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Racial and Socio-Economic Disparities in Breast Cancer Hospitalization Outcomes by Insurance Status

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Abstract

Background—Breast cancer remains a major cause of morbidity and mortality among women in the US, and despite numerous studies documenting racial disparities in outcomes, the survival difference between Black and White women diagnosed with breast cancer continues to widen. Few studies have assessed whether observed racial disparities in outcomes vary by insurance type e.g. Medicare/Medicaid versus private insurance. Differences in coverage, availability of networked physicians, or cost-sharing policies may influence choice of treatment and treatment outcomes, even after patients have been hospitalized, effects of which may be differential by race.

Purpose—The aim of this analysis was to examine hospitalization outcomes among patients with a primary diagnosis of breast cancer and assess whether differences in outcome exist by insurance status after adjusting for age, race/ethnicity and socio-economic status.

Methods—We obtained data on over 67,000 breast cancer patients with a primary diagnosis of breast cancer for this cross-sectional study from the 2007-2011 Healthcare Cost and Utilization project Nationwide Inpatient Sample (HCUP-NIS), and examined breast cancer surgery type (mastectomy vs. breast conserving surgery or BCS), post-surgical complications and in-hospital mortality. Multivariable regression models were used to compute estimates, odds ratios and 95% confidence intervals.

Results—Black patients were less likely to receive mastectomies compared with White women (OR: 0.80, 95% CI: 0.71 - 0.90), regardless of whether they had Medicare/Medicaid or Private insurance. Black patients were also more likely to experience post-surgical complications (OR: 1.41, 95% CI: 1.12-1.78) and higher in-hospital mortality (OR: 1.57, 95%: 1.21-2.03) compared with White patients, associations that were strongest among women with Private insurance. Women residing outside of large metropolitan areas were significantly more likely to receive

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mastectomies (OR: 1.89, 95% CI: 1.54-2.31) and experience higher in-hospital mortality (OR: 1.74, 95% CI: 1.40-2.16) compared with those in metropolitan areas, regardless of insurance type.

Conclusion—Among hospitalized patients with breast cancer, racial differences in hospitalization outcomes existed and worse outcomes were observed among Black women with private insurance. Future studies are needed to determine factors associated with poor outcomes in this group of women, as well as to examine contributors to low BCS adoption in non-metropolitan areas.

Keywords

Race/Ethnicity; Socio-Economic Status; Insurance type; mortality; post-surgical complications

INTRODUCTION

Breast cancer is a leading cause of loss of more potential life years in women under 65 years of age compared to any other non-traumatic condition in the U.S [1]. Even though it is the most commonly diagnosed cancer among both Black and White women in the United States [2], significant racial disparities are evident both in breast cancer incidence and mortality [3], as well as in receipt of adequate treatment and outcomes [4-9]. Black women continue to experience significantly lower five-year survival rates despite decades of research in this area [10-12], and while numerous reasons have been presented to account for survival disparity, the root cause of the disparity and potential strategies to eliminate them remain elusive. Racial differences in breast cancer outcomes have been attributed to racial differences in access to and utilization of high-quality screening and treatment [10, 11, 13], primary risk factors such as breastfeeding and obesity that are differentially distributed by race [12-15], socioeconomic status [14, 16-20], and biological differences such as tumor aggressiveness [21, 22].

Differences in healthcare outcomes based on access to healthcare have been a subject of considerable debate in the United States. According to the Centers for Disease control, approximately 36 million people in the United States do not have health insurance, leading to either significant delay or lack of necessary medical care due to significant out of pocket costs [23]. Ayanian et al. showed that women who did not have private insurance, most often obtained through an employer, were more likely to experience adverse outcomes of breast cancer [1]. A few other studies demonstrated treatment differences based on type of insurance; for instance, women with private insurance were more likely to undergo breast conserving surgery compared with those who were uninsured or had Medicaid or Medicare insurance [24-26]. Furthermore, mastectomy rates have also been shown to vary by insurance payer status, with patients on Medicaid insurance more likely to receive mastectomy [27]. National guidelines for breast cancer treatment in the US recommends breast conservation therapy plus radiation in lieu of mastectomy as the preferable treatment option for most women with early stage breast cancer [25]. However, since both treatment modalities are associated with similar survival rates, the decision to have BCS versus mastectomy is likely based on issues of cost as well as individual and physician preference.

Although the influence of insurance status and type of insurance on treatment options have been extensively studied [25, 28], it is still not clear whether differences exist in terms of hospitalization outcomes based on insurance type. These differences may be driven by policy-specific differences in allowable procedures, hospital length of stay before discharge, or it may be due to demographic-related differences since patients with private insurance through an employer tend to be younger, healthier and of higher SES compared with patients on Medicare or Medicaid [29]. The aim of this analysis was to examine hospitalization outcomes among patients with a primary diagnosis of breast cancer and assess whether differences in outcome exist by insurance status after adjusting for age, race/ethnicity and socio-economic status.

METHODS

Study Design And Data Source

We obtained data for this cross-sectional study from the Healthcare Cost and Utilization project Nationwide Inpatient Sample (HCUP-NIS). The HCUPNIS discharge database includes administrative claims on hospital inpatient stays representing a 20% of stratified sample of hospitals in the United States, including public hospitals and academic medical centers [1]. This dataset is widely considered the most valid and reliable source of epidemiological data on inpatient care and outcomes in the US. Currently, HCUP covers about 1000 US hospitals with data on over seven million hospital stays. The dataset includes claims on all diagnoses and procedures performed during admission, captured with ICD-9 codes, and also includes non-clinical variables assessed upon admission such as race/ethnicity, residential region, and median household income in the patient's zip code. Further details about NIS can be obtained from: http://www.hcupus.ahrq.gov/nisoverview.jsp.

Clinical Variables

We used the International Classification of Diseases, 9th Revision or the ICD-9 diagnostic and primary procedure codes to identify patients admitted with a primary diagnosis of breast cancer for this analysis. As cancer stage data is not captured in the dataset, a proxy breast cancer stage variable was created using the clinical criteria of disease staging. Patients with breast cancer were assigned into metastatic stage when ICD-9 code indicated metastatic disease to other organs (196.0), non-metastatic stage when those codes were absent, and in-situ stage was defined using ICD-9 code 2330. Multiple previous studies have used similar staging criteria using the HCUP-NIS database [30]. To determine the presence of other comorbid conditions among patients, a modified Deyo Comorbidity Index was created using ICD-9 codes to identify major comorbid conditions including: congestive heart failure, chronic pulmonary disease, cerebrovascular disease, diabetes mellitus with or without chronic complications, dementia, myocardial infarctions, rheumatic disease, peripheral vascular disease, mild, moderate or severe liver disease, peptic ulcer disease, renal disease, hemiplegia or paraplegia, and HIV/AIDS. The presence of each condition within each patient was identified and summed up to get a single comorbidity score per patient. The modified Deyo Comorbidity Index was previously used in several studies utilizing the HCUP-NIS database [2-4].

Other Covariates

Our main predictor for this analysis was race/ethnicity (categorized into: White, Black, Hispanic and Other) and area-level income (based on median household income at the zip-code level, divided into quartiles ranging from lowest income zip-code to the highest income zip-code). The aim of this analysis was to determine whether racial and socio-economic disparities in breast cancer hospitalization outcomes differed by insurance status. We defined insurance status using the HCUP insurance variable [1], classified as: Medicaid/Medicare, private (this includes private commercial carriers, Health Maintenance Organizations or HMOs and Preferred Provider Organizations or PPOs) and others (includes self-insured and Worker's Compensation, Title V, and other government programs). We adjusted for *a priori* specified confounders, including age at admission and residential region. Residential region was based on the 2003 version of the Urban Influence Codes [5], and categorized into: large metropolitan areas with 1 million residents or more), small metropolitan areas (metropolitan areas with less than 1 million residents), micropolitan areas (non-metropolitan areas adjacent to metropolitan areas) and non-metropolitan or micropolitan areas (noncore areas with or without its own town).

Outcome Variable

We focused on three sets of breast cancer hospitalization outcomes in our analysis: first, receipt of surgery (Mastectomy vs Breast conserving surgery or BCS) among patients with a primary diagnosis of breast cancer; second, post-surgical complications among breast cancer patients who received surgery; and third, in-hospital mortality among all women with a primary diagnosis of breast cancer. To address these questions, we created two analytic datasets; the full dataset with all women diagnosed with breast cancer, and a restricted dataset with only patients who received breast cancer surgery. Receipt of surgery was defined based on ICD-9 diagnosis and procedure codes for mastectomy (ICD-9 codes 85.41-85.48), and BCS (ICD-9 codes 85.21, 85.22, 85.23). In-hospital mortality was based on deaths occurring during hospitalization. The presence of post-surgical complications was determined by using ICD-9 codes to identify infections, mechanical wounds, pulmonary, gastrointestinal, urinary cardiovascular and intra-operative complications. HCUP-NIS does not contain information on patient outcomes such as mortality or complications after discharge and so those outcomes were not included in our analysis.

Statistical Analysis

Descriptive statistics was used to examine the differences between baseline study characteristics including race/ethnicity and residential income, stratified by insurance status using chi-square for categorical variables and ANOVA for continuous variables. The association between race/ethnicity and residential income on each study outcome (1. receipt of surgery, 2. post-surgical complications, and 3. In-hospital mortality) stratified by insurance status and adjusted for stage of presentation, residential region, age, and comorbidities was analyzed using multivariable logistic regression analysis. The models examining receipt of the surgery and post-surgical complication outcomes was based on the restricted dataset containing only breast cancer patients who received mastectomy or BCS. All analysis was conducted using SAS 9.4 (Cary, NC).

RESULTS

There were 67,084 women ages 40 years and older who were hospitalized with a primary diagnosis of breast cancer between 2007 and 2011. Of these, 34,653 (51.7%) received mastectomy and 2,762 (4.12%) received BCS as a treatment for breast cancer, and 1,206 (1.8%) died during hospitalization (Table 1). About 48.1% of women had Medicare or Medicaid insurance, 47.6% had a private insurance, and the remaining 4.3% were classified as having any other type of insurance-these include self-insured, Veteran's Affairs or other types of insurance coverage. Patients with Medicaid/Medicare (mean age: 69.8 years) were older at the time of admission compared to those with Private (mean age: 54.2 years) or other (mean age: 56.1 years) insurance. About 50.4% of patients with metastatic disease were covered under Medicare/Medicaid, compared with 44.1% with Private insurance Patients with Private insurance had had significantly lower average number of comorbidities (0.13) compared with those on Medicare/Medicaid (0.34) and Other (0.16) insurance types (p-value <0.0001), while patients on Medicare/Medicaid were more likely to experience in-hospital mortality (p-value <.0001). About 46% of women with private insurance received mastectomies, compared with 50% of those with Medicaid/Medicare, while 54.34% of women with private insurance had BCS treatment, compared with 40.33% of those with Medicaid/Medicare (p-value < 0.0001). White patients were more likely to have Private health insurance (49.3%) relative to other types of health insurance, while most of the Black (53.2%) and Hispanic (50%) patients had Medicaid/Medicare insurance. Women with Private insurance were mostly from large metropolitan areas as compared with those having other types of health insurance (50.81% with Private, 44.6% with Medicare/ Medicaid and 4.6% with other). About 60% of patients with Medicaid/ Medicare insurance resided in low area-level income areas, compared to 34% of patients with private insurance and 5.8% of patients with Other insurance types.

Racial and socio-economic differences in the receipt of mastectomy compared with BCS was evaluated, overall and stratified by insurance status among patients who received surgery (Table 2). After adjusting for age, number of comorbidities, stage of presentation, and residential region, the odds of receiving mastectomy compared to BCS was significantly lower among Black (OR: 0.80, 95% CI: 0.71 – 0.90) and Hispanic (OR: 0.77, 95% CI: 0.67 – 0.88) patients in the entire sample compared with White patients, with similar findings for patients on Medicaid/Medicare (Black OR=0.82, 95% CI: 0.70 - 0.97; Hispanics OR=0.78, 95% CI: 0.64-0.95). However, among patients with Private insurance, only Black patients still had lower odds of receiving mastectomies compared with White patients (OR: 0.80, 95% CI: 0.66 – 0.97). In addition, the odds of mastectomy compared to BCS were lower among patients in lower area-level income in the entire sample (OR: 0.86, 95% CI: 0.77 – 0.97), and among patients with Private insurance (OR=0.82, 95% CI: 0.69-0.98) compared with patients in highest area-level income areas. Residing outside of large metropolitan areas significantly increased the odds of receiving mastectomies in the overall sample and especially among patients on Medicare/Medicaid (OR=1.90, 95%CI: 1.48-2.44) and Other (OR: 3.84, 95% CI: 1.16 – 12.64) insurance. Finally, women with higher number of comorbidities had significantly lower odds of mastectomy compared to BCS in the total

sample and all insurance types except Other, although the association was non-significant in this group.

Among patients who received surgery, odds of post-operative complications were assessed overall and stratified by insurance status (Table 3). Overall, Black patients were significantly more likely to experience post-operative complications compared with Whites (OR: 1.21, 95% CI: 1.03 – 1.42), however this association was only observed among Black patients with Private insurance (OR=1.41, 95%CI: 1.12-1.78). There were no other racial differences in post-operative complications, although patients with more comorbid conditions experienced significantly more complications in both Medicaid/Medicare (OR= 1.45, 95%CI: 1.32-1.60) as well as Private (OR= 1.34, 95%CI: 1.12-1.60) insurance holders.

Among the entire sample of hospitalized breast cancer patients during the study period (Table 4), in-hospital mortality outcomes were evaluated overall and stratified by insurance status. After adjusting for age, disease stage, residential region and comorbidities, Black (OR: 1.37, 95% CI: 1.17 – 1.62) and Hispanic (OR: 1.25, 95% CI: 1.01 – 1.56) patients experienced significantly higher in-hospital mortality compared with White patients, as did patients residing in the lowest areal-level income areas (OR: 1.34, 95% CI: 1.11 – 1.62) compared with patients in the highest area-level income areas. Similar results were observed by race among patients with Medicare/Medicare insurance, however Black patients with Private insurance experienced even higher odds of in-hospital mortality than those on Medicare/Medicaid (OR=1.57, 95%CI: 1.21-2.03) compared with Whites, while the association for Hispanics became non-significant. The association between area-level income and in-hospital mortality was attenuated and non-significant among patients with Medicare/Medicaid, but remained among patients with Private insurance (OR: 1.63, 95% CI: 1.27 – 2.10).

DISCUSSION

In this large dataset of patients hospitalized with a primary diagnosis of breast cancer, only about 4% received BCS and 52% received mastectomies, in line with recommendations by the National Institutes of Health regarding the use of BCS plus radiation as the preferred treatment for early-stage breast cancer [6]. Other US studies have shown higher rates of BCS, with estimates ranging from 50% to 70% [8-10]. Although both BCS and mastectomies are associated with similar survival rates [11-14], BCS is less invasive, and associated with less disfigurement, with superior quality of life outcomes related to body image and sexual functioning [15-17]. Thus, there are likely other factors such as socio-economic status and health insurance, in addition to individual or physician preferences that may influence treatment type. Health insurance coverage has been well studied as an important factor in determining the timing and quality of breast cancer treatment among US women [25, 31], but access to health insurance does not fully account for the notable racial/ethnic disparities in care. By utilizing the data from the large Nationwide Inpatient Sample database and focusing on hospitalized patients who had theoretically accessed the healthcare successfully, we are able to determining whether type of insurance made a difference in post-operative complications, hospital length of stay and inhospital mortality. This information may help to further shed light on persistent disparities in breast cancer

outcomes, and possibly highlighting areas where targeted efforts may be focused to improve survival for all women with breast cancer.

We observed that after adjusting for clinical factors such as stage at presentation and number of comorbidities, Black and Hispanic patients were less likely to receive Mastectomies, however patients residing outside of large metropolitan areas were almost twice as likely to receive Mastectomies compared with BCS. The observed association was consistent across insurance types (private insurance or Medicare/Medicaid), but strongest among patients with Other insurance types, with those patients almost four times more likely to receive mastectomies compared with BCS. This finding may be driven by other aspects of healthcare access beyond insurance status, such as distance and availability of radiation therapy (RT) in non-metropolitan areas, which has been shown to influence cancer treatment and utilization of radiation therapy. Several studies have demonstrated that patients living greater distance from the RT facility statistically significant lower probability of receiving BCS [32-35]. Many patients choose mastectomy over BCS and RT to avoid the protracted course of daily treatment involved with RT, which consists of daily radiotherapy to the whole breast followed by a boost to the tumor bed, delivered over the course of 6–7.5 weeks [32].

We also observed that upon adjusting for clinical factors including stage and comorbidities, racial disparities persisted in in-hospital mortality among patients, with Black patients at 37% higher odds of dying during hospitalization compared with Whites in the overall sample, and 32% higher odds among patients with Medicaid/Medicare. The association was stronger among patients with Private insurance, with Black patients at 57% higher odds of dying during hospitalization compared with White patients, but no significant difference among patients with Other insurance types. There were also significant differences by region, with patients residing outside of large metropolitan areas more likely to die during hospitalization across insurance types, although the strongest association was among patients with Medicare/Medicaid. Similarly, Black patients experienced significantly higher odds of post-surgical complications, and this appeared to be driven mainly by the association among patients with Private insurance. Our results suggest that although Black patients were more likely to receive BCS according to national recommendations, they were more likely to experience negative hospitalization outcomes, and these negative outcomes were more likely among those with private insurance. Our observation of strong regional differences in surgery type and in-hospital mortality requires further investigation to determine whether this is driven by lack of healthcare resources in rural areas where hospitals may lack trained medical personnel or equipment to perform the newer BCS procedures, and/or to provide necessary post-surgical care. However, the regional differences do not fully explain racial differences in hospitalization outcomes, since Blacks tend to reside in urban, metropolitan areas [36].

Private insurance is most often obtained through employment, implying that private insurance holders are likely younger [37] and of higher socio-economic status [38]. These trends were observed in our study population, with 61% of women at the highest area-level income category on Private insurance, compared with 36% on Medicare/Medicaid and 2.8% on Other insurance types. In addition, the average age at admission for women on Private

insurance was 54 years, compared with 70 years among women on Medicare/Medicaid and 56 years among women on Other insurance. In addition, women on Private insurance likely have better access to high-quality healthcare resources, as Private insurance tends to provide higher reimbursements to physicians compared to Medicare/Medicaid [39]. The observation of worse hospitalization outcomes among women with Private insurance warrants further study for several reasons: 1) we adjusted for stage at presentation and number of comorbidities at admission, reducing the possibility of confounding due to disease severity; 2) the established higher prevalence of aggressive (hormone-receptor negative) sub-types of breast cancer among Black women does not explain the stronger association with Private insurance as similar distribution of sub-types would be expected among Black women with other insurance types. Yet women on Private insurance still experienced much higher in-hospital mortality, and post-surgical complications compared with Black women with other insurance types. Future studies may be needed to examine the quality of cancer care among Black women, especially for younger, higher SES women with Private insurance. In addition, previous studies have shown that patient-physician interactions vary by race [40]. To the extent that such variations result in worse health outcomes for Black patients, interventions at both the patient and physician level will be critical to ensuring that patient-physician communication is improved, and guideline-adherent treatment is offered and received. Despite increased access to coverage, cost sharing continues to be a concern, particularly in the Medicare and privately insured populations [41]. Out-of pocket expenses have risen to a degree that is often thought to be unmanageable by many patients, and having insurance is not enough to alleviate the considerable burden posed by the high cost of treatment [42]. More research is also needed to better understand factors associated with *realized vs. potential access* [43] for those with insurance coverage as well as improved patient education regarding health insurance benefits and coverage for women with breast cancer.

There are several limitations of this study that should be noted. First, we were unable to conduct detailed assessment of non-surgical treatment, e.g. chemotherapy and hormonal therapy, as those are often outpatient procedures. Second, we were limited in our ability to adjust for aggressiveness of disease using variables such as ER, PR, and HER2 status as those are not available in the HCUP dataset. These variables are critical in determining the treatment modalities for breast cancer, including targeted therapy in women testing positive for any one of these measures, and may influence choice of surgery. In addition, our analyses include only inpatient stays and do not capture outpatient care or mortality occurring after discharge.

CONCLUSION

There were significant regional differences in the receipt of BCS compared with mastectomies among hospitalized women in the HCUP dataset, however significant racial differences existed in mortality and post-surgical complications, especially among women with Private insurance. Future studies are required to identify factors associated with low BCS adoption in non-metropolitan areas, and to determine whether biological factors, individual preference, patient-provider communication or lack of awareness of insurance

benefits/coverage is responsible for poor breast cancer hospitalization outcomes among Black women with Private insurance.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Baseline characteristics by insurance among hospitalized breast cancer patients, Nationwide Inpatient Sample, 2007-2011

	Insurance Status N(%)				
	All[β] 67084	**Medicare/Medicaid[€] 32262(48.09)**	**Private[€] 31923(47.59)**	**Other[€] 2899(4.32)**	**p-value[*]**
Race					<.0001
White	48978 (73.01)	23285(47.54)	24143 (49.29)	1550 (3.16)	
Blacks	8617 (12.85)	4585(53.21)	3440 (39.92)	592 (6.87)	
Hispanic	5132 (7.65)	2566(50.00)	2047 (39.89)	519 (10.11)	
Other	4357 (6.49)	1826(41.91)	2293 (52.63)	238 (5.46)	
Area-level Income					<.0001
Q4-Highest	20185 (30.09)	7351 (36.42)	12253 (60.70)	581 (2.88)	
Q3	16043 (23.91)	7369(45.93)	8006 (49.90)	668 (4.16)	
Q2	15313 (22.83)	8183(53.44)	6376 (41.64)	754 (4.92)	
Q1-Lowest	15543 (23.17)	9359(60.21)	5288 (34.02)	896 (5.76)	
Region					<.0001
Large metro	40017(59.65)	17852(44.61)	20332(50.81)	1833(4.58)	
Small metro	16741(24.96)	8459(50.53)	7662(45.77)	620(3.70)	
Micropolitan	6160(9.18)	3424(55.58)	2476(40.19)	260(4.22)	
Not metro or micro	4166(6.21)	2527(60.66)	1453(34.88)	186(4.46)	
Disease stage					<.0001
Non-metastatic	46866(69.86)	22081(47.12)	23006(49.09)	1779(3.80)	
Metastatic	20218(30.14)	10181(31.56)	8917(44.10)	1120(5.54)	
Mastectomy					<.0001
No	32431 (48.34)	14901(45.95)	15918(49.08)	1612(4.97)	
Yes	34653 (51.66)	17361(50.10)	16005(46.19)	1287(3.71)	
Breast Conserving					<.0001
No	64322 (95.88)	30761(47.82)	30809(47.90)	2752(4.28)	
Yes	2762 (4.12)	1501(54.34)	1114(40.33)	147(5.32)	
Died During Hospitalization					<.0001
No	65878 (98.20)	31740(48.18)	31405(47.67)	2733(4.15)	
Yes	1206(1.80)	522(43.28)	518(42.95)	166(13.76)	
Complications					0.2872
0	64196 (95.69)	30829(48.02)	30585(47.64)	2782(4.33)	
1	2689 (4.01)	1336(49.68)	1248(46.41)	105(3.90)	
>=2	199 (0.30)	97(48.74)	90(45.23)	12(6.03)	
Age at admission-years [†]	61.76(13.00)	69.79(11.96)	54.16(8.69)	56.14(10.31)	<.0001
Number of Comorbidities [†]	0.23(0.52)	0.34(0.62)	0.13(0.38)	0.16(0.44)	<.0001

[†]Mean (Standard Deviation)

*Estimated using ANOVA or Chi-square test

βColumn percentage

ϵRow percentage

Table 2

Multivariable adjusted odds ratios for mastectomy vs. BCS stratified by insurance Status among surgically treated breast cancer patients, Nationwide Inpatient Sample, 2007-2011.

	All		Medicaid/Medicare		Private		Other	
	n	AOR(95%CI) [a]	n	AOR(95%CI) [a]	n	AOR(95%CI) [a]	n	AOR(95%CI) [a]
Race/Ethnicity								
White	27350	**Ref**	13809	**Ref**	12814	**Ref**	727	**Ref**
Black	4651	**0.80(0.71- 0.90)**	2493	**0.82(0.70-0.97)**	1889	**0.80(0.66-0.97)**	269	0.76(0.47-1.25)
Hispanic	2873	**0.77(0.67- 0.88)**	1451	**0.78(0.64-0.95)**	1127	0.88(0.69-1.12)	295	0.66(0.42-1.05)
Other	2541	0.86(0.74- 1.00)	1109	0.91(0.73-1.14)	1289	0.87(0.70-1.10)	143	0.60(0.34-1.06)
Area-level Income								
Q4-Highest	10975	**Ref**	4204	**Ref**	6490	**Ref**	281	**Ref**
Q3	8831	0.97(0.87- 1.08)	4215	1.07(0.91-1.25)	4299	0.95(0.81-1.12)	317	0.59(0.34-1.06)
Q2	8728	**0.86(0.77- 0.97)**	4896	0.96(0.82-1.13)	3465	**0.82(0.69-0.98)**	367	0.64(0.36-1.15)
Q1-Lowest	8881	0.95(0.84- 1.08)	5547	1.07(0.91-1.26)	2865	0.96(0.78-1.17)	469	0.59(0.34-1.04)
Region								
Large metro	21877	**Ref**	10124	**Ref**	10841	**Ref**	912	**Ref**
Small metro	9398	**1.37(1.24- 1.51)**	5037	**1.50(1.31-1.72)**	4066	**1.23(1.05-1.44)**	295	1.07(0.68-1.68)
Micropolitan	3702	**1.44(1.24-1.68)**	2167	**1.62(1.32-1.98)**	1402	1.18(0.93-1.51)	133	1.50(0.74-3.03)
Not metro or micro	2438	**1.89(1.54- 2.31)**	1534	**1.90(1.48-2.44)**	810	**1.75(1.22-2.52)**	94	**3.84(1.16-12.64)**
Stage at Presentation								
Non-metastatic/in-situ	27066	**Ref**	13617	**Ref**	12446	**Ref**	1003	**Ref**
Metastatic	10349	**0.85(0.78- 0.93)**	5245	1.06(0.94-1.19)	4673	**0.65(0.57-0.74)**	431	0.93(0.64-1.34)
Age at admission-years	37415	**0.99(0.99- 0.99)**	18862	0.99(0.99-1.00)	17119	**0.99(0.98-0.99)**	1434	0.99(0.98-1.01)
Number of Co-morbidities	37415	**0.84(0.78-0.90)**	18862	**0.83(0.77-0.90)**	17119	**0.83(0.71-0.96)**	1434	1.04(0.68-1.60)

[a] Adjusted for race, age, area-level income, region, stage of presentation and number of comorbidities.

AOR= Adjusted Odds Ratio

Table 3

Multivariable adjusted odds ratios for post-operative complications stratified by insurance status among surgically treated breast cancer patients, Nationwide Inpatient Sample, 2007-2011.

	All		Medicaid/Medicare		Private		Other	
	n	AOR(95%CI) [a]	n	AOR(95%CI) [a]	n	AOR(95%CI) [a]	n	AOR(95%CI) [a]
Race/Ethnicity								
White	27350	**Ref**	13809	**Ref**	12814	**Ref**	727	**Ref**
Black	4651	**1.21(1.03-1.42)**	2493	1.09(0.87- 1.37)	1889	**1.41(1.12-1.78)**	269	0.69(0.25- 1.88)
Hispanic	2873	0.96(0.78-1.19)	1451	0.90(0.67- 1.22)	1127	0.88(0.63-1.25)	295	2.01(1.00- 4.05)
Other	2541	0.93(0.74-1.15)	1109	0.84(0.60- 1.17)	1289	0.93(0.68-1.29)	143	2.10(0.93- 4.74)
Area-level Income								
Q4-Highest	10975	**Ref**	4204	**Ref**	6490	**Ref**	281	**Ref**
Q3	8831	1.08(0.94-1.25)	4215	0.91(0.74- 1.12)	4299	1.22(0.99-1.49)	317	1.36(0.62- 2.98)
Q2	8728	0.99(0.85-1.15)	4896	0.86(0.69- 1.07)	3465	1.13(0.90-1.42)	367	1.03(0.45- 2.37)
Q1-Lowest	8881	0.86(0.73-1.02)	5547	**0.76(0.60- 0.95)**	2865	1.03(0.80-1.33)	469	0.56(0.22- 1.41)
Region								
Large metro	21877	**Ref**	10124	**Ref**	10841	**Ref**	912	**Ref**
Small metro	9398	0.96(0.84-1.09)	5037	**0.77(0.64- 0.93)**	4066	**1.21(1.00-1.45)**	295	1.11(0.53- 2.29)
Micropolitan	3702	1.06(0.88-1.28)	2167	1.07(0.84- 1.37)	1402	1.02(0.75-1.38)	133	1.04(0.35- 3.14)
Not metro or micro	2438	1.12(0.89-1.40)	1534	**0.97(0.64- 0.93)**	810	1.31(0.91-1.88)	94	1.86(0.59- 5.88)
Stage at Presentation								
Non-metastatic	27066	**Ref**	13617	**Ref**	12446	**Ref**	1003	**Ref**
Metastatic	10349	0.89(0.79-1.00)	5245	0.84(0.71- 1.00)	4673	0.95(0.80-1.13)	431	0.70(0.37- 1.32)
Age at admission-years	37415	1.00(1.00-1.01)	18862	1.00(0.99- 1.01)	17119	**1.01(1.00-1.02)**	1434	1.01(0.99- 1.04)
Number of Co-morbidities	37415	**1.39(1.28-1.51)**	18862	**1.45(1.32- 1.60)**	17119	**1.34(1.12-1.60)**	1434	0.65(0.28- 1.52)

[a] Adjusted for race, age, area-level income, region, stage of presentation and number of comorbidities.

AOR= Adjusted Odds Ratio

Table 4

Multivariable adjusted odds ratios for in-hospital mortality stratified by Insurance status among all breast cancer patients, Nationwide Inpatient Sample, 2007-2011.

	All		Medicaid/Medicare		Private		Other	
	n	AOR(95%CI)[a]	n	AOR(95%CI)[a]	n	AOR(95%CI)[a]	n	AOR(95%CI)[a]
Race/Ethnicity								
White	48978	**Ref**	23285	**Ref**	24143	**Ref**	1550	**Ref**
Black	8617	**1.37(1.17-1.62)**	4585	**1.32(1.03-1.68)**	3440	**1.57(1.21-2.03)**	592	0.68(0.42-1.08)
Hispanic	5132	**1.25(1.01-1.56)**	2566	**1.38(1.01-1.89)**	2047	1.37(0.96-1.96)	519	**0.38(0.21-0.69)**
Other	4357	0.92(0.70-1.21)	1826	1.14(0.77-1.69)	2293	0.88(0.57-1.34)	238	**0.38(0.16-0.90)**
Area-level Income								
Q4-Highest	20185	**Ref**	7351	**Ref**	12253	**Ref**	581	**Ref**
Q3	16043	**1.35(1.13-1.60)**	7369	1.13(0.84-1.50)	8006	**1.63 (1.27-2.10)**	668	0.67(0.39-1.16)
Q2	15313	1.20(1.00-1.45)	8183	0.99(0.74-1.32)	6376	1.30 (0.99-1.72)	754	0.95(0.57-1.60)
Q1-Lowest	15543	**1.34(1.11-1.62)**	9359	1.20(0.90-1.59)	5288	1.30 (0.97- 1.75)	896	1.02(0.60-1.73)
Region								
Large metro	40017	**Ref**	17852	**Ref**	20332	**Ref**	1833	**Ref**
Small metro	16741	1.09(0.94-1.26)	8459	1.05(0.84-1.32)	7662	**1.26(1.02- 1.57)**	620	0.88(0.56-1.37)
Micropolitan	6160	**1.27(1.03-1.56)**	3424	1.30(0.96-1.77)	2476	**1.43(1.04- 1.98)**	260	0.99(0.54-1.82)
Not metro or micro	4166	**1.74(1.40-2.16)**	2527	**2.01(1.48-2.72)**	1453	**1.62(1.10- 2.39)**	186	**1.36(0.73-2.52)**
Stage at Presentation								
Non-metastatic	46866	**Ref**	22081	**Ref**	23006	**Ref**	1779	**Ref**
Metastatic	20218	**14.25(12.12-16.76)**	10181	**11.52(9.09-14.60)**	8917	**18.48(14.21-24.03)**	1120	**10.20(6.58-15.81)**
Age at admission-years	67084	1.01(1.00-1.01)	32262	0.99(0.98-1.00)	31923	**1.06(1.05-1.07)**	2899	**1.05(1.03-1.06)**
Number of Co-morbidities	67084	**1.45(1.33-1.59)**	32262	**1.49(1.32-1.67)**	31923	**1.65(1.40-1.95)**	2899	**1.39(1.04-1.85)**

[a] Adjusted for race, age, area-level income, region, stage of presentation and number of comorbidities.

AOR= Adjusted Odds Ratio