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Ethnic differences in initiation and timing of adjuvant endocrine therapy among older women with hormone receptor-positive breast cancer enrolled in Medicare Part D

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Abstract

The aim of this study was to determine whether there are racial/ethnic differences in initiation and timing of adjuvant endocrine therapy (AET) after Medicare Part D drug coverage. We conducted a retrospective cohort study using data from the Surveillance, Epidemiology, and End Results-Medicare-linked data to assess ethnic, socio-demographic, and tumor characteristic variations in the initiation of AET among patients ≥65 with hormone receptor-positive breast cancer in 2007–2009 enrolled in Medicare Part D through 2010. Logistic regression models were performed to assess the association between race/ethnicity and the initiation of tamoxifen, aromatase inhibitors (AIs), and overall AET (tamoxifen or AIs) within the first 12 months of diagnosis. Of the 12,198 women with hormone receptor-positive breast cancer, 74.8 % received AET within 12 months of diagnosis, of which 17.3 % received tamoxifen and 82.8 % received AIs. After controlling for all variables, only Asian women were found to have a greater odds of initiation of overall AET compared to non-Hispanic white women (odds ratio (OR): 1.28, 95 % CI: 1.03–1.58). Hispanic Mexicans and non-Hispanic black patients had a significantly lower odds of tamoxifen initiation (0.70, 0.54–0.91; 0.25, 0.10–0.62). For AI initiation, Hispanic Mexicans and Asians had a higher odds compared to non-Hispanic white women (2.06, 1.34–3.10; 1.33, 1.11–1.61). A suboptimal proportion of women (25.2 %) did not initiate AET within 12 months of diagnosis and therefore did not receive the full benefits of treatment to reduce the risk of breast cancer recurrence and mortality. Racial/ethnic differences in the initiation of tamoxifen and AIs have important implications that require further investigation.

Keywords

Breast cancer; Adjuvant endocrine therapy; Initiation; Hormone receptor-positive

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Introduction

Black and Hispanic women experience an increased risk of breast cancer death compared to non-Hispanic white women [1–4]. These ethnic disparities in mortality have been reported to be attributed to late stage at diagnosis [2, 3], socioeconomic status [4], tumor subtypes [5, 6], and the initiation and timing of effective recommended treatment for breast cancer [2, 4]. Nearly two-thirds of all breast cancer cases in the USA are hormone receptor-positive (estrogen or progesterone) and these women are eligible for adjuvant endocrine treatment (AET) [7, 8]. AET is recommended for five years for women with localized- or regional-stage hormone receptor-positive breast cancer [9]. AET treatment includes two classes of drugs, tamoxifen and the aromatase inhibitors (AIs include exemestane, letrozole, and anastrozole). The treatment recommendations are based upon an assessment of menopausal status where premenopausal women are generally indicated to take tamoxifen [9], while recommendations for postmenopausal women can include either tamoxifen, AIs, or a combination of one drug following the other [9].

Given the well-documented efficacy of AET treatment to reduce breast cancer recurrence and mortality [10–13], the timely initiation of AET following a breast cancer diagnosis is potentially important and amenable. However, a number of studies found that a substantial proportion of women with breast cancer indicated for treatment did not take AET altogether [14] or did not initiate the treatment in a timely manner [15–17], especially among ethnic minorities [16–18]. One study found that in a cohort of women enrolled in a large HMO health plan, Hispanic women were less likely to initiate AET compared to non-Hispanic white women [16], but the use of AET was not significantly associated with race/ethnicity in another study of an ethnically diverse national cohort of women [14]. However, this study used a self-report of hormonal therapy use which might have had differential recall or reporting bias [14].

What remains unclear is whether the initiation and timing of AET, including tamoxifen and AIs, is different for an ethnically diverse cohort of older women. Since 2006, the Medicare Part D program started to cover AET for breast cancer for the first time, making it possible to address the above research questions. Although we recently reported an internal validity of Medicare Part D data for hormone therapy and its geographic and racial variation for breast cancer [17], the study did not examine the initiation and timing of hormone therapy. To add new information to the existing literature, we determined whether there were racial/ethnic differences in initiation and timing of AET among a large cohort of older women diagnosed with hormone receptor-positive breast cancer in 2007–2009 with Part D drug claims through 2010 in the SEER areas, accounting for approximately 30 % of the US population. To the best of our knowledge, this is the first study to examine the ethnic disparities in initiation and timing of AET for breast cancer in these women following Medicare Part D drug coverage in SEER areas.

Methods

Data source

This study utilized the Surveillance, Epidemiology, and End Results (SEER)-Medicare-linked data with Part D plan claims from 2007 to 2010. The National Cancer Institute's SEER Program contracts with population-based cancer registries to provide data on all incident cancer cases (with the exception of non-melanoma). The population covered by SEER is comparable to the general US population with regard to measures of poverty [19]. Data collected include patient demographics, primary tumor site, tumor morphology and stage at diagnosis, first course of treatment, and follow-up vital statistics. The population data such as poverty status and education at the census tract level were from the Census Bureau.

Study design and population

This was a retrospective cohort study. Because AET is recommended to women diagnosed with early-stage (AJCC stages I–III) breast cancer as an adjuvant therapy following cancer-directed surgery with or without chemotherapy [9], we restricted our study cohort to include women with stages I–III and hormone receptor-positive breast cancer at age ≥65 who were enrolled in Medicare Part D for at least 12 months after the date of diagnosis (Fig. 1). Women with tumors of unknown hormone receptor status were excluded. Patients were also excluded if they were not enrolled in Part D plan, had lack of both Medicare Part A and Part B, and were enrolled with a health maintenance organization from the year of diagnosis to the last follow-up. Our final sample included 12,198 women who remained continuously enrolled in Medicare Part D for at least 1 year after breast cancer diagnosis.

Dependent variable

Medicare Part D pharmacy claims data contain information on detailed person-specific information for drug utilization such as date of service, product generic drug name identifier, quantity dispensed, days' supply, and fill number. Initiation of AET was defined as a single prescription fill for a tamoxifen or an aromatase inhibitor (AIs) based on their generic drug name in Medicare Part D pharmacy claims data up to 1 year after the date of breast cancer diagnosis. AIs were defined as anastrozole, exemestane, or letrozole. We created a binary variable for initiation if eligible women filled a prescription for any AET medication (yes versus no).

Main exposure variable

We identified women who belonged to six categories of race/ethnicity: non-Hispanic white, black/African American, Hispanic Mexican, Hispanic South or Central American, other Hispanic, or Asian. Race was identified using the SEER race recode variable which is not mutually exclusive for whites, blacks, Asian/Pacific Islanders, and American Indians/Alaska Natives. This variable was combined with the Hispanic origin variable which is derived from the NAACCR Hispanic Identification Algorithm (NHIA) that uses a combination of variables to directly or indirectly classify cases of Hispanic for analytic purposes [20]. If race/ethnicity data were missing or unknown in the SEER data, we used Medicare data to

identify the patient's race/ethnicity. Women with other racial/ethnic groups were excluded from this analysis due to small numbers (Fig. 1).

Other study variables

We examined patient socio-demographic, tumor, and clinical characteristics. Demographic information included age at diagnosis and marital status obtained from the SEER data. Socio-demographic information included the percent of residents living below the poverty level at the census tract level and whether the patient lived in a metropolitan region. Tumor characteristics included AJCC tumor stage, tumor size, tumor grade, and lymph node status. Chemotherapy use was identified through Medicare claims within 6 months of diagnosis using procedure codes, and information on radiotherapy and surgery was obtained from both SEER and Medicare data as documented before [21]. The number of comorbid conditions was ascertained from Medicare claims data between 1 year prior to and 1 month after the diagnosis of breast cancer [21–23]. We also included year of diagnosis and SEER geographic area categorized as Northeast, South, Midwest, and West.

Statistical analysis

Differences in the distribution of socio-demographic and tumor characteristics were first examined across racial/ethnic groups. Chi-square tests were used to assess significant differences between groups with respect to categorical variables, and t tests were used to assess differences with respect to continuous variables. Three multivariate logistic regression models were performed to assess the association of race/ethnicity and initiation of AET, tamoxifen, and AI's. Collinearity of all independent variables was tested using multiple collinearity tests, and no variables were removed because no variables had a value greater than 0.7 and the variance inflation factor was >10. We considered a priori significance level at $p < 0.05$. Analyses were performed using SAS 9.4.

Results

Of the 12,198 women diagnosed with stages I–III hormone receptor-positive breast cancer in 2007–2009 who were continuously enrolled in Medicare Part D, 83 % were non-Hispanic white, 6.5 % were black, 1.2 % were Hispanic Mexican, 0.7 % were Hispanic South or Central American, 4.0 % were other Hispanic, and 4.8 % were Asian. Table 1 presents the distribution of socio-demographic and tumor characteristics by race/ethnicity. Hispanic women of Mexican, South or Central American, or Other Hispanic were younger (median age 73–74) than non-Hispanic white, black, and Asian patients who had a median age of 75 years. Almost all Hispanic women (96.6 %) lived in Metropolitan areas compared to non-Hispanic white women (79.7 %). Compared to non-Hispanic white women (41.5 %), a smaller proportion of South or Central American (<35 %), other Hispanic (34.7 %), and black patients (18 %) were married. A larger proportion of black (71.9 %), Hispanic (Mexican: 66.2 %, South or Central American: 53.4 %, other Hispanic: 58.7 %), and Asian (34.1 %) patients lived in census tract regions where greater than 11.8 % of the population were living below the federal poverty level compared to non-Hispanic white patients (28.5 %). A greater proportion of black (14.4 %) and Hispanic (Mexican: 17.2 %, other Hispanic: 14.1 %) patients were diagnosed with stage III breast cancer compared to non-

Hispanic white patients (8.4 %). A greater proportion of black (26.0 %), Hispanic (23.9–30.9 %), and Asian (22.6 %) patients received chemotherapy compared to non-Hispanic white patients (19.3 %). However, a greater proportion of Hispanics (58.3–65.9 %) received radiation therapy compared to non-Hispanic white patients (57.6 %), while a smaller percentage of black patients (47.5 %) received radiation therapy.

Table 2 presents the percentage of women who received AET, tamoxifen, and AIs by race/ethnicity, socio-demographic, and tumor characteristics. The overall proportion of patients receiving AET was 74.8 %, of which 17.3 % and 82.8 % received tamoxifen and AIs, respectively. A smaller proportion of Hispanic Mexicans (<10.0 %), South/Central Hispanics (<17.0 %), other Hispanics (14.9 %), Asians (13.7 %), and non-Hispanic black patients (13.0 %) received tamoxifen compared to non-Hispanic white patients (18.2 %), whereas a greater percentage of minorities received AIs compared to non-Hispanic white patients. A greater proportion of younger women compared to older women initiated AET (81.7 % for age 65–69 versus 64.9 % for age 80+). A greater proportion of patients without comorbidities initiated AET compared to women with comorbidity score of ≥3. Patients who received chemotherapy or radiotherapy had a higher percentage of receiving AET than those who did not.

Table 3 presents the percentage of women who initiated AET by month of enrollment and by race/ethnicity, socio-demographic, and tumor characteristics. Among patients who initiated AET, 38.5 % initiated therapy within 0–3 months, 36.7 % initiated therapy within 3–6 months, 16.5 % initiated within 6–9 months, and 8.3 % initiated within 9–12 months of breast cancer diagnosis. A greater proportion of women initiated at earlier months (75.2 % initiated AET within the first 6 months, while 18.8 % initiated during months 6–12). A greater proportion of non-Hispanic white patients (76.2 %) initiated AET during months 0–6 compared to black (70.5 %), Hispanic Mexican (68.3 %), Hispanic South/Central (68.2 %), and other Hispanic patients (67.3 %). Among women who received chemotherapy, a smaller proportion (34.6 %) initiated AET at months 0–6. In women who received radiation treatment, a greater proportion (69.6 %) initiated at earlier months (0–6 months).

Table 4 presents the adjusted odds ratio (OR) of receiving AET, tamoxifen, and AIs by race/ethnicity, socio-demographic, and tumor characteristics. There were no significant differences in the initiation of AET between any of the Hispanic subgroups compared to non-Hispanic white patients after controlling for all socio-demographic and tumor characteristics. Women of Asian race/ethnicity were associated with a greater odds of initiating AET compared to non-Hispanic white patients (adjusted OR: 1.28, 95 % CI: 1.03–1.58). Black (OR: 0.70, 95 % CI: 0.54–0.91) and Hispanic Mexican patients (0.25, 0.10–0.62) had a significantly lower odds of receiving tamoxifen compared to non-Hispanic white women. Hispanic Mexican patients (2.06, 1.34–3.10) and Asians (1.33, 1.11–1.61) had a significantly higher odds of receiving AIs compared to non-Hispanic white women. Other significant predictors of receiving AET included age, marital status, SES, SEER Cancer Registry region, comorbidity scores, stage at diagnosis, lymph node status, tumor grade, surgical treatment, chemotherapy, and radiation therapy. Significant predictors of initiating tamoxifen were SES, SEER Cancer Registry region, comorbidity score, stage at diagnosis, receipt of surgery, and chemotherapy. Significant predictors of AI initiation were age,

marital status, SEER Cancer Registry region, tumor stage, tumor size, lymph node status, tumor grade, receipt of surgery, and radiation treatment.

Table 5 presents the adjusted OR of initiating AET, tamoxifen, and AIs by the number of months from diagnosis by race/ethnicity. Non-Hispanic black patients had a significantly lower odds of initiating any AET 0–3 months after the date of diagnosis compared to non-Hispanic white women (adjusted OR: 0.78, 95 % CI: 0.65–0.94), while Asian patients had a higher odds of initiation (1.44, 1.18–1.75). The same pattern was observed for women who initiated AIs during the same time period. Non-Hispanic black women (0.85, 0.72–1.00) compared to non-Hispanic white women who initiated any AET 0–6 months after the date of diagnosis had a lower odds of receiving any AET, while Asian patients had a higher odds (1.23, 1.02–1.48) after controlling for other covariates. Non-Hispanic black and Hispanic Mexican women had a significantly lower odds of initiating tamoxifen therapy 0–6 months after the date of diagnosis compared to non-Hispanic white women (0.67, 0.50–0.90 and 0.27, 0.10–0.74, respectively). Hispanic Mexican women and Asians had a significantly higher odds of initiating AI therapy 0–6 months (1.57, 1.11–2.23 and 1.29, 1.08–1.54, respectively, and of receiving any AET 0–9 months after the date of diagnosis compared to non-Hispanic white women (1.56, 1.05–2.32 and 1.25, 1.03–1.52, respectively). Non-Hispanic black and Hispanic women had a significantly lower odds of initiating tamoxifen 0–9 months after the date of diagnosis compared to non-Hispanic white women (0.72, 0.55–0.93 and 0.28, 0.12–0.70, respectively), while Hispanic Mexicans and Asians had a significantly higher odds of initiation AIs within 0–9 months of diagnosis compared to non-Hispanic white women (2.11, 1.45–3.07 and 1.29, 1.08–1.55, respectively).

Discussion

This study described the association between race/ethnicity and the initiation of AET (tamoxifen and AIs) in women with early-stage hormone receptor-positive breast cancer with Medicare Part D drug coverage. Overall, close to three quarters (74.8 %) of early-stage hormone receptor-positive breast cancer patients initiated treatment, but still 25 % did not initiate therapy within the first 12 months of diagnosis. There also were substantial racial/ethnic differences in the initiation and timing of AET where Hispanic Mexicans and non-Hispanic black patients had a significantly lower odds of tamoxifen initiation (0.70, 0.54–0.91; 0.25, 0.10–0.62) and black patients had a significantly lower odds of early initiation within the first 6 months of diagnosis compared to non-Hispanic white patients (0.85, 0.72–1.00).

The percentage of women who initiated AET within 12 months was slightly higher than that of previous studies which found between 68 and 71 % of women initiated AET [15–17]. However, those studies included younger commercially insured women [15, 16], or included women with stage 0 breast cancer [17], which may have explained some of the observed differences in proportion of women that initiated AET.

In our study, we found racial/ethnic differences among women who initiated AET where higher levels of initiation were found for Asian women. One study by Livaudais et al. found that Chinese women compared to non-Hispanic white women had a lower odds of AET

initiation in a cohort of younger, commercially insured women [16]. We were not able to stratify Asian race/ethnicity into smaller subgroups due to limitations in sample size. Our finding regarding no association between other race/ethnicities and initiation of AET is consistent with previous studies [14, 15]. However, contradictory to these findings, studies showed that the use of AET is independently associated with lower proportion of initiation among Hispanic [16, 18] and black patients [17, 18] compared to white women. These studies were conducted among different study populations and used self-report of AET use, included stage 0 or stage IV breast cancer, and/or studied a younger cohort of women.

This is the first study to find that the proportion of female Medicare beneficiaries with breast cancer who initiated tamoxifen and AIs varied significantly by race/ethnicity even after controlling for other covariates in SEER areas following Medicare Part D coverage, whereas Hispanic Mexican and black patients were less likely to receive tamoxifen and Hispanic Mexican and Asian patients were more likely to receive AIs compared to non-Hispanic white women. A recent study by Wang & Du did find lower levels of initiation by AET type among black women, but it did not examine ethnic differences in the initiation and timing of AET [17]. Other studies combined tamoxifen and AIs into one category of AET [15, 16, 18]. Current national guidelines recommend that women with hormone receptor-positive breast cancer take AIs as part of adjuvant treatment either up-front or following tamoxifen [24], but the guidelines do not provide a clear indication as to which drug is superior at initiation. Despite this, we did find that the initiation of tamoxifen and AIs varied significantly by race/ethnicity. This is an important finding since the type of hormonal therapy use may be associated with adherence to the medication regimen [25, 26], cost of the drugs [27, 28], and potential short- and long-term side effects [29, 30]. These factors may all influence breast cancer recurrence [11, 31] and mortality [31]. While we did control for geographic region, racial/ethnic differences in treatment with tamoxifen versus AIs may be partially attributed to geographic-specific treatment practices [17], especially since racial/ethnic minorities represented in the sample are clustered into regions such that the majority of Hispanic Mexican patients were from the Western region of the USA.

Our study found significant differences in the early initiation of AET by race/ethnicity where black patients are less likely to initiate AET within 6 months from diagnosis and black and Hispanic Mexican women less likely to initiate tamoxifen therapy within 6 months from diagnosis compared to non-Hispanic white patients. However, there is no clear guideline on the timing for which women should initiate hormonal therapy in relationship to her diagnosis, surgical treatment, chemotherapy, and/or radiation therapy date. A previous study examining the cumulative rates of initiation of AET among non-elderly Medicaid insured women found that a small proportion of women continued to initiate AET more than 12 months after breast cancer diagnosis [15]. Similar to other studies, significant predictors of initiating AET included comorbidity status, tumor stage, age, socioeconomic status, geographic region, tumor stage, chemotherapy, and radiation therapy [15–17].

Our study had several strengths. First, our study was able to utilize a large, nationally represented sample of elderly breast cancer patients including subgroups of Hispanic ethnicity. Second, this study applied the innovative use of the nationwide, population-based computerized Medicare claims and SEER Cancer Registry data on cancer therapies which

have been validated for internal and external validity [17, 32, 33]. Furthermore, population-based cancer registries alone tend to underestimate the use of adjuvant treatment such as AET [33] and most studies on use of AET have relied solely on medical claims and pharmacy data which do not contain tumor characteristic information that allows to identify which women are indicated for AET treatment [25, 27, 34]. Hence, the SEER-Medicare-linked data used in this study offered the unique opportunity to examine the initiation and timing of AET among those who are indicated for such therapy.

Our study also had limitations. First, our study population included only women aged 65 and older enrolled in Medicare Part D plan and the results may not be generalized to younger patients or those not enrolled in Part D. Second, there could be unmeasured confounding such as patient psychosocial factors that may influence women's initiation of AET which cannot be captured in this study. For example, patients' strong belief in the necessity of a treatment and familial support may improve initiation of therapy [35]. Treatment recommendations made by physicians are also influential, and this information was not available in the current dataset; therefore, we were unable to determine whether treatment with tamoxifen or AIs was influenced by physician recommendation [36]. Third, there may have been misclassification of race/ethnicity. However, this bias may be minimal since the SEER Cancer Registry data use incidence data for Hispanics based on the NAACCR Hispanic/Latino Identification Algorithm (NHIA) which have been previously validated [37]. Also, we used race/ethnicity data from the Medicare dataset which was also well validated for accuracy of race/ethnicity to augment the information on missing or unknown ethnicity in SEER [20].

Conclusions

In conclusion, while a large proportion of women with hormone receptor-positive breast cancer initiated AET, a substantial proportion of women (25.2 %) still did not initiate AET within 12 months of diagnosis. According to the clinical guidelines, all women in our study cohort are eligible and should have initiated AET based on breast cancer tumor characteristics alone in order to maximize the full benefits of effective treatment to reduce the risk of breast cancer recurrence and mortality, with the exception for patients with a history of blood clots, stroke, uterine cancer or osteoporosis [9]. Furthermore, we observed differences in the use of tamoxifen and AIs by race/ethnicity even after controlling for other socio-demographic and tumor characteristics. The underlying factors and consequences associated with prescription of tamoxifen and AIs by race/ethnicity need to be investigated further.

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References

1. Ooi SL, Martinez ME, Li CI. Disparities in breast cancer characteristics and outcomes by race/ethnicity. Breast Cancer Res Treat. 2011; 127:729–38. [PubMed: 21076864]
2. Silber JH, Rosenbaum PR, Clark AS, Giantonio BJ, Ross RN, Teng Y, Wang M, Niknam BA, Ludwig JM, Wang W, Even-Shoshan O, Fox KR. Characteristics associated with differences in survival among black and white women with breast cancer. JAMA. 2013; 310:389–97. [PubMed: 23917289]
3. Banegas MP, Li CI. Breast cancer characteristics and outcomes among hispanic black and hispanic white women. Breast Cancer Res Treat. 2012; 134:1297–304. [PubMed: 22772379]
4. Du XL, Fang S, Meyer TE. Impact of treatment and socioeconomic status on racial disparities in survival among older women with breast cancer. Am J Clin Oncol. 2008; 31:125–32. [PubMed: 18391595]
5. O'Brien KM, Cole SR, Tse CK, Perou CM, Carey LA, Foulkes WD, Dressler LG, Geradts J, Millikan RC. Intrinsic breast tumor subtypes, race, and long-term survival in the carolina breast cancer study. Clin Cancer Res. 2010; 16:6100–10. [PubMed: 21169259]
6. Carey LA, Perou CM, Livasy CA, Dressler LG, Cowan D, Conway K, Karaca G, Troester MA, Tse CK, Edmiston S, Deming SL, Geradts J, Cheang MC, Nielsen TO, Moorman PG, Earp HS, Millikan RC. Race, breast cancer subtypes, and survival in the carolina breast cancer study. JAMA. 2006; 295:2492–502. [PubMed: 16757721]
7. American Cancer Society. Breast cancer facts and figures 2013–2014. Atlanta: American Cancer Society; 2013.
8. DeSantis C, Ma J, Bryan L, Jemal A. Breast cancer statistics, 2013. CA Cancer J Clin. 2014; 64:52–62. [PubMed: 24114568]
9. National Comprehensive Cancer Network. Nccn clinical practice guidelines in oncology (nccn guidelines®), breast cancer. 2014:2015.
10. Davies C, Godwin J, Gray R, Clarke M, Cutter D, Darby S, McGale P, Pan HC, Taylor C, Wang YC, Dowsett M, Ingle J, Peto R. EBCTCG (EBCTCG). Relevance of breast cancer hormone receptors and other factors to the efficacy of adjuvant tamoxifen: patient-level meta-analysis of randomised trials. Lancet. 2011; 378:771–84. [PubMed: 21802721]
11. Haque R, Ahmed SA, Fisher A, Avila CC, Shi J, Guo A, Craig Cheetham T, Schottinger JE. Effectiveness of aromatase inhibitors and tamoxifen in reducing subsequent breast cancer. Cancer Med. 2012; 1:318–27. [PubMed: 23342281]
12. Coombes RC, Hall E, Gibson LJ, Paridaens R, Jassem J, Delozier T, Jones SE, Alvarez I, Bertelli G, Ortmann O, Coates AS, Bajetta E, Dodwell D, Coleman RE, Fallowfield LJ, Mickiewicz E, Andersen J, Lønning PE, Cocconi G, Stewart A, Stuart N, Snowdon CF, Carpentieri M, Massimini G, Bliss JM, van de Velde C. Study IE. A randomized trial of exemestane after two to three years of tamoxifen therapy in postmenopausal women with primary breast cancer. N Engl J Med. 2004; 350:1081–92. [PubMed: 15014181]
13. Howell A, Cuzick J, Baum M, Buzdar A, Dowsett M, Forbes JF, Hoctin-Boes G, Houghton J, Locker GY, Tobias JS. Group AT. Results of the atac (arimidex, tamoxifen, alone or in combination) trial after completion of 5 years' adjuvant treatment for breast cancer. Lancet. 2005; 365:60–2. [PubMed: 15639680]
14. Livaudais JC, Lacroix A, Chlebowski RT, Li CI, Habel LA, Simon MS, Thompson B, Erwin DO, Hubbell FA, Coronado GD. Racial/ethnic differences in use and duration of adjuvant hormonal therapy for breast cancer in the women's health initiative. Cancer Epidemiol Biomark Prev. 2013; 22:365–73.
15. Yung RL, Hassett MJ, Chen K, Gesten FC, Roohan PJ, Boscoe FP, Sinclair AH, Schymura MJ, Schrag D. Initiation of adjuvant hormone therapy by medicaid insured women with nonmetastatic breast cancer. J Natl Cancer Inst. 2012; 104:1102–5. [PubMed: 22773822]
16. Livaudais JC, Hershman DL, Habel L, Kushi L, Gomez SL, Li CI, Neugut AI, Fehrenbacher L, Thompson B, Coronado GD. Racial/ethnic differences in initiation of adjuvant hormonal therapy among women with hormone receptor-positive breast cancer. Breast Cancer Res Treat. 2012; 131:607–17. [PubMed: 21922245]

17. Wang X, Du XL. Socio-demographic and geographic variations in the utilization of hormone therapy in older women with breast cancer after medicare Part-D coverage. Med Oncol. 2015; 32:599.
18. Freedman RA, Virgo KS, He Y, Pavluck AL, Winer EP, Ward EM, Keating NL. The association of race/ethnicity, insurance status, and socioeconomic factors with breast cancer care. Cancer. 2011; 117:180–9. [PubMed: 20939011]
19. Kohler BA, Sherman RL, Howlader N, Jemal A, Ryerson AB, Henry KA, Boscoe FP, Cronin KA, Lake A, Noone AM, Henley SJ, Eheman CR, Anderson RN, Penberthy L. Annual report to the nation on the status of cancer, 1975–2011, featuring incidence of breast cancer subtypes by race/ethnicity, poverty, and state. J Natl Cancer Inst. 2015; 107:djv048. [PubMed: 25825511]
20. NAACCR Race and Ethnicity Work Group: Naaccr guideline for enhancing hispanic/latino identification: Revised naaccr hispanic/latino identification algorithm [nhia v2.2.1]. Springfield IL: North American Association of Central Cancer Registries; 2011.
21. Hu CY, Delclos GL, Chan W, Du XL. Assessing the initiation and completion of adjuvant chemotherapy in a large nationwide and population-based cohort of elderly patients with stage-III colon cancer. Med Oncol. 2011; 28:1062–74. [PubMed: 20714945]
22. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chronic Dis. 1987; 40:373–83. [PubMed: 3558716]
23. Romano PS, Roos LL, Jollis JG. Adapting a clinical comorbidity index for use with icd-9-cm administrative data: differing perspectives. J Clin Epidemiol. 1993; 46:1075–9. discussion 1081–1090. [PubMed: 8410092]
24. Burstein HJ, Prestrud AA, Seidenfeld J, Anderson H, Buchholz TA, Davidson NE, Gelmon KE, Giordano SH, Hudis CA, Malin J, Mamounas EP, Rowden D, Solky AJ, Sowers MR, Stearns V, Winer EP, Somerfield MR, Griggs JJ. Oncology ASoC. American society of clinical oncology clinical practice guideline: update on adjuvant endocrine therapy for women with hormone receptor-positive breast cancer. J Clin Oncol. 2010; 28:3784–96. [PubMed: 20625130]
25. Sedjo RL, Devine S. Predictors of non-adherence to aromatase inhibitors among commercially insured women with breast cancer. Breast Cancer Res Treat. 2011; 125:191–200. [PubMed: 20495864]
26. Hadji P. Improving compliance and persistence to adjuvant tamoxifen and aromatase inhibitor therapy. Crit Rev Oncol Hematol. 2010; 73:156–66. [PubMed: 19299162]
27. Neugut AI, Subar M, Wilde ET, Stratton S, Brouse CH, Hillyer GC, Grann VR, Hershman DL. Association between prescription co-payment amount and compliance with adjuvant hormonal therapy in women with early-stage breast cancer. J Clin Oncol. 2011; 29:2534–42. [PubMed: 21606426]
28. Hershman DL, Tsui J, Meyer J, Glied S, Hillyer GC, Wright JD, Neugut AI. The change from brand-name to generic aromatase inhibitors and hormone therapy adherence for early-stage breast cancer. J Natl Cancer Inst. 2014; 106(11):1–9.
29. Amir E, Seruga B, Niraula S, Carlsson L, Ocaña A. Toxicity of adjuvant endocrine therapy in postmenopausal breast cancer patients: a systematic review and meta-analysis. J Natl Cancer Inst. 2011; 103:1299–309. [PubMed: 21743022]
30. Carlson RW, Hudis CA, Pritchard KI. Adjuvant endocrine therapy in hormone receptor-positive postmenopausal breast cancer: evolution of nccn, asco, and st gallen recommendations. J Natl Compr Canc Netw. 2006; 4:971–9. [PubMed: 17112447]
31. Hershman DL, Shao T, Kushi LH, Buono D, Tsai WY, Fehrenbacher L, Kwan M, Gomez SL, Neugut AI. Early discontinuation and non-adherence to adjuvant hormonal therapy are associated with increased mortality in women with breast cancer. Breast Cancer Res Treat. 2011; 126:529–37. [PubMed: 20803066]
32. Du XL, Key CR, Dickie L, Darling R, Geraci JM, Zhang D. External validation of medicare claims for breast cancer chemotherapy compared with medical chart reviews. Med Care. 2006; 44:124–31. [PubMed: 16434911]

33. Du XL, Key CR, Dickie L, Darling R, Delclos GL, Waller K, Zhang D. Information on chemotherapy and hormone therapy from tumor registry had moderate agreement with chart reviews. J Clin Epidemiol. 2006; 59:53–60. [PubMed: 16360561]

34. Partridge AH, LaFountain A, Mayer E, Taylor BS, Winer E, Asnis-Alibozek A. Adherence to initial adjuvant anastrozole therapy among women with early-stage breast cancer. J Clin Oncol. 2008; 26:556–62. [PubMed: 18180462]

35. Maly RC, Umezawa Y, Ratliff CT, Leake B. Racial/ethnic group differences in treatment decision-making and treatment received among older breast carcinoma patients. Cancer. 2006; 106:957–65. [PubMed: 16402372]

36. Goff SL, Mazor KM, Meterko V, Dodd K, Sabin J. Patients' beliefs and preferences regarding doctors' medication recommendations. J Gen Intern Med. 2008; 23:236–41. [PubMed: 18204991]

37. Bonito, A.; Bann, C.; Eicheldinger, C.; Carpenter, L. Final report. Rockville, MD: RTI International; 2008. Creation of new race/ethnicity codes and socioeconomic status (ses) indicators for medicare beneficiaries. Sub-task 2

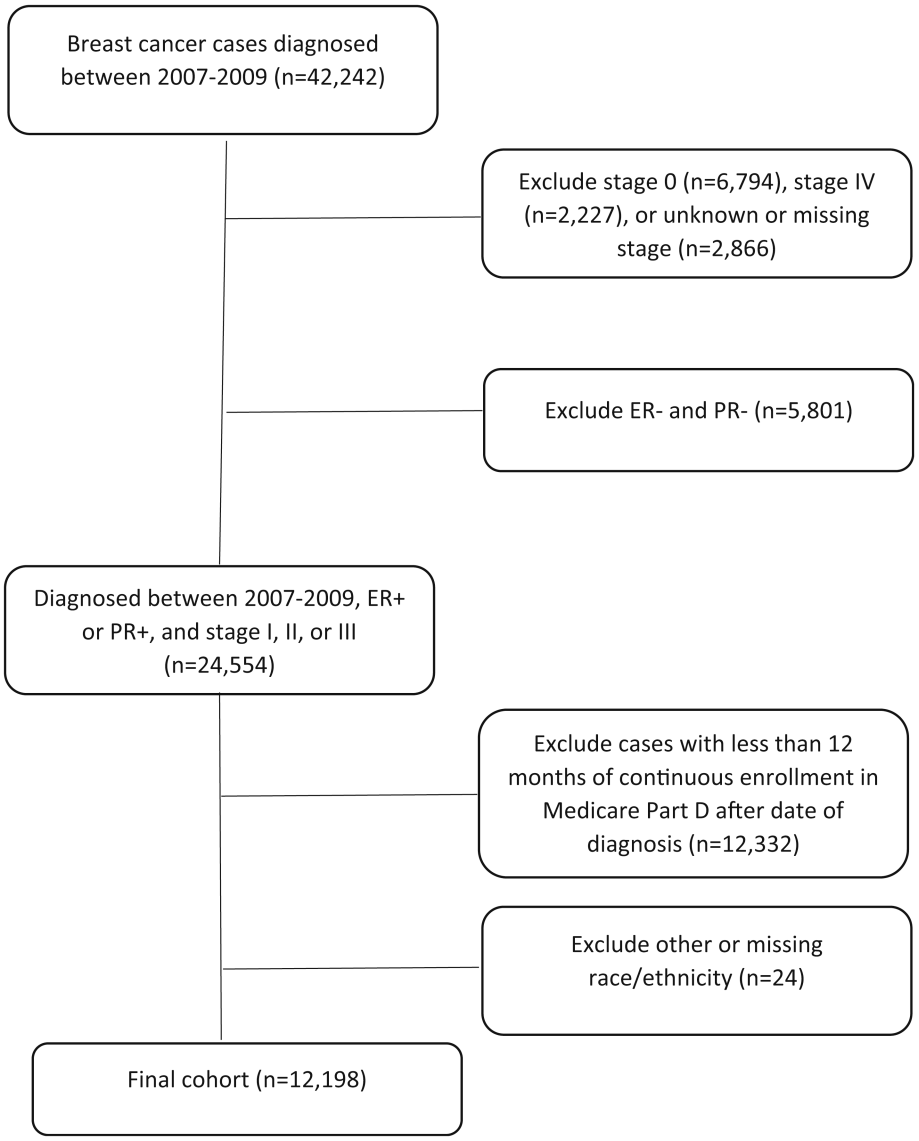

Fig. 1.

Diagram for identifying study cohort of women with breast cancer in 2007–2009. *Note* ER and PR denote estrogen and progesterone receptor status

Table 1

Characteristics of women diagnosed with stages I–III hormone receptor-positive breast cancer in 2007–2009, by race/ethnicity

	Non-Hispanic white, *n* (%)	Black, *n* (%)	Hispanic Mexican, *n* (%)	Hispanic South or Central American, *n* (%)	Other Hispanic, *n* (%)	Asian, *n* (%)
Age, median (range)	75 (65–115)	75 (65–101)	73 (65–93)	73 (65–93)	74 (65–95)	75 (65–97)
Age (years)						
65–69	2370 (23.4)	173 (22.3)	48 (33.1)	22 (25.0)	135 (28.0)	129 (23.9)
70–74	2404 (23.7)	210 (27.0)	36 (24.8)	26 (29.6)	130 (27.0)	134 (23.1)
75–79	2099 (20.7)	171 (22.0)	30 (20.7)	16 (18.2)	100 (20.8)	157 (27.0)
80+	3252 (32.1)	223 (28.7)	31 (21.4)	24 (27.3)	117 (24.3)	151 (26.0)
Marital status						
Married	4203 (41.5)	140 (18.0)	<40 %[a]	<35 %[a]	167 (34.7)	<50 %[a]
Unmarried	5560 (54.9)	601 (77.4)	88 (60.7)	59 (67.1)	294 (61.0)	287 (49.4)
Unknown	362 (3.6)	36 (4.6)	<8 %[a]	<13 %[a]	21 (4.4)	<5 %[a]
SES (% living below poverty)						
First tertile (<5.4 %)	3655 (36.1)	74 (9.5)	14 (9.7)	20 (22.7)	82 (17.0)	180 (31.0)
Second tertile (5.4–11.8 %)	3584 (35.4)	144 (18.5)	35 (24.1)	21 (23.9)	117 (24.3)	203 (34.9)
Third tertile (>11.8 %)	2886 (28.5)	559 (71.9)	96 (66.2)	47 (53.4)	283 (58.7)	198 (34.1)
SEER Cancer Registry region						
Northeast	2189 (21.6)	157 (20.2)	0 (0)	<25 %[a]	98 (20.3)	43 (7.4)
South	2574 (25.4)	377 (48.5)	<8 %[a]	<13 %[a]	18 (3.7)	<5 %[a]
Midwest	1338 (13.2)	83 (10.7)	0 (0)	0 (0)	<5 %[a]	<5 %[a]
West	4024 (39.7)	160 (20.6)	<98 %[a]	62 (70.5)	<75 %[a]	510 (87.8)
Metropolitan area (yes)	8069 (79.7)	656 (84.4)	140 (96.6)	85 (96.6)	425 (88.2)	554 (95.4)
Comorbidity scores						
0	5843 (57.7)	305 (39.3)	75 (51.7)	49 (55.7)	237 (49.2)	295 (50.8)
1	2543 (25.1)	220 (28.3)	34 (23.5)	25 (28.4)	150 (31.1)	192 (33.1)
2	1001 (9.9)	119 (15.3)	22 (15.2)	<13 %[a]	53 (11.0)	58 (10.0)
3+	738 (7.3)	133 (17.1)	14 (9.7)	<13 %[a]	42 (8.7)	36 (6.2)
Year of diagnosis						

	Non-Hispanic white, *n* (%)	Black, *n* (%)	Hispanic Mexican, *n* (%)	Hispanic South or Central American, *n* (%)	Other Hispanic, *n* (%)	Asian, *n* (%)
2007	3235 (32.0)	249 (32.1)	43 (29.7)	28 (31.8)	151 (31.3)	176 (30.3)
2008	3380 (33.4)	267 (34.4)	65 (44.8)	22 (25.0)	162 (33.6)	199 (34.3)
2009	3510 (34.7)	261 (33.6)	37 (25.5)	38 (43.2)	169 (35.1)	206 (35.5)
AJCC tumor stage						
Stage I	6071 (60.0)	353 (45.4)	70 (48.3)	45 (51.1)	244 (50.6)	330 (56.8)
Stage II	3206 (31.7)	312 (40.2)	50 (34.5)	<40 %[a]	170 (35.3)	<35 %[a]
Stage III	848 (8.4)	112 (14.4)	25 (17.2)	<13 %[a]	68 (14.1)	<5 %[a]
Tumor size (cm)						
<1.0	5993 (59.2)	347 (44.7)	70 (48.3)	45 (51.1)	229 (47.5)	319 (54.9)
>=1.0	3593 (35.5)	396 (51.0)	<50 %[a]	<45 %[a]	231 (47.9)	227 (39.1)
Unknown size	529 (5.3)	34 (4.4)	<8 %[a]	<13 %[a]	22 (4.6)	35 (6.0)
Lymph node positivity						
0 (node negative)	6657 (65.8)	415 (53.4)	87 (60.0)	52 (59.1)	289 (60.0)	388 (66.8)
1+	1249 (22.2)	224 (28.8)	38 (26.2)	<35 %[a]	142 (29.5)	<25 %[a]
Unknown	1219 (12.0)	138 (17.8)	20 (13.8)	<13 %[a]	51 (10.6)	<5 %[a]
Tumor grade						
Well differentiated	3012 (29.8)	157 (20.2)	39 (26.9)	22 (25.0)	108 (224)	163 (28.1)
Moderately differentiated	4890 (48.3)	353 (45.4)	73 (50.3)	43 (48.9)	237 (49.2)	276 (47.5)
Poorly differentiated	1792 (17.7)	214 (27.5)	<20 %[a]	<25 %[a]	115 (23.9)	122 (21.0)
Unknown	431 (4.3)	53 (6.8)	<8 %[a]	<13 %[a]	22 (4.6)	20 (3.4)
Surgery treatment						
No surgery	222 (2.2)	55 (7.1)	<8 %[a]	<13 %[a]	13 (2.7)	11 (1.9)
BCS	6238 (61.6)	379 (48.8)	79 (54.5)	59 (67.1)	276 (57.3)	319 (54.9)
Mastectomy	3665 (36.2)	343 (44.1)	<45 %[a]	<30 %[a]	193 (40.0)	251 (43.2)
Chemotherapy (yes)	1954 (19.3)	202 (26.0)	39 (26.9)	21 (23.9)	149 (30.9)	131 (22.6)
Radiation therapy (yes)	5830 (57.6)	369 (47.5)	90 (62.1)	58 (65.9)	281 (58.3)	314 (54.0)
Total	10,125 (83.0)	777 (6.4)	145 (1.2)	88 (0.7)	482 (4.0)	581 (4.8)

[a]Actual percentages were not reported to avoid $N < 11$ reporting as required by the data-user agreement

Table 2

Percent of patients initiating adjuvant endocrine therapy treatment in those with stages I–III hormone receptor-positive breast cancer, by AET type

	Percentage (%) of patients receiving AET	Percentage (%) of patients receiving tamoxifen	Percentage (%) of patients receiving AIs
Race/ethnicity			
Non-Hispanic white	74.5	18.2	81.9
Non-Hispanic black	73.4	13.0	87.0
Hispanic (Mexican)	80.7	<10.0[a]	<97[a]
Hispanic (South/Central)	75.0	<17.0[a]	<89[a]
Hispanic (other/unknown)	79.5	14.9	85.1
Asian	77.8	13.7	86.3
Age (years)			
65–69	81.7	14.2	85.8
70–74	80.6	15.7	84.3
75–79	75.1	17.5	82.5
80+	64.9	21.5	78.5
Marital status			
Married	77.8	16.7	83.3
Unmarried	72.6	18.0	82.0
Unknown	76.7	12.9	87.1
SES (% living below poverty)			
First tertile (<5.4 %)	75.1	14.6	85.4
Second tertile (5.4–11.8 %)	73.8	18.1	81.9
Third tertile (>11.8 %)	75.6	19.0	81.0
SEER Cancer Registry region			
Northeast	77.3	11.7	88.3
South	75.7	18.2	81.8
Midwest	71.6	27.3	72.7
West	74.0	16.8	83.2
Metropolitan area (yes)	75.1	15.5	84.5
Comorbidity scores			
0	76.5	17.7	82.3
1	74.5	16.9	83.1
2	70.6	16.1	83.9
3+	69.8	16.5	83.5
Year of diagnosis			
2007	75.4	17.5	82.5
2008	74.0	16.8	83.2
2009	75.1	17.5	82.5
AJCC tumor stage			
Stage I	71.6	20.1	79.9

	Percentage (%) of patients receiving AET	Percentage (%) of patients receiving tamoxifen	Percentage (%) of patients receiving AIs
Stage II	79.5	14.4	85.6
Stage III	79.1	10.7	89.3
Tumor size (cm)			
<1.0	74.0	18.4	81.6
>=1.0	77.9	14.9	85.1
Unknown size	61.9	23.9	76.1
Number of positive nodes			
0 (node negative)	74.8	18.7	81.3
1+	82.2	12.2	87.9
Unknown	61.1	20.5	79.5
Tumor grade			
Well differentiated	71.2	19.6	80.4
Moderately differentiated	76.9	16.8	83.2
Poorly differentiated	75.3	14.8	85.2
Unknown	73.3	17.8	82.2
Surgery treatment			
No surgery	68.6	11.7	88.3
BCS	74.7	17.7	82.3
Mastectomy	75.4	16.9	83.1
Chemotherapy			
Yes	78.7	10.5	89.5
No	73.8	19.1	80.9
Radiation therapy			
Yes	79.3	15.3	84.7
No	68.9	20.2	79.8
Total	74.8	17.3	82.8

[a]Actual percentages were not reported to avoid $N < 11$ reporting as required by the data-user agreement

Table 3

Time to adjuvant endocrine therapy treatment initiation among those with stages I–III hormone receptor-positive breast cancer receiving endocrine therapy, by month of initiation

	0–3 Months (%)	3–6 Months (%)	6–9 Months (%)	9–12 Months (%)
Race/ethnicity				
Non-Hispanic white	38.9	37.3	15.8	8.0
Non-Hispanic black	37.9	32.6	20.5	9.0
Hispanic (Mexican)	33.3	35.0	24.8	<10.0[a]
Hispanic (South/Central)	39.4	31.8	19.7	<17.0 %[a]
Hispanic (other/unknown)	31.3	36.0	19.3	13.3
Asian	40.5	34.5	16.4	8.6
Age (years)				
65–69	27.9	37.5	21.9	12.8
70–74	32.7	36.8	20.3	10.1
75–79	40.1	38.7	14.3	6.9
80+	37.2	25.3	15.1	11.3
Marital status				
Married	34.3	38.8	17.7	9.2
Unmarried	41.6	35.4	15.3	7.8
Unknown	40.5	33.6	19.5	6.3
SES (% living below poverty)				
First tertile (<5.4 %)	38.1	37.8	16.2	7.8
Second tertile (5.4–11.8 %)	36.5	39.1	16.0	8.5
Third tertile (>11.8 %)	40.9	33.3	17.1	8.7
SEER Cancer Registry region				
Northeast	41.1	36.1	15.6	7.2
South	46.6	31.7	14.6	7.1
Midwest	39.6	35.4	16.1	8.9
West	32.2	40.3	18.0	9.5
Metropolitan area (yes)	37.4	37.5	16.8	8.3
Comorbidity scores				
0	36.2	38.4	17.1	8.3
1	39.2	35.2	16.7	8.8
2	41.8	35.2	14.4	8.6
3+	49.3	31.0	13.4	6.2
Year of diagnosis				
2007	39.6	36.2	17.2	7.0
2008	37.1	37.6	16.7	8.6
2009	38.9	36.3	15.5	9.3
AJCC tumor stage				
Stage I	41.4	41.2	13.2	4.2

	0–3 Months (%)	3–6 Months (%)	6–9 Months (%)	9–12 Months (%)
Stage II	35.4	33.7	19.8	11.1
Stage III	32.9	21.9	23.0	22.3
Tumor size (cm)				
<1.0	39.0	40.1	14.8	6.1
>=1.0	37.3	31.7	19.1	11.9
Unknown size	43.0	37.7	14.1	5.3
Number of positive nodes				
0 (node negative)	39.0	41.5	14.3	5.2
1+	29.8	28.7	23.9	17.6
Unknown	57.2	26.4	11.5	4.9
Tumor grade				
Well differentiated	40.0	40.5	14.0	5.4
Moderately differentiated	38.4	37.4	16.2	8.1
Poorly differentiated	34.6	30.8	21.1	13.5
Unknown	46.8	31.0	14.7	7.4
Surgery treatment				
No surgery	67.8	15.4	12.2	4.7
BCS	34.5	41.3	16.7	7.5
Mastectomy	43.1	30.7	16.4	9.8
Chemotherapy (yes)				
Yes	12.2	22.4	37.1	28.3
No	45.7	40.7	10.8	2.9
Radiation therapy (yes)				
Yes	28.7	40.9	19.8	10.6
No	53.4	30.3	11.3	4.9
Total	38.5	36.7	16.5	8.3

[a]Actual percentages were not reported to avoid $N < 11$ reporting as required by the data-user agreement

Table 4

Multivariable logistic regression for the initiation of adjuvant endocrine therapy among women diagnosed with stages I–III hormone receptor-positive breast cancer

	Initiate any AET		Initiate tamoxifen		Initiate AI	
	AOR	95 % CI[a]	AOR	95 % CI[a]	AOR	95 % CI[a]
Race/ethnicity						
Non-Hispanic white	1		1		1	
Non-Hispanic black	0.87	(0.72–1.04)	0.70	(0.54–0.91)	1.05	(0.89–1.23)
Hispanic (Mexican)	1.38	(0.90–2.13)	0.25	(0.10–0.62)	2.06	(1.34–3.10)
Hispanic (South/Central)	0.91	(0.55–1.50)	0.71	(0.34–1.49)	1.07	(0.68–1.70)
Hispanic (other/unknown)	1.23	(0.97–1.57)	0.97	(0.72–1.29)	1.20	(0.98–1.48)
Asian	1.28	(1.03–1.58)	0.83	(0.63–1.09)	1.33	(1.11–1.61)
Age (years)						
65–69	1		1		1	
70–74	0.93	(0.81–1.06)	1.06	(0.91–1.25)	0.92	(0.82–1.03)
75–79	0.69	(0.60–0.79)	1.10	(0.93–1.30)	0.71	(0.63–0.80)
80+	0.47	(0.41–0.53)	1.13	(0.96–1.33)	0.50	(0.45–0.57)
Marital status						
Married	1		1		1	
Unmarried	0.89	(0.81–0.98)	1.01	(0.90–1.14)	0.91	(0.84–0.99)
Unknown	1.04	(0.82–1.33)	0.78	(0.55–1.07)	1.18	(0.95–1.47)
SES (% living below poverty)						
First tertile (<5.4 %)	1		1		1	
Second tertile (5.4–11.8 %)	1.02	(0.91–1.13)	1.10	(0.96–1.27)	0.96	(0.87–1.06)
Third tertile (>11.8 %)	1.15	(1.02–1.30)	1.28	(1.10–1.49)	0.99	(0.89–1.11)
SEER Cancer Registry Region						
Northeast	1		1		1	
South	0.84	(0.73–0.97)	1.35	(1.11–1.63)	0.77	(0.68–0.87)
Midwest	0.70	(0.59–0.82)	2.09	(1.70–2.56)	0.51	(0.44–0.59)
West	0.69	(0.61–0.78)	1.37	(1.15–1.62)	0.65	(0.58–0.72)
Metropolitan area (yes vs no)	1.08	(0.96–1.23)	0.74	(0.64–0.85)	1.27	(1.14–1.42)

	Initiate any AET		Initiate tamoxifen		Initiate AI	
	AOR	**95 % CI[a]**	**AOR**	**95 % CI[a]**	**AOR**	**95 % CI[a]**
Comorbidity scores						
0	1		1		1	
1	0.95	(0.86–1.05)	0.92	(0.81–1.05)	1.00	(0.91–1.10)
2	0.81	(0.71–0.94)	0.81	(0.67–0.98)	0.94	(0.82–1.06)
3+	0.81	(0.69–0.95)	0.82	(0.66–1.02)	0.92	(0.78–1.07)
Year of diagnosis						
2007	1		1		1	
2008	0.92	(0.83–1.03)	0.94	(0.82–1.08)	0.96	(0.88–1.06)
2009	0.98	(0.89–1.09)	1.00	(0.88–1.14)	0.98	(0.90–1.08)
AJCC tumor stage						
Stage I	1		1		1	
Stage II	1.41	(1.19–1.67)	0.78	(0.62–0.96)	1.50	(1.29–1.75)
Stage III	1.17	(0.90–1.51)	0.66	(0.47–0.94)	1.38	(1.09–1.73)
Tumor size (cm)						
<1.0	1		1		1	
>=1.0	1.04	(0.90–1.21)	1.15	(0.96–1.38)	0.97	(0.85–1.10)
Unknown size	0.56	(0.47–0.67)	1.13	(0.89–1.42)	0.57	(0.48–0.68)
Number of positive nodes						
0 (node negative)	1		1		1	
1+	1.30	(1.10–1.53)	0.99	(0.81–1.22)	1.22	(1.05–1.40)
Unknown	0.74	(0.64–0.85)	0.96	(0.80–1.17)	0.77	(0.67–0.87)
Tumor grade						
Well differentiated	1		1		1	
Moderately differentiated	1.25	(1.13–1.38)	1.03	(0.91–1.16)	1.18	(1.08–1.29)
Poorly differentiated	1.07	(0.94–1.22)	0.99	(0.83–1.17)	1.07	(0.95–1.20)
Unknown	1.13	(0.91–1.40)	1.11	(0.84–1.47)	1.05	(0.86–1.28)
Surgery treatment						
No surgery	1		1		1	
BCS	0.69	(0.53–0.91)	1.69	(1.08–2.63)	0.58	(0.45–0.75)
Mastectomy	0.85	(0.64–1.12)	1.53	(0.98–2.40)	0.73	(0.56–0.95)

	Initiate any AET		Initiate tamoxifen		Initiate AI	
	AOR	95 % CI[a]	AOR	95 % CI[a]	AOR	95 % CI[a]
Chemotherapy (yes vs no)	0.74	(0.65–0.84)	0.65	(0.54–0.77)	0.95	(0.85–1.06)
Radiation therapy (yes vs no)	1.65	(1.48–1.85)	0.86	(0.74–1.00)	1.65	(1.48–1.83)

[a]Adjusted odds ratio (AOR) controlled for all other socio-demographic and tumor characteristics listed in Table 1

Table 5

Multivariable logistic regression by time to initiation of adjuvant endocrine therapy among women diagnosed with stages I–III hormone receptor-positive breast cancer

	0–3 Months		0–6 Months		0–9 Months	
	AOR	**95 % CI[a]**	**AOR**	**95 % CI[a]**	**AOR**	**95 % CI[a]**
Initiate any hormonal therapy[a]						
Race/ethnicity						
Non-Hispanic white	1		1		1	
Non-Hispanic black	0.78	(0.65–0.94)	0.85	(0.72–1.00)	0.92	(0.78–1.10)
Hispanic (Mexican)	1.24	(0.84–1.84)	1.18	(0.82–1.69)	1.56	(1.05–2.32)
Hispanic (South/Central)	1.28	(0.79–2.07)	0.97	(0.62–1.51)	0.97	(0.61–1.54)
Hispanic (other/unknown)	1.04	(0.83–1.30)	1.10	(0.99–1.34)	1.10	(0.89–1.36)
Asian	1.44	(1.18–1.75)	1.23	(1.02–1.48)	1.25	(1.03–1.52)
Initiate tamoxifen therapy[a]						
Race/ethnicity						
Non-Hispanic white	1		1		1	
Non-Hispanic black	0.77	(0.55–1.08)	0.67	(0.50–0.90)	0.72	(0.55–0.93)
Hispanic (Mexican)	0.59	(0.21–1.62)	0.27	(0.10–0.74)	0.28	(0.12–0.70)
Hispanic (South/Central)	0.70	(0.22–2.23)	0.68	(0.29–1.57)	0.79	(0.38–1.65)
Hispanic (other/unknown)	0.71	(0.43–1.18)	0.97	(0.70–1.35)	0.98	(0.72–1.32)
Asian	1.02	(0.69–1.50)	0.86	(0.64–1.17)	0.86	(0.64–1.14)
Initiate AI therapy[a]						
Race/ethnicity						
Non-Hispanic white	1		1		1	
Non-Hispanic black	0.83	(0.68–1.00)	0.98	(0.84–1.15)	1.07	(0.91–1.25)
Hispanic (Mexican)	1.43	(0.95–2.14)	1.57	(1.11–2.23)	2.11	(1.45–3.07)
Hispanic (South/Central)	1.43	(0.87–2.36)	1.10	(0.71–1.70)	1.07	(0.69–1.66)
Hispanic (other/unknown)	1.14	(0.90–1.45)	1.11	(0.91–1.35)	1.11	(0.91–1.35)
Asian	1.50	(1.22–1.84)	1.29	(1.08–1.54)	1.29	(1.08–1.55)

[a]Adjusted odds ratio (AOR) controlled for all other socio-demographic and tumor characteristics listed in Table 1