Use of Annual Mammography Among Older Women with Ductal Carcinoma In Situ

Phyllis Brawarsky, MPH[1], Bridget A. Neville, MPH[2], Garrett M. Fitzmaurice, ScD[3], Michael J. Hassett, MD, MPH[4], and Jennifer S. Haas, MD, MSPH[1]

[1]Division of General Medicine and Primary Care, Department of Medicine, Brigham and Women's Hospital, Boston, MA, USA; [2]Department of Medical Oncology, Dana-Farber Cancer Institute, Boston, USA; [3]Laboratory for Psychiatric Biostatistics, McLean Hospital and Harvard Medical School, Belmont, USA; [4]Center for Outcomes and Policy Research, Dana Farber Cancer Institute and Harvard Medical School, Boston, USA.

BACKGROUND: As ductal carcinoma in situ (DCIS) is a risk factor for invasive breast cancer, ongoing annual mammography is important for cancer control, yet little is known about racial/ethnic and other disparities in use among older women with DCIS.

METHODS: SEER-Medicare data was used to identify women age 65–85 years, diagnosed with DCIS from 1992 to 2005 and treated with surgery, but not bilateral mastectomy. We examined factors associated with receipt of an initial mammogram within 1 year of treatment and subsequent annual mammograms for 3 and 5 years. We examined whether follow-up care, by a primary care physician or cancer specialist, or neighborhood characteristics mediated disparities in mammography use.

RESULTS: Overall, 91.3% of women had an initial mammogram. After adjustment, blacks and Hispanics were less likely than whites to receive an initial mammogram (odds ratio (OR) 0.74, 95% confidence interval (CI) 0.55–0.99 and OR 0.65, CI 0.46–0.93, respectively, as were women of lower socioeconomic status (SES), women who had a mastectomy or breast conserving surgery without radiation therapy, and women who did not have a physician visit. Overall rates of annual mammography decreased over time. Disparities by SES, initial treatment type, and physician visit did not diminish over time. Physician visits had a modest effect on reducing initial racial/ethnic disparities.

CONCLUSIONS: Annual mammography among women age 65 to 85 with DCIS declines as women get further from diagnosis. Interventions should focus on reducing disparities in the use of initial surveillance mammography, and increasing surveillance over time.

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INTRODUCTION

Over the past 20 years, there has been a substantial increase in the incidence of ductal carcinoma in situ (DCIS) of the breast among all age groups, with greatest increases among women age 50 and older, due in large part to increased detection attributed to their use of mammography.[1,2] An estimated 50,000 new cases of DCIS were diagnosed in the United States in 2010 with greater prevalence in white women compared to women of other racial/ethnic groups.[1,3] Over the past decade the incidence of DCIS, stable among white women, has been increasing among black women.[1,3] The prognosis for women with DCIS is excellent; the 5-year survival rate approaches 100%.[4] However, among women with DCIS, the risk of a second DCIS is approximately four times greater than the risk of a first DCIS among women in the general population and the risk of an invasive cancer in the same or opposite breast is approximately twice as great and persists at least 5 years or longer.[5–7] Thus, continued mammographic surveillance for women with DCIS is important. Current guidelines for mammography screening recommend annual surveillance mammography after treatment for women with DCIS.[8,9]

Previous studies have documented disparities in the use of screening mammography among older women based on race/ethnicity and income.[10–12] Given the increased risk of subsequent cancer, the purpose of this study is to describe rates of mammography use after a diagnosis of DCIS among women covered by Medicare, to determine whether racial/ethnic or economic disparities persist, and to assess the extent to which any such disparities would be mediated by physician follow-up care or the characteristics of the area where a woman resides including income, ethnic/racial composition and mammography facility availability. We hypothesized that any disparities would be mediated by these factors. This study builds on previous work where we found that racial/ethnic disparities in cancer screening and care

were mitigated, to some extent, by characteristics of the area where an individual lives, including neighborhood racial composition, socioeconomic status (SES), and screening capacity.[13,14]

METHODS

Data

This analysis is based on data from the Surveillance, Epidemiology and End Results (SEER)-Medicare file and Area Resource File (ARF). The SEER program collects information on all incident cancer cases for persons residing in SEER program areas which covered 25% of the United States population in 2000.[15] SEER data, including cancer stage, primary tumor site, and patient demographics, are linked to Medicare claims data by the National Cancer Institute. These SEER data are also linked to 1990 and 2000 US census data; this study used the 2000 census tract characteristic variables. The ARF includes information about the number of hospitals in each county having mammography facilities and population demographics, including the population by gender and age in each county. The ARF file was linked by the county variable to the SEER data file. This study was reviewed and approved by the Institutional Review Board of Partners HealthCare.

Study Design and Sample

The design of this study is a retrospective cohort. Women age 65 to 85 years, whose race/ethnicity was reported as white, black or Hispanic, who were diagnosed with DCIS of the breast as a single, first cancer between 1992 and 2005 and whose primary course of treatment was surgery, were included in this study (N=15,086). DCIS was defined based on American Joint Committee on Cancer TNM coding for in situ breast cancer and histology codes.[16,17]

We excluded women older than age 85 at diagnosis to account for the possibility that women diagnosed at an older age in the early years of our study may not be candidates for mammography due to competing comorbidity and life expectancy. Although guidelines for surveillance mammography for survivors of invasive breast cancer do not include an upper age limit,[8,9] common guidelines for screening average risk women recommend stopping around age 75 to 85, and encourage physicians to consider health status and life expectancy in recommending ongoing mammography.[18,19]

We excluded women with a second SEER cancer diagnosis within 6 months of the index diagnosis date (N=240), as this would have made it difficult to distinguish claims for the index and later cancers, as well as women who had chemotherapy within 6 months of diagnosis, as this treatment is not indicated for DCIS (N=136). We also excluded women who did not have Medicare part A and B coverage or who were members of a health maintenance organization (HMO) for any time after diagnosis until date of death or end of study, December 31, 2007, because these individuals may not have complete claims in SEER-Medicare (N = 5,326).[20] Finally, we excluded women who were not eligible to receive a mammogram during the first 22 months after diagnosis due to death, end of the study period, second or bilateral mastectomy, or attainment of age 86 during the time interval (N = 531), for a final sample of 8,853 women.

OUTCOME

Our primary outcome measure was annual use of mammography based on Medicare claims. We considered the first 6 months post diagnosis as part of the treatment period.[21] Starting at 7 months post diagnosis, we created five surveillance intervals of 15 months each. Fifteen months was chosen as the time interval as women may not be able to schedule their mammogram at exactly a 12-month interval.[22] We examined use of initial mammography within the first interval and continuing "annual" mammography for three and five surveillance intervals. Because Medicare claims may not reliably differentiate between surveillance and diagnostic exams for women with DCIS,[10,23] we assessed whether a women had at least one mammogram during each of the specified surveillance intervals. The sample of women who were eligible to receive an initial mammogram was 8,853, and 6,046, and 3,531 respectively for the three and five surveillance intervals.

Individual-Level Characteristics

Patient characteristics included age at diagnosis (in categories defined as: 65–70, 71–75, 76–80, 81–85), year of diagnosis, race/ethnicity (white, black, Hispanic), marital status (married, not married), Charlson comorbidity index, a summary measure of comorbid conditions, each assigned a weight according to its influence on mortality, with higher scores indicating greater comorbidity (categorized as 0, 1, 2, $\geq$ 3),[20] whether an individual was of "low SES," based on eligibility for state assistance with Medicare premiums and co-payments, and initial course of treatment (mastectomy, breast conserving surgery (BCS) only, BCS with radiation therapy (RT)). Subjects were categorized as having BCS or mastectomy if surgery was received from 1 month prior to 6 months post diagnosis date. Women who received both BCS and mastectomy were classified as having had a mastectomy.

Outpatient visits were identified by Medicare Carrier file Current Procedural Terminology (CPT) codes for office visits and Health Care Financing Administration Provider Specialty (HCFASPEC) codes for type of physician including primary care physician (PCP), including family practice, internal medicine, general practice, geriatrics, and cancer specialist (radiation oncologist, medical oncologist, general surgeon, surgical oncologist). Outpatient visits for each time interval were categorized as (1) none; (2) PCP only; (3) cancer specialist only; and (4) both PCP and cancer specialist.

Area-Level Characteristics

Measures of area characteristics, categorized in tertiles determined from the distribution of these variables in the study population, included the percentage of the census tract

population that was black (≤ 0.9%, 0.91–4.0%, 4.1–100%) or Hispanic (≤ 2.3%, 2.4–6.8%, 6.9–98.4%), median household income (≤ $40,681, $40,682–58,431, $58,432–200,008), and the number of hospitals in the county with a mammography facility per 100,000 women age 45 and older (≤ 3.13, 3.14–4.25, 4.26–99.1).

Analysis

Our analysis is based on Andersen's conceptual model of health care use which considers the influence of the external environment and health care system on use of health services.[24] We used bivariate analyses to examine the associations of an individual's race/ethnicity with demographic, area, and outcome variables; chi-square tests were used to determine statistical significance. To examine the use of mammography by race/ethnicity, we developed three sets of logistic regression models for each of the three time periods specified above, using SAS version 9.2 (SAS Institute, Cary, NC). For each outcome, initial models included race/ethnicity and adjusted for individual sociodemographic and clinical characteristics including age at diagnosis, marital status, comorbidity, eligibility for state buy-in coverage, initial course of treatment, year of diagnosis, and indicators of HMO membership or lack of Medicare in the 13 months prior to diagnosis to adjust for potentially incomplete comorbidity data. We then added outpatient physician variables to the models and then area variables to the models that included physician variables. If inclusion of the physician variables or area measures reduced the racial/ethnic effect then these characteristics were considered to be potential mediators of disparities in receipt of mammogram.

RESULTS

Sample Characteristics

Compared to whites with DCIS, both blacks and Hispanics were more likely to be disadvantaged, and have a higher burden of comorbid conditions (Table 1). Blacks were least likely to be married (31.5%) compared to whites (54.4%) and Hispanics (50.0%). Initial treatment did not vary among the racial/ethnic groups; over 25% of subjects had BCS without RT. Both blacks and Hispanics lived in census tracts with a lower household income than whites and lived in counties having fewer hospitals with mammography facilities.

Overall, 91.3% of women had a mammogram within the initial period following treatment decreasing to 78.0% and 66.2% for annual mammograms at three and five surveillance intervals post-treatment, respectively. Whites were more likely than blacks and Hispanics to receive a mammogram in all time intervals studied (Table 2). In the first surveillance interval post-treatment, whites were least likely to have had no physician visits (6.4% vs. 9.5% for blacks and 9.4% for Hispanics). In each of the subsequent time intervals, blacks were more likely than whites and Hispanics to not have had an annual physician visit.

Table 1. Description of the Sample by Race/Ethnicity

	White	Black	Hispanic	p-value[1]
Number	7,856	656	341	
	%	%	%	
Individual Characteristics				
Age (years)				0.021
65–70	36.7	38.0	46.0	
71–75	29.7	29.3	28.7	
76–80	23.1	22.9	17.6	
81–85	10.4	9.9	7.6	
Marital Status [2]				<0.001
Married	54.5	31.5	50.0	
Not married	45.5	68.5	50.0	
Comorbidity Index				<0.001
0	77.2	57.5	68.0	
1	17.5	28.8	26.1	
2	3.5	7.5	2.6	
3 and greater	1.8	6.3	3.2	
State buy-in coverage				<0.001
Ever eligible	9.0	41.6	40.8	
Never eligible	91.0	58.4	59.2	
Treatment				0.127
Mastectomy	28.9	27.3	32.0	
Breast conserving surgery only	27.2	31.3	24.6	
Breast conserving surgery and radiation	43.9	41.5	43.4	
Area Characteristics				
Percentage of blacks in census tract[3]				<0.001
Low (≤ 0.90%)	36.5	2.0	25.0	
Middle (0.91%–4.0%)	35.1	4.9	39.9	
High (4.1%–100%)	28.3	93.1	35.1	
Percentage of Hispanics in census tract[3]				<0.001
Low (≤ 2.3%)	33.0	54. 1	3.9	
Middle (2.4%–6.8%)	35.5	14.4	12.8	
High (6.9%–98.4%)	31.5	31.5	83.3	
Median income in census tract[3]				<0.001
Low (≤ $40,681)	29.7	72.5	41.4	
Middle ($40,682–$58,431)	34.7	17.0	31.3	
High ($58,432–$200,008)	35.6	10.5	27.4	
Number of hospitals with mammography facilities per 100 k women age ≥45 and older in county				<0.001
Low (≤ 3.13)	30.6	15.7	33.4	
Middle (3.14–4.25)	36.4	59.6	46.9	
High (4.26–99.1)	33.0	24.7	19.7	

Notes
[1] *p-value for chi-square*
[2] *Missing: married 361; percentage blacks in census tract 70, percentage Hispanics in census tract 70; median income in census tract 70*

Factors Associated with Annual Mammography

First Surveillance Interval Post Treatment. After adjusting for individual, physician and area characteristics, black (OR 0.74, CI 0.55–0.99) and Hispanic women (OR 0.65, CI 0.46–0.93) were less likely than white women to undergo mammography (Table 3). Others with lower odds of having mammography included those eligible for state buy-in insurance, women older than age 65–70, and those treated with either BCS without RT or mastectomy compared to those who had BCS followed by RT. Compared to women who did not have a physician visit with either a PCP or cancer specialist, women who had at least one office visit were more likely to undergo mammography (PCP only, OR 6.85, CI 5.60–8.37;

Table 2. Yearly Rates of Mammography and Physician Office visits, Stratified by Race/Ethnicity

	Year 1			Each year, 3 years			Each year, 5 years		
	White	Black	Hispanic	White	Black	Hispanic	White	Black	Hispanic
N	7,856	656	341	5,407	423	216	3,174	234	123
	%	%	%	%	%	%	%	%	%
Mammogram Mammogram[1]	92.0	85.7	85.6	79.4	64.3	69.9	67.5	53.4	56.1
Doctor visits[2]									
PCP only	81.2	77.3	76.8	39.8	39.9	45.8	46.5	43.2	55.3
Cancer specialist only	11.2	11.3	12.0	10.7	8.7	10.2	7.7	6.4	5.7
PCP and cancer specialist	1.3	2.0	1.8	34.5	30.5	27.3	22.2	19.7	13.8
Neither PCP nor cancer specialist	6.4	9.5	9.4	15.1	20.8	16.7	23.7	30.8	25.2

[1] *p-value for chi square test for difference in mammogram by race <0.001 for each surveillance interval*
[2] *p-value for chi square test for difference in doctor visits by race: Year 1, 0.008; Each year, 3 years, 0.012; Each year, 5 years, 0.052*

cancer specialist only OR 8.82, CI 6.30–12.3; both, OR 12.4, CI 3.83–40.1). Women who lived in areas with higher percentages of blacks were less likely to undergo mammography. Adding physician visits to the model that included all other individual characteristics decreased the odds ratio differences between blacks and whites by 6% and Hispanics and whites by 3% (data not shown). Addition of area variables to the model that included individual characteristics and physician variables did not affect racial/ethnic disparities in mammography use (data not shown)

Three Surveillance Intervals Post Treatment. Upon adjustment for individual-level, physician and area covariates, black women were less likely than white women (OR, 0.66 CI, 0.50–0.86) to undergo annual mammography three years after surgery, but Hispanic-white disparities were not significant (OR 0.83, CI 0.58–1.17) (Table 3). Similar to the results for initial mammograms, women who were eligible for state buy-in insurance, women older than age 65–70, and women who were treated by BCS only or mastectomy were less likely to have

Table 3. Multivariate Analysis, Factors Associated with Annual Mammography

	Had annual mammography		
	First year following surgery OR (95% CI)	3 years following surgery	5 years following surgery
Race/ethnicity			
White	Ref.	Ref.	Ref.
Black	0.74 (0.55–0.99)	0.66 (0.50–0.86)	0.80 (0.57–1.12)
Hispanic	0.65 (0.46–0.93)	0.83 (0.58–1.17)	0.88 (0.58–1.34)
Age at diagnosis			
65–70	Ref.	Ref.	Ref.
71–75	0.92 (0.74–1.13)	0.80 (0.67–0.95)	0.71 (0.59–0.85)
76–80	0.83 (0.67–1.04)	0.60 (0.50–0.72)	0.55 (0.45–0.68)
81–85	0.65 (0.50–0.85)	0.43 (0.32–0.59)	0.37 (0.07–1.80)
Eligible for state buy-in insurance	0.55 (0.44–0.68)	0.52 (0.43–0.64)	0.43 (0.34–0.55)
Treatment			
BCS with RT	Ref.	Ref.	Ref.
BCS alone	0.41 (0.34–0.51)	0.58 (0.49–0.68)	0.67 (0.55–0.82)
Mastectomy	0.39 (0.32–0.48)	0.62 (0.53–0.74)	0.80 (0.66–0.96)
Out-patient visits			
Did not see MD each year	Ref.	Ref.	Ref.
PCP only each year	6.85 (5.60–8.37)	2.35 (1.99–2.77)	2.01 (1.68–2.39)
Cancer specialist only each year	8.82 (6.30–12.3)	9.28 (6.70–12.9)	7.41 (4.94–11.1)
PCP and cancer specialist each year	12.4 (3.83–40.1)	8.86 (7.16–11.0)	4.93 (3.87–6.27)
Area characteristics			
% Black			
Low	Ref.	Ref.	Ref.
Middle	0.94 (0.77–1.16)	0.88 (0.74–1.04)	0.85 (0.70–1.03)
High	0.80 (0.65–0.99)	0.89 (0.74–1.08)	1.00 (0.81–1.24)
% Hispanic			
Low	Ref.	Ref.	Ref.
Middle	0.77 (0.63–0.95)	0.87 (0.73–1.03)	1.03 (0.85–1.25)
High	0.85 (0.69–1.05)	0.82 (0.69–0.98)	0.95 (0.78–1.15)
Median income			
Low	Ref.		
Middle	0.91 (0.75–1.11)	1.07 (0.90–1.27)	1.12 (0.91–1.36)
High	1.04 (0.83–1.30)	1.13 (0.94–1.37)	0.89 (0.72–1.10)
Hospitals with mammography facilities			
Low	Ref.		
Middle	1.24 (1.02–1.51)	1.10 (0.93–1.30)	1.09 (0.90–1.33)
High	1.08 (0.88–1.33)	1.02 (0.85–1.23)	1.18 (0.95–1.46)

All models also adjusted for comorbidity, year of diagnosis, marital status, whether the subject was an HMO member or did not have Medicare at any time in the 13 months prior to diagnosis

annual mammograms for three years. Women who had annual outpatient physician visits were more likely to undergo yearly mammograms. Compared to women who did not have a physician visit, women who had an office visit were more likely have a mammogram (PCP only, OR 2.35, CI 1.99–2.77; cancer specialist only OR 9.28, CI 6.70–12.9; both, OR 8.86, CI 7.16–11.0); associations were strongest for visits with cancer specialists. However, addition of the physician visit variables to models that included individual characteristics reduced the racial/ethnic disparity in mammography use by only 2% to 4% (data not shown). Women who lived in areas with the highest percentages of Hispanic residents were less likely to have mammograms. Adding area variables to the model including individual and physician covariates did not affect the black/white disparity in mammogram use but reduced the Hispanic/white odds ratio disparity by 9.2% (data not shown).

Five Surveillance Intervals Post Treatment. Rates of annual mammography in each of the five years following surgery were similar for all racial/ethnic groups (Table 3). Similar to results for other time periods, women eligible for state buy-in insurance, women older than age 65–70, and women treated with BCS only or mastectomy were less likely to undergo annual mammograms for five years. Compared to women who did not see a doctor in each year, women who saw a PCP or cancer specialist in each of the five years were more likely to have a mammogram in each of the five years (PCP only: OR 2.01, CI 1.68–2.39; cancer doctor only: OR 7.41, CI 4.94–11.1; both OR 4.93, CI 3.87–6.27). Area characteristics were not associated with mammogram use.

DISCUSSION

Our data show that the vast majority of Medicare-insured women age 65–85 with DCIS received mammograms in the first year after surgery but that continued receipt of annual mammograms declined over the study period. We found that women older than age 65–70 and disadvantaged women with DCIS are less likely to receive a mammogram and that these disparities persisted over the study period, similar to findings that have been seen for screening mammography among women without a history of DCIS.[25–28] We also found significant racial/ethnic disparities in mammogram use in the first year following surgery. Physician office visits were highly associated with mammogram use in all time periods examined; visits to cancer specialists had the strongest positive association. However physician visits did little to reduce the racial/ethnic disparities in mammography at either 1 or 3 years.

These rates for an initial mammogram are higher than rates reported for the general Medicare population,[10,12] possibly because these patients understand that they are at higher risk for recurrence, or because they have had previous mammograms leading to their diagnosis of DCIS. However, rates of annual mammography decline over time for all racial/ethnic groups and disparities increase for women older than age 65–70 and disadvantaged women, a concern given that risks of recurrence and invasive cancer persist beyond the five years studied.[29]

Our findings of racial disparities are consistent with earlier studies of older survivors of early stage breast cancer but also raise concerns.[30,31] The incidence of DCIS has been increasing among black women relative to white women and studies have shown breast cancer recurrence and mortality among women with DCIS is higher among black compared to white women.[2,3,5] In addition, both black and Hispanic women have elevated risk of recurrence at an advanced stage.[29] Our finding of no racial/ethnic disparities over five surveillance intervals may be due to lower mammography rates for all groups and fewer Hispanics and blacks for this time period. The importance of physician endorsement on the receipt of screening mammography is well established.[21,30,32] Our study highlights how important it is for DCIS patients to continue annual visits, and for physicians, particularly PCPs, to stress the importance of ongoing mammography. However, consistent with a previous study of surveillance mammography among older women with early stage breast cancer, women who saw cancer specialists were most likely to undergo surveillance mammography, but physician visits had only a modest effect on mediating racial disparities.[21]

We also found that women treated with BCS only or with mastectomy are less likely than those treated with BCS and RT to receive a mammogram in the initial and subsequent years. This finding about BCS only, consistent with other studies of women with DCIS or early stage invasive cancer, is a further cause for concern.[21,23,33] Over 25% of our subjects had BCS without RT and although there are a number of clinical factors associated with recurrence or invasive breast cancer after DCIS,[34–36] studies have found risks to generally be lower for women treated with BCS and RT opposed to BCS alone.[1,2,16,37,38] Lower screening among women with mastectomy is also problematic as women with DCIS are at higher risk for a second cancer in the opposite breast.[5–7,39] Even though neighborhood characteristics, including racial composition, income and mammography capacity differed for white, black and Hispanic women in our study, these neighborhood characteristics had little associations with annual mammography use and, contrary to our hypothesis, did not mediate racial/ethnic disparities in mammography use.

Our study has several limitations. Although we had information on the socioeconomic status of the area where an individual lived, we were limited to information about eligibility for state buy-in coverage for Medicare as a marker of individual low-income status. In addition, as our analysis focused on seniors with Medicare fee-for-service coverage, our findings may not be generalizable to younger or uninsured women or older HMO members. Further, although we had dates of physician visits and mammograms, many women had multiple mammograms and physician visits in the time frames studied. Our data show a strong association between physician visits and mammograms but not the temporal direction of the association. In addition, women who do not see physicians regularly may be systematically different from those who do not in ways that cannot be observed in this type of study.

Because we cannot currently predict which women with DCIS will subsequently develop invasive breast cancer, continued surveillance is vital for all women with DCIS. Our study of a large population-based cohort of older women with DCIS highlights declining rates of mammography use over time and significant disparities based on race/ethnicity, SES, and primary treatment. It also highlights the importance of follow-up care by physicians, but

suggests a more limited impact of neighborhood characteristics on the continued use of annual mammography.

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Conflict of Interest: *None disclosed.*

Corresponding Author: *Jennifer S. Haas, MD, MSPH; Division of General Medicine and Primary Care, Department of Medicine, Brigham and Women's Hospital, 1620 Tremont Street, Boston, MA 02120-1613, USA (e-mail: jhaas@partners.org).*

REFERENCES

1. **Allegra CJ, Aberle DR, Ganschow P, et al.** National Institutes of Health State-of-the-Science Conference statement: Diagnosis and Management of Ductal Carcinoma In Situ September 22–24. J Natl Cancer Inst. 2009;102(3):161–9.
2. **Virnig BA, Tuttle TM, Shamliyan T, Kane RL.** Ductal carcinoma in situ of the breast: a systematic review of incidence, treatment, and outcomes. J Natl Cancer Inst. Feb 3;102(3):170–8.
3. American Cancer Society. Cancer Facts & Figures, 2010. Atlanta2010.
4. **Howlader N, Noone A, Krapcho M, et al.** SEER Cancer Statistics Review, 1975–2008, National Cancer Institute. Bethesda MD, http://seer.cancer.gov/csr/1975_2008/, Based on November 2010 SEER data submission, posted to the SEER web site, 2011. Acessed 9/27/2011.
5. **Innos K, Horn-Ross PL.** Risk of second primary breast cancers among women with ductal carcinoma in situ of the breast. Breast Cancer Res Treat. 2008;111(3):531–40.
6. **Claus EB, Stowe M, Carter D, Holford T.** The risk of a contralateral breast cancer among women diagnosed with ductal and lobular breast carcinoma in situ: data from the Connecticut Tumor Registry. Breast. 2003;12(6):451–6.
7. **Habel LA, Moe RE, Daling JR, Holte S, Rossing MA, Weiss NS.** Risk of contralateral breast cancer among women with carcinoma in situ of the breast. Ann Surg. 1997;225(1):69–75.
8. NCCN Clinical Practice Guidelines in Oncology - v.2.2011 - Breast Cancer http://www.nccn.org/professional/physician_gls/PDF/breast.pdf. Acessed 9/27/2011.
9. **Khatcheressian JL, Wolff AC, Smith TJ, et al.** American Society of Clinical Oncology 2006 update of the breast cancer follow-up and management guidelines in the adjuvant setting. J Clin Oncol. 2006;24(31):5091–7.
10. **Kagay CR, Quale C, Smith-Bindman R.** Screening mammography in the American elderly. Am J Prev Med. 2006;31(2):142–9.
11. **Smith-Bindman R, Miglioretti DL, Lurie N, et al.** Does utilization of screening mammography explain racial and ethnic differences in breast cancer? Ann Intern Med. 2006;144(8):541–53.
12. **Williams BA, Lindquist K, Sudore RL, Covinsky KE, Walter LC.** Screening mammography in older women. Effect of wealth and prognosis. Arch Intern Med. 2008;168(5):514–20.
13. **Haas JS, Brawarsky P, Iyer A, et al.** Association of local capacity for endoscopy with individual use of colorectal cancer screening and stage at diagnosis. Cancer. 2010;116(12):2922–31.
14. **Haas JS, Earle CC, Orav JE, et al.** Racial segregation and disparities in breast cancer care and mortality. Cancer. 2008;113(8):2166–72.
15. **Warren JL, Klabunde CN, Schrag D, Bach PB, Riley GF.** Overview of the SEER-Medicare data: content, research applications, and generalizability to the United States elderly population. Med Care. 2002;40(8 Suppl):IV-3–IV-18.
16. **Warren JL, Weaver DL, Bocklage T, et al.** The frequency of ipsilateral second tumors after breast-conserving surgery for DCIS: a population based analysis. Cancer. 2005;104(9):1840–8.
17. **Sieffert J.** SEER program: comparative staging guide for cancer 2003.
18. **Smith RA, Saslow D, Sawyer KA, et al.** American Cancer Society guidelines for breast cancer screening: update 2003. CA Cancer J Clin. 2003;53(3):141–69.
19. Screening for breast cancer: U.S. Preventive Services Task Force recommendation statement. Ann Intern Med. Nov 17 2009;151(10):716–26, W-236.
20. **Klabunde CN, Warren JL, Legler JM.** Assessing comorbidity using claims data: an overview. Med Care. 2002;40(8 Suppl):IV-26–IV-35.
21. **Keating NL, Landrum MB, Guadagnoli E, Winer EP, Ayanian JZ.** Factors related to underuse of surveillance mammography among breast cancer survivors. J Clin Oncol. 2006;24(1):85–94.
22. **Doubeni CA, Field TS, Ulcickas Yood M, et al.** Patterns and predictors of mammography utilization among breast cancer survivors. Cancer. 2006;106(11):2482–8.
23. **Schapira MM, McAuliffe TL, Nattinger AB.** Underutilization of mammography in older breast cancer survivors. Med Care. 2000;38(3):281–9.
24. **Andersen RM.** Revisiting the behavioral model and access to medical care: does it matter? J Health Soc Behav. 1995;36(1):1–10.
25. Breast cancer screening and socioeconomic status–35 metropolitan areas, 2000 and 2002. MMWR Morb Mortal Wkly Rep. Oct 7 2005;54(39):981–5.
26. **Peek ME, Han JH.** Disparities in screening mammography. Current status, interventions and implications. J Gen Intern Med. 2004;19(2):184–94.
27. **Kim J, Jang SN.** Socioeconomic disparities in breast cancer screening among US women: trends from 2000 to 2005. J Prev Med Public Health. 2008;41(3):186–94.
28. **Harrison RV, Janz NK, Wolfe RA, Tedeschi PJ, Huang X, McMahon LF Jr.** 5-Year mammography rates and associated factors for older women. Cancer. 2003;97(5):1147–55.
29. **Li CI, Malone KE, Saltzman BS, Daling JR.** Risk of invasive breast carcinoma among women diagnosed with ductal carcinoma in situ and lobular carcinoma in situ, 1988–2001. Cancer. 2006;106(10):2104–12.
30. **Field TS, Doubeni C, Fox MP, et al.** Under utilization of surveillance mammography among older breast cancer survivors. J Gen Intern Med. 2008;23(2):158–63.
31. **Keating NL, Landrum MB, Guadagnoli E, Winer EP, Ayanian JZ.** Surveillance testing among survivors of early-stage breast cancer. J Clin Oncol. 2007;25(9):1074–81.
32. **Schonberg MA, McCarthy EP, York M, Davis RB, Marcantonio ER.** Factors influencing elderly women's mammography screening decisions: implications for counseling. BMC Geriatr. 2007;7:26.
33. **Nekhlyudov L, Habel LA, Achacoso NS, et al.** Adherence to long-term surveillance mammography among women with ductal carcinoma in situ treated with breast-conserving surgery. J Clin Oncol. 2009;27(19):3211–6.
34. **Di Saverio S, Catena F, Santini D, et al.** 259 Patients with DCIS of the breast applying USC/Van Nuys prognostic index: a retrospective review with long term follow up. Breast Cancer Res Treat. 2008;109(3):405–16.
35. **Habel LA, Capra AM, Achacoso NS, et al.** Mammographic density and risk of second breast cancer after ductal carcinoma in situ. Cancer Epidemiol Biomarkers Prev. 2010;19(10):2488–95.
36. **Schnitt SJ.** Local outcomes in ductal carcinoma in situ based on patient and tumor characteristics. J Natl Cancer Inst Monogr. 2010;2010(41):158–61.
37. **Bijker N, Meijnen P, Peterse JL, et al.** Breast-conserving treatment with or without radiotherapy in ductal carcinoma-in-situ: ten-year results of European Organisation for Research and Treatment of Cancer randomized phase III trial 10853–a study by the EORTC Breast Cancer Cooperative Group and EORTC Radiotherapy Group. J Clin Oncol. 2006;24(21):3381–7.
38. **Solin LJ.** The impact of adding radiation treatment after breast conservation surgery for ductal carcinoma in situ of the breast. J Natl Cancer Inst Monogr. 2010;2010(41):187–92.
39. **Dawood S, Broglio K, Gonzalez-Angulo AM, et al.** Development of new cancers in patients with DCIS: the M.D. Anderson experience. Ann Surg Oncol. 2008;15(1):244–9.