Surgeon Re-Excision Rates after Breast-Conserving Surgery: A Measure of Low-Value Care

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BACKGROUND: To better understand re-excision practice patterns after breast-conserving therapy (BCT), we evaluated variation in surgeon-specific re-excision rates and associated factors.

STUDY DESIGN: We performed a retrospective analysis using Medicare claims from 2012 to 2018 to identify patients undergoing BCT and subsequent breast resection procedures within 12 months. We compared rates before and after the 2014 "no tumor on ink" consensus guideline. A hierarchical logistic regression model was also used to evaluate patient and physician characteristics associated with re-excision.

RESULTS: We identified 291,065 female Medicare beneficiaries who underwent an initial BCT procedure, of which 19.0% had a re-excision. The overall re-excision rate was 22.1% in the pre-guideline period and 17.2% in the post-guideline period. For the 5,337 physicians that performed more than 10 initial BCT procedures during the study period, their physician-level re-excision rate ranged from 0% to 91.7% (median 18.2%). In total, 17.5% of the physicians had a re-excision rate greater than the expert consensus cutoff of 30%. The percentage of outlier physicians decreased from 22.2% in 2012 to 8.8% in 2017. High surgeon volume of BCT was associated with a lower re-excision odds ($\geq$51 cases vs $\leq$20 cases: adjusted odds ratio 0.78; 95% CI 0.74 to 0.82; 21 to 50 cases vs $\leq$20 cases: adjusted odds ratio 0.92; 95% CI 0.88 to 0.96). Patient factors associated with decreased odds of re-excision were age older than 75 years and Northeast region of the US (adjusted odds ratio 0.93; 95% CI 0.89 to 0.98).

CONCLUSIONS: Marked variation exists in surgeon re-excision rates among patients undergoing BCT, which might represent unnecessary operations for patients and a financial burden to the healthcare system. Formalizing a re-excision frequency metric could have implications for quality improvement and data-driven surgeon feedback aimed at reducing unwarranted variation. (J Am Coll Surg 2019;228:504–515. © 2019 Published by Elsevier Inc. on behalf of the American College of Surgeons.)

In the US, an estimated total of 332,630 people will be diagnosed with invasive breast cancer or ductal carcinoma in situ in 2018, many of whom will undergo breast-conserving therapy (BCT),[1] also known as a lumpectomy or partial mastectomy. Historically, widespread implementation and practice of BCT led to controversy about the definition of negative margins. Although it was widely accepted that margins for lumpectomy should be "free of

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tumor," wide variation existed among breast surgeons on the definition of negative margins. Common definitions have included "no tumor on ink," tumor ≥2 mm from ink, tumor ≥5 mm from ink, and tumor ≥10 mm from ink, with selection varying according to surgeon preference, institutional policies, and histopathologic evaluation.[2-4]

Recent studies have demonstrated no significant difference in local recurrence rates between close (<2 mm) and negative (≥2 mm) margins in invasive breast cancer,[5-7] leading to the adoption of the 2014 Society of Surgical Oncology (SSO)/American Society of Radiation Oncology consensus guideline establishing "no tumor on ink" as the goal for an adequate surgical margin.[8] The presence of a positive margin, however, warrants additional operations to achieve a negative margin. Although breast re-excision is an established practice in the setting of positive margins, it is associated with increased healthcare costs, greater risk of postoperative complication, inferior cosmetic results, patient emotional distress, and delay to adjuvant therapy.[9] As a result, it is important to minimize re-excision risk when it does not compromise patient safety or adequacy of tumor margin status.

Despite surgeon practice variation and recent guideline alterations, individual physician re-excision rates after initial BCT have not been evaluated nationally. We examined the variation in breast surgeon re-excision rates and propose a quality benchmark to guide quality improvement efforts around best practices. We also evaluated re-excision rates before and after the establishment of the 2014 consensus guideline.

METHODS

Study population

We conducted a retrospective analysis using 100% Medicare claims between January 2012 and June 2018. Our study population was Medicare fee-for-service beneficiaries undergoing their initial BCT for breast cancer between January 1, 2012 and June 30, 2017.

We identified BCT procedures, that is, excisional biopsy or partial mastectomy, using CPT codes and ICD-9 and ICD-10 Procedure Coding System codes (eTable 1). We excluded patients without a diagnosis of breast cancer (eTable 1) within 6 months before or after their initial BCT (n = 100,944); patients with any history of breast operation before their initial BCT for breast cancer (n = 6,612); patients whose initial BCT was performed by multiple surgeons (n = 5,417); patients who received a re-excision procedure by a surgeon different from the one who performed the initial BCT (n = 3,970); a patients who had been enrolled in Medicare Parts A and B for fewer than 6 months before the initial BCT procedure (n = 10,249); patients of male sex (n = 1,288); and patients missing demographic information (n = 161).

Patient characteristics and patient-level outcomes

We obtained patient demographic information such as age, sex, race, and residential ZIP code from Medicare Master Beneficiary Summary File. The ZIP code was mapped to Federal Information Processing Standard code using the sashelp.zipcode file (SAS Institute) and then Federal Information Processing Standard to core-based statistical area code using a National Bureau of Economic Research Federal Information Processing Standard code to core-based statistical area code crosswalk to determine the region and type of residence.[10]

With reference to 2014 in which year SSO/American Society of Radiation Oncology established "no tumor on ink" consensus guidelines, we defined 2012 to 2013 as pre-guideline period and 2014 to 2017 as post-guideline period. Based on a patient's initial BCT procedure date, we categorized the patient's procedure timing as pre- or post-guideline period.

We examined whether each patient underwent a re-excision procedure, defined as an excisional biopsy, partial mastectomy, or mastectomy (eTable 1), within 12 months after the initial BCT procedure (follow-up period through June 2018). We required the re-excision procedure to be performed by the same physician who performed the initial BCT surgery for more accurate attribution.

Physician characteristics and physician-level metric

Using the National Provider Identification number available on each claim, we linked the performing physicians to their information in the Medicare Data on Provider Practice and Specialty data set and the Physician Compare National Downloadable File.[11-13] Physician characteristics of interest included sex, years since medical school graduation, practice at an SSO-approved teaching site for breast surgical oncology, volume of initial BCT procedures during the study period, and practice location (metropolitan, micropolitan, and rural) and region. We identified SSO-approved teaching sites from the SSO website.[14,15]

For physicians who performed more than 10 initial BCTs during the study period, we calculated their physician-level breast cancer re-excision rate. The denominator was the number of patients who underwent an

Table 1. Demographic Characteristics of Patients Who Did vs Did Not Undergo a Breast Re-Excision Operation Within 12 Months after the Initial Breast-Conserving Therapy

Patient characteristic	Without a re-excision (n = 235,753)	With a re-excision (n = 55,312)
Age, y, median (minimum−maximum)	72.9 (23.8−106.8)	72.2 (23.6−103.1)
64 y and younger, n (%)	17,667 (7.5)	4,678 (8.5)
65−74 y, n (%)	124,009 (52.6)	30,692 (55.5)
75−84 y, n (%)	72,372 (30.7)	16,638 (30.1)
85−94 y, n (%)	20,772 (8.8)	3,243 (5.9)
95 y and older, n (%)	933 (0.4)	61 (0.1)
Race, n (%)		
White	203,626 (86.4)	46,961 (84.9)
Black	21,492 (9.1)	5,861 (10.6)
Asian	2,726 (1.2)	685 (1.2)
Hispanic	2,525 (1.1)	557 (1.0)
North America Native	916 (0.4)	220 (0.4)
Other or unknown	4,468 (1.9)	1,028 (1.9)
Residence, n (%)		
Metropolitan	194,379 (82.5)	44,187 (79.9)
Micropolitan	23,902 (10.1)	6,344 (11.5)
Rural	17,472 (7.4)	4,781 (8.6)
Region, n (%)		
Midwest	53,578 (22.7)	12,619 (22.8)
Northeast	50,164 (21.3)	10,992 (19.9)
South	86,024 (36.5)	20,745 (37.5)
West	45,037 (19.1)	10,739 (19.4)
Other	950 (0.4)	217 (0.4)
Timing of breast-conserving therapy, n (%)		
Pre-guideline, 2012−2013	82,475 (35.0)	23,363 (42.2)
Post-guideline, 2014−2017	153,278 (65.0)	31,949 (57.8)

initial BCT for breast cancer by a given physician. The numerator was the number of patients from the denominator who underwent a re-excision by the same physician within 12 months after the initial BCT. Outlier physicians were defined as those whose re-excision rate was >30% based on an expert consensus threshold established by the current study's co-authors. We plotted a histogram to depict the national distribution of physician-level re-excision rates during the study period. We also plotted the distribution of physician-level re-excision rate by year from 2012 to 2017 to show the change of physician practice pattern over time.

Statistical analysis

We used a hierarchical logistic regression model to evaluate patient and physician characteristics associated with re-excision after initial BCT. The first-level covariates included patient characteristics such as age, race, region and location of residence, and procedure timing. The second-level covariates included physician characteristics such as physician sex, years since medical school graduation, BCT volume, and practice at SSO-approved teaching sites or not. This model included a physician-level random intercept in the second level and accounted for within-physician correlation of patient outcomes. We performed all statistical analyses with SAS Enterprise, version 7.1 (SAS Institute).

This study was approved by the Johns Hopkins University School of Medicine IRB.

RESULTS

We identified 291,065 female Medicare beneficiaries who underwent an initial BCT procedure between January 2012 and June 2017 (Table 1). The overall re-excision rate during the study period was 19.0% (55,312 of 291,065). The re-excision rate was 22.1% (23,363 of 105,838) in pre-guideline period (2012 to 2013) and 17.2% (31,949 of 185,227) in the post-guideline period (2014 to 2017). Compared with patients without a re-excision, patients with a re-excision were more likely to

Table 2. Characteristics of Outlier Physicians (>30% Re-Excision Rate) Compared with Inlier Physicians

Physician characteristic	Inlier (re-excision rate ≤30%) (n = 4,405)	Outlier (re-excision rate >30%) (n = 932)
Sex, n (%)		
Male	2,864 (65.0)	713 (76.5)
Female	1,541 (35.0)	219 (23.5)
Calendar year of medical school graduation, median (minimum−maximum)	1990 (1961−2014)	1987 (1958−2014)
Practice at Society of Surgical Oncology-approved teaching site, n (%)		
Yes	330 (7.5)	36 (3.9)
No	4,075 (92.5)	896 (96.1)
Practice location, n (%)		
Metropolitan	3,744 (85.0)	726 (77.9)
Micropolitan	467 (10.6)	133 (14.3)
Rural	100 (2.3)	52 (5.6)
Unknown	94 (2.1)	21 (2.3)
Practice region, n (%)		
Midwest	1,098 (24.9)	234 (25.1)
Northeast	841 (19.1)	121 (13.0)
South	1,566 (35.6)	382 (41.0)
West	881 (20.0)	192 (20.6)
Other or unknown	19 (0.4)	3 (0.3)
Volume of initial breast-conserving therapy procedures during the study period, median (minimum−maximum)	32 (11−603)	21 (11−509)
11−20, n (%)	1,381 (31.4)	461 (49.5)
21−50, n (%)	1,571 (35.7)	348 (37.3)
≥51, n (%)	1,453 (33.0)	123 (13.2)

Included physicians who performed more than 10 initial breast-conserving therapy procedures during the study period.

be of black race (10.6% vs 9.1%) and reside in rural areas (8.6% vs 7.4%).

There were 5,337 physicians that performed more than 10 initial BCT procedures during the study period (Table 2). The physician-level re-excision rate ranged from 0% to 91.7% with a mean of 20.2% and median of 18.2% (Fig. 1). In total, 17.5% (932 of 5,337) of all eligible physicians had a re-excision rate greater than the expert consensus cutoff of 30%; 3.7% (198 of 5,337) of the physicians had a re-excision rate of 0%. The median physician-level re-excision rate decreased from 18.8% in 2012 to 13.3% in 2017 (Fig. 2). The percentage of outlier physicians decreased from 22.2% in 2012 to 8.8% in 2017. We listed 10 example outlier physicians with both high re-excision rate and high BCT volume (Table 3).

Compared with inliers, outlier physicians were more likely to be male (76.5% vs 65.0%), practice at non-SSO-approved teaching sites (96.1% vs 92.5%), in micropolitan (14.3% vs 10.6%) or rural (5.6% vs 2.3%) areas, in the South region (41.0% vs 35.6%), and have lower initial BCT volume during the study period (median 21 vs 32).

In the hierarchical logistic regression, we found that patient characteristics associated with re-excision included black race vs white (adjusted odds ratio [aOR] 1.13; 95% CI 1.09 to 1.17), residence in micropolitan (aOR 1.07; 95% CI 1.03 to 1.11) or rural area (aOR 1.09, 95% CI 1.05 to 1.14) vs metropolitan (Table 4). Older age, residence in the Northeast region vs South (aOR 0.93; 95% CI 0.89 to 0.98), and receiving initial BCT in the post-guideline period vs pre-guideline period (aOR 0.73; 95% CI 0.72 to 0.75) were associated with decreased odds of re-excision. Physician characteristics, such as practice at an SSO-approved teaching site (aOR 0.91; 95% CI 0.85 to 0.98) and higher volume of initial BCT (≥51 vs ≤20: aOR 0.78; 95% CI 0.74 to 0.82; 21 to 50 vs ≤20: aOR 0.92; 95% CI 0.88 to 0.96) were associated with decreased odds of re-excision.

DISCUSSION

With approximately 300,000 new diagnoses in 2018, breast cancer is the most commonly diagnosed cancer

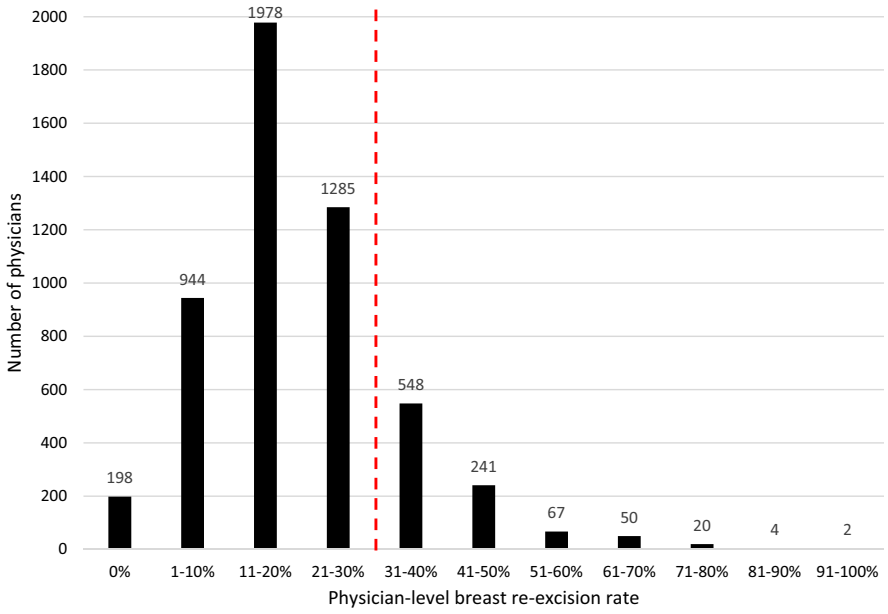

Figure 1. Distribution of US physicians by their breast re-excision rates after lumpectomy, also known as breast-conservation therapy or partial mastectomy. Dashed line represented the consensus threshold of an outlier physician.

and the second leading cause of cancer death among women in the US.[1] Because breast cancer is a common indication for operation, there is increasing effort to standardize BCT practices. The importance of these efforts is magnified by the current overtreatment endemic in healthcare. We previously reported the results of a survey of 2,100 US physicians, indicating that 21% of all medical care and 11% of all procedures are unnecessary.[16] As quality improvement collaboratives shift to measuring low-value care, new measures of clinical appropriateness are needed to inform these efforts.[17-19] The current analysis suggests that there is marked individual surgeon practice variation in re-excision rates after initial BCT. Among 5,337 surgeons included in the study, 17.5% had outlier re-excision rates, defined as >30%. Patient factors associated with breast re-excision were younger patient age, black race, micropolitan or rural residence, South region, and pre-guideline period. Physician factors associated with breast re-excision included practicing at a non-SSO-teaching site and lower surgeon volume of BCT.

Variation

There was marked variation in individual physician re-excision rates with an overall range of 0% to 91.7%. This variation was especially prominent in the early years of our study period. In 2012, the range of re-excision rates was 0% to 100%. This was likely influenced by the historical lack of consensus on margin definitions. A study published in 2010 elucidated breast surgeon attitudes toward margin width, in which 11% of surgeons endorsed a "no tumor on ink" margin, 42% a 1 mm to 2 mm margin, 28% a ≥5 mm margin, and 19% a >1 cm margin.[2] In the absence of governing guidelines, a breast cancer patient's surgical care was at the individual surgeon's discretion. Our study demonstrates a decrease in physician variation after the establishment of the 2014 SSO/American Society of Radiation Oncology "no tumor on ink" guideline, exhibited by a range of 0% to 60% in 2017. This might be demonstrative of the impact of an established guideline in promoting more uniform practice patterns among breast surgeons in the US.

Despite this trend, a significant percentage of breast surgeons (8.8%) exhibited outlier re-excision rates in 2017, suggesting that the "no tumor on ink" guideline is still frequently violated 3 years after guideline implementation. Potential factors influencing surgeon adherence to clinical practice guidelines include inadequate surgical technique as a consequence of low surgical volume, financial incentive, limited availability of adjunctive technologies, skepticism or lack of awareness of guidelines, and unwillingness to change practice habits. Similar barriers influence guideline adherence in other fields in medicine. For example, a study on primary care physician adherence to COPD guidelines showed that adherence was influenced by individual physician agreement with the guidelines, self-efficacy and skill,

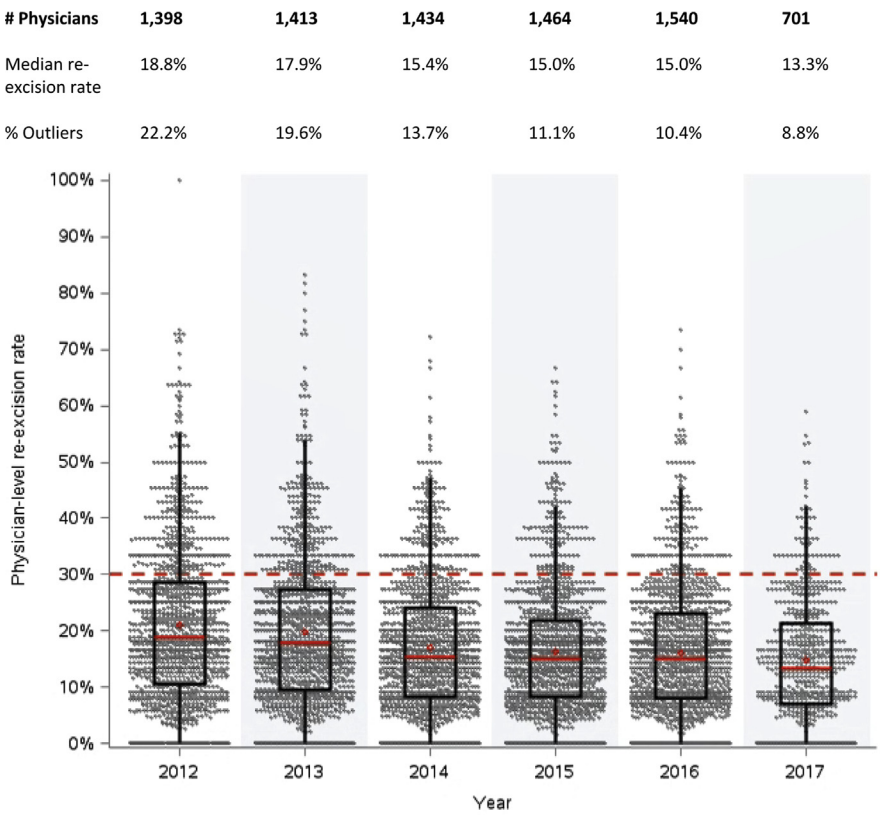

Figure 2. Variation in physician-level breast re-excision rate from 2012 to 2017. Each gray diamond represents an individual physician. Boxplot overlaid with the red bar marking the median physician re-excision rate and the red diamond marking the mean physician re-excision rate. Red dashed line represents the consensus threshold of an outlier physician.

and perceived impact of the guidelines on patient outcomes.[20] Formalizing a re-excision frequency metric could have implications for quality improvement and data-driven surgeon feedback aimed at reducing unwarranted variation.

Surgical volume implications

Several studies have demonstrated an association between high breast cancer surgical volume and improved patient outcomes. Two studies showed improved 5-year and 10-year survival rates in patients who underwent breast

Table 3. Examples of High-Volume Outlier Surgeons with a High Re-Excision Rate

Physician	Practice location	Initial breast-conserving therapy volume*	Re-excision rate, %
A	Gulfport, MS	83	66.3
B	Ukiah, CA	155	60.0
C	Indianapolis, IN	509	59.5
D	Richmond, VA	54	57.4
E	Gainesville, FL	84	56.0
F	Brick, NJ	137	54.8
G	Suffolk, VA	128	50.0
H	Wichita Falls, TX	94	50.0
I	Natchez, MS	89	49.4
J	Mountain Home, AR	64	48.4

*Volume of Centers for Medicare and Medicaid Services patients in a physician's practice.

Table 4. Patient and Physician Characteristics Associated with Re-Excision

Characteristic	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Patient-level characteristic		
Age		
64 y and younger	1.07 (1.03−1.11)	0.99 (0.96−1.04)
65−74 y	Reference	Reference
75−84 y	0.93 (0.91−0.95)	0.91 (0.89−0.93)
85−94 y	0.63 (0.61−0.66)	0.59 (0.57−0.62)
≥95 y	0.26 (0.20−0.34)	0.23 (0.18−0.30)
Race		
White	Reference	Reference
Black	1.18 (1.14−1.21)	1.13 (1.09−1.17)
Asian	1.07 (0.98−1.17)	1.09 (0.99−1.19)
Hispanic	0.95 (0.86−1.04)	0.94 (0.85−1.04)
North America Native	1.06 (0.91−1.23)	0.98 (0.83−1.15)
Other or unknown	0.99 (0.92−1.06)	1.03 (0.95−1.11)
Residence		
Metropolitan	Reference	Reference
Micropolitan	1.18 (1.15−1.22)	1.07 (1.03−1.11)
Rural	1.20 (1.16−1.25)	1.09 (1.05−1.14)
Region		
Midwest	0.99 (0.96−1.01)	0.96 (0.92−1.00)
Northeast	0.91 (0.88−0.93)	0.93 (0.89−0.98)
South	Reference	Reference
West	0.99 (0.97−1.02)	0.98 (0.93−1.03)
Other	0.95 (0.81−1.10)	0.81 (0.66−1.00)
Timing of BCT		
Pre-guideline, 2012−2013	Reference	Reference
Post-guideline, 2014−2017	0.73 (0.72−0.75)	0.73 (0.72−0.75)
Physician-level characteristic		
Sex		
Male	Reference	Reference
Female	0.90 (0.88−0.92)	1.01 (0.96-1.05)
Year since medical school graduation		
0−10	1.02 (0.98−1.06)	0.94 (0.88−1.00)
11−20	1.04 (1.01−1.06)	0.98 (0.93−1.02)
21−30	1.03 (1.00−1.05)	0.99 (0.96−1.03)
≥31	Reference	Reference
Practice at Society of Surgical Oncology-approved teaching site		
Yes	0.91 (0.88−0.94)	0.91 (0.85−0.98)
No	Reference	Reference
Volume of initial BCT procedures during the study period		
≤20	Reference	Reference
21−50	0.90 (0.88−0.93)	0.92 (0.88−0.96)
≥51	0.74 (0.72−0.76)	0.78 (0.74−0.82)

BCT, breast-conserving therapy.

cancer operations at high-volume hospitals in comparison with those who underwent operations at medium or low-volume hospitals.[21,22] Another study showed lower re-excision rates among surgeons with high annual breast operation volumes. High-volume surgeons had a mean re-excision rate of 17.8% (range 13% to 21%) compared with 33.3% (range 14% to 71%) in low-volume surgeons.[23] Our study similarly shows that surgeons who

have low or medium breast cancer operation volumes are more likely to have outlier re-excision rates compared with surgeons with high-volume practices.

Among patients who underwent re-excision, it is unclear whether re-excision was performed due to positive pathologic margins or differing surgeon-specific definitions of negative margins. One study evaluated the documented reasons for performing re-excision in breast cancer patients. Regardless of surgeon volume, a majority (range 53.3% to 66.7%) of patients underwent re-excision for positive margins.[23] However, there is still a large percentage of patients who underwent re-excision despite negative margins, emphasizing the continued variation in surgeon interpretation of negative margins and compliance with the guidelines.

Surgeons with a 0% re-excision rate

Among the 5,337 surgeons included in our study, 198 had 0% re-excision rates. Despite 0% re-excision rates, it is statistically unlikely that all of the BCT procedures performed by these surgeons resulted in negative margins, especially among those with high-volume practices. One study showed that approximately 14% of BCT operations demonstrate ductal carcinoma in situ and/or invasive cancer at the margin on final pathology.[24] Potential factors contributing to 0% re-excision rates include patient selection with exclusion of certain patient and tumor characteristics associated with involved margins,[25] use of localization techniques,[26] intraoperative margin techniques (targeted shaves),[27] and surgeon acceptance of positive margins in anticipation of adjuvant chemotherapy and/or radiation.[28] This category of breast surgeons should undergo additional evaluation to determine the percentage of patients with positive margins after initial BCT and assess patient outcomes.

Measurement science

This study has important implications for quality improvement efforts aimed at reducing low-value care. The Improving Wisely program (ImprovingWisely.org) uses a specialist authored metric of a low-value practice pattern and then sends individual physicians a confidential report showing where they stand relative to their peers nationally.[29] This model has been found to reduce low-value care and lower overall healthcare costs.

Another approach to reducing unwarranted variation in surgeon breast re-excision rates is adjust physician reimbursement rates based on inlier vs outlier performance around a specialty-endorsed quality metric. The Medicare Access and CHIP Reauthorization Act of 2015 (MACRA) created a quality payment program in which clinicians are rewarded and reimbursed according to quality of care rather than volume. The Meaningful Measurement framework identifies areas of improvement within each field and develops methods of quality measurement with the goal of promoting high-quality care and improved patient outcomes. With this model, outliers can be identified and incentivized to alter their practice to adhere to current guidelines. Given the high percentage of breast surgeons that continue outlier practice patterns, this could be a useful and practical tool to improve and standardize patient care.

Study limitations

A primary limitation of our study is that our study does not account for clinical patient factors and tumor characteristics. Certain patient and tumor characteristics, such as age younger than 60 years, lobular subtype, tumor size >2 cm, intermediate and high grade, and presence of ductal carcinoma in situ, are associated with positive margins on pathology.[22] Without this information, we were not able to study subgroups based on tumor characteristics and each surgeon's patient population. However, we accounted for differences in a surgeon's practice and population by broadly defining an outlier as a surgeon with a re-excision rate >30%. Risk-adjusted analyses with clinical data in the future could use a lower threshold for outlier performance. In addition, our data are limited to surgeons who perform BCT on Medicare beneficiaries and, therefore, does not include third-party private payers and physicians belonging to the Department of Veterans Affairs or US Armed Services. Because the same CPT codes are used to bill for the initial BCT and the subsequent re-excision procedure(s), it is possible that some of the re-excisions included in the study could be the initial excision procedures for a different primary breast tumor. Because this study is limited to Medicare patients, our analysis might have missed re-excisions performed on non-Medicare patients. Finally, our data are limited to the current publicly available Medicare data. As a result, we are only able to report on data from January 2012 to June 2017. Practice patterns might have changed since June 2017.

CONCLUSIONS

Marked variation exists in surgeon re-excision rates among patients undergoing BCT, where a large percentage of breast surgeons continue to exhibit outlier re-excision rates. This might represent unnecessary operations on individual patients and a financial burden to the healthcare system. Establishment of a practice pattern measure of appropriate care can inform quality improvement efforts aimed at reducing avoidable surgical care in the US.

Author Contributions

Study conception and design: Kaczmarski, Wang, Gilmore, Euhus, Makary

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Drafting of manuscript: Kaczmarski, Wang, Gilmore, Euhus, Makary

Critical revision: Kaczmarski, Wang, Gilmore, Euhus, Jacobs, Habibi, Camp, Weiss, Makary

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eTable 1. Breast-Conserving Therapy, Breast Re-Excision, and Breast Cancer Diagnosis CPT, ICD-9, and ICD-10 Codes

Operation type	Description
Breast-conserving therapy code	
CPT code	
Excisional biopsy	
19125	Excision of breast lesion identified by preoperative placement of radiologic marker, open; single lesion
19126	Excision of breast lesion identified by preoperative placement of radiologic marker, open; each additional lesion separately identified by preoperative radiologic marker
Partial mastectomy	
19301	Partial mastectomy (eg lumpectomy, tylectomy, quadrectomy, segmentectomy)
19302	Partial mastectomy with axillary dissection
19160	Partial mastectomy in addition to adequate margins around the lump or mass
19120	Excision of cyst, fibroadenoma, or other benign or malignant tumor
ICD-9 code	
Excisional biopsy	
85.12	Open biopsy of the breast
Partial mastectomy	
85.20	Unspecified excision or destruction of breast tissue
85.21	Local excision of lesion of breast (lumpectomy, removal of area of fibrosis from breast)
85.22	Resection of quadrant of breast
85.23	Subtotal mastectomy
ICD-10 code	
Excisional biopsy	
0HBT0ZX	Excision of right breast, open approach, diagnostic
0HBU0ZX	Excision of left breast, open approach, diagnostic
Partial mastectomy	
0HBT0ZZ	Excision of right breast, open approach
0HBU0ZZ	Excision of left breast, open approach
Breast re-excision code	
CPT code	
Excisional biopsy	
19125	Excision of breast lesion identified by preoperative placement of radiologic marker, open; single lesion
19126	Excision of breast lesion identified by preoperative placement of radiologic marker, open; each additional lesion separately identified by preoperative radiologic marker
Partial mastectomy	
19301	Partial mastectomy (eg lumpectomy, tylectomy, quadrectomy, segmentectomy)
19302	Partial mastectomy with axillary dissection
19160	Partial mastectomy in addition to adequate margin around the lump or mass
19120	Excision of cyst, fibroadenoma, or other benign or malignant tumor
Mastectomy	
19303	Simple total/complete mastectomy
19304	Subcutaneous mastectomy
19305	Radical mastectomy including pectoral muscle and axillary lymph node
19306	Radical mastectomy including pectoral muscle, axillary and internal mammary lymph nodes
19307	Modified radical mastectomy including axillary lymph node, with or without pectoralis minor muscle but excluding pectoralis major muscle

(Continued)

eTable 1. Continued

Operation type	Description
ICD-9 code	
Excisional biopsy	
85.12	Open biopsy of the breast
Partial mastectomy	
85.20	Unspecified excision or destruction of breast tissue
85.21	Local excision of lesion of breast (lumpectomy, removal of area of fibrosis from breast)
85.22	Resection of quadrant of breast
85.23	Subtotal mastectomy
Mastectomy	
85.41	Unilateral simple mastectomy
85.43	Unilateral extended simple mastectomy (modified radical mastectomy, simple mastectomy with excision of regional lymph node)
85.45	Unilateral radical mastectomy (excision of breast, pectoral muscle, and regional lymph node [axillary, clavicular, and supraclavicular])
85.47	Unilateral extended radical mastectomy (excision of breast, muscle, and lymph node [axillary, clavicular, supraclavicular, internal mammary, and mediastinal])
ICD-10 code	
Excisional biopsy	
0HBT0ZX	Excision of right breast, open approach, diagnostic
0HBU0ZX	Excision of left breast, open approach, diagnostic
Partial mastectomy	
0HBT0ZZ	Excision of right breast, open approach
0HBU0ZZ	Excision of left breast, open approach
Mastectomy	
0HTT0ZZ	Resection of right breast, open approach
0HTU0ZZ	Resection of left breast, open approach
Breast cancer diagnosis code	
ICD-9 code, ICD-10 code*	
174.0, C50.011, C50.012, C50.019	Malignant neoplasm of nipple and areola of female breast
174.1, C50.111, C50.112, C50.119	Malignant neoplasm of central portion of female breast
174.2, C50.211, C50.212, C50.219	Malignant neoplasm of upper-inner quadrant of female breast
174.3, C50.311, C50.312, C50.319	Malignant neoplasm of lower-inner quadrant of female breast
174.4, C50.411, C50.412, C50.419	Malignant neoplasm of upper-outer quadrant of female breast
174.5, C50.511, C50.512, C50.519	Malignant neoplasm of lower-outer quadrant of female breast
174.6, C50.611, C50.612, C50.619	Malignant neoplasm of axillary tail of female breast
174.8, C50.811, C50.812, C50.819	Malignant neoplasm of overlapping sites of female breast
174.9, C50.911, C50.912, C50.919	Malignant neoplasm of breast (female) unspecified site
175.0, C50.021, C50.022, C50.029	Malignant neoplasm of nipple and areola of male breast
NA, C50.121, C50.122, C50.129	Malignant neoplasm of central portion of male breast
NA, C50.221, C50.222, C50.229	Malignant neoplasm of upper-inner quadrant of male breast
NA, C50.321, C50.322, C50.329	Malignant neoplasm of lower-inner quadrant of male breast
NA, C50.421, C50.422, C50.429	Malignant neoplasm of upper-outer quadrant of male breast
NA, C50.521, C50.522, C50.529	Malignant neoplasm of lower-outer quadrant of male breast
NA, C50.621, C50.622, C50.629	Malignant neoplasm of axillary tail of male breast
NA, C50.821, C50.822, C50.829	Malignant neoplasm of overlapping sites of male breast
175.9, C50.921, C50.922, C50.929	Malignant neoplasm of breast (male) unspecified site
233.0, D05.11, D05.12, D05.10	Intraductal carcinoma in situ

NA, not available.
*ICD-10 codes applied to claims from October 2015 forward.