

Surgeon Influence on Variation in Receipt of Contralateral Prophylactic Mastectomy For Women With Breast Cancer

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IMPORTANCE Rates of contralateral prophylactic mastectomy (CPM) have markedly increased but we know little about the influence of surgeons on variability of the procedure in the community.

OBJECTIVE To quantify the influence of the attending surgeon on rates of CPM and clinician attitudes that explained it.

DESIGN, SETTING, AND PARTICIPANTS In this population-based survey study, we identified 7810 women with stages 0 to II breast cancer treated in 2013 to 2015 through the Surveillance, Epidemiology, and End Results registries of Georgia and Los Angeles County. Surveys were sent approximately 2 months after surgery. Surveys were also sent to 488 attending surgeons identified by the patients.

MAIN OUTCOMES AND MEASURES We conducted multilevel analyses to examine the impact of surgeon influence on variations in patient receipt of CPM using information from patient and surgeon surveys merged to Surveillance, Epidemiology, and End Results data.

RESULTS A total of 5080 women responded to the survey (70% response rate), and 377 surgeons responded (77% response rate). The mean (SD) age of responding women was 61.9 (11) years; 28% had an increased risk of second primary cancer, and 16% received CPM. Half of surgeons (52%) practiced for more than 20 years and 30% treated more than 50 new patients with breast cancer annually. Attending surgeon explained a large amount (20%) of the variation in CPM, controlling for patient factors. The odds of a patient receiving CPM increased almost 3-fold (odds ratio, 2.8; 95% CI, 2.1-3.4) if she saw a surgeon with a practice approach 1 SD above a surgeon with the mean CPM rate (independent of age, diagnosis date, BRCA status, and risk of second primary). One-quarter (25%) of the surgeon influence was explained by attending attitudes about initial recommendations for surgery and responses to patient requests for CPM. The estimated rate of CPM was 34% for surgeons who least favored initial breast conservation and were least reluctant to perform CPM vs 4% for surgeons who most favored initial breast conservation and were most reluctant to perform CPM.

CONCLUSIONS AND RELEVANCE In this study, attending surgeons exerted influence on the likelihood of receipt of CPM after a breast cancer diagnosis. Variations in surgeon attitudes about recommendations for surgery and response to patient requests for CPM explain a substantial amount of this influence.

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 Invited Commentary

 Supplemental content

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Use of contralateral prophylactic mastectomy (CPM) for the treatment of breast cancer has increased markedly over the last decade in the wake of greater patient awareness of the procedure. Currently, about 20% of patients receive CPM, representing about half of those who get any mastectomy, and rates vary markedly by region and age.¹⁻³ Surgeons play a dominant role in advising patients newly diagnosed as having breast cancer regarding their locoregional treatment decisions.¹ Virtually all patients with curable disease see a surgeon and most patients are treated by the first surgeon they see. About two-thirds of patients diagnosed as having breast cancer receive a recommendation for initial breast-conserving surgery or mastectomy from their surgeon, and virtually all receive the recommended treatment.⁴ Similarly, when a surgeon recommends against CPM, few patients undergo the procedure.¹

Consensus statements by professional associations reinforce that CPM should be considered in patients at higher risk for second primary breast cancer but discouraged in those who are at average risk.⁵⁻⁷ Despite this, only about a third of patients at average risk of a second primary who desired CPM reported a recommendation from their surgeon discouraging it.^{1,8} Patients with the same risk for contralateral breast cancer may take in very different information and recommendations regarding CPM depending on which surgeon they see. However, to our knowledge, no published study has examined the influence of the attending surgeon on variations in receipt of CPM. Do patients with the same attributes get different treatment depending on which surgeon they see? What surgeon attitudes influence this potential variability? To address these questions, we used information from a large diverse contemporary sample of patients newly diagnosed as having breast cancer and their attending surgeons to examine the influence of individual surgeons on the receipt of CPM.

Methods

Patient Sample and Data Collection

The iCanCare study identified women with early-stage breast cancer who were aged 20 to 79 years, diagnosed as having ductal carcinoma in situ or invasive breast cancer, and reported to the Georgia or Los Angeles County Surveillance, Epidemiology, and End Results registry. Surveys were sent approximately 2 months after surgical treatment between July 2013 and August 2015. Exclusions included prior breast cancer, stage III/IV disease, tumors larger than 5 cm, or more than 3 positive lymph nodes. Patients were mailed materials and a \$20 cash gift. We used a modified Dillman method to encourage response (median [SD] time from diagnosis to survey completion, 6 [2.8] months). We sent surveys to 7810 patients: 507 women were ineligible because they had exclusions previously noted; were deceased, institutionalized, or too ill to complete; or unable to complete a survey in Spanish or English. The survey was completed by 5080 of the eligible patients (70%) and linked to Surveillance, Epidemiology, and End Results data. The study protocol was approved by the University of Michigan, the University of Southern California, Emory

Key Points

Question How much does the attending surgeon influence variation in receipt of contralateral prophylactic mastectomy (CPM) in the community?

Findings This population-based survey study found that the attending surgeon explained 20% of the variation in CPM. The estimated rate of CPM was 34% for surgeons who least favored initial breast conservation and were least reluctant to perform CPM vs 4% for surgeons who most favored initial breast conservation and were most reluctant to perform CPM.

Meaning Attending surgeons exert strong influence on the likelihood of receipt of CPM after diagnosis of breast cancer.

University, and state health departments. We received a waiver of written informed consent, as participation in the survey study was considered adequate informed consent after patients received detailed information about the study, benefits and risks, and their rights as a participant.

Surgeon Sample and Data Collection

We identified attending surgeons through patient report. Nearly all patients (98%) identified an attending surgeon. Surveys were sent to surgeons toward the end of the patient data collection period (N = 488) and 377 completed them (response rate, 77%).

Merged Sample

We linked 3727 respondent patients with unilateral disease to 366 respondent surgeons. Of these, 116 patients were missing Surveillance, Epidemiology, and End Results data about stage or unilateral vs bilateral disease. Of the remaining observations, 93% were complete in the variables we included in our analyses: 3353 women with stage 0 to II breast cancer, without bilateral disease, and 349 surgeons. On average, there were 9.6 patients per surgeon (range, 1-72) (Table).

Measures

The dependent variable was patient report of receipt of CPM. Patient covariates considered included age, risk of a second primary breast cancer (following National Comprehensive Cancer Network guidelines on risk of breast cancer pathologic mutation based on patient age, detailed family history of cancer, and tumor characteristics),^{1,9,10} and a variable indicating patient report of genetic testing results (*BRCA*). We also included geographic location and the date of diagnosis because both variables have a strong association with CPM receipt.

Surgeon variables considered included (1) a unique surgeon identifier, (2) report of the annual volume of newly diagnosed breast cancer cases treated, (3) age, (4) years in practice, and (5) sex. We hypothesized that surgeon differences in how strongly they favored initial breast conservation and how reluctant they were to perform CPM if asked by the patient might explain some of the differences in whether patients received CPM. We developed 2 scales based on response to items in a scenario of a patient with localized disease and no obvious contraindications to breast conservation: a 55-year-old woman with no family history of breast cancer and normal

Table. Patient and Surgeon Characteristics

Characteristic	No. (%)
Patients^a	
Total No.	3353
Age, mean (SD), y	61.9 (11)
Surgery type	
BCS	2156 (64)
Unilateral mastectomy	663 (20)
Bilateral mastectomy	534 (16)
BRCA+	
No	3295 (98)
Yes	58 (2)
High risk	
No	2401 (72)
Yes	952 (28)
Site	
Georgia	1829 (55)
Los Angeles County	1524 (45)
SEER stage	
DCIS	604 (18)
Stage I	1868 (56)
Stage II	881 (26)
Surgeons^b	
Total No.	339
Age, mean (SD), y	53.9 (10.7)
Sex	
Male	256 (75)
Female	87 (25)
Time in practice, y	
0-10	73 (21)
11-20	96 (28)
>20	180 (52)
Volume in past 12 mo	
≤20 cases	129 (38)
21-50 cases	109 (32)
>50 cases	104 (30)

Abbreviations: BCS, breast-conserving surgery; DCIS, ductal carcinoma in situ; SEER, Surveillance, Epidemiology, and End Results.

^a The total (N = 3262) reflects patients with complete data in all variables used in the analysis.

^b The total (N = 349) reflects the number of surgeons with complete data for the surgeon variables used in the analysis. Some of the demographic variables shown above have missing data and are provided for descriptive purposes here but are not used in the analysis.

screening mammogram. In this case, bilateral screening ultrasonography showed a 1.2-cm solid mass, and a core biopsy demonstrated infiltrating ductal carcinoma; estrogen receptor expression, 95%; progesterone receptor expression, 90%; and human epidermal growth factor receptor 2 negative.

The first scale (favor initial breast conservation scale) was derived from 4 separate items: surgeons were asked (based on the scenario) if they would recommend breast-conserving surgery, unilateral mastectomy, bilateral mastectomy, or against CPM (4-point response categories for each item, from definitely yes to definitely no). The items were scaled so that a higher

score indicated favoring initial breast conservation. The second scale (reluctance to perform CPM if requested scale) was derived from responses to the question in the clinical scenario, “why might you perform bilateral mastectomy if requested by your patients like this?” Reasons for performing CPM included (1) giving patients greater peace of mind, (2) improving cosmetic outcomes, (3) avoiding conflict with patient, (4) avoiding losing patient to another surgeon, (5) avoiding the need for surveillance, (6) improving long-term quality of life, (7) reducing recurrence of invasive disease, and (8) improving survival. Each item included a 5-point response category, from very likely to not likely. The items were scaled so that a higher score represented more reluctance to perform CPM.

Both scales were developed using a partial credit item response model that allows the different items to have different thresholds for the responses and treats them as nominal, so that the response order can be tested.¹¹ The standardized latent scale from the model for the favor initial breast conservation scale had a reliability that ranged from 0.66 to 0.83 over the range provided by the surgeons in our study and was standardized to have a mean of 0 and SD of 1. The latent scale for reluctance to perform CPM if requested had a reliability from 0.66 to 0.87 over the range of the response data and was similarly standardized.

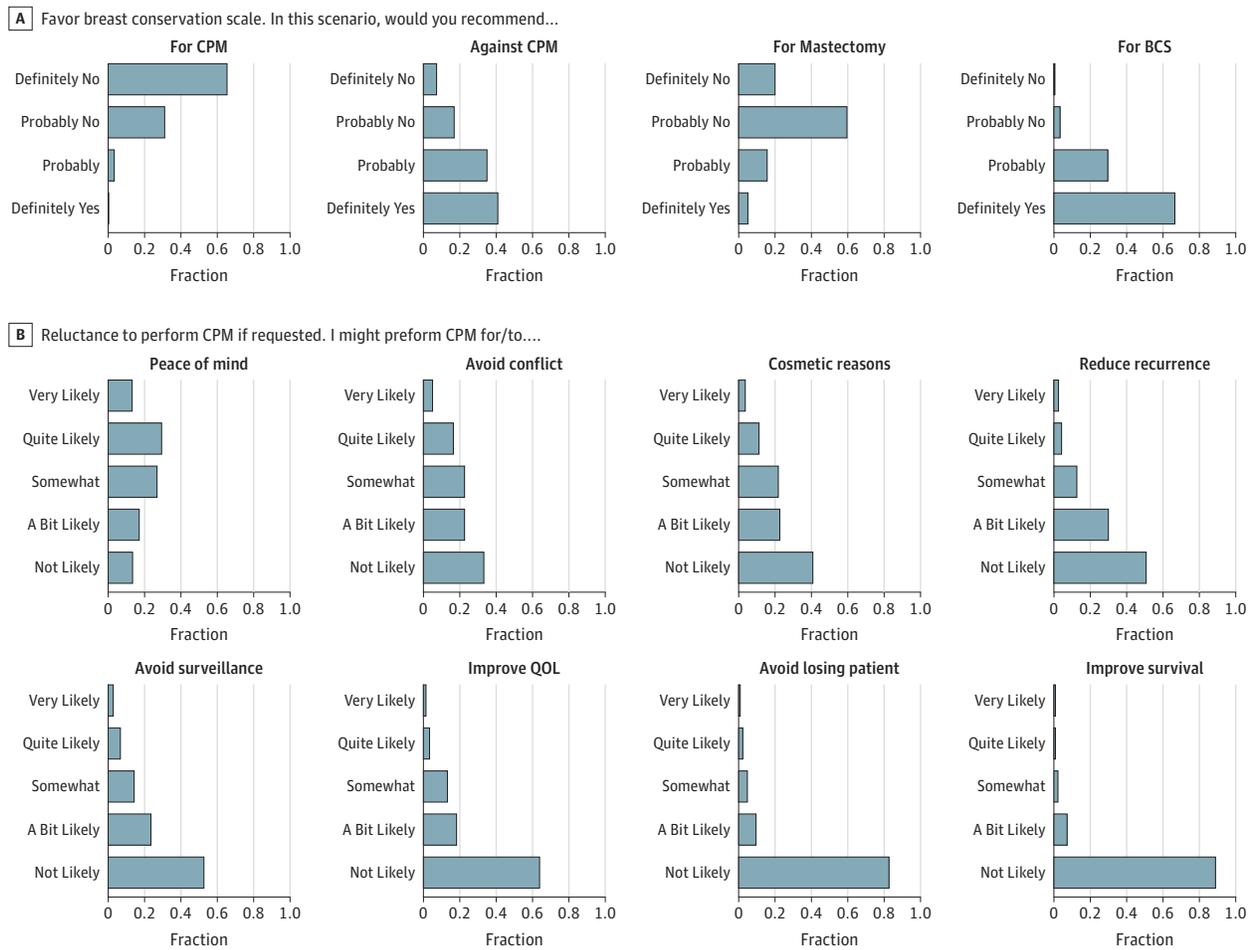
Statistical Analysis

We first described the distribution of the patient and surgeon characteristics, the distribution of responses to the items that comprise the 2 surgeon scales, and distribution and correlation of the estimated underlying surgeon scale scores. The primary analysis was a multilevel logistic regression model with the surgeon identifier code defining the second level and the patient as the primary unit of observation.¹² Our base model included higher risk of second primary breast cancer or known BRCA mutation (clinical factors for which guidelines recommend consideration of CPM), patient age (may capture some of the difference in patient demand for surgery faced by a surgeon and which is strongly associated with CPM), and date of diagnosis. We calculated the surgeon-level variation in the base model after adjusting for our baseline patient predictors. Our second model step included the set of surgeon predictors previously described. Only our 2 scale measures are shown in the model output as the other measures had small effect sizes and were not significant. We display the marginal effects of the 2 surgeon attitudes scale scores on the probability that a woman receives CPM averaged across the baseline set of covariates and the remaining effects attributable to the surgeons for the sample of women. Finally, in our third model step, geographic site was included because we had noted large site differences in rates of CPM and wanted to quantify the degree to which the surgeon differences were attributable to a systematic difference in practice across geographic area as opposed to individual surgeon-level variability with geographic area.

Results

The Table shows the distribution of patient and surgeon characteristics. The mean (SD) patient age was 61.9 (11) years. A total

Figure 1. Scale Distribution Scores



The distribution of items used in creating the 2 scales is shown. Both sets of items were elicited in response from 370 surgeons with complete information to a scenario involving a 55-year-old woman with no family history of breast cancer and a normal screening mammogram. Bilateral screening ultrasonography shows a 1.2-cm solid mass and core biopsy demonstrates classic infiltrating ductal carcinoma, estrogen receptor expression, 95%; progesterone receptor expression, 90%; and human epidermal growth factor

receptor 2 negative. A, Four items used in creating the favor breast conservation scale. B, Eight items used in creating the reluctance to perform contralateral prophylactic mastectomy (CPM) if requested scale. These items referred again to the scenario and further stipulated that this patient had no family history of breast cancer. BCS indicates breast-conserving surgery; QOL, quality of life.

of 28% had an increased risk of second primary cancer, 2% reported a *BRCA* mutation on testing, and 16% of the total sample received CPM. Half of surgeons (52%) practiced for 20 years or more; almost one-third (30%) reported they treated more than 50 new cases of breast cancer per year; and one-quarter were female (25%).

Figure 1 shows the frequency of responses for the individual items in each surgeon scale. For the favor initial breast-conservation scale, there was strong consensus favoring breast-conserving surgery (96%, probably or definitely) in the hypothetical case with no obvious contraindications to breast conservation. On the other hand, very few surgeons favored CPM (96% probably or definitely not recommend), and a less unanimous but still substantial proportion would recommend against it (76%) (Figure 1). There was wide variability with regard to the items that comprised the reluctance to perform CPM

scale. Common reasons for performing CPM if requested were to (1) give patients peace of mind, (2) avoid patient conflict, and (3) improve cosmetic outcomes. Less common reasons were to (1) avoid surveillance, (2) reduce recurrence, and (3) improve long-term quality of life. Least frequently endorsed were to avoid losing the patient or to improve survival.

Figure 2 shows the lack of a strong association between the 2 scales as demonstrated by the broad distribution of points representing individual surgeons in the scatterplot and the correlation of 0.30. There was a large number of surgeons who scored relatively high on one scale and much lower on the other. There is some asymmetry in that while there is a reasonable number of surgeons who both favor breast conservation and are reluctant to do CPM, there is a much smaller number who are low on both scales. The 2 histograms show the distribution of surgeons across each scale on the respective axes.

Figure 2. Distribution and Relationship of 2 Scale Scores

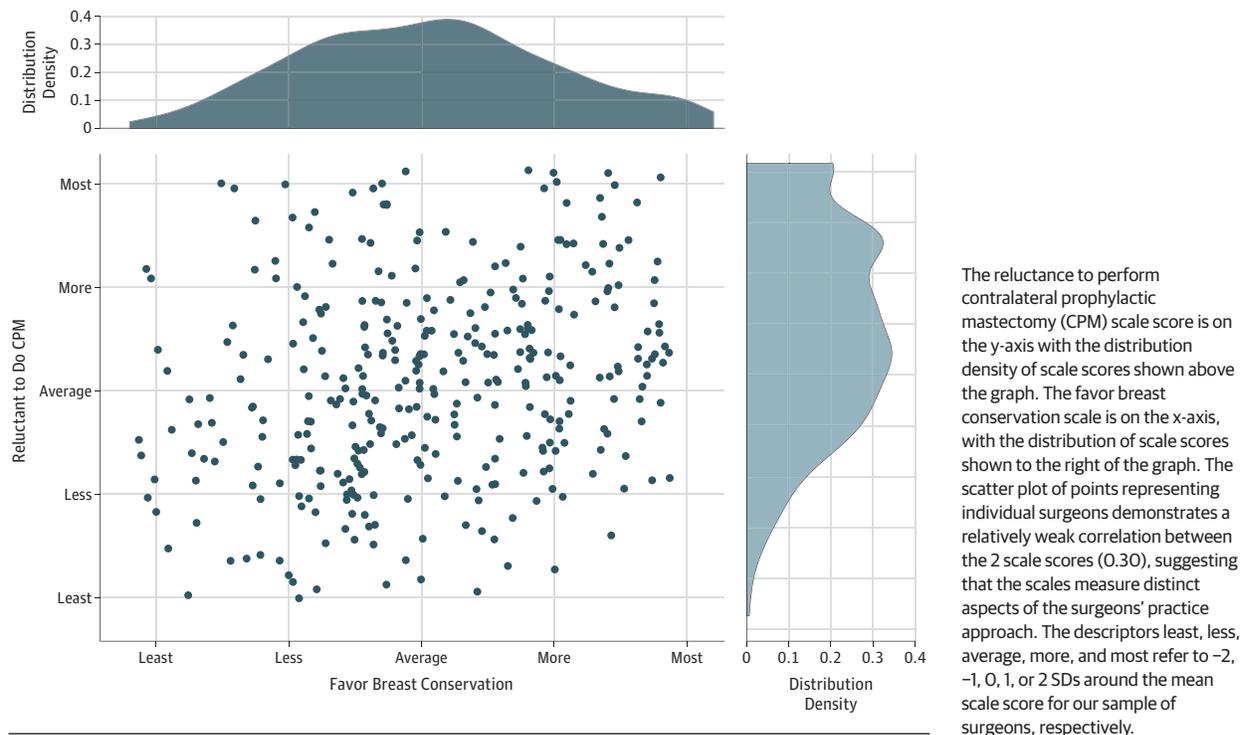
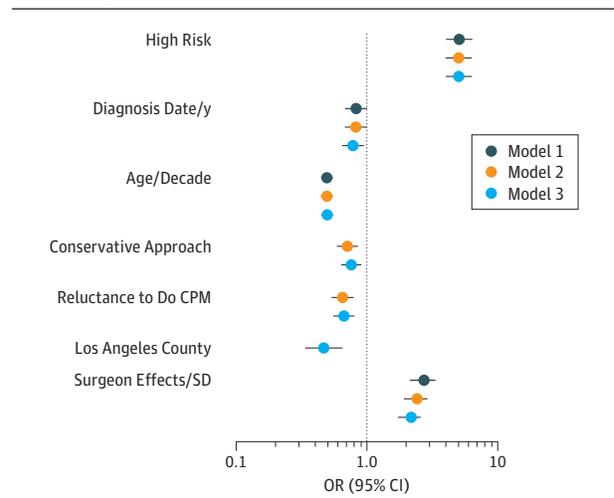


Figure 3 shows the results of the 3 successive multilevel models including baseline patient variables, surgeon variables, and site. The base model 1 included elevated risk of a second primary breast cancer (high risk), *BRCA* mutation, and age. Mutation status had a dominant effect, with an odds ratio of about 6 (6.2 [95% CI, 3.3-11.8] in model 1 to 5.8 [95% CI, 3.1-10.8] in model 3) for CPM receipt when the women reported being mutation positive, and this estimate was omitted from Figure 3 so that the other odds ratios are better compared (odds ratios are shown in the eTable in the Supplement). However, less than 2% of the women reported being mutation positive (Table).

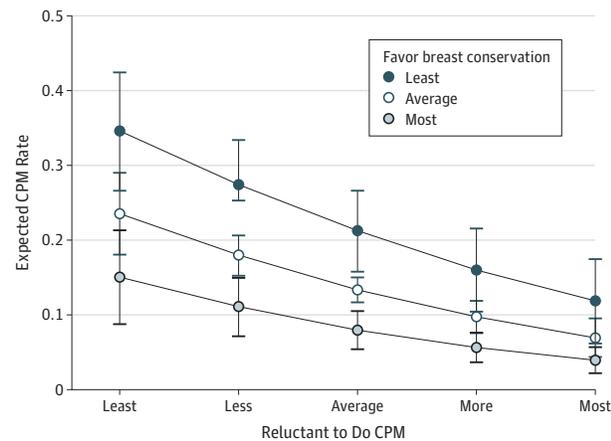
Age was one of the strongest predictors after *BRCA* status, with a 50% reduction in odds of CPM for each decade increase in age. Overall, model 1 predicted CPM well, with an area under the curve of 0.84 (95% CI, 0.83-0.86), and the model explains 35% of the variability in the likelihood of CPM. Patient factors explained about 15% of the variability in the likelihood of CPM, but the surgeon identifier by itself explains even more, about 20% of the variance. The odds of a patient receiving CPM would increase 2.8-fold (95% CI, 2.1-3.4) if she were to see a surgeon with a practice approach 1 SD above a surgeon with the mean CPM rate (independent of age, date of diagnosis, *BRCA* status, and risk of recurrence). In model 2, we added the 2 surgeon scale scores for favor initial breast conservation and reluctance to perform CPM. Both substantially decreased the odds of receipt of CPM (adjusted odds ratios, 0.7 [95% CI, 0.6-0.8] and 0.6 [95% CI, 0.5-0.8] per SD, respectively) and explain 25% of the surgeon influence. Finally, in model 3, we added patient geographic site, which is highly correlated with receipt of CPM: patients in Los Angeles County

Figure 3. Odds Ratios (ORs) for Receipt of Contralateral Prophylactic Mastectomy (CPM) From 3 Models



The estimated ORs for 3 successive multilevel logistic regression models are shown. Model 1 is the baseline model including patient factors that are mentioned by guidelines as possible indications for CPM as well as patient age. Model 2 adds the 2 surgeon scales describing their practice styles. Model 3 adds the location of the patients and physicians (Los Angeles County vs Georgia). All models include a surgeon identifier and quantify the amount of surgeon variation that remains after including the variables in each respective model. The OR listed for the surgeon effect represents the amount by which a patient's odds of CPM are multiplied if they see a surgeon with a propensity to do CPM 1 SD above the average surgeon (or, in other words, a surgeon in the 84th percentile as opposed the 50th percentile for propensity to do CPM). Large ORs for *BRCA* positive (5-6) are omitted to allow better comparisons between the ORs.

Figure 4. Probability of Contralateral Prophylactic Mastectomy (CPM) by Surgeon Practice Approach



The estimated marginal probability that a woman would receive CPM as a function of the 2 surgeon scales describing the practice approach of the surgeons in our sample is shown. On the x-axis are the levels of the reluctance to perform CPM scale, with the descriptors least, less, average, more, and most referring to -2, -1, 0, 1, or 2 SDs around the mean scale score for the population, respectively. The 3 lines represent 2 SDs below to 2 SDs above the mean scale score on the favor breast conservation scale. The y-axis shows the expected mean rate of CPM in the population from which we sampled, if the entire population were treated by a surgeon at any of the specified levels of the 2 scales. The estimates are averaged over *BRCA* status, risk of second primary breast cancer, patient age, date of diagnosis, and the residual surgeon differences (eg, these are marginal predictions).

are much less likely to have received CPM (odds ratio, 0.5; 95% CI, 0.3-0.6) and the variable explains a quarter of the remaining surgeon effect.

Figure 4 shows the independent effects of both attitude scales on rates of CPM in the population in model 2. The probabilities estimated the effect of changing the scale values in the population averaging over all the other variables and remaining surgeon variation. The x-axis represents the score for the reluctance to do CPM scale (from least to most reluctant surgeons). The modifiers “most,” “more,” “less,” and “least” refer to 1 or 2 SDs on either side of the mean (average) scale score in our population of surgeons. The y-axis shows the expected CPM rate. The vertical lines indicate the effect of different reluctance scale scores on the favor initial breast-conservation scale (least, average, and most favoring surgeons). For example, 13% was the mean rate of CPM for a surgeon who had mean scores for both scale scores. But there was a wide variation in CPM rates based on variation in these scale levels. At the extreme, the rate of CPM was 34% for surgeons who least favored initial breast conservation and were least reluctant to perform CPM. By contrast, the estimated rate was 4% for surgeons who most favored initial breast conservation and were most reluctant to perform CPM.

Discussion

In our study, we observed an influence of the attending surgeon on whether a patient undergoes CPM after diagnosis of

unilateral breast cancer. The individual attending surgeon explained a large amount (20%) of the overall variation in CPM use in this large diverse population-based patient sample, after adjusting for factors that determine the risk of second primary breast cancer and age, one of the major determinants of CPM. Surgeon attitudes about the approach to initial surgery or response to patient requests for CPM explained about a quarter of this surgeon effect. In a scenario of a typical patient with no contraindications to breast conservation and at average risk for a second primary cancer, most surgeons favored an initial breast-conservation approach and most would recommend against CPM. There was less consensus about the willingness to perform CPM if requested by the patient. We observed a range of reasons why a surgeon would be willing to perform CPM if asked: give peace of mind, yield better cosmetic outcomes, avoid conflict with patient, reduce need for surveillance, improve long-term quality of life, reduce recurrence of invasive disease, avoid losing patient to another surgeon, or improve survival (in order of endorsement). Both of the attitudes scales independently affected the likelihood that a patient would get CPM. This varied from 34% for the (relatively rare) attending surgeon who least favored initial breast conservation and was least reluctant to perform CPM if asked, to 4% for the surgeon who strongly favored initial breast conservation and was most reluctant to perform CPM if asked.

We also examined pertinent patient factors. Contralateral prophylactic mastectomy was correlated with guideline-concordant clinical factors (elevated risk of genetic mutation or *BRCA* mutation on testing) and patient age, which may reflect physician and/or patient views that CPM is an increasingly more relevant alternative the younger the age at onset of breast cancer. Finally, the geographic location variable explained some of the remaining surgeon variation, suggesting at least some regional surgeon peer effects and potentially a regional difference in patient population attitudes toward CPM.

Prior literature has demonstrated the marked increase in receipt of CPM after diagnosis of breast cancer and underlying factors driving the trend (dominantly greater patient awareness and interest for the procedure).^{2,13-18} More recent research has shown that surgeon recommendation against CPM reduces receipt. But only about one-third of patients who consider CPM report that their surgeon recommended against it and one-third reported no substantial discussion with their surgeon about it.^{1,8} However, to our knowledge, our study is the first to estimate how much the likelihood of a woman receiving CPM varies across surgeon.

Strengths and Limitations

Aspects of the study merit comment. We used a large population-based contemporary diverse patient sample with a high response rate. Virtually all patients identified their attending surgeon and surgeon survey response was high. The measures were highly relevant to clinical practice and the methods were appropriate to the research questions and study design. However, there were some weaknesses. Despite high

survey response rates, there was inevitable decay in the sample given the requirement for completed surveys from both the surgeon and the patient. Finally, the findings were limited to large regions of the country.

Conclusions

Contralateral prophylactic mastectomy represents an important paradox in cancer management. There has been a sea change in clinician attitudes about the approach to management of curable breast cancer favoring less-extensive locoregional approaches. Yet, rates of CPM have increased over the last decade largely owing to greater patient awareness and interest in the procedure. In this context, we found that the attending surgeon explains more of the variation in CPM than patient clinical factors. Surgeon attitudes about the

options for initial surgery and their reactions to patient requests for treatment influence whether a patient with similar attributes receives CPM. These attitudes could shape the course of the discussion about treatment with patients by influencing the strength to which a surgeon (1) endorses breast conservation as the initial surgery option, (2) feels compelled to discuss the details of CPM as a possible treatment alternative, or (3) tries to discourage a woman from CPM as a treatment. Our findings motivate the need to help surgeons address this growing clinical conundrum in the examination room. This has already begun as oncology surgeon associations revise and promote clearer guidelines about CPM.^{5,6} Our findings reinforce the need to address better ways to communicate with patients with regard to their beliefs about the benefits of more extensive surgery and their reactions to the management plan including surgeon training and deployment of decision aids.

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