NIH Public Access
Author Manuscript
Ann Surg. Author manuscript; available in PMC 2013 November 23.

Published in final edited form as:
Ann Surg. 2009 May ; 249(5): . doi:10.1097/SLA.0b013e3181a38f6f.

Surgeon characteristics and use of breast conservation surgery in women with early stage breast cancer

Dawn L Hershman, MD, MS[1,3,4], **Donna Buono, MS**[4], **Judith S Jacobson, PhD, MBA**[3,4], **Russell B McBride**[4], **Wei Yann Tsai, PhD**[3,5], **Kathie Ann Joseph, MD, MPH**[2,3], and **Alfred I Neugut, MD, PhD**[1,3,4]

[1]Department of Medicine, Mailman School of Public Health, Columbia University, and from the New York Presbyterian Hospital, New York, NY, 10032

[2]Department of Surgery, Mailman School of Public Health, Columbia University, and from the New York Presbyterian Hospital, New York, NY, 10032

[3]Herbert Irving Comprehensive Cancer Center, Mailman School of Public Health, Columbia University, and from the New York Presbyterian Hospital, New York, NY, 10032

[4]College of Physicians and Surgeons, and the Departments of Epidemiology, Mailman School of Public Health, Columbia University, and from the New York Presbyterian Hospital, New York, NY, 10032

[5]Department of Biostatistics, Mailman School of Public Health, Columbia University, and from the New York Presbyterian Hospital, New York, NY, 10032

Abstract

Background—Most women with localized breast cancer (BC) have a choice between mastectomy and breast conserving surgery (BCS). Aside from clinical factors, this decision may be associated with surgeon and patient characteristics. We investigated the effect of surgeon characteristics on the BCS rate.

Methods—We used the SEER-Medicare database to identify women >65 years, diagnosed with stages I-II BC, between 1991–2002, and used the Physician Unique Identification Number linked to the American Medical Association Masterfile to obtain information on surgeons. We investigated the association of patient demographic, tumor, and surgeon-related factors with receipt of BCS, using Generalized Estimating Equations to control for clustering.

Results—Of 56,768 women with BC, 30,006 (53%) underwent BCS while 26,762 (47%) underwent mastectomy. From 1991 to 2002, the proportion of patients undergoing BCS increased from 35% to 60%. In a multivariate analysis, patients who received BCS were younger, of higher SES, and had more favorable tumor characteristics. They were also more likely to be black and live in metropolitan areas. Women who underwent BCS were more likely to have surgeons who were female (OR=1.40; 95%CI 1.25–1.55), US-trained (OR=1.12; 95%CI 1.02–1.22), with a larger patient panel (OR=1.29; 95%CI 1.21–1.39), and completed training after 1975 (OR=1.16; 95%CI 1.08–1.25), than surgeons of patients who underwent mastectomy.

Conclusions—Surgeon characteristics, such as gender, training, year of graduation and volume, are small but significant independent predictor of BCS. Efforts to differentiate whether these associations reflect patients' preferences, quality of physician training, surgeon attitudes, physician-patient communication, or other effects on decision-making are warranted.

All correspondence to Dawn Hershman, MD, MS, Herbert Irving Comprehensive Cancer Center, 161 Ft Washington Ave, Room 1068, New York, NY 10032; dlh23@columbia.edu.

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

NIH-PA Author Manuscript NIH-PA Author Manuscript NIH-PA Author Manuscript

Introduction

Research on the determinants of receipt of cancer treatment has mostly focused on patient factors, such as race/ethnicity, geographic location, age, and socioeconomic status. Relatively less research has evaluated the role of the physician/surgeon in cancer treatment decisions and cancer outcomes. Investigators have reported associations between physician characteristics and the receipt of androgen deprivation therapy for prostate cancer,[1] as well as on referral to an oncologist after a diagnosis of colon[2] or lung cancer.[3] Referrals to subspecialists have also been associated with the primary care physician's gender, number of years in practice, practice patient volume, and practice case mix.[4, 5] It is increasingly apparent that patients who are similar with regard to demographic and clinical characteristics may be treated differently depending on the physician they see.

Women with breast cancer often have many treatment decisions to make. The first is usually surgical, and involves the decision to undergo a mastectomy versus breast conservation surgery (BCS) with radiation. Since the introduction of BCS and the demonstration that survival was equivalent between BCS with RT and mastectomy, despite higher local recurrence rates, [6] its use has increased steadily. Current studies indicate that between 40–70% of eligible women receive it.[7–9] Clinical and demographic features, such as patient age, geographic location and tumor aggressiveness can influence BCS use,[8] BCS fees seem to influence use,[10], and patient preferences also play a strong role.[9] Furthermore, some of this is influenced by physician characteristics. Katz and colleagues found that both patient and surgeon characteristics, such as surgical volume, practice setting, surgeon's attitudes toward treatment recommendations, and surgeon demographics, explained a small amount of the variation in mastectomy vs BCS rates among patients with DCIS and invasive breast cancer, suggesting that similar patients may receive different treatment depending on their surgeon.[11, 12] Others have shown that pre-operative consultations with radiation oncologists[13] and medical oncologists can also influence BCS use.[14]

We utilized a large US population-based registry to investigate the independent association between surgeon-related factors, such as gender, location of training (US vs foreign), year of graduation, practice volume, and type of practice on the receipt of BCS among a large cohort of women with stages I and II invasive breast cancer after accounting for other known clinical and demographic factors, and accounting for the influence of physician clustering.

PATIENTS AND METHODS

Patient Selection Criteria

We included women, who participated in Medicare and were therefore over 65 years old, diagnosed with stage I or II breast cancer between 1991 and 2002, who underwent breast cancer surgery within 3 months after their date of diagnosis, and who were not members of a health maintenance organization (HMO) (n=80,109); members of an HMO would not generally bill Medicare for services. We excluded women who did not participate in Medicare Parts A and B during the 12 months prior to their diagnosis (n=8,680), women with unknown primary breast surgery (n=3,652), women who had a prior breast cancer or other cancer (n=8,354), or a diagnosis without histological confirmation (n=605).

We excluded women whose physician did not have a UPIN number or a primary or secondary specialty (n=1680). Many patients had several physicians. Patients whose physician did not have a primary or secondary specialty of surgery were excluded (n=105). For women with two physicians in these categories, if both had a specialty on the list, then the one who was defined as the operating physician was selected and, if neither was an

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

operating physician, then the first one listed was used. Patients whose physicians were missing the primary specialty (n=25) or for whom neither had a specialty in surgery or general practice (n=21) were excluded. Of 195 women with 3 or more physicians, only those who had a surgical oncologist (n=21) were included.

Surgeon Characteristics

Surgeon characteristics included as variables in the AMA Masterfile were gender, graduation year, primary employment setting (private practice vs. other), patient volume, location of training (United States vs. other), and type of degree (Medical Degree (MD) or Doctor of Osteopathy (DO)). We categorized physician age by year of medical graduation (<1975 or ≥1975). Over 85% of the physicians were in private practice (self-employed solo, 2-physician, group or other); those who were not in private practice were either employed in a medical school, federal, state or government hospital. We categorized physicians by total number of claims each surgeon had for breast cancer-directed surgery for 1991–2002, dichotomized as 1–10 vs ≥10 subjects. This was chosen because the top 15% of physicians operated on >10 subjects. This does not include the surgeon's total volume, only the absolute number of patients that met our inclusion criteria.

Measurement of Treatments and Outcomes

We identified and categorized patients with respect to surgery using the SEER-Medicare databases and ICD-9-CM procedure, CPT-4, HCPCS, and ICD-9-CM V codes, which have been found to capture virtually all breast cancer cases.[15]

We categorized patients as having BCS if they had any of the following: segmental mastectomy, lumpectomy, quadrantectomy, excisional biopsy and partial mastectomy as the last surgical procedure. We categorized patients as having mastectomy if they had any of the following: modified radical, simple or radical mastectomy as the last surgical procedure prior to treatment or within 6 months of diagnosis. We calculated the total number of surgical procedures (biopsies/excisions) within 6 months of diagnosis date.

Socioeconomic status

We generated an aggregate SES score based on zip code from education, poverty and income data from the 2000 census, following the method adapted by Du et al.[16] Patients were ranked on a 1–5 scale, where 1 was the lowest value, based on a formula incorporating these variables weighted equally. The 394 patients with missing data were assigned to the lowest SES category. The results did not change if they were assigned a separate category.

Comorbid disease

To assess the prevalence of comorbid disease in our cohort, we used the Klabunde adaptation of the Charlson comorbidity index.[17] Medicare inpatient and outpatient claims were searched for ICD-9-CM diagnostic codes in the Medicare files from 12 months before to 1 month after the diagnosis of cancer. Each condition was weighted, and patients were assigned a score based on the Klabunde-Charlson index.[17]

Statistical Analysis

The chi-square test was used to compare surgeon-related, demographic, and clinical characteristics between patients who received BCS and those who received mastectomy, and between patients who were operated on by a female or by a male surgeon. All hypothesis tests were two-sided.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

The Generalized Estimating Equations (GEE) methodology was introduced by Liang and Zeger to deal with clustering in data that otherwise would be analyzed by means of a generalized linear model. GEEs (PROC GENMOD in SAS) have become an important strategy in the analysis of correlated data.[18] We used GEEs to account for the correlation of outcome measures among patients who had the same physician. The unit of analysis was the patient. For each patient, the physician's unique UPIN number was used as the clustering variable.

We evaluated the odds of BCS for all the categories of each variable, controlling for all other variables in the model and year of diagnosis; the model included: (1) operating physician characteristics (gender, type of degree, country of training, practice type, year of graduation, surgical volume); (2) demographic variables (age, race, marital status, SES); and (3) clinical variables (tumor grade, AJCC stage, receptor status, comorbidity). To evaluate for changes over time, we performed a separate analysis for patients diagnosed in 1991–1999 and 2000–2002. We also performed the same analysis for the odds of BCS followed by radiation therapy. Statistical analyses were conducted using the SAS Version 9.13.

Results

We identified 56,768 women in SEER-Medicare who were diagnosed with stages I-II breast cancer between January 1, 1991 and December 31, 2002 who met our eligibility criteria for this study; these women were operated on by 6,224 surgeons. Among these women, 30,006 (53%) underwent BCS, and 26,762 (47%) underwent mastectomy. Women who underwent mastectomy had more surgical procedures (biopsies/excisions) than women who underwent BCS. The surgeons who performed BCS in this cohort were predominantly male (89%); in private practice (80%); trained in the United States (80%), and holders of a medical degree (MD) (96%) as opposed to an osteopathic degree (DO) (4%) (Table 1). The proportion of women who underwent BCS as opposed to mastectomy increased over the 12 years of our study, but stabilized after 1999. While the proportion of DOs (versus MDs) and foreign-trained physicians remained stable at 4% and 16%, respectively, the proportion of surgeries performed by female surgeons increased from 7% in 1991 to 24% in 2002. In addition, female surgeons were more likely to be trained in the US, perform fewer surgeries per diagnosis, and were less likely to be employed in private practice.

Table 2 compares patients who did and did not receive BCS by the characteristics of their surgeons as well as their own demographic and clinical characteristics. BCS was associated with all the clinical, demographic, and physician variables studied, except for type of practice in which the operating surgeon was employed. Specifically, in unadjusted analyses, patients who received BCS were significantly more likely than those who did not to have a surgeon who was female (66% vs 51%; OR=1.88), had an M.D. degree (53% vs 45%; OR=1.37), was US-trained (54% vs 47%; OR=1.30), graduated after 1975 (57% vs 49%; OR=1.34) or had performed procedures on >10 subjects in the cohort (56% vs 44%; OR=1.43). Female surgeons were more likely than male surgeons to have patients who resided in a metropolitan location, were married, received chemotherapy, and had fewer comorbid conditions. They were also more likely to have M.D. degrees, to be US-trained, and to perform more BCS procedures. They were less likely to practice in a private setting.

The multivariate analysis using GEE is shown in Table 3. Controlling for all other factors, patients who received BCS were more likely than patients who had mastectomy to have their BCS performed by a surgeon who was female (OR=1.40, 95%CI 1.25–1.55), US-trained (OR=1.12, 95%CI 1.02–1.22), graduated 1975 or later (OR=1.16, 95%CI 1.08–1.24), and who had performed procedures on >10 subjects in this cohort (OR=1.29, 95%CI 1.21–1.38). In contrast, patients who received mastectomy were more likely than those who

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

did not to be older, to have stage II rather than stage I disease, to have more biopsies/ excisions, to have ≥1 comorbid conditions, to reside in a metropolitan area, and to be white. The odds of receiving BCS in women diagnosed in 2002 was >2.5 fold higher that those who were diagnosed in 1991. Interestingly, socioeconomic status was linearly related to receipt of BCS, with those in the highest SES quintile being 34% more likely to undergo BCS ($p < 0.001$). The association between physician characteristics and BCS was similar in the early and late time intervals.

To control for the interaction between year of diagnosis and surgeon gender, we conducted separate GEE analyses of the association between surgeon gender and receipt of BCS, among patients stratified into two groups by year of diagnosis (1991–1999 and 2000–2002) (Table 4). Surgeon gender was similarly associated with BCS in both time cohorts.

The analysis was also performed including only the 22,030 women with BCS who had radiation therapy following surgery. In this analysis, black race was not associated with receipt of BCS (OR=1.09, 95%CI 0.98–1.21), suggesting that black women are more likely than white women to get BCS without RT than mastectomy, an indicator of poorer quality care. In this analysis as well, patients of female physicians were 42% more likely to have BCS followed by radiation than patients of male surgeons ($p<0.0001$).

Discussion

In this population-based study of over 50,000 elderly women with stage I/II breast cancer, we found that the number of women undergoing BCS rose from 34% to 55% between 1991 and 1997, and since then has been fairly constant at a rate of 60%. Surgeon characteristics, such as gender, location of medical training, year of graduation and surgical volume, were independently associated with receipt of BCS. In addition, our study confirmed that patients with poorer prognosis tumors, advanced age, lower socioeconomic status, and those who were unmarried, were less likely than others to undergo BCS, despite the fact that studies have shown that over 70% of patients with stage II tumors can successfully undergo BCS.[19, 20]

While BCS rates have gone up over time, one concerning finding has been that the omission of both radiation following BCS and axillary node dissection have also gone up, suggesting that those with BCS may be more likely to get “inappropriate care”.[21] Our group has shown that physician factors, such as surgeon gender, location of training, and type of medical degree influence post BCS radiation.[22]. Others have shown that surgeon training and academic affiliation also influence the quality and degree of axillary node dissection.[23, 24]

Patient preference has a strong influence on BCS rate. However, patient preference is often influenced by numerous factors, including the information provided by physicians. It was originally thought that the rates of BCS did not increase to higher levels because the eligibility criteria for BCS were not well understood or communicated well to patients; hence, patients may believe that more extensive surgery has greater survival benefits.[20] However, studies have shown that numerous other factors go into this decision making. For example, women who have a consultation with a medical oncologist prior to surgery are more likely to undergo definitive surgery and axillary node dissection.[14]. Also, women seen by general surgeons as opposed to surgical oncologists are less likely to have reconstruction discussed during the decision making process, which may impact the treatment choice,[25] and women who participate in the surgeon selection process are more likely to be treated by more experienced surgeons.[26] While we know that patient-surgeon communication practices influence women’s perceptions of their decision making,[27] this increasing involvement in

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

the decision making process by patients does not necessarily translate into increased use of BCS.[28]

We, as have others,[12] found that surgeon procedure volume, as represented by the number of patients the surgeon operated on in this cohort, was associated with receipt of BCS. Other studies have also shown that surgeon procedure volume and subspecialty training are associated with treatment patterns, morbidity and mortality.[29] While the majority of women in our sample were treated by physicians trained in the US, those who were not had a higher odds of receiving a mastectomy. Despite the fact that 25% of physicians in the US are foreign trained, little is known regarding their clinical behavior and outcomes relative to US-trained physicians. The literature evaluating the performance of Doctors of Osteopathy relative to M.D.s is also limited. Our group found that, to a lesser degree, these surgeon characteristics were also associated with the receipt of post-lumpectomy adjuvant radiation therapy in women with early stage breast cancer.[22]

Although all the patients in the cohort were Medicare beneficiaries and therefore had access to care, patient socioeconomic status was also associated with receipt of BCS; women in the highest SES quintile were 25% more likely to undergo BCS than women in the lowest quintile. SES also influences cancer screening,[30] quality of adjuvant breast cancer chemotherapy as measured by intentionally reduced first cycle dose levels,[31] and breast cancer mortality.[32] The reasons for this disparity are not known.

We found the association of surgeon gender and receipt of BCS of interest. Studies report that female patients have a preference for physicians of their own gender;[33, 34] this preference is stronger when the health concern is gender-related.[35, 36] Women seen by a female physician are more likely to undergo screening with Pap smears and mammograms than those seen by a male physician, particularly if the physician is a family practitioner.[37] Female physicians are more likely to engage patients in discussions that are critical to the establishment of a therapeutic relationship.[38] With regard to breast cancer, one small study in women with early-stage breast cancer also suggests that patients seen by female surgeons are more likely to receive BCS than mastectomy.[39] We recognize that the number of female physicians has increased over time, however, we saw a similar effect size for the association between physician gender and odds of BCS in the earlier years as opposed to later years of this analysis.

The SEER-Medicare dataset that we analyzed has the virtue of being population-based, and therefore over 95% of patients are captured without concern for selection bias. Furthermore, unlike some of the studies previously described, the large number of patients in our cohort allow us to adequately control for the multiple confounding variables that influence these associations, as well as control for the influence of physician clustering in a hierarchical model.

The dataset, however, has limitations. It does not include data on a number of variables that might have also been associated with receipt of mastectomy, such as patient choice, psychological outlook, communication with the physician, or health behaviors and specific contraindications to BCS, such as positive margins, ratio of tumor size to breast size, and presence of multicantric disease. The AMA data lacks some detail on practices that have academic affiliations. In addition, our study was limited to patients over the age of 65; it may therefore not be generalizable to younger populations. Although these factors may influence the overall rate of BCS, they are not likely to largely influence the association of BCS with the physician characteristics that we observed.

Our study demonstrates a small but independent association between certain specific surgeon characteristics and the choice of surgical treatment of localized breast cancer. While

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

we don't advocate choosing a surgeon based on gender, we do recognize that differences in communication styles and surgeon preferences may influence patient choice when the decisions are complex. Efforts aimed at understanding how specific physician characteristics may influence treatment variability for all aspects of breast cancer care are warranted. A better understanding of whether these differences stem from physician training, communication styles or other factors may result in interventions to improve cancer care..

Acknowledgments

Dr. Hershman is the recipient of an ASCO Advanced Clinical Research Award and a grant from the American Cancer Society (RSGT-08-009-01-CPHPS). Russell McBride was supported in part by an R25T fellowship from NCI (CA94061).

The authors would like to acknowledge Barron Lerner, MD, PhD, for his editorial assistance.

This study used the linked SEER-Medicare database. The interpretation and reporting of these data are the sole responsibility of the authors. The authors acknowledge the efforts of the Applied Research Branch, Division of Cancer Prevention and Population Science, NCI; the Office of Information Services, and the Office of Strategic Planning, HCFA; Information Management Services (IMS), Inc; and the Surveillance, Epidemiology, and End Results (SEER) Program tumor registries in the creation of the SEER-Medicare database.

References

1. Shahinian VB, Kuo YF, Freeman JL, Goodwin JS. Determinants of androgen deprivation therapy use for prostate cancer: role of the urologist. J Natl Cancer Inst. 2006; 98(12):839–845. [PubMed: 16788157]
2. Luo R, Giordano SH, Zhang DD, et al. The role of the surgeon in whether patients with lymph node-positive colon cancer see a medical oncologist. Cancer. 2007; 109(5):975–982. [PubMed: 17265530]
3. Earle CC, Neumann PJ, Gelber RD, et al. Impact of referral patterns on the use of chemotherapy for lung cancer. J Clin Oncol. 2002; 20(7):1786–1792. [PubMed: 11919235]
4. Franks P, Williams GC, Zwanziger J, et al. Why do physicians vary so widely in their referral rates? J Gen Intern Med. 2000; 15(3):163–168. [PubMed: 10718896]
5. Freiman MP. The rate of adoption of new procedures among physicians. The impact of specialty and practice characteristics. Med Care. 1985; 23(8):939–945. [PubMed: 4021579]
6. Fisher B, Anderson S, Bryant J, et al. Twenty-year follow-up of a randomized trial comparing total mastectomy, lumpectomy, and lumpectomy plus irradiation for the treatment of invasive breast cancer. N Engl J Med. 2002; 347(16):1233–1241. [PubMed: 12393820]
7. Nattinger AB, Gottlieb MS, Veum J, et al. Geographic variation in the use of breast-conserving treatment for breast cancer. N Engl J Med. 1992; 326(17):1102–1107. [PubMed: 1552911]
8. Morrow M, White J, Moughan J, et al. Factors predicting the use of breast-conserving therapy in stage I and II breast carcinoma. J Clin Oncol. 2001; 19(8):2254–2262. [PubMed: 11304779]
9. Katz SJ, Lantz PM, Janz NK, et al. Patient involvement in surgery treatment decisions for breast cancer. J Clin Oncol. 2005; 23(24):5526–5533. [PubMed: 16110013]
10. Hadley J, Mitchell JM, Mandelblatt J. Medicare fees and small area variations in breast-conserving surgery among elderly women. Med Care Res Rev. 2001; 58(3):334–360. [PubMed: 11523293]
11. Hawley ST, Hofer TP, Janz NK, et al. Correlates of between-surgeon variation in breast cancer treatments. Med Care. 2006; 44(7):609–616. [PubMed: 16799355]
12. Katz SJ, Lantz PM, Janz NK, et al. Surgeon perspectives about local therapy for breast carcinoma. Cancer. 2005; 104(9):1854–1861. [PubMed: 16161056]
13. Baldwin LM, Taplin SH, Friedman H, Moe R. Access to multidisciplinary cancer care: is it linked to the use of breast-conserving surgery with radiation for early-stage breast carcinoma? Cancer. 2004; 100(4):701–709. [PubMed: 14770424]

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

14. Keating NL, Landrum MB, Ayanian JZ, et al. Consultation with a medical oncologist before surgery and type of surgery among elderly women with early-stage breast cancer. J Clin Oncol. 2003; 21(24):4532–4539. [PubMed: 14673040]
15. Du XL, Osborne C, Goodwin JS. Population-based assessment of hospitalizations for toxicity from chemotherapy in older women with breast cancer. J Clin Oncol. 2002; 20(24):4636–4642. [PubMed: 12488407]
16. Du XL, Fang S, Vernon SW, et al. Racial disparities and socioeconomic status in association with survival in a large population-based cohort of elderly patients with colon cancer. Cancer. 2007; 110(3):660–669. [PubMed: 17582625]
17. Klabunde CN, Potosky AL, Legler JM, Warren JL. Development of a comorbidity index using physician claims data. J Clin Epidemiol. 2000; 53(12):1258–1267. [PubMed: 11146273]
18. Panageas KS, Schrag D, Russell Localio A, et al. Properties of analysis methods that account for clustering in volume-outcome studies when the primary predictor is cluster size. Stat Med. 2006; 26(9):2017–2035. [PubMed: 17016864]
19. Morrow M, Bucci C, Rademaker A. Medical contraindications are not a major factor in the underutilization of breast conserving therapy. J Am Coll Surg. 1998; 186(3):269–274. [PubMed: 9510257]
20. Stewart JA, Foster RS Jr. Breast cancer and aging. Semin Oncol. 1989; 16(1):41–50. [PubMed: 2645649]
21. Nattinger AB, Hoffmann RG, Kneusel RT, Schapira MM. Relation between appropriateness of primary therapy for early-stage breast carcinoma and increased use of breast-conserving surgery. Lancet. 2000; 356(9236):1148–1153. [PubMed: 11030294]
22. Hershman DL, Buono D, McBride RB, et al. Surgeon characteristics and receipt of adjuvant radiotherapy in women with breast cancer. J Natl Cancer Inst. 2008; 100(3):199–206. [PubMed: 18230795]
23. Edge SB, Gold K, Berg CD, et al. Patient and provider characteristics that affect the use of axillary dissection in older women with stage I-II breast carcinoma. Cancer. 2002; 94(10):2534–2541. [PubMed: 12173318]
24. Petrik DW, McCready DR, Sawka CA, Goel V. Association between extent of axillary lymph node dissection and patient, tumor, surgeon, and hospital factors in patients with early breast cancer. J Surg Oncol. 2003; 82(2):84–90. [PubMed: 12561062]
25. Alderman AK, Hawley ST, Waljee J, et al. Understanding the impact of breast reconstruction on the surgical decision-making process for breast cancer. Cancer. 2008; 112(3):489–494. [PubMed: 18157830]
26. Katz SJ, Hofer TP, Hawley S, et al. Patterns and correlates of patient referral to surgeons for treatment of breast cancer. J Clin Oncol. 2007; 25(3):271–276. [PubMed: 17235044]
27. Hawley ST, Lantz PM, Janz NK, et al. Factors associated with patient involvement in surgical treatment decision making for breast cancer. Patient Educ Couns. 2007; 65(3):387–395. [PubMed: 17156967]
28. Lantz PM, Janz NK, Fagerlin A, et al. Satisfaction with surgery outcomes and the decision process in a population-based sample of women with breast cancer. Health Serv Res. 2005; 40(3):745–767. [PubMed: 15960689]
29. Begg CB, Riedel ER, Bach PB, et al. Variations in morbidity after radical prostatectomy. N Engl J Med. 2002; 346(15):1138–1144. [PubMed: 11948274]
30. Bao Y, Fox SA, Escarce JJ. Socioeconomic and racial/ethnic differences in the discussion of cancer screening: "between-" versus "within-" physician differences. Health Serv Res. 2007; 42(3 Pt 1):950–970. [PubMed: 17489898]
31. Griggs JJ, Culakova E, Sorbero ME, et al. Effect of patient socioeconomic status and body mass index on the quality of breast cancer adjuvant chemotherapy. J Clin Oncol. 2007; 25(3):277–284. [PubMed: 17159190]
32. Bouchardy C, Verkooijen HM, Fioretta G. Social class is an important and independent prognostic factor of breast cancer mortality. Int J Cancer. 2006; 119(5):1145–1151. [PubMed: 16557599]
33. Fennema K, Meyer DL, Owen N. Sex of physician: patients' preferences and stereotypes. J Fam Pract. 1990; 30(4):441–446. [PubMed: 2324696]

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

34. Weyrauch KF, Boiko PE, Alvin B. Patient sex role and preference for a male or female physician. J Fam Pract. 1990; 30(5):559–562. [PubMed: 2332747]
35. Haar E, Halitsky V, Stricker G. Factors related to the preference for a female gynecologist. Med Care. 1975; 13(9):782–790. [PubMed: 1177543]
36. van den Brink-Muinen A, de Bakker DH, Bensing JM. Consultations for women's health problems: factors influencing women's choice of sex of general practitioner. Br J Gen Pract. 1994; 44(382): 205–210. [PubMed: 8204333]
37. Lurie N, Slater J, McGovern P, et al. Preventive care for women. Does the sex of the physician matter? N Engl J Med. 1993; 329(7):478–482. [PubMed: 8332153]
38. Roter DL, Hall JA. Why physician gender matters in shaping the physician-patient relationship. J Womens Health. 1998; 7(9):1093–1097. [PubMed: 9861586]
39. Cyran EM, Crane LA, Palmer L. Physician sex and other factors associated with type of breast cancer surgery in older women. Arch Surg. 2001; 136(2):185–191. [PubMed: 11177139]

NIH-PA Author Manuscript

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Table 1

Characteristics of surgeons performing breast cancer surgery 1991–2002, (N=6224)

		Total	
		N	**%***
Degree			
	MD	5954	96
	DO	270	4
US-trained			
	No	1233	20
	Yes	4991	80
Year of medical graduation			
	<1975	3114	50
	≥1975	3110	50
Type of practice			
	Other	1276	21
	Private	4948	79
# BSC Patients in Cohort			
	1–10	5157	83
	>10	1067	17

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

Table 2

Unadjusted associations between receipt of breast conservation surgery (BCS) as opposed to mastectomy among elderly patients with early stage breast cancer, and the characteristics of their surgeons, and their own demographic and clinical characteristics (N=56,768)

Characteristics	N	%	Odds Ratios	95% Confidence intervals
Received BCS	30,006	53%		
a. Surgeon characteristics				
Degree				
DO	773	45	1.00	Referent
MD	29,233	53	1.37	1.24–1.50
US-trained				
No	4,332	47	1.00	Referent
Yes	25,674	54	1.30	1.24–1.36
Year of graduation				
<1975	14,289	49	1.00	Referent
≥1975	15,717	57	1.34	1.29– 1.38
Type of practice				
Non-private	4,804	53	1.00	Referent
Private	25,202	53	1.01	0.97–1.06
#BCS procedures				
1–10	16,550	44	1.00	Referent
>10	20,789	56	1.43	1.38–1.49
Sex				
Male	25,146	51	1.00	Referent
Female	4,859	66	1.88	1.79–1.98
b. Patient demographic characteristics				
Age at diagnosis				
65–69	6,077	55	1.00	Referent
70–74	8,318	54	0.97	0.92–1.02
75–79	7,436	52	0.91	0.87–0.96
80+	8,175	51	0.87	0.83–0.92
Race				

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

Characteristics	N	%	Odds Ratios	95% Confidence intervals
White	27,245	53	1.00	Referent
Black	1,452	52	0.97	0.90–1.05
Hispanic	307	52	0.98	0.83–1.15
Other	1,002	48	0.82	0.75–0.90
Residence				
Metropolitan	28,179	55	1.00	Referent
Non-metropolitan	1,827	34	0.43	0.40–0.45
Marital status				
Unmarried	11,027	52	1.00	Referent
Married	13,197	54	1.13	1.09–1.16
Socioeconomic status				
Lowest quintile	4,895	45	1.00	Referent
2nd quintile	5,526	47	1.09	1.03–1.15
3rd quintile	6,233	53	1.39	1.32–1.46
4th quintile	6,725	59	1.78	1.69–1.88
Highest quintile	6,627	59	1.74	1.65–1.84
c. Patient clinical characteristics				
Stage				
I	21,531	62	1.00	Referent
II	8,475	38	0.36	0.35–0.37
Hormone receptor status				
ER− and PR−	2,830	54	1.00	Referent
Er+ and/or PR+	22,199	48	1.28	1.21–1.35
Unknown	4,997	49	1.05	0.98–1.12
Grade				
Well/moderately differentiated	19,094	58	1.00	Referent
Poorly differentiated	6,687	46	0.62	0.59–0.64
Unknown	4,225	47	0.63	0.60–0.67
Comorbidity score				
0	18,429	54	1.00	Referent
1	7,394	51	0.87	0.84–0.91

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

Characteristics	N	%	Odds Ratios	95% Confidence intervals
>1	4,183	50	0.82	0.79–0.86
Number of biopsies/excisions				
0	20,956	62	1.00	Referent
1	8.133	40	0.41	0.39–0.42
>1	917	35	0.33	0.31–0.36

* DO=Doctor of Osteopathic Medicine; ER=estrogen receptor; PR=progesterone receptor.

NIH-PA Author Manuscript

Table 3

Multivariate analysis of association between demographic, tumor, and surgeon characteristics of elderly patients with early stage breast cancer and receipt of lumpectomy as compared to mastectomy (N=56,768)

DEMOGRAPHIC CHARACTERISTICS	Odds Ratio	95% CI	P Value	CLINICAL CHARACTERISTICS	Odds Ratio	95% CI	P Value	SURGEON CHARACTERISTICS	Odds Ratio	95% CI	P Value
Age at diagnosis				Stage of Breast Cancer				Gender			
65–69	~	~	~	I	~	~	~	Male	~	~	~
70–74	0.91	0.87–0.96	0.001	II	0.33	0.36–0.39	<.0001	Female	1.40	1.25–1.55	<.0001
75–79	0.83	0.78–0.87	<.0001	Hormone Receptors				Degree			
80+	0.77	0.73–0.82	<.0001	ER and/or PR Negative	~	~	~	D.O.	~	~	~
Race				ER and PR Positive	1.08	1.02–1.15	0.003	M.D.	0.89	0.75–1.07	0.68
White	~	~	~	Unknown	0.90	0.84–0.97	0.0003	US–Trained			
Black	1.19	1.08–1.29	0.0004	Grade				No	~	~	~
Hispanic	1.07	0.91–1.27	0.26	Well/Moderately diff	~	~	-	Yes	1.12	1.03–1.22	<.0001
Other	0.69	0.62–0.77	<.0001	Poorly-differentiated	0.82	0.78–0.85	<.0001	Type of Practice			
Residence in Metropolitan Location				Unknown	0.93	0.88–0.97	<.0001	Private	~	~	~
Yes	~	~	~	Comorbidity score				Other *	0.94	0.86–1.01	0.12
No	0.60	0.54–0.64	<.0001	0	~	~	~	# of patients operated on in cohort			
Marital Status				1	0.86	0.82–0.89	<.0001	1–10	~	~	~
No	~	~	~	≥2	0.82	0.78–0.86	<.0001	>10	1.29	1.21–1.38	<.0001
Yes	1.06	1.02–1.11	0.001	Number of surgeries				Year of Graduation			
SES				0	~	~	~	<1975	~	~	~
Lowest quintile	~	/~	~	1	0.35	0.34–0.37	<.0001	≥1975	1.16	1.08–1.25	<.0001
2nd quintile	1.03	0.97–1.09	0.33	>1	0.24	0.22–0.26	<.0001				
3rd quintile	1.14	1.07–1.21	<.0001								
4th quintile	1.26	1.18–1.35	<.0001								
Highest quintile	1.30	1.23–1.37	<.0001								

* GEE Analysis, each variable corrected for others and year of diagnosis

NIH-PA Author Manuscript
NIH-PA Author Manuscript
NIH-PA Author Manuscript

Table 4

Relative odds that a patients with stage I/II breast cancer would undergo breast conservation surgery as opposed to mastectomy, given that the physician performing surgery was female (vs male), stratified by year of diagnosis*

Year of diagnosis	Odds ratios	95% Confidence interval	P Value
1991–1999	1.35	1.17–1.57	<0.0001
2000–2002	1.37	1.21–1.54	<0.0001

*Each model controls for age, year of diagnosis, race, hormone receptor status, socioeconomic status, breast cancer grade, marital status, comorbidity, physician characteristics and physician volume.