Chapter 1
Breast Cancer Statistics

Jiemin Ma and Ahmedin Jemal

Abstract Among U.S. women, breast cancer is the most commonly diagnosed cancer (excluding skin cancers) and the second leading cause of cancer death, following lung cancer. In 2012, an estimated 226,870 new cases of invasive breast cancer and 39,510 breast cancer deaths are expected to occur among U.S. women. Breast cancer rates vary largely by race/ethnicity and socioeconomic status (SES), and geographic region. Death rates are higher in African American women than in whites, despite their lower incidence rates. Historically, breast cancer was recognized as a disease of western countries. However, over the past 20 years, breast cancer incidence and mortality rates have been increasing rapidly in economically less developed regions. According to 2008 GLOBOCAN estimates, half of the new worldwide breast cancer cases (1.38 million) and 60 % of the breast cancer deaths (458,000) occurred in developing countries. This chapter reviews breast cancer incidence and mortality patterns among women in the U.S. and worldwide, and the possible explanations for these patterns.

Keywords Breast cancer · Cancer incidence · Age-standardized rate (ASR) · Cancer mortality · 5-year relative survival · Cancer statistics · Age · Race/ethnicity · Socioeconomic status (SES) · Geographic variation · Trends · Global patterns · Cancer burden

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1.1 Introduction

Among U.S. women, breast cancer is the most common cancer diagnosis (excluding skin cancers) and the second leading cause of cancer death, preceded only by lung cancer. The American Cancer Society estimated that approximately 226,870 new cases of invasive breast cancer and 39,510 breast cancer deaths are expected to occur among U.S. women in 2012 [1]. Over the past 20 years, breast cancer mortality rates have been decreasing in the U.S. and in many other developed countries, whereas increasing incidence and mortality have been seen in most developing countries [2]. In 2008, approximately 1.4 million newly diagnosed breast cancer cases and about 460,000 breast cancer deaths occurred among women worldwide [3, 4]. In this chapter, we review the female breast cancer burden in the United States focusing on incidence and mortality and their temporal trends by race/ethnicity, along with an overview of global burden of this disease. We also briefly discuss possible explanations for the observed patterns and comment on established preventive measures that can reduce breast cancer burden.

1.2 Common Indicators in Cancer Statistics

1.2.1 Incidence

Cancer incidence is the number of new cancer cases occurring in a defined population during a specified time period, usually expressed as the number of cancers per 100,000 persons per year. The numerator only counts new cancers in their primary sites not including metastasized cancers. To facilitate comparing rates between populations that may have different age structures, age-standardized rate (ASR) is routinely reported in cancer statistics, which is a weighted average of the age-specific rates, with each weight being the proportion of persons in the corresponding age groups of a standard population.

1.2.2 Mortality

Cancer mortality is the number of cancer deaths in a specified population during a specific time period, usually expressed as the number of deaths per 100,000 persons per year. As a product of cancer incidence and case fatality (1-survival), cancer mortality is influenced by factors affecting either occurrence, survival, or both. When comparing rates between two populations, mortality rate sometimes can serve as a proxy measure of cancer incidence, under an assumption of equal survival. This approach is reasonable for cancers with high fatality, such as cancers of the lung and pancreas, but may not be appropriate for breast cancer, of which survival rates vary largely across different populations [5].

1.2.3 Survival

Cancer survival, a measure of cancer prognosis, is the proportion of patients alive at some point subsequent to the cancer diagnosis. In cancer statistics, the most commonly reported survival estimate is relative survival rate, which is an estimate of the percentage of patients who would be expected to survive a specified time period after diagnosis, usually 5 years. It is calculated as the ratio of the observed survival of cancer patients to the expected survival of a comparable group of the general population with respective to age, sex, and calendar time, such that relative survival removes the effect of death causes other than cancer. When relative survival is inestimable (e.g., life-table data are unavailable), cause-specific survival rate could be used as an alternative, which is the probability of not dying of the cancer diagnosed within a specified time period following diagnosis [6].

1.3 Data Sources

1.3.1 Incidence and Mortality Data in the United States

Incidence rates for 2004–2008 were estimated using data from the North American Association of Central Cancer Registries (NAACCR)'s Incidence-CiNa Analytic File [7], which was based on incidence data from the Surveillance, Epidemiology, and End Results (SEER) program and the National Program of Cancer Registries (NPCR). Incidence trend data were from SEER 9 registries for whites and blacks (1975–2008) and from SEER 13 registries for other racial/ethnic groups (1992–2008). Survival data for 2001–2007 were from SEER 17 registries.

The SEER program of the National Cancer Institute (NCI) has been collecting information on patient demographics, tumor morphology and stage at diagnosis, treatment, and follow-up for vital status since 1973. Currently, this program comprises 17 population-based cancer registries covering approximately 28 % of U.S. populations [8]. The NPCR, which is administered by the Centers for Disease Prevention and Control (CDC) and began operating in 1995, has substantially increased population-based cancer registration coverage in the U.S. Currently, the SEER and NPCR together collect data for the entire U.S. population [9].

Mortality data were obtained from the SEER program's SEER*Stat database as provided by the National Center for Health Statistics (NCHS) [10]. For whites and blacks, data are available since 1969, and for other racial/ethnic groups, data are available since 1990. The accuracy of recording breast cancer as an underlying cause of death in cancer statistics is high in the U.S., with an agreement rate about 92 % between cause of death on the death certificates and breast cancer diagnosis in cancer registries [11]. All rates (both incidence and mortality) for the U.S. were age standardized to the 2000 U.S. standard population.

1.3.2 Worldwide Incidence and Mortality Data

Breast cancer incidence and mortality rates for all countries in 2008 were obtained from GLOBOCAN 2008 published by the International Agency for Research on Cancer (IARC) [12]. The methods used to estimate cancer incidence and mortality rates, which vary country from country according to the availability and the accuracy of data, are described in detail elsewhere [3]. In GLOBOCAN 2008, incidence data are derived from population-based cancer registries, which cover about 21 % of the world population [13]. Mortality data are available for approximately 30 % of the world population. In Asian and African countries, data are often lacking, incomplete, and/or of poor quality.

Breast cancer incidence trend data were obtained from the Cancer Incidence in Five Continents (CI5) series and mortality trend data were obtained from the WHO mortality database. Worldwide incidence and mortality rates were age standardized to the 1960 world standard population. Thus, they cannot be directly compared with the U.S. rates that were age standardized to the 2000 U.S. standard population.

1.4 Breast Cancer Patterns in the United States

During 2004–2008, the age-standardized breast cancer incidence and mortality rates (per 100,000 females) were 121.2 and 23.5, respectively. However, breast cancer rates in the U.S. vary markedly by demographic and geographic characteristics, such as age, race/ethnicity, and state.

1.4.1 Age

Age is the strongest risk factor for breast cancer in women. Incidence of breast cancer increases sharply with increasing age among premenopausal women (aged $\leq$ 50 years) and then increases at a slower rate among postmenopausal women (aged > 50 years) until age of 80 years (Fig. 1.1). This pattern largely reflects the influence of reproductive hormones on breast cancer occurrence [14]. The decline after age 80 may be due to decreased rates of mammography screening in this age group. During 2004–2008, the incidence rate among U.S. women ranged

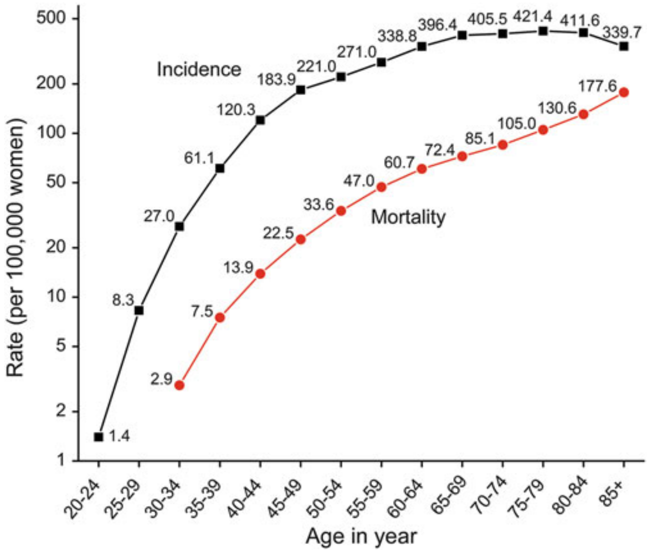

Fig. 1.1 Breast cancer incidence and mortality rates (rates are age adjusted to the 2000 U.S. standard population) by age, U.S., 2004–2008

from 1.4 per 100,000 women for ages 20–24 to 421.4 per 100,000 women for ages 75–79 (Fig. 1.1); the median age at diagnosis of breast cancer was 61 years, with approximately 22 % new cases occurring under age 50, 36 % between ages 50 and 64, 29 % between ages 65 and 79, and 16 % at age 80 or above [15].

In contrast to the incidence patterns, mortality rate increases monotonically with increasing age without interruption (Fig. 1.1). This pattern may partly reflect the poorer survival of breast cancer diagnosed after age 75 [15]. During 2004–2008, breast cancer mortality rate increased from 2.9 per 100,000 women for ages 30–34 to 177.6 per 100,000 women for ages $\geq$ 85; the median age at death from breast cancer was 68 years, with approximately 13 % deaths occurring under age 50, 30 % between ages 50 and 64, 31 % between ages 65 and 79, and 26 % at age 80 or above [15].

1.4.2 Race/Ethnicity

Breast cancer incidence rates vary markedly by race/ethnicity in the United States (Fig. 1.2). During 2004–2008, the age-standardized incidence rate of breast cancer was highest among non-Hispanic whites (125.4/100,000 women) and lowest among Asian Americans/Pacific Islanders (84.9/100,000 women). The high incidence rate among whites may reflect combined effects of early menarche, late child bearing, fewer pregnancies, greater use of menopausal hormone therapy, as well as increased detection through mammography [16, 17]. Although breast

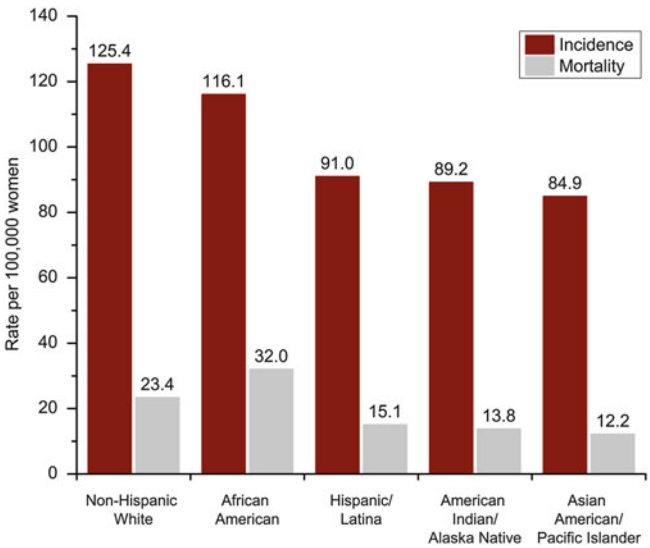

Fig. 1.2 Breast cancer incidence and mortality rates (rates are age adjusted to the 2000 U.S. standard population) by race and ethnicity, U.S., 2004–2008

cancer incidence rates are higher in non-Hispanic white women than in black women for most age groups, African American women have a higher incidence rate before age 45 [15].

Breast cancer mortality rates also varied substantially across different racial/ethnic groups in the United States (Fig. 1.2). Despite lower incidence rate than non-Hispanic whites, African Americans have the highest death rate (32.0/100,000 women during 2004–2008). The higher mortality rate among African Americans is in part due to later stage at diagnosis as a result of poorer quality of screening and delayed follow-up for abnormal mammography findings, as well as due to poorer stage-specific survival rates as a result of delayed treatment [18–20]. In addition, African American women are more likely to be diagnosed with breast cancers with predictors of poor prognosis, such as triple-negative tumors [21, 22]. As observed in incidence, Asian Americans/Pacific Islanders also have the lowest breast cancer death rates (12.2/100,000 women during 2004–2008) among the five major racial/ethnic groups (Fig. 1.2). The racial disparity in breast cancer is discussed in more detail in Chap. 3.

1.4.3 Socioeconomic Status

Unlike most other diseases, the risk of developing breast cancer is positively associated with socioeconomic status as measured either by income or education [23, 24]. This association may partly be explained by the established reproductive risk factors for breast cancer, such as less parity and later age at first child birth

[25]. Women with high SES are often to have fewer children and a later full-term pregnancy than women with low SES. However, due to better survival, women with high SES do not necessarily have higher breast cancer mortality rates than low SES women. In fact, women in affluent areas (poverty rate < 10 %) had a 7 % lower risk of breast cancer death than those in poor areas (poverty rate > 20 %) during 2003–2007, although breast cancer death rates were lower in poor areas than in affluent areas before 1990 [26]. Socioeconomic disparities in breast cancer related factors have been thought to be a major driving factor for racial/ethnic disparities in breast cancer burden in the Unites States [27].

1.4.4 Geographic Variation

Moderate geographic variations in breast cancer incidence and mortality exist in the United States (Table 1.1). During 2004–2008, breast cancer incidence rate for all races combined was highest in Connecticut (136.2/100,000 women) and lowest in Arizona (106.7/100,000 women); for non-Hispanic white women, the incidence rates ranged from 110.8 per 100,000 women in Arkansas to 140.4 per 100,000 women in California and the District of Columbia; among African American women, the incidence rate was lowest in New Mexico (73.2/100,000 women) and highest in Delaware (131.0/100,000 women).

During 2004–2008, District of Columbia had the highest breast cancer death rate for all races combined (27.6/100,000 women) and Hawaii had the lowest rate (17.8/100,000 women) (Table 1.1). Among non-Hispanic white women, breast cancer death rates ranged from 20.9 per 100,000 women in Montana to 27.4 per 100,000 women in New Jersey. In contrast, breast cancer death rates among African American women ranged from 23.1 per 100,000 women in Colorado to 36.8 per 100,000 women in Tennessee. The state variations in breast cancer rates are partly explained by the differential prevalence of known risk factors associated with socioeconomic status [28–31]. State differences in mammography screening may also contribute to the state variation in breast cancer incidence, in part because of early detection and over diagnosis [26, 32].

1.4.5 Trends in Breast Cancer Incidence

During the early 1980s, breast cancer incidence rate increased sharply by 4.0 % per year (Fig. 1.3). This rapid increase largely reflected increased diagnosis due to the introduction of mammography screening [33]. Changes in reproductive patterns including delayed childbearing and less parity may also have contributed to this trend. The rates stabilized during 1987–1994 and then increased again at a relatively lower rate (1.7 %) till 1999. This decelerated increase may be due to combined effects of leveled screening rates, increased use of postmenopausal

Table 1.1 Breast cancer incidence and mortality rates (rates are per 100,000 and age adjusted to the 2000 U.S. standard population) by race/ethnicity and state, U.S., 2004–2008

State	All races		Non-Hispanic white		African American	
	Incidence	Mortality	Incidence	Mortality	Incidence	Mortality
Alabama	117.2	24.5	117.2	22.3	115.8	32.1
Alaska	130.4	21.7	132.6	22.6	122.1	[a]
Arizona	106.7	21.0	112.6	21.9	95.8	27.2
Arkansas	109.0	24.0	110.8	22.9	101.5	32.0
California	122.4	22.5	140.4	25.2	121.0	33.0
Colorado	122.3	20.5	125.0	21.4	103.5	23.1
Connecticut	136.2	23.2	139.4	23.7	112.8	26.4
Delaware	126.6	24.3	125.5	24.6	131.0	24.8
District of Columbia	127.0	27.6	140.4	23.6	122.4	31.6
Florida	113.6	21.9	118.6	21.9	102.3	29.9
Georgia	119.2	23.2	121.2	21.5	118.5	29.9
Hawaii	122.4	17.8	136.3	23.4	78.9	[a]
Idaho	116.5	21.2	118.6	21.6	[a]	[a]
Illinois	123.9	24.7	128.7	24.0	119.5	36.0
Indiana	115.1	24.0	115.1	23.7	113.8	33.6
Iowa	122.5	22.1	123.7	22.3	110.3	32.5
Kansas	124.4	23.1	124.7	22.9	127.0	30.9
Kentucky	120.5	23.5	120.2	23.3	128.3	31.2
Louisiana	118.2	26.8	118.5	23.6	122.3	35.9
Maine	128.9	21.5	128.7	21.4	[a]	[a]
Maryland	123.4	25.6	127.3	24.2	117.8	32.1
Massachusetts	133.4	22.3	136.6	22.8	109.0	25.6
Michigan	120.3	24.4	120.1	23.3	119.2	34.5
Minnesota	126.4	21.6	127.3	21.7	109.0	29.0
Mississippi	112.8	25.5	111.7	21.8	115.4	34.0
Missouri	120.6	25.4	120.9	24.9	125.6	33.5
Montana	120.0	20.7	119.6	20.9	[a]	[a]
Nebraska	125.0	22.0	126.1	21.9	129.1	28.9
Nevada	110.8	23.5	115.7	25.8	104.4	25.7
New Hampshire	132.2	22.8	132.5	23.1	[a]	[a]
New Jersey	129.7	26.5	138.8	27.4	111.9	31.6
New Mexico	110.5	21.5	124.4	23.3	73.2	[a]
New York	124.3	23.1	133.5	23.4	106.7	27.4
North Carolina	123.3	24.4	124.5	22.7	122.3	32.8
North Dakota	124.2	22.3	123.7	21.6	[a]	[a]
Ohio	119.8	25.9	119.4	25.2	120.7	34.8
Oklahoma	125.6	24.1	125.1	24.2	125.3	35.4
Oregon	130.3	22.5	129.9	23.1	93.4	24.3
Pennsylvania	124.8	24.8	124.9	24.5	125.5	32.0
Rhode Island	132.5	22.2	136.1	22.8	118.8	[a]
South Carolina	119.9	24.3	121.5	22.0	114.5	31.2
South Dakota	117.4	21.8	118.3	22.0	[a]	[a]
Tennessee	117.2	24.5	117.3	22.8	116.4	36.8

(continued)

Table 1.1 (continued)

State	All races		Non-Hispanic white		African American	
	Incidence	Mortality	Incidence	Mortality	Incidence	Mortality
Texas	113.7	22.6	121.6	22.7	117.1	34.4
Utah	109.5	22.1	112.1	22.7	75.7	[a]
Vermont	130.1	21.7	131.5	22.0	[a]	[a]
Virginia	124.2	25.1	125.8	23.6	126.4	34.7
Washington	129.8	22.4	131.6	23.5	117.7	26.5
West Virginia	112.6	23.9	113.3	23.8	98.9	35.1
Wisconsin	123.4	22.1	123.4	22.2	113.0	27.1
Wyoming	114.6	22.1	116.3	22.2	[a]	[a]

[a] Statistic not displayed due to fewer than 25 cases or deaths

hormone therapy, and rising obesity epidemic [34]. After peaking in 1999, incidence rate started to decrease and sharply dropped by 7 % during 2002–2003 [35]. This dramatic decline is thought to be a result of decreased use of menopausal hormones following the publication of the results of the Women's Health Initiative trial in 2002, which linked hormone use with increased breast cancer risk [36]. This trend has also been attributed to a reduced pool of prevalent cases as a result of widespread screening [34, 37]. Since 2003, breast cancer incidence rates have remained relatively stable [38].

The overall trends in breast cancer incidence largely reflected the trend for women 50 years of age and older, among whom the incidence rates increased annually by 5.4 % during 1982–1987, stabilized from 1987 to 1993, then increased again at a slower rate (1.9 % per year) during 1993–1999, then declined by 2.6 % per year from 1999 to 2005, and have since stabilized. In contrast, after a rapid increase (3.2 % per year) during 1980–1985, the incidence rates for women younger than 50 years have since remained almost constant (Fig. 1.3).

The temporal trends in breast cancer incidence were generally similar between white and black women from 1980 to the early 1990s (Fig. 1.3). However, different patterns between these two racial groups have been observed since then, partly due to differences in the use of mammography screening and menopausal hormone therapy. During 1994–1999, the rates for white women increased annually by 2.0 %, then decreased by 2.4 % per year during 1999–2004 with a dramatic decline between 2002 and 2003, and have remained relatively stable since then. In contrast, the rates in black women have remained relatively stable since 1992, although they are slightly increasing in the most recent time period.

1.4.6 Trend in Breast Cancer Mortality

In contrast to some dramatic changes in incidence, trends in breast cancer mortality rates have evolved gradually over time (Fig. 1.4), which reflected combined effects of trends in underlying risks of breast cancer occurrence, changes in

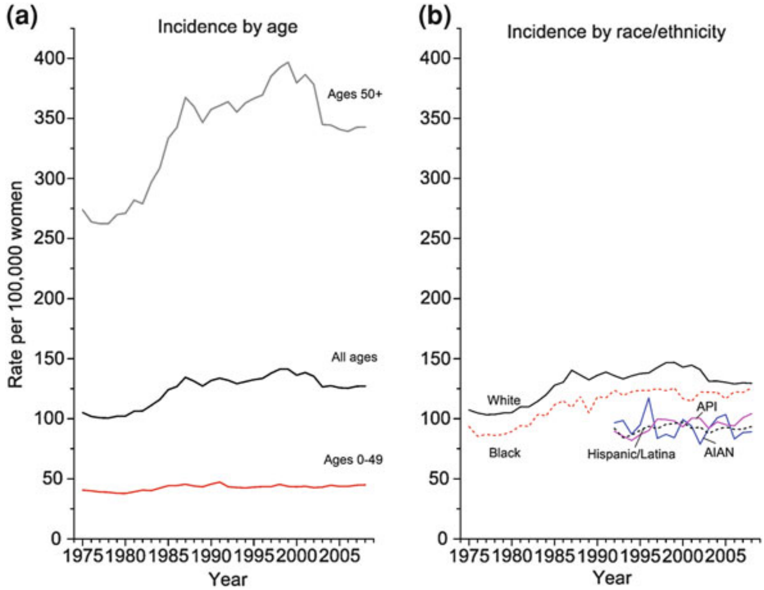

Fig. 1.3 Breast cancer incidence rates (rates are age adjusted to the 2000 U.S. standard population) by age and race/ethnicity (data for whites and blacks are from the SEER 9 areas; data from other races/ethnicities are from the SEER 13 areas; incidence data for AIAN are based on contract health service delivery area (CHSDA) counties), U.S., 1975–2008. Abbreviation: *AIAN* American Indian/Alaska Native, *API* Asian American/Pacific Islander

screening practices, and advances in cancer treatment. From 1975 to 1990, breast cancer death rates slowly increased by 0.4 % per year and then decreased annually by 2.2 % from 1990 to 2008. The recent decline in death rates has been attributed to both improvements in treatment and early detection. Researchers in the Cancer Intervention and Surveillance and Modeling Network (CISNET) estimated that screening and adjuvant treatment equally contributed to the reduction in breast cancer mortality rates in the United States [39].

The overall trends in breast cancer mortality mask some important variations by race. Historically, breast cancer death rates were slightly higher among white women than among black women. After converging in the late 1970s, the rates for white and black women diverged rapidly (Fig. 1.4). Specifically, breast cancer death rates for white women increased slowly by 0.3 % per year from 1975 to 1990, and then decreased annually by 2.3 % from 1990 to 2008. Among black women, in contrast, death rates increased rapidly by 1.5 % per year from 1975 to 1992 and then declined annually by 1.4 % from 1992 to 2008. The differential trends between whites and blacks have resulted in a widening black-white disparity in breast cancer death rates in the U.S. since 1980. By 2008, breast cancer death rates were 43 % higher in black women than in white women (Fig. 1.4). This difference is thought to reflect differences in access to care as well as survival.

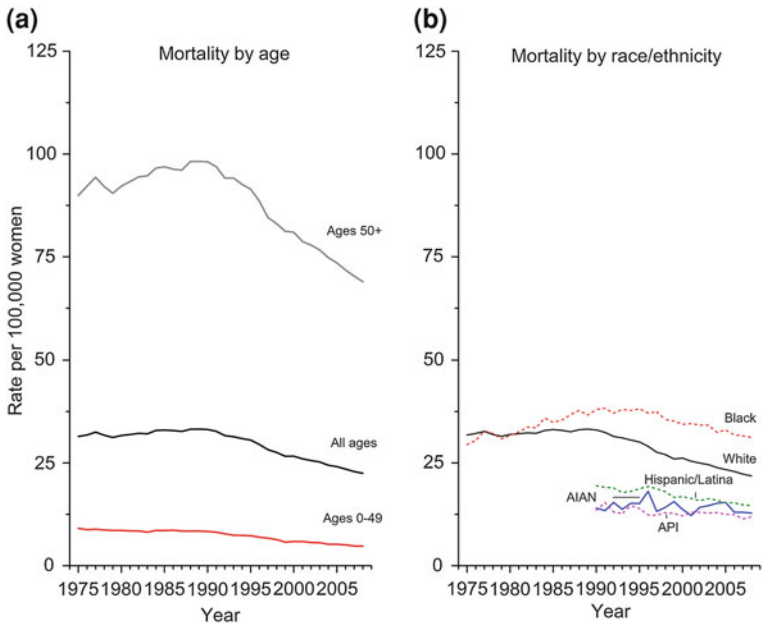

Fig. 1.4 Breast cancer mortality rates (rates are age adjusted to the 2000 U.S. standard population) by age and race/ethnicity, U.S., 1975–2008. Abbreviation: *AIAN* American Indian/ Alaska Native, *API*, Asian American/Pacific Islander

1.4.7 Survival

Survival of breast cancer has improved greatly over the last 30 years in the U.S. Based on data from SEER 17 registries, the 5 year relative survival rate was 90.0 % for cancers diagnosed in 2001–2007 [15]. Because of this relatively good prognosis as well as the high incidence, breast cancer is by far the most prevalent cancer among women in the U.S., with an estimated 2.6 million women with a history of breast cancer in 2008 [15].

Stage at diagnosis is an important predictor of breast cancer prognosis. For cancers diagnosed in 2001–2007, the 5 year survival rate was 98.6 % for localized (confined to primary site), 83.8 % for regional (spread to regional lymph nodes), and 23.3 % for distant (cancer has metastasized) disease. Survival of breast cancer is also associated with age at diagnosis, with a lower 5 year survival rate for cancers diagnosed at either a younger or an older age [15]. Tumors diagnosed at younger age tend to be more aggressive and or/less response to treatment [40]. Compared with white women, black women are more likely to have poorer breast cancer survival rates at all ages of diagnosis [15], due to both later stage at diagnosis and poorer stage-specific survival among black women (Fig. 1.5).

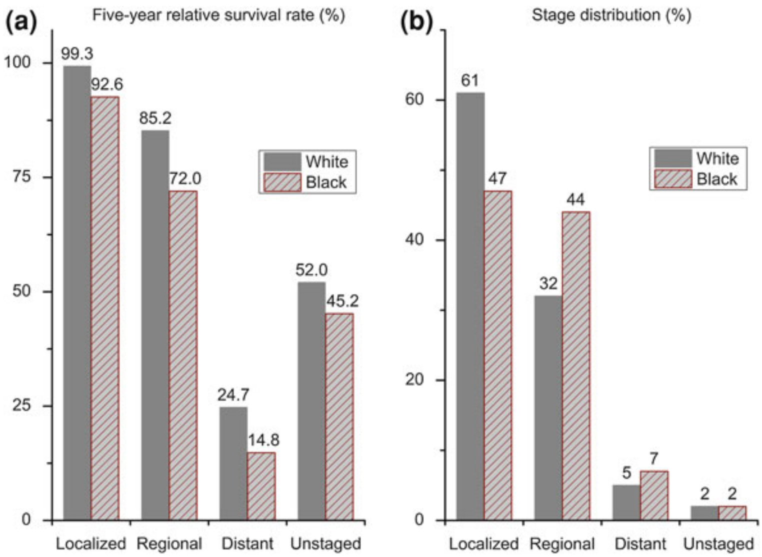

Fig. 1.5 Five-year relative survival rate and stage distribution of breast cancer, U.S., 2001–2007

1.5 Global Patterns of Breast Cancer Incidence and Mortality

Worldwide, breast cancer is the most common cancer and the leading cause of cancer death among women, with approximately 1.38 million new cases and 458,000 deaths in 2008 [3, 4]. It was estimated that in 2008, there were about 5.2 million women alive who were diagnosed with breast cancer in the previous 5 years [41]. Worldwide, the burden of breast cancer varies substantially across regions and countries. The geographical and temporal patterns in breast cancer incidence and mortality are described below.

1.5.1 Global Variations in Incidence and Mortality

In general, breast cancer incidence rates are highest in Western and Northern Europe, North America, and Australia/New Zealand; intermediate in Southern and Eastern Europe, South America, the Caribbean, and Northern Africa; and lowest in sub-Saharan Africa and Asia (Figs. 1.6, 1.7). According to GLOBOCAN 2008 [12], age-standardized (1960 world standard population) breast cancer incidence rates ranged from 19.3 per 100,000 women in Eastern Africa to 89.7 per 100,000 women in Western Europe (Fig. 1.6); the incidence rate in more developed regions (66.4/100,000 women) was 2.5 times as high as in less developed regions

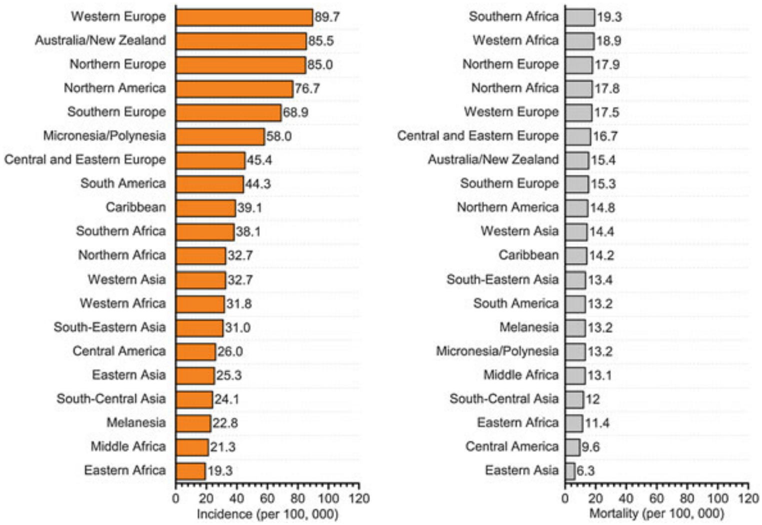

Fig. 1.6 Breast cancer incidence and mortality rates (rates are adjusted to the 1960 world standard population) by world region, 2008

(27.1/100,000 women). Between countries, the rates varied about 10-fold, with the highest rates in some Northern and Western European countries and the lowest rates in some Eastern African countries [12]. Results from migrant studies suggest that international variations in breast cancer incidence largely reflect differences in environmental or lifestyle factors rather than genetic differences [42, 43].

Wide variations in breast cancer incidence rates were also seen within regions and countries [12]. For example, the incidence in Southern Africa (38.1/100,000 women) was twice as high as in Eastern Africa (19.3/100,000 women); the incidence in Singapore was 55.9 per 100,000 women, which is much higher than the average rate of Asian populations (26.0/100,000 women); in China, the 1993–1997 incidence of breast cancer in Shanghai was 27.2 per 100,000 women, compared with 10.0 per 100,000 women in the more rural Qidong county [44]. These variations were likely due to differences in population make-up, health resources, and/or lifestyle factors. A notably high breast cancer incidence (96.8/100,000 women) was found in Israel, in part due to the high prevalence of BRCA1 and BRCA2 mutations in the Ashkenazi Jewish population [45].

Similar to the observed patterns for incidence, breast cancer mortality rates were higher in more developed regions (15.3/100,000 women) than in less developed regions (10.7/100,000 women) [12]. Across different geographic regions, breast cancer mortality rates ranged from 19.3 per 100,000 women in Southern Africa to 6.3 per 100,000 women in Eastern Asia in 2008 (Fig. 1.7). Across countries, the rates varied about 5-fold, with the highest rates in some European countries and the lowest rates in some Eastern Asian countries [12]. The

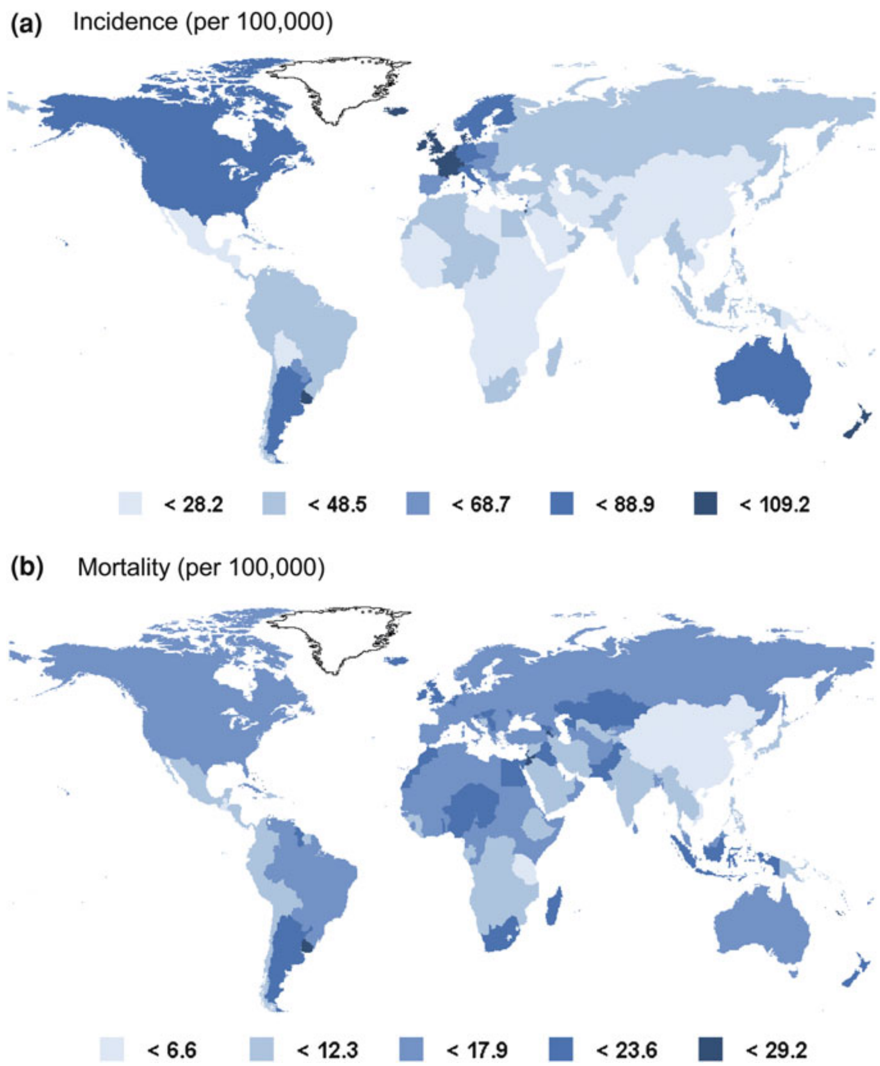

Fig. 1.7 Breast cancer incidence and mortality rates (rates are adjusted to the 1960 world standard population), world map, 2008

smaller geographic variations in mortality than in incidence are due to more favorable survival of breast cancer in countries with higher incidence rates (more developed countries). For example, only 40 % of women in Campinas (Brazil) and Setif (Algeria) survive 5 years after a diagnosis of breast cancer, compared with 83 % of women in Canada, 80 % of women in Finland, and 81 % of women in Australia [5].

1.5.2 Global Trends in Incidence and Mortality

Over the past two or three decades, breast cancer incidence has increased rapidly in countries that historically had a low incidence rate (e.g., several developing countries and Japan). For example, incidence rates increased by 140 % in Miyagi (Japan) from 1973–1977 to 1998–2002, by 40 % in Chennai (India) from 1983–1987 to 1998–2002 [2, 41], and by 4.5 % per year in Kampala (Uganda) from 1991 to 2006 [46]. The rapid increases in these countries are widely attributed to the 'westernization' of lifestyles, such as late childbearing, less parity, increased exogenous hormonal intake, and reduced physical activity [47]. In developed countries, the incidence rates of breast cancer increased substantially from the 1980s through the middle or late 1990s. However, since the early 2000s, a downward trend in breast cancer incidence has been seen in the United States and many other western countries, which has been partly attributed to the reduced use of menopausal hormone therapy [48–50].

In contrast to the trends in incidence, breast cancer mortality rates have been decreasing in North America, Western Europe, Australia, and New Zealand over the past two or three decades. For instance, the mortality rate from breast cancer decreased from 29.4 per 100,000 women in 1986 to 17.4 per 100,000 women in 2009 in the United Kingdom [2, 41]. The decreasing trends in these countries have been attributed to improved breast awareness, extended use of mammographic screening, intensified early clinical diagnosis, and advances in both primary and adjuvant treatments for breast cancer [51]. In most developing countries and Japan, however, breast cancer mortality rates continued to increase. For example, breast cancer mortality rates in the Philippines increased from 9.0 per 100,000 women in 1992 to 16.8 per 100,000 women in 2008; in Japan, the rates increased from 4.4 per 100,000 women in 1970 to 8.9 per 100,000 women in 2009 [41].

1.6 Summary

Breast cancer is the most common cancer (excluding skin cancers) among U.S. women and kills more women than any other cancers except lung cancer. There are large variations in breast cancer rates across racial/ethnic and socioeconomic groups. The incidence rates are high among whites and high SES populations, whereas African American and low SES women have high mortality rate. Eliminating breast cancer disparities between different population segments has been an overarching goal of government and private public health agencies in the United States.

Over the last few decades, breast cancer incidence and mortality rates have been increasing rapidly in developing countries, in part due to a wide adoption of western lifestyles, which are characterized by delayed childbirth, reduced parities, physical inactivity, and early-menarche-causing dietary habits. In 2008, the majority of breast cancer deaths occurred in developing rather than developed countries, although incidence rates remained high in more developed regions (except Japan). The wide spread of population-based mammographic screening programs and extensive use of adjuvant therapy have led to large decreases in breast cancer mortality in the U.S. and many other developed countries. However, challenges remain to curb the growing burden of breast cancer in many low- and middle-income countries, where limited health and financial resources hinder the adoption of these effective but resource-demanding strategies. Alternatively, raising breast awareness among the public and medical communities and promoting clinical breast examination, as an early detection strategy, should be a viable approach to reduce breast cancer burden in these countries [52]. In addition, national and international collaborations between governments, non-governmental organizations, research institutes, and biochemical or pharmaceutical companies are needed to improve the accessibility and affordability of early detection services and treatment among populations with limited resources.

References

1. Siegel R, Naishadham D, Jemal A (2012) Cancer statistics. CA Cancer J Clin 62(1):10–29
2. Jemal A, Center MM, DeSantis C, Ward EM (2010) Global patterns of cancer incidence and mortality rates and trends. Cancer epidemiology, biomarkers and prevention: A publication of the American association for cancer research, cosponsored by the American society of preventive oncology 19(8):1893–1907
3. Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM (2010) Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. Int J Cancer 127(12):2893–2917
4. Jemal A, Bray F, Center MM, Ferlay J, Ward E, Forman D (2011) Global cancer statistics. CA Cancer J Clin 61(2):69–90
5. Coleman MP, Quaresma M, Berrino F, Lutz JM, De Angelis R, Capocaccia R et al (2008) Cancer survival in five continents: a worldwide population-based study. Lancet Oncol 9(8):730–756
6. Howlader N, Ries LA, Mariotto AB, Reichman ME, Ruhl J, Cronin KA (2010) Improved estimates of cancer-specific survival rates from population-based data. J Natl Cancer Inst 102(20):1584–1598
7. NAACCR (2011) Surveillance, epidemiology and end results (SEER) program database (2011) CiNA Analytic File, 1995–2008, for expanded races, custom file with county, ACS facts and figures projection project, North American association of central cancer registries.www.seer.cancer.gov. Assessed 2011
8. National Cancer Institute (2012) SEER Surveillance, epidemiology, and end results registries. http://seer.cancer.gov/registries/index.html. Assessed 19 April 2012
9. National Program of Cancer Registries (2012) Centers for disease control and prevention. http://www.cdc.gov/cancer/npcr/about.htm. Assessed 6 April 2012
10. SEER (2011) Surveillance, epidemiology, and end results (SEER) program database www.seer.cancer.gov National cancer institute, DCCPS, surveillance research program, surveillance systems branch. Assessed April 2011
11. German RR, Fink AK, Heron M, Stewart SL, Johnson CJ, Finch JL et al (2011) The accuracy of cancer mortality statistics based on death certificates in the United States. Cancer Epidemiol 35(2):126–131
12. GLOBOCAN 2008 v1.2 (2010) Cancer incidence and mortality worldwide: IARC CancerBase No. 10. International agency for research on cancer. http://globocan.iarc.fr.Assessed 20, April 2012

13. Parkin DM (2006) The evolution of the population-based cancer registry. Nat Rev Cancer 6(8):603–612
14. Kelsey JL, Gammon MD, John EM (1993) Reproductive factors and breast cancer. Epidemiol Rev 15(1):36–47
15. Howlader N, Noone AM, Krapcho M, Neyman N, Aminou R, Waldron W et al (2011) SEER cancer statistics review, 1975–2008. National Cancer Institute Bethesda, Maryland
16. Ghafoor A, Jemal A, Ward E, Cokkinides V, Smith R, Thun M (2003) Trends in breast cancer by race and ethnicity. CA Cancer J Clin 53(6):342–355
17. Chlebowski RT, Chen Z, Anderson GL, Rohan T, Aragaki A, Lane D et al (2005) Ethnicity and breast cancer: Factors influencing differences in incidence and outcome. J Natl Cancer Inst 97(6):439–448
18. Li CI, Malone KE, Daling JR (2003) Differences in breast cancer stage, treatment, and survival by race and ethnicity. Arch Intern Med 163(1):49–56
19. Hershman D, Weinberg M, Rosner Z, Alexis K, Tiersten A, Grann VR et al (2003) Ethnic neutropenia and treatment delay in African American women undergoing chemotherapy for early-stage breast cancer. J Natl Cancer Inst 95(20):1545–1548
20. Gerend MA, Pai M (2008) Social determinants of Black-White disparities in breast cancer mortality: A review. Cancer epidemiology, biomarkers and prevention: A publication of the American association for cancer research, cosponsored by the American society of preventive oncology 17(11):2913–2923
21. Carey LA, Perou CM, Livasy CA, Dressler LG, Cowan D, Conway K et al (2006) Race, breast cancer subtypes, and survival in the Carolina breast cancer study. JAMA 295(21):2492–2502
22. DeSantis C, Jemal A, Ward E (2010) Disparities in breast cancer prognostic factors by race, insurance status, and education. Cancer Causes Control 21(9):1445–1450
23. Clegg LX, Reichman ME, Miller BA, Hankey BF, Singh GK, Lin YD et al (2009) Impact of socioeconomic status on cancer incidence and stage at diagnosis: selected findings from the surveillance, epidemiology, and end results: national longitudinal mortality study. Cancer Causes Control 20(4):417–435
24. Singh GK, Miller BA, Hankey BF, Edwards BK (2003) Area socioeconomic variations in U.S. Cancer incidence, mortality, stage, treatment, and survival, 1975–1999. NCI cancer surveillance monograph series, number 4. Bethesda, Maryland
25. Klassen AC, Smith KC (2011) The enduring and evolving relationship between social class and breast cancer burden: a review of the literature. Cancer Epidemiol 35(3):217–234
26. Desantis C, Siegel R, Bandi P, Jemal A (2011) Breast cancer statistics. CA Cancer J Clin 61(6):409–418
27. Siegel R, Ward E, Brawley O, Jemal A (2011) Cancer statistics, 2011: the impact of eliminating socioeconomic and racial disparities on premature cancer deaths. CA Cancer J Clin 61(4):212–236
28. Polednak AP (2005) Explaining geographic variation in breast and cervical cancer incidence rates in US Hispanic women. Ethn Dis 15(4):727–732
29. Laden F, Spiegelman D, Neas LM, Colditz GA, Hankinson SE, Manson JE et al (1997) Geographic variation in breast cancer incidence rates in a cohort of U.S. women. J Natl Cancer Inst 89(18):1373–1378
30. Canto MT, Anderson WF, Brawley O (2001) Geographic variation in breast cancer mortality for white and black women: 1986–1995. CA Cancer J Clin 51(6):367–370
31. Sturgeon SR, Schairer C, Gail M, McAdams M, Brinton LA, Hoover RN (1995) Geographic variation in mortality from breast cancer among white women in the United States. J Natl Cancer Inst 87(24):1846–1853
32. Kalager M, Adami HO, Bretthauer M, Tamimi RM (2012) Overdiagnosis of invasive breast cancer due to mammography screening: results from the norwegian screening program. Ann of int med 156(7):491–499

33. Wun LM, Feuer EJ, Miller BA (1995) Are increases in mammographic screening still a valid explanation for trends in breast cancer incidence in the United States? Cancer Causes Control 6(2):135–144
34. Glass AG, Lacey JV Jr, Carreon JD, Hoover RN (2007) Breast cancer incidence, 1980–2006: combined roles of menopausal hormone therapy, screening mammography, and estrogen receptor status. J Natl Cancer Inst 99(15):1152–1161
35. Ravdin PM, Cronin KA, Howlader N, Berg CD, Chlebowski RT, Feuer EJ et al (2007) The decrease in breast-cancer incidence in 2003 in the United States. N Engl J Med 356(16):1670–1674
36. Rossouw JE, Anderson GL, Prentice RL, LaCroix AZ, Kooperberg C, Stefanick ML et al (2002) Risks and benefits of estrogen plus progestin in healthy postmenopausal women: principal results from the Women's health Initiative randomized controlled trial. JAMA 288(3):321–333
37. Jemal A, Ward E, Thun MJ (2007) Recent trends in breast cancer incidence rates by age and tumor characteristics among U.S. women. Breast Cancer Res 9(3):R28
38. DeSantis C, Howlader N, Cronin KA, Jemal A (2011) Breast cancer incidence rates in U.S. women are no longer declining. Cancer epidemiology, biomarkers and prevention: a publication of the American association for cancer research, cosponsored by the American society of preventive oncology 20(5):733–739
39. Berry DA, Cronin KA, Plevritis SK, Fryback DG, Clarke L, Zelen M et al (2005) Effect of screening and adjuvant therapy on mortality from breast cancer. N Engl J Med 353(17):1784–1792
40. Anders CK, Hsu DS, Broadwater G, Acharya CR, Foekens JA, Zhang Y et al (2008) Young age at diagnosis correlates with worse prognosis and defines a subset of breast cancers with shared patterns of gene expression. J Clin Oncol 26(20):3324–3330
41. CANCERMondial (2012) International agency for cancer research. http://www-dep.iarc.fr. Assessed 20, April 2012
42. Ziegler RG, Hoover RN, Pike MC, Hildesheim A, Nomura AM, West DW et al (1993) Migration patterns and breast cancer risk in Asian-American women. J Natl Cancer Inst 85(22):1819–1827
43. Tominaga S (1985) Cancer incidence in Japanese in Japan, Hawaii, and western United States. Natl Cancer Inst Monogr 69:83–92
44. Parkin DM, Whelan SL, Ferlay J, Teppo L, Thomas DB (eds) (2002) Cancer incidence in five continents, vol 8. Lyon, France
45. Roa BB, Boyd AA, Volcik K, Richards CS (1996) Ashkenazi Jewish population frequencies for common mutations in BRCA1 and BRCA2. Nat Genet 14(2):185–187
46. Parkin DM, Nambooze S, Wabwire-Mangen F, Wabinga HR (2010) Changing cancer incidence in Kampala, Uganda, 1991–2006. Int J Cancer 126(5):1187–1195
47. Althuis MD, Dozier JM, Anderson WF, Devesa SS, Brinton LA (2005) Global trends in breast cancer incidence and mortality 1973–1997. Int J Epidemiol 34(2):405–412
48. Parkin DM (2009) Is the recent fall in incidence of post-menopausal breast cancer in UK related to changes in use of hormone replacement therapy? Eur J Cancer 45(9):1649–1653
49. Seradour B, Allemand H, Weill A, Ricordeau P (2009) Changes by age in breast cancer incidence, mammography screening and hormone therapy use in France from 2000 to 2006. Bull Cancer 96(4):E1–E6
50. Canfell K, Banks E, Moa AM, Beral V (2008) Decrease in breast cancer incidence following a rapid fall in use of hormone replacement therapy in Australia. Med J Aust 188(11):641–644
51. Peto R, Boreham J, Clarke M, Davies C, Beral V (2000) UK and USA breast cancer deaths down 25 % in year 2000 at ages 20–69 years. Lancet 355(9217):1822
52. Anderson BO, Yip CH, Smith RA, Shyyan R, Sener SF, Eniu A et al (2008) Guideline implementation for breast healthcare in low-income and middle-income countries: overview of the breast health global initiative global summit. Cancer 113(8):2221–22243