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Immediate Breast Reconstruction among Patients with Medicare and Private Insurance: A Matched Cohort Analysis

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Background: By eliminating economic hurdles, the Women's Health and Cancer Rights Act of 1998 represented a paradigm shift in the availability of breast reconstruction. Yet, studies report disparities among Medicare-insured women. These studies do not account for the inherent differences in age and comorbidities between a younger privately insured and an older Medicare population. We examined immediate breast reconstruction (IBR) utilization between a matched pre- and post-Medicare population.

Methods: Using the Nationwide Inpatient Sample database (1992–2013), breast cancer patients undergoing IBR were identified. To minimize confounding medical variables, 64-year-old privately insured women were compared with 66-year-old Medicare-insured women. Demographic data, IBR rates, and complication rates were compared. Trend over time was plotted for both cohorts.

Result: A total of 21,402 64-year-old women and 25,568 66-year-old women were included. Both groups were well matched in terms of demographic type of reconstruction and complication rates. 72.3% of 64-year-old and 71.2 of % 66-year-old women opted for mastectomy. Of these, 25.5% ($n = 3,941$) of 64-year-old privately insured and 17.7% ($n = 3,213$) of 66-year-old Medicare-insured women underwent IBR ($P < 0.01$). During the study period, IBR rates increased significantly in both cohorts in a similar cohort.

Conclusion: This study demonstrates significant increasing IBR rates in both cohorts. Moreover, after an initial slower upward trend, after a decade, IBR in 66-year-old Medicare-insured women approached similar rates of breast reconstruction among those with private insurance. Trends in unilateral versus bilateral mastectomy are also seen. *(Plast Reconstr Surg Glob Open 2018;6:e1552; doi: 10.1097/GOX.0000000000001552; Published online 12 January 2018.)*

INTRODUCTION

The Women's Health and Cancer Rights Act (WHCRA) was federally enacted in 1998 to ensure that all group and individual health plans provide insurance coverage for reconstruction after mastectomy regardless of diagnosis. WHCRA also extended coverage for reconstruction or revision of the contralateral breast to produce a symmetric appearance. This legislation represented a paradigm shift in the availability of reconstruction by eliminating economic hurdles to care.

Although increasing number of women opted for breast reconstruction in the years after the WHCRA, this trend was not consistent across all demographic groups. Significant disparities exist based on access to health care, age, race, geographic location, and patient education.[1–15] As a result, patient education events, such as Breast Reconstruction Awareness Day instituted in 2012, have emerged to increase awareness of breast reconstruction. More recently, the Breast Cancer Patient Education Act, passed in December 2015, was designed to implement an educa-

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tional campaign to inform women in minority and lower socioeconomic groups about their options for breast reconstruction.[16]

To date, there is a large body of available literature to suggest that insurance status plays a role key in patients' access to immediate breast reconstruction (IBR).[1,2,5–7,9,17–19] These reports suggest that women with Medicare are significantly less likely to undergo breast reconstruction when compared to women with private insurance. However, many of these studies do not always take the inherent differences in age and comorbidities between a younger privately insured population and an older Medicare population into account.[2,4,5,8,20–22] This study aims to bridge this knowledge gap, by performing a matched cohort analysis to examine the differences between pre- and post-Medicare and utilization of breast reconstruction in a matched cohort.

METHODS

Patient data were obtained from the Healthcare Cost and Utilization Project Nationwide Inpatient Sample (NIS) database. The NIS, compiled by the Agency for Healthcare Research and Quality (Rockville, Md.), represents the largest all-payer inpatient administrative database in the United States. It contains data from over 1000 hospitals and more than 8 million hospital stays annually and is designed to approximate a 20% sample of all hospital discharges, which includes all nonfederal, short-term, general, and other specialty hospitals, including public hospitals and academic institutions.[23]

Patient Selection

The International Classification of Diseases, Ninth Revision (ICD-9) procedural coding terminology was used to identify all patients who underwent any type of IBR; all implant-based and autologous techniques of breast reconstruction were included. To make the study population as similar as possible and minimize confounding medical variables, a cohort of 64-year-old women with private insurance was compared with a cohort of 66-year-old women with Medicare. Demographic data, IBR rates, and major complication rates were compared between these 2 cohorts over a 15-year period from 1998 to 2013. Trend over time was plotted for the years 1992 to 2013 to provide an overview of the years before the WHCRA act.

Patients diagnosed with invasive breast cancer (ICD-9 diagnosis codes 174.0, 174.1, 174.2, 174.3, 174.4, 174.5, 174.6, 174.8 and 174.9) undergoing unilateral or bilateral mastectomy were included. Patients with multiple ICD-9 procedure codes or with an additional prophylactic mastectomy code were classified as having bilateral mastectomy. Implant-based breast reconstructions were defined as either placement of immediate silicone implant or tissue expander after mastectomy. Autologous breast reconstructions included both pedicled and free-tissue options: latissimus dorsi flap, pedicled transverse rectus abdominis muscle flap, free transverse rectus abdominis muscle flap, deep inferior epigastric perforator flap, superficial inferior epigastric artery perforator flap, or gluteal artery perforator flaps (**see Table, Supplemental Digital Content 1,** which shows the ICD-9 procedure codes for mastectomy, implant-based and autologous breast reconstruction, ***http://links.lww.com/PRSGO/A632***). Male patients and those of unknown gender or age were excluded. Cases of breast reconstruction without concurrent mastectomy were considered delayed and were also excluded from analysis.

Analyzed Variables

The analyzed variables included calendar year, geographic region, race, hospital status (teaching or nonteaching, and urban or rural), and number of hospital beds. The hospital's geographic region was broken down into 4 areas: Northeast (Maine, N.H., Vt., Mass., R.I., Conn., N.Y., N.J., Pa.), Midwest (Ohio, Ind., Ill., Mich., Wis., Minn., Iowa, Mo., N.Dak., S.Dak., Neb., Kans.), South (Del., Md., D.C., Va., W.Va., N.C., S.C., Ga., Fla., Ky., Tenn., Ala., Miss., Ark., La., Okla., Tex.), and West (Mont., Idaho, Wyo., Colo., N.Mex., Ariz., Utah, Nev., Wash., Ore., Calif., Alaska, Hawaii).

Hospital teaching status is determined by NIS as those hospitals with American Medical Association-approved residency programs, or are members of the council of Teaching Hospitals, or have a ratio of full-time residents to beds of 0.25 or greater.[24] The number of hospital beds was organized into groups determined by the NIS as follows: small (1–49 beds for rural hospitals, 1–99 for urban nonteaching hospitals, and 1–299 beds for urban teaching hospitals); medium (50–99 for rural hospitals, 100–199 for urban nonteaching hospitals, and 300–499 for urban teaching hospitals); and large (>100 for rural hospitals, >200 beds for urban nonteaching hospitals, and >500 for urban teaching hospitals).[10,25] Comorbidities identified using ICD-9 codes were used to calculate the Charlson comorbidity index (CCI).[26] The CCI has been validated for administrative databases and has been used previously to examine the influence of comorbidity on breast cancer treatment and outcomes.[26–28] CCI score was divided into 4 groups; CCI score 0, CCI score 1, CCI score 2, and CCI score ≥3. Postoperative complications were determined by using ICD-9 codes. The NIS does not contain information on patient outcomes after discharge because it records inpatient data only. Complications occurring after hospital discharge were therefore not captured in our analysis.

Statistical Analysis

The frequencies of categorical variables are expressed as a percentage of the group of origin. Categorical variables were compared using Chi-square analyses. Trends were analyzed using the Cochran–Armitage test. All analyses were performed using IBM SPSS Version 22.0 (IBM Corp., Armonk, N.Y.), and statistical significance was set at $P < 0.05$.

RESULTS

During the study period, a total of 21,402 women with private insurance (age 64) and 25,568 women with Medicare (age 66) were diagnosed with invasive breast

cancer and included in the study. Of these, 72.3% (n = 15,469) within the privately insured cohort and 71.2% (n = 18,194) within the Medicare cohort opted for mastectomy (P = 0.007). During the study period, rates of unilateral mastectomy decreased significantly, whereas rates of bilateral mastectomy increased significantly in both groups. Unilateral mastectomy decreased from 96.8% in 1992 to 49.1% in 2013 (P < 0.001) in the privately insured group (Fig. 1A). Similar trends were seen in Medicare cohort: unilateral mastectomy decreased from 96.5% in 1992 to 65.5% in 2013 (P < 0.001) (Fig. 1B). Bilateral mastectomy consequently increased from 3.5% to 50.9% in the privately insured cohort (P < 0.001) and from 3.2% to 34.5% in the Medicare-insured cohort (P < 0.001) between 1992 and 2013 (Figs. 1A, B).

Table 1 demonstrates the overall characteristics of patients who underwent postmastectomy IBR. Overall, 25.5% (n = 3,941) of the privately insured patients and 17.7% (n = 3,213) of the Medicare-insured patients underwent IBR (P < 0.001). No significant differences were seen between the 2 groups with respect to type of reconstruction: implant, autologous, or combined (P = 0.225). The majority of women in both cohorts were white (P < 0.001), were operated on in an urban (P < 0.040), teaching hospital (P < 0.004), with a large bed size (P < 0.025), and had a length of stay of 2 days (P = 0.005). Most of privately insured women underwent IBR in the Northeast region (29.9%), whereas the most Medicare-insured women underwent IBR in the Southern region (30.9%) (P < 0.001). No significant difference was seen between the groups in terms of complications or CCI (P = 0.444) (Table 2).

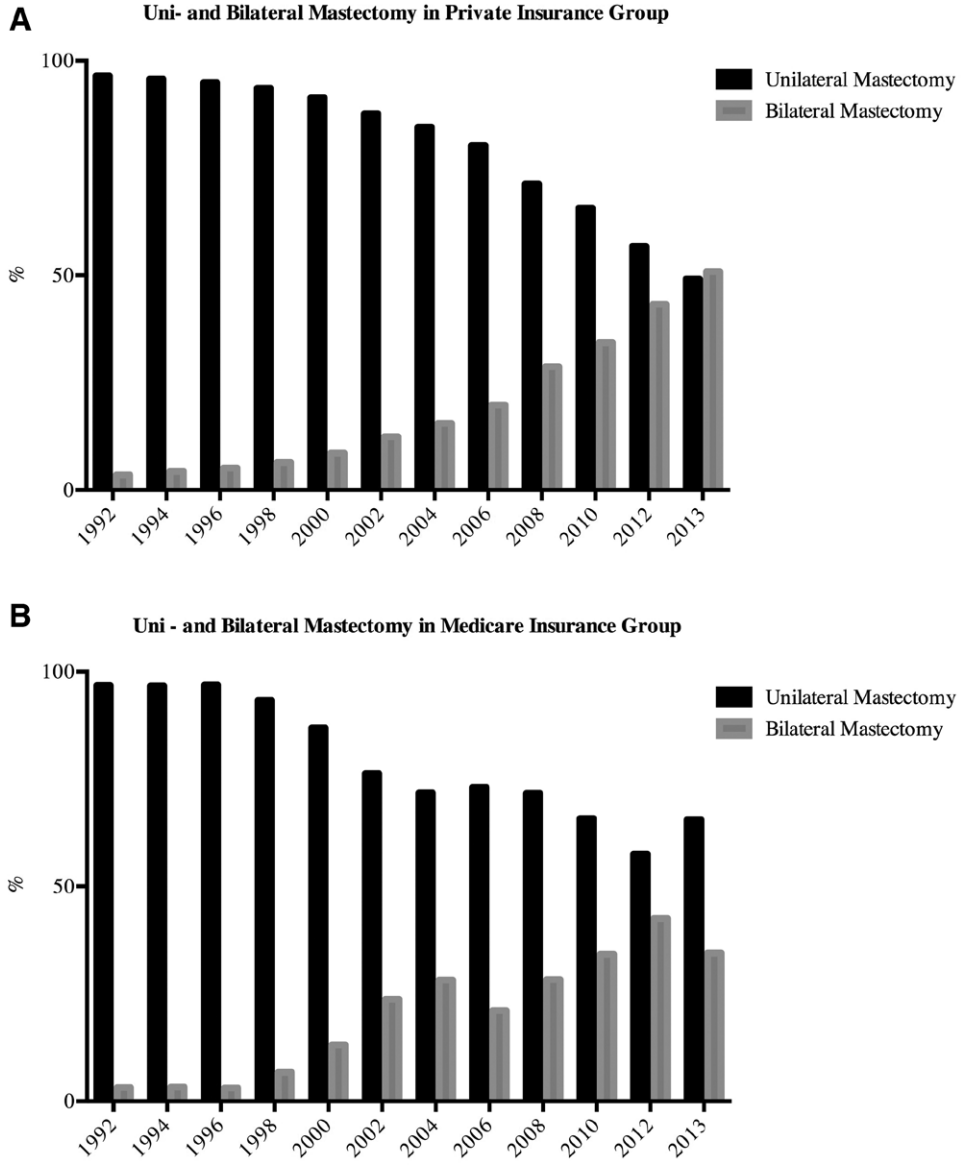

Fig. 1. Rates of unilateral and bilateral mastectomy among (A) 64-year-old privately insured women and (B) 66-year-old Medicare-insured women. Cochrane–Armitage test for trend, P < 0.001 in both cohorts.

Table 1. Summary of Patient Characteristics

	Privately Insured		Medicare Insured		
	n	%	*n*	%	*P*
Breast cancer (*n*)	21,402		25,568		
Mastectomy	15,469	72.3	18,194	71.2	0.007
Postmastectomy IBR	3,941	25.5	3,213	17.7	0.001
Type of IBR					0.225
Implant	3,212	81.5	2,589	80.6	
Autologous	440	11.2	353	11.0	
Combined	289	7.3	271	8.4	
Reconstruction					0.001
Unilateral	2,325	59.0	2,107	65.6	
Bilateral	1,616	41.0	1,106	34.4	
Race					0.001
White	2,878	73.0	2,330	72.5	
Black	210	5.3	213	6.6	
Hispanic	142	3.6	134	4.2	
Asian/Pacific Islander	87	2.2	33	1.0	
Other	624	15.8	502	15.6	
Hospital type					0.004
Nonteaching	1,542	39.2	1,362	42.6	
Teaching	2,390	60.8	1,836	57.4	
Hospital location					0.040
Rural	109	2.8	116	3.6	
Urban	3,822	97.2	3,082	96.4	
Hospital bed size					0.025
Small	409	11.5	316	10.9	
Medium	715	20.1	663	22.8	
Large	2,438	68.4	1,923	66.3	
Length of stay (d)					0.005
0	9	0.2	4	0.1	
1	1,219	30.9	1,085	33.8	
2	1,529	38.8	1,252	39.0	
3	623	15.8	498	15.5	
4+	560	14.2	373	11.6	
Region					0.001
Northeast	1,178	29.9	877	27.3	
Midwest	918	23.3	595	18.5	
South	1,023	26.0	994	30.9	
West	822	20.9	787	23.2	

Table 2. Comparison of Complication Rates

	Privately Insured		Medicare Insured		
	n	%	*n*	%	*P*
CCI					0.444
0	0	0.0	0	0.0	
1	0	0.0	0	0.0	
2	1,369	34.7	1,144	35.6	
≥3	2,572	65.3	2,069	64.4	
Complications					
Seroma	27	0.7	10	0.3	0.028
Hematoma	73	1.0	50	1.6	0.015
Wound dehiscence	5	0.1	5	0.2	0.746
Wound infection	25	0.6	19	0.6	0.817
Deep venous thrombosis	5	0.1	10	0.3	0.090
Respiratory failure	15	0.4	8	0.2	0.328
Renal insufficiency	10	0.3	9	0.3	0.829
Urinary tract infection	15	0.4	10	0.3	0.621
Sepsis	5	0.1	0	0.0	0.043
Pneumonia	10	0.3	5	0.2	0.367

Finally, when looking at the trend over time, IBR increased significantly in both privately insured women and Medicare-insured women (Fig. 2). IBR increased from 3.9% in 1992 to 47.2% in 2013 among privately insured patients ($P < 0.001$). A similar upward trend was seen in Medicare-insured women, with IBR rates increasing from 2.3% in 1992 to 43.7% in 2013 ($P < 0.001$) (Fig. 2). The difference in IBR rates between the 2 cohorts is demonstrated in Figure 3. After an initial increase in differences of IBR utilization to 2006 ($P < 0.001$), a significant decline in different rates is observed up to 2013 ($P < 0.001$).

DISCUSSION

Since the passage of the WHCRA, which mandated coverage of breast reconstruction, there has been an increase

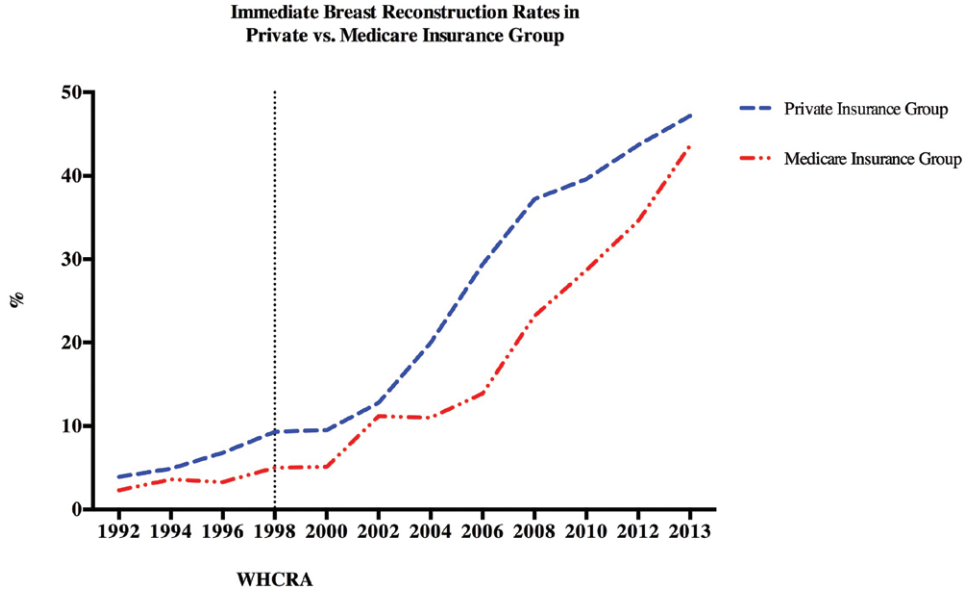

Fig. 2. Rates of IBR over study period. Cochrane–Armitage test for trend, $P < 0.001$ in both cohorts.

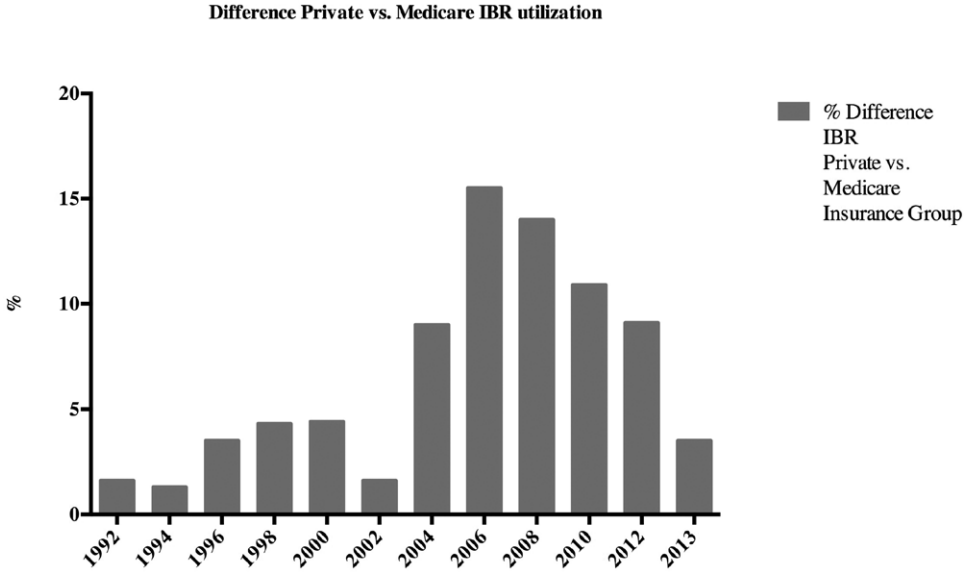

Fig. 3. Differences of privately insured cohort IBR rates compared with Medicare-insured cohort IBR rates.

in breast reconstruction among both privately and publicly insured patients.[2,21,29–31] These findings were corroborated by our study. However, the majority of these articles reported disparities in Medicare-insured women. A recent report by Wexelman et al., using the NIS database, shows that Medicare-insured women are one and a half times less likely to undergo IBR when compared with private-insured women.[4] Reports by Roughton and Yang also demonstrated similarly low rates of IBR among Medicare-insured women.[2,18] Notably, these articles have not traditionally accounted for the inherent differences in age and comorbidities between the typically younger patients with private insurance and the typically older Medicare population.

In this study, we examined and compared the trends of IBR between women with Medicare and those with privately insurance. To ensure similar groups and minimize bias with respect to inherent differences in medical comorbidities, only women 64 years of age with private insurance and 66 years of age with Medicare were included. Not only did this study show increased rates of IBR over time in both groups, but that after an initial slower upward trend, the rate of IBR in Medicare-insured women nearly equaled that among private insurance over the duration of this study (Fig. 2). In 2013, the final year of this study period, IBR was performed in 47.2% of privately insured women versus 43.7% of women in the Medicare group (data not shown).

This study demonstrates that in recent years, there have been no significant differences in the receipt of IBR in both groups. One reason for the disparity in the literature may be due to the fact that women have been analyzed based on insurance type (Medicare versus private insurance) without regard for patient age and associated comorbidities. This distinction is of particular importance in the group of patients insured by Medicare where there exists a large bimodal distribution of very young and very old women, based on eligibility requirements for coverage. Unlike previous manuscripts, this study is the first to take into account and minimize the differences in comorbidities between these groups before analyzing the rates of IBR by creating matched cohorts.

There are likely many reasons for the observed increased rates of IBR among breast cancer patients. Passage of the WHCRA has lessened the financial barriers to this procedure among a large number of patients. Additionally, the feasibility of prophylactic mastectomy and reconstruction has brought to the public's attention by several prominent celebrities. In the future, further patient education may likely be a driver toward increased access to IBR as a favorable option for breast cancer patients. Of note, Congress has recently passed the Breast Cancer Patient Education Act of 2015, which will allocate more resources toward patient education regarding options for breast reconstruction after mastectomy.[16]

Recently, there has been much ongoing speculation among plastic surgeons in the literature that declining reimbursement rates may be limiting the reconstructive options offered to patients.[32–35] To this end, Hernandez-Boussard et al. examined surgeon fee schedules using the national average Medicare physician reimbursement rates compared with the type of reconstruction chosen by patients. They observed a steady decrease in the rates of autologous breast reconstruction from 1998 to 2008, which closely paralleled a decrease in physician reimbursement over that same time period.[1] Our study did not show a similar trend, but rather that regardless of insurance type, women are being offered IBR at ever increasing rates over a similar time period.

There are several limitations of this study that should be noted. First, although data from the NIS are a reflection of the entire country and provide valuable information on current practices in the United States, this study is retrospective in nature. Second, this study was only limited to patients undergoing breast reconstruction in an immediate fashion after mastectomy. Accordingly, as patients undergoing delayed reconstruction were excluded from this study, there is a cohort of women who ultimately had breast reconstruction that were not included in this study. Finally, we were unable to conduct a detailed assessment of nonsurgical treatment, patient's background, and the decision-making processes. Nevertheless, this study provides a comprehensive overview of a matched cohort privately insured and Medicare-insured women undergoing IBR.

CONCLUSION

In this study, we examined IBR utilization between a matched population based on insurance type, Medicare or private insurance. The results of this study demonstrate a significant increase in rates of IBR among women regardless of insurance type over the time period of this study. Moreover, after an initial slower upward trend, after a decade, IBR in Medicare-insured women approached nearly similar rates among those with private insurance. Trends in unilateral versus bilateral mastectomy are also seen.

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