

# Race/Ethnicity Has No Effect on Outcome for Breast Cancer Patients Treated at an Academic Center with a Public Hospital

Quyen D. Chu,<sup>1,3</sup> Mark H. Smith,<sup>1</sup> Mallory Williams,<sup>1</sup> Lori Panu,<sup>2,3</sup> Lester W. Johnson,<sup>4</sup> Runhua Shi,<sup>2,3</sup> Benjamin D.L. Li,<sup>1,3</sup> and Jonathan Glass<sup>2,3</sup>

Departments of <sup>1</sup>Surgery and <sup>2</sup>Medicine and <sup>3</sup>Feist-Weiller Cancer Center, Louisiana State University Health Sciences Center in Shreveport, Shreveport, Louisiana; and <sup>4</sup>Department of Surgery, E.A. Conway Hospital, Monroe, Louisiana

## Abstract

**Background:** African American women have a higher breast cancer mortality rate than Caucasian women. To understand this difference, socioeconomic status (SES) needs to be controlled, which can be achieved by evaluating outcome within a population that is underinsured or low SES. We elected to examine the effect of race/ethnicity on outcome of patients with operable breast cancer by evaluating outcome in a population with low SES and similar access to care.

**Methods:** From a prospective breast cancer database created in 1998, we examined outcome for 786 patients with stage 0 to III breast cancer treated up to September 2008. Patients were treated at Louisiana State University Health Sciences Center in Shreveport and E.A. Conway Hospital and the majority received standard definitive surgery as well as appropriate adjuvant treatment. Primary endpoints were cancer recurrence

and death. Statistical analysis performed included Kaplan-Meier survival analysis, log-rank test, Cox proportional hazards model, independent-samples *t* test, and  $\chi^2$  test.  $P \leq 0.05$  was considered statistically significant.

**Results:** Sixty percent of patients were African American and over two thirds of patients were classified as either free care or Medicaid. The 5-year overall survival (OS) for African American and Caucasian patients was similar (81% and 84%, respectively;  $P = 0.23$ ). On multivariate analysis, race/ethnicity was not an independent predictor of OS ( $P = 0.5$ ); OS for the entire cohort was comparable with what was reported in the National Cancer Data Base.

**Conclusion:** In a predominantly indigent population, race/ethnicity had no effect on breast cancer outcome. (Cancer Epidemiol Biomarkers Prev 2009;18(8):2157–61)

## Introduction

It is well recognized that African American women have a lower incidence of breast cancer yet a higher mortality rate than Caucasian women (1-3). It remains to be determined whether this disparity is due to some intrinsic biological differences between the two races and/or socioeconomic factors leading to a disparity in receipt of known efficacious adjuvant treatment (4-6). Attempts at answering this controversy have largely been based on analysis of large national databases such as the Surveillance, Epidemiology and End Results registry.<sup>5</sup> Although informative, the question of race/ethnicity remains a challenge because many of these analyses rely heavily on information that may be inaccurate (missing data, selection bias, reporting bias, etc.). Therefore, to gain insight on whether race/ethnicity is an independent predictor of poor breast cancer outcome, potential confounding factors [socioeconomic status (SES)] needed to be controlled.

Louisiana is the third most impoverished state and ranks as having the third lowest median income

(\$39,461 versus \$49,901 for 2005-2007 national average).<sup>6</sup> As a consequence of this poverty and the attendant low levels of education, health care suffers. The Louisiana State University Health Sciences Center in Shreveport (LSUHSC-S) is 1 of 10 state-run hospitals that serve as the health-care safety net for the 715,000 uninsured citizens of Louisiana.<sup>6</sup> The Feist-Weiller Cancer Center (FWCC) is a part of LSUHSC-S and was created to provide high-level cancer care to all residents of Louisiana regardless of patients' ability to pay for services. Given this mission, we have now analyzed whether, in fact, the mortality rates can be reduced in a public hospital and, for this analysis, have addressed outcomes in breast cancer patients seen at the FWCC.

Because many of the patients at LSUHSC-S are considered "indigent" (>68% free care or Medicaid), SES as a potential confounder in our analysis becomes less of an issue. Using our breast cancer database, we culled 786 patients with stage 0 to III breast cancer, evaluated the effect of race/ethnicity on outcome, and compared our outcomes with a larger national database. This analysis addressed the questions: Is there a difference in breast cancer outcome between African American and

Received 3/13/09; revised 6/5/09; accepted 6/9/09; published OnlineFirst 7/21/09.

**Grant support:** The Shreveport Bossier Affiliate of Susan G. Komen for the Cure.

**Note:** Presented as a poster presentation at the 2nd Annual American Association for Cancer Research Science of Cancer Health Disparities 2009, Carefree, AZ.

**Requests for reprints:** Quyen D. Chu, Feist-Weiller Cancer Center, Louisiana State University Health Sciences Center in Shreveport, 1501 Kings Highway, Shreveport, LA 71130. Phone: 318-675-6123; Fax: 318-675-6171. E-mail: qchu@lsuhsc.edu

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doi:10.1158/1055-9965.EPI-09-0232

<sup>5</sup> <http://seer.cancer.gov/statistics/>

<sup>6</sup> <http://www.statehealthfacts.org>

Caucasian women, and is it possible to achieve high-quality breast cancer care for the medically underserved?

## Materials and Methods

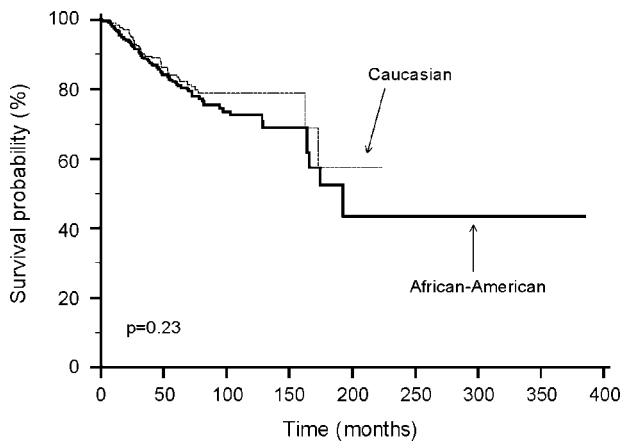
In 1998, the Division of Surgical Oncology created a prospective breast cancer database to further understand the biology of breast cancer. From this prospectively maintained breast cancer database, data on patients with stage 0 to III breast cancer who were treated up to September 2008 were analyzed. Almost 90% of patients were treated at FWCC/LSUHSC-S, whereas the remaining patients were treated at E.A. Conway Hospital, a sister safety-net hospital. Of the 803 patients identified in the database, 17 were excluded from analysis due to patients' ethnicity (Hispanics or Asians) or incomplete data. Two Society of Surgical Oncology fellowship-trained surgical oncologists performed all breast surgeries at FWCC/LSUHSC-S, whereas three general surgeons, each of whom had been in practice for >10 years, performed all breast surgeries at E.A. Conway Hospital. All breast cancer cases were presented at a weekly multidisciplinary tumor board, which included a team of surgical oncologists, medical oncologists, radiation oncologists, radiologists, geneticists, nurses, researchers, coordinators, educators, residents, and fellows. Patients treated at E.A. Conway Hospital were presented to the tumor board via telemedicine. Treatment and surveillance protocols were standardized to ensure study homogeneity. Compliance with treatment and surveillance protocols was >90%. All patients were offered standard treatment protocols for adjuvant and neoadjuvant chemotherapy, hormonal therapy, radiation therapy, and biological therapy. Surgical treatment consisted of either a mastectomy (with or without axillary lymph node dissection in select cases) or breast conservation therapy (lumpectomy with tumor-free margin, sentinel lymph node dissection and/or axillary lymph node dissection, and breast irradiation). Adjuvant systemic chemotherapy, antiestrogen therapy, and Herceptin were offered and administered as indicated per current standard of care. Patients were all offered similar surveillance regimen. The surveillance protocol consisted of a history and physical examination every 3 months for 3 years, every 6 months in years 4 and 5, and annually thereafter. Chest X-ray, mammogram, complete blood count, and liver function tests were obtained annually. Any additional radiologic and/or histologic evaluation was done based on the patient's examination and history. Clinical data were accrued and recorded prospectively and included age at diagnosis, comorbid conditions, stage of disease, treatment protocol, surveillance protocol compliance, and the study endpoints of cancer recurrence and cancer-related death. Approval to analyze our database was obtained from our institutional review board. Complete clinicopathologic data from the 786 patients who had stage 0 to III breast cancers according to the American Joint Committee on Cancer 6th edition were examined (7).

The SES of patients treated at FWCC was assessed by two sources. These different sources were used to describe the socioeconomic disparity of our patient population. These sources did not differ between African American and Caucasian women and data were not combined

**Table 1. Distribution of patient, clinicopathologic, and socioeconomic characteristics**

Characteristics	African American (n = 468), 60%	Caucasian (n = 318), 40%	P
Mean (range) age, y	51 (24-90)	54 (26-87)	0.0004
Mean tumor size (cm)	2.97	2.75	0.16
Tumor size distribution, n (%)			
T <sub>0</sub> (7%)	43 (9)	15 (5)	
T <sub>1</sub> (37%)	161 (35)	130 (41)	0.75
T <sub>2</sub> (41%)	190 (41)	134 (42)	
T <sub>3</sub> (9%)	44 (9)	22 (7)	
T <sub>4</sub> (6%)	30 (6)	17 (5)	
Nodal distribution, n (%)			
N <sub>0</sub> (57%)	264 (56)	185 (58)	
N <sub>1</sub> (23%)	111 (24)	71 (23)	0.82
N <sub>2</sub> (13%)	62 (13)	39 (12)	
N <sub>3</sub> (7%)	31 (7)	23 (7)	
Stage distribution, n (%)			
Stage 0 (7%)	41 (9)	15 (5)	
Stage I (28%)	119 (25)	101 (32)	0.96
Stage II (40%)	188 (40)	125 (39)	
Stage III (25%)	120 (26)	77 (24)	
Mean tumor grade	2.34	2.23	0.018
Tumor grade (%)			
1	25/406 (6)	22/287 (8)	0.03
2	216/406 (53)	173/287 (60)	
3	165/406 (41)	92/287 (32)	
ER (+)/PR (+), n (%)	139 (30)	144 (45)	
ER (-)/PR (-), n (%)	235 (50)	110 (35)	0.0001
ER (+)/PR (-), n (%)	43 (9)	24 (8)	
ER (-)/PR (+), n (%)	17 (4)	13 (4)	
Unknown ER/PR status, n (%)	34 (7)	27 (8)	
Definitive surgery, n (%)			
Breast conservation therapy (26%)	128 (27)	77 (24)	0.37
Mastectomy (74%)	340 (73)	241 (76)	
Systemic treatment, n (%)			
Adriamycin alone	51 (11)	26 (8)	
Adriamycin + taxane	98 (21)	43 (14)	0.004
Taxane alone	8 (2)	6 (2)	
Hormone therapy alone	98 (21)	66 (21)	
Hormone therapy + chemotherapy	129 (27)	128 (40)	
Others	84 (18)	49 (15)	
Median annual income	\$16,510	\$16,737	
Mean (range) annual income	\$18,334 (\$15,367-98,035)	\$21,817 (\$15,610-98,035)	<0.0001
Financial class (%)			
Commercial (12%)	22/239 (9)	27/157 (17)	
Medicare (16%)	44/239 (19)	19/157 (12)	0.06
Medicaid (7%)	15/239 (6)	11/157 (7)	
Free care (65%)	158/239 (66)	100/157 (64)	

across methods. We requested financial payment information from our hospital's Computer Services. Computer Services maintains a dynamic, retrospective database for patient information, including financial payment classification. A search was done by Computer Services according to patient name, medical record number, initial date of diagnosis, and *International Classification of Diseases, Ninth Edition* diagnosis codes 174.0 to 174.9. From the generated list, financial code at initial diagnosis was recorded and further classified into one of four subsets: commercial insurance, Medicare, Medicaid, or indigent/free care. Because this database only tracks patients for the past 7 years, only 50% (396) of patients were identified from this database. The second method was assessed by use of the Internal Revenue Service 2001 ZIP code-based income tract, which reports income as median annual



**Figure 1.** Effect of race/ethnicity on OS. This Kaplan-Meier survival curve shows that race/ethnicity had no effect on OS for the entire cohort of patients. The 5-year OS for African American and Caucasian women was 81% and 84%, respectively ( $P = 0.23$ ).

income per ZIP code stratified into quintiles based on \$10,000 increments. If the percentage of patients fell within 1% of either stratification group, the average of both groups was used to estimate the median annual income. The 2001 tax year was chosen because it approximates the middle of dates of surgery for our patient population. All patients were assigned a median annual income.

We determined the effect of race/ethnicity on outcome by comparing results between Caucasian and African American women. Asian and Hispanic women were excluded from analysis because they comprised <5 patients. Study endpoints were compared with the National Cancer Data Base.<sup>7</sup>

Statistical analyses were done using MedCalc software (Microsoft). The independent-samples *t* test was used to analyze median age and mean tumor size, whereas the  $\chi^2$  test was used to analyze categorical data. Overall survival (OS) was calculated from the date of surgery to the date of death from any cause or date of last follow-up. Disease-free survival was calculated from the date of surgery to the date of first recurrence (local or distant) or date of last follow-up. Survival analysis was done using the Kaplan-Meier method, the log-rank test was used to compare the curves, and Cox proportional hazard regression models were applied for multivariate analysis. There was no violation of the underlying assumption of the Cox proportional hazards. Risk ratios and 95% confidence intervals were calculated from the model.  $P \leq 0.05$  was considered statistically significant.

## Results

Seven hundred eighty-six patients with stages 0 to III breast cancer were accrued between 1998 and September 2008. There were 468 (60%) African American women and 318 (40%) Caucasian women. The median age at diagnosis was 52 years, and the mean follow-up time was 58 months. The median annual income by ZIP code for

the entire group was \$16,594 (range, \$15,367-98,035). The median annual income for African American women was statistically significantly lower than that for Caucasian women ( $P < 0.0001$ ), although the magnitude of such differences does not appear to be clinically relevant. For African Americans, it was \$16,510 (range, \$15,367-93,218); for Caucasians, it was \$16,737 (range, \$15,610-98,035). Almost all (784 of 786) patients resided within geographic areas with reported median annual incomes of  $\leq$ \$40,000, and ~86% (678 of 786) were in areas with a reported median annual income of  $<$ \$30,000. Less than 1% (2 of 786) resided within an area with a reported median annual income  $>$ \$50,000. The financial data from our institution's computer services was as follows: 12% commercial insurance, 16% Medicare, 7% Medicaid, and 65% free care ( $P = 0.06$ ; Table 1).

Overall, 245 of 786 (31.1%) experienced recurrences: 139 of 468 (29.7%) African American women and 106 of 318 (33.3%) Caucasian women had recurrences. Additionally, 132 of 786 (16.8%) experienced death: 86 of 468 (18.4%) African American women and 46 of 318 (14.5%) Caucasian women had died. The patient, clinicopathologic, and socioeconomic characteristics are shown in Table 1. Only the patient age, tumor grade, hormone receptor status, receipt of systemic treatment, and median annual income were significantly different between African American and Caucasian women. African American women had significantly higher percentage of estrogen receptor (ER) (-) tumors and progesterone receptor (PR) (-) tumors than Caucasian women ( $P = 0.0001$ ). Although a significantly higher percentage of African American women received combined anthracycline plus taxane-based chemotherapy than Caucasian women, and more Caucasian women received combined hormonal therapy and chemotherapy than African American women, these differences did not affect OS. Twenty-two (3%) patients refused adjuvant treatment; however, this was not significantly different between the two racial/ethnic groups who had refused adjuvant treatment (13 African Americans and 9 Caucasians;  $P = 0.52$ ).

To discern the role of race/ethnicity on outcomes, we analyzed OS based on race/ethnicity. OS was not significantly different between African American and Caucasian women (Fig. 1); the 5-year OS for African American and Caucasian women was 81% and 84%, respectively ( $P = 0.23$ ).

Using the Cox proportional hazards model, we compared race/ethnicity, age at diagnosis, surgical procedure, ER and PR status, median income, tumor grade, T stage, N stage, and systemic therapy for risk of cancer

**Table 2. Effect of race on cancer recurrence (Cox proportional hazards model)**

	Relative risk (95% confidence interval)	<i>P</i>
Race	1.28 (0.94-1.73)	0.11
Age	1.00 (0.98-1.01)	0.79
Breast conservation therapy	1.11 (0.78-1.58)	0.56
ER status	0.91 (0.58-1.41)	0.67
PR status	0.85 (0.54-1.33)	0.48
Median income	1.00 (1.0-1.0)	0.13
Tumor grade	1.31 (0.99-1.71)	0.05
T stage	1.44 (1.21-1.72)	<0.0001
N stage	1.50 (1.29-1.74)	<0.0001
Systemic therapy	1.13 (1.03-1.24)	0.01

<sup>7</sup> <http://www.facs.org/cancer/ncdb>

**Table 3. Effect of race on OS (Cox proportional hazards model)**

	Relative risk (95% confidence interval)	P
Race	0.87 (0.58-1.31)	0.5
Age	1.02 (1.00-1.03)	0.04
Breast conservation therapy	0.89 (0.54-1.46)	0.64
ER status	0.77 (0.43-1.38)	0.38
PR status	1.34 (0.75-2.40)	0.33
Median income	1.00 (1.0-1.0)	0.27
Tumor grade	1.62 (1.12-2.32)	0.01
T stage	1.54 (1.24-1.90)	0.0001
N stage	1.59 (1.31-1.91)	<0.0001
Systemic therapy	0.97 (0.86-1.10)	0.62

recurrence and OS (Tables 2 and 3). As expected, tumor grade ( $P = 0.05$ ), T stage ( $P < 0.0001$ ), and nodal stage ( $P < 0.0001$ ) were independent predictors of cancer recurrence. Independent predictors of OS were tumor grade ( $P = 0.01$ ), T stage ( $P = 0.0001$ ), nodal stage ( $P < 0.0001$ ), and age ( $P = 0.04$ ). Type of systemic adjuvant therapy was a significant predictor for recurrence ( $P = 0.01$ ) but not for OS ( $P = 0.62$ ). Race/ethnicity was not an independent predictor of recurrence ( $P = 0.11$ ) or OS ( $P = 0.5$ ).

Suboptimal outcomes run the risk of masking any potential differences that may exist between subgroups. Therefore, we compared our outcomes to both the Louisiana and the national (National Cancer Data Base) 5-year survival data.<sup>7</sup> Our overall 5-year survival was comparable with both state and national outcomes (Table 4).

## Discussion

The recent devastation of Louisiana's medical infrastructure inflicted by Hurricanes Katrina and Rita in 2005 has, no doubt, negatively affected health-care delivery in Louisiana and thereby affected the health status of its residents. Louisiana ranks first in breast cancer mortality despite ranking 19th in the incidence of invasive breast cancer (6).<sup>8</sup>

The incidence of cancer in Louisiana tracks the national cancer rates; however, mortality due to cancer in Louisiana is the highest in the nation. Specifically, breast cancer mortality among African American women is 17% above the national mortality rate. Disparities in breast cancer survival are attributed to a disadvantaged SES, some of which include limited access to health care, low income, race/ethnicity, and lack of adequate insurance coverage, (2, 3, 8-13). Louisiana's status as the leading state in cancer mortality can, in part, be explained by the fact that Louisiana has one of the highest percentages of its population without health insurance, 20% compared with the 15% national uninsured rate.<sup>6</sup> Hence, the equity in breast cancer outcomes that we report in this article shows that, in a population at high risk for succumbing to breast cancer, provision of state-of-the-art treatment can reverse the adverse outcomes imposed by the socioeconomic factors noted above.

Race/ethnicity has also been attributed as playing a major role in breast cancer disparities (1, 2, 6). Although

the breast cancer mortality rate for Caucasian women in Louisiana is comparable with the national average (25.7 per 100,000 versus 25.0 per 100,000), the breast cancer mortality rate of 40.3 per 100,000 for African American women in Louisiana is the worst in the United States, higher even than the national average for African American women (33.8 per 100,000; ref. 6).

The most important issue when determining the effect of race/ethnicity in breast cancer outcome is to control for SES. To achieve this, we set forth to establish that our population represents a socioeconomically disadvantaged cohort. Our study is limited by the lack of individual socioeconomic data, but similar limitations are present for most U.S. public health surveillance systems (3, 14-16). These shortcomings can be addressed by using area-based socioeconomic metrics such as the census tract, the block group, or the ZIP code-based income (14, 17-19). When evaluating the results from the three different sources for SES, we can surmise that our data set represents a largely impoverished population. In addition, 60% of our patients were African Americans, making our cohort one of the largest studies comparing outcomes of breast cancer in African American and Caucasian women.

The differences we observed in age, tumor grade, and hormone receptor status did not, however, translate into significant differences in breast cancer outcomes. These results suggest that, although biological differences might exist between breast cancer in African American and Caucasian women, these differences either have no effect on outcome or are overcome by treatment factors.

A potential confounder in our analysis is a beta error resulting from a poor outcome for both groups. However, an analysis comparing our outcomes with the National Cancer Data Base shows that our 5-year OS and disease-free survival for the entire cohort were comparable, if not better than this database.

The factors that have allowed us to achieve breast cancer results that match national norms for a population that is socioeconomically challenged have yet to be elucidated. Although we have not yet identified these factors, we have made the following observations. Most of our patients were navigated through the system. Patients were closely followed by members of our multidisciplinary team. The team meets on a weekly basis and communications among health-care personnel were excellent. We also have dedicated nurse coordinators and data managers who make frequent calls or send certified mail to patients to ensure attendance at the time of appointments. In addition, as about one third of our patients

**Table 4. Comparison of 5-year OS based on stage of disease**

	Stage 0 (%)	Stage I (%)	Stage II (%)	Stage III (%)
FWCC	100	94	84	62
NCDB* <sup>†</sup>	93	88	80	55
Louisiana (all hospitals)*	92	87	77	49

Abbreviation: NCDB, National Cancer Data Base.

\*<http://www.facs.org/cancer/ncdb>.

<sup>†</sup>Data represent all the cancer programs captured by the National Cancer Data Base.

<sup>8</sup> <http://www.cdc.gov/cancer/npcr>

travel >100 miles, we have developed support systems to assist patients with travel and lodging arrangements. Another advantage of our system is the accessibility of health-care personnel with expertise in their respective fields (surgical oncologists, geneticists, medical oncologists, radiation oncologists, physicists, etc.), and because LSUHSC-S is a public institution, these services were rendered without regards to the patients' financial status.

### Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

### Acknowledgments

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