Published in final edited form as:

Breast Cancer Res Treat. 2013 December ; 142(3): 667–672. doi:10.1007/s10549-013-2759-8.

Assessing racial/ethnic disparities in chemotherapy treatment among breast cancer patients in context of changing treatment guidelines

Abigail Silva¹, Garth H. Rauscher¹, Kent Hoskins², Ruta Rao³, and Carol Estwing Ferrans⁴

¹University of Illinois at Chicago School of Public Health Division of Epidemiology and Biostatistics

²University of Illinois at Chicago College of Medicine Division of Hematology and Oncology

³Rush University Medical Center Division of Medical Oncology

⁴University of Illinois at Chicago College of Nursing

Abstract

Conflicting study results with regards to racial/ethnic disparities in chemotherapy use among breast cancer patients may be due to the different sample populations, treatment data sources, and treatment eligibility definitions used. This study examined chemotherapy disparity in the context of changing treatment guidelines and explored factors that may help explain treatment differences observed.

The data come from a population-based study that included interview and medical record data (including state cancer registry) from non-Hispanic (nH) White, nH Black, and Hispanic breast cancer patients diagnosed in 2005–2008. Logistic regression using model-based standardization was used to estimate age-adjusted risk differences and multivariate analysis was conducted to identify explanatory factors of the differences.

Per the 2005/2006 National Comprehensive Cancer Network (NCCN) guidelines, minority patients appeared more likely than nH White patients to receive a chemotherapy recommendation (0.87 vs 0.75, $p=0.003$). When eligibility was determined per the 2007 guidelines, there was no disparity because under these guidelines, nH White patients were more likely than minority patients to have tumors that no longer required chemotherapy. There was evidence that chemotherapy advances for breast cancer patients are implemented in the clinical setting well ahead of NCCN guidelines. Finally, among eligible patients, chemotherapy recommendation was very high and virtually always accepted and received, with no disparities found at these points of clinical care.

The findings suggest that an evaluation of guideline-adherent chemotherapy treatment patterns must carefully consider the definition of treatment eligibility, given ongoing changes in treatment guidelines and early uptake of new diagnostic tools and treatments.

Introduction

The racial/ethnic disparity in breast cancer mortality may be due, in part to, differences in chemotherapy use [1]. However, it is not entirely clear if there are racial/ethnic disparities in chemotherapy use. Some studies have found that non-Hispanic (nH) Black patients were less likely than nH White patients to receive chemotherapy [2, 3] while others have not found such a disparity [4–6]. In addition, while a recent study revealed that Hispanic women were more likely to receive adjuvant chemotherapy than White women [5], two other studies did not find Hispanic:nH White differences [2, 6]. These conflicting results may be due to the

different sample populations (e.g. hospital- or population-based, treatment eligible) and treatment data sources (e.g. medical records, cancer registry, self-report) used. Furthermore, chemotherapy guidelines have changed dramatically over the last several years and so require attention when estimating treatment underuse. For example, the 2007 guidelines no longer strongly recommend chemotherapy for patients with some lower risk tumors. Including these patients in the chemotherapy-eligible denominator would underestimate the prevalence of guideline-adherent chemotherapy use. Moreover, because nH White patients tend to have lower risk tumors than minority patients [7], they are now also less likely to require chemotherapy. Therefore, attention to the denominator of treatment-eligible patients is required in order to accurately assess racial/ethnic disparities in chemotherapy underuse.

In order to better understand how changes in the treatment guidelines can influence the chemotherapy prevalence observed, this study aimed to: 1) examine chemotherapy treatment recommendation by treatment-eligibility status per 2005/2006 and 2007 guidelines; 2) estimate racial/ethnic-specific rates of guideline-adherent chemotherapy recommendation, acceptance, and initiation in context of the changing treatment guidelines; 3) explore factors that may help explain any differences in treatment observed.

Material and Methods

The primary data came from a population-based study that included 411 African American, 397 nH White, and 181 Hispanic female patients living in Chicago, age 30 to 79 years, who were diagnosed with first in situ or invasive primary breast cancer in 2005–2008. Patients were identified through rapid case ascertainment via the Illinois State Cancer Registry (ISCR). Face-to-face interviews were conducted (in Spanish or English) a median of 3.5 months post-diagnosis. Patients were interviewed on a wide range of topics including psychosocial, health care access, and treatment factors. Most patients (87%) also consented to medical record (MR) abstraction, including linkage with the ISCR. More information on the parent study can be found elsewhere [8].

At interview, patients were asked a series of yes/no questions: “Were you offered chemotherapy as part of the treatment plan, or has a doctor suggested that you need it?; If yes, have you agreed to have chemotherapy?; If yes, have you begun chemotherapy yet?” The MR and ISCR data sources also provided information on chemotherapy recommendation, acceptance, and initiation. Treatment recommendation was coded “yes” if there was evidence of a recommendation in any data source; otherwise, recommendation was coded “no” if there was evidence of no recommendation in any data source. Treatment acceptance and initiation variables were similarly coded.

The National Comprehensive Cancer Network (NCCN) Clinical Practice Guidelines were used to determine chemotherapy eligibility because they are evidence-based and widely used by clinicians and patients to make informed treatment decisions.

Logistic regression using model-based standardization (predictive margins) was employed to estimate age-adjusted racial/ethnic risk differences [9, 10]. Multivariate logistic regression was employed to examine factors that may explain differences in chemotherapy recommendation. Analyses were performed with Stata 12 (Stata Corp., College Station, Texas) and SAS 9.2 (SAS Institute, Cary, North Carolina). Two-sided tests were used to determine statistical significance.

Results

Chemotherapy recommendation by treatment-eligibility status

The 2005/2006 NCCN guidelines strongly recommended chemotherapy for patients with Stage I–II tumors that contained axillary lymph node metastases or for node-negative tumors with primary tumor classification of T1c–T3 (> 1 cm in size). All patients with Stage III cancer should have been offered chemotherapy. However, the 2007 guidelines changed for a subset of patients with large (>1 cm) node-negative tumors. Specifically, chemotherapy became discretionary for patients with ER/PR-positive but HER2-negative tumors.

Table 1 shows that when the 2005/2006 guidelines were used to identify chemotherapy-eligible patients, 425 patients were deemed eligible. However, per the 2007 guidelines, only 261 patients remained eligible. Due to missing HER2 status, the chemotherapy eligibility status became unknown for 55 patients. For the remaining 109 patients, chemotherapy became discretionary.

A closer look at chemotherapy recommendation by tumor characteristics and year of diagnosis revealed an interesting pattern. Among patients who remained chemotherapy-eligible under both sets of guidelines (e.g., node-positive), treatment recommendation was consistently high (83%–100%). Conversely, when a patient's eligibility became discretionary or could not be determined due to changes in the guidelines (e.g., ER/PR-positive and HER2-negative status), treatment recommendation was consistently lower (44%–68%) during all three years.

Racial/ethnic-specific estimates of chemotherapy recommendation, acceptance and initiation

Table 2 presents chemotherapy recommendation, acceptance, and initiation by race/ethnicity. Among patients eligible for chemotherapy per the 2005/2006 guidelines, minority patients were more likely than nH White patients to receive a recommendation (0.87 versus 0.75, RD=0.12, $p=0.003$). Treatment acceptance and initiation were high and no racial/ethnic differences were noted.

Interestingly, when eligibility was determined per the 2007 guidelines, no racial/ethnic differences in recommendation was observed because under the 2007 guidelines only 54% of nH White patients remained chemotherapy-eligible as compared to 65% of minority patients. Once chemotherapy was recommended, virtually all accepted and initiated treatment.

Finally, among the 109 patients for whom chemotherapy became discretionary (i.e., > 1 cm tumor, node-negative, ER/PR-positive, and HER2-negative status), minority patients appear to be more likely than nH White patients to have been offered chemotherapy (0.62 versus 0.41, RD=0.21, $p=0.022$). Additionally, among patients who received a recommendation, one in four patients refused treatment. Non-Hispanic White patients were somewhat more likely to do so than minority patients. However, nH White patients were more likely than minority patients to initiate treatment.

Explaining the racial/ethnic differences in discretionary chemotherapy recommendation

It was suspected that the racial/ethnic difference in discretionary chemotherapy recommendation would be largely explained by tumor differences. Indeed, the multivariate analysis revealed that after accounting for tumor size and grade the minority:nH White risk difference of 0.21 (95% CI=0.02–0.39) to 0.13 (95% CI=–0.05–0.31) (Table 3).

Discussion

Breast cancer treatment is constantly advancing and guidelines must integrate the new evidence on effective treatments [11]. This study sought to examine chemotherapy treatment pattern in the context of changing guidelines. We made four important observations.

First, among patients diagnosed in 2005–2008, the association observed between race/ethnicity and treatment recommendation differed depending on which guideline was used to determine chemotherapy-eligibility. Under the 2005/2006 NCCN guidelines, eligible minority patients appeared more likely than eligible nH White patients to be recommended chemotherapy (0.87 vs 0.75, RD=0.12, $p=0.003$). However, when eligibility was determined per the 2007 guidelines, chemotherapy recommendation was higher and there was no racial/ethnic difference because under these guidelines, chemotherapy became discretionary for patients with >1 cm node-negative tumors that were ER/PR-positive but HER2-negative. Non-Hispanic White patients were more likely than minority patients to have such tumors.

Second, among patients for whom chemotherapy became discretionary, minority patients were more likely than nH White patients to receive a recommendation (0.62 vs 0.41, RD=0.21, $p=0.022$). However, this was largely explained by the fact that larger and higher grade tumors were more common in minority patients. Patients with such unfavorable tumor characteristics generally receive more aggressive treatment [12, 13] and so it appears that minority patients were not necessarily “over-treated” or that nH White patients were “under-treated”.

Third, once chemotherapy was offered, virtually all chemotherapy-eligible patients accepted and received treatment, and thus no disparities were found at this point in clinical care.

Fourth, our study results suggest an early implementation of NCCN guidelines. Consider that the treatment patterns observed among patients for whom chemotherapy became discretionary (>1 cm node-negative tumors with ER/PR-positive but HER2-negative status). Throughout the three main years of the study (2005–2007), treatment recommendation in these patients remained low and constant (44–56%). Clinicians seemingly changed their treatment patterns well ahead of the 2007 guidelines. Also, the role of 21-gene recurrence score (RS) testing cannot be ignored. RS testing predicts the rate of recurrence for breast cancer patients with early stage tumors that are ER-positive and node-negative [14]. Patients are recommended chemotherapy if their tumors are ER-positive but node-negative and have either a high RS (≥ 31) or RS testing was not done. Chemotherapy is considered optional or not recommended if they have an intermediate or low score, respectively. While RS testing was not introduced into the NCCN guidelines until 2008 [15], it was included in the 2007 American Society of Clinical Oncology treatment guidelines [16]. Also, studies show that RS testing was employed in various institutions (e.g. cancer centers, academic hospitals, inner-city hospitals) across the country as early as 2005 [13, 17–20]. An increase in the use of RS testing has resulted in a reduction of chemotherapy among early stage ER-positive patients [13, 18, 19]. Our study population came from Chicago, home to two NCI-designated cancer centers as well as several academic and community cancer centers. Therefore, it is likely that RS testing was implemented on some level during the study period. This provides further indirect evidence that, among patients for whom chemotherapy became discretionary, minority patients were not necessarily more likely than nH White patients to be over-treated as they had tumors with characteristics often associated with higher RS scores, thus making them treatment-eligible [20–23]. Conversely, nH White breast cancer patients have tumors with more favorable features usually associated with lower RS scores, thus making them less likely to require chemotherapy [24].

We assessed chemotherapy recommendation only among patients for whom treatment was strongly recommended because we were primarily concerned with treatment underuse. A number of prior studies adjusted their models to include tumor characteristics rather than restricting their sample to treatment-eligible patients, thereby including data from non-eligible patients in their estimates of adjuvant treatment [5, 25–26]. Other studies that restricted their sample to treatment-eligible patients were conducted during a period when guidelines did not change [2–3, 6]. One study that was conducted during a transition in guidelines incorporated changes in guidelines into their definition of treatment eligibility [27]; in doing so, it was not possible to examine the effect of guideline changes on observed associations.

Our findings can be compared to that of Neugut and colleagues [4] who examined chemotherapy non-initiation among patients diagnosed between 2006 and 2010. While they used the 2006 NCCN guidelines to determine treatment eligibility, they acknowledged the change in treatment recommendations during their study period and included year of diagnosis in the multivariate model as part of a sensitivity analysis. They did not report a racial/ethnic disparity among patients for whom treatment was clearly indicated. However, they did find that patients with HER2-negative tumors were less likely than those with HER2-positive tumors to receive chemotherapy. This may have been because under more recent guidelines, some of these patients would actually be ineligible for chemotherapy. In a population-based study of breast cancer patients diagnosed between 2005 and 2007, Griggs et al found that compared to nH White patients, Hispanic patients were more likely to receive chemotherapy [5]. While their results were adjusted for stage, grade, and ER/PR-receptor status, they did not adjust for HER2 status. The authors acknowledged that the absence of HER2 status limited their ability to adequately explain their findings.

This study has some limitations. For instance, given our small sample of Hispanic patients, we could not adequately assess differences across the three racial/ethnic groups. However, we did not find any differences between Hispanic and nH Black patients in terms of surgery type, tumor size, grade, node-status, ER/PR-status, and chemotherapy recommendation. Therefore, the results would probably not differ between Hispanic and nH Black patients. In addition, we did not have detailed information on chemotherapy quality so we cannot address possible disparities in treatment quality or completion as others have shown [28, 29]. Finally, the interview response rate was 56% (proportion interviewed among total estimated eligible sample) and so selection bias cannot be ruled out.

Our study has strengths worth noting. First, by using a sociodemographically diverse sample of patients from a population-based study, our findings may be generalizable to an urban population of US breast cancer patients. Second, unlike many studies which use administrative datasets, we had access to self-reported race/ethnicity and so there was no concern about misclassification. Finally, we used self-reports, medical records, and cancer registry information to ascertain chemotherapy treatment. Therefore, the possibility of treatment underascertainment is low.

In summary, our study findings suggest that an evaluation of guideline-adherent chemotherapy patterns, including the assessment of racial/ethnic disparities, must carefully consider how to best define treatment eligibility given the ongoing changes in treatment guidelines and the advent of more personalized medicine [30]. We must also remain vigilant about possible disparities in the uptake of new chemotherapy advances. For instance, some have already noted that among eligible patients, RS testing was lower for nH Black patients, lower-educated patients, and patients of public or community hospitals [17, 20]. If not all patients are benefitting equally from improved diagnostic testing, disparities in outcomes and quality of life may result.

Acknowledgments

This work was funded by the National Cancer Institute (2P50CA106743) to the University of Illinois at Chicago Center for Population Health and Health Disparities. In addition, training support was received from the National Cancer Institute Cancer Education and Career Development Grant (5R25 CA057699) and the Susan G. Komen for the Cure Post-Baccalaureate Training in Disparities Research Grant (KG111385) which were awarded to the University of Illinois at Chicago.

References

1. van Ravesteyn NT, Schechter CB, Near AM, Heijnsdijk EA, Stoto MA, Draisma G, de Koning HJ, Mandelblatt JS. Race-specific impact of natural history, mammography screening, and adjuvant treatment on breast cancer mortality rates in the United States. *Cancer Epidemiol Biomarkers Prev*. 2011; 20(1):112–122. [PubMed: 21119071]
2. 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(1):180–189. [PubMed: 20939011]
3. Bickell NA, Wang JJ, Oluwole S, Schrag D, Godfrey H, Hiotis K, Mendez J, Guth AA. Missed opportunities: racial disparities in adjuvant breast cancer treatment. *J Clin Oncol*. 2006; 24(9):1357–1362. [PubMed: 16549830]
4. Neugut AI, Hillyer GC, Kushi LH, Lamerato L, Leoce N, Nathanson SD, Ambrosone CB, Bovbjerg DH, Mandelblatt JS, Magai C, et al. Noninitiation of adjuvant chemotherapy in women with localized breast cancer: the breast cancer quality of care study. *J Clin Oncol*. 2012; 30(31):3800–3809. [PubMed: 23008305]
5. Griggs JJ, Hawley ST, Graff JJ, Hamilton AS, Jagsi R, Janz NK, Mujahid MS, Friese CR, Salem B, Abrahamse PH, et al. Factors associated with receipt of breast cancer adjuvant chemotherapy in a diverse population-based sample. *J Clin Oncol*. 2012; 30(25):3058–3064. [PubMed: 22869890]
6. Wu XC, Lund MJ, Kimmick GG, Richardson LC, Sabatino SA, Chen VW, Fleming ST, Morris CR, Huang B, Trentham-Dietz A, et al. Influence of race, insurance, socioeconomic status, and hospital type on receipt of guideline-concordant adjuvant systemic therapy for locoregional breast cancers. *J Clin Oncol*. 2012; 30(2):142–150. [PubMed: 22147735]
7. Elledge RM, Clark GM, Chamness GC, Osborne CK. Tumor biologic factors and breast cancer prognosis among white, Hispanic, and black women in the United States. *J Natl Cancer Inst*. 1994; 86(9):705–712. [PubMed: 7908990]
8. Rauscher GH, Ferrans CE, Kaiser K, Campbell RT, Calhoun EE, Warnecke RB. Misconceptions about breast lumps and delayed medical presentation in urban breast cancer patients. *Cancer Epidemiol Biomarkers Prev*. 2010; 19(3):640–647. [PubMed: 20200436]
9. Localio AR, Margolis DJ, Berlin JA. Relative risks and confidence intervals were easily computed indirectly from multivariable logistic regression. *J Clin Epidemiol*. 2007; 60(9):874–882. [PubMed: 17689803]
10. Ahern J, Hubbard A, Galea S. Estimating the effects of potential public health interventions on population disease burden: a step-by-step illustration of causal inference methods. *Am J Epidemiol*. 2009; 169(9):1140–1147. [PubMed: 19270051]
11. Llombart-Cussac A. Improving decision-making in early breast cancer: who to treat and how? *Breast Cancer Res Treat*. 2008; 112(Suppl 1):15–24. [PubMed: 19082929]
12. Kurian AW, Lichtensztajn DY, Keegan TH, Leung RW, Shema SJ, Hershman DL, Kushi LH, Habel LA, Kolevska T, Caan BJ, et al. Patterns and predictors of breast cancer chemotherapy use in Kaiser Permanente Northern California: 2004–2007. *Breast Cancer Res Treat*. 2013; 137(1):247–260. [PubMed: 23139057]
13. Ademuyiwa FO, Miller A, O'Connor T, Edge SB, Thorat MA, Sledge GW, Levine E, Badve S. The effects of oncotype DX recurrence scores on chemotherapy utilization in a multi-institutional breast cancer cohort. *Breast Cancer Res Treat*. 2011; 126(3):797–802. [PubMed: 21197567]
14. Paik S. Development and clinical utility of a 21-gene recurrence score prognostic assay in patients with early breast cancer treated with tamoxifen. *Oncologist*. 2007; 12(6):631–635. [PubMed: 17602054]

15. NCCN. NCCN Clinical practice guidelines for breast cancer. Network NCC. 2008
16. Harris L, Fritsche H, Mennel R, Norton L, Ravdin P, Taube S, Somerfield MR, Hayes DF, Bast RC Jr. American Society of Clinical Oncology 2007 update of recommendations for the use of tumor markers in breast cancer. *J Clin Oncol*. 2007; 25(33):5287–5312. [PubMed: 17954709]
17. Hassett MJ, Silver SM, Hughes ME, Blayney DW, Edge SB, Herman JG, Hudis CA, Marcom PK, Pettinga JE, Share D, et al. Adoption of gene expression profile testing and association with use of chemotherapy among women with breast cancer. *J Clin Oncol*. 2012; 30(18):2218–2226. [PubMed: 22585699]
18. Malo TL, Lipkus I, Wilson T, Han HS, Acs G, Vadaparampil ST. Treatment Choices Based on OncotypeDx in the Breast Oncology Care Setting. *J Cancer Epidemiol*. 2012; 2012:941495. [PubMed: 22927848]
19. Partin JF, Mamounas EP. Impact of the 21-gene recurrence score assay compared with standard clinicopathologic guidelines in adjuvant therapy selection for node-negative, estrogen receptor-positive breast cancer. *Ann Surg Oncol*. 2011; 18(12):3399–3406. [PubMed: 21537874]
20. Lund MJ, Mosunjac M, Davis KM, Gabram-Mendola S, Rizzo M, Bumpers HL, Hearn S, Zelnak A, Styblo T, O'Regan RM. 21-Gene recurrence scores: racial differences in testing, scores, treatment, and outcome. *Cancer*. 2012; 118(3):788–796. [PubMed: 21720988]
21. Ooi SL, Martinez ME, Li CI. Disparities in breast cancer characteristics and outcomes by race/ethnicity. *Breast Cancer Res Treat*. 2011; 127(3):729–738. [PubMed: 21076864]
22. Banegas MP, Li CI. Breast cancer characteristics and outcomes among Hispanic Black and Hispanic White women. *Breast Cancer Res Treat*. 2012; 134(3):1297–1304. [PubMed: 22772379]
23. Geradts J, Bean SM, Bentley RC, Barry WT. The oncotype DX recurrence score is correlated with a composite index including routinely reported pathobiologic features. *Cancer Invest*. 2010; 28(9):969–977. [PubMed: 20873988]
24. Lund MJ, Brawley OP, Ward KC, Young JL, Gabram SS, Eley JW. Parity and disparity in first course treatment of invasive breast cancer. *Breast Cancer Res Treat*. 2008; 109(3):545–557. [PubMed: 17659438]
25. Du XL, Key CR, Osborne C, Mahnken JD, Goodwin JS. Discrepancy between consensus recommendations and actual community use of adjuvant chemotherapy in women with breast cancer. *Ann Intern Med*. 2003; 138(2):90–97. [PubMed: 12529090]
26. Harlan LC, Abrams J, Warren JL, Clegg L, Stevens J, Ballard-Barbash R. Adjuvant therapy for breast cancer: practice patterns of community physicians. *J Clin Oncol*. 2002; 20(7):1809–1817. [PubMed: 11919238]
27. Giordano SH, Hortobagyi GN, Kau SW, Theriault RL, Bondy ML. Breast cancer treatment guidelines in older women. *J Clin Oncol*. 2005; 23(4):783–791. [PubMed: 15681522]
28. Hershman DL, Unger JM, Barlow WE, Hutchins LF, Martino S, Osborne CK, Livingston RB, Albain KS. Treatment quality and outcomes of African American versus white breast cancer patients: retrospective analysis of Southwest Oncology studies S8814/S8897. *J Clin Oncol*. 2009; 27(13):2157–2162. [PubMed: 19307504]
29. Griggs JJ, Sorbero ME, Lyman GH. Undertreatment of obese women receiving breast cancer chemotherapy. *Arch Intern Med*. 2005; 165(11):1267–1273. [PubMed: 15956006]
30. Ellsworth RE, Decewicz DJ, Shriver CD, Ellsworth DL. Breast cancer in the personal genomics era. *Curr Genomics*. 2010; 11(3):146–161. [PubMed: 21037853]

Proportion of patients who received a chemotherapy treatment recommendation by tumor characteristics and year of diagnosis

TABLE 1

Chemotherapy eligibility ^a		Year of Diagnosis			
2005/2006	2007	Stage I-II Tumors		n	2005 2006 2007
Yes	Yes	- with node-positive status		112	1.00 0.94 0.96
Yes	Yes	- >1 cm with node-negative and ER/PR receptor-negative status		51	1.00 1.00 1.00
Yes	Yes	- >1 cm with node-negative, ER/PR receptor-positive, and HER2 receptor-positive status		15	1.00 0.83 1.00
Yes	Discretionary	- >1 cm with node-negative, ER/PR receptor-positive, and HER2 receptor-negative status		109	0.56 0.54 0.44
Yes	Undetermined	- with node-negative status and unknown ER/PR or HER2 receptor status		55	0.68 0.63 0.66
		Stage III Tumors			
Yes	Yes	- all		83	1.00 0.97 1.00

^aExcludes tumors with favorable (tubular or colloid) histology and patients age>70

TABLE 2

Age-adjusted proportions (p) and risk differences (using model-based standardization) in chemotherapy treatment by minority status

<i>Chemotherapy eligibility per 2005/2006 guidelines^a</i>						
	All	Minority	nH White	Risk difference	95% CI	p-value
Chemotherapy recommended	p 0.82 (425)	0.87 (268)	0.75 (157)	0.12	0.04-0.19	0.003
Chemotherapy accepted (among recommended)	p 0.94 (349)	0.95 (233)	0.92 (116)	0.03	-0.03-0.08	0.339
Chemotherapy initiated (among accepted)	p 0.97 (327)	0.97 (221)	0.97 (106)	0.00	-0.03-0.04	0.871
<i>Chemotherapy eligibility per 2007 guidelines^b</i>						
	All	Minority	nH White	Risk difference	95% CI	p-value
Chemotherapy recommended	p 0.98 (261)	0.98 (174)	0.98 (87)	0.00	-0.03-0.04	0.993
Chemotherapy accepted (among recommended)	p 0.98 (255)	0.98 (170)	0.99 (85)	0.01	-0.01-0.04	0.432
Chemotherapy initiated (among accepted)	p 0.99 (250)	0.99 (166)	0.99 (84)	0.00	-0.01-0.03	0.996
<i>Chemotherapy discretionary per 2007 guidelines^c</i>						
	All	Minority	nH White	Risk difference	95% CI	p-value
Chemotherapy recommended	p 0.52 (109)	0.62 (57)	0.41 (52)	0.21	0.02-0.38	0.022
Chemotherapy accepted (among recommended)	p 0.76 (56)	0.81 (36)	0.68 (20)	0.13	-0.13-0.34	0.280
Chemotherapy initiated (among accepted)	p 0.91 (43)	0.86 (29)	1.00 (14)	0.14	--	--

^a includes patients with Stage I-II tumors that are node-positive or node-negative but > 1 cm, as well as those Stage III tumors

^b includes same patients as above except those with Stage I-II tumors > 1 cm, node-negative, ER/PR-positive, and HER2-negative status and those with Stage I-II, node-negative status but unknown ER/PR or HER2 status

^c includes patients with Stage I-II tumors > 1 cm, node-negative, ER/PR-positive, and HER2-negative status

TABLE 3

Proportions and risk differences in discretionary chemotherapy recommendation^a logistic regression with model-based standardization

	Adjusted for age	Adjusted for age, tumor size, and grade
<i>Race/Ethnicity</i>		
Minority	0.62	0.57
nH White	0.41	0.44
Risk difference	0.21 *	0.13
95% CI	0.02–0.39	–0.05–0.31
<i>Tumor size</i>		
<2 cm		0.42
≥2cm		0.69
Risk difference		0.27 **
95% CI		0.09–0.48
<i>Tumor Grade</i>		
Low		0.39
Moderate-high		0.57
Risk difference		0.17
95% CI		–0.02–0.40
n	109	107

*
p<0.05,

**
p<0.01

^a includes patients with tumors > 1 cm, node-negative, ER/PR-positive, and HER2-negative status