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

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Reconstruction 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. 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. 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 of cancer care in the U.S., given the implementation of the Affordable Care Act (ACA). 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.

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. Excluding 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.

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
bivariable analysis. The model was iteratively refined to minimize collinearity and remove nonsignificant covariates 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.\textsuperscript{14} Time trends for each cohort were assessed using the Cochran-Armitage test for trend. Associations of immediate reconstruction with race

Table 1. Cohort Selection

| Steps | Criterion | Medicaid | Criterion | MarketScan |
|-------|-----------|----------|-----------|------------|
| 1     | Female, breast cancer, diagnosed 2000–2007 in Texas Mastectomy performed within -1 to +12 months of reported diagnosis | 17,998 | Female, invasive (174.X) or in situ (233.0) breast cancer diagnosis code in 2000–2007 in Texas | 35,610 |
| 2     | Age 18–64 years at the time of mastectomy | 1,484 | Age 18–64 years at the time of mastectomy | 4,388 |
| 3     | No distant metastasis by summary stage | 1,366 | No distant metastasis by diagnosis code within -3 to +9 months of mastectomy | 3,898 |
| 4     | 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 | 3,809 |
| 5     | Private insurance coverage within -3 to +9 months | | | 2,771 |

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

| Variable | Medicaid Cohort | MarketScan Cohort* |
|----------|-----------------|--------------------|
|          | Immediate | N (%) | P† | Immediate | N (%) | P† |
| Age (y)  |                    |        |    |                    |        |    |
| 18–39    | 195     | 46 (23.6) | < 0.001 | 288     | 189 (65.6) | < 0.001 |
| 40–49    | 429     | 89 (20.8) | 0.24 | 904     | 522 (57.7) | 0.009 |
| 50–59    | 517     | 59 (11.4) | 0.10 | 1219    | 583 (47.8) | 0.009 |
| 60–64    | 219     | 19 (8.7)  | 0.10 | 361     | 111 (30.8) | 0.009 |
| Year     |                    |        |    |                    |        |    |
| 2000     | 124     | 13 (10.5) | 0.24 | 42      | 16 (38.1)  | 0.009 |
| 2001     | 128     | 20 (15.6) | 0.24 | 49      | 19 (38.8)  | 0.009 |
| 2002     | 158     | 23 (14.6) | 0.24 | 107     | 55 (51.4)  | 0.009 |
| 2003     | 198     | 33 (16.7) | 0.24 | 195     | 92 (47.2)  | 0.009 |
| 2004     | 191     | 33 (17.3) | 0.24 | 269     | 138 (51.3) | 0.009 |
| 2005     | 189     | 30 (15.9) | 0.24 | 258     | 124 (48.1) | 0.009 |
| 2006     | 191     | 31 (16.2) | 0.24 | 773     | 379 (49.0) | 0.009 |
| 2007     | 181     | 30 (16.6) | 0.24 | 1079    | 582 (53.9) | 0.009 |
| Bilateral mastectomy | Yes 1,305 | 193 (14.8) | < 0.001 | 2,196 | 972 (44.3) | < 0.001 |
|          | Yes 55 | 20 (36.4) | 0.10 | 576 | 433 (75.2) | < 0.001 |
| Lymph node surgery | Yes 1,257 | 180 (14.3) | < 0.001 | 2,383 | 1,147 (48.1) | < 0.001 |
| Chemotherapy | Yes 721 | 135 (18.7) | < 0.001 | 1,193 | 714 (59.9) | < 0.001 |
| Radiation | Yes 639 | 78 (12.2) | 0.82 | 1,579 | 691 (43.8) | < 0.001 |
| Population of county in which patient resides | Yes 1,194 | 188 (15.8) | 0.82 | 2,017 | 1,184 (58.7) | < 0.001 |
| $0–34,301 | 166 | 25 (15.1) | 0.10 | 755 | 221 (29.3) | < 0.001 |
| $34,302–41,219 | 366 | 59 (16.1) | 0.10 | 694 | 292 (42.1) | < 0.001 |
| $41,220–48,406 | 317 | 49 (15.5) | 0.10 | 859 | 517 (60.2) | < 0.001 |
| $>48,406 | 255 | 51 (20.0) | 0.10 | 602 | 315 (52.3) | < 0.001 |
| Median household income for county in which patient resides | Yes 1,194 | 188 (15.8) | 0.82 | 2,017 | 1,184 (58.7) | < 0.001 |
| Race | White, non-Hispanic 498 | 92 (18.5) | 0.12 | N/A | 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 | 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.
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 year of diagnosis (P = 0.06) were significantly associated with immediate reconstruction. 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    |         |       |
| 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 |      |         |       |
| < $49,306 | 1    |         |       |
| $49,306–$118,601 | 0.77 | 0.64 | 0.90 | 0.001 |
| $118,601–$412,200 | 1.10 | 0.94 | 1.27 | 0.23  |
| $412,200–1,446,219 | 1.04 | 0.87 | 1.21 | 0.07  |
| ≥ $1,446,219 | 1.31 | 1.17 | 1.49 | <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-
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. 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. 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. 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. 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. 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. 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. 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. 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. 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); 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, 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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