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Health and Economic Impact of Breast Cancer Mortality in Young Women, 1970–2008

Donatus U. Ekwueme, PhD, MS, **Gery P. Guy Jr., PhD, MPH**, **Sun Hee Rim, MPH**, **Arica White, PhD, MPH**, **Ingrid J. Hall, PhD, MPH**, **Temeika L. Fairley, PhD, MPH**, and **Hazel D. Dean, ScD, MPH**
Division of Cancer Prevention and Control (Ekwueme, Guy, Rim, White, Hall, Fairley), National Center for Chronic Disease Prevention and Health Promotion, and the Office of the Director (Dean), National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, Centers for Disease and Control Prevention, Atlanta, Georgia

Abstract

Background—Breast cancer is the second-leading cause of cancer-related deaths among women aged <50 years. Studies on the effects of breast cancer mortality among young women are limited.

Purpose—To assess trends in breast cancer mortality rates among women aged 20–49 years, estimate years of potential life lost (YPLL), and the value of productivity losses due to premature mortality.

Methods—Age-adjusted rates and rate ratios (RRs) were calculated using 1970–2008 U.S. mortality data. Breast cancer mortality rates over time were assessed using Joinpoint regression modeling. YPLL was calculated using number of cancer deaths and the remaining life expectancy at the age of death. Value of productivity losses was estimated using the number of deaths and the present value of future lifetime earnings.

Results—From 1970 to 2008, the age-adjusted breast cancer mortality rate among young women was 12.02/100,000. Rates were higher in the Northeast (RR=1.03, 95% CI, 1.02–1.04). The annual decline in breast cancer mortality rates among blacks was smaller (−0.68%) compared with whites (−2.02%). The total number of deaths associated with breast cancer was 225,866, which accounted for an estimated 7.98 million YPLL. The estimated total productivity loss in 2008 was $5.49 billion and individual lifetime lost earnings were $1.10 million.

Conclusions—Considering the effect of breast cancer on women of working age and the disproportionate impact on black women, more age-appropriate interventions with multiple strategies are needed to help reduce these substantial health and economic burdens, improve survival, and in turn reduce productivity costs associated with premature death.

Address correspondence to: Donatus U. Ekwueme, PhD, MS, Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, 4770 Buford Highway, Chamblee Bldg. 107, MS F-76, Floor 3, Room 250, Chamblee GA 30341. dce3@cdc.gov.

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Introduction

Breast cancer in women younger than 50 years represents approximately 17% of deaths in this age group, making it the second-leading cause of cancer-related deaths among these women.[1] Although breast cancer in young women (i.e., aged 20–49 years) is rare, it is often more aggressive and rapidly growing, and less likely to be amenable to treatment at the time of diagnosis.[1,2–4]

Studies have demonstrated that screening mammography is effective in reducing mortality rates associated with breast cancer through early detection, diagnosis, and subsequent treatment.[5–7] As a result, the U.S. Preventive Services Task Force (USPSTF) recommends routine screening for women beginning at age 50 years.[8] For women aged 40 to 49 years, the USPSTF recommends that the decision to receive regular biennial screening should take into account the patient's values regarding specific screening-associated benefits and harms.[8] The American Cancer Society (ACS) recommends biennial mammography screening beginning at age 40 years.[9] For average-risk women aged less than 40 years, the ACS recommends clinical breast exam (CBE) every 3 years and breast self-exam (BSE) as an option starting at age 20 years.[9] The USPSTF, however, states insufficient evidence to evaluate the additional effects of CBE, but recommends against BSE.[8]

Given recent public health interest in breast cancer among women younger than 50 years (e.g., the Education and Awareness Requires Learning Young [EARLY] Act, Section 10413 of the Affordable Care Act [Public Law 111–148]),[10] it is important to assess how this disease affects women in this population. To date, no published studies have reported on both the trends and economic effects of breast cancer mortality among young women. Such information could shed light on the magnitude of the burden of breast cancer in young women and in specific subpopulations. This study examines trends in breast cancer mortality rates by racial/ethnic categories and geographic regions, years of potential life lost (YPLL), and the value of productivity losses in young women from 1970 through 2008.

Methods

Data

Three broad measures of disease burden were used to quantify the impact of breast cancer mortality among young women: mortality rates, YPLL, and the value of productivity loss from premature mortality. Breast cancer was identified as the underlying cause of death using CDC's National Vital Statistics Surveillance System[11] data on breast cancer mortality from 1970 through 2008 and according to the appropriate revisions of the ICD for the study years. The following ICD codes were used: ICD-8 code 174 for breast cancer deaths from 1970 to 1978; ICD-9 codes 174–175 for 1979–1998; and ICD-10 code C50 for 1999–2008.[12–14] Population counts and rates were derived and calculated using SEER*Stat software, version 7.0.5 (Surveillance, Epidemiology, and End Results Program). Data were extracted for women aged 20–49 years by 10-year age group (i.e., 20–29, 30–39, and 40–49); racial/ethnic categories; and geographic regions. Many studies have different age cut-offs when defining a "young woman."[15–18] Based on the considerations of both the USPSTF recommended age for breast cancer screening[8] and the EARLY Act definition of "young women,”[10] a broader, inclusive definition of young women aged between 20 and 49 years was chosen.

Statistical Analyses

Breast cancer mortality rates and rate ratios—Breast cancer mortality rates and corresponding 95% CIs were computed based on yearly population estimates from the U.S. Census Bureau and stratified by race/ethnicity and geographic region. The 95% CIs were based on the modified gamma method to ensure proper coverage for small case counts, low mortality rates, and populations with age distributions that differed from the standard age distribution.[19] Estimated rates were expressed per 100,000 population and were age-adjusted by the direct method to the SEER 2000 U.S. standard population.[20] Rates were based on at least 20 deaths in order to obtain stable estimates. To compare mortality rates across geographic regions, rate ratios (RRs) and 95% CIs were calculated using the South as the reference region.

Annual percent change—Joinpoint regression software (version 3.4.3) was used to examine the annual percentage change in breast cancer mortality rates. This modeling software uses a Monte Carlo permutation test to identify points where the direction or magnitude of the trend changes and fits a model containing the fewest number of trend segments.[21] A detailed description of the Joinpoint modeling approach is presented in the Appendix A (available at www.ajpmonline.org). Trends in mortality rates were calculated by racial/ethnic categories, age groups, and geographic regions. The significance of calculated trends were assessed using a two-sided t-test with $p<0.05$.

Estimating years of potential life lost—The U.S. life tables from 1970 through 2008 were used to obtain average life expectancy for women across racial/ethnic categories. Using the calculated average life expectancy and the age of death, the potential years of life remaining were calculated. From these data, YPLL, YPLL per death, and age-adjusted YPLL rates per 100,000 U.S. population were calculated for each racial/ethnic group. Detailed methods used are presented in Appendix A (available at www.ajpmonline.org).

Estimating the value of mortality-related productivity losses—Previously published methods were used to estimate the value of lifetime mortality-related productivity losses in 2008.[22–24] To account for future inflation, a zero (0%), 3%, and 5% annual discount rate was applied to estimate the present value of foregone future lifetime earnings (PVFLE). In addition to estimating the PVFLE lost due to breast cancer mortality at the national level, cost of premature death was also estimated at the individual level. To appraise uncertainty in the estimated PVFLE, the lower and upper bounds of the 95% CI of the death rates were used. All estimated PVFLE were converted to 2008 U.S. dollars using the consumer price index, available at www.bls.gov/cpi/data.htm. Detailed description of the estimation methods are presented in Appendix A (available at www.ajpmonline.org).

Results

Breast Cancer Mortality Rates and Rate Ratios Among Young Women

The overall results for women aged 20–49 years were presented; however, the results for specific 10-year age groups were reported in Appendix B (available at www.ajpmonline.org). From 1970 through 2008, the age-adjusted breast cancer mortality rate among women aged 20–49 years was 12.02/100,000 (95% CI=11.97–12.07) for all racial/ethnic groups; 11.45/100,000 (95% CI=11.40–11.50) for whites; and 17.97/100,000 (95% CI=17.79–18.14) for blacks. For all racial/ethnic groups, rates were slightly higher in the Northeast compared to the South (RR=1.03, 95% CI=1.02–1.04), whereas rates were slightly lower in the Midwest and lowest in the West (Table 1). The estimated rates among whites followed the same geographic pattern observed among all racial/ethnic groups. Compared with all racial/ethnic groups and whites, blacks had substantially higher age-adjusted breast cancer mortality rates in all U.S. regions. Significantly lower mortality rates among blacks occurred in the Northeast (RR=0.91, 95% CI=0.89–0.94) compared to the South. Detailed results are presented in Appendix B (available at www.ajpmonline.org).

Annual Percent Change (APC)

Among all races/ethnicities, overall breast cancer mortality rates significantly decreased from 1970 to 1981 (APC=–1.33%), followed by a nonsignificant increase (0.22% annually) between 1981 and 1989, and a sharp decline during 1989–2008 (−3.11% annually; Table 2). All regions experienced a significant decrease in breast cancer mortality rates across all years; however, the South had a nonsignificant increase in breast cancer mortality rates from 1980 to 1990 (0.83%). Trends in breast cancer mortality rates among blacks were unstable from 1970 to 2008 compared with all racial/ethnic groups and whites (Table 2). Most notably, blacks experienced periods of significant increases during periods when overall mortality rates were decreasing. Significant increases among blacks were found nationwide between 1976 and 1988 (1.92% annually); in the South between 1976 and 1989 (2.27%); in the Midwest between 1970 and 1987 (0.89%) and between 1987 and 2008 (1.63%); and in the West between 1970 and 1988 (1.61%). Detailed estimates on trends in breast cancer mortality rates are presented in Appendix C (available at www.ajpmonline.org).

Overall, the decline in breast cancer mortality rates among blacks aged 20–49 years since 1970 has been very small (−0.68%) compared with whites (−2.02%) and all racial/ethnic groups (−1.77%; Figure 1). From 1970 through 2008, decreasing trends were significant for all age groups and for all racial/ethnic categories. In addition, mortality rate reductions were greatest among whites across all age groups, with the largest reduction among women aged 20–29 years. However, by examining mortality trends over 10-year time periods, substantial differences were found across both racial/ethnic categories and time periods (Figure 2). From 1970 through 2008, the largest significant annual percent decreases occurred among whites during 1990–1999 (4.10%), among all racial/ethnic groups during 1990–1999 (−3.56%), and among blacks during 2000–2008 (−2.18%). The only significant increase in mortality rates was found among blacks in the 1980s, with an increase of 1.80% per year (Figure 2).

Years of Potential Life Lost

From 1970 through 2008, the total number of deaths associated with breast cancer in women aged 20–49 years was 225,866 for all racial/ethnic groups, 179,557 for whites, and 41,357 for blacks. These deaths accounted for an estimated 7.98 million YPLL (95% CI=7.97–7.99 million) in all racial/ethnic groups; 6.32 million YPLL (95% CI=6.31–6.33 million) in whites; and 1.48 million YPLL (95% CI, 1.480–1.484 million) in blacks (Table 3). Regardless of racial/ethnic category, on average, a woman who died from breast cancer between the ages of 20 and 49 years from 1970 through 2008 was estimated to lose more than 35 years of potential life.

The extent to which the observed increases (or decreases) in the number of breast cancer deaths during different time periods over- or under-estimates premature mortality was also examined. Using the 1970s as a reference period, it was estimated that in the 2000s, a 6.12% decrease in breast cancer mortality for all racial/ethnic groups would account for a 4.59% increase in YPLL (Table 3). This implies that premature deaths observed in the 2000s were experienced more in women at a younger age than that observed in the 1970s. During the same time period, a 65.80% increase in breast cancer deaths among blacks would increase YPLL by 82.86%. Detailed estimates by racial/ethnic group and by specific age group are presented in Appendix D (available at www.ajpmonline.org).

Mortality-related Productivity Losses

In 2008, the estimated total lifetime productivity loss associated with breast cancer mortality in young women aged 20–49 years discounted at a 3% rate was $5.49 billion per year (Table 4). Among the total productivity losses, lost market productivity accounted for $3.06 billion (55.74%). When the values of both total and market productivity losses were discounted at an annual rate ranging from 5% to 0%, the estimates ranged from $4.23 to $8.81 billion for lifetime total productivity losses and $2.47 to $4.39 billion for lifetime market productivity losses. At an individual level, cost per death was estimated to be $1.10 million (discount rate range from 5% to 0%: $0.85–$1.77 million) for the total productivity loss and $0.62 million (discount rate range from 5% to 0%: $0.50–$0.89 million) for the market productivity loss. Detailed estimates by racial/ethnic groups and by specific age group on the PVFLE due to breast cancer mortality are presented in Appendix E (available at www.ajpmonline.org). The estimated sensitivity analysis of the PVFLE among all racial/ethnic groups and among whites and blacks separately were close to the estimates presented in Table 4. These results were presented in Appendix F (available at www.ajpmonline.org).

Discussion

The findings in this study provide estimates of the substantial health and economic burden associated with breast cancer mortality to young women, their families, and society. These findings underscore the importance of developing aggressive educational initiatives for young women with breast cancer. Furthermore, this study indicates that considerable progress has been made in reducing breast cancer mortality rates, but more progress is needed to reduce rates and improve outcomes, particularly among young black women. To our knowledge, there are no studies that have used a combination of measures to quantify trends in mortality rates, YPLL, and the value of productivity loss from premature breast cancer mortality among women aged 20–49 years. This study also provides a baseline of health and economic indicators, which can be used to assess future progress in reducing the disease, mortality, and health effects of breast cancer among young women.

To put these findings into context, during the past 39 years, breast cancer mortality rates have significantly declined (APC=−1.77%) among women aged <50 years. At the same time, the incidence rates have increased, but at a smaller rate (0.30%). Conversely, breast cancer mortality rates among women aged >50 years have declined at a much smaller rate (−0.70%) compared with the rate of women aged <50 years. Breast cancer incidence rates for women aged >50 years significantly increased (0.80%) compared with a lower rate observed for women aged <50 years. In the past 40 years, incidence of breast cancer was much higher in the older age group and mortality rate was higher in the younger age group.

This study follows patterns similar to a study by Max et al.,[26] although the study was specific to California women with differences in age distribution and study population. Similarly, Bradley et al.[27] used the human capital approach to ascertain the value of lost productivity attributable to premature death, although the findings from this study are not comparable because of differences in age groups and time spans. Further, in the past decade, many studies have reported temporal trends in breast cancer mortality rates in the general population but not in subpopulations such as women aged 20–49 years.[28–30] As a result, the findings on trends in mortality rates may not be directly comparable to previously reported rates.

From 1970 through 2008, breast cancer mortality rate in younger women aged 20–29 years in all racial/ethnic groups was estimated to decline significantly more than those in other age groups. These findings indicate that although younger women may have poorer breast cancer survival outcomes than older women,[31] over time, more are surviving from this disease. This may be due, at least in part, to the increased use of tamoxifen, adjuvant chemotherapy, and other chemopreventive agents, which has led to declines in breast cancer mortality rates across several age groups, including younger women.[32,33] A study by a Danish group confirmed this observation and found that breast cancer prognosis was worse for young women who were not treated with chemotherapy.[34]

Although breast cancer is relatively uncommon in young women, clinical studies have shown that they have a more aggressive form of the disease, larger tumors, a higher prevalence of adverse prognostic outcomes, fewer hormone receptor–positive tumors, earlier and more frequent local recurrences, and poorer overall survival compared with older women.[14–16,35–39] Further, studies have reported that not only is breast cancer a heterogeneous disease with different morphologies, breast cancer is expressed in diverse molecular profiles with important clinical differences among populations in terms of incidence, mortality, diagnosis, treatment, and prognosis.[40,41] These clinical differences are more profound in black women, who bear the greatest impact among all racial/ethnic groups according to this study.

Many studies have reported that black women are more likely to have estrogen receptor–negative tumors that unfavorably influence their use of tamoxifen, a preventive drug of choice for premenopausal women; in addition, a higher proportion of black women have more aggressive tumors, which are clinically associated with poor health outcomes.[42–45] Over time and even in recent years (i.e., 2000–2008), the observed decline in breast cancer mortality rates has been significantly smaller in black women compared with other racial/ethnic groups. This suggests the need for more age-appropriate interventions to improve patient outcomes that target young black women and their healthcare providers. Initiatives to increase the awareness of breast cancer and quality of care in black communities may help black women to identify breast lumps, be knowledgeable about changes to their breasts, and participate in decisions regarding options for treatment. Such initiatives could help reduce the widening mortality disparity between young black women and young white women observed in this study.

Limitations

This study has some limitations. First, mortality data were based on death certificates, and the quality of the information recorded can vary. However, a previous study concluded that there were no problems with coding of breast cancer as cause of death,[46] and another study has verified the quality of demographic data on death certificates.[47] Second, the human capital approach[27] was used to calculate the PVFLE lost due to breast cancer mortality in young women. This approach assumes that an individual produces a stream of earnings that is valued only through employment. Because the approach is based on market wages and, on average, American women earn less than their male counterparts at every level of educational attainment,[48] it may have underestimated productivity losses from breast cancer mortality among young women. Further, the human capital approach also fails to recognize the costs of intangibles, including pain and suffering, the psychosocial consequences of cancer, and reductions in the quality of life.[49] Third, the analysis excludes morbidity costs associated with breast cancer, which include productivity loss from individuals with breast cancer before they die, costs of medical treatment, nonmedical costs such as those associated with time spent seeking cancer treatment and care,[50] and productivity losses for caregivers. Finally, multiple factors that might explain the differences in black mortality rates compared with all racial/ethnic groups and whites were not considered. These factors may include prognostic, socioeconomic, demographic, and behavioral access to health care and health insurance.

Conclusion

In his 1991 address to the Society for Epidemiologic Research, Sir Richard Doll suggested that monitoring cancer trends in young adults would be beneficial because it could serve as an early warning system or, in the case of a declining trend, an early indication of the effectiveness of a preventive strategy or risk-reducing agent.[51] These findings provide direct evidence that in the past four decades, breast cancer mortality in young women have not decreased as fast in black women as in white women. Further, this study also reported substantial health and economic burden associated with breast cancer mortality in young women.

Given the findings from this study and considering that this cancer affects women who are in their productive years with maximum family and social responsibilities, this implies that the nation and families are losing current and future productivity and it underscores the need for more-aggressive interventions. Decision makers may have a role in creating and sustaining multifaceted prevention programs, including intensive treatment regimens, educational initiatives, and initiating systems and environmental change to reduce the burden, improve survival, and in turn, reduce productivity costs associated with premature death.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Appendix. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.amepre.2013.08.016.

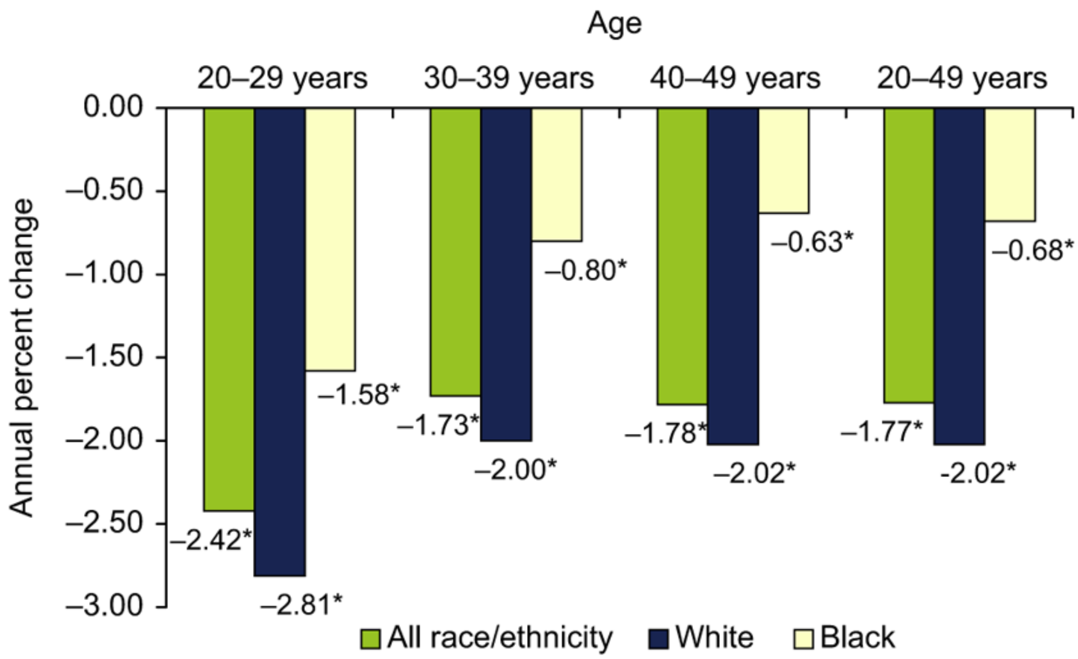

Figure 1.

Annual percent change in breast cancer mortality rates in young women by age group and racial/ethnic category, US., 1970–2008.

*The annual percent change is significantly different from 0 (two-sided *p*<0.05).

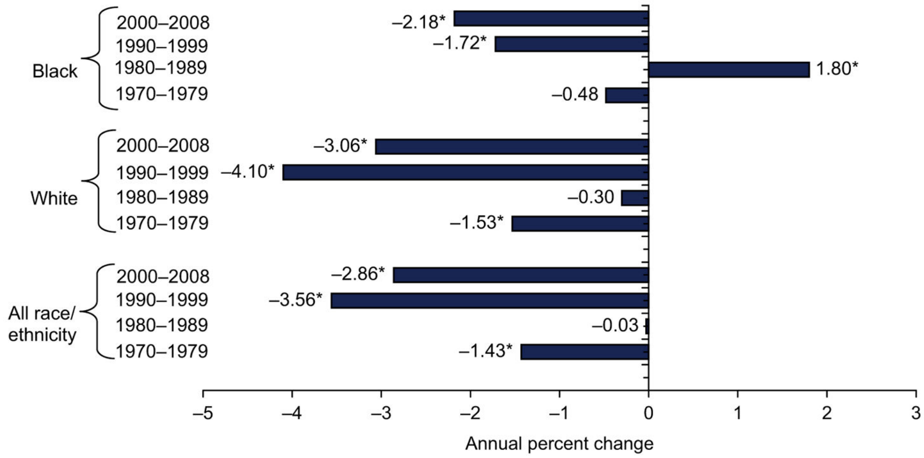

Figure 2.

Annual percent change in breast cancer mortality rates in young women age 20–49 years by racial/ethnic category and time period, US., 1970–2008.

*The annual percent change is significantly different from 0 (two-sided p<0.05).

Table 1

Age-adjusted breast cancer mortality rates, rate ratios in young women by racial/ethnic categories, U.S., 1970–2008[a]

Racial/ethnic category	Rate[b] (95% CI)	RR (95% CI)
All race/ethnicity	12.02 (11.97–12.07)	—
South	12.32 (12.23–12.40)	1.00 (ref)
Northeast	12.69* (12.58–12.80)	1.03* (1.02–1.04)
Midwest	12.09* (11.99–12.19)	0.98* (0.97–0.99)
West	10.79* (10.69–10.90)	0.88* (0.87–0.89)
White	11.45 (11.40–11.50)	—
South	11.12 (11.03–11.22)	1.00 (ref)
Northeast	12.43* (12.31–12.55)	1.12* (1.10–1.13)
Midwest	11.56* (11.45–11.66)	1.04* (1.03–1.05)
West	10.83* (10.72–10.94)	0.98* (0.96–0.99)
Black	17.97 (17.79–18.14)	—
South	18.34 (18.09–18.58)	1.00 (ref)
Northeast	16.73* (16.35–17.10)	0.91* (0.89–0.94)
Midwest	18.45 (18.04–18.86)	1.01 (0.98–1.03)
West	17.61* (17.03–18.20)	0.96* (0.93–0.99)

[a] Rates are for young women aged 20–49 years. Detailed age group–specific and time period–specific rates are presented in Appendix B (available at www.ajpmonline.org).

[b] Rates are per 100,000 population and are age adjusted to the 2000 U.S. standard population (See Day 1996.[25] Current population reports no. 25–1130. Washington, DC: U.S. Bureau of the Census, 1996). 95% CIs (Tiwari mod).

* The rate ratio (RR) indicates the rate is significantly different from the rate for the South (p<0.05).

Table 2

Trends in breast cancer mortality rates among young women by racial/ethnic category and geographic region, U.S., 1970–2008[a]

			Joinpoint analysis (1970–2008)							
			Trend 1		Trend 2		Trend 3		Trend 4	
Racial/ethnic category	Geographic region	APC[b] 1970–2008	Year	APC	Year	APC	Year	APC	Year	APC
All race/ethnicity		−1.77*	1970–1981	−1.33*	1981–1989	0.22	1989–2008	−3.11*	—	—
	South	−1.34*	1970–1980	−1.31*	1980–1990	0.83	1990–2008	−2.92*	—	—
	Northeast	−2.19*	1970–1991	−1.29*	1991–2008	−3.60*	—	—	—	—
	Midwest	−1.81*	1970–1989	−0.60*	1989–2008	−3.09*	—	—	—	—
	West	−1.95*	1970–1991	−0.83*	1991–2008	−3.40*	—	—	—	—
White		−2.02*	1970–1981	−1.47*	1981–1989	−0.02	1989–2008	−3.49*	—	—
	South	−1.73*	1970–1980	−1.45*	1980–1991	0.32	1991–1999	−4.31*	1999–2008	−2.64*
	Northeast	−2.33*	1970–1991	−1.38*	1991–2008	−3.88*	—	—	—	—
	Midwest	−2.01*	1970–1989	−0.75*	1989–2008	−3.40*	—	—	—	—
	West	−2.05*	1970–1991	−0.90*	1991–2008	−3.61*	—	—	—	—
Black		−0.68*	1970–1973	3.54	1973–1976	−5.19	1976–1988	1.92*	1988–2008	−2.01*
	South	−0.48*	1970–1976	−2.77*	1976–1989	2.27*	1989–2008	−2.06*	—	—
	Northeast	−1.25*	1970–1991	−0.31	1991–2008	−2.43*	—	—	—	—
	Midwest	−0.65*	1970–1987	0.89*	1987–2008	1.63*	—	—	—	—
	West	−0.95*	1970–1988	1.61*	1988–2008	−2.67*	—	—	—	—

[a]Rates are for young women aged 20–49 years old. Detailed age group–specific rates are presented in Appendix C (available at www.ajpmonline.org).

[b] APC in breast cancer mortality rates based on Joinpoint analyses. APC was calculated using weighted least squares method.

* The APC is significantly different from 0 (two-sided $p < 0.05$).

APC, annual percent change

Table 3

Total number of deaths and years of potential life lost due to breast cancer mortality among young women by race/ethnicity, U.S., 1970–2008

Race/ethnicity	Total number of deaths	YPLL			Percent change in total number of deaths[c]	Percent change in estimated total YPLL[d]
		Total number (95% CI)[a]	Rate[b] (95% CI)[a]	Per death[c] (95% CI)[a]		
1970–1979 (ref)						
All race/ethnicity	53,368	1,761,232 (1,757,499–1,764,964)	409.30 (408.43–410.16)	33.00 (32.93–33.07)	—	—
White	45,803	1,506,519 (1,503,316–1,509,723)	404.86 (404.00–405.72)	32.89 (32.82–32.96)	—	—
Black	7,103	239,194 (238,697–239,690)	483.03 (482.03–484.04)	33.67 (33.60–33.74)	—	—
1980–1989						
All race/ethnicity	57,115	2,054,187 (2,050,750–2,057,625)	389.48 (388.83–390.14)	35.97 (35.91–36.03)	7.02	16.63
White	46,681	1,672,868 (1,670,058–1,675,678)	377.26 (376.63–377.89)	35.84 (35.78–35.90)	1.92	11.04
Black	9,532	348,556 (347,982–349,130)	529.15 (528.28–530.02)	36.57 (36.51–36.63)	34.20	45.72
1990–1999						
All race/ethnicity	65,283	2,344,837 (2,339,779–2,349,895)	391.48 (390.63–392.32)	35.92 (35.84–36.00)	22.33	33.14
White	50,615	1,810,187 (1,806,265–1,814,109)	370.65 (369.85–371.46)	35.76 (35.69–35.84)	10.51	20.16
Black	12,945	472,835 (471,832–473,838)	590.73 (589.48–591.98)	36.53 (36.45–36.60)	82.25	97.68
2000–2008						
All race/ethnicity	50,100	1,842,103 (1,838,963–1,845,243)	326.18 (325.63–326.74)	36.77 (36.71–36.83)	−6.12	4.59
White	36,458	1,335,721 (1,333,437–1,338,006)	298.57 (298.06–299.09)	36.64 (36.57–36.70)	−20.40	−11.34
Black	11,777	437,394 (436,656–438,132)	545.85 (544.92–546.77)	37.14 (37.08–37.20)	65.80	82.86
1970–2008						
All race/ethnicity	225,866	7,981,115 (7,969,204–7,993,027)	376.21 (375.65–376.77)	35.34 (35.28–35.39)	323.22	356.16
White	179,557	6,323,015 (6,313,545–6,332,484)	361.05 (360.51–361.59)	35.21 (35.16–35.27)	292.02	319.71
Black	41,357	1,482,670 (1,480,489–1,484,852)	538.05 (537.26–538.84)	35.85 (35.80–35.90)	482.25	519.86

[a] Detailed age group–specific estimates are presented in Appendix D (available at www.ajpmonline.org).

[b] YPLL rates are per 100,000 women.

[c] YPLL per death was calculated by dividing the estimated number of YPLL by the number of deaths that occurred prematurely at each time period.

[d] Percent change in the total number of deaths was calculated by subtracting the number of deaths in each of the time periods: 1980s, 1990s, and 2000s from the number of deaths in the 1970s and dividing this difference by the number of deaths in the 1970s (reference time period). The estimated % change in YPLL was calculated in an analogous manner.

YPLL, years of potential life lost

Table 4

Present value of discounted future lifetime productivity losses due to breast cancer mortality among young women aged 20–49 years by race/ethnicity, U.S., 2008[a]

	Discounted total cost ($ x 1 million)[b]		Discounted total cost per death ($ x 1 million)[b]	
Race/ethnicity	**Lifetime total production[c] 3% (5%–0%)**	**Lifetime market production[d] 3% (5%–0%)**	**Lifetime total production[c] 3% (5%–0%)**	**Lifetime market production[d] 3% (5%–0%)**
All race/ethnicity	$5488.6 ($4230.1–8805.1)	$3057.6 ($2465.9–4394.9)	$1.10 ($0.85–1.77)	$0.62 ($0.50–0.89)
White	$3920.4 ($3099.1–6207.7)	$2198.6 ($1775.4–3153.1)	$1.09 ($0.86–1.73)	$0.61 ($0.50–0.88)
Black	$1323.2 ($2148.9–2071.5)	$743.8 ($597.5–1075.5)	$1.11 ($0.86–1.80)	$0.62 ($0.50–0.90)

[a] All costs were expressed in 2008 U.S. dollars.

[b] Discounted cost per death was calculated by dividing the estimated amount of productivity losses by the number of deaths that occurred prematurely.

[c] Lifetime total production consists of earnings received through the labor market and household services.

[d] Lifetime market production consists of earnings received only through the labor market.