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Breast cancer epidemiology in blacks and whites: disparities in incidence, mortality, survival rates and histology

Claudia R. Baquet, MD, MPH^{1,2,3}, Shiraz I. Mishra, MBBS, PhD^{2,3}, Patricia Commiskey, MA⁴, Gary L. Ellison, PhD, MPH³, and Mary DeShields, MD⁵

¹Departments of Medicine, University of Maryland School of Medicine, Baltimore, MD

²Departments of Family and Community Medicine, University of Maryland School of Medicine, Baltimore, MD

³Departments of Office of Policy and Planning, University of Maryland School of Medicine, Baltimore, MD

⁴Tulane University School of Public Health and Tropical Medicine

⁵Eastern Shore Oncology, Easton

Abstract

Background—This study presents black-white breast cancer statistics, tumor histology and receptor status, and treatment patterns for all ages and by age groups (under 40, between ages 40 and 49, and age 50 and over).

Methods—The study used data from the National Cancer Institute (NCI) Surveillance, Epidemiology and End Results (SEER) program for the time period 1995–2004. Age-adjusted incidence, mortality, relative survival rates, tumor grade, histology and receptor status, and treatment patterns for invasive breast cancer were calculated for nine SEER cancer registries for 1995–2004.

Results—Invasive breast cancer age-adjusted incidence for black women age <40 was significantly higher than those for white women (rate ratio=1.16, 95% confidence interval=1.10–1.23). Age-adjusted mortality rate for black women age <40 was twice that for white women. Compared to white women, black women were significantly more likely to be diagnosed with regional or distant disease, have lower relative five-year survival rate, and have higher likelihood of being diagnosed with tumors with poorer prognosis. Black women were less likely to receive breast cancer surgery as part of the treatment plan.

Address correspondence and reprint requests to Claudia R. Baquet, MD, MPH cbaquet@som.umaryland.edu. Phone: 410-706-1742. Fax: 410-706-6150.

Claudia R. Baquet, MD, MPH, University of Maryland School of Medicine, Office of Policy and Planning, 685 W. Baltimore Street, Suite #618, Baltimore, MD 21201. Areas of specialty: cancer epidemiology, health disparities, health policy, rural health, community based participatory research

Shiraz I. Mishra, MBBS, PhD, University of Maryland School of Medicine, Office of Policy and Planning, 401 W. Redwood Street, Suite #100, Baltimore, MD 21201. smishra@som.umaryland.edu. Phone: 410-706-8887. Fax: 410-706-8891. Areas of specialty: health services research, health disparities research, intervention research

Patricia Commiskey, MA, Tulane University School of Public Health and Tropical Medicine, 1440 Canal Street, # 2301, New Orleans, LA 70112. patriciacommiskey@yahoo.com. Phone: 443-413-4162. Areas of specialty: cancer health disparities research, community based participatory partnerships/research, research ethics.

Gary L. Ellison, PhD, MPH, University of Maryland School of Medicine, Office of Policy and Planning, Center for Health Policy/Health Services Research, 685 West Baltimore Street, HSFI, Suite 614, Baltimore, MD 21201. gellison@som.umaryland.edu. Phone: 410-706-6753. Fax: 410-706-6150. Areas of specialty: social epidemiology, cancer surveillance, multi-level modeling.

Mary DeShields, MD, Attending Physician Medical Oncology, Shore Health System and Clinical Assistant Professor of Medicine, University of Maryland School of Medicine, 401 Purdy Street, Suite 101, Easton, MD 21601. mdeshields@goeaston.net. Phone: 410-819-3332. Fax: 410-819-3322. Area of specialty: medical oncology.

Conclusions—Race/ethnic disparities in invasive breast cancer epidemiology, prognostic indicators, and treatment patterns exist between black and white women. The study findings support the need for innovative research, especially on the multifaceted determinants of the differential epidemiology of breast cancer. Equally importantly, there is a need for evidence-guided equal delivery of quality care to eliminate breast cancer disparities among black women.

Keywords

breast cancer; minority health; mortality; survival; receptor; tumor

Introduction

In recent years, incidence and mortality rates for all cancers combined have shown measurable stabilization, if not declines^{1, 2}. Despite these gains, race/ethnic disparities still persist in cancer incidence, mortality, stage-at-diagnosis, and survival.^{1–8} Black women have lower incidence rate but higher mortality rate than non-Hispanic white (hereafter referred as “white”) women for all cancer sites combined^{2, 8}. In addition, black women compared with white women are more likely to have poorer stage distribution (i.e., regional or distant) when diagnosed with cancer and to have lower 5-year survival rates (risk adjusted for age and stage of diagnosis) for most cancer sites^{1, 9}. Furthermore, black women have benefited less than white women from advances made in early detection and treatment¹⁰. Such race/ethnic disparities in cancer epidemiology are evident even for common cancers, including cancer of the breast.

Globally, breast cancer incidence and mortality rates remain highest in developed countries compared with developing countries¹¹. Trends in age-adjusted incidence and mortality rates over three decades (1973–77 and 1993–97) show breast cancer incidence rising 30–40% from the 1970s to the 1990s in most countries, with the most marked increases among women aged ≥ 50 years¹¹. In the United States, between the period 1997–2002, the rate of increase (0.4% per year) in age-adjusted breast cancer incidence rate was slower than that observed during the period 1980–1987 (3.7% per year)¹². In addition, from 1990–2002, there was an annual decline of 2.3% in age-adjusted breast cancer-related mortality rate¹².

Epidemiologic studies suggest that substantial disparities exist between black and white women in their breast cancer experience. For women in the United States, breast cancer is the most common cancer, excluding skin cancers, and is the second leading cause of cancer-related mortality. Trends in age-adjusted incidence and mortality rates over three decades (1973–77 and 1993–97) show that the percent change in age-adjusted incidence rates between the 1970s and 1990s was higher for black (37%) than white (27%) women and, for the same time period, the percent change in age-adjusted mortality rates was higher for black (17%) than white (–12%) women¹¹. Furthermore, for the period 1993–1997, the mortality rate of 19.7 per 100,000 women-years for white women in the United States was ranked ninth (a rate lower than in all other high risk countries except Australia) and the mortality rate of 26.0 per 100,000 women-years for black women in the United States was the second highest in the world¹¹.

In the United States, for the period 1988–2002, age-adjusted breast cancer incidence and mortality rates for white women were 134.4 per 100,000 and 26.4 per 100,000, respectively, and those for black women were 119.4 per 100,000 and 34.7 per 100,000², respectively. Compared with black women age ≥ 50 who have had stable incidence since 1993, white women in the same age group have had an increase in incidence since 1987⁴. Among women age <50 , breast cancer incidence rates have been stable for white women since 1986 and have declined among black women since 1991⁴. Although overall age-adjusted breast

cancer incidence rate is higher among white than black women, black women age <35 have a higher incidence rate than white women⁴.

In addition to disparities in breast cancer incidence and mortality, there are substantial black-white differences in stage-at-diagnosis, five-year survival, and treatment patterns. Compared to white women, black women have elevated risk for stage-III and stage-IV tumors, adjusting for age at diagnosis; year of diagnosis; and Surveillance, Epidemiology and End Results (SEER) registry^{13–15}. Black women compared with white women are more likely to be diagnosed with breast cancer at a regional or distant stage of the disease and have lower relative survival rates within each stratum of stage of diagnosis of breast cancer^{2, 4, 10, 14}. Moreover, the survival disparities between white and black women persist even after adjusting for insurance status and access to health care⁹. Compared with white women, black women have 50% great risk of breast cancer-related mortality after adjusting for stage, estrogen(ER)/progesterone (PR) receptor status, surgical treatment, radiation therapy, age at diagnosis, and SEER registry¹³.

In terms of appropriateness of treatment, evidence indicates that the proportion of women receiving inappropriate care for breast cancer is rising in the United States¹⁶. Among women with stage-I or -II breast cancer with tumors <5.0 cm, black women are 40% more likely than white women to receive inappropriate primary surgical and radiation breast cancer treatment¹³. In terms of surgery for breast cancer treatment, evidence suggests that black women are less likely to receive surgery (of any type) than white women¹⁷; although there are mixed results for breast-conserving surgery. One study indicated that among women who had surgery for breast cancer, black women were more likely than white women to receive breast conserving surgery¹⁷; whereas, another study suggested that black women were less likely than white women to receive breast-conserving surgery¹⁸.

This study provides a comprehensive analysis of breast cancer statistics for black and white women for three age groups: <40, 40–49, and 50. In addition to incidence, mortality and survival rates, key prognostic factors such as stage, histology and tumor grade, hormone receptor (ER and PR) status, and treatment differences are also presented for black and white women using the most recent data derived from the National Cancer Institute (NCI) SEER program, a population-based registry, for the time period 1995–2004¹⁹. Data presented in this study could suggest areas for additional research that may explain breast cancer disparities in black women. Additional research may produce further documentation of specific disparities and identify possible explanatory factors related to risk, mortality, poorer survival or treatment differences and tumor biology between black and white women. As with any biomedical research, the ultimate intention of this research is the reduction or elimination of these disparities.

Methods

Data on breast cancer incidence, mortality, survival, stage at diagnosis, ER/PR status, histology, surgical and radiation treatment for black and white women were obtained from population-based data collected by NCI's SEER program¹⁹. The SEER-9 registry is utilized to obtain statistics for the most recent decade of available data, 1995–2004. Invasive breast cancers are included for black and white women residing in nine geographical regions comparable to the general United States population. These nine areas are: Atlanta, Connecticut, Detroit, Hawaii, Iowa, New Mexico, San Francisco-Oakland, Seattle-Puget Sound and Utah. Data from these nine areas represent an estimated 10% of the United States population.

The data were analyzed using the NCI SEER software SEER*Stat version 6.3.5²⁰ unless otherwise stated. Data are presented for women of all ages and for three age groups--<40, 40–49, and 50--for both races. For the period 1995–2004, there were 155,495 cases of invasive breast cancer for white women and 15,877 cases for black women reported in the nine geographic areas. Incidence rates were age-adjusted to the 2000 US standard by direct standardization²¹ and include the total number of invasive cancers, including unstaged cancers but excluding in situ lesions.

Data on female breast cancer mortality from 1995–2004 were derived from the National Center for Health Statistics (NCHS)²² and NCI's SEER program²³, and analyzed using SEER*Stat software²⁰. The mortality rates were calculated based on the number of deaths with breast cancer given as the underlying cause of death occurring in black and white females during the years 1995–2004 in the nine geographic areas. The mortality rates were age-adjusted by the direct method to the 2000 US standard population²¹.

The stage-at-diagnosis categories used in this report were localized, regional, distant, and unstaged diseases. Localized disease denoted an invasive neoplasm confined entirely to the breast; regional disease was a neoplasm that had extended beyond the limits of the breast directly into surrounding organs, tissues, or regional lymph nodes; and, distant disease was defined as a neoplasm that had spread to remote sites of the body. The category of unstaged disease was used for cancers for which insufficient information was available to permit accurate assignment of a stage.

The SEER program has classified breast cancer tumors according to the International Classification of Diseases for Oncology, 3rd edition (ICD-O3)²⁴. This analysis considered several different histopathologic subtypes of breast cancer, including: infiltrating duct carcinoma (8500), lobular carcinoma (8520), infiltrating duct and lobular carcinoma (8522), mucinous adenocarcinoma (8480–8481), comedocarcinoma (8501), adenocarcinoma (8140), tubular adenocarcinoma (8201 and 8211), medullary carcinoma (8510), papillary carcinoma (8050), and all other histopathologic breast carcinoma subtypes. More than 70% of breast cancer tumors in this analysis were infiltrating duct carcinomas.

The relative survival rate is a net measure of the influence of breast cancer on normal life expectancy in the absence of other causes of death. Since cause of death information on death certificates is often inadequate to determine whether an individual died from the primary cancer diagnosis, the relative survival rate is the preferred method for reporting survival from cancer registry data. Relative survival is the ratio of the proportion of the observed survivors in a cancer cohort to the proportion of expected survivors in a comparable cancer-free cohort based on the assumption of independent competing causes of death. The relative survival rate adjusts for the general survival rate of the standard United States population for the race, gender, age and date for which the age was coded^{25, 26}.

Results

Age-adjusted incidence and mortality rates

For the period 1995–2004, the age-adjusted incidence rate was 16% higher among black than among white women age <40 (incidence rate ratio (IRR)=1.16; 95% confidence interval (CI)=1.10–1.23) (Table 1). For the same period, compared with white women, black women ages 40–49, and those 50 had lower age-adjusted incidence rates. Figure 1 presents the age-adjusted incidence rates by race and age groups. For the period 1995–2004, the age-adjusted incidence rates increased by 0.8% per year [estimated annual percent change (EAPC)=0.8] and 0.2% (EAPC=0.2), respectively, among white and black women age <40, but these increase were not statistically significant. Over the same period, the age-adjusted

incidence rates for black and white women ages 40–49 years, and age 50 showed small declines (data not shown).

For all age groups, black women had statistically significantly higher age-adjusted mortality rates than white women between 1995–2004 (Table 1). The age-adjusted mortality rate for black women age <40 was more than twice the rate for white women age <40. In addition, the age-adjusted mortality rates were 80% and 24%, respectively, higher for black women ages 40–49, and age 50 than white women in the same age group. Age-adjusted mortality rates by race and age groups for the period 1995–2004 are presented in Figure 2. For the period 1995–2004, there were statistically significant ($p<0.05$) declines in the age-adjusted mortality rates for black and white women in each age group, but the rate of decline was faster for white women. The age-adjusted mortality rate decreased 3.2% per year for white (EAPC=−3.2) and 2.1% for black (EAPC=−2.1, $p<0.05$) women age <40. Among women ages 40–49, the age-adjusted mortality rate decreased 4.0% per year for white women (EAPC=−4.0) and 2.6% for black (EAPC=−2.6, $p<0.05$) women; and, among women age 50 and over, the age-adjusted mortality rate decreased 2.1% for white women (EAPC=−2.1) and 1.4% (EAPC=−1.4) for black women.

Stage-at-diagnosis

Black women were significantly more likely than white women (9.0 vs. 5.3%, $p<0.0001$) to receive a breast cancer diagnosis at an advanced stage of the disease and, an additional 34.2% of black women received a breast cancer diagnosis at a regional stage compared with 27.8% of white women ($p<0.0001$) (data not shown). Women (black and white) age <40 were proportionally more likely to receive a breast cancer diagnosis at a regional stage (44.6% of black women and 41.6% of white women, $p<0.05$) than women ages 40–49 (38.9% of black women and 35.2% of white women, $p<0.0001$) and women age 50 (31.1% of black women and 25.4% of white women, $p<0.0001$).

Relative survival rates

Table 2 presents five-year relative survival rates for female invasive breast cancer by race, age groups, and stage-at-diagnosis. Black women (77.1%) compared with white women (89.7%, $p<0.0001$) had a significantly lower five-year survival rate regardless of the stage of breast cancer diagnosis and age groups. Although five-year survival rates for both black (17.5%) and white (28.8%) women diagnosed with distant stage cancer were relatively low, white women age <40 diagnosed with distant breast cancer had a five-year relative survival rate more than twice that of black women in the same age group and with similar stage-of-diagnosis (37.4% for white women vs. 13.4% for black women, $p<0.0001$).

Histology and tumor grade

Infiltrating ductal carcinoma, is the most common breast cancer cell type for both black (71.1%) and white (68.8%) women (data not shown). Compared to white women, black women were proportionally less likely to be diagnosed with lobular carcinoma (5.5% of black women and 8.9% of white women) but were more likely to be diagnosed with medullary carcinoma (1.6% of black vs. 0.6% of white). In terms of tumor grade, 43.6% of black women compared with 29.7% of white women were diagnosed with poorly differentiated breast cancer (data not shown). More than one-half of black (59.2%) and white (51.5%) women age <40 were diagnosed with poorly differentiated invasive breast cancer. Among women ages 40–49 years, 51.0% of black and 37.6% of white women were diagnosed with poorly differentiated invasive breast cancer; and, among women 50, 38.9% of black and 26.7% of white women were diagnosed with poorly differentiated invasive breast cancer.

Hormone receptor status

Table 3 presents data on estrogen (ER+/ER-) and progesterone (PR+/PR-) status by age group for black and white women with invasive breast cancer. Regardless of age groups, black women were proportionally more likely than white women to be diagnosed with ER- (ER- and ER-/PR-) and PR- breast cancers.

Treatment patterns

Although the majority of women with invasive breast cancer had surgery performed on their malignancies, black women (88.8%) were proportionally less likely than white women (94.0%) with invasive breast cancer to have surgery performed on their malignancies (Table 4). In addition, black women (5.4%) compared with white women (2.5%) with invasive breast cancer were proportionally more likely to not have surgery recommended for their invasive breast cancer. A similar distribution for surgical intervention (or lack thereof) was observed among black and white women by the three age groups. In terms of receipt of radiation therapy, the majority of women with invasive breast cancer did not receive radiation, with black women (60.8%) more likely than white women (54.3%) to not receive radiation treatment.

Discussion

This paper presents racial disparities in female invasive breast cancer incidence, mortality, stage-at-diagnosis, tumor grade, relative survival rates, and histology and treatment patterns based on data from the NCI SEER program, a population based registry, for the period 1995–2004. Previous studies^{2, 4, 13–15} have reported these rates based on the SEER data for varying periods ending 2002. This report extends findings reported previously with an emphasis on breast cancer epidemiology disparities between black and white women, uses the most recent data available from the NCI SEER program (1995–2004), and presents data for three age groups (i.e., age <40, 40–49, and 50).

The results indicate that there are persistent age-adjusted disparities in invasive breast cancer epidemiology between black and white women. Overall, compared with white women, black women had lower age-adjusted incidence rate, higher mortality rate, lower relative survival rate, higher likelihood of being diagnosed with regional or distant disease and with poorly differentiated tumors, higher likelihood of being diagnosed with tumors associated with poorer prognosis (i.e., the more dangerous medullary carcinoma, ER negative (ER- and ER-/PR-) tumors, and poorly differentiated tumors), lower likelihood of to receive cancer surgery, and higher likelihood of having breast surgery contraindicated for their cancer.

Analyses by race-age sub-groups revealed more striking disparities among younger (age <40) black women. Compared with white women age <40, black women in the same age group had 16% higher age-adjusted breast cancer incidence rate and more than twice the age-adjusted mortality rate. In addition, black women age <40 compared with women in other race-age sub groups were more likely to be diagnosed with breast cancer at a regional stage, have a lower relative survival rate, and were more likely to be diagnosed with poorly differentiated tumors.

Prevalence of risk factors may help explain disparities in breast cancer incidence. Unfortunately, very few studies which could establish the prevalence of risk factors have included black women²⁷. It is suggested^{6, 27} that the higher breast cancer incidence rate among black women 45 years and the lower incidence rate at older ages may be a function of the differences in breast cancer risk profile between black and white women. In terms of prevalence of risk factors^{6, 27}, compared to white women, black women have slightly younger age at menarche, greater frequency of ovulatory menstrual cycles during

adolescence, higher birth rate (especially among those < 20 years), lower likelihood of breast-feeding, greater propensity to use oral contraceptives before age 20, lower likelihood to use hormone replacement therapy, higher prevalence of overweight and obesity (especially postmenopausal), and lower propensity for physical activity. There is some evidence to suggest that, unlike the protective effect of pregnancy on breast cancer risk among women after age 45, early childbearing and higher birth rate observed among black women could increase the likelihood of higher incidence of premenopausal breast cancer^{28–30}. Moreover, among younger black women, multiparity³¹ coupled with lower likelihood of lactation and shorter duration of lactation³² may also contribute to a higher incidence rate. The reduction in modifiable risk factors including, hormone replacement therapy, alcohol consumption, physical activity, and duration of breast-feeding, could substantially reduce breast cancer incidence³³.

Black-white difference in survival and mortality may be due to differences in tumor phenotypes, molecular biology, and genetic alterations. These differences include a higher prevalence of among black women of breast cancer with poor prognostic indicators such as, no estrogen receptor (ER-) expression^{8, 9, 15, 29, 34}; poorly differentiated tumors⁸; basal-like tumor subtype³⁵; high nuclear grade^{34, 36, 37} and high S-phase³⁶; higher frequency of hypermethylation in ER-/PR- and being younger (<50 years) with breast cancer³⁸; higher mitotic index and marked tumor necrosis^{34, 37}; defects in specific cell cycle-regulatory proteins³⁴; overexpression of p53³⁹; and tumors that are grade-III, and high grade nuclear atypia³⁷. Premenopausal black women, unlike postmenopausal black and non-black women, have a higher prevalence of basal-like subtype of breast tumors³⁵. Basal-like sub-type of breast tumors are associated with more aggressive attributes including higher proliferative capacity (i.e., higher mitotic index) and histologic grade (i.e., poorly differentiated vs. well- or moderately differentiated) and marked pleomorphism³⁵. Compared with white women, black women have a decreased risk of lobular carcinoma and increased risk of medullary carcinoma¹⁵. Lobular carcinoma is associated with better prognosis⁴⁰. However, despite controlling for tumors with several of these poor prognostic characteristics, black women still have poorer survival than white women⁴¹. Therefore, it is still to be determined whether these characteristics are sufficient to explain the poorer prognosis and excess mortality among black women with breast cancer.

Poorer survival rates for black women may also be due to racial differences in patterns of care and/or unequal patterns of care. Black women receive less than adequate care for breast cancer as compared with that received by white women^{42, 43}. Black women age <50 with ER+ or ER- tumors had significantly lower stage-specific survival rates than white women¹⁴; whereas, there were no significant differences in stage-specific survival rates between black and white women age 65 years or older regardless of the ER status¹⁴. Comparable survival rates between black and white women were observed when there was equivalent treatment for comparable disease stage^{44, 45}. In addition, black women were more likely to terminate chemotherapy prematurely than white women and premature termination of chemotherapy is associated with poorer survival⁴¹. Moreover, black women are less likely than white women to receive surgical removal of their tumors¹⁷, even after controlling for age, socioeconomic status and insurance coverage. Some of the reasons for black-white disparities in breast cancer patterns of care include differential occurrences of adverse events, noncompliance with planned therapy, and incomplete adherence to treatment regimen^{6, 41, 46, 47} – factors which may impact adjuvant chemotherapy and subsequent survival. Poorer survival due to diagnosis with late-stage disease among black women is also due to underuse of mammography (adjusting for socioeconomic status and other comorbidities)⁴⁸ and taking longer time to obtain an initial medical consultation⁴⁹ after a diagnosis of breast cancer.

The reasons presented here are, by themselves, not sufficient to explain disparities in breast cancer care and outcomes. There is a need to address race-based and socioeconomic discrimination in the provision of appropriate, evidence-based quality care for breast cancer, including consideration of treatment decisions based on insurance coverage, access to care, physician-patient interactions, cultural factors, historical mistrust.

There is mixed evidence for socio-economic factors as predictors of disparities in breast cancer epidemiology, especially mortality and survival^{7, 17, 50, 51}. Socioeconomic status (SES) is poorly understood and inconsistently defined. Socioeconomic factors reflect income, poverty level, education, geography of residence, population density, occupation and occupational category, access to and utilization of health care, diet, age at bearing children, physical activity, compliance/adherence to patterns of preventive care and treatment, and other determinants of cancer etiology, early detection and treatment, and survivorship. A meta-analysis of survival in black and white women with breast cancer indicated that race/ethnicity was an independent predictor of poor survival, even after controlling for SES⁷. Another study reported that black race and socioeconomic factors were independent predictors of breast cancer mortality and that the association between black race and breast cancer mortality persisted, albeit weaker, even after adjusting for socioeconomic factors⁵¹. However, it has also been shown that, after adjusting for socioeconomic factors, there was no association between being black and unfavorable breast cancer outcomes¹⁷. On the other hand, low SES (and not race) was associated with late-stage breast cancer, types of treatment received, and mortality rates¹⁷. It has been suggested⁵² that socioeconomic factors should be considered as “cross-cutting risk factors” both for developing breast cancer as well as for breast cancer related mortality. Moreover, focusing solely on socioeconomic factors without due consideration of racial and cultural factors that affect health and cancer-related behaviors would provide a confounded assessment of disparities in breast cancer epidemiology and patterns of care⁵². These findings further reinforce the need for further research on the biologic, genetic, and socioeconomic and cultural determinants which may impact breast cancer epidemiology.

Limitations of this study are those inherent in archived dataset, including the population-based cancer registry data of the SEER program. First, there may be errors introduced during the process of registering cancer patients, and the abstraction and coding of data by the respective SEER registries. The SEER program has in place a rigorous quality control system. The program conducts various types of quality control studies, including casefinding, recoding, and reliability which are designed using appropriate statistical procedures that provide for obtaining measures used to assess the performance of the SEER registries⁵³. Second, the age-adjusted incidence data are not adjusted for delayed reporting, which affects the most recent 1 to 3 years of incidence data (in this case, 2002–2004). The age-adjusted incidence rate data presented here are for a 10-year period, thus reducing the potential error due to delayed reporting of breast cancer. Furthermore, delays in reporting in SEER registries are primarily relevant for cancers frequently diagnosed in outpatient settings². Third, racial or ethnic misclassifications can occur in registering mortalities, which would affect the mortality rates. The true extent of racial or ethnic misclassifications in death certificate coding remains unknown¹⁹.

In conclusion, persistent breast cancer disparities experienced by black women, especially younger black women, present an important opportunity for research advances in prevention, early detection and treatment. There is a need for innovative research, especially in the multifaceted (biologic, social, and cultural) determinants of the differential epidemiology of breast cancer. Moreover, and equally importantly, there is a need to eliminate barriers to health care access and to evidence-guided equal delivery of quality care to improve treatment, prognosis, and survivability of black women with breast cancer.

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Biography

The bibliography was created using Endnote reference manager software program. The databases utilized to find the appropriate citations included PubMed/Medline, National Cancer Institute's Surveillance, Epidemiology, and End Results Program database, and the National Center for Health Statistics database.

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Figure 1.
Breast cancer age-adjusted incidence rates by race and age groups, SEER, 1995–2004

Figure 2.
Breast cancer age-adjusted mortality rates by race and age groups, SEER, 1995–2004

Table 1

Age-adjusted incidence and mortality rates for female invasive breast cancer by race and age group, 1995–2004

Age (Years)	Incidence rates				Mortality rates			
	White	Black	B/W Rate Ratio	95% CI	White	Black	B/W Rate Ratio	95% CI
All ages	139.2	120.4	0.87	0.85–0.88	26.4	35.2	1.33	1.32–1.34
<40	12.9	15.0	1.16	1.10–1.23	1.6	3.4	2.07	1.99–2.14
40–49	158.7	147.2	0.93	0.90–0.96	20.1	36.2	1.80	1.76–1.84
50	388.6	322.8	0.83	0.81–0.85	80.9	100.1	1.24	1.22–1.25

Incidence and mortality rates are per 100,000 and age-adjusted to the 2000 U.S. population by direct standardization. The p-values test the equality of the incidence and mortality rates for black and white women.

CI: Confidence Interval

B/W: Black-white

Table 2

Five-year relative survival rates for female invasive breast cancer by race, age groups, and stage-at-diagnosis, 1995–2004.

Stage	All Ages			Age <40			Ages 40–49			Age 50		
	White (%)	Black (%)	p-value	White (%)	Black (%)	p-value	White (%)	Black (%)	p-value	White (%)	Black (%)	p-value
All stages	89.7	77.1	<0.0001	85.2	68.4	<0.0001	89.6	78.1	<0.0001	90.1	78.3	<0.0001
Localized	98.7	93.0	<0.0001	94.3	86.2	<0.0001	96.4	90.9	<0.0001	99.6	94.7	<0.0001
Regional	84.3	71.1	<0.0001	81.0	65.3	0.0284	85.9	74.0	<0.0001	84.1	71.2	<0.0001
Distant	28.8	17.5	<0.0001	37.4	13.4	<0.0001	38.4	24.7	<0.0001	26.0	15.7	<0.0001
Unstaged	45.3	40.8	<0.0001	71.9	40.4	0.0177	68.9	50.1	<0.0001	39.7	37.1	<0.0001

The p-values test the equality of 5-year relative survival rates for black and white women.

Table 3
Estrogen- and progesterone-receptor status for invasive breast cancer by race and age groups, 1995–2004.

	All Ages			Age <40			Ages 40–49			Age 50		
	White (%)	Black (%)	p-value	White (%)	Black (%)	p-value	White (%)	Black (%)	p-value	White (%)	Black (%)	p-value
ER receptor status												
ER+	66.2	47.5		51.1	37.9		62.3	43.6		68.0	50.2	
ER–	17.2	29.8		34.7	41.3		23.5	35.9		14.8	26.0	
Other	16.6	22.7		14.2	20.8		14.2	20.5		17.2	23.8	
			<0.0001			<0.0001			<0.0001			<0.0001
PR receptor status												
PR+	56.1	39.4		46.2	33.6		57.2	39.3		56.5	40.4	
PR–	25.6	36.7		38.3	45.1		27.0	39.2		24.5	34.5	
Other	18.3	23.9		15.5	21.3		15.8	21.5		19.0	25.1	
			<0.0001			<0.0001			<0.0001			<0.0001
ER/PR receptor status												
ER+/PR+	66.4	48.7	<0.0001	50.6	37.9	<0.0001	64.3	45.8	<0.0001	67.9	51.4	<0.0001
ER+/PR–	12.8	12.4	0.2720	8.9	9.9	0.2869	8.1	8.9	0.1667	14.1	14.1	<0.9834
ER–/PR+	2.3	3.2	<0.0001	4.0	4.9	0.2023	3.7	4.1	0.2457	1.8	2.5	<0.0001
ER–/PR–	18.5	35.7	<0.0001	36.5	47.3	<0.0001	23.9	41.2	<0.0001	16.2	32.0	<0.0001

Estrogen receptor positive, ER+, Estrogen receptor negative, ER–, Progesterone receptor positive, PR+, Progesterone receptor negative, PR–.
The p-values test the equality of proportions for black and white women in each category classified by ER and PR status jointly.

Table 4

Treatment patterns for female invasive breast cancer by race and age group, 1995–2004

	All Ages			Age <40			Ages 40–49			Age 50		
	White (%)	Black (%)	p-value	White (%)	Black (%)	p-value	White (%)	Black (%)	p-value	White (%)	Black (%)	p-value
Surgery ^a												
Cancer directed surgery performed	94.0	88.8	<0.0001	95.9	89.8	<0.0001	96.3	92.0	<0.0001	93.3	87.6	<0.0001
Cancer directed surgery not recommended	2.5	5.4	<0.0001	1.7	5.3	<0.0001	1.6	4.1	<0.0001	2.7	5.8	<0.0001
Contraindicated due to other conditions	0.2	0.2	0.9727	0.1	0.1	0.5832 ^c	0.1	0.0	0.7165 ^c	0.3	0.3	0.3172
Other	3.3	5.6	<0.0001	2.3	4.8	<0.0001	2.0	3.9	<0.0001	3.6	6.3	<0.0001
Radiation ^b												
Performed	45.7	39.2	<0.0001	48.7	40.3	<0.0001	51.9	43.2	<0.0001	44.2	37.7	<0.0001
Not performed	54.3	60.8		51.3	59.7		48.1	56.8		55.8	62.3	

^a p-values are for testing the equality of proportions for black and white women in each surgery status

^b p-values are 2-sided and are for testing whether ethnicity and radiation status are associated within age category

^c Fisher's Exact p-value