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Florida Initiative for Quality Cancer Care: Improvements in Breast Cancer Quality Indicators During a 3-Year Interval

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Abstract

BACKGROUND—The Florida Initiative for Quality Cancer Care (FIQCC), composed of 11 practice sites across Florida, conducted its initial evaluation of adherence to breast cancer quality of care indicators (QCI) in 2006, with feedback provided to encourage quality improvement efforts at participating sites. In this study, our objective was to reassess changes over time resulting from these efforts.

STUDY DESIGN—Quality care indicators were derived from the Quality Oncology Practice Initiative, the National Comprehensive Cancer Network, the American College of Surgeons, and expert panel consensus. Medical records were reviewed for breast cancer patients first seen by medical oncologists in 2009 at the FIQCC sites, using the same performance indicators as in 2006.

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Statistical comparisons of 2006 vs 2009 data across sites were made by Pearson chi-square exact test using Monte Carlo estimation.

RESULTS—Charts of 602 patients in 2006 and 636 patients in 2009 were compared. Performance on medical oncology QCI improved over time for documentation of clinical trial participation discussion ($p = 0.001$), documentation of consent for chemotherapy ($p = 0.047$), definitive surgery done after neoadjuvant chemotherapy ($p = 0.017$), and planned dose of chemotherapy consistent with published regimens ($p = 0.02$). Improvements in surgical QCI were seen for documentation of specimen orientation ($p < 0.001$), inking of margins ($p < 0.0001$), and performance of sentinel lymph node biopsy ($p = 0.035$).

CONCLUSIONS—The 2006 FIQCC study identified several medical and surgical oncology QCI improvement needs. Quality improvement efforts resulted in better performance for numerous metrics, therefore speaking to the benefits of reassessment of adherence to performance indicators to guide QCI efforts.

Numerous tools have been developed serving as benchmarks not only for monitoring but also for safeguarding quality cancer care. These efforts resulted from a landmark 1999 report by the Institute of Medicine's National Cancer Policy Board regarding the quality of cancer care.¹ Tools measuring quality of care indicators (QCIs) can encompass structural, process, and outcomes measures.¹

Process QCIs have several advantages, such as being closely related to outcomes, easily modifiable, and providing clear guidance for quality improvement efforts.² For example, the Quality Oncology Practice Initiative (QOPI) has provided medical oncology practices with the opportunity to participate in a practice-based quality of care self-assessment on a regular basis.^{3,4} Although QOPI sites have experienced performance improvements,^{4,5} changing cancer care outside of QOPI may require other local, regional, or national efforts.¹ The American College of Surgeons (ACS) Commission on Cancer (COC), using hospital-based cancer registries to import high-quality data into the National Cancer Database (NCDB), provides feedback to participating sites on accountability and quality improvement measures.

The Florida Initiative for Quality Cancer Care (FIQCC), established in 2004, had the overall goal of evaluating and improving the quality of cancer care at a regional level in Florida.⁶⁻¹⁰ The FIQCC is a consortium of 3 academic and 8 community practices that electively agreed to participate in a thorough practice-based self-assessment of quality indicators focusing on 3 common cancers (breast, colorectal, nonsmall cell lung [NSCLC]). This project was conceived with the aim of identifying obstacles involved in the consistent delivery of quality cancer care, providing feedback to the sites, and enabling quality of cancer care improvements at these participating sites. Here, we examined QCIs for breast cancer assessed during 2 time periods (2006 and 2009), with disclosure of the results to the consortium in 2008 and 2012. Our objectives were to examine the overall difference in adherence between the 2 assessments; to determine if change over time was independent of other factors that could have changed over time; and to determine if variability among the practice sites still remained.

METHODS

Selection of practices

When formed in 2004, the FIQCC consisted of 11 medical oncology practices in Florida (Appendix Fig. 1, online only).¹⁰ Each practice met the following criteria for initial participation: medical oncology services provided by more than 1 oncologist; availability of a medical record abstractor; and estimate of 40 or more cases each of colorectal, breast, and NSCLC for calendar year 2006. Ten practices still met eligibility criteria to participate in the 2009 abstraction. The project received approval from Institutional Review Boards at each institution. Based on exempt status, informed consent from patients was not required. To maintain patient privacy, records were coded with a unique project identifier before transmission to the central data management site.

Selection of indicators

In 2005, representatives from the participating FIQCC sites identified quality measures consistent with evidence-, consensus-, and safety-based guidelines that could be abstracted from medical records of breast, colorectal, and NSCLC patients. The indicators selected were from well-accepted standard indicators—QOPI, National Comprehensive Cancer Network (NCCN), COC, and by panel consensus of the principal investigators from each FIQCC site.¹¹⁻¹⁶ Consensus among the investigators at Moffitt Cancer Center and the site principal investigators was required for each indicator. The resulting indicators were organized by diagnosis (breast, colorectal, and NSCLC) and by domains of care (eg, symptom management). In this article, we focused only on results of 30 main quality indicators and their subcategories of breast cancer patients.⁶

Chart reviews/abstraction/quality control

Medical chart reviews were conducted on randomly sampled patients (>18 years of age) diagnosed with invasive breast cancer in 2006 and on randomly selected corresponding newly diagnosed patients in 2009. Chart review and quality control procedures were conducted throughout the study as reported previously,^{7,10,17} including training of chart reviewers using the comprehensive abstraction manual and quality control of retrieved data via 2 audits, both performed by the chief abstractor.

Disclosure of 2006 analysis/initiation of quality improvement plans

During annual FIQCC conferences (2007 to 2012), site representatives received performance results regarding their individual quality improvement efforts in a blinded fashion. In 2008, results of the 2006 breast cancer chart abstractions were discussed. Particular attention was given to performance indicators with less than 85% adherence or with significant variance in performance among the sites. Potential explanations for variance among the sites, such as age distribution of a site's patient population, community vs academic center, and large vs small volume practice, were analyzed and discussed.^{6,18,19} At the conference, a strategic plan was drafted in which site representatives would share analysis results with their respective practices and multidisciplinary cancer committees or tumor boards, thereby disseminating all QCI across disciplines. Each practice was tasked

with developing and implementing a site-specific quality improvement plan for any performance indicator <85%. The same chart abstraction process would be repeated with 2009 cases to assess changes in all indicators.

Formalized and uniform quality improvement efforts were not conducted for several reasons: to determine whether sharing data and site-specific quality improvement efforts resulted in changes in adherence before launching large-scale quality improvement efforts; a standardized quality improvement “algorithm” may not be feasible across all sites given the variability in practice/institutional characteristics; and autonomy to design and implement their own quality improvement plan, as opposed to a mandated algorithm, fostered buy-in from the individualized health care providers at each respective site.

Statistical analysis

To compare case characteristics between 2006 and 2009, we used Pearson chi-square exact test, using Monte Carlo estimation. Each indicator variable was summarized using descriptive statistics and graphic illustrations. The adherence proportion (% of yes for each indicator) with its 95% confidence interval was calculated based on the exact binomial distribution. Comparisons of QCIs between 2006 and 2009 data and across practice sites were also made by the Pearson chi-square exact test. Multivariable logistic regression models were used to evaluate whether the effects of time (2006 vs 2009) on adherence to QCIs were independent of practice site. We tested the effects of practice site variation across time in a logistic regression model. Firth's penalized maximum likelihood estimation was used to fit the logistic regression models for small sample sizes.^{20,21} A p value of 0.05 (2-sided test) was declared significant. All analyses were conducted using SAS 9.3 (SAS Institute Inc).

RESULTS

Case characteristics

Our analyses included 1,238 invasive breast cancer cases from 10 FIQCC sites (602 patients from 2006 and 636 from 2009) (Table 1). Across the consortium, a few patients had their surgical procedures performed at an academic center but returned to their respective communities for medical/radiation oncology care. The median age of the patients was 60 years (range 22 to 95 years) and 62 years (range 24 to 94 years) in 2006 and 2009, respectively ($p = 0.511$); 99% of patients were women. No significant differences between 2006 and 2009 in age, payor mix, community vs academic setting, race, or pathologically confirmed stage of disease at presentation were seen. In light of these findings, analyses were not performed to determine if observed changes over time in QCIs were independent of other outside factors.

Surgical and pathology quality indicators over time

Surgical and pathology adherence rates in 2006 vs 2009 are summarized in Table 2. Pathology QCIs were applied only to patients who were staged nonmetastatic, had surgery, and had a pathology report in their medical records. We found a high compliance (>90%) for presence of a pathology report and documentation of the TNM staging, tumor size and

grade, status of margins, and receptor status for both 2006 and 2009. Nonetheless, significant improvements were made in some QCIs (eg, reporting of histologic tumor grade rose from 96% in 2006 to 98% in 2009 [$p = 0.033$]). Although tumor staging by the TNM system was consistent between 2006 and 2009 (93% vs 95% adherence, $p = 0.122$), American Joint Committee on Cancer (AJCC) staging was significantly improved from 79% in 2006 to 83% in 2009 ($p = 0.040$).

Areas of concern in 2006 were overall low adherence and site variability in orienting the specimen and inking the margin. In 2006, specimen orientation was recorded in 68.8% of patients; it increased to 77.9% in 2009 (9.1% increase; $p < 0.001$). Inking also improved, from 89.1% in 2006 to 96.3% in 2009 ($p < 0.001$).

For the remaining surgery quality measures, the patient had to be nonmetastatic and have a surgical procedure. In 2006, sentinel lymph node biopsy (SLNB) was performed in 82% of all patients with invasive breast cancer; in 2009, adherence increased to 87% ($p = 0.035$). Of the patients with a metastatic SLNB, 79% of patients in 2006 and 86% of patients in 2009 went on to have a complete axillary node dissection (CALND) ($p = 0.104$). Obtaining a mammogram within 14 months of definitive surgery for breast conservation or unilateral mastectomy patients was not significantly improved, with adherence of 77% and 79% in 2006 and 2009, respectively ($p = 0.381$).

Medical and radiation oncology indicators over time

Table 3 outlines the comparisons in medical/radiation oncology indicators from 2006 to 2009. In 2006 and 2009, family history was documented in 79% and 83% of cases, respectively ($p = 0.143$). Menopausal status was documented in 51% of cases in 2006; of the 87 reported premenopausal women, 12% indicated that fertility preservation had been discussed (range 0% to 20%). These results were not different in 2009, when menopausal status was recorded in 50% ($p = 0.773$) and fertility preservation was discussed in 16% (range 0% to 36%) of cases ($p = 0.491$).

Other indicators without significant changes included discussion or recommendation of adjuvant trastuzumab for Her2Neu-positive disease (81.3% vs 82.4%; $p = 1.000$), discussion or recommendation for administration of an aromatase inhibitor, tamoxifen, or fulvestrant in metastatic estrogen receptor/progesterone receptor-positive breast cancer ($p = 1.000$), and rationale for not administering treatment (96.0% vs 98%; $p = 1.000$) (Table 3).

Although a high adherence rate was evident initially, documentation that a discussion/recommendation for adjuvant therapy with an aromatase inhibitor and/or tamoxifen improved significantly over time from 97.9% to 99.6% ($p = 0.032$). Additionally, 89% of patients in 2006 receiving neoadjuvant chemotherapy had documentation of a surgical procedure after chemotherapy in 2006, with improvement to 100% in 2009 ($p = 0.017$).

Of the 317 patients in 2006 and the 300 patients in 2009 who received chemotherapy, documentation of informed consent improved from 74% in 2006 to 81% in 2009 ($p = 0.047$). Positive changes in adherence were also seen for documentation of the planned dose of chemotherapy falling within the published regimen range (74% vs 84%; $p = 0.020$) and

selection of chemotherapy for patients with metastatic disease from an approved list (89% vs 100%; $p = 0.017$).

Variability in adherence across practice sites

To examine if adherence changes over time were consistent across the practice sites, adherence rate was visualized graphically (Fig. 1), and an interaction term of practice site and time was tested in multivariable logistic regression models. There was significant variability in the magnitude and direction of the change in adherence over time for several QCIs, which was not evident when examining aggregate changes over time across all sites. As demonstrated in Figure 1A, change in documentation of the patient's menopausal status varied by oncology practice, ranging from a decrease of 30% to an increase in 60% of cases. This variability in change in adherence over time was statistically significant in logistic regression modeling of the interaction between time and practice site ($p < 0.0001$, data not shown). However, we found no change in performance on the quality indicator for all sites combined. This was similarly seen with documentation of family history (site-by-time interaction, $p = 0.008$, data not shown) and mammography within 14 months of definitive (site-by-time interaction, $p = 0.009$).

In contrast, changes over time were consistent across practice sites for several QCIs, including documenting that the surgical specimen was inked and oriented (site-by-time interaction, $p = 0.135$ and $p = 0.228$, respectively; Figs. 1B and 1C), with significant improvements in performance (all sites combined) for both metrics when comparing 2006 and 2009 data ($p < 0.001$ for both). Documentation of tumor grade and Her2/neu status are other examples of overall improvement over time but without significant variability among practice sites ($p = 0.779$ and $p = 0.790$, respectively).

Lastly, as evident in Figure 1D, some QCIs (eg, overall performance of documenting informed consent) improved over time ($p = 0.047$), and there was significant variability among practice sites in the magnitude and direction of the change ($p = 0.021$). Some practice sites increased adherence (eg, 1 site had a positive change of 29%); others decreased (eg, negative 14% change for 1 site).

DISCUSSION

The FIQCC consortium conducted repetitive quality of cancer care assessments for 10 Florida medical oncology practices. The FIQCC framework afforded us the opportunity to compare adherence to QCIs for each site for 2006 vs 2009. Notably, because FIQCC assessment results were shared with respective Institutional Quality Review committees and/or multidisciplinary tumor board meetings, improvement efforts at sites were not only “practice-driven” but “physician-driven.” Each site selected which quality indicators they would focus their efforts on, explaining why some metrics may have been high overall for the FIQCC consortium but low at a particular practice site. Variability of magnitude and direction of change between sites were therefore analyzed in addition to aggregate data to uncover improvements seen at the practice level.

Significant improvements were seen among a few medical/radiation oncology indicators that were low at baseline (2006) but failed to achieve >85% performance in 2009 (eg, documentation of informed consent). A variety of approaches to improve informed consent documentation were undertaken, including requiring a standardized, signed informed consent document before administration of chemotherapeutics. Other indicators were high at baseline but still improved: performance of a surgical procedure after neoadjuvant chemotherapy, documentation of metastatic chemotherapy agents from an approved list, and discussion of adjuvant hormonal therapy.

Similarly, surgical and pathologic indicators that improved from 2006 to 2009 included specimen orientation in breast-conserving surgery and AJCC staging on pathology report. Two indicators that were initially high at baseline further improved in 2009: inking of pathology margins, especially in breast-conserving surgery, and reporting of histologic grade. Although some sites adopted the College of American Pathologists synoptic pathology templates during this time period, most practice sites discussed required elements per FIQCC and College of American Pathologists guidelines at their tumor boards and incorporated them into their new reporting template. One site needed to incorporate the outside hormone receptor report. Auditing and monitoring the completeness of pathology reports has been shown to improve report quality.^{13,14,22,23} Therefore, the FIQCC may have positively affected the quality between assessments, as evidenced by the presence of the AJCC staging system on the pathology report. However, the impact was different among the sites, as shown by a statistically significant interaction between practice site and the magnitude of change over time.

Similar to the medical/radiation oncology indicators, no surgical and pathology indicators significantly regressed. Performance of SLNB improved significantly over time. Although the variability of change across practice sites was statistically significant, for most sites this change was an increase in use resulting from feedback by our medical oncology practices to local surgeons and changes in the College of American Pathologists reporting template requiring AJCC inclusion of nodal status by category. Performance of a complete CALND for SLNB-positive disease, however, did not improve significantly. A decline in this indicator was already evident nationally before the American College of Surgeons Oncology Group Z0011 data findings were published and therefore may be reflected in our findings.¹⁶

Even with these successes, our approach has limitations. Some sites reported barriers in implementing improvement efforts for some QCI, as a result of conversion to an electronic medical record or collecting documents from non-FIQCC sites. This explained those indicators that remained low over time, including documentation of menopausal status, family history, planned chemotherapy regimen, and performance of a mammo-gram within 14 months of definitive surgery.

Improving the quality of care within any medical specialty requires high-quality data, efficient mechanisms to provide feedback of the results to hospitals/practices, systems adaptable to act on the needed changes based on the data, and acknowledgement/acceptance from the providers.¹⁵ Improvements in oncology practice performance via QOPI have been consistently reported nationally⁴; however, QOPI provides only site-specific feedback. In

contrast, the COC's NCDB provides feedback to each participating site in comparison to other centers within their region, state, or nationally.^{11,12} The COC centers usually have more cancer-related services available to patients. This results in certain limitations extrapolating data analysis results to the public at large. The FIQCC overcomes these limitations based on its selected practice sites (academic institutions, community-based medical oncology practices). So, the FIQCC is a better reflection of the standard of practice for quality of cancer care within the state of Florida. The FIQCC, with its structure of evaluating performance measures and site-directed intervention, allows for improvement and maintenance of our quality indicators over time at each site. Being able to discuss quality improvement strategies among the sites in an open forum has allowed each site to take advantage of lessons learned.

Tracking adherence to quality indicators, interventions used, and reassessments of performance pose challenges. The success of our project was dependent on site and site representative engagement. With the changing dynamics of health care, adaptability will be required to successfully deliver and document quality cancer care in the future. Areas of deficiency will need to be identified, while barriers are deconstructed. Organizational commitment, leadership support, resources, and communication are 4 factors essential to successful improvements in treatment measurements and reporting.²⁴ Institutional commitment requires a financial investment for resources, training, and sustainability as well as physician commitment. Leadership support entails the appreciation of the nonrevenue-earning time submitted by specialists who supervise the quality improvement process. Finally, communication among all components of the hospital/ practice is needed so that cyclical analysis of data, feedback of information, development and implementation of quality improvement plans, and finally, reassessment of success or failure can be cost- and time-efficient, streamlined, and nonredundant.

CONCLUSIONS

In summary, improvements in QCI adherence over a 3-year period highlighted the dedication of each practice site in conducting self-directed improvement efforts. Improvements in QCI were seen in each discipline, demonstrating the true multidisciplinary coordination of care that occurs in treating cancer patients. The FIQCC serves as a model by which identification, re-education, and intervention can positively affect quality cancer care done on a local or regional level. A focus on quality of care will lead to improvements and ultimately, excellence in delivery of cancer care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations and Acronyms

AJCC	American Joint Committee on Cancer
CALND	complete axillary lymph node dissection
COC	Commission on Cancer
FIQCC	Florida Initiative for Quality Cancer Care
NSCLC	nonsmall cell lung cancer
QCI	quality of care indicators
QOPI	Quality Oncology Practice Initiative
SLNB	sentinel lymph node biopsy

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FURTHER POINTS

- Any (grey) halftones (photographs, micrographs, etc.) are best viewed on screen, for which they are optimized, and your local printer may not be able to output the greys correctly.
- If the PDF files contain colour images, and if you do have a local colour printer available, then it will be likely that you will not be able to correctly reproduce the colours on it, as local variations can occur.
- If you print the PDF file attached, and notice some 'non-standard' output, please check if the problem is also present on screen. If the correct printer driver for your printer is not installed on your PC, the printed output will be distorted.

Figure 1.

Adherence changes over time (2006 vs 2009) across the 10 medical oncology practice sites. An interaction term of practice site and time was tested in multivariable logistic regression models and p value of interaction over time is included. (A) Documentation of menopausal status. In 2006: n = 602, mean overall 51%, range 28% to 78%; in 2009: n = 636, mean overall 50%, range 5% to 88% (p = 0.651). (B) Documentation on the pathology report that the specimen was inked. In 2006, n = 522, mean overall 89%, range 54% to 98%; in 2009: n = 566, mean overall 96%, range 90% to 100% (p < 0.001). (C) Documentation on the pathology report stating the specimen was oriented. In 2006: n = 522, mean overall 69%, range 44% to 90% seen in gray; in 2009: n = 566, mean overall 78%, range 56% to 98% (p < 0.001). (D) Documentation in the medical record chart of consent for treatment. In 2006, n = 317, mean overall 74%, range 43% to 100%; in 2009: n = 300, mean overall 81%, range 29% to 100% (p = 0.107). Gray bars, 2006 data; black bars, 2009 data.

Table 1

Characteristics of Breast Cancer Cases Within FIQCC Consortium

Variable	n (%)			p Value
	Total	2006 Cases	2009 Cases	
Age, y				
<50	301 (24.3)	152 (25.2)	149 (23.4)	0.347
50–70	627 (50.6)	292 (48.5)	335 (52.7)	–
>70	310 (25)	158 (26.2)	152 (23.9)	–
Total	1238	602 (48.6)	636 (51.4)	–
Sex				
Female	1233 (99.6)	598 (99.3)	635 (99.8)	0.202
Male	5 (0.4)	4 (0.7)	1 (0.2)	–
Total	1238	602 (48.6)	636 (51.4)	–
Health insurance				
Medicaid/charity	101 (8.2)	50 (8.3)	51 (8)	0.462
Medicare	497 (40.1)	228 (37.9)	269 (42.3)	–
None/unclassified	43 (3.5)	22 (3.7)	21 (3.3)	–
Private	597 (48.2)	302 (50.2)	295 (46.4)	–
Total	1238	602 (48.6)	636 (51.4)	–
Race				
American Indian	2 (0.2)	0 (0)	2 (0.4)	0.175
Asian	13 (1.2)	4 (0.7)	9 (1.6)	–
Black	108 (9.9)	50 (9.2)	58 (10.6)	–
White	966 (88.7)	488 (90)	478 (87.4)	–
Total	1089	542 (49.8)	547 (50.2)	–
Stage				
I	519 (44.7)	240 (43)	279 (46.3)	0–526
II–III	580 (50)	288 (51.6)	292 (48.4)	–
IV	62 (5.3)	30 (5.4)	32 (5.3)	–
Total	1161	558 (48.1)	603 (51.9)	–

FIQCC, Florida Initiative for Quality Cancer Care.

Table 2

Change in Adherence (%) to Surgical and Pathologic Breast Cancer Indicators from 2006 to 2009

Indicator	2006 Adherence, %	2006 Cases, n/total	2009 Adherence, %	2009 Cases, n/total	Increase 2006 to 2009, %	p Value *
Documentation: pathology report in medical record chart	99.6	526/528	99.3	567/571	-0.3	0.692
Documentation: AJCC staging system on pathology report	79.2	477/602	83.8	533/636	4.6	0.040
Documentation: TNM elements on pathology report	92.7	588/602	94.8	603/636	2.1	0.122
Documentation: tumor size reported	98.5	514/522	98.4	557/566	-0.1	1.000
Documentation: specimen was inked	89.1	465/522	96.3	545/566	7.2	<0.001
Documentation: specimen was oriented	68.8	359/522	77.9	441/566	9.1	<0.001
Documentation: status of margins	97.9	511/522	98.1	555/566	0.2	1.000
Documentation: grade of tumor	96.4	503/522	98.4	557/566	2	0.033
Documentation: hormone receptor status	99	517/522	99.3	562/566	0.3	0.750
Discussion: SLN performed	82	433/528	86.7	495/571	4.7	0.035
Discussion: if SLN+, CALND performed	78.9	120/152	86.4	140/162	7.5	0.104
Discussion: explanation why no CALND performed	20	4/20	20	3/15	0	1.000
Documentation: mammogram within 14 mo of definitive surgery	76.9	347/451	79.4	373/470	2.4	0.381

AJCC, American Joint Committee on Cancer; CALND, complete axillary node dissection; SLN, sentinel lymph node biopsy.

* p Values are calculated using chi-square test using exact method with Monte Carlo estimation, excluded missing level for p value calculation.

Table 3

Change in Adherence (%) to Medical and Radiation Oncology Breast Cancer Indicators from 2006 to 2009

Indicator	2006 Adherence, %	2006 Cases, n/total	2009 Adherence, %	2009 Cases, n/total	Increase 2006 to 2009, %	p Value *
Documentation: family history	79.4	478/602	82.7	526/636	3.3	0.143
Documentation: menopausal status	50.5	304/602	49.7	316/636	-0.8	0.773
Documentation: hormone receptor status	99.8	557/558	99.3	599/603	-0.5	0.366
HER2NEU status recorded in medical record	97.8	546/558	99	597/603	1.2	0.151
Discussion/recommendation: adjuvant ai or tamoxifen for ER/PR positive breast cancer	97.9	421/430	99.6	469/471	1.7	0.032
Discussion/recommendation: metastatic AI, tamoxifen, or fulvestrant	91.7	22/24	92	23/25	0.3	1.000
Discussion/recommendation: adjuvant trastuzumab for HER2NEU+ breast cancer	81.3	87/107	82.4	70/85	1	1.000
Documentation: informed consent	74.1	235/317	81	243/300	6.9	0.047
Documentation: chemotherapy flow sheet	95.6	303/317	98	294/300	2.4	0.113
Documentation: planned chemotherapy regimen	74.4	215/289	70.4	178/253	-4	0.336
Documentation: planned chemotherapy dose fell within published regimen doses	73.9	147/199	84.2	139/165	10.4	0.020
Documentation: body surface area	98.4	312/317	99.7	299/300	1.2	0.211
Documentation: surgery after neoadjuvant chemotherapy	89.2	33/37	100	63/63	10.8	0.017
Documentation: initiation of adjuvant chemotherapy within 8 wk of surgery	85.2	230/270	83.5	198/237	-1.6	0.629
Documentation: initiation of adjuvant chemotherapy within 4 mo of diagnosis	93	251/270	90.7	215/237	-2.2	0.419
Documentation: referral to radiation oncology within 1 y	97.5	277/284	99.4	322/324	1.8	0.091

AI, aromatase inhibitor; ER, estrogen receptor; PR, progesterone receptor.

* p Values are calculated using chi-square test using exact method with Monte Carlo estimation, excluded missing level for p value calculation.