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Comparison of the Initial Loco-Regional Treatment Received for Early-Stage Breast Cancer between Elderly Women in Appalachia and a United States - Based Population: Good and Bad News

Traci LeMasters*, S. Suresh Madhavan, and Usha Sambamoorthi

Department of Pharmaceutical Systems and Policy, School of Pharmacy, West Virginia University, USA

Abstract

Background—Breast conserving surgery (BCS) followed by radiation therapy (RT) (BCS+RT) is as effective for long-term survival of invasive early-stage breast cancer (ESBC) as mastectomy, and is the local treatment option selected by the majority of women with ESBC. Women of older age and vulnerable socio-demographic characteristics are at greater risk for receiving substandard (BCS only) and non-preferred treatments (mastectomy), such as populations of women from the Appalachian region of United States.

Methods—Using a retrospective cohort study design, we identified 26,106 patients from the Surveillance, Epidemiology, and End Results (SEER)-Medicare linked dataset and 811 patients from the West Virginia Cancer Registry (WVCR)-Medicare dataset age ≥ 66 diagnosed from 2003 to 2006 with stage I–II breast cancer. Multivariable logistic regression models estimated type of initial treatment received between WVCR-Medicare and SEER-Medicare patients, and the association with type of treatment.

Results—Overall, women in WV were 0.82 (95% CI 0.68–0.99) and 0.70 (95% CI 0.58–0.84) times less likely to have mastectomy or BCS only vs. BCS+RT, than those in SEER regions. Women in WV of increasing age, greater comorbidity, stage II disease, and non-white race were more likely to have mastectomy or BCS only vs. BCS+RT, whereas, those residing in areas of higher income, higher education, and metro status were less likely, than similarly characterized women from SEER regions.

Conclusions—Findings from this study suggest that the magnitude of disparities in breast cancer treatment between groups of women with more and less resources are even greater in the Appalachian region, than they are among US populations. Improving access to oncology treatment services, as well as, the implementation of patient navigation programs are needed to improve patterns of initial treatment for ESBC among at-risk populations.

* Address correspondence to this author at the School of Pharmacy Robert C. Byrd Health Sciences Center, West Virginia University, P.O. Box 9500, Morgantown, WV 26506-9500, USA; Tel: 1-304-293-7177; tlemasters@hsc.wvu.edu.

1. INTRODUCTION

Breast conserving surgery (BCS) followed by radiation therapy (RT) (BCS+RT) is as effective for long-term survival of invasive early-stage breast cancer (ESBC) as mastectomy [1–5]. Yet, as ~ 60% or more women receiving BCS+RT, it remains the preferred local treatment due to breast preservation and fewer physical limitations [6–9]. Aside from patient preference, several factors influence the type of local treatment received for ESBC. Epidemiological studies have shown age and comorbidity to be the strongest predictors of treatment, such that as age and comorbidity increase, so does the likelihood for treatment with mastectomy or BCS only, compared to BCS+RT [10–14]. Often times, the omission of RT or use of mastectomy in older women, is intended to preserve quality of life and avoid adverse effects for those with limited life expectancy, frail health, or low functional status. However, treatment with BCS only is associated with an increased risk of short-term treatment failure, requiring additional surgeries, as well as, an increased risk of and recurrence and mortality [15–19]. Moreover, one in four women who have BCS will undergo additional surgery, and about one in ten will eventually undergo mastectomy after treatment failure with BCS [22,23]. Based on findings from the Cancer and Leukemia Group B (CALGB) C9343 trial study [24], National Comprehensive Cancer Network (NCCN) treatment guidelines permit a limited subset of older women, age > 70 years, stage I, ER positive, and taking tamoxifen, to omit RT following BCS, but recommend RT following BCS for all others [25]. In addition to age and comorbidity, other associations with receipt of mastectomy or BCS only for ESBC include rural residence, greater travel distances to RT centers, low levels of income and education, being uninsured or underinsured, having a male surgeon, a surgeon who was not trained in the United States (US), or with less recent training. Additional predictors of mastectomy are later stage at diagnosis, estrogen-receptor (ER) and progesterone-receptor (PR) negative tumors, lower grade tumors, and non-White race [7,8,26–32].

Despite breast cancer being the most common cancer among women in the US and WV [33], little is known about treatment patterns for ESBC among older women in WV and how they compare to US estimates. Furthermore, patterns of initial local treatment among older women in WV with ESBC remain unknown. Given that WV has the 2nd largest proportion of residents age > 65 years in the US, alongside high rates of comorbidity, rurality, medically underserved regions, poverty, and low levels of education, there is a considerable need to determine patterns of initial treatment for ESBC and how treatment may be influenced by these factors. The purpose of this study is to determine patterns of initial local treatment (BCS+RT, mastectomy, or BCS only) among women age > 66 years, with stage I and II breast cancer using data from the WV Cancer Registry (WVCR)-Medicare and Surveillance, Epidemiology, and End Results (SEER)-Medicare linked datasets. Moreover, this study aims to determine how age, health, clinical prognostic factors, oncology care resources, and socio-demographic characteristics are associated with type of initial local treatment received for ESBC.

2. METHODS

2.1. Data Source

The SEER-Medicare linked dataset was created in collaboration by the National Cancer Institute (NCI) and Centers for Medicare and Medicaid Services (CMS). SEER data from this study was collected from 17 tumor registries, representing 26% of the US population, and matched to Medicare enrollment records for 94% of patients age > 65 years old [34]. The resulting linkage contains information about date of diagnosis, cancer site, stage, tumor characteristics, treatment, health care use, patient enrollment and eligibility, selected demographic characteristics, and vital status information. Claims information are available for physician office visits, outpatient hospital visits, inpatient hospital stays, home health care services, skilled nursing facility services, hospice, and durable medical equipment. County and state of diagnosis were used to identify the area-level density of mammography screening and oncology treatment centers from the U.S. Department of Health and Human Resource's 2009 Area Resource File (ARF) [35]. Modeled after the SEER-Medicare dataset, the WVCR-Medicare linked dataset was created by the West Virginia Department of Health and Human Resources (WVDHHR), West Virginia University (WVU), WV Bureau of Public Health, and CMS. Additional details about the dataset and its creation have been described elsewhere [36].

2.2. Study Cohorts

We identified women age > 66 years diagnosed with stage I and II breast cancer as their first or only primary tumor between January 1, 2003 and December 31, 2006. We excluded women diagnosed upon death or autopsy, died within 366 days of diagnosis so that local treatment received within the first year after diagnosis could be fully captured, not continuously enrolled in Medicare Part A and B fee-for-service programs 12 months before and after diagnosis, enrolled in a health maintenance organization during the 12 months before and after diagnosis, missing tumor size, and missing surgeon specialty. The final analytic cohort consisted of 26,917 patients, 811 from the WVCR-Medicare and 26,106 from the SEER-Medicare dataset.

2.3. Measures

The study outcome, initial local treatment (BCS+RT, mastectomy, or BCS only) was identified using surgical and radiation claims where the claim date was within 366 days of the diagnosis date. Surgery claims were identified using ICD-9 procedure codes 85.20–85.29 and CPT/HCPCS 19120, 19125, 19126, 19160, 19162, 19301, and 9302 to identify BCS (i.e. lumpectomy, partial mastectomy, segmental mastectomy) and ICD-9 procedure codes 85.33–85.48 and CPT/HCPCS 19140, 19180, 19182, 19300, 19303, 19304, 19200, 19220, 19240, 19305, 19306, 19307, 19260, 19271, and 19272 to identify mastectomy. Receipt of RT was identified using ICD-9 diagnosis codes V580, V661, and V671, ICD-9 procedure codes 9220–9239, and HCPCS codes 77261–77799, G0256, G0261, G0173, G0174, G0243, G0251, and G0338–G03340.

Independent variables examined included year of diagnosis, age, health, clinical prognostic factors, oncology care resources, and socio-demographic characteristics. Comorbidity score

(Charlson index, 0, 1, > 2) [37,38] and frequency of primary care provider (PCP) visits were used as indicators of health status, with a higher number of visits considered an indication of poorer health. Frequency of PCP visits was determined by counting the number of unique PCP claim dates the year before diagnosis and dividing by lower and upper 50th percent median cutoffs. Clinical prognostic factors were stage at diagnosis, ER status, PR status, and tumor grade. Oncology care resources were analyzed by comparing the area-level density of mammography screening and oncology treatment centers, and specialization of the treating surgeon(s). Area-level densities were determined by dividing proportions found in the ARF by lower and upper 50th percent median cutoffs. Surgeon(s) specialty (general only, oncology only, or both) was ascertained using provider specialty claims codes 02, 49 (general) and 83, 90, 91, 98 (oncology). Demographic characteristics examined were race, education (measured by the 2000 Census tract survey of percent of persons age > 25 with at least 4 years college education), annual income (measured by the 2000 Census tract survey of median income by census), and metro status.

2.4. Statistical Analysis

Pearson X², Mantel-Haenszel X² tests of location shift using modified ridit scores or table scores, and Mantel-Haenszel X² tests of general association (depending on whether the independent measure was nominal or ordinal) were used to compare group differences between WVCR-Medicare and SEER-Medicare patients. Multivariable logistic regression models were used to estimate the adjusted odds of receiving mastectomy *vs.* BCS+RT and BCS only *vs.* BCS+RT between WVCR-Medicare and SEER-Medicare patients, adjusting for covariates. Parameter estimates are presented as adjusted odds ratios (AOR) with their corresponding 95% confidence intervals (CI). P values < .05 were considered statistically significant. All analysis were conducted using SAS version 9.4 software (SAS Institute Inc., Cary, NC). This study was approved for exemption by the West Virginia Institutional Review Board.

3. RESULTS

Greater proportions of women from WV were of white race (97.7% *vs.* 89.8%; $p < 0.001$), lower education (44.5% *vs.* 30.1%; $p < 0.001$), lower income (91.7% *vs.* 21.2%; $p < 0.001$), rural residence (42.1% *vs.* 16.9%; $p < 0.001$), greater comorbidity (score = 2, 16.2% *vs.* 14.8% and score = 1, 30.3% *vs.* 27.0%; $p = 0.014$), resided in areas with a low density of mammography screening centers (55.2% *vs.* 51.7%; $p = 0.048$), and diagnosed at stage I (67.0% *vs.* 62.3%; $p = 0.007$), compared to the SEER-Medicare cohort (Table 1). Patients within the WVCR-Medicare cohort also had higher rates of reported borderline/unknown tumor receptors and undifferentiated/unknown tumor grades.

Compared to older women in the SEER-Medicare cohort, older women from WV were 18% (AOR = 0.82; 95% CI 0.68–0.99) and 30% (AOR = 0.70; 95% CI 0.58–0.84) less likely to mastectomy and BCS only *vs.* BCS+RT, respectively (Table 2). Still yet, controlling for the effects of the SEER-Medicare population, among women in WV those of increasing age, greater comorbidity, non-white race, lower education, lower income, rural residence, and stage II *vs.* I diagnosis were more likely to receive mastectomy or BCS only *vs.* BCS+RT.

Women treated by an oncology surgeon only (AOR = 0.73; 95% CI 0.62–0.85 and AOR = 0.78; 95% CI 0.72–0.84) or both an oncology and general surgeon (AOR = 0.53; 95% CI 0.46–0.62 and AOR = 0.57; 95% CI 0.53–0.61), compared to a general surgeon only, were less likely to receive mastectomy or BCS only. Women who had ER negative (AOR = 1.18; 1.05–1.33) PR negative (AOR = 1.14; 95% CI 1.03–1.24), moderately (AOR = 1.21; 95% CI 1.11–1.31), poorly (AOR = 1.36; 95% CI 1.23–1.50), and undifferentiated/unknown tumors (AOR = 1.29; 95% CI 1.13–1.48) were more likely to have mastectomy vs. BCS+RT. Women who resided in an area with a high density of mammography screening centers were less likely to have BCS only (AOR = 0.87; 95% CI 0.76–0.99), while those who resided in areas with a high density of oncology treatment centers were less likely to have mastectomy (AOR = 0.87; 95% CI 0.76–0.99).

4. DISCUSSION

Previous research has shown that among older women with ESBC of increasing age, comorbidity, and vulnerable socio-demographic characteristics are more likely to be treated by mastectomy or BCS only, as compared to BCS+RT. This is the first study to determine initial treatment patterns for ESBC among older women diagnosed with ESBC in WV, a state characterized by these disparities, and compare these rates to US estimates. Findings from the current study demonstrate both good and bad news for WV. Rates of BCS+RT, mastectomy, and BCS only received for the initial treatment of ESBC did not differ between older women in WV and US estimates. In fact, we found that overall, older women in WV were 18% and 30% less likely to have mastectomy and BCS only, than BCS+RT, compared to those in SEER regions. However, examination factors associated with receipt of treatment, showed that vulnerable populations of women in WV were at greater risk of mastectomy or BCS only for ESBC, than women from SEER regions of the same characteristics.

The overall decreased likelihood for mastectomy or BCS only observed among older women in WV with ESBC, compared to US estimates, may be due to the awareness raising and call for aggressive comprehensive cancer control measures taking place in WV during this study time period. Collaborative efforts by the American Cancer Society, Mary Babb Randolph Cancer Center, WV Breast and Cervical Cancer Screening Program, and WV Comprehensive Cancer Program resulted in the 2007 publication of the WV Cancer Plan by the Mountains of Hope Cancer Coalition, which among other initiatives, included a goal of increasing access to quality cancer care [39]. The ongoing efforts for cancer control and prevention during this time may also explain the greater proportion of older WV women diagnosed at stage I vs. II, compared to residents of SEER regions, decreasing the likelihood for mastectomy. An important factor that decreased the likelihood of mastectomy and BCS only, thus increasing the likelihood for BCS+RT, for ESBC was having an oncology surgeon directly involved in patient care. Studies of treatment decisions and provider specialty have found that oncologists are willing to use more aggressive and advanced methods of treatment [40,41]. Moreover, patients treated by an oncology surgeon may have shorter travel distances to access specialty care and oncology treatment centers, making them more likely to undergo treatments that require repeated visits, such as BCS+RT [42]. Therefore, it is not surprising that women in this study who resided in areas with a high density of

mammography screening and oncology treatment centers were less likely to have BCS only or mastectomy. This finding highlights the importance of increasing accessibility of oncology specialists and services to cancer patients within WV, especially those residing in rural locations.

Despite the good news regarding overall treatment patterns between WV and SEER populations, women in WV characterized by older age, greater comorbidity, non-white race, low education, low income, non-metro residence, and later stage at diagnosis, were more likely to have mastectomy or BCS only as their initial treatment for ESBC, compared to women from SEER regions with the same characteristics. It is unlikely that they have an isolated effect on the type of initial treatment received, and is highly probable that these factors are interacting with each other, magnifying the effect of one another. The high rates of all of these disparate characteristics among the WV population likely explains the increased risk for mastectomy and BCS only associated with these factors for women from WV, as compared to US-based estimates. In fact, women age > 80 years from WV were over twice and three times as likely to have mastectomy or BCS only, than women the same age from SEER regions. Similarly, women from WV of greater comorbidity were at increased risk for mastectomy and BCS only, compared to women from SEER regions. The relationship between increasing age and comorbidity on breast cancer treatment has been well-documented [10–14]. In WV, it is likely that the treatment of elderly and comorbid breast cancer patients is further complicated by high rates of rurality as shown by the association between metro status and type of treatment. Fewer elderly individuals may be able to drive themselves for repeated visits or have a family member that can do so for them, than younger persons. The relationship between race and treatment disparities is not well understood, in the context of uniform Medicare coverage. However, a recently published study may shed light on this subject [43]. Compared to white women, black and Hispanic women were found to be less likely to be knowledgeable about their breast cancer characteristics, a factor that may prevent them from taking part in the treatment decision making process. It is safe to assume that women of low income and education are also less likely to be knowledgeable about their disease and treatment options. A potential solution for improving access to treatment for these populations could be the implantation of patient navigation programs. Previous assessments of such navigation programs have shown them to be helpful for improving patient access and adherence to treatment [44,45].

The current study holds several strengths. It is the first study to determine the initial treatment received for ESBC among older women in WV and compare these outcomes to national estimates using a large population-based dataset. The relationship between treatment and numerous health, clinical, oncology resource, and demographic characteristics was also examined. However, several limitations should be kept in mind when interpreting the results of this study. This study did not assess the completion of RT, only the initiation of therapy. Another limitation is that many patients in the WVCR had a reported “unknown” ER and PR tumor status, indicating that hormone receptor status was not tested or the result was not recorded, making it difficult to interpret the association between hormone receptor status and treatment among women in WV. Also, generalizations from the findings of this study are likely limited to the state of WV and similar nearby regions.

In summary, older women in WV were less likely to receive mastectomy or BCS only for the initial treatment of ESBC, compared to a US representative population. Cancer prevention and control efforts taking shape during this time period may have contributed to these treatment successes. Yet, vulnerable populations of older women in WV still were at greater risk of mastectomy and BCS only, than US women, demonstrating the need for continued efforts to increase access to oncology treatment services and the implementation of patient navigation programs for at risk elderly populations.

References

1. Fisher B, Redmond C, Poisson R, Margolese R, Wolmark N, Wickerham L, et al. Eight-year results of a randomized clinical trial comparing total mastectomy and lumpectomy with or without irradiation in the treatment of breast cancer. *N Engl J Med.* 1989; 320(13):822–828. <http://dx.doi.org/10.1056/NEJM198903303201302>. [PubMed: 2927449]
2. Fisher B, Anderson S, Bryant J, Margolese R, Deutsch M, Fisher E, et al. Twenty-year follow-up trial comparing total mastectomy, lumpectomy, and lumpectomy plus irradiation for the treatment of invasive breast cancer. *N Engl J Med.* 2002; 347(16):1233–241. <http://dx.doi.org/10.1056/NEJMoA022152>. [PubMed: 12393820]
3. Veronesi U, Cascinelli N, Mariani L, Greco M, Saccozzi R, Luini A, et al. Twenty-year follow-up of a randomized study comparing breast-conserving surgery with radical mastectomy for early breast cancer. *N Engl J Med.* 2002; 347(16):1227–1232. <http://dx.doi.org/10.1056/NEJMoA020989>. [PubMed: 12393819]
4. Litière S, Werutsky G, Fentiman I, Rutgers E, Christiaens M, Limbergen E, et al. Breast conserving therapy versus mastectomy for stage I–II breast cancer: 20 year follow-up of the EORTC 10801 phase 3 randomised trial. *Lancet Oncol.* 2012; 13(4):412–19. [http://dx.doi.org/10.1016/S1470-2045\(12\)70042-6](http://dx.doi.org/10.1016/S1470-2045(12)70042-6). [PubMed: 22373563]
5. Simone N, Dan T, Shih J, Smith S, Sciuto L, Lita E, et al. Twenty-five year results of the national cancer institute randomized breast conservation trial. *Breast Cancer Res Treat.* 2012; 132(1):197–203. <http://dx.doi.org/10.1007/s10549-011-1867-6>. [PubMed: 22113254]
6. American Cancer Society. Cancer Treatment and Survivorship Facts & Figures 2014–2015. Atlanta: American Cancer Society; 2014.
7. Dragun A, Huang B, Tucker T, Spanos W. Increasing mastectomy rates among all age groups for early-stage breast cancer: a 10-year study of surgical choice. *Breast J.* 2012; 18(4):318–325. <http://dx.doi.org/10.1111/j.1524-4741.2012.01245.x>. [PubMed: 22607016]
8. Mahmood U, Hanlon A, Koshy M, Buras R, Chumsri S, Tkaczuk K, et al. Increasing national mastectomy rates for the treatment of early-stage breast cancer. *Ann Surg Oncol.* 2013; 20(5):1436–1443. <http://dx.doi.org/10.1245/s10434-012-2732-5>. [PubMed: 23135312]
9. Nesvold IL, Dahl AA, Løkkevik E, Marit Mengshoel A, Fosså SD. Arm and shoulder morbidity in breast cancer patients after breast-conserving therapy versus mastectomy. *Acta Oncol.* 2008; 47(5): 835–842. <http://dx.doi.org/10.1080/02841860801961257>. [PubMed: 18568481]
10. Dragun A, Huang B, Tucker T, Spanos W. Disparities in the application of adjuvant radiotherapy after breast-conserving surgery for early-stage breast cancer: impact on overall survival. *Cancer.* 2011; 117(12):2590–2598. <http://dx.doi.org/10.1002/cncr.25821>. [PubMed: 21656737]
11. Schonberg M, Marcantonio E, Li D, Silliman R, Ngo L, McCarthy E. Breast cancer among the oldest old: tumor characteristics, treatment choices, and survival. *J Clin Oncol.* 2010; 28(12): 2038–2045. <http://dx.doi.org/10.1200/JCO.2009.25.9796>. [PubMed: 20308658]
12. Anderson, R.; Morris, C.; Kimmick, G., et al. Patterns of Locoregional Treatment for Nonmetastatic Breast Cancer by Patient and Health System Factors. *Cancer.* 2014 Nov 4. [Epub ahead of print]. <http://dx.doi.org/10.1002/cncr.29092>
13. McCormick B, Ottesen R, Hughes M, et al. Impact of guideline changes on use or omission of radiation in the elderly with early breast cancer: practice patterns at National Comprehensive Cancer Network institutions. *J Am Coll Surg.* 2014; 219(4):796–802. <http://dx.doi.org/10.1016/j.jamcollsurg.2014.05.013>. [PubMed: 25127504]

14. Lautner M, Lin H, Shen Y, et al. Disparities in the Use of Breast-Conserving Therapy Among Patients With Early-Stage Breast Cancer. *JAMA Surg.* 2015 Aug 1; 150(8):778–86. <http://dx.doi.org/10.1001/jamasurg.2015.1102>. [PubMed: 26083835]
15. Field TS1, Bosco JL, Prout MN, et al. Age, comorbidity, and breast cancer severity: impact on receipt of definitive local therapy and rate of recurrence among older women with early-stage breast cancer. *J Am Coll Surg.* 2011; 213:757–765. <http://dx.doi.org/10.1016/j.jamcollsurg.2011.09.010>. [PubMed: 22014658]
16. Albert J, Pan I, Shih Y, et al. Effectiveness of Radiation for Prevention of Mastectomy in Older Breast Cancer Patients Treated With Conservative Surgery. *Cancer.* 2012; 118:4642–4651. <http://dx.doi.org/10.1002/cncr.27457>. [PubMed: 22890779]
17. Tuttle T, Jarosek S, Habermann E, Yee D, Yuan J, Virnig B. Omission of radiation therapy after breast-conserving surgery in the United States. *Cancer.* 2012; 118(8):2004–2013. <http://dx.doi.org/10.1002/cncr.26505>. [PubMed: 21952948]
18. Showalter S, Grover S, Sharma S, Lin L, Czerniecki B. Factors influencing surgical and adjuvant therapy in stage I breast cancer: a SEER 18 database analysis. *Ann Surg Oncol.* 2013; 20(4):1287–1294. <http://dx.doi.org/10.1245/s10434-012-2693-8>. [PubMed: 23135311]
19. Luu C, Goldstein L, Goldner B, Schoellhammer HF, Chen SL. Trends in radiotherapy after breast-conserving surgery in elderly patients with early-stage breast cancer. *Ann Surg Oncol.* 2013; 20(10):3266–3273. <http://dx.doi.org/10.1245/s10434-013-3150-z>. [PubMed: 23975294]
20. Nagar, H.; Yan, W.; Christos, P.; Chao, KS.; Nori, D.; Ravi, A. Older patients with early-stage breast cancer: adjuvant radiation therapy and predictive factors for cancer-related death. *Am J Clin Oncol.* 2014 Oct 20. Epub ahead of print. <http://dx.doi.org/10.1097/COC.0000000000000144>
21. Hughes K, Schnaper L, Bellon J, et al. Lumpectomy plus tamoxifen with or without irradiation in women age 70 years or older with early breast cancer: long-term follow-up of CALGB 9343. *J Clin Oncol.* 2013; 31(19):2382–2387. <http://dx.doi.org/10.1200/JCO.2012.45.2615>. [PubMed: 23690420]
22. Wilke L, Czechura T, Wang C, et al. Repeat surgery after breast conservation for the treatment of stage 0 to II breast carcinoma: a report from the National Cancer Data Base, 2004–2010. *JAMA Surg.* 2014; 149(12):1296–1305. <http://dx.doi.org/10.1001/jamasurg.2014.926>. [PubMed: 25390819]
23. McCahill L, Single R, Aiello Bowles E, et al. Variability in reexcision following breast conservation surgery. *JAMA.* 2012; 307(5):467–475. <http://dx.doi.org/10.1001/jama.2012.43>. [PubMed: 22298678]
24. Hughes K, Schnaper L, Berry D, Cirincione C, McCormick B, Shank B, et al. Lumpectomy plus tamoxifen with or without irradiation in women 70 years of age or older with early breast cancer. *N Engl J Med.* 2004; 351(10):971–977. <http://dx.doi.org/10.1056/NEJMoa040587>. [PubMed: 15342805]
25. Gradishar W, Anderson B, Blair S, et al. Breast cancer version 3.2014. *J Natl Compr Canc Netw.* 2014; 12:542–90. [PubMed: 24717572]
26. Smith G, Xu Y, Shih Y, et al. Breast-Conserving Surgery in Older Patients with Invasive Breast Cancer: Current Patterns of Treatment Across the United States. *J Am Coll Surg.* 2009; 209(4):425–433. e2. <http://dx.doi.org/10.1016/j.jamcollsurg.2009.06.363>. [PubMed: 19801315]
27. Churilla TM, Donnelly PE, Leatherman ER, Adonizio CS, Peters CA. Total Mastectomy or Breast Conservation Therapy? How Radiation Oncologist Accessibility Determines Treatment Choice and Quality: A SEER Data-base Analysis. *Breast J.* 2015; 21(5):473–80. <http://dx.doi.org/10.1111/tbj.12449>. [PubMed: 26133235]
28. McGuire K, Santillan A, Kaur P, Meade T, Parbhoo J, Mathias M, et al. Are mastectomies on the rise? A 13-year trend analysis of the selection of mastectomy versus breast conservation therapy in 5865 patients. *Ann Surg Oncol.* 2009; 16(10):2682–2690. <http://dx.doi.org/10.1245/s10434-009-0635-x>. [PubMed: 19653046]
29. Goyal S, Chandwani S, Haffty B, Demissie K. Effect of travel distance and time to radiotherapy on likelihood of receiving mastectomy. *Ann Surg Oncol.* 2014 Sep 23. Epub ahead of print.

30. Bradley C, Given C, Baser O, Gardiner J. Influence of surgical and treatment choices on the cost of breast cancer care. *Eur J Health Econ.* 2003; 4(2):96–101. <http://dx.doi.org/10.1007/s10198-002-0150-5>. [PubMed: 15609175]
31. Jacobs L, Kelley K, Rosson G, Detrani M, Chang D. Disparities in urban and rural mastectomy populations : the effects of patient- and county-level factors on likelihood of receipt of mastectomy. *Ann Surg Oncol.* 2008; 15(10):2644–2652. <http://dx.doi.org/10.1245/s10434-008-0053-5>. [PubMed: 18663535]
32. Schroen A, Brenin D, Kelly M, Knaus W, Slingluff C. Impact of patient distance to radiation therapy on mastectomy use in early-stage breast cancer patients. *J Clin Oncol.* 2005; 23(28):7074–7080. <http://dx.doi.org/10.1200/JCO.2005.06.032>. [PubMed: 16192590]
33. American Cancer Society. [Accessed Sept 15, 2015] Cancer Facts & Figures. 2015. <http://www.cancer.org/acs/groups/content/@editorial/documents/document/acspc-044552.pdf>
34. Engels E, Pfeiffer R, Ricker W, Wheeler W, Parsons R, Warren J. Use of Surveillance, Epidemiology, and End Results-Medicare data to conduct case-control studies of cancer among the US elderly. *Am J Epidemiol.* 2011; 174(7):860–870. <http://dx.doi.org/10.1093/aje/kwr146>. [PubMed: 21821540]
35. U.S. Health Resources and Services Administration. Bureau of Health Professions. Area Resource File, 2009–2010 Release. Rockville, MD: U.S. Department of Health and Human Services; Fairfax, VA: Quality Resource Systems, Inc; 2010. Codebook: HE-001(2010)
36. Nadpara PA, Madhavan SS. Linking Medicare, Medicaid, and Cancer Registry data to study the burden of cancers in West Virginia. *Medicare Medicaid Res Rev.* 2012; 2(4):E1–E25. <http://dx.doi.org/10.5600/mmrr.002.04.A01>.
37. Klabunde C, Potosky A, Legler J, Warren J. Development of a comorbidity index using physician claims data. *J Clin Epidemiol.* 2000; 53(12):1258–1267. [http://dx.doi.org/10.1016/S0895-4356\(00\)00256-0](http://dx.doi.org/10.1016/S0895-4356(00)00256-0). [PubMed: 11146273]
38. Charlson M, Pompei P, Ales K, MacKenzie C. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis.* 1987; 40(5):373–383. [http://dx.doi.org/10.1016/0021-9681\(87\)90171-8](http://dx.doi.org/10.1016/0021-9681(87)90171-8). [PubMed: 3558716]
39. Mountains of Hope, West Virginia Comprehensive Cancer Program of the West Virginia Department of Health and Human Resources, Division of Health Promotion and Chronic Disease. [Accessed Sept 15, 2015] West Virginia Cancer Plan. 2007. <http://www.dhhr.wv.gov/hpcd/FocusAreas/wvcancer/Documents/FINAL%20Cancer%20Plan%203-26-07.pdf>
40. Hurria A, Wong FL, Villaluna D, et al. Role of Age and Health in Treatment recommendations for Older Adults With Breast Cancer: The Perspective of Oncologists and Primary Care Providers. *J Clin Oncol.* 2008; 26:5386–5392. <http://dx.doi.org/10.1200/JCO.2008.17.6891>. [PubMed: 18955446]
41. Yen T, Laud P, Sparapani R, Nattinger A. Surgeon specialization and use of sentinel lymph node biopsy for breast cancer. *JAMA Surg.* 2014; 149(2):185–192. <http://dx.doi.org/10.1001/jamasurg.2013.4350>. [PubMed: 24369337]
42. Wheeler S, Kuo T, Durham D, Frizzelle B, Reeder-Hayes K, Meyer A. Effects of distance to care and rural or urban residence on receipt of radiation therapy among North Carolina Medicare enrollees with breast cancer. *N C Med J.* 2014; 75(4):239–246. <http://dx.doi.org/10.18043/ncm.75.4.239>. [PubMed: 25046086]
43. Freedman R, Kouri E, West D, Keating N. Racial/Ethnic Disparities in Knowledge About One's Breast Cancer Characteristics. *Cancer.* 2015 Jan 26. [Epub ahead of print]. doi: 10.1002/cncr.28977
44. Ko N, Darnell J, Calhoun E, Freund K, Wells K, Shapiro C, et al. Can Patient Navigation Improve Receipt of Recommended Breast Cancer Care? Evidence From the National Patient Navigation Research Program. *Clin Oncol.* 2014; 32(25):2758–2764. <http://dx.doi.org/10.1200/JCO.2013.53.6037>.
45. Freund K, Battaglia T, Calhoun E, Darnell J, Dudley D, Fiscella K, et al. Impact of Patient Navigation on Timely Cancer Care: The Patient Navigation Research Program. *J Natl Cancer Inst.* 2014; 106(6):dju115.doi: 10.1093/jnci/dju115 [PubMed: 24938303]

Table 1

Comparison of Characteristics Between Elderly Women Diagnosed with Early-Stage Breast Cancer in WV and SEER Regions WVCR-Medicare, 2003–2006 & SEER-Medicare, 2003–2006

	Total		WVCR-Medicare		SEER-Medicare		<i>p</i> -value
	N	%	N	%	N	%	
All	26917	100.0	811	100.0	26106	100.0	
Year of Diagnosis ^b							0.023 *
2003	6884	25.6	217	26.8	6667	25.5	
2004	6750	25.1	223	27.5	6527	25.0	
2005	6626	24.6	208	25.7	6418	24.6	
2006	6657	24.7	163	21.1	6494	24.9	
Age at Diagnosis ^c							0.143
66–69	5859	21.8	167	20.6	5692	21.8	
70–74	6813	25.3	227	28.0	6586	25.2	
75–79	6496	24.1	226	27.9	6270	24.0	
80	7749	28.8	191	23.6	7558	29.0	
Race ^d							<0.001 ***
White	24233	90.0	792	97.7	23441	89.8	
Other	2684	10.0	19	2.3	2665	10.2	
Education ^d							<0.001 ***
< 15% college degree	8229	30.6	361	44.5	7868	30.1	
15% college degree	18688	69.4	450	55.5	18238	69.9	
Annual Income ^d							<0.001 ***
\$35,000	7067	26.3	744	91.7	6323	24.2	
> \$35,000	19850	73.8	67	8.3	19783	75.8	
Metro Status ^d							<0.001 ***
Non-metro	4745	17.6	341	42.1	4404	16.9	
Metro	22172	82.4	470	58.0	21702	83.1	

All	Total		WVCR-Medicare		SEER-Medicare		p-value
	N	%	N	%	N	%	
	26917	100.0	811	100.0	26106	100.0	
Comorbidity Score ^b							0.014 *
0	15627	58.1	438	53.4	15194	58.2	
1	7286	27.1	249	30.3	7037	27.0	
2	4004	14.9	134	16.3	3875	14.8	
PCP Visits ^d							0.274
Low	14448	53.7	420	51.8	14028	53.7	
High	12469	46.3	391	48.2	12078	46.3	
Mammography Screening Centers ^d							0.048 *
Low	13948	51.8	448	55.2	13500	51.7	
High	12969	48.2	363	44.8	12606	48.3	
Oncology Treatment Centers ^d							0.734
Low	15044	55.9	458	56.5	14586	55.9	
High	11873	44.1	353	43.5	11520	44.2	
Stage at Diagnosis ^d							0.007 **
I	16811	62.5	543	67.0	16268	62.3	
II	10106	37.6	268	33.1	9838	37.7	
ER Status ^a							<0.001 ***
Positive	20556	76.4	458	56.5	20098	77.0	
Negative	3710	13.8	81	10.0	3629	13.9	
Borderline/Unknown	2651	9.9	272	33.5	2379	9.1	
PR Status ^a							<0.001 ***
Positive	17027	63.2	379	46.7	16648	63.8	
Negative	6970	25.9	156	19.2	6814	26.1	
Borderline/Unknown	2920	10.9	276	34.0	2644	10.1	
Tumor Grade ^a							<0.001 ***
Well Differentiated	6889	25.6	222	27.4	6667	25.5	

All	Total		WVCR-Medicare		SEER-Medicare		p-value
	N	%	N	%	N	%	
	26917	100.0	811	100.0	26106	100.0	
Moderately Differentiated	11524	42.8	312	38.5	11212	43.0	
Poorly Differentiated	6414	23.8	169	20.8	6245	23.9	
Undifferentiated/Unknown	2090	7.8	108	13.3	1982	7.6	
Treatment ^a							0.730
BCS+RT	14417	53.6	430	53.0	13987	53.6	
Mastectomy	6169	22.9	195	24.0	5974	22.9	
BCS Only	6331	23.5	186	22.9	6145	23.5	
Type of Surgeon Seen ^a							0.078
General Only	5675	21.1	185	22.8	5490	21.0	
Oncology Only	1419	5.3	30	3.7	1389	5.3	
Both	19823	73.6	596	73.5	19227	73.7	

^a cmh chi square test of general association

^b cmh chi square test of location shift using table scores

^c cmh chi square test of location shift using modified ridit scores

^d Pearson's chi square test of association

PCP = Primary Care Provider, BCS = Breast-Conserving Surgery, RT = Radiation Therapy, ER = Estrogen Receptor, PR = Progesterone Receptor

* p < 0.05;

** p < 0.01;

*** p < 0.001

Table 2

Comparison of Initial Local Treatment Between Elderly Women Diagnosed with Early Stage Breast Cancer Between WV and SEER Regions WVCR-Medicare, 2003–2006 & SEER-Medicare, 2003–2006

	Treatment					
	Mastectomy vs. BCS+RT			BCS Only vs. BCS+RT		
	AOR	95% CI	Sig.	AOR	95% CI	Sig.
Population						
SEER-Medicare	1.00	—		1.00	—	
WVCR-Medicare	0.82	[0.68,0.99]	*	0.70	[0.58,0.84]	***
Year of Diagnosis						
2003	1.00	—		1.00	—	
2004	0.97	[0.89,1.06]		1.18	[1.08,1.28]	***
2005	1.02	[0.93,1.11]		1.23	[1.13,1.34]	***
2006	0.96	[0.88,1.05]		1.14	[1.04,1.25]	**
Age at Diagnosis						
66–69	1.00	—		1.00	—	
70–74	1.16	[1.06,1.28]	**	1.16	[1.06,1.28]	**
75–79	1.43	[1.30,1.57]	***	1.45	[1.32,1.60]	***
80	2.48	[2.26,2.72]	***	3.18	[2.91,3.49]	***
Race						
White	1.00	—		1.00	—	
Other	1.28	[1.15,1.42]	***	1.26	[1.14,1.40]	***
Education						
< 15% college degree	1.00	—		1.00	—	
15% college degree	0.74	[0.68,0.80]	***	0.80	[0.74,0.87]	***
Annual Income						
\$35,000	1.00	—		1.00	—	
> \$35,000	0.86	[0.78,0.93]	***	0.82	[0.75,0.89]	***
Metro Status						
Non-metro	1.00	—		1.00	—	

	Treatment					
	Mastectomy vs. BCS+RT			BCS Only vs. BCS+RT		
	AOR	95% CI	Sig.	AOR	95% CI	Sig.
Metro	0.71	[0.65,0.79]	***	0.73	[0.66,0.80]	***
Comorbidity Score						
0	1.00	—		1.00	—	
1	1.08	[1.00,1.17]	*	1.22	[1.13,1.31]	***
2	1.14	[1.04,1.25]	**	1.39	[1.27,1.52]	***
PCP Visits						
Low	1.00	—		1.00	—	
High	1.05	[0.98,1.12]		1.12	[1.05,1.20]	***
Mammography Screening Centers						
Low	1.00	—		1.00	—	
High	0.98	[0.86,1.12]		0.87	[0.76,0.99]	*
Oncology Treatment Centers						
Low	1.00	—		1.00	—	
High	0.87	[0.76,0.99]	*	1.05	[0.92,1.20]	
Stage at Diagnosis						
I	1.00	—		1.00	—	
II	3.32	[3.11,3.55]	***	1.29	[1.21,1.38]	***
ER Status						
Positive	1.00	—		1.00	—	
Negative	1.18	[1.05,1.33]	**	1.03	[0.91,1.17]	
Borderline/Unknown	1.38	[1.05,1.81]	*	1.33	[1.02,1.74]	*
PR Status						
Positive	1.00	—		1.00	—	
Negative	1.14	[1.03,1.24]	**	0.96	[0.88,1.06]	
Borderline/Unknown	1.29	[0.99,1.67]		1.26	[0.97,1.63]	
Tumor Grade						
Well Differentiated	1.00	—		1.00	—	

	Treatment					
	Mastectomy vs. BCS+RT			BCS Only vs. BCS+RT		
	AOR	95% CI	Sig.	AOR	95% CI	Sig.
Moderately Differentiated	1.21	[1.11,1.31]	***	0.99	[0.92,1.07]	
Poorly Differentiated	1.36	[1.23,1.50]	***	1.04	[0.95,1.15]	
Undifferentiated/Unknown	1.29	[1.13,1.48]	***	1.44	[1.27,1.62]	***
Type of Surgeon Seen						
General Only	1.00	—		1.00	—	
Oncology Only	0.73	[0.62,0.85]	***	0.53	[0.46,0.62]	***
Both	0.78	[0.72,0.84]	***	0.57	[0.53,0.61]	***

PCP = Primary Care Provider, BCS = Breast-Conserving Surgery, RT = Radiation Therapy, ER = Estrogen Receptor, PR = Progesterone Receptor

* p < 0.05;
** p < 0.01;
*** p < 0.001