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Background: Our group sought to determine the influence of health insurance coverage on use of immediate breast reconstruction for working-age women undergoing mastectomy for breast cancer.

Methods: We used 2 complementary databases, the Texas Cancer Registry–linked Medicaid database and the MarketScan private insurance database, to identify working-age women in Texas from 2000 to 2007 treated with mastectomy for incident breast cancer. Logistic regression tested the association between Medicaid versus private insurance and receipt of immediate breast reconstruction, adjusting for patient, treatment, and socio-demographic covariates. Reimbursement for reconstruction, adjusted for inflation and reported in 2014 dollars, was estimated from claims.

Results: Median age was 49.7 years for the Medicaid cohort compared with 50.4 years for the MarketScan cohort ($P = 0.02$). From 2000 to 2007, use of reconstruction increased significantly for patients in the MarketScan cohort (38.1–53.9%; $P_{trend} = 0.009$) but not those in the Medicaid cohort (10.5–16.6%; $P_{trend} = 0.24$). In total, 15.7% of patients in the Medicaid cohort underwent immediate reconstruction (n = 213/1,360) compared with 50.7% (n = 1,405/2,772) of patients in the MarketScan cohort (adjusted relative risk, 3.09; 95% CI, 2.78–3.40). Reimbursement for reconstruction was $3,167 (95% CI, $2,512–$3,820) for patients in the Medicaid cohort compared with $15,432 (95% CI, $14,030–$16,834) for patients in the MarketScan cohort.

Conclusions: Type of insurance coverage is an important factor associated with receipt of immediate breast reconstruction. We postulate that the marked difference in reimbursement for reconstruction between Medicaid and private insurance creates a relative disincentive for plastic surgeons and hospitals to offer breast reconstruction to patients with Medicaid. *(Plast Reconstr Surg Glob Open 2017;5:e1360; doi: 10.1097/GOX.0000000000001360; Published online 26 July 2017.)*

Receipt of breast reconstruction is a unique and important quality measure in the treatment of breast cancer. Following mastectomy, reconstruction is widely thought to confer important psychosocial and functional benefits, specifically by addressing certain appearance, body image, and clothing fit issues resulting from mastectomy.[1–7] However, reconstruction itself does not influence classical oncologic outcomes such as recurrence-free or overall survival. Hence, receipt of reconstruction is a unique marker of quality in cancer care, indicating a healthcare system that has sufficient resources to not simply cure cancer but to actively intervene to restore damage caused by treatment itself.[8] Recognizing the importance of access to reconstructive surgery, the Women's Health and Cancer Rights Act of 1999 mandated insurance coverage of postmastectomy breast reconstruction.[9]

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Potentially in response to this legislation, use of immediate postmastectomy breast reconstruction for women diagnosed with invasive breast cancer in the U.S. increased to 50% by 2007.[10] In contrast, within the single-payer Canadian health care system, where postmastectomy reconstruction is also a covered benefit, use of reconstruction for invasive breast cancer did not increase, with an immediate reconstruction rate of only 7% from 2002 to 2011.[11] This observation prompts the hypothesis that structure of insurance coverage may be an important determinant of receipt of breast reconstruction.

Understanding the influence of insurance structure on provision of cancer care is increasingly important in the U.S., given the implementation of the Affordable Care Act (ACA). Specifically, the ACA seeks to expand coverage both through increasing access to the private insurance market and Medicaid enrollment.[12] Even with recent proposed changes to the ACA known as the American Health Care Act (AHCA), Medicaid enrollment is likely to continue through at least 2020. To project the potential impact of the ACA's dual-pronged approach to coverage specifically on breast cancer care, we evaluated rates of immediate breast reconstruction and reimbursement for breast reconstruction among women with Medicaid compared with women with private insurance, all of whom underwent mastectomy for a diagnosis of breast cancer in the state of Texas between 2000 and 2007.

METHODS

Data and Cohort Selection

We used 2 complementary datasets to evaluate the role of insurance status on receipt of immediate breast reconstruction. To study patients with Medicaid, we partnered with the Texas Cancer Registry (TCR) and the Centers for Medicare and Medicaid Services to link Medicaid claims to TCR data. The linkage rate was 24.5%, indicating that 24.5% of all patients with incident cancers in the TCR from 2000 to 2007 were found to have Medicaid claims. To study patients with private insurance, we used the MarketScan Commercial Claims and Encounters database, licensed by Truven Health Analytics, which is a convenience sample selected from 45 large employers covered by more than 100 payers. Initially, the database included only clients with coverage provided through large, self-insured companies; in 2002, the database was expanded to include small and medium-sized firms providing coverage through health plan clients.[10]

Criteria used to select the Medicaid and MarketScan cohorts are listed in Table 1. Incident cases of breast cancer in the TCR–Medicaid cohort were identified using TCR data, whereas incident cases of breast cancer in the MarketScan data were identified using a validated, claims-based algorithm.[13] Excepting this difference, both cohorts were constructed similarly, limited to women residing in Texas with incident breast cancers diagnosed between the ages of 18 and 64 during the years 2000–2007, treated with mastectomy, with no distant metastasis. The MarketScan cohort was limited to patients with complete coverage between 3 months before mastectomy through 9 months after mastectomy, as these claims were required to determine adjuvant treatments and patient baseline characteristics. In contrast, we did not require continuous Medicaid coverage during this time window, as adjuvant treatments could be determined from TCR data instead.

Primary Outcome

The primary outcome was receipt of immediate breast reconstruction, defined as the presence of a procedural claim for any form of breast reconstruction on the same date as mastectomy. Reconstruction was further classified as implant, autologous, or tissue expander only in accordance with our previously published methods.[10]

Covariables

Covariables included age, year of diagnosis, bilateral mastectomy, lymph node surgery, and receipt of chemotherapy or radiation therapy before or after mastectomy (Table 2). For the Medicaid cohort, patients were considered to have received radiation therapy if such treatment was documented in either claims or TCR data. County-level population and median household income were determined from the Area Resource File. Race and summary stage were available for the Medicaid cohort but not the MarketScan cohort.

Cost of Reconstruction

Total cost on the date of mastectomy was determined using all available claims and adjusted for medical inflation using the Medicare Economic Index for outpatient costs and the Prospective Pricing Index for inpatient costs. All costs are reported in 2014 dollars. Because many claims only included aggregate costs inclusive of both the reconstructive procedure(s) and the mastectomy, cost of reconstruction could not be directly calculated. However, cost of reconstruction was inferred by calculating the difference in total cost on the date of mastectomy between those patients undergoing mastectomy with immediate reconstruction and those patients undergoing mastectomy without immediate reconstruction. Given the significant differences in the rate of bilateral mastectomy by reconstruction status, a sensitivity analysis determined the cost of reconstruction limited only to those patients who underwent unilateral mastectomy. As costs limited to the date of mastectomy may not include immediate downstream costs of additional procedures, complications, or hospital care, a second sensitivity analysis was conducted including all costs incurred within 7 days of mastectomy.

Statistical Analysis

Differences in covariable distribution between the Medicaid and MarketScan cohorts were compared using the chi-square test for categorical variables and *t* test for age. To evaluate the association between insurance status and receipt of immediate reconstruction, a multivariable logistic regression model was created for this outcome, with type of insurance (Medicaid versus MarketScan) included as a covariable. Covariables were selected for inclusion if associated with the outcome at $P < 0.20$ in

Table 1. Cohort Selection

Steps	Criterion	Medicaid	Criterion	MarketScan
1	Female, breast cancer, diagnosed 2000–2007 in Texas	17,998	Female, invasive (174.X) or in situ (233.0) breast cancer diagnosis code in 2000–2007 in Texas	35,610
	Mastectomy performed within -1 to +12 months of reported diagnosis	2,069	Mastectomy performed within 2000–2007	4,388
2	Age 18–64 years at the time of mastectomy	1,484	Age 18–64 years at the time of mastectomy	4,388
4	No distant metastasis by summary stage	1,366	No distant metastasis by diagnosis code within -3 to +9 months of mastectomy	3,898
5	Microscopically confirmed invasive or in situ cancer	1,360	2 or more diagnosis codes for invasive or in situ breast cancer within -3 to +9 months of mastectomy	3,869
6			Private insurance coverage within -3 to +9 months	2,771

Table 2. Baseline Patient Characteristics and Association with Use of Immediate Reconstruction

	Medicaid Cohort			MarketScan Cohort*		
Variable	N	Immediate Reconstruction, N (%)	*P*†	N	Immediate Reconstruction, N (%)	*P*†
Age (y)						
18–39	195	46 (23.6)	< 0.001	288	189 (65.6)	< 0.001
40–49	429	89 (20.8)		904	522 (57.7)	
50–59	517	59 (11.4)		1219	583 (47.8)	
60–64	219	19 (8.7)		361	111 (30.8)	
Year						
2000	124	13 (10.5)	0.24	42	16 (38.1)	0.009
2001	128	20 (15.6)		49	19 (38.8)	
2002	158	23 (14.6)		107	55 (51.4)	
2003	198	33 (16.7)		195	92 (47.2)	
2004	191	33 (17.3)		269	138 (51.3)	
2005	189	30 (15.9)		258	124 (48.1)	
2006	191	31 (16.2)		773	379 (49.0)	
2007	181	30 (16.6)		1079	582 (53.9)	
Bilateral mastectomy						
No	1,305	193 (14.8)	< 0.001	2,196	972 (44.3)	< 0.001
Yes	55	20 (36.4)		576	433 (75.2)	
Lymph node surgery						
No	103	33 (32.0)	< 0.001	389	258 (66.3)	< 0.001
Yes	1,257	180 (14.3)		2,383	1,147 (48.1)	
Chemotherapy						
No	721	135 (18.7)	< 0.001	1,193	714 (59.9)	< 0.001
Yes	639	78 (12.2)		1,579	691 (43.8)	
Radiation						
No	1,194	188 (15.8)	0.82	2,017	1,184 (58.7)	< 0.001
Yes	166	25 (15.1)		755	221 (29.3)	
Population of county in which patient resides						
0–89,306	422	54 (12.8)	0.10	617	281 (45.5)	< 0.001
89,306–354,452	366	59 (16.1)		694	292 (42.1)	
354,452–1,446,219	317	49 (15.5)		859	517 (60.2)	
>1,446,219	255	51 (20)		602	315 (52.3)	
Median household income for county in which patient resides						
$0–34,301	539	58 (10.8)	< 0.001	511	214 (41.9)	< 0.001
$34,302–41,219	463	76 (16.4)		918	424 (46.2)	
$41,220–48,405	188	43 (22.9)		559	301 (53.9)	
≥$48,406	170	36 (21.2)		784	466 (59.4)	
Race						
White, non-Hispanic	498	92 (18.5)	0.12	N/A	N/A	
Black, non-Hispanic	295	47 (15.9)		N/A	N/A	
Hispanic	545	71 (13.0)		N/A	N/A	
Other, non-Hispanic	22	3 (13.6)		N/A	N/A	
Stage						
Localized	506	94 (18.6)	0.06	N/A	N/A	
Regional	808	111 (13.7)		N/A	N/A	
Unknown	46	8 (17.4)		N/A	N/A	

*Race and stage information are not available in the MarketScan database.
†Chi-square *P* value reported for all covariables except year, where the Cochran-Armitage test for trend is reported.
N/A, not available.

bivariable analysis. The model was iteratively refined to minimize colinearity and remove nonsignificant covariables from the final model. Goodness of fit was assessed with the Hosmer and Lemeshow test. As the outcome was not rare, odds ratios were converted to risk ratios using the method of Zhang and Yu.[14] Time trends for each cohort were assessed using the Cochran-Armitage test for trend. Associations of immediate reconstruction with race

and stage in the Medicaid cohort were assessed using the chi-square test. All analyses were 2-sided with alpha = 0.05 and were conducted using SAS v9.3 (SAS Institute, Inc., Cary, N.C.). This research was reviewed and approved by The University of Texas MD Anderson Institutional Review Board and granted a waiver of informed consent.

RESULTS

Comparison of the Cohorts

A total of 1,360 patients were identified in the Medicaid cohort and 2,772 patients in the MarketScan cohort (Table 1). Median age was 49.7 for the Medicaid cohort compared with 50.4 for the MarketScan cohort ($P = 0.02$). Patients in the Medicaid cohort were more likely to reside in counties in the lowest quartile of population and median household income quartile ($P < 0.001$ for both comparisons).

Lymph node surgery was more common in the Medicaid cohort, with 92.4% of Medicaid patients undergoing lymph node surgery (n = 1,257) compared with 86.0% of MarketScan patients (n = 2,383; $P < 0.001$). In contrast, bilateral mastectomy was more common in the MarketScan cohort, with 20.8% (n = 576) of MarketScan cohort patients undergoing bilateral mastectomy compared with 4.0% (n = 55) of Medicaid cohort patients ($P < 0.001$). Radiation and chemotherapy were more commonly used in the MarketScan cohort ($P < 0.001$ for both comparisons).

Use of Immediate Reconstruction

A total of 15.7% of patients in the Medicaid cohort underwent immediate reconstruction (n = 213) compared with 50.7% (n = 1,405) of patients in the MarketScan cohort [adjusted relative risk (RR), 3.09; 95% confidence interval (CI), 2.78–3.40]. Use of immediate reconstruction was less likely in patients who received nodal surgery (adjusted RR, 0.83; 95% CI, 0.73–0.92), chemotherapy (adjusted RR, 0.77; 95% CI, 0.69–0.85) or radiation therapy (adjusted RR, 0.49; 95% CI, 0.42–0.57) and more likely in patients who underwent bilateral mastectomy (adjusted RR, 1.89; 95% CI, 1.74–2.04). Patients residing in more populous and higher income counties were also more likely to undergo immediate reconstruction (Table 3). Within the Medicaid cohort, neither race ($P = 0.12$) nor stage ($P = 0.06$) were significantly associated with immediate reconstruction (Table 2).

Over time, use of reconstruction increased significantly for patients in the MarketScan cohort (38.1–53.9%; $P_{trend} = 0.009$) but not those in the Medicaid cohort (10.5–16.6%; $P_{trend} = 0.24$; Table 2). Type of reconstruction also differed by cohort ($P < 0.001$). Among patients who underwent immediate reconstruction in the Medicaid cohort, 4.2% underwent implant reconstruction (n = 9/213), 61.5% underwent autologous reconstruction (n = 131/213), and 30.1% received a tissue expander only (n = 64/213). Among patients who underwent immediate reconstruction in the MarketScan cohort, 5.4% underwent implant reconstruction (n = 76/1405), 49.2% underwent autologous reconstruction (n = 691/1405), and 44.9% received a tissue expander only (n = 631/1405).

Table 3. Predictors of Immediate Reconstruction

Variables	RR	95% CI		P
Cohort				
Medicaid	1			
MarketScan	3.09	2.78	3.40	< 0.001
Age (y)				
18–39	1			
40–49	0.77	0.66	0.89	0.000
50–59	0.55	0.45	0.65	< 0.001
60–64	0.31	0.24	0.40	< 0.001
Year of diagnosis				
2000	1			
2001	1.33	0.82	2.02	0.24
2002	1.40	0.91	2.05	0.12
2003	1.68	1.15	2.34	0.009
2004	1.83	1.27	2.49	0.002
2005	1.58	1.08	2.21	0.02
2006	1.59	1.10	2.18	0.01
2007	1.76	1.24	2.37	0.002
Bilateral mastectomy				
No	1			< 0.001
Yes	1.89	1.74	2.04	
Lymph node surgery				
No	1			
Yes	0.83	0.73	0.92	< 0.001
Chemotherapy				
No	1			
Yes	0.77	0.69	0.85	< 0.001
Radiation				
No	1			
Yes	0.49	0.42	0.57	< 0.001
Population of county in which patient resides				
0–89,306	1			
89,306–354,452	0.77	0.64	0.90	0.001
354,452–1,446,219	1.10	0.94	1.27	0.23
>1,446,219	1.04	0.87	1.21	0.67
Household median income				
< $34,302	1			
$34,303–$41,220	1.21	1.03	1.41	0.02
$41,221–$48,406	1.56	1.33	1.81	< 0.001
≥ $48,406	1.71	1.47	1.95	< 0.001

Odds ratios have been converted to risk ratios as the outcome receipt of immediate reconstruction is not rare. Hosmer and Lemeshow *P* value for this model is 0.09, indicating appropriate goodness of fit. An RR greater than 1 indicates a higher likelihood of receiving immediate reconstruction.

Cost of Reconstruction by Insurance Status

Mean reimbursed cost on the date of mastectomy with or without reconstruction is presented in Figures 1, 2. Payment for reconstruction, inferred by taking the difference in the reimbursed cost for patients undergoing reconstruction compared with patients not undergoing reconstruction, was estimated to be $3,167 (95% CI, $2,512–$3,820) for patients in the Medicaid cohort compared with $15,432 (95% CI, $14,030–$16,834) for patients in the MarketScan cohort (Fig. 1). Similar differences in cost were noted when including only patients who underwent unilateral mastectomy (Fig. 2). No meaningful difference in cost of reconstruction was noted in a sensitivity analysis that evaluated all costs incurred within 7 days of mastectomy.

DISCUSSION

In this large, statewide cohort of working-age women diagnosed with breast cancer, insurance status was strongly associated with receipt of immediate reconstruction, with private insurance associated with more than 3 times greater likelihood of immediate recon-

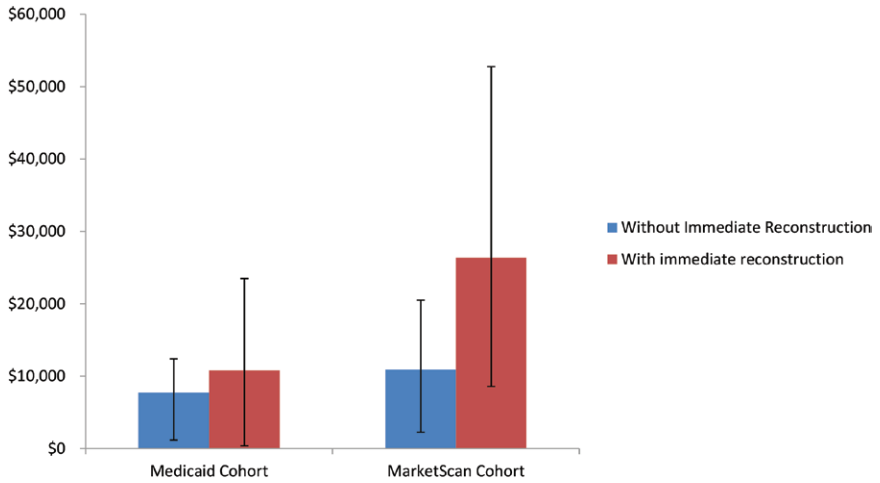

Fig. 1. Cost by insurance status with and without immediate reconstruction in all patients.

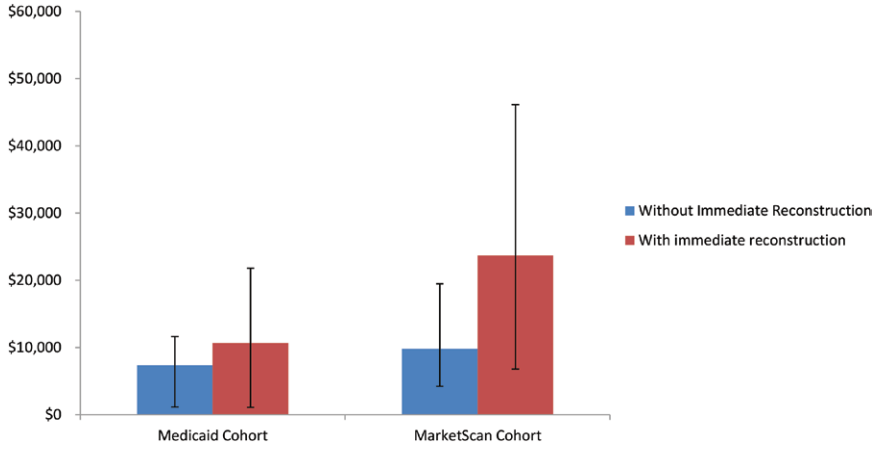

Fig. 2. Cost by insurance status with and without immediate reconstruction in patients with unilateral mastectomy only. Mean costs and associated 95% confidence bounds are reported in 2014 dollars for patients treated without and with reconstruction in the Medicaid and MarketScan cohorts.

struction compared with Medicaid. The importance of insurance status persisted, despite adjustment for other factors known to predict use of reconstruction, such as bilateral mastectomy, receipt of radiation and chemotherapy, and sociodemographic factors.[10,11] To our knowledge, this is the first-ever study to use claims-based databases to compare cancer treatment received by individuals with Medicaid with individuals with private insurance.

Our data support the hypothesis that differences in reimbursement for immediate breast reconstruction between private insurance compared with Medicaid may account for the observed differences in utilization of immediate breast reconstruction. Specifically, reimbursement for reconstruction was nearly 5 times, or $12,265, higher for patients with private insurance compared with Medicaid. We hypothesize that the marked difference in reimbursement for breast reconstruction creates a relative disincentive for plastic surgeons and hospitals to offer breast reconstruction to patients with Medicaid compared with those with private insurance.

Our study findings are particularly timely in light of the vast changes underway with implementation of the ACA. To date, it is estimated that approximately 20 million Americans have gained insurance coverage under the ACA, of whom approximately 6 million gained Medicaid coverage through provisions of this law.[12] Unfortunately, our data suggest that Medicaid expansion is unlikely to support the full complement of cancer therapy needed to provide comprehensive care, at least with respect to provision of breast reconstructive services. Recently proposed legislative changes to the ACA, known as the AHCA, are still being discussed at the Congressional level and include the possibility of halting Medicaid enrollment by 2020 and decreasing federal funding of Medicaid. Specifically, recent analysis of the AHCA has shown that there could be as much as $370 billion in Medicaid funding slashed from the federal level and placed on individual states over the course of 10 years, leading to further budgetary constraints at the state level.[15,16] Although these changes may slow and eventually decrease the number of Medicaid enrollees, disparities in care could worsen even further if

the number of uninsured rises. Prior research has similarly illustrated meaningful disparities in cancer care experienced by patients with Medicaid. For example, among breast imaging facilities in the Chicago area, those with a higher proportion of patients with private insurance more frequently perform image-guided biopsy, place a clip at the time of biopsy, and offer breast magnetic resonance imaging.[17] Image-guided biopsy and clip placement are particularly important to guide surgical planning and have been shown to optimize initial choice of surgery and minimize the total number of invasive procedures required to treat the index cancer.[18] When considering common cancers including breast cancer, a recent analysis reporting on 473,000 patients reported in the SEER registry from 2007 to 2010 concluded that cancer patients with Medicaid were more likely to present at advanced stages, less likely to receive curative treatment, and substantially more likely to die from their cancer than patients with private insurance.[19] In light of these issues, the American Society for Clinical Oncology recently released a policy statement on Medicaid reform, setting forth guiding principles intended to promote high-quality cancer care for all low-income individuals.[20] Relevant to our findings, this policy statement recommends increasing Medicaid reimbursement to Medicare levels, which would at least partially address the cost disparity between Medicaid and private insurance for breast reconstruction.

Our current study builds upon these findings in several important, concrete ways. For example, a limitation of prior work is that patients may not be enrolled in Medicaid until after their cancer becomes symptomatic. Hence, Medicaid coverage itself is not necessarily the cause of their suboptimal care and outcomes but merely symptomatic of patient's lack of insurance and thus their difficulty accessing the health care system. In contrast, for this study, all patients were enrolled in Medicaid at the time of mastectomy and yet were still unable to access breast reconstructive services, despite undergoing mastectomy by a care team that accepted their Medicaid insurance. These findings therefore illustrate the challenges that Medicaid beneficiaries face in receiving comprehensive care even after granted Medicaid enrollment. This challenge may be particularly great for plastic surgery services, as many plastic surgeons perform procedures outside the scope of traditional health insurance, and thus have greater latitude in the type of insurance plans they accept and procedures they will perform for certain insurers.

This study has several important limitations to consider. First, continuity of Medicaid claims in the state of Texas is poor, as patients must reapply every 6 months. As a result, Medicaid data cannot reliably identify longitudinal events in cancer care. Most relevant to this study, this limitation prevented ascertainment of delayed reconstruction in the Medicaid cohort. A prior survey study of women in the Detroit and Los Angeles SEER regions reported that, of those undergoing reconstruction within 4 years, 59% underwent immediate reconstruction.[21] In contrast, a prior study from our group conducted using the nationwide MarketScan cohort reported that, of those undergoing reconstruction within 2 years, 79% underwent immediate reconstruction.[10] These studies illustrate that the majority of women initiate reconstruction at the time of mastectomy and thus the marked disparity of receipt of immediate reconstruction reported in this study is likely to persist even if we could account for delayed reconstructions. Another limitation is the absence of staging data in the MarketScan cohort. Nevertheless, stage was not significantly correlated with receipt of reconstruction in the Medicaid cohort, indicating that immediate reconstruction was uniformly poor in this cohort regardless of stage. Further, it is likely that receipt of adjuvant chemotherapy and radiation therapy may have been under-ascertained in the Medicaid cohort, given the limited longitudinal nature of this cohort, which could modestly influence the measured effect size of insurance status in our logistic model. Finally, this analysis was limited to 1 state. It is possible that other states may have more generous Medicaid coverage and a smaller disparity in reconstruction by insurance type. However, Texas has one of the higher reconstruction rates in the country and a relatively high supply of plastic surgeons (2.64 plastic surgeons per 100,000)[10]; it is likely that other states with more limited supply of plastic surgeons could face an even greater disparity in reconstruction rates.

In summary, although breast reconstruction is considered an important health benefit by the American people and coverage is mandated by federal legislation,[9] the current health care system fails to equitably facilitate this benefit. Women with private insurance are 3 times more likely than women with Medicaid to undergo immediate reconstruction at the time of mastectomy for their breast cancer. This difference is likely driven by a nearly 5-fold difference in reimbursement for reconstruction between private insurance and Medicaid, creating a relative disincentive for plastic surgeons and hospitals to offer breast reconstruction to patients with Medicaid compared with those with private insurance. Expansion of the Medicaid low reimbursement system to cover more low-income uninsured patients may further propagate a 2-tiered breast cancer care system. Conversely, increasing reimbursement for breast reconstruction in the Medicaid population, as advocated by the ASCO policy statement, may lead to increased equality in access to breast reconstruction.

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