Receipt of Appropriate Surgical Care for Medicare Beneficiaries With Cancer

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Objective: To investigate receipt of appropriate surgical care in Medicare beneficiaries with cancer.

Design: Retrospective cohort study.

Setting: National Surveillance, Epidemiology, and End Results registry linked to Medicare claims data.

Patients: Fee-for-service Medicare patients aged 65 years or older who underwent a definitive surgical resection for breast, colon, gastric, rectal, or thyroid cancer diagnosed between January 2000 and December 2005. Claims data were available from January 1999 through December 2007.

Main Outcome Measures: Receipt of care concordant with established practice guidelines in surgical oncology in the aggregate and by hospital.

Results: Concordance with guidelines was greater than 90% for 7 of 11 measures. All guidelines regarding adjuvant therapy had concordance rates greater than 90%. Only 2 of 5 measures for nodal management had concordance rates greater than 90%. At least 50% of hospitals provided guideline-concordant care to 100% of their patients for 6 of 11 guidelines. Patients receiving appropriate care tended to be younger, healthier, white, and more affluent, to have less advanced disease, and to live in the Midwest.

Conclusions: We found a high level of concordance with guidelines in some domains of surgical oncology care but far less so in others, particularly for gastric and colon nodal management. Given the current national focus on improving the quality of health care, surgeons must focus on generating data to define appropriate care and translating those data into everyday practice.


THERE IS CURRENTLY A MAJOR FOCUS ON IMPROVING THE QUALITY OF HEALTH CARE IN AMERICA. QUALITY HEALTH CARE MEANS DELIVERING THE RIGHT CARE TO THE RIGHT PATIENT AT THE RIGHT TIME. TO ENSURE SUCH CARE IS PROVIDED, WE MUST FIRST KNOW WHAT THE RIGHT OR APPROPRIATE CARE IS AND THEN BE ABLE TO DETERMINE WHETHER THAT CARE WAS PROVIDED. THE PRACTICE OF HEALTH CARE IN AMERICA VARIES WIDELY ACROSS BOTH INSTITUTIONS AND DEMOGRAPHIC POPULATIONS; THIS IS TRUE ACROSS SPECIALTIES AND DISEASE SITES.1 2 THIS VARIATION MAY REFLECT 2 THINGS: (1) A LACK OF KNOWLEDGE ABOUT THE OPTIMAL APPROACH TO CARE; OR (2) A LACK OF ACCEPTANCE REGARDING CURRENTLY DEFINED STANDARDS OF CARE.

We sought to use practice guidelines to investigate whether appropriate surgical care was provided to Medicare beneficiaries with a new diagnosis of cancer. We first determined the percentage of patients receiving guideline-concordant care at an aggregate patient level. We then analyzed the degree of variation in hospital-level performance to understand whether each guideline has been accepted into routine practice. Finally, we identified patient and institutional factors associated with the likelihood of receiving appropriate care.

METHODS

IDENTIFICATION OF EXISTING CLINICAL PRACTICE GUIDELINES

We organized our study around the 3 areas in which a surgeon treating cancer must be proficient: (1) surgical management of the primary tumor; (2) evaluation and treatment of regional nodal basins; and (3) appropriate referral for multidisciplinary adjuvant therapy. We first identified existing disease-specific guidelines in each of these areas for 5 common cancers in which surgery plays an important role, including breast, colon, gastric, rectal, and thyroid cancers, based on the following criteria: (1) the guideline must be endorsed by a professional organization or society whose members are considered experts in that dis-
IDENTIFICATION OF THE OVERALL COHORT

The Surveillance, Epidemiology, and End Results (SEER) program of the National Cancer Institute collects detailed data including stage at diagnosis, tumor morphology, first course of treatment, and demographic variables for persons with cancer living in a SEER region. The SEER data have been linked to Medicare enrollment during this period.

Patients diagnosed with breast, colon, gastric, rectal, or thyroid cancer as their first or only cancer between January 2000 and December 2005 were identified and linked to Medicare claims data from January 1999 through December 2007. We required that all patients have at least 1 cancer-specific surgical procedure between 30 days before through 365 days after diagnosis and be associated with a nonmissing hospital identificer. Patients were also required to be continuously enrolled in Medicare and have no health maintenance organization enrollment during this period.

Between 2000 and 2005, there were a total of 181,534 patients with breast cancer, 116,383 with colon cancer, 22,625 with gastric cancer, 41,857 with rectal cancer, and 10,453 with thyroid cancer identified. Criteria used to specify the cohort are shown in Figure 1. We excluded patients younger than 65 years at the time of diagnosis and those with end-stage renal disease or disability as their qualifying condition. Patients with stage IV disease, disease of an unknown stage (except for thyroid cancer), or a discrepancy in the death date reported by SEER and Medicare of greater than 3 months were also excluded.

DEFINITION OF SPECIFIC CONCORDANCE MEASURES

Additional specific inclusion and exclusion criteria for the denominator and numerator for each guideline were applied and are available on request. For situations where there was a discrepancy or ambiguity between identified guidelines regarding appropriate criteria, we performed sensitivity analyses varying the inclusion criteria. Tumor size criteria for receipt of total thyroidectomy were varied between 1 and 2 cm. As conclusions did not change, results are presented only for a threshold of 1.5 cm. Because this study focused specifically on the surgical practitioner, guidelines that related to the receipt of adjuvant therapy were expanded to include a visit with a medical oncologist or radiation oncologist regardless of whether the patient received treatment. Medical oncologists were identified by an associated Medicare specialty code for medical oncology or hematology/oncology or by having submitted a claim for chemotherapy. Radiation oncologists were defined by a Medicare specialty code for radiation oncology or by having submitted a claim for radiation planning or administration.

STATISTICAL ANALYSIS

Concordance was measured as the proportion of patients who met the numerator criteria among all patients who met the denomenator criteria.
RESULTS

IDENTIFICATION OF GUIDELINES AND COHORT

Eleven guidelines were identified and are listed in Table 1, showing the original sources, the year they were proposed, and whether the NCCN grades them as based on a high level of evidence (grade 1) or uniform consensus but a lower level of evidence (grade 2A).

AGGREGATE PATIENT-LEVEL CONCORDANCE RATES

Concordance with guidelines was greater than 90% for 7 of the 11 measures (Table 3). All guidelines regarding evaluation for or receipt of adjuvant therapy had concordance rates greater than 90%. The measures that evaluated breast cancer management had the highest concordance rates. These included radiation therapy or evaluation following breast-conserving surgery (99.2%), chemotherapy or medical oncology evaluation for estrogen receptor-negative breast cancer (98.1%), axillary dissection for node-positive breast cancer (96.7%), postmastectomy radiation therapy or evaluation for patients with more than 4 positive nodes, with positive lymph nodes and a tumor greater than 5 cm, or with stage III cancer (94.9%), and nodal evaluation for invasive breast cancer (91.8%). The lowest concordance rates were seen for central neck dissection for node-positive thyroid papillary cancer (72.7%), colon cancer nodal evaluation of at least 12 nodes (48.5%), and gastric nodal evaluation of at least 15 nodes (32.9%).

Table 1. Current Guidelines for Surgical Oncology Care

<table>
<thead>
<tr>
<th>Domain</th>
<th>Guideline Recommendation</th>
<th>Original Source</th>
<th>Original Year</th>
<th>NCCN Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery directed at primary cancer</td>
<td>Total thyroidectomy for papillary cancer $\geq 1.5$ cm or node positive</td>
<td>ATA guidelines</td>
<td>1996</td>
<td>2A</td>
</tr>
<tr>
<td>Nodal management</td>
<td>Central neck dissection for node-positive papillary cancer</td>
<td>ATA guidelines</td>
<td>1996</td>
<td>2A</td>
</tr>
<tr>
<td></td>
<td>Gastric node count $\geq 15$</td>
<td>AJCC Cancer Staging Manual, fifth edition</td>
<td>1997</td>
<td>2A</td>
</tr>
<tr>
<td></td>
<td>Colon node count $\geq 12$</td>
<td>AJCC Cancer Staging Manual, fourth edition</td>
<td>1992</td>
<td>2A</td>
</tr>
<tr>
<td>Referral for or receipt of adjuvant therapy</td>
<td>Axillary dissection for node-positive breast cancer</td>
<td>NCCN guideline</td>
<td>1998</td>
<td>2A</td>
</tr>
<tr>
<td></td>
<td>Nodal evaluation for invasive breast cancer</td>
<td>NIH consensus</td>
<td>1990</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Chemotherapy or medical oncology evaluation for stage III colon cancer (for patients aged $&lt;80$ y)</td>
<td>NIH consensus</td>
<td>1990</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>XRT or radiation oncology evaluation for T4 or stage III rectal cancer (for patients aged $&lt;80$ y)</td>
<td>NIH consensus</td>
<td>1990</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Chemotherapy or medical oncology evaluation for ER-negative breast cancer (for patients aged $&lt;70$ y)</td>
<td>NCCN guideline</td>
<td>1996</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>XRT or radiation oncology evaluation following BCS (for patients aged $&lt;70$ y)</td>
<td>NIH consensus</td>
<td>1990</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>PMRT or radiation oncology evaluation for $&gt;4$ positive nodes, stage III, node positive, and $\geq 5$ cm</td>
<td>NCCN guideline</td>
<td>1996</td>
<td>1</td>
</tr>
</tbody>
</table>

Abbreviations: AJCC, American Joint Committee on Cancer; ATA, American Thyroid Association; BCS, breast-conserving surgery; ER, estrogen receptor; NCCN, National Comprehensive Cancer Network; NIH, National Institutes of Health; PMRT, postmastectomy radiation therapy; XRT, radiation therapy.

*Guidelines are grouped according to the domain of surgical oncology expertise represented. The original source of the guideline, the year it was first suggested, and whether the 2009 NCCN categories grade the guideline as based on a high level of evidence (grade 1) or expert consensus with a lower level of evidence (grade 2A) are presented. (See the “Identification of Existing Clinical Practice Guidelines” subsection of the “Methods” section for explanation of the grades.)
HOSPITAL-LEVEL ANALYSIS

There was wide variation in the proportion of hospitals providing uniformly guideline-concordant care, ie, treating 100% of their patients according to the guideline recommendation (Figure 2). Fewer than 1% of institutions met this standard for colon cancer nodal evaluation or central neck dissection, while 93% provided either evaluation for or treatment with radiation for all patients following breast-conserving surgery. More institutions had uniformly concordant care for guidelines concerning adjuvant therapy than for guidelines dealing with surgery directed at the primary cancer or nodal management.

PREDICTORS OF RECEIPT OF APPROPRIATE CARE

Table 4 summarizes the factors associated with increased or decreased likelihood of receiving concordant care by guideline. For a number of the guidelines, younger age, less aggressive disease, white race, higher income level, being married, and care at a hospital that participates in an oncology group were independently associated with higher guideline concordance. Patients treated in the Midwest were more likely than patients treated in the Northeast to receive guideline-concordant care for all measures; the direction of the effect for the South and West (as compared with the Northeast) varied by measure.

COMMENT

Using practice guidelines to define appropriate care, we found that more than 90% of all patients received recommended care for 7 of the 11 guidelines examined at an aggregate patient level. We also identified 6 measures for which at least half of the institutions were concordant with

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Table 2. Patient and Hospital Characteristics for Each Cohort

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Breast</th>
<th>Colon</th>
<th>Rectal</th>
<th>Gastric</th>
<th>Thyroid</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patients</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, No.</td>
<td>37 941</td>
<td>31 647</td>
<td>1983</td>
<td>3037</td>
<td>1357</td>
</tr>
<tr>
<td>Age at diagnosis, median, y</td>
<td>74.8</td>
<td>77.9</td>
<td>72.4</td>
<td>76.5</td>
<td>73.4</td>
</tr>
<tr>
<td>Female, No. (%)</td>
<td>37 941 (100)</td>
<td>18 638 (59)</td>
<td>907 (46)</td>
<td>1320 (43)</td>
<td>951 (70)</td>
</tr>
<tr>
<td>Race, No. (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>34 048 (90)</td>
<td>27 802 (88)</td>
<td>1723 (87)</td>
<td>2138 (70)</td>
<td>1711 (86)</td>
</tr>
<tr>
<td>Black</td>
<td>2515 (6)</td>
<td>2352 (7)</td>
<td>136 (7)</td>
<td>331 (11)</td>
<td>63 (5)</td>
</tr>
<tr>
<td>Asian or Pacific Islander</td>
<td>1166 (3)</td>
<td>1352 (4)</td>
<td>114 (5)</td>
<td>546 (18)</td>
<td>123 (9)</td>
</tr>
<tr>
<td>Other</td>
<td>212 (1)</td>
<td>141 (1)</td>
<td>10 (1)</td>
<td>20 (1)</td>
<td>NA</td>
</tr>
<tr>
<td>Married, No. (%)</td>
<td>16 533 (44)</td>
<td>15 422 (49)</td>
<td>1199 (60)</td>
<td>1742 (57)</td>
<td>755 (56)</td>
</tr>
<tr>
<td>Charlson Comorbidity Index score, No. (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>25 715 (68)</td>
<td>18 683 (59)</td>
<td>1353 (68)</td>
<td>1644 (54)</td>
<td>901 (66)</td>
</tr>
<tr>
<td>1</td>
<td>8139 (21)</td>
<td>7674 (24)</td>
<td>428 (22)</td>
<td>828 (27)</td>
<td>298 (22)</td>
</tr>
<tr>
<td>2</td>
<td>2239 (6)</td>
<td>2744 (9)</td>
<td>121 (6)</td>
<td>281 (9)</td>
<td>90 (7)</td>
</tr>
<tr>
<td>&gt;=3</td>
<td>1848 (5)</td>
<td>2546 (8)</td>
<td>81 (4)</td>
<td>284 (9)</td>
<td>68 (5)</td>
</tr>
<tr>
<td>Income, median, $</td>
<td>38 518b</td>
<td>36 663b</td>
<td>37 918b</td>
<td>40 305</td>
<td></td>
</tr>
<tr>
<td>College education, median, %</td>
<td>28.2</td>
<td>27.5</td>
<td>27.8</td>
<td>26.6</td>
<td>27.5</td>
</tr>
<tr>
<td>Disease stage, No. (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>17 962 (47)</td>
<td>7654 (24)</td>
<td>NA</td>
<td>1123 (37)</td>
<td>537 (40)</td>
</tr>
<tr>
<td>II</td>
<td>16 405 (43)</td>
<td>13 281 (42)</td>
<td>173 (9)</td>
<td>1914 (63)</td>
<td>689 (51)</td>
</tr>
<tr>
<td>III</td>
<td>3574 (9)</td>
<td>10 712 (34)</td>
<td>1810 (91)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>IV</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>131 (10)</td>
</tr>
<tr>
<td><strong>Hospitals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total, No.</td>
<td>1314</td>
<td>1182</td>
<td>593</td>
<td>612</td>
<td>476</td>
</tr>
</tbody>
</table>

Abbreviations: NA, not applicable; NCI, National Cancer Institute.

a Includes patients who were included in at least 1 of the 11 measures by site of disease. Because patients may have been included in the cohort for more than 1 measure, the number represented here does not necessarily represent the sum of the final cohorts depicted in the last box of Figure 1.

b Fewer than 1% of data missing.
Table 3. Population-Level Concordance Rate for Each Guideline in Surgical Oncology Care

<table>
<thead>
<tr>
<th>Domain</th>
<th>Guideline Recommendation</th>
<th>NCCN Grade</th>
<th>Aggregate Patient-Level Analysis</th>
<th>Hospital-Level Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery directed at primary cancer</td>
<td>Total thyroidectomy</td>
<td>2A</td>
<td>Proportion</td>
<td>Concordance, % (95% CI)</td>
</tr>
<tr>
<td>Nodal management</td>
<td>Central neck dissection</td>
<td>2A</td>
<td>1213/1357</td>
<td>89.4 (87.7-91.0)</td>
</tr>
<tr>
<td></td>
<td>Gastric node count ≥15</td>
<td>2A</td>
<td>266/366</td>
<td>72.7 (67.8-77.6)</td>
</tr>
<tr>
<td></td>
<td>Colon node count ≥12</td>
<td>2A</td>
<td>987/3041</td>
<td>32.5 (29.2-35.7)</td>
</tr>
<tr>
<td></td>
<td>Axillary dissection for node-positive IBC</td>
<td>2A</td>
<td>15 266/31 504</td>
<td>48.5 (46.7-50.3)</td>
</tr>
<tr>
<td></td>
<td>Referral for or receipt of adjuvant therapy</td>
<td>1</td>
<td>10 779/11 144</td>
<td>96.7 (96.3-97.1)</td>
</tr>
<tr>
<td></td>
<td>Nodal evaluation for IBC</td>
<td>1</td>
<td>31 979/34 827</td>
<td>91.8 (91.3-92.4)</td>
</tr>
<tr>
<td></td>
<td>Chemotherapy or MOE for colon cancer</td>
<td>1</td>
<td>5917/6112</td>
<td>96.8 (96.4-97.3)</td>
</tr>
<tr>
<td></td>
<td>XRT or ROE for rectal cancer</td>
<td>1</td>
<td>1812/1983</td>
<td>91.4 (89.9-92.8)</td>
</tr>
<tr>
<td></td>
<td>Chemotherapy or MOE for ER-negative breast cancer</td>
<td>1</td>
<td>1369/1395</td>
<td>98.1 (97.4-98.9)</td>
</tr>
<tr>
<td></td>
<td>XRT or ROE following BCS</td>
<td>1</td>
<td>6535/6590</td>
<td>99.2 (98.9-99.4)</td>
</tr>
<tr>
<td></td>
<td>PMRT or ROE</td>
<td>1</td>
<td>3808/4014</td>
<td>94.9 (94.0-95.7)</td>
</tr>
</tbody>
</table>

Abbreviations: BCS, breast-conserving surgery; CI, confidence interval; ER, estrogen receptor; IBC, invasive breast cancer; MOE, medical oncology evaluation; NCCN, National Comprehensive Cancer Network; PMRT, postmastectomy radiation therapy; ROE, radiation oncology evaluation; XRT, radiation therapy.

a Data reported are limited by Surveillance, Epidemiology, and End Results–Medicare confidentiality rules. The guidelines are arranged according to the domain of surgical care to which they apply. For each guideline, the NCCN grade is depicted. (See the “Identification of Existing Clinical Practice Guidelines” subsection of the “Methods” section for explanation of the grades.) The aggregate patient-level results show the proportion and overall concordance rate for all patients in the cohort. At the hospital level, the proportion of hospitals providing concordant care to 100% of eligible patients is depicted in the first column followed by the range of observed institutional concordance rates.

b Among hospitals with 5 or more cases included in the cohort under analysis.

Figure 2. Hospital distribution of 100% concordance for each guideline, depicting the percentage of hospitals with 5 or more cases and providing guideline-concordant care to 100% of eligible patients treated. BCS indicates breast-conserving surgery; ER, estrogen receptor; IBC, invasive breast cancer; MOE, medical oncology evaluation; XRT, radiation therapy; and XRT, radiation therapy. (See the “Identification of Existing Clinical Practice Guidelines” subsection of the “Methods” section for explanation of the grades.)

the guidelines 100% of the time. These high concordance rates suggest that the factors influencing clinical decision making are adequately captured in the current guidelines and that surgeons recognize the importance of these therapies. As a result, we were able to demonstrate that Medicare beneficiaries are highly likely to receive appropriate care and that this finding is consistent across hospitals.

For several of the guidelines related to nodal management, however, concordance rates were low and few hospitals provided appropriate care to all patients. Specifically, we found that published guidelines recommending examination of a minimum number of lymph nodes in colon and gastric cancer have not resulted in routine adoption of this practice in elderly Americans despite the inclusion of these recommendations in the AJCC Cancer Staging Manual. It is possible that despite apparent expert consensus regarding the importance of evaluation of a minimum number of nodes, the lack of definitive evidence supporting a particular threshold has left many health care practitioners (surgeons and/or pathologists) unconvinced. They may not believe that the potential benefits of more extensive lymph node harvests outweigh the added operative risks, perhaps particularly in older patients. The limitations of the evidence base supporting nodal evaluation and the difficulty in defining an appropriate nodal threshold for use in guidelines or quality measurement are well described in 2 recent reviews, a report from the Cochrane Collaboration regarding the extent
of lymph node dissection for gastric cancer and a meta-
analysis on colon cancer nodal evaluation.\textsuperscript{19,20}

We observed a somewhat different pattern of concor-
dance for central neck dissection for node-positive pap-
illary thyroid cancer. A higher aggregate concordance rate
of 71.6% was observed; however, in the hospital-level
analysis, no institutions performed neck dissections in
all of their patients. Instead, most institutions per-
formed them in approximately 80% of patients. Possible
explanations for these findings are that there is agree-
ment that a central neck dissection constitutes appro-
priate care for most but not all elderly patients with node-
positive papillary thyroid cancer and that the factors
relevant to selecting patients for the procedure are not
adequately captured by the current guideline inclusion
criteria, at least in this population of elderly Americans.
Such factors might include the presence of a macrome-
tastasis rather than a micrometastasis or nodes detect-
able preoperatively or at the time of surgery rather than
only on postoperative pathology review.

Several other explanations could account for the pat-
terns observed in this study. Prior research on the Hospi-
tal Quality Alliance measures has suggested an associ-
ation between the length of time guidelines have been in place
and concordance rates.\textsuperscript{21} We found high concordance rates
and minimal variation for the breast cancer measures, guide-
lines among the first to be developed in cancer care.

It is also possible that because referral for adjuvant
therapy is a dichotomous decision, facilitating both com-
pliance and measurement, it is easier for institutions to
achieve consistent and high concordance rates on these
measures than on guidelines measuring a continuous out-
come such as number of lymph nodes examined. Alterna-
tively or in addition, the fact that referrals result in re-
bursement for the health care provider or the health
care system while lymph node harvests do not may con-
tribute to the higher concordance we observed for guide-
lines related to adjuvant therapy.

Finally, there is a suggestion in our data that the level
of evidence on which a guideline is based is associated with
the level of concordance. Six of the 7 guidelines with concor-
dance rates greater than 90% were based on a high level
of evidence, and all of the 4 guidelines with concordance
rates lower than 90% were based on a lower level of evi-
dence (Table 3). Similarly, 5 of the 6 guidelines for which
more than 50% of institutions provided concordant care
to 100% of their patients were graded as 1, while 4 of the
5 guidelines for which fewer than half of the institutions
provided fully concordant care were graded as 2A
(Figure 2). The role that level of evidence may play in ac-
ceptance of guidelines deserves further investigation.

This study has the usual limitations associated with
analyses of large national databases, including incom-
plete capture of cases, loss to follow-up, and missing data,
with these limitations varying from level of evidence to
level of evidence. As the limitations of claims data such as
level of evidence, level of evidence, and level of evidence.

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analysis on colon cancer nodal evaluation.\textsuperscript{19,20}

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with these limitations varying from level of evidence to
level of evidence. As the limitations of claims data such as
level of evidence, level of evidence, and level of evidence.

| Table 4. Results of Multivariable Analysis of Factors Associated With Receipt of Appropriate Care* |
|---|---|---|---|---|---|---|---|---|---|
| Characteristic | TT | CND | TT | CND | TT | CND | TT | CND | TT | CND |
| Gastric Node | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| Node-Positive | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| Breast Cancer | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| Colon Node | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| Evaluation | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| IBC | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| Chemotherapy | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| or MOE for | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| Colon Cancer | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| XRT or ROE | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| for Rectal | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| Cancer | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| Chemotherapy | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| or MOE for | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| ER-Negative | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| Breast Cancer | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| XRT or ROE | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| for BCS | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| or ROE | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| PMRT | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| or ROE | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |

Abbreviations: AXD, axillary dissection; BCS, breast-conserving surgery; CND, central neck dissection; ER, estrogen receptor; IBC, invasive breast cancer;
MOE, medical oncology evaluation; NCI, National Cancer Institute; PMRT, postmastectomy radiation therapy; Ref, reference; ROE, radiation oncology evaluation; TT, total
thyroidectomy; XRT, radiation therapy.

*Direction of odds ratios that were significant (\(P<.05\)) in the logistic regression model. A downward arrow represents an odds ratio below 1 (indicating that the
variable is associated with a lower rate of concordance), and an upward arrow represents an odds ratio above 1 (indicating that the variable is associated with a higher
rate of concordance). Region is the only categorical variable presented, with Northeast used as the reference group.
delivered, our analysis was limited to patients aged 65 years and older. A focus on older patients did allow us to study a particularly vulnerable population and one that makes up the majority of patients with gastric and colorectal cancers. However, breast and thyroid cancers are common in younger Americans, so our reliance on Medicare data represents a more significant limitation for these diagnoses.

We found a high level of concordance with guidelines in some domains of surgical oncology care but far less so in others, especially those associated with nodal management. Five of the 6 measures with wide acceptance into practice (as evidenced by the majority of hospitals providing recommended care to 100% of their patients) relate to appropriate referral for or receipt of adjuvant therapy. Given the current national focus on quality in health care, there is increasing pressure to develop measures to determine whether patients are getting appropriate care; however, within the surgical disciplines, there is a paucity of data to support what constitutes appropriate care. It is critical that surgeons focus on generation of the data necessary to inform clinical decision making and promote high-quality surgical care.

Accepted for Publication: March 11, 2011.
Published Online: June 20, 2011. doi:10.1001/archsurg.2011.141

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Financial Disclosure: None reported.

Funding/Support: This work was supported in part by a grant from the American Surgical Association Foundation.

Role of the Sponsors: The sponsor had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; or preparation, review, or approval of the manuscript.

Disclaimer: This study used the linked SEER-Medicare database. The interpretation and reporting of these data are the sole responsibility of the authors.

Additional Contributions: We acknowledge the efforts of the Applied Research Program, National Cancer Institute; the Office of Research, Development and Information, Centers for Medicare and Medicaid Services; Information Management Services, Inc; and the SEER program tumor registries in the creation of the SEER-Medicare database. Scott Regenbogen, MD, MPH, contributed to study conception and design, and Katherine Corso, MPH, assisted with manuscript preparation.

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