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## Ethnic Disparities in Adherence to Breast Cancer Survivorship Surveillance Care

Pragati S. Advani, M.P.H.<sup>1</sup>, Jun Ying, MS<sup>2</sup>, Richard Theriault, D.O.<sup>3</sup>, Amal Melhem-Bertrand, M.D.<sup>3</sup>, Stacy Moulder, M.D.<sup>3</sup>, Isabelle Bedrosian, M.D., F.A.C.S.<sup>4</sup>, Welela Tereffe, M.D., M.P.H.<sup>5</sup>, Shon Black, M.D.<sup>4</sup>, Tunghi May Pini, M.D., M.P.H.<sup>6</sup>, and Abenaa M. Brewster, MD, M.H.S.<sup>6</sup>

<sup>1</sup>Department of Health Promotion and Behavioral Sciences, University of Texas (UT) School of Public Health, Houston, Texas

<sup>2</sup>Department of Biostatistics, the UT, MD Anderson Cancer Center, Houston, Texas

<sup>3</sup>Department of Breast Medical Oncology, the UT, MD Anderson Cancer Center, Houston, Texas

<sup>4</sup>Department of Surgical Oncology, the UT, MD Anderson Cancer Center, Houston, Texas

<sup>5</sup>Department of Radiation Oncology, the UT, MD Anderson Cancer Center, Houston, Texas

<sup>6</sup>Department of Clinical Cancer Prevention, the UT, MD Anderson Cancer Center, Houston, Texas

### Abstract

**Background**—Adherence to guidelines for surveillance mammography and clinic visits is an important component of breast cancer survivorship care. Identifying ethnic disparities in adherence may lead to improved care delivery and outcomes.

**Methods**—We evaluated records of 4,535 patients treated for stage I, II, or III breast cancer at our cancer center between January 1997 and December 2006. We used generalized estimating equations and Cox proportional hazards analyses to evaluate ethnic differences in missed mammograms and clinic visits up to 4 years of follow-up and the impact of those differences on overall survival.

**Results**—Nonadherence to guidelines for mammography ( $P = .0002$ ) and clinic visits ( $P < .0001$ ) increased over time. Hispanic and black patients were more likely to be nonadherent to guidelines for mammography (odds ratio [OR] = 1.35, 95% confidence interval [CI] = 1.10 to 1.65), OR = 1.36, 95% CI = 1.11 to 1.66, respectively) and clinic visits (OR = 1.62, 95% CI = 1.27 to 2.06, OR = 1.45, 95% CI = 1.13 to 1.86, respectively) than white patients. There was an interaction between Hispanic ethnicity and endocrine therapy on nonadherence to mammography guidelines ( $P = .001$ ). Nonadherence to mammography and clinic visit guidelines was not associated with overall survival.

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Correspondence to: Abenaa M. Brewster, MD, MHS, P.O. Box 301439, Houston, Texas 77230-1439 (abrewster@mdanderson.org, telephone: 713-745-4928, fax: 713-563-5746).

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**Conclusions**—Withdrawal from breast cancer survivorship care increases over time, and black and Hispanic patients are more likely to be nonadherent. An understanding of the reasons for ethnic disparities in adherence to guidelines for mammography and clinic visits is needed to improve retention in survivorship care.

### Keywords

Breast Cancer; Patient Adherence; Survivorship; Ethnicity; Health Care Disparities; Surveillance

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### Introduction

Population based mammography screening and innovations in breast cancer treatment over the past decade have led to a decrease in breast cancer mortality in the United States.<sup>1</sup> Over the past 15 years, the death rate for breast cancer patients has declined by approximately 2.2% per year,<sup>2</sup> and the National Cancer Institute estimated in 2013 that there were approximately 2.6 million breast cancer survivors in the United States.<sup>3</sup> With the growing number of breast cancer survivors, surveillance for treatment-related side effects, disease recurrence, or new primary cancers (in addition to promotion of healthy lifestyles among breast cancer survivors) is an important component of the oncological clinical practice.<sup>4,5</sup>

Guidelines for the surveillance of women with a history of breast cancer have recommended that women undergo annual mammography and have a follow-up clinic visit every 4 to 6 months for 5 years.<sup>5-6</sup> Previous studies evaluating adherence to the guidelines for breast cancer survivorship care have focused largely on understanding the predictors of the utilization of surveillance mammography. Older age at diagnosis,<sup>7-13</sup> a lack of adequate health insurance,<sup>10-12</sup> the presence of comorbidities,<sup>7-10</sup> minority ethnicities,<sup>7-13</sup> and less education<sup>10-13</sup> have been associated with lower adherence to the guidelines for surveillance mammography. There is limited information on the association between patient-related factors and adherence to follow-up clinic visits. Using the Surveillance, Epidemiology, and End Results (SEER)-Medicare data, Keating et al. showed that patients aged 65 years who had fewer follow-up clinic visits with an oncologist, breast surgeon or radiation oncologist were less likely to undergo surveillance mammograms.<sup>7</sup>

Given the important goals of breast cancer survivorship care and the existing ethnic disparities in breast cancer mortality,<sup>14</sup> identifying disparities in adherence to survivorship care is critical for creating opportunities to improve care delivery and patient outcomes. In this retrospective study of a large, diverse (by age and ethnicity) cohort of breast cancer survivors treated at The University of Texas MD Anderson Cancer Center, we examined the relationship between patient characteristics and adherence to surveillance mammography and follow-up clinic visits, and overall survival. We hypothesized that ethnic disparities will exist in adherence to breast cancer survivorship care and negatively affect overall survival.

## Patients and Methods

### Patient Selection

After we obtained approval from the Institutional Review Board of The University of Texas, MD Anderson Cancer Center, we used the MD Anderson Breast Cancer Management System database to identify patients who underwent treatment at MD Anderson Cancer Center for stage I, II or III breast cancer (as defined by the American Joint Committee on Cancer Staging Manual 5<sup>th</sup> edition and the American Joint Committee on Cancer Staging Manual 6<sup>th</sup> edition)<sup>15, 16</sup> between January 1997 and November 2008. Only patients who were residents of the state of Texas were included to improve ascertainment of clinical outcomes. We identified 5,137 patients who met the study criteria and defined the start of follow-up in survivorship care as the time of the first clinic visit or mammogram that occurred between 9 and 18 months after the start of first treatment for breast cancer (surgery or systemic therapy). We excluded patients who did not have a mammogram or clinic visit (n = 430) and patients who experienced a breast cancer event (new primary breast cancer, recurrence, or death; n = 172) between 9 and 18 months after the start of first treatment. Those patients were excluded to ensure that we had a disease-free cohort at the start of the study and that the goal of the mammography and clinic visits was breast cancer survivorship care and not treatment.<sup>7</sup> The final cohort for analysis consisted of 4,535 patients. We examined survivorship care that took place up to 48 months after the follow-up starting point or until December 1, 2012, whichever date came first. To be included in analyses of a surveillance year evaluating frequency of mammography, participants had to be female, alive, breast cancer-free and not have undergone bilateral mastectomies before the end of the surveillance year. To be included in analyses of a surveillance year evaluating frequency of clinic visits, patients had to be alive and breast cancer-free before the end of the surveillance year.

### Variables Collected

The Breast Cancer Management System database contains detailed information on patient demographics, breast tumor characteristics, treatment and has previously been described.<sup>17</sup> MD Anderson Cancer Center is located in the Houston metropolitan area, whose 10 counties<sup>18</sup> provide the majority of patient referrals to the institution. We therefore categorized the participants' county of residence as being within the metropolitan area or outside the metropolitan area in order to assess the effect of distance from home residence to the treatment facility on nonadherence to survivorship care. A patient was considered to have received systemic therapy if there was documentation of treatment in the medical record. Follow-up information for patients listed in the Breast Cancer Management System is updated every 2 years by direct review of the medical records and linkage to the MD Anderson Tumor Registry, whose staff mail annual follow-up letters to each registered patient known to be alive to determine the patient's clinical status. Tumor Registry staff also check the Social Security Death Index and the Texas Bureau of Vital Statistics data for the status of patients who have not responded to a follow-up letter.

## Metrics for Adherence to Survivorship Care Guidelines

We identified mammogram and clinic visit records by CPT (current procedural terminology) codes obtained from the MD Anderson Enterprise Warehouse Database. We included clinic visits to medical oncology, breast surgery, radiation oncology and the Cancer Prevention Center at the MD Anderson Cancer Center. Patients were considered nonadherent to mammogram guidelines if they did not have at least one annual mammogram during the survivorship follow-up period. Full adherence to clinic visit guidelines was defined as a mean of  $\geq 2$  clinic visits per year during the survivorship follow-up period.<sup>6</sup> Individuals with a mean of  $< 2$  and  $\geq 1$  clinic visit per year during the survivorship follow-up period were categorized as partially adherent, and individuals who did not have at least one clinic visit per year over all years of survivorship care were defined as nonadherent.

**Statistical Analyses**—Univariable and multivariable analyses for repeated measures with generalized estimating equation (GEE) models were used to estimate the association between nonadherence to mammography or clinic visits and patient and clinical characteristics to model the probability of nonadherence. We used two comparisons to investigate nonadherence to clinic visit guidelines: (i) nonadherence and partial adherence versus full adherence and (ii) nonadherence versus partial and full adherence combined. The trend of nonadherence over time was estimated by modeling the probability of nonadherence over years of survivorship follow-up. Backward stepwise selection was used to select main-effect models in multivariable analyses. Variables with  $p < 0.05$  for Wald statistics of maximum likelihood estimates were retained in multivariable models. The interaction between endocrine therapy and ethnicity was evaluated in multivariable models because adherence to endocrine therapy has been identified as suboptimal among breast cancer survivors.<sup>4</sup> We also evaluated for interaction between ethnicity and education level on nonadherence to mammography and clinic visits. Interaction terms with  $p < 0.05$  for Wald statistic of maximum likelihood estimates in any ethnicity category were retained in the final multivariable models. The association between overall survival and nonadherence to mammography and clinic visit guidelines was evaluated with multivariable Cox proportional hazards regression analyses modeling the probability of nonadherence with adjustment for ethnicity as well as the statistically significant ( $p < 0.05$ ) variables. Time to event was calculated from the beginning of first treatment to the end of data collection (December 1, 2012) or death from any cause. All  $p$  values were reported at two-sided significance level of 0.05. Data were processed and analyzed with SAS version 9.3 software (SAS Institute Inc., Cary, NC).

## Results

### Association between Patient Characteristics and Nonadherence to Surveillance Guidelines over Time

Patients included in the analysis differed significantly from patients excluded from the analysis in ethnicity, age, type of health insurance, educational level and distance between residence and MD Anderson Cancer Center (Table 1). Of the 4,535 patients included in the study analysis, 88 developed a new primary breast cancer, 496 had a breast cancer recurrence, and 129 died during the study period examined.

The Spearman correlation between nonadherence to mammography guidelines and nonadherence to clinic visit guidelines was 0.52. There was a significant trend for increasing nonadherence to both mammography and clinic visit guidelines over time among all study participants ( $p=0.0002$  and  $p<.0001$ , respectively) and within each ethnic group.

Approximately twenty percent of white patients were nonadherent to mammography guidelines in year 4 of survivorship care, compared with approximately 30% and 25% of Hispanic and black patients, respectively (Figure 1a). Similarly, approximately 15% of white patients were nonadherent to clinic visit guidelines in year 4 of survivorship care, compared with approximately 26% and 20% of Hispanic and black patients, respectively (Figure 1b).

### Association between Ethnicity and Nonadherence to Surveillance Guidelines

In univariable analysis, patient characteristics associated with nonadherence to mammography included year of survivorship care ( $P < .0001$ ), older age ( $P = .002$ ), Hispanic and Black ethnicity ( $P < .0001$ ), type of insurance ( $P = .0004$ ), body mass index ( $P = .05$ ), county of residence outside of metropolitan area ( $P < .0001$ ) and education level ( $P < .0001$ ) (data not shown). In adjusted multivariable analysis, Hispanic patients (odds ratio [OR] = 1.35, 95% confidence interval [CI] = 1.10 to 1.65) and black patients (OR = 1.36, 95% CI = 1.11 to 1.66) were more likely to be nonadherent to guidelines for mammography than were white patients (Table 2). There was a statistically significant interaction between Hispanic ethnicity and endocrine therapy in relation to nonadherence to mammography guidelines ( $P = .001$ ). Compared with white patients who didn't receive endocrine therapy, Hispanic patients who did not receive endocrine therapy were more likely to be nonadherent to mammography guidelines (OR = 2.28, 95% CI = 1.63 to 3.18) (Table 2). Black patients were more likely than white patients to be nonadherent to mammography guidelines whether or not they received endocrine therapy. There was no significant interaction between ethnicity and education level on nonadherence to mammography guidelines ( $P=.32$ ).

In univariable GEE analysis using the categories of nonadherence versus full or partial adherence to clinic visit guidelines, patient characteristics associated with nonadherence to clinic visits included year of survivorship care ( $P < .0001$ ), age at diagnosis ( $P = .005$ ), ethnicity ( $P = .0001$ ), type of insurance ( $P = .005$ ), area of residence ( $P < .0001$ ) and education level status ( $P<0.0001$ ) (data not shown). In adjusted multivariable analysis, Hispanic patients (OR = 1.62, 95% CI = 1.27 to 2.06) and black patients (OR = 1.45, 95% CI = 1.13 to 1.86) were more likely to be nonadherent to clinic visit guidelines than white patients (Table 3). There was a statistically significant interaction between Hispanic ethnicity and endocrine therapy in relation to nonadherence to clinic visit guidelines ( $P = .04$ ). In adjusted multivariable GEE model stratified by endocrine therapy use, compared with white patients who did not receive endocrine therapy, Hispanic patients (OR = 2.19, 95% CI = 1.52 to 3.17) who did not receive endocrine therapy were more likely to be nonadherent to clinic visit guidelines (Table 3). There was no significant interaction between ethnicity and education level on nonadherence to clinic visit guidelines ( $P=0.13$ ).

For clinic visits, in the adjusted multivariable GEE model using the combined categories of nonadherence and partial adherence versus full adherence, there was no evidence of an

interaction between ethnicity and endocrine therapy. Hispanic patients were more likely than white patients to be nonadherent or partially adherent to clinic visit guidelines (OR = 1.22, 95% CI 1.02 to 1.47). Black patients were more likely than white patients to be nonadherent or partially adherent to clinic visit guidelines, but the association was not statistically significant (OR = 1.12, 95% CI = 0.94 to 1.34) (data not shown).

### **Association between Nonadherence to Surveillance Guidelines and Overall Survival**

In the adjusted multivariable Cox regression analysis, nonadherence to mammography guidelines (hazard ratio [HR] = 0.94, 95% CI = 0.76 to 1.18) and clinic visit guidelines (HR = 1.03, 95% CI 0.80 to 1.34) were not associated with overall survival (Table 4). However, compared with white patients, Hispanic patients had a decreased risk of death (HR = 0.71, 95% CI = 0.51 to 0.98) and black patients had an increased risk of death that bordered on statistical significance (HR=1.26, 95% CI 0.98 to 1.62).

## **Discussion**

We evaluated ethnic and racial disparities in adherence to the surveillance guidelines for breast cancer survivorship care (mammography and clinic visits) given the increasing recognition of the importance of long-term follow-up care for cancer survivors. We found that Hispanic and black patients are more likely to be nonadherent than white patients, but nonadherence increased among all ethnicities over time. Among Hispanic patients, nonadherence to surveillance guidelines varied significantly in relation to whether endocrine therapy was received. There was no relationship between nonadherence to the guidelines and overall survival.

Among minority and underserved patient populations, psychosocial factors including higher levels of worrying about health, the perceived stigma of breast cancer,<sup>19-22</sup> and a higher financial burden<sup>11, 22, 23</sup> have been identified as important components of the cancer survivorship experience that may influence adherence. Having to travel a long distance to see an oncologist has also been described as a practical hardship affecting the adherence of many cancer patients to care guidelines.<sup>24-26</sup> We found that distance from a patient's residence to MD Anderson Cancer Center was significantly associated with a lack of follow-up after the completion of treatment and with nonadherence to survivorship care guidelines. Black and Hispanic patients were less likely than white patients to follow up with survivorship care after the completion of treatment and were also likely to live further from MD Anderson Cancer Center than white patients. Since it is possible that some patients may have continued their survivorship care at oncological or primary care facilities closer to their residences, our findings highlight the importance of coordination of survivorship care among different types of providers and between providers and patients.<sup>27-29</sup>

In a finding unique to our study, we observed a significant interaction between Hispanic ethnicity and endocrine therapy in association with nonadherence to guidelines. Hispanic breast cancer patients who were not eligible for endocrine therapy or who declined or were not offered such therapy may have had a lower incentive to maintain a relationship with a provider, especially if language barriers existed, and lack of a relationship with a provider may have contributed to their worse adherence to recommendations for follow-up care. An

estimated 30% to 50% of breast cancer patients stop adhering to adjuvant endocrine therapy guidelines by the fifth year of treatment.<sup>30,31</sup> Specific educational interventions may be needed to retain minority patients not receiving endocrine therapy in survivorship care.

Our study enrolled patients who were alive and cancer-free 9 to 18 months after the start of first treatment, therefore it may have been biased toward patients with a relatively high short-term life expectancy, for whom a longer follow-up period would be needed to detect an association between survivorship care and overall survival. No randomized clinical trials have been conducted to evaluate the impact of annual surveillance mammography on patient survival after a diagnosis of breast cancer. However, three randomized studies evaluating reduced follow-up strategies compared to routine scheduled clinic follow-up did not show a negative impact of reduced follow-up on patient-report outcomes or early detection of cancer.<sup>32-34</sup> More research is needed to define the elements of breast survivorship care that influence survival and quality of life outcomes and to identify subsets of patients most likely to derive benefit.<sup>5</sup>

The improved overall survival of Hispanic breast cancer patients compared to white patients has been previously described<sup>1</sup> and may be partially attributed to a lower prevalence of comorbidities<sup>35</sup> and dependent on the nativity status of the individual.<sup>36</sup> Factors such as comorbidities, lifestyle factors, utilization of the health care system and neighborhood socioeconomic conditions may have contributed to the survival gap between black and white breast cancer patients.<sup>37-39</sup>

This study had several limitations that should be considered in interpreting the findings. Because the analyses were restricted to the information stored in the Breast Cancer Management System database, we were unable to evaluate the role of other factors that can affect survivorship care, such as socioeconomic status,<sup>10-12</sup> patient spoken language,<sup>40</sup> acculturation,<sup>41</sup> psychosocial variables,<sup>42-44</sup> and the presence of comorbidities.<sup>45,46</sup> In addition, it is possible that even after adjustment for known confounders, the multivariable GEE models with two-way interactions or the Cox proportional hazards survival analyses were affected by residual confounding.

In conclusion, ethnic disparities exist in adherence with breast cancer surveillance guidelines and given the importance of survivorship care, new strategies are needed to promote adherence to care guidelines among breast cancer survivors.<sup>7,47,48</sup> Further investigations should focus on determining the efficacy of health promotion interventions aimed at improving patient retention in survivorship care that take into account an individual's health and cultural beliefs, social and financial support, and ease of access to survivorship care.

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## References

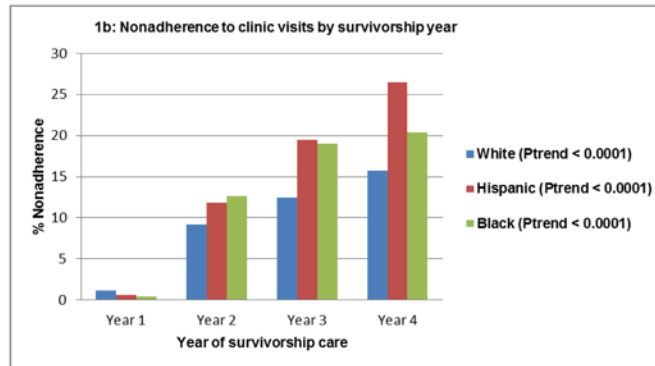
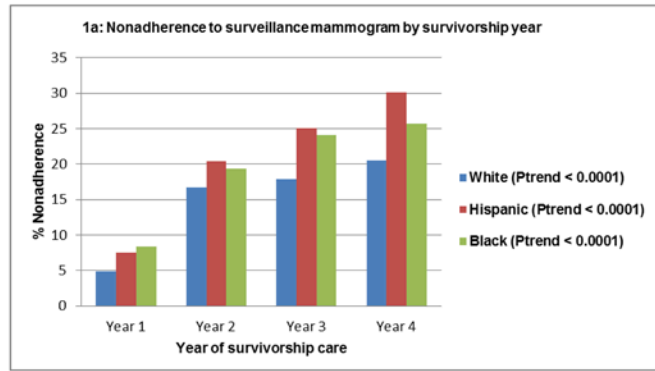
1. Siegel R, Naishadham D, Jemal A. Cancer statistics, 2013. *CA Cancer J Clin.* 2013; 63(1):11–30. [PubMed: 23335087]

2. Howlader, N.; Noone, AM.; Krapcho, M., editors. SEER Cancer Statistics Review: 1975-2010. National Cancer Institute; Bethesda, MD: Available from URL: [http://seer.cancer.gov/csr/1975\\_2010/](http://seer.cancer.gov/csr/1975_2010/). Posted April 2013
3. Cancer Facts & Figures 2013. Atlanta: American Cancer Society; 2013. American Cancer Society.
4. Murphy CC, Bartholomew LK, Carpentier MY, Bluethmann SM, Vernon SW. Adherence to adjuvant hormonal therapy among breast cancer survivors in clinical practice: A systematic review. *Breast Cancer Res Treat.* 2012; 134(2):459–478. [PubMed: 22689091]
5. Khatcheressian JL, Hurley P, Bantug E, et al. Breast Cancer Follow-Up and Management After Primary Treatment: American Society of Clinical Oncology Clinical Practice Guideline Update. *Journal of Clinical Oncology.* 2013; 31(7):961–965. [PubMed: 23129741]
6. Breast Cancer Version 3.2013. National Comprehensive Cancer Network; 2013. National Comprehensive Cancer Network (NCCN): NCCN Clinical Practice Guidelines in Oncology. Available from URL: [www.NCCN.com](http://www.NCCN.com)
7. Keating NL, Landrum MB, Guadagnoli E, Winer EP, Ayanian JZ. Factors related to underuse of surveillance mammography among breast cancer survivors. *Journal of Clinical Oncology.* 2006; 24(1):85–94. [PubMed: 16382117]
8. Doubeni CA, Field TS, Yood MU, et al. Patterns and predictors of mammography utilization among breast cancer survivors. 2006 American Cancer Society. 2006; 106(11):2482–2488.
9. Field TS, Doubeni C, Fox MP, et al. Underutilization of surveillance mammography among older breast cancer survivors. *Journal of Gen Intern Med.* 2007; 23(2):158–163. [PubMed: 18060463]
10. Carcaise-Edinboro P, Bradley CJ, Dahman B. Surveillance mammography for Medicaid/Medicare breast cancer patients. *Journal of Cancer Survivors.* 2010; 4(1):59–66.
11. Sabatino SA, Thompson TD, Richardson LC, Miller J. Health insurance and other factors associated with mammography surveillance among breast cancer survivors. *Medical Care.* 2012; 50(3):270–276. [PubMed: 22193416]
12. Breslau ES, Jeffery DD, Davis WW, Moser RP, McNeel TS, Hawley S. Cancer screening practices among racially and ethnically diverse breast cancer survivors: results from the 2001 and 2003 California Health Interview Survey. *Journal of Cancer Survivors.* 2010; 4(1):1–14.
13. Shelby RA, Scipio CD, Somers TJ, Soo MS, Weinfurt KP, Keefe FJ. Prospective study of factors predicting adherence to surveillance mammography in women treated for breast cancer. *American Society of Clinical Oncology.* 2012; 30(8):813–819.
14. Menashe I, Anderson WF, Jatoi I, Rosenberg PS. Underlying Causes of the Black–White Racial Disparity in Breast Cancer Mortality: A Population-Based Analysis. *Journal of the National Cancer Institute.* 2009; 101(14):993–1000. [PubMed: 19584327]
15. Fleming, ID.; Cooper, JS.; Henson, DE., et al. *AJCC Cancer Staging Manual.* 5th. Philadelphia: Lippincott-Raven; 1997.
16. Greene, FL.; Page, DL.; Fleming, ID., et al. *AJCC Cancer Staging Manual.* 6th. New York: Springer; 2002.
17. Litton JK, Gonzalez-Angulo AM, Warneke CL, et al. Relationship Between Obesity and Pathologic Response to Neoadjuvant Chemotherapy Among Women With Operable Breast Cancer. *Journal of Clinical Oncology.* 2008; 26(25):4072–4077. [PubMed: 18757321]
18. Houston, Sugar Land, Baytown Metro Area. 2010. Available from USA.com URL: <http://www.usa.com/houston-sugar-land-baytown-tx-area.htm>
19. Janz NK, Hawley ST, Mujahid MS, et al. Correlates of worry about recurrence in a multiethnic population-based sample of women with breast cancer. *Cancer.* 2011; 117(9):1827–36. [PubMed: 21445916]
20. Chatman MC, Green RD. Addressing the unique psychosocial barriers to breast cancer treatment experienced by African-American women through integrative navigation. *Journal of National Black Nurses' Association.* 2011; 22(2):20–28.
21. Rust C, Davis C. Health Literacy and Medication Adherence in Underserved African-American Breast Cancer Survivors: A Qualitative Study. *Social Work in Health Care.* 2011; 50(9):739–761. [PubMed: 21985113]



22. Ashing-Giwa KT, Lim J. Examining the Impact of Socioeconomic Status and Socioecologic Stress on Physical and Mental Health Quality of Life Among Breast Cancer Survivors. *Oncology Nursing Forum*. 2009; 36(1):79–88. [PubMed: 19136341]
23. Darby K, Davis C, Likes W, Bell J. Exploring the Financial Impact of Breast Cancer for African American Medically Underserved Women: A Qualitative Study. *Journal of Health Care for the Poor and Underserved*. 2009; 20(3):721–728. [PubMed: 19648700]
24. Payne S, Jarrett N, Jeffs D. The impact of travel on cancer patients' experiences of treatment: a literature review. *European Journal of Cancer Care*. 2008; 9(4):197–203. [PubMed: 11829366]
25. Crawford MS, Sauerzapf V, Haynes R, Forman D, Jones AP. Social and geographical factors affecting access to treatment of colorectal cancer: a cancer registry study. *BMJ Open*. 2012; 2(2): 1–6.
26. Holmes J, Carpenter WR, Wu Y, et al. Impact of Distance to a Urologist on Early Diagnosis of Prostate Cancer Among Black and White Patients. *The Journal of Urology*. 2012; 187(3):883–888. [PubMed: 22248516]
27. Mao JJ, Bowman MA, Stricker CT, et al. Delivery of Survivorship Care by Primary Care Physicians: The Perspective of Breast Cancer Patients. *Journal of Clinical Oncology*. 2009; 27(6): 933–938. [PubMed: 19139437]
28. Cheung WY, Aziz N, Noone AM, et al. Physician preferences and attitudes regarding different models of cancer survivorship care: a comparison of primary care providers and oncologists. *Journal of Cancer Survivorship*. 2013; 7(3):343–354. [PubMed: 23526165]
29. Virgo KS, Lerro CC, Klabunde CN, Earle C, Ganz PA. Barriers to Breast and Colorectal Cancer Survivorship Care: Perceptions of Primary Care Physicians and Medical Oncologists in the United States. *Journal of Clinical Oncology*. 2013; 31(18):2322–2336. [PubMed: 23690429]
30. Makubate B, Donnan PT, Dewar JA, Thompson AM, McCowan C. Cohort study of adherence to adjuvant endocrine therapy, breast cancer recurrence and mortality. *British Journal of Cancer*. 2013; 108:1515–524. [PubMed: 23519057]
31. Hershman DL, Kushi LH, Shao T, et al. Early Discontinuation and Nonadherence to Adjuvant Hormonal Therapy in a Cohort of 8,769 Early-Stage Breast Cancer Patients. *Journal of Clinical Oncology*. 2010; 28(27):4120–4128. [PubMed: 20585090]
32. Kimman ML, Bloebaum MM, Dirksen CD, Houben RM, Lambin P, Boersma LJ. Patient satisfaction with nurse-led telephone follow-up after curative treatment for breast cancer. *BMC Cancer*. 2010; 10(174):1–10. [PubMed: 20047689]
33. Sheppard C, Higgins B, Wise M, Yiangou C, Dubois D, Kilburn S. Breast cancer follow up: a randomised controlled trial comparing point of need access versus routine 6-monthly clinical review. *Eur J Oncol Nurs*. 2009; 13(1):2–8. [PubMed: 19119079]
34. Beaver K, Tysver-Robinson D, Campbell M, et al. Comparing hospital and telephone follow-up after treatment for breast cancer: randomized equivalence trial. *British Medical Journal*. 2009; 338:a3147. [PubMed: 19147478]
35. Ruiz JM, Steffen P, Smith TB. Hispanic Mortality Paradox: A Systematic Review and Meta-Analysis of the Longitudinal Literature. *American Journal of Public Health*. 2013; 103(3):e52–e60. [PubMed: 23327278]
36. Borrell LN, Lancet EA. Race/ethnicity and all-cause mortality in US adults: revisiting the Hispanic paradox. *American Journal of Public Health*. 2012; 102(5):836–843. [PubMed: 22493998]
37. Newman LA, Mason J, Cote D, et al. African-American ethnicity, socioeconomic status, and breast cancer survival. A meta-analysis of 14 studies involving over 10,000 African-American and 40,000 white American patients with carcinoma of the breast. *Cancer*. 2002; 94(11):2844–2854. [PubMed: 12115371]
38. Gerend MA, Pai M. Social Determinants of Black-White Disparities in Breast Cancer Mortality: A Review. *Cancer Epidemiology Biomarkers Prevention*. 2008; 17(11):2913–2923.
39. Tannenbaum SL, Koru-Sengul T, Miao F. Disparities in survival after female breast cancer diagnosis: a population-based study. *Cancer Causes & Control*. 2013; 24(9):1705–1715. [PubMed: 23775026]

40. Ashing-Giwa KT, Padilla G, Tejero J, et al. Understanding the breast cancer experience of women: a qualitative study of African American, Asian American, Latina and Caucasian cancer survivors. *Psychooncology*. 2004; 13(6):408–428. [PubMed: 15188447]
41. Lim JW, Gonzalez P, Wang-Letzkus MF, Ashing-Giwa KT. Understanding the cultural health belief model influencing health behaviors and health-related quality of life between Latina and Asian-American breast cancer survivors. *Supportive Care in Cancer*. 2009; 17(9):1137–47. [PubMed: 19050938]
42. Grunfeld EA, Hunter MS, Sikka P, Mittala S. Adherence beliefs among breast cancer patients taking tamoxifen. *Patient Education and Counseling*. 2005; 59(1):97–102. [PubMed: 16198223]
43. Dogrell SA. Adherence to oral endocrine treatments in women with breast cancer: can it be improved? *Breast Cancer Research and Treatment*. 2011; 129(2):299–308. [PubMed: 21594663]
44. Ruddy K, Mayer E, Partridge A. Patient adherence and persistence with oral anticancer treatment. *CA: A Cancer Journal for Clinicians*. 2009; 59(1):56–66. [PubMed: 19147869]
45. Owusu C, Buist DSM, Field TS, et al. Predictors of tamoxifen discontinuation among older women with estrogen receptor-positive breast cancer. *Journal of Clinical Oncology*. 2008; 26(4):549–555. [PubMed: 18071188]
46. Tammemagi CM, Nerenz D, Neslund-Dudas C, Feldkamp C, Nathanson D. Comorbidity and Survival Disparities Among Black and White Patients With Breast Cancer. *The Journal of the American Medical Association*. 2005; 294(14):1765–1772.
47. Edelman MJ, Meyers FJ, Siegel D. The utility of follow-up testing after curative cancer therapy. A critical review and economic analysis. *The Journal of General Internal Medicine*. 1997; 12(5):318–331.
48. Smith TJ, Davidson NE, Schapira DV, et al. American Society of Clinical Oncology 1998 update of recommended breast cancer surveillance guidelines. *Journal of Clinical Oncology*. 1999; 17(3): 1080–1082. [PubMed: 10071303]



**Figure 1.**  
**a.** Nonadherence of breast cancer patients to guidelines for surveillance mammography over time.  
**b.** Nonadherence of breast cancer patients to guidelines for follow-up clinic visits over time.

Table 1

## Patient characteristics

Characteristic	Included in analysis n = 4,535 (%)	Excluded from analysis n = 602 (%)	P*
Ethnicity			.03
White	3242 (71.5)	433 (71.9)	
Hispanic	518 (11.4)	86 (14.3)	
Black	541 (11.9)	64 (10.6)	
Native American/Asian	234 (5.2)	19 (3.2)	
Age (yr) at diagnosis			<.01
50	1846 (40.7)	223 (37.0)	
51–65	1849 (40.8)	229 (38.0)	
>65	840 (18.5)	150 (24.9)	
BMI (kg/m <sup>2</sup> )			.28
<25 (normal/underweight)	1646 (36.3)	222 (36.9)	
25–<30 (overweight)	1402 (30.9)	168 (27.9)	
30 (obese)	1487 (32.8)	212 (35.2)	
Education level			<.01
< High school	262 (5.8)	49 (8.1)	
High or technical school	1024 (22.6)	150 (24.9)	
College and above	1952 (43.0)	215 (35.7)	
Missing	1297 (28.6)	188 (31.2)	
Health insurance			<.01
Medicaid	158 (3.5)	17 (2.8)	
Medicare	563 (12.4)	105 (17.4)	
Private	2885 (63.6)	336 (55.8)	
Missing	929 (20.5)	144 (23.9)	
Area of residence			<.01
Houston metropolitan	3008 (66.3)	84 (14.0)	

Characteristic	Included in analysis n = 4,535 (%)	Excluded from analysis n = 602 (%)	P*
Other	1527 (33.7)	518 (86.0)	
Cancer stage			<.01
I	1863 (41.1)	291 (48.3)	
II	1949 (43.0)	251 (41.7)	
III	722 (15.9)	60 (10.0)	

\* Chi-square for the difference between the patients included in the analysis and the patients excluded from the analysis.

Abbreviations: BMI, body mass index.

**Table 2**  
**Patient nonadherence to surveillance mammography in relation to ethnicity and endocrine therapy**

Ethnicity	OR	(95% CI)	P
Model with main effects <sup>†</sup>			
White	1.00	--	--
Hispanic	1.35	(1.10 to 1.65)	<.01
Black	1.36	(1.11 to 1.66)	<.01
Native American/Asian	1.11	(0.81 to 1.52)	.51
Model stratified by endocrine therapy <sup>‡</sup>			
Did not have endocrine therapy			
White	1.00	--	--
Hispanic	2.28	(1.63 to 3.18)	<.01
Black	1.47	(1.04 to 2.00)	.03
Native American/Asian	1.00	(0.55 to 1.82)	.99
Had endocrine therapy			
White	1.00	--	--
Hispanic	1.18	(0.93 to 1.50)	.17
Black	1.43	(1.11 to 1.85)	<.01
Native American/Asian	1.14	(0.79 to 1.63)	.48

<sup>†</sup>The model was adjusted for year, age at diagnosis, chemotherapy, radiation therapy, endocrine therapy, area of residence and education level.

<sup>‡</sup>The model was adjusted for year, age at diagnosis, chemotherapy, radiation therapy, area of residence and education level.

Abbreviations: OR, odds ratio; CI, confidence interval.

**Table 3**  
**Patient nonadherence to clinic visit guidelines in relation to ethnicity and endocrine therapy**

Ethnicity	OR	(95% CI)	P
Model with main effects <sup>†</sup>			
White	1.00	--	--
Hispanic	1.62	(1.27 to 2.06)	<.01
Black	1.45	(1.13 to 1.86)	<.01
Native American/Asian	1.18	(0.80 to 1.73)	.41
Model stratified by endocrine therapy <sup>‡</sup>			
Did not have endocrine therapy			
White	1.00	--	--
Hispanic	2.19	(1.52 to 3.17)	<.01
Black	1.61	(1.11 to 2.32)	.01
Native American/Asian	1.12	(0.55 to 2.27)	.76
Had endocrine therapy			
White	1.00	--	--
Hispanic	1.34	(0.98 to 1.84)	.06
Black	1.36	(0.97 to 1.90)	.08
Native American/Asian	1.20	(0.76 to 1.89)	.44

<sup>†</sup>The model was adjusted for year, age at diagnosis, chemotherapy, hormonal receptor status, radiation therapy, endocrine therapy, area of residence and education level.

<sup>‡</sup>The model was adjusted for year, health insurance status, age at diagnosis, chemotherapy, radiation therapy, area of residence and education level.

Abbreviations: OR, odds ratio; CI, confidence interval.

**Table 4**  
**Association between patient nonadherence to guidelines and overall survival**

Parameter	HR	(95% CI)	P
Mammography guidelines			
Adherence	1.00	--	--
Nonadherence	0.95	(0.76 to 1.18)	.62
Clinic visit guidelines			
Adherence	1.00	--	--
Nonadherence	1.03	(0.80 to 1.34)	.80
Ethnicity			
White	1.00	--	--
Hispanic	0.71	(0.51 to 0.98)	.03
Black	1.26	(0.98 to 1.62)	.07
Native American/Asian	0.49	(0.28 to 0.87)	.01

The model was adjusted for age, stage, nuclear grade, chemotherapy, radiation therapy, surgery, education level.

Abbreviations: HR, hazard ratio; CI, confidence interval.