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ARTICLE

Race and Ethnicity and Breast Cancer Outcomes in an Underinsured Population

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Background The disparity in breast cancer mortality between African American women and non-Hispanic white women has been the subject of increased scrutiny. Few studies have addressed these differences in the setting of equal access to health care. We compared the breast cancer outcomes of underinsured African American and non-Hispanic white patients who were treated at a single institution.

Methods We conducted a retrospective review of medical records for breast cancer patients who were treated at Wishard Memorial Hospital from January 1, 1997, to February 28, 2006. A total of 574 patients (259 non-Hispanic whites and 315 African Americans) were evaluated. A Cox proportional hazards regression analysis for competing risks was performed. All statistical tests were two-sided.

Results Sociodemographic characteristics were similar in the two groups, and both racial groups were equally unlikely to have undergone screening mammography during the 2 years before diagnosis. Most (84%) of the patients were underinsured. The median time from diagnosis to operation, receipt of adequate surgery, and use of all types of adjuvant therapy were similar in the two groups. Median follow-up was 80.3 months for non-Hispanic whites and 77.9 months for African Americans. After accounting for the effect of comorbidities, African American race was statistically significantly associated with breast cancer–specific mortality (African Americans vs non-Hispanic whites: 26.0% vs 17.5%, $P = .028$; hazard ratio [HR] of death = 1.64, 95% confidence interval [CI] = 1.06 to 2.55). Adjustment for age at diagnosis, clinical stage, and hormone receptor status attenuated the effect, and the effect of race on breast cancer–specific survival was no longer statistically significant (HR of death from breast cancer = 1.43, 95% CI = 0.89 to 2.30). After adjustment for sociodemographic factors, the hazard ratio for race was further attenuated (HR = 1.26; 95% CI = 0.79 to 2.00).

Conclusions In this underinsured population, African American patients had poorer breast cancer–specific survival than non-Hispanic white patients. After adjustment for clinical and sociodemographic factors, the effect of race on survival was no longer statistically significant.

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The disparity in breast cancer mortality between African American and non-Hispanic white women has been the subject of increased scrutiny (1–7). Initial studies found that African American women had poorer overall survival than non-Hispanic white women. Results of epidemiological studies implicate a number of factors that might explain these differences: Sociodemographic variables, including income, education level, and inadequate access to health care are now recognized as major contributors to disparities in survival between these groups. Barriers to health-care access that result in underutilization of breast cancer screening, delays in diagnosis and treatment, and a later stage at diagnosis also contribute to these differences between racial and ethnic groups (2,5,7–10). A lower rate of adequate surgical treatment and a lower proportion of patients receiving adjuvant therapy among African American patients have been reported and may also contribute to the differences in survival (6,11,12). Behavioral and cultural differences between racial and ethnic groups have also been implicated in survival disparities (3,13). More recently, racial and ethnic differences in the susceptibility to more aggressive tumor subtypes have been identified in African American and non-Hispanic white women. For example, African American women have a higher incidence of new breast cancer diagnoses before the age of 45 years compared with non-Hispanic white women (4,14,15). In addition, compared with non-Hispanic white women, African American women have a higher incidence of hormone receptor–negative and triple-negative (ie, hormone receptor–negative and nonoverexpression of the Her2-neu [ERBB2] receptor by immunohistochemistry or lack of amplification of *HER2* by fluorescence in situ hybridization) basaloid breast cancers (4,16,17).

Most of the studies that have examined these racial and ethnic differences have done so using patient populations from diverse geographic locations at different types of institutions with different

treating physicians (1–3,5,6,13,15,16). Furthermore, previous studies that have compared African American patients with non-Hispanic white patients have reported that these groups have dissimilar socioeconomic backgrounds, regardless of the method that was used to determine socioeconomic status (3). Four studies have addressed differences between racial and ethnic groups in breast cancer outcomes in a setting of equal access to health care (18–21). Two studies that were conducted within the United States Department of Defense health care system found that the African American patients had worse survival than their non-Hispanic white counterparts, even though all patients were treated in the same equal access setting (18,19). Another study that examined differences in outcomes among breast cancer patients enrolled at a metropolitan health maintenance organization (HMO) found that compared with European American women, African American women were at increased risk for death (20). However, after adjustment for stage of disease and sociodemographic factors, the hazard ratio (HR) of death for African American women was 1.0 (95% confidence interval [CI] = 0.7 to 1.5) (20). More recently, the Cancer Research Network, a consortium of research groups that includes the databases of 11 integrated health-care member organizations of the HMO Research Network, found that after adjustment for typical clinical variables, the African American women in this network had increased risks of death compared with the non-Hispanic white women (21).

Of the four studies that were based on equal access health-care systems (18–21), only one (20) controlled for sociodemographic factors other than age and none involved an uninsured or underinsured patient population. The objective of this study was to examine breast cancer outcomes in uninsured or underinsured African American and non-Hispanic white patients with comparable sociodemographic and access-to-health-care limitations who were treated at the same institution and by the same physicians.

CONTEXT AND CAVEATS

Prior knowledge

African American women have worse breast cancer outcomes compared with non-Hispanic white women. Most studies that have examined these racial and ethnic differences have used patient populations from diverse geographic locations at different types of institutions with different treating physicians, few have controlled for sociodemographic factors other than age, and none involved an uninsured or underinsured patient population.

Study design

Retrospective review of medical records for 574 breast cancer patients treated at a single institution and comparison of breast cancer outcomes of underinsured African American and non-Hispanic white patients with comparable sociodemographic and access-to-health-care characteristics who were treated at the same institution and by the same physicians.

Contribution

There was no difference in breast cancer–free survival between the African American and non-Hispanic white women. However, African American women had worse overall survival compared with non-Hispanic white women. After accounting for competing causes of death, African American women had a higher risk of death from breast cancer compared with non-Hispanic white women. After adjustment for clinical and sociodemographic factors, this increased risk was reduced and no longer statistically significant. The African American women presented with a more advanced clinical stage of breast cancer compared with the non-Hispanic white population, even though both populations were equally unlikely to use screening mammography in the 2 years before their cancer diagnosis.

Implications

Differences in clinical and sociodemographic factors between African American and non-Hispanic white breast cancer patients contribute to the disparities in survival.

Limitations

All data were collected retrospectively. The sample size in this single-institution study was small. The survival analysis assumed that patient censoring was not related to breast cancer death.

From the Editors

Methods

Study Population

The study population was drawn from patients who were treated at Wishard Memorial Hospital, a hospital in Marion County that is affiliated with the Indiana University School of Medicine in Indianapolis, IN; it is the sixth largest public safety net hospital in the United States (22). Wishard Memorial Hospital serves a predominantly underinsured patient population that comprises similar numbers of African American and non-Hispanic white patients. In this study, underinsured patients were considered as all patients without commercial insurance or HMO coverage. In the state of Indiana, these patients are covered by Medicare, Medicaid, and the Wishard Advantage assistance program. Self-pay or charity care patients were considered to be uninsured and were also included in the underinsured patient population in this study. Wishard Advantage is Wishard Memorial Hospital's charity care assistance program, which is designed to provide coordinated care for uninsured individuals. Sociodemographic variables such as race and ethnicity, highest level of education completed, employment status, and household income were self-reported by the patients at registration or in their medical history. Institutional review board approval was obtained from Indiana University and Purdue University Indianapolis and Clarian Health before the start of the study.

Collection of Patient Data and Outcomes

We performed a retrospective medical record review for all patients who were treated at Wishard Memorial Hospital for a primary breast cancer from January 1, 1997, to February 28, 2006. The patients were identified based on having "breast cancer" as a diagnosis or by *International Classification of Diseases, Ninth Revision* code 174.x (23). A total of 970 patients were initially identified. Exclusion criteria were all patients who had their primary operation for breast cancer before January 1, 1997, and for patients who did not receive surgical care, those who were diagnosed before January 1, 1997. In addition, we excluded all patients who had their primary surgical care for breast cancer at an institution other than

Wishard Memorial Hospital, male breast cancer patients, and patients who did not self-identify as African American or non-Hispanic white. A total of 574 patients were eligible for evaluation. Sociodemographic variables, clinical characteristics, treatment received, and clinical outcomes were extracted from medical records and analyzed. Positive Her2-neu status was defined as an immunohistochemistry score of 3+ or evidence of amplification by fluorescence in situ hybridization (24). In defining margin status for breast-conserving operations, a positive (transected) margin was indicated by microscopic evidence of tumor touching an inked margin. A close margin was defined as tumor within 1 mm of an inked margin. Patients received their care and clinic visits at Wishard Memorial Hospital. Patients who missed appointments were contacted by clinic staff to reschedule appointments. If an event (ie, death and recurrence) occurred, it was noted in the patient's chart along with the date of occurrence. For patients who were lost to follow-up, the last date of contact was the end of follow-up.

Statistical Analysis

The study population was classified into two groups, African American and non-Hispanic whites. Fisher exact test for independence was used to examine differences in the categorical sociodemographic characteristics, use of screening mammography, cigarette smoking status, and clinical characteristics and tumor markers between the two patient groups. Insurance status was considered as a categorical variable and was classified as commercial insurance vs underinsured or uninsured. Patients covered by Medicare, Medicaid, or Wishard Advantage were considered to be underinsured because there are several limitations to the coverage provided by these programs despite the fact that each helps to cover costs of cancer-related treatments. Wishard Memorial Hospital is the only institution where Wishard Advantage is accepted. Furthermore, although all institutions in the United States must accept Medicare and Medicaid, many physicians do not accept either form of coverage, therefore limiting the choice of physicians, and indirectly, the choice of some institutions for these patients. A national survey by Hing and Burt (25) showed that many physicians do not accept underinsured patients. The categorization of health insurance used in this study was based on evidence from Ward et al. (26) and Halpern et al. (27) that showed that patients with Medicare and Medicaid have results that differ from those of patients with private insurance and in some cases have results that track more closely with those of uninsured patients. A binary indicator was created to indicate each patient's employment status (employed vs unemployed, disabled, or retired). Unpaired (two-sample) *t* tests were used to compare mean values of the continuous sociodemographic characteristics (ie, age, body mass index, and weight) for the two populations. American Joint Committee on Cancer clinical stage (28) was treated as a continuous variable to reflect the ordinal nature of the variable. All statistical tests were two-sided, and a *P* less than or equal to .05 was considered statistically significant.

Survival analysis techniques were used to compare disease-free interval, overall survival, and breast cancer–specific survival between the African American and non-Hispanic white populations. Overall survival time was calculated from the date of diagnosis to the date of death from any cause. Disease-free interval was the time interval from diagnosis to locoregional recurrence, distant recurrence, or death from any cause, whichever occurred first. The Kaplan–Meier method was used to construct curves for 7-year disease-free survival and overall survival. Log-rank tests were used to compare unadjusted overall survival curves between the two racial and ethnic groups. Conventional Cox proportional hazards regression analysis was used to assess the effect of confounding variables such as age, employment status, insurance status, and clinical stage on the association between race and ethnicity and overall survival. Breast cancer–specific survival examines the chance that an individual has survived breast cancer since diagnosis; deaths from other causes are not considered as death from breast cancer and are treated as competing risks when estimating breast cancer–specific survival. Hence, breast cancer–specific survival could be subject to comorbidity. In this study, proportional hazards regression for competing risks (29) was performed to adjust for comorbidities that compete with death from breast cancer in the analysis of breast cancer–specific survival and used to derive 10-year breast cancer–specific mortality cumulative incidence rates. Factors that were considered in the final competing risk proportional hazard models include those that were statistically significantly associated with race and ethnicity and with breast cancer–specific survival. Employment status was retained in the final model because it was highly associated with income ($P < .001$) and its inclusion resulted in a more parsimonious model. R statistical software (R Foundation for Statistical Computing, Vienna, Austria) was used to perform the conventional Cox proportional hazards model and to fit a competing risk proportional hazards model. Graphical, goodness-of-fit, and time-dependent variable approaches were used to confirm the assumptions of proportionality.

Results

Sociodemographic information for the two populations is displayed in Table 1. There was no statistically significant difference between the two groups in the age distribution at diagnosis. However, there was a slightly higher proportion of women who were younger than 40 years at diagnosis in the African American group compared with the non-Hispanic white group (13% vs 9%). The two groups did not differ statistically significantly with regard to highest level of education completed, employment status, or type of insurance. A higher proportion of the non-Hispanic white patients were employed compared with the African American patients (23% vs 16%). The non-Hispanic white patients were more likely than the African American patients to have commercial insurance (19% vs 14%) or to have no insurance (13% vs 8%) (Table 1). More than 75% of the patients in both groups who reported their approximate household income earned less than $18 000 per year. African American patients and non-Hispanic white patients aged 40 years or older were equally unlikely to have undergone screening mammography during the 2 years before their diagnosis (51% vs 56%, respectively). Non-Hispanic white women were statistically significantly more likely to be smokers ($P = .02$), whereas African American women had a higher mean body mass index (African Americans vs non-Hispanic whites: 32.6 vs 30.4 kg/m^2, $P = .03$).

Table 1. Sociodemographic characteristics, screening mammography, cigarette smoking, and body mass index (BMI) of the study population by race and ethnicity

Characteristic	Non-Hispanic whites (N = 259)	African Americans (N = 315)	P*
Age at diagnosis, y			
Median (range)	57 (26–85)	57 (23–97)	.37
Mean (SD)	56.5 (12.1)	57.5 (14.6)	
<40, No. (%)	24 (9)	42 (13)	
40–49, No. (%)	55 (21)	52 (17)	.20
50–59, No. (%)	75 (30)	79 (25)	
60–69, No. (%)	64 (25)	79 (25)	
≥70, No. (%)	41 (16)	63 (20)	
Mean weight at diagnosis, kg (SD)	78.6 (20.5)	83.5 (24.2)	.01
Mean BMI at diagnosis, kg/m^2 (SD)	30.4 (8.0)	32.6 (8.7)	.03
Education level, No. (%)			.64
College	33 (17)	34 (14)	
High school graduate	64 (33)	94 (38)	
Some high school	86 (44)	105 (42)	
Less than high school	12 (6)	17 (7)	
Missing	64	65	
Employment status, No. (%)			.07
Employed	59 (23)	52 (17)	
Unemployed	129 (50)	153 (49)	
Retired or disabled	71 (27)	110 (35)	
Annual household income, No. (%)			.04
>$45 000	13 (7)	6 (2)	
$18 000–$45 000	34 (17)	38 (15)	
<$18 000	149 (76)	204 (82)	
Missing	65	67	
Type of insurance, No. (%)			.11
Commercial	49 (19)	44 (14)	
Medicare	96 (37)	142 (45)	
Medicaid	32 (12)	58 (15)	
Wishard Advantage	49 (19)	46 (15)	
None	33 (13)	25 (8)	
Screening mammogram during the 2 years before diagnosis†			.18
Yes	105 (44)	139 (49)	
No	135 (56)	141 (51)	
Current cigarette smoker			.02
Yes	115 (66)	114 (55)	
No	58 (34)	94 (46)	

* Derived from Fisher exact test for categorical variables or from a two-sample *t* test for continuous variables (both tests were two-sided).

† Includes patients aged 40 years or older.

African American patients presented with more advanced clinical stage disease compared with non-Hispanic white patients, despite the similar age at diagnosis and similar use of screening mammography in the two groups (Table 2). Compared with non-Hispanic white women, African American women were more likely to present with tumors that were estrogen receptor (ER) negative (41% vs 31%), progesterone receptor (PR) negative (56% vs 44%), and triple negative (basaloid subtype, ER and PR negative, and Her2-neu receptor negative or normal: 32% vs 19%) (Table 2).

The median time between diagnosis and operation for breast cancer for non-Hispanic white and African American women was 38 days (range = 7–200 days) and 39 days (range = 6–474 days), respectively (Table 3). Compared with non-Hispanic white patients, African American patients were more likely to undergo a breast-conserving procedure for stage 0 (noninvasive) cancers (87% vs 69%, $P = .04$) and for clinical stage II invasive cancers (59% vs 40%, $P = .05$). For clinical stage 0–II breast cancer overall, more African American patients underwent breast-conserving procedures than non-Hispanic white (72% vs 61%, $P = .02$). The rates of positive (transected) or close (<1 mm) margins and the need for re-excision lumpectomy were similar in the two groups (Table 3). All patients who underwent breast-conserving procedures had margins that were microscopically tumor-free at final operation. The use of all types of adjuvant therapies was not statistically significantly different between the African American and non-Hispanic white groups (Table 4). The use of adjuvant chemotherapy was slightly higher in African American patients compared with non-Hispanic white patients (78% vs 70%). The use of hormonal therapy did not differ between the two groups (62% vs 65%), and the use of adjuvant radiation therapy was also similar (80% vs 76%).

The median follow-up time was 80.3 months for non-Hispanic whites (range = 0.3–136 months) and 77.9 months for African Americans (range = 0.5–137 months). There were more recurrences overall among the African Americans than among the

Table 2. Breast cancer clinical characteristics and tumor marker status by race and ethnicity*

Characteristic	Non-Hispanic whites (N = 259)	African Americans (N = 315)	P†
AJCC clinical stage, No. (%)			.008
0	42 (16)	61 (19)	
I	110 (42)	92 (29)	
II	59 (23)	77 (24)	
III	32 (12)	65 (21)	
IV	16 (6)	20 (6)	
Predominant histology, No. (%)			.88
Ductal	169 (88)	178 (89)	
Lobular	23 (12)	23 (11)	
Other	1 (0.5)	0 (0)	
AJCC pathological stage, No. (%)			.82
0/pathological complete response	49 (21)	70 (26)	
I	104 (44)	97 (36)	
II	57 (24)	64 (24)	
III	27 (11)	38 (14)	
IV	0 (0)	2 (1)	
Estrogen receptor status, No. (%)			.02
Positive	152 (69)	159 (59)	
Negative	67 (31)	110 (41)	
Missing	40	46	
Progesterone receptor status, No. (%)			.04
Positive	75 (56)	73 (44)	
Negative	58 (44)	92 (56)	
Missing	126	150	
Her 2/neu positive, No. (%)‡			.20
Yes	38 (30)	54 (37)	
No	90 (70)	91 (63)	
Missing	131	170	
Triple negative, no. (%)	25 (19)	43 (32)	.05
Missing	131	170	

* AJCC = American Joint Committee on Cancer.

† Derived from a Fisher exact test (two-sided).

‡ Positivity defined as immunohistochemistry 3+ or amplified by fluorescence in situ hybridization.

non-Hispanic whites (70 vs 49). This difference appeared to reflect the higher number of distant recurrences as a first event in the African American patients vs the non-Hispanic white patients (43 vs 23). There were similar numbers of locoregional recurrences as first events in the two groups (27 vs 26). Seven-year breast cancer–free survival was 69.7% for non-Hispanic white patients and 64.7% for African American patients; however, the difference was not statistically significant (P = .17, log-rank test). The 7-year overall survival was statistically significantly higher for the non-Hispanic white patients than for the African American patients (75.4% vs 69.2%, P = .048) (Figure 1). In a univariate analysis, clinical stage (P < .001) and age at diagnosis (P = .03) were statistically significantly associated with overall survival. ER status was also statistically significantly associated with overall survival (P = .042). In multivariable Cox proportional hazards models that included clinical stage and age at diagnosis, race remained statistically significantly associated with overall survival (HR of death = 1.39, 95% CI = 1.00 to 1.92, P = .05). When ER status was included in the multivariable model, the hazard ratio was decreased and race was no longer statistically significantly associated with overall survival (HR of death = 1.37, 95% CI = 0.96 to 1.96, P = .08).

Proportionately more African American patients than non-Hispanic white patients died of breast cancer (18.6% vs 12.2%, P = .058). By contrast, the same proportion of patients in the two populations died of causes other than breast cancer (non-Hispanic whites: 12.2% [30/244]; African Americans: 12.2% [36/295]). To account for comorbidities that could compete with death from breast cancer, we fitted a competing risk proportional hazards model in which other causes of death were treated as competing risks to breast cancer (Figure 2). In that model, African American patients had a higher 10-year breast cancer–specific mortality cumulative incidence rate compared with non-Hispanic white patients (26.0% vs 17.5%, P = .028; HR of death from breast cancer = 1.64, 95% CI = 1.06 to 2.55) (Figure 2, Table 5). Employment status (P < .001) was the only socioeconomic factor that remained statistically significantly associated with breast cancer–specific survival in the multivariable model. Results from the competing risk proportional hazards model revealed that adjustment for age and employment status did not appreciably change the results (HR of death from breast cancer = 1.57, 95% CI = 1.01 to 2.44; Table 5). When age at diagnosis and clinical stage were included, the effect of race and ethnicity changed little (HR of death from breast cancer = 1.54, 95% CI = 0.98 to 2.41). Adjustment for age, stage, and ER and PR status attenuated the effect of African American race and death from breast cancer such that race was no longer statistically significantly associated with dying from breast cancer (HR of death from breast cancer = 1.43, 95% CI = 0.89 to 2.30). In the fully adjusted model that included all covariates, the hazard ratio of death from breast cancer (HR = 1.26, 95% CI = 0.79 to 2.00) was further attenuated (Table 5).

Discussion

In this "equal access" study of uninsured and underinsured breast cancer patients at Wishard Memorial Hospital, we found no statistically significant difference in breast cancer–free survival between African American and non-Hispanic white women. However, African American women had worse overall survival compared with non-Hispanic white women. After taking into account competing causes of death, we found that African American women had a higher risk of death from breast cancer compared with non-Hispanic white women. However, this increased risk was reduced and no longer statistically significant after adjustment for clinical and sociodemographic factors. In most published studies that compare survival in breast cancer patients, sociodemographic factors are unequally weighted against the African American population. In this study, we considered Wishard Memorial Hospital to be an equal access setting because most of the patients in both the African American and non-Hispanic white populations were uninsured or underinsured. Despite having similar levels of access to medical care, the African American women presented with a more advanced clinical stage of breast cancer compared with the

Table 3. Breast cancer surgical management by race and ethnicity*

Surgical management	Non-Hispanic whites (N = 259)	African Americans (N = 315)	P†
Time from diagnosis to operation (no neoadjuvant therapy), d			.07
Mean (SD)	38 (29)	39 (46)	
Median (range)	45 (7–200)	51 (6–474)	
Operation for DCIS, No. (%)			.04
Breast conserving	29 (69)	53 (87)	
Mastectomy	13 (31)	8 (13)	
Operation for stage I invasive carcinoma, No. (%)			.88
Breast conserving	75 (69)	64 (71)	
Mastectomy	33 (31)	26 (29)	
Operation for stage II invasive carcinoma, No. (%)			.05
Breast conserving	23 (40)	40 (59)	
Mastectomy	35 (60)	28 (41)	
Lumpectomy margin status, No. (%)			.55
Positive	18 (14)	24 (14)	
Close (<1 mm)	26 (20)	39 (23)	
Total	44 (34)	63 (37)	
Re-excision lumpectomy, No. (%)	42 (32)	62 (37)	.46
Reconstruction after mastectomy, No. (%)‡	28/82 (34)	24/74 (32)	.86
Contralateral prophylactic mastectomy, No. (%)	0/116 (0)	1/110 (1)	.49

* DCIS = ductal carcinoma in situ.

† Derived from a Fisher exact test for categorical variables and a two-sample *t* test for continuous variables (all tests were two-sided).

‡ Includes mastectomy for patients with DCIS and stages I, II, and III invasive carcinoma.

non-Hispanic white population. This difference cannot be explained by a disparity in use of screening mammography because both populations were equally unlikely to use screening mammography in the 2 years before their cancer diagnosis.

Previous studies have suggested that African American breast cancer patients were more likely to experience a delay in getting treatment or to receive inadequate treatment compared with non-Hispanic white patients (6,11,12), which contributed to their poorer survival outcomes. In this study, the time from diagnosis to operation was similar in the two patient populations (39 vs 38 days). Therefore, a delay from diagnosis to operation in the African American population cannot be considered a cause for their poorer survival. Furthermore, all patients received adequate surgical therapy consisting of mastectomy or breast-conserving operation with microscopically tumor-free margins (30). Breast conservation is the preferred treatment for early-stage breast cancer according to National Comprehensive Cancer Network guidelines (24). At Wishard Memorial Hospital, African American patients were statistically significantly more likely to receive this treatment for stage 0–II breast cancer than non-Hispanic white (72% vs 61%, $P = .02$). By contrast, previous studies reported that African Americans had lower rates of breast conservation than non-Hispanic whites (31,32). Treatment at higher volume or more specialized institutions and more contemporary time periods have been associated with increased use of breast conservation (33–36). The higher rate of breast conservation in African American women compared with non-Hispanic white women in this study provides some evidence that African American women are more likely to preserve their breast when given the option and equal access to the procedure in a health-care system. Other surgical outcomes, such as margin status and the need for re-excision lumpectomy, were also similar in the two groups. Therefore, both groups had equivalent rates of adequate surgical treatment, which was expected because both groups were operated on by the same surgeons (33,37–39).

In this study, African Americans had a slightly higher rate of undergoing treatment with all types of adjuvant therapy compared with non-Hispanic whites. This finding differs from previous data indicating that African American women are less likely to receive

Table 4. Use of breast cancer adjuvant therapy by race and ethnicity

Type of adjuvant therapy	Non-Hispanic whites (N = 259)	African Americans (N = 315)	P*
Preoperative systemic therapy, No. (%)	65 (30)	91 (36)	.35
Radiation therapy, No. (%)†	121/159 (76)	163/204 (80)	.44
After breast conservation	98/118 (83)	125/152 (82)	1.0
After mastectomy	23/41 (56)	38/52 (73)	.12
Chemotherapy, No. (%)	91/129 (71)	116/148 (78)	.17
Hormonal therapy, No. (%)	112/171 (66)	100/162 (62)	.50
Ductal carcinoma in situ	8/33 (24)	12/50 (24)	1.0
Invasive cancer	104/138 (75)	88/112 (79)	.65

* Derived from a Fisher exact test (two-sided).

† Excludes five non-Hispanic white women with missing data for total sample (four women for radiation after breast conservation and one woman for radiation after mastectomy).

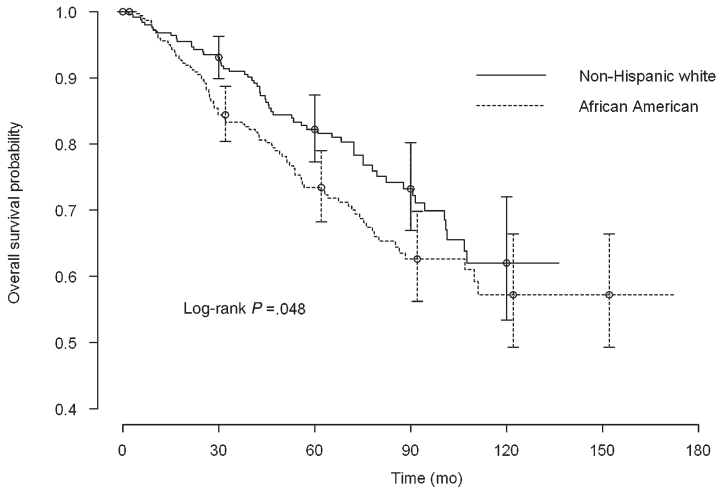
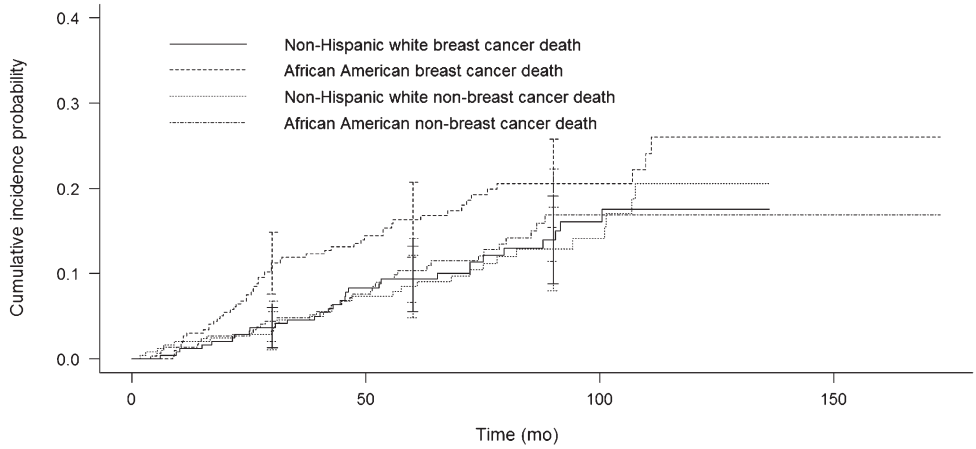


Figure 1. Kaplan–Meier analysis of overall survival for African American and non-Hispanic white women. **Error bars** correspond to 95% confidence intervals.

Time (mo)	0	12	24	36	48	60	72	84	96	108	120
Non Hispanic White											
No. at risk	244	236	229	208	169	138	117	84	55	34	19
Events	8	6	8	14	4	3	8	4	5	0	0
Censored	0	1	13	25	27	18	25	25	16	15	19
African American											
No. at risk	295	282	267	227	185	141	115	79	55	35	17
Events	13	15	21	11	12	6	7	3	1	2	0
Censored	0	0	19	31	32	20	29	21	19	16	17

adjuvant therapy (6,11,12). This difference may reflect the fact the all of the women in this study had similar access to and use of health care and were treated by the same physicians, who had the same resources and who followed the same indications for determining the need for adjuvant therapies. Therefore, when African American and non-Hispanic white patients have equivalent access to breast cancer care and similar socioeconomic limitations and are treated by the same physicians, they appear to make similar choices about their use of adjuvant therapies. The comparable use of adjuvant therapies in the two groups in this study suggests that previously reported differences in use of adjuvant therapies (6,11,12) may have been due, at least in part, to disparities beyond that of race and ethnicity. Four studies (18–21) have examined differences in survival between African American and non-Hispanic white women in equal access health-care systems. Of those, only two reported the type of surgical treatment that was provided (18,19).



Time (mo)	0	12	24	36	48	60	72	84	96	108	120
Non Hispanic White											
No. at risk	244	236	229	208	169	138	117	84	55	34	19
Events (BC/non-BC)	3/5	4/2	4/4	8/6	2/2	1/2	4/4	3/1	1/4	0	0
Censored	0	1	13	25	27	18	25	25	16	15	19
African American											
No. at risk	295	282	267	227	185	141	115	79	55	35	17
Events (BC/non-BC)	9/4	11/4	15/6	4/7	6/6	4/2	3/4	0/3	1/0	2/0	0
Censored	0	0	19	31	32	20	29	21	19	16	17

Figure 2. Plot of cumulative incidence probability of death from breast cancer from Cox proportional hazards model for competing risks. Breast cancer deaths and non-breast cancer deaths are presented for African American and non-Hispanic whites. **Error bars** correspond to 95% confidence intervals. BC = breast cancer death; non-BC = non-breast cancer death.

Table 5. Breast cancer–specific mortality for African American vs Non-Hispanic white race after adjustment for clinical and sociodemographic characteristics*

Model: adjustment(s)	HR of death from breast cancer for African Americans vs non-Hispanic whites (95% CI)
Model 1: race	1.64 (1.06 to 2.55)
Model 2: race, age, employment	1.57 (1.01 to 2.44)
Model 3: race, age, stage	1.54 (0.98 to 2.41)
Model 4: race, age, ER/PR	1.49 (0.93 to 2.37)
Model 5: race, age, stage, ER/PR	1.43 (0.89 to 2.30)
Model 6: race, age, stage, ER/PR, employment	1.26 (0.79 to 2.00)

* Based on a Cox proportional hazards model for competing risks in which death from other causes was considered as a competing risk to death from breast cancer. CI = confidence interval; ER/PR = estrogen and progesterone receptor status; HR = hazard ratio.

Furthermore, only the study by Jatoi et al. (19) differentiated between breast conservation and mastectomy but reported no information on the adequacy of the operation or on margin status. The study by Jatoi et al. (19) was also the only one to report the use of systemic therapy but not whether the systemic therapy use occurred in the adjuvant setting. Also, the overall rates of systemic therapy use were very low compared with modern standards. Therefore, it is difficult to accurately assess the potential effect of surgery and adjuvant therapies on breast cancer survival in these previous studies.

In this study, the unadjusted analysis, which did not account for competing risk, revealed a non-statistically significant difference in disease-free survival between the African American and non-Hispanic white patients. However, overall survival at 7 years after diagnosis was statistically significantly higher for non-Hispanic white vs African American patients (75.4% vs 69.2%, $P = .048$). A combined analysis of seven prospective randomized clinical trials from the National Surgical Adjuvant Breast and Bowel Project (NSABP) evaluated the difference in outcomes between African American patients and non-Hispanic white patients (40). Sociodemographic data were not reported as part of any of these trials; however, African American and non-Hispanic white patients received similar treatment as participants in these trials. The NSABP data revealed a non-statistically significant difference in disease-free interval and, similar to the results of this study, a statistically significant excess risk of mortality in the African American population. The combined analysis indicated that this excess risk would translate to an absolute difference in 5-year mortality of 4%–5% in patients with "less favorable" disease (40). The 6.2% absolute difference in 7-year overall survival between African American and non-Hispanic white patients from Wishard Memorial Hospital is comparable to the disparity revealed by the NSABP data.

Our findings regarding tumor characteristics are similar to those of previous studies that have shown that African Americans have a higher percentage of hormone receptor–negative and triple-negative (basal-like) subtype breast cancers compared with non-Hispanic whites (16,17,41). For example, data from the Carolina Breast Cancer Study showed that the basal-like breast cancer subtype was more prevalent in African American women compared with non-African American women (16). When we adjusted our proportional hazards models for ER and PR status, the effect of race and ethnicity was still of borderline statistical significance as a risk factor associated with of breast cancer mortality.

Patient comorbidities that contribute to deaths from competing causes have been found to contribute to differences in overall survival between similarly treated African American and non-Hispanic white women (40,42). In particular, Dignam (40) found a small but consistent excess of deaths without evidence of breast cancer recurrence among African American patients in NSABP trials, suggesting that these patients had greater mortality from causes other than breast cancer. Tammemagi et al. (42) found that blacks had more comorbidities and a higher Charlson comorbidity index score compared with whites from the same geographic region, and, as a result, proportionately more blacks died of competing causes as well as from breast cancer. Data on comorbid medical conditions were not collected in this study. We did, however, collect data on body mass index and current smoking status, which are known to adversely affect survival (43,44). Substantial proportions of both the non-Hispanic white and African American populations were obese (body mass index greater than 30 kg/m^2) and/or were current cigarette smokers. Furthermore, an identical proportion of patients in each group (12%) died of causes other than breast cancer. This relatively large number of deaths due to causes other than breast cancer indicates that in this disadvantaged population, both African American and non-Hispanic white patients suffered equally from substantial comorbid conditions. We used a competing risk regression model to evaluate the effect of comorbidities that compete with breast cancer death and found that compared with non-Hispanic white patients, African American patients had worse breast cancer–specific survival (HR of death from breast cancer = 1.64, 95% CI = 1.06 to 2.55). We then considered the effect of other variables on breast cancer–specific survival in this equal access health-care setting. When age at diagnosis and clinical stage were included in the multivariable model, the effect of race and ethnicity changed little (HR of death from breast cancer = 1.54, 95% CI = 0.98 to 2.41). In the four previous studies that have examined equal access health-care systems, the unadjusted hazard ratios found statistically significant differences in survival that were based on race and ethnicity (18–21). The two studies conducted within the Department of Defense health care system found that when survival was adjusted for age and stage, African American patients still had poorer survival compared with the non-Hispanic white patients (18,19).

In equal access health-care systems, all patients are insured and have similar access to health-care resources but may not be similar with respect to other sociodemographic variables. Patients in all four of the previous equal access studies were insured and had access to health care (18–21), but only the study by Yood et al. (20) assessed the effect of sociodemographic variables on breast cancer mortality. In that study, when sociodemographic factors were included in the multivariable model with stage, the hazard ratio of breast cancer–specific death for African Americans vs European Americans became null. In our study, employment status was the only sociodemographic factor that remained statistically significantly associated with breast cancer–specific survival in the multivariable model. When age and employment status were included in the model with stage and ER/PR status, the effect of ethnicity/race was further attenuated and no longer statistically significant (HR of death from breast cancer = 1.23, 95% CI = 0.70 to 2.17).

Limitations of this study include the retrospective nature of the data collection from chart review. Therefore, although the initiation of adjuvant therapy and the number of doses of chemotherapy completed were recorded, data on chemotherapy dose reductions and dose delays were not. Accurate data on deviations from radiation schedules and daily compliance with hormonal therapy were also not collected. There is little doubt that level 1 evidence from prospective randomized trials obviously provides optimal data for clinical decision making. Unfortunately, racial and ethnic minorities and underinsured or uninsured populations comprise a very small percentage of participants in clinical trials (40). A second limitation of this study is that this is a single-institution study and therefore includes a relatively small sample size. Although larger samples provide greater statistical power, a comprehensive retrospective medical record review that involves multiple centers may have difficulty in obtaining accurate data on sociodemographic variables, type and adequacy of surgical therapy, and initiation of adjuvant therapy. A third limitation is that the survival analysis in this study relied on the assumption of independent censoring, where it is assumed that the reasons that a patient was censored were not related to the event of interest (breast cancer death). When dependent censoring exists, breast cancer patients could drop out of the study because of severity of breast cancer. In the case of independent censoring, where drop outs are not related to severity of disease, bias in survival estimates can be introduced and distort the results based on survival differences.

To our knowledge, this is the first equal access study to assess a predominantly uninsured or underinsured population. Both African American and non-Hispanic white patients received similar surgical care and were equally likely to undergo all types of adjuvant therapy. These findings differ from those of previous studies that suggested that African American patients are less likely to undergo breast-conserving procedures and adjuvant therapy compared with non-Hispanic white patients. Despite the similar surgical care and adjuvant therapy, African American women in this study had lower overall and breast cancer–specific survival compared with non-Hispanic white women. After adjustment for competing causes of death, the survival disparity between African American and non-Hispanic white women appears to be attributable in part to differences in clinical and sociodemographic factors between the two groups. Additional data among uninsured and underinsured breast cancer patients that include information on the clinical and sociodemographic factors included in this study as well as the specific cause of death will help further clarify the causes of racial and ethnic differences in overall survival among breast cancer patients. Results of these future studies will further contribute to improvement in our understanding of racial and ethnic disparities related to breast cancer outcomes.

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