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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%,[1] 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]

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A Cochrane Review published by Lostumbo et al[8] 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.[1,9,10] 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.[9] Another study suggested increased rates of CPM were associated with having a female surgeon.[11,12]

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[13] or adjuvant radiation, and use of breast conserving surgery)[14–16] are associated with race, ethnicity, socioeconomic status (SES) and insurance status,[17–19] 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

using SAS v 9.3 for Windows (SAS Institute Inc., Cary, NC, USA). The study was approved by the Institutional Review Boards of both University of Miami and Florida Department of Health.

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 comorbidities (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 substantative 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 longer 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					
			Unilateral			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	1.0	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 <10%), 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

Table 2 Clinical and pathological characteristics of female breast cancer patients in Florida (1996–2009)

	All female patients		Laterality of procedure done					
			Unilateral			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
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

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.[36–39] 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 3 Multivariate logistic regression models for the primary binary outcome of undergoing bilateral mastectomy from the FCDS and AHCA datasets (1996–2009)

Variable	Category	Model 1		Model 2*	
		OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Race	White	1.00 (reference)		1.00 (ref)	
	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 (ref)		1.00 (ref)	
	Hispanic	1 (0.78, 1.27)	0.972	0.99 (0.79, 1.25)	0.965
SES	Lowest	1.00 (ref)		1.00 (ref)	
	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 (ref)		1.00 (ref)	
	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	Private insurance	1.00 (ref)		1.00 (ref)	
	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 (ref)		1.00 (ref)	
	Rural	0.83 (0.55, 1.25)	0.371	0.82 (0.54, 1.25)	0.355
Teaching hospital	Teaching hospital	1.00 (ref)		1.00 (ref)	
	Non-teaching hospital	0.69 (0.49, 0.99)	0.042	0.73 (0.51, 1.05)	0.091
Hospital volume	High	1.00 (ref)		1.00 (ref)	
	Low	0.53 (0.39, 0.72)	<0.001	0.53 (0.4, 0.72)	<.001
Surveillance, Epidemiology, and End Results stage	Localized	1.00 (ref)		1.00 (ref)	
	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)

		No		Yes	
		n	%	n	%
CPM					
All	21,608	20,771	96.1	837	3.9
Year of diagnosis					
1996	1,640	1,604	97.8	36	2.2
1997	1,054	1,032	97.9	22	2.1
1998	1,069	1,046	97.8	23	2.2
1999	1,314	1,287	97.9	27	2.1
2000	1,221	1,200	98.3	21	1.7
2001	1,210	1,181	97.6	29	2.4
2002	1,301	1,267	97.4	34	2.6
2003	1,478	1,437	97.2	41	2.8
2004	1,482	1,431	96.6	51	3.4
2005	1,972	1,907	96.7	65	3.3
2006	1,920	1,828	95.2	92	4.8
2007	1,902	1,801	94.7	101	5.3
2008	2,011	1,879	93.4	132	6.6
2009	2,034	1,871	92.0	163	8.0

Abbreviation: CPM, contralateral prophylactic mastectomy.

anemia (OR =0.64, 95% CI =0.43–0.95, *P*=0.028) or neurological disorders (OR =0.66, 95% CI =0.45–0.99, *P*=0.44), were approximately 35% less likely to undergo CPM; this may stem from a clinical recognition of these patients being less suitable for the more extensive surgery.

Limitations of this study include a relatively small sample size for appropriate subgroup analysis and the lack of data about the presence of BRCA deleterious mutations. Also, the FCDS and AHCA databases do not contain accurate or sufficient information on hormone receptor-negative status of tumors, and therefore, we were unable to explore the association of estrogen/progesterone receptors or triple negative patients with receipt of CPM. Finally, detailed information on additional risk factors such as number and degree of affected relatives or opportunities for nonsurgical risk reduction are not available in the databases. Nonetheless, this study is based on a large statewide cancer registry database and allows us

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.

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