Factors associated with contralateral preventive mastectomy

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Introduction: Contralateral prophylactic mastectomy (CPM) is an option for women who wish to reduce their risk of breast cancer or its local recurrence. There is limited data on demographic differences among patients who choose to undergo this procedure.

Methods: The population-based Florida cancer registry, Florida’s Agency for Health Care Administration data, and US census data were linked and queried for patients diagnosed with invasive breast cancer from 1996 to 2009. The main outcome variable was the rate of CPM. Primary predictors were race, ethnicity, socioeconomic status (SES), marital status and insurance status.

Results: Our population was 91.1% White and 7.5% Black; 89.1% non-Hispanic and 10.9% Hispanic. Out of 21,608 patients with a single unilateral invasive breast cancer lesion, 837 (3.9%) underwent CPM. Significantly more White than Black (3.9% vs 2.8%; P = 0.001) and more Hispanic than non-Hispanic (4.5% vs 3.8%; P=0.0909) underwent CPM. Those in the highest SES category had higher rates of CPM compared to the lowest SES category (5.3% vs 2.9%; P<0.001). In multivariate analyses, Blacks compared to Whites (OR = 0.59, 95% CI = 0.42–0.83, P = 0.002) and uninsured patients compared to privately insured (OR = 0.60, 95% CI = 0.36–0.98, P = 0.043) had significantly less CPM.

Conclusion: CPM rates were significantly different among patients of different race, socioeconomic class, and insurance coverage. This observation is not accounted for by population distribution, incidence or disease stage. More in-depth study of the causes of these disparities in health care choice and delivery is critically needed.

Keywords: breast cancer, bilateral mastectomy, cancer disparities, social factors, ethnic factors

Introduction

Contralateral prophylactic/preventive mastectomy (CPM) patients with unilateral invasive breast cancer (BC) increased in the US by 150% since 1988, with no evidence of a geographic difference in practice or plateau effect.1 The annual incidence of contralateral breast cancer (CBC) is 0.5% to 0.75%, but has now radically decreased with the recent use of newer therapies such as Tamoxifen, aromatase inhibitors, Trastuzumab and neo/adjuvant chemotherapy.2–5 Even in subgroups thought to be at higher risk for CBC, such as those younger than 45 years and those with lobular histologies, the actuarial CBC rate at 10 years remains <7%.2 At present, the only two groups of women at a substantially increased risk of CBC are those with BRCA mutations,6 and women with a history of mantle irradiation during childhood and adolescence.7
A Cochrane Review published by Lostumbo et al. found that although CPM reduces the risk of developing CBC, there is insufficient evidence that CPM improves survival. Although it is unclear why the aggressive and irreversible procedure of CPM is growing in prevalence, speculation includes that greater awareness and availability of genetic testing may be responsible, but this is uncertain. In a recent study on 2,504 patients using multivariate logistic regression to identify independent predictors of CPM, 30.6% of patients <50 years of age underwent CPM compared with only 18.2% of women ≥50 years of age (odds ratio [OR] = 2.2). They were more likely to be surgeon identified, White race (OR = 3.3), have a family history of BC (OR = 2.9), have invasive lobular histology, be able to have immediate reconstruction (OR = 3.3), and have multicentric disease. Most of these women did not have positive genetic mutation findings. Another study suggested increased rates of CPM were associated with having a female surgeon. However, these previous studies were not performed using large comprehensive databases. Therefore, the current study explored factors associated with use of CPM in a large enriched population-based cancer registry database which included demographic, clinical and co-morbidity factors. The main aim of this study was to determine which demographic and social factors were associated with receipt of CPM. As previous research has shown that disparities in treatments and procedures in the care of BC patients (eg, time to initiation of chemotherapy or adjuvant radiation, and use of breast conserving surgery) are associated with race, ethnicity, socioeconomic status (SES) and insurance status, we were particularly interested in exploring the association of these variables with receipt of CPM. Our secondary aim was to investigate clinical (treatment and hospital characteristics) and comorbidity associations with CPM surgery.

Materials and methods

Our study used data from three sources to investigate CPM in patients with invasive BC. The Florida Cancer Data System (FCDS), a population-based Florida cancer registry, was used to identify BC patients diagnosed from 1996 to 2009. Florida’s Agency for Health Care Administration (AHCA) database provided procedure and diagnoses information from all in- and out-patient facilities, and data from the US census provided a proxy for individual SES. Female patients who were 18 years or older were included if they resided in Florida during the study period. Patients with carcinoma in situ or with missing data on surgery (bilateral or unilateral), race, ethnicity, SES, marital status or insurance status were excluded from the study. Patients with unilateral BC were identified by having a single record of malignant neoplasm of the breast with diagnostic code 174 (2012 version of International Classification of Diseases, Ninth Revision (ICD-9)). Patients with more than one 174 code either with the same date or different dates were assumed to be multifocal, bilateral, or recurrent BC, and were excluded from the study. As the majority of patients receive surgical treatment at the time of diagnosis, patients receiving CPM later in the course of their disease were not included in this study.

The dichotomous primary outcome variable was whether the patient had CPM (yes/no). Patients’ sociodemographic variables were age at diagnosis, race (White, Black, other), ethnicity (Hispanic and non-Hispanic), neighborhood SES based on percent of individuals living below the federal poverty line from US census tract-level information (lowest SES ≥20%, middle-low ≥10% and <20%, middle-high [≥5% and <10%], or highest <5%), marital status (never married, married, or divorced/separated/widowed), primary payer at diagnosis (private insurance, Medicare, Medicaid, defense/military, Indian Health Service, other insurance, or uninsured), urban or rural geographic residence (by zip code), and characteristics of the treating facility (teaching vs non-teaching hospital and high vs low volume hospital). Clinical characteristics included tumor and treatment related variables such as the Surveillance, Epidemiology, and End Results (SEER) stage, histological differentiation grade, and history of chemotherapy or radiation. Finally, comorbidities were available for all patients based on ICD-9 diagnoses.

Statistical analysis

Demographic and clinical characteristics of patients were calculated as frequencies and percentages for categorical variables and means and standard deviations (Std) for continuous variables, and compared for all patients in the population, and then for patients with unilateral and CPM. To assess what demographics and clinical factors were significantly associated with having a CPM, multivariate logistic regression models using generalized estimation equations were fitted. Robust standard errors were calculated to take into account clustering of patients within facilities. The first multivariate model (Model 1) included covariates for sociodemographic and clinical variables; the second multivariate model (Model 2) included all diagnostic information to fully adjust for other co-morbidities. Adjusted ORs, corresponding 95% confidence intervals (95% CIs), and P-values were calculated from these models. Statistical significance was considered at $P<0.05$. All statistical analyses were performed...
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Results
Between 1996 and 2009, 54,275 women were diagnosed with invasive BC and underwent a unilateral or CPM. Of these, 32,667 records had no data on whether there was unilateral or bilateral disease, race, ethnicity, SES, marital status, or insurance status, and therefore these cases were excluded from the analyses, for a final sample of 21,608 patients with unilateral disease and a record of the type of surgery. Descriptive statistics for demographics characteristics are provided for overall sample and by laterality of procedure done (Table 1). Mean age at diagnosis of all patients was 67.5 years (Std =13.9). The majority of patients were White (19,684; 91.1%), while 1,625 (7.5%) were Black, and 299 (1.4%) were other races. Non-Hispanics (19,257; 89.1%) outnumbered the Hispanics (2,351; 10.9%). There were 719 (3.3%) uninsured patients, 642 (3%) on Medicaid compared to 6,342 (29.4%) with private insurance and 11,778 (54.5%) on Medicare.

Of the 21,608 patients in our population, all with a single unilaterally diagnosed lesion, 837 (3.9%) underwent bilateral mastectomy. Those who had CPM were significantly younger (mean =56.9 years, SD =14.2) than those who had a unilateral procedure (mean =68 years, SD =13.7). Only 2.8% of Black patients had CPM as compared to 3.9% of White patients (P<0.001). Lower rates of CPM were seen in non-Hispanic patients (3.8%) compared to Hispanics (4.5%). There was a monotonic relationship between SES and rate of CPM, with CPM increasing from 2.9% in the lowest SES up to 5.3% in the highest SES (P<0.001).

Clinical characteristics of all patients and patients with unilateral and CPM are shown in Table 2. Patients undergoing CPM have lower rates of four or more comorbid conditions than those undergoing unilateral procedures (40.6% vs 58.1%) and are more likely to get adjuvant chemotherapy (23.7% vs 11.7%), but are similar on other clinical and pathological characteristics.

In the multivariate logistic regression model without co-morbidities (Table 3; Model 1), Black patients were less likely than Whites to have CPM (OR =0.55, 95% CI =0.39–0.78, P<0.001). Those in the highest SES category were more likely to have CPM compared with lowest SES category (OR =1.37, 95% CI =1.06–1.76, P=0.016). Uninsured patients had significantly lower rates of CPM as compared with privately insured patients (OR =0.58, 95% CI =0.36–0.95, P=0.029). As patients aged they were less likely to undergo this surgery (OR =0.95, 95% CI =0.94–0.96, P<0.001). The characteristics of the facility where patients were treated also played a significant role, as patients at non-teaching compared to teaching (OR =0.69, 95% CI =0.49–0.99, P=0.042) and low compared to high volume hospitals (OR =0.53, 95% CI =0.39–0.72, P<0.001) had significantly lower rates of CPM. Finally, those patients with an SEER graded tumor stage of regional, lymph nodes only, had almost a 25% lower rate of CPM as compared to patients with localized disease (OR =0.78, 95% CI =0.62–0.98, P=0.03).

When co-morbidities were included in the multivariate analysis (Table 3; Model 2), the only results that changed in a substantive way, ie, went from significant to non-significant, were that patients at non-teaching hospitals no longer had significantly lower CPM rates (P=0.091) and patients with a SEER stage of regional, lymph nodes only, no longer had lower rates than those with localized disease, indicating that once comorbidities were controlled for, patients with a worse tumor stage were no more likely to receive CPM. We also were able to investigate whether any comorbidities were associated with receipt of CPM. We found that two comorbidities were associated with a higher likelihood of CPM: fluid and electrolyte disorder (OR =1.23, 95% CI =1.01–1.49, P=0.038) and depression (OR =1.52, 95% CI =1.24–1.85, P<0.001); and two were associated with a lower rate of CPM: deficiency anemia (OR =0.64, 95% CI =0.43–0.95, P=0.028) and neurological disorders (OR =0.66, 95% CI =0.45–0.99, P=0.44) (results not shown in table). Throughout the period of data collection, the rates of CPM are about 2% from 1996 to 2000 but increase up to 8% in 2008 (Table 4).

Discussion
In this study using large, comprehensive databases, we found a number of associations between demographics characteristics and the likelihood of undergoing CPM. For example, we found that Black women were significantly less likely than Whites to undergo CPM. This may be due to physician differential advice on risks and benefits of this procedure or system issues such as access. Previous studies of clinicians’ prescription and treatment behavior have revealed racial differences in the treatment of breast carcinoma, as well as other conditions for Black patients, including neoadjuvant therapy for esophageal and gastric cancer, chronic cardiac conditions, and lower extremity amputation for peripheral vascular disease.17,18,20–35

We found that age, SES, and insurance status were associated with which patients were more likely to receive...
Table 1  Sociodemographic characteristics of female breast cancer patients from the Florida Cancer Data System and Agency for Health Care Administration datasets (1996–2009)

|                                | All female patients | Laterality of procedure done | Bilateral |
|--------------------------------|---------------------|-----------------------------|-----------|
|                                | n   | Column % | n   | Column %  | Row %  | n   | Column % | Row %  |
| All                            | 21,608 | 100.0 | 20,771 | 100.0 | 96.1 | 837 | 100.0 | 3.9 |
| Race                           |      |         |        |         |      |      |         |      |
| White                          | 19,684 | 91.1 | 18,919 | 91.1 | 96.1 | 765 | 91.4 | 3.9 |
| Black                          | 1,625 | 7.5 | 1,579 | 7.6 | 97.2 | 46 | 5.5 | 2.8 |
| Other                          | 299 | 1.4 | 273 | 1.3 | 91.3 | 26 | 3.1 | 8.7 |
| Hispanic origin                |      |         |        |         |      |      |         |      |
| Non-Hispanic                   | 19,257 | 89.1 | 18,526 | 89.2 | 96.2 | 731 | 87.3 | 3.8 |
| Hispanic                       | 2,351 | 10.9 | 2,245 | 10.8 | 95.5 | 106 | 12.7 | 4.5 |
| Race and ethnicity             |      |         |        |         |      |      |         |      |
| White/Non-Hispanic             | 17,408 | 80.6 | 16,747 | 80.6 | 96.2 | 661 | 79.0 | 3.8 |
| White/Hispanic                 | 2,276 | 10.5 | 2,172 | 10.5 | 95.4 | 104 | 12.4 | 4.6 |
| Black/Non-Hispanic             | 1,577 | 7.3 | 1,531 | 7.4 | 97.1 | 46 | 5.5 | 2.9 |
| Black/Hispanic                 | 48 | 0.2 | 48 | 0.2 | 100.0 |      |      |      |
| Other/Non-Hispanic             | 272 | 1.3 | 248 | 1.2 | 91.2 | 24 | 2.9 | 8.8 |
| Other/Hispanic                 | 27 | 0.1 | 25 | 0.1 | 92.6 | 2 | 0.2 | 7.4 |
| SES                            |      |         |        |         |      |      |         |      |
| Lowest                         | 2,628 | 12.2 | 2,553 | 12.3 | 97.1 | 75 | 9.0 | 2.9 |
| Middle-low                     | 6,597 | 30.5 | 6,376 | 30.7 | 96.6 | 221 | 26.4 | 3.4 |
| Middle-high                    | 7,926 | 36.7 | 7,623 | 36.7 | 96.2 | 303 | 36.2 | 3.8 |
| Highest                        | 4,457 | 20.6 | 4,219 | 20.3 | 94.7 | 238 | 28.4 | 5.3 |
| Marital status                 |      |         |        |         |      |      |         |      |
| Never married                  | 2,227 | 10.3 | 2,129 | 10.2 | 95.6 | 98 | 11.7 | 4.4 |
| Married                        | 11,240 | 52.0 | 10,700 | 51.5 | 95.2 | 540 | 64.5 | 4.8 |
| Divorced/separated/widowed     | 8,141 | 37.7 | 7,942 | 38.2 | 97.6 | 199 | 23.8 | 2.4 |
| Primary payer at diagnosis     |      |         |        |         |      |      |         |      |
| Uninsured                      | 719 | 3.3 | 690 | 3.3 | 96.0 | 29 | 3.5 | 4.0 |
| Private insurance              | 6,342 | 29.4 | 5,906 | 28.4 | 93.1 | 436 | 52.1 | 6.9 |
| Medicaid                       | 642 | 3.0 | 613 | 3.0 | 95.5 | 29 | 3.5 | 4.5 |
| Medicare                       | 11,778 | 54.5 | 11,538 | 55.5 | 98.0 | 240 | 28.7 | 2.0 |
| Defense/military/veteran       | 206 | 0.9 | 196 | 0.9 | 95.1 | 10 | 1.2 | 4.9 |
| Indian health services         | 41 | 0.2 | 39 | 0.2 | 95.1 | 2 | 0.2 | 4.9 |
| Insurance, NOS                 | 1,880 | 8.7 | 1,789 | 8.6 | 95.2 | 91 | 10.9 | 4.8 |
| Tobacco use                    |      |         |        |         |      |      |         |      |
| Never                          | 11,148 | 51.6 | 10,719 | 51.6 | 96.2 | 429 | 51.3 | 3.8 |
| History                        | 3,876 | 17.9 | 3,707 | 17.8 | 95.6 | 169 | 20.2 | 4.4 |
| Current                        | 2,341 | 10.8 | 2,246 | 10.8 | 95.9 | 95 | 11.4 | 4.1 |
| Unknown                        | 4,243 | 19.6 | 4,099 | 19.7 | 96.6 | 144 | 17.2 | 3.4 |
| Urban/rural living             |      |         |        |         |      |      |         |      |
| Rural                          | 1,383 | 6.4 | 1,351 | 6.5 | 97.7 | 32 | 3.8 | 2.3 |
| Urban                          | 20,225 | 93.6 | 19,420 | 93.5 | 96.0 | 805 | 96.2 | 4.0 |
| Teaching hospital              |      |         |        |         |      |      |         |      |
| No                             | 19,470 | 90.1 | 18,792 | 90.5 | 96.5 | 678 | 81.0 | 3.5 |
| Yes                            | 2,138 | 9.9 | 1,979 | 9.5 | 92.6 | 159 | 19.0 | 7.4 |
| Hospital volume                |      |         |        |         |      |      |         |      |
| Low                            | 13,474 | 62.4 | 13,125 | 63.2 | 97.4 | 349 | 41.7 | 2.6 |
| High                           | 8,134 | 37.6 | 7,646 | 36.8 | 94.0 | 488 | 58.3 | 6.0 |

Notes: SES, neighborhood SES was based on percent of individuals living below the federal poverty line from US census tract-level information: lowest (≥20%), middle-low (10% and <20%), middle-high (5% and ≤5%), or highest (<5%).

Abbreviations: SES, socioeconomic status; NOS, not otherwise specified.

a CPM. For SES in the fully adjusted model, we found that patients living in highest SES neighborhoods had a 38% greater likelihood of undergoing CPM compared with the lowest SES. Whether this is a reflection of education of that group or access to health care cannot be concluded from analyses of our large dataset. Older patients were less likely to undergo CPM, but it is unclear if this is related to higher anxiety in younger women, different
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self-image in older women, or some other factor. Finally, uninsured patients in our study were less likely to have CPM compared with those patients who are privately insured; whether this is related to access to care or patient preference is unclear.

Hospital characteristics were also found to be significant predictors of CPM in our study. In the model adjusted for all covariates other than comorbidities, those treated in non-teaching hospitals were less likely to have CPM than those in teaching hospitals. This became non-significant when co-morbidities were added to the model. However, those in low vs high volume hospitals remained less likely to undergo CPM in the fully adjusted model controlling for comorbidities. This could be an admission rate bias or a lower threshold in high volume centers where more complex procedures are embarked upon more frequently.

A novel finding for us was that a few comorbidities were associated with a statistically significant incidence of CPM; the strongest association was with major depression where patients with depression were over 50% more likely to undergo CPM (OR = 1.52; 95% CI = 1.24–1.85, P < 0.001). The limited research that has been done on the psychosocial implications of the preventive surgery suggests that prophylactic mastectomy may be effective in reducing distress levels in high-risk women. Therefore, it may be that a higher likelihood of undergoing CPM is associated with a larger fear of CBC and higher levels of distress and depression after a diagnosis of unilateral breast cancer. Conversely, those with deficiency

| Table 2 Clinical and pathological characteristics of female breast cancer patients in Florida (1996–2009) |
|---------------------------------------------------------------|
| **All female patients** | **Laterality of procedure done** |
| **n** | **Column %** | **n** | **Column %** | **Row %** | **n** | **Column %** | **Row %** |
| All | 21,608 | 100.0 | 20,771 | 100.0 | 96.1 | 837 | 100.0 | 3.9 |
| Elixhauser co-morbidity count |
| None | 454 | 2.1 | 417 | 2.0 | 91.9 | 37 | 4.4 | 8.1 |
| 1–2 | 3,719 | 17.2 | 3,479 | 16.7 | 93.5 | 240 | 28.7 | 6.5 |
| 3–4 | 5,027 | 23.3 | 4,807 | 23.1 | 95.6 | 220 | 26.3 | 4.4 |
| >4 | 12,408 | 57.4 | 12,068 | 58.1 | 97.3 | 340 | 40.6 | 2.7 |
| Surveillance, Epidemiology, and End Results stage |
| Unknown/unstaged | 1,072 | 5.0 | 1,036 | 5.0 | 96.6 | 36 | 4.3 | 3.4 |
| Localized | 15,380 | 71.2 | 14,750 | 71.0 | 95.9 | 630 | 75.3 | 4.1 |
| Regional, direct extension ± lymph nodes | 1,068 | 4.9 | 1,039 | 5.0 | 97.3 | 29 | 3.5 | 2.7 |
| Regional, lymph nodes only | 3,675 | 17.0 | 3,544 | 17.1 | 96.4 | 131 | 15.7 | 3.6 |
| Distant | 413 | 1.9 | 402 | 1.9 | 97.3 | 11 | 1.3 | 2.7 |
| Histological grade |
| Unknown/not stated | 3,849 | 17.8 | 3,710 | 17.9 | 96.4 | 139 | 16.6 | 3.6 |
| Well-differentiated | 3,836 | 17.8 | 3,677 | 17.7 | 95.9 | 159 | 19.0 | 4.1 |
| Moderately differentiated | 8,121 | 37.6 | 7,805 | 37.6 | 96.1 | 316 | 37.8 | 3.9 |
| Poorly differentiated | 5,507 | 25.5 | 5,294 | 25.5 | 96.1 | 213 | 25.4 | 3.9 |
| Undifferentiated | 295 | 1.4 | 285 | 1.4 | 96.6 | 10 | 1.2 | 3.4 |
| Histological type |
| Ductal carcinoma | 15,836 | 73.3 | 15,223 | 73.3 | 96.1 | 613 | 73.2 | 3.9 |
| Lobular carcinoma | 3,612 | 16.7 | 3,443 | 16.6 | 95.3 | 169 | 20.2 | 4.7 |
| Other | 2,160 | 10.0 | 2,105 | 10.1 | 97.5 | 55 | 6.6 | 2.5 |
| Adjuvant chemotherapy |
| Unknown | 1,002 | 4.6 | 969 | 4.7 | 96.7 | 33 | 3.9 | 3.3 |
| No | 17,988 | 83.2 | 17,382 | 83.7 | 96.6 | 606 | 72.4 | 3.4 |
| Yes | 2,618 | 12.1 | 2,420 | 11.7 | 92.4 | 198 | 23.7 | 7.6 |
| Adjuvant radiation therapy |
| Unknown | 621 | 2.9 | 605 | 2.9 | 97.4 | 16 | 1.9 | 2.6 |
| No | 16,670 | 77.1 | 15,912 | 76.6 | 95.5 | 758 | 90.6 | 4.5 |
| Yes | 4,317 | 20.0 | 4,254 | 20.5 | 98.5 | 63 | 7.5 | 1.5 |
| Death within 30 days of surgery |
| No | 21,482 | 99.4 | 20,647 | 99.4 | 96.1 | 835 | 99.8 | 3.9 |
| Yes | 126 | 0.6 | 124 | 0.6 | 98.4 | 2 | 0.2 | 1.6 |
| Survival status |
| Dead | 4,871 | 22.5 | 4,803 | 23.1 | 98.6 | 68 | 8.1 | 1.4 |
| Alive | 16,737 | 77.5 | 15,968 | 76.9 | 95.4 | 769 | 91.9 | 4.6 |
### Table 3: Multivariate logistic regression models for the primary binary outcome of undergoing bilateral mastectomy from the FCDS and AHCA datasets (1996–2009)

| Variable                  | Model 1 | Model 2* |
|---------------------------|---------|----------|
|                           | OR (95% CI) | P-value | OR (95% CI) | P-value |
| **Race**                  |         |         |
| White                     | 1.00 (reference) |       | 1.00 (reference) |       |
| Black                     | 0.55 (0.39, 0.78) | <0.001 | 0.59 (0.42, 0.83) | 0.002 |
| Other                     | 1.27 (0.83, 1.93) | 0.270 | 1.31 (0.87, 1.99) | 0.200 |
| **Hispanic**              |         |         |
| Non-Hispanic              | 1.00 (reference) |       | 1.00 (reference) |       |
| Hispanic                  | 1.07 (0.78, 1.27) | 0.972 | 0.99 (0.79, 1.25) | 0.965 |
| **SES**                   |         |         |
| Lowest                    | 1.00 (reference) |       | 1.00 (reference) |       |
| Middle-low                | 1.08 (0.83, 1.41) | 0.551 | 1.09 (0.83, 1.41) | 0.545 |
| Middle-high               | 1.15 (0.85, 1.56) | 0.352 | 1.16 (0.86, 1.58) | 0.329 |
| Highest                   | 1.37 (1.06, 1.76) | 0.016 | 1.38 (1.07, 1.8) | 0.014 |
| **Age at diagnosis**      |         |         |
| Years                     | 0.95 (0.94, 0.96) | <0.001 | 0.95 (0.94, 0.96) | <0.001 |
| **Marital status**        |         |         |
| Never married             | 1.00 (reference) |       | 1.00 (reference) |       |
| Married                   | 1.07 (0.84, 1.37) | 0.573 | 1.08 (0.85, 1.38) | 0.519 |
| Divorced/separated/widowed| 0.99 (0.76, 1.27) | 0.908 | 0.99 (0.76, 1.28) | 0.931 |
| **Primary payer at diagnosis** |     |         |
| Uninsured                 | 0.58 (0.36, 0.95) | 0.029 | 0.60 (0.36, 0.98) | 0.043 |
| Medicaid                  | 0.83 (0.59, 1.17) | 0.292 | 0.81 (0.57, 1.15) | 0.230 |
| Medicare                  | 0.86 (0.67, 1.11) | 0.248 | 0.86 (0.67, 1.11) | 0.249 |
| Defense/military/veteran  | 0.81 (0.46, 1.45) | 0.482 | 0.80 (0.45, 1.42) | 0.440 |
| Indian/public             | 0.72 (0.24, 2.11) | 0.547 | 0.66 (0.22, 1.97) | 0.461 |
| Insurance, NOS            | 0.70 (0.55, 0.89) | 0.004 | 0.7 (0.55, 0.89) | 0.003 |
| **Urban/rural living**    |         |         |
| Urban                     | 1.00 (reference) |       | 1.00 (reference) |       |
| Rural                     | 0.83 (0.55, 1.25) | 0.371 | 0.82 (0.54, 1.25) | 0.355 |
| **Teaching hospital**     |         |         |
| Teaching hospital         | 1.00 (reference) |       | 1.00 (reference) |       |
| Non-teaching hospital     | 0.69 (0.49, 0.99) | 0.042 | 0.73 (0.51, 1.05) | 0.091 |
| **Hospital volume**       |         |         |
| Low                       | 0.53 (0.39, 0.72) | <0.001 | 0.53 (0.4, 0.72) | <0.001 |
| **Surveillance, Epidemiology, and End Results stage** | |         |
| Regional, direct extension ± lymph nodes | 0.93 (0.67, 1.28) | 0.651 | 0.99 (0.7, 1.4) | 0.969 |
| Regional, lymph nodes only | 0.78 (0.62, 0.98) | 0.030 | 0.85 (0.64, 1.14) | 0.276 |
| Distant                   | 0.83 (0.45, 1.55) | 0.568 | 0.94 (0.46, 1.91) | 0.862 |

Notes: *Model 2 also includes comorbidities. OR (95% CI): Odds ratio and 95% confidence interval. SES = neighborhood SES was based on percent of individuals living below the federal poverty line from US census tract-level information: lowest (≥20%), middle-low (10% and <20%), middle-high (5% and <10%), or highest (<5%).

Abbreviations: FCDS, Florida Cancer Data System; AHCA, Florida’s Agency for Health Care Administration; SES, socioeconomic status; NOS, not otherwise specified.

### Table 4: Rates of CPM (1996–2009)

| Year of diagnosis | No | % | Yes | % |
|-------------------|----|---|-----|---|
| 1996              | 21,608 | 20.771 | 96.1 | 837 | 3.9 |
| 1997              | 1,640 | 1.604 | 97.8 | 36 | 2.2 |
| 1998              | 1,054 | 1.032 | 97.9 | 22 | 1.3 |
| 1999              | 1,609 | 1.046 | 97.8 | 23 | 2.2 |
| 2000              | 1,314 | 1.287 | 97.9 | 27 | 2.1 |
| 2001              | 1,221 | 1.200 | 98.3 | 21 | 1.7 |
| 2002              | 1,210 | 1.181 | 97.6 | 29 | 2.4 |
| 2003              | 1,301 | 1.267 | 97.4 | 34 | 2.6 |
| 2004              | 1,478 | 1.437 | 97.2 | 41 | 2.8 |
| 2005              | 1,482 | 1.431 | 96.6 | 51 | 3.4 |
| 2006              | 1,972 | 1.907 | 96.7 | 65 | 3.3 |
| 2007              | 1,920 | 1.828 | 95.2 | 92 | 4.8 |
| 2008              | 1,902 | 1.801 | 94.7 | 101 | 5.3 |
| 2009              | 2,011 | 1.879 | 93.4 | 132 | 6.6 |
| **All**           | 2,034 | 1.871 | 92.0 | 163 | 8.0 |

Abbreviation: CPM, contralateral prophylactic mastectomy.
to examine a wide variety of associations of demographic, clinical and comorbid characteristics, with choice of CPM. Thus, it paves the way for subsequent studies that will look more in depth into factors affecting whether patients undergo CPM, in order to ensure treatment equality for all patients.

In conclusion, CPM rates reveal significant differences among patients of different race, socioeconomic class, and insurance coverage. The reasons for these differences as well as the rising rates of CPM in the face of lack of evidence of survival benefits remain unexplained. It seems that personal and psychosocial factors are driving the choices about this treatment. It may be that more public health education is needed to better inform patients in their decision making process. Health care delivery systems optimization for more equitable and accessible delivery of breast cancer care, at the same standard, to different socioeconomic classes of patients, at different geographical locations, and regardless of insurance status, should be planned and attempted. More in-depth study of the causes of these disparities is critically needed so as to guide future planning for health care delivery in this area.

Acknowledgment

Funding source: James and Esther King Florida Biomedical Research Program (Grant 10KG-06).

Disclosure

There are no financial disclosures or conflicts of interest to report for any of the authors.

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