Breast Cancer
Facts & Figures 2015-2016

American Cancer Society®

Contents

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Breast Cancer Basic Facts

What is breast cancer?

Cancer is a group of diseases that cause cells in the body to change and grow out of control. Most types of cancer cells eventually form a lump or mass called a tumor, and are named after the part of the body where the tumor originates.

The vast majority of breast cancers begin in the parts of the breast tissue that are made up of glands for milk production, called lobules, and ducts that connect the lobules to the nipple. The remainder of the breast is made up of fatty, connective, and lymphatic tissues.

Breast cancer is typically detected either during a screening examination, before symptoms have developed, or after a woman notices a lump. Most masses seen on a mammogram and most breast lumps turn out to be benign; that is, they are not cancerous, do not grow uncontrollably or spread, and are not life-threatening. When cancer is suspected, microscopic analysis of breast tissue is necessary for a definitive diagnosis and to determine the extent of spread (in situ or invasive) and characterize the type of the disease. The tissue for microscopic analysis can be obtained via a needle or surgical biopsy. Selection of the type of biopsy is based on individual patient clinical factors, availability of particular biopsy devices, and resources.

In situ

- Ductal carcinoma in situ (DCIS) refers to a condition where abnormal cells replace the normal epithelial cells of the breast ducts and may greatly expand the ducts and lobules. DCIS is considered a noninvasive form of breast cancer because the abnormal cells have not grown beyond the layer of cells where they originated. It is the most common type of in situ breast cancer, accounting for about 83% of in situ cases diagnosed during 2008-2012. DCIS may or may not progress to invasive cancer; in fact, some of these tumors grow so slowly that even without treatment they would not affect a woman's health. Long-term studies of women whose DCIS was untreated because it was originally misclassified as benign found that 20%-53% were diagnosed with an invasive breast cancer over the course of 10 or more years.[1-5] Since there is no certain way to determine the progressive potential of a DCIS lesion, surgery and sometimes radiation and/or hormonal therapy is the usual course of action following a diagnosis of DCIS. Identifying molecular characteristics of DCIS that predict recurrence or progression to invasive cancer is an active area of research.[6]
- Lobular carcinoma in situ (LCIS, also known as lobular neoplasia) refers to cells that look like cancer cells growing within the lobules of the breast. LCIS is generally not thought to be a precursor of invasive cancer. Instead, it is considered a marker for increased risk for developing invasive cancer. LCIS is much less common than DCIS, accounting for about 13% of female in situ breast cancers diagnosed during 2008-2012.
- Other in situ breast cancers have characteristics of both ductal and lobular carcinomas or have unknown origins.

See page 12 for additional information on DCIS and LCIS. More information can also be found in the *Cancer Facts & Figures 2015*, Special Section: Breast Carcinoma In Situ.

Table 1. Estimated New Female Breast Cancer Cases and Deaths by Age, US, 2015*

Age	In Situ Cases	Invasive Cases	Deaths
<40	1,650	10,500	1,010
40-49	12,310	35,850	3,690
50-59	16,970	54,060	7,600
60-69	15,850	59,990	9,090
70-79	9,650	42,480	8,040
80+	3,860	28,960	10,860
All ages	**60,290**	**231,840**	**40,290**

*Rounded to the nearest 10.

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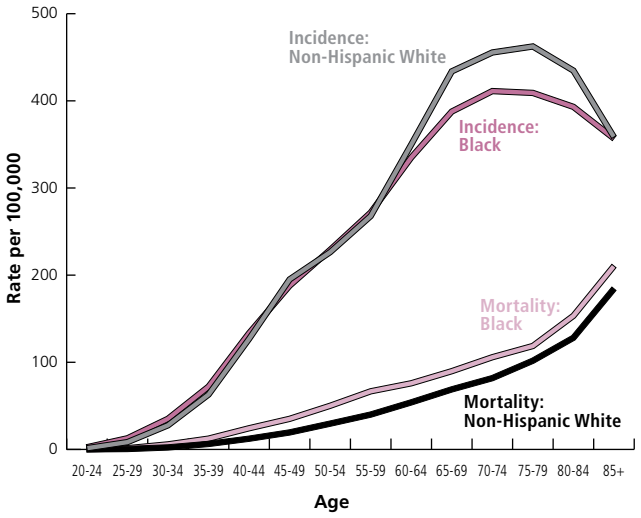
Invasive

Most breast cancers are invasive, or infiltrating. These cancers have broken through the walls of the glands or ducts where they originated and grown into surrounding breast tissue.

The prognosis of invasive breast cancer is strongly influenced by the stage of the disease – that is, the extent or spread of the cancer when it is first diagnosed. There are two main staging systems for cancer. The TNM classification of tumors uses information on tumor size and how far it has spread within the breast and to adjacent tissues (T), the extent of spread to the nearby lymph nodes (N), and the presence or absence of distant metastases (spread to distant organs) (M).[7] Once the T, N, and M are determined, a stage of 0, I, II, III, or IV is assigned, with stage 0 being in situ, stage I being early stage invasive cancer, and stage IV being the most advanced disease. The TNM staging system is commonly used in clinical settings.

The Surveillance, Epidemiology, and End Results (SEER) Summary Stage system is more simplified and is commonly used in reporting cancer registry data and for public health research and planning.[8]

Figure 1. Age-specific Female Breast Cancer Incidence and Mortality Rates, US, 2008-2012



Sources: Incidence: North American Association of Central Cancer Registries (NAACCR), 2015. Mortality: US mortality data, National Center for Health Statistics, Centers for Disease Control and Prevention.

American Cancer Society, Inc., Surveillance Research, 2015

According to the SEER Summary Stage system:

- Local stage refers to cancers that are confined to the breast (corresponding to stage I and some stage II cancers in the TNM staging system).
- Regional stage refers to tumors that have spread to surrounding tissue or nearby lymph nodes (generally corresponding to stage II or III cancers, depending on size and lymph node involvement).
- Distant stage refers to cancers that have metastasized (spread) to distant organs or lymph nodes above the collarbone (corresponding to some stage IIIc and all stage IV cancers).

Although we generally refer to breast cancer as a single disease, it is important to note that it is distinguished by up to 21 distinct histological subtypes and at least four different molecular subtypes, which are biologically variable in presentation, response to treatment, and outcomes, and also associated with distinct risk factors.[9-14] Gene expression profiling techniques have allowed us to better understand the genetic variability among tumors; however this is a costly and complicated process and is not currently standard practice. More convenient approximations of molecular subtypes have been identified using routinely evaluated biological markers, including the presence or absence of hormone (estrogen or progesterone) receptors (HR+/HR-) and excess levels of human epidermal growth factor receptor 2 (HER2+/HER2-), a growth-promoting protein.[15-18] The four main molecular subtypes are described above.

- **Luminal A (HR+/HER2-).** Most (74%) breast cancers express the estrogen receptor (ER+) and/or the progesterone receptor (PR+) but not HER2 (HER2-). These cancers tend to be slow-growing and less aggressive than other subtypes. Luminal A tumors are associated with the most favorable prognosis, particularly in the short term, in part because expression of hormone receptors is predictive of a favorable response to hormonal therapy (see page 24).[15, 19]
- **Triple negative (HR-/HER2-).** Overall, about 12% of breast cancers are triple negative, so called because they are ER-, PR-, and HER2-; however, these cancers are nearly two times more common in black women than white women in the US. They are also more common in premenopausal women and those with a *BRCA1* gene mutation.[20] The majority (about 75%) of triple negative breast cancers fall in to the basal-like subtype. Triple negative breast cancers have a poorer short-term prognosis than other breast cancer types, in part because there are currently no targeted therapies for these tumors.[19, 21]
- **Luminal B (HR+/HER2+).** Like luminal A breast cancers, luminal B breast cancers are ER+ and/or PR+ and are further defined by being highly positive for Ki67 (indicator of a large proportion of actively dividing cells) or HER2. About 10% of breast cancers are ER+ and/or PR+ and HER2+. Luminal B breast cancers tend to be higher grade and more aggressive than luminal A breast cancers.[22]
- **HER2-enriched (HR-/HER2+).** About 4% of breast cancers produce excess HER2 and do not express hormone receptors. These cancers tend to grow and spread more aggressively than other breast cancers and are associated with poorer short-term prognosis compared to ER+ breast cancers.[19] However, the recent widespread use of targeted therapies for HER2+ cancers has reversed much of the adverse prognostic impact of HER2 overexpression. For more information about the treatment of HER2+ breast cancers, see the section on targeted therapy on page 25.

What are the signs and symptoms of breast cancer?

Breast cancer typically produces no symptoms when the tumor is small and most easily treated. Therefore, it is very important for women to follow recommended screening guidelines for detecting breast cancer at an early stage. When breast cancer has grown to a size that can be felt, the most common physical sign is a painless lump. Sometimes breast cancer can spread to underarm lymph nodes and cause a lump or swelling, even before the original breast tumor is large enough to be felt. Less common signs and symptoms include breast pain or heaviness; persistent changes to the breast, such as swelling, thickening, or redness of the breast's skin; and nipple abnormalities such as spontaneous discharge (especially if bloody), erosion, or retraction. It is important to note that pain (or lack thereof) does not indicate the presence or the absence of breast cancer. Any persistent change in the breast should be evaluated by a physician as soon as possible.

Table 2. Female Breast Cancer Incidence and Mortality Rates* by Race/Ethnicity and State, 2008-2012

	Non-Hispanic White		Non-Hispanic Black		Hispanic		Asian/Pacific Islander	
State	**Incidence**	**Mortality**	**Incidence**	**Mortality**	**Incidence**	**Mortality**	**Incidence**	**Mortality**
Alabama	117.5	20.4	125.9	30.7	53.8	†	96.7	†
Alaska	126.7	21.2	141.7	†	81.6	†	90.7	†
Arizona	118.8	20.6	103.2	29.7	87.7	15.1	70.9	10.7
Arkansas‡	107.7	21.4	106.1	31.4	73.1	†	75.1	†
California	140.5	24.2	129.1	33.1	89.3	14.9	95.0	12.9
Colorado	127.7	20.1	120.2	26.0	105.5	15.9	76.5	10.3
Connecticut	141.1	20.6	122.1	24.6	123.4	11.2	80.3	9.4
Delaware	126.8	21.9	127.5	26.5	113.2	†	82.0	†
District of Columbia	164.4	24.1	137.9	34.0	74.4	†	72.9	†
Florida	120.4	21.3	109.7	28.5	98.7	15.4	63.3	9.9
Georgia	125.8	21.2	124.1	29.5	94.0	7.8	71.7	8.2
Hawaii	138.3	18.9	134.0	†	125.3	†	125.0	13.9
Idaho	120.9	21.4	†	†	79.8	†	85.5	†
Illinois	133.2	22.9	126.8	32.8	86.5	10.0	89.3	10.2
Indiana	119.7	22.3	123.7	31.0	83.6	12.7	65.8	13.4
Iowa	124.3	20.9	111.6	25.6	71.4	†	66.8	†
Kansas	123.1	21.3	131.4	29.4	89.7	12.5	84.6	†
Kentucky	121.6	22.1	133.2	32.7	60.2	†	59.4	†
Louisiana	121.2	21.9	130.0	34.8	86.8	9.7	52.9	†
Maine	125.2	19.2	†	†	†	†	84.9	†
Maryland	133.5	22.1	130.2	30.6	85.1	11.1	87.3	9.9
Massachusetts	141.7	20.9	115.1	23.7	88.3	9.5	82.8	8.5
Michigan	121.2	22.1	122.7	33.1	81.0	16.7	78.5	8.0
Minnesota‡	131.2	20.3	94.0	21.7	105.1	†	68.8	10.2
Mississippi	113.9	20.4	124.0	33.3	44.3	†	43.0	†
Missouri	124.6	22.6	135.6	33.7	78.7	8.9	77.1	11.2
Montana	123.5	20.3	†	†	134.5	†	†	†
Nebraska	123.4	19.7	134.2	29.0	100.9	†	68.5	†
Nevada‡	121.2	25.4	109.9	29.3	77.6	11.2	71.1	16.9
New Hampshire	136.2	20.5	†	†	120.2	†	54.4	†
New Jersey	140.7	24.7	124.4	32.5	94.9	13.1	87.8	11.3
New Mexico	125.6	22.4	107.2	30.2	99.6	18.3	50.1	†
New York	138.9	21.8	119.2	28.4	100.9	15.4	86.6	8.9
North Carolina	128.9	21.0	128.1	28.8	85.9	9.4	69.3	7.5
North Dakota	122.9	19.7	†	†	†	†	†	†
Ohio	121.0	23.2	121.0	30.9	59.6	8.9	75.5	13.2
Oklahoma	116.9	23.0	131.3	35.4	104.1	11.5	83.2	†
Oregon	130.4	21.5	121.6	28.5	97.3	11.7	80.0	12.1
Pennsylvania	129.0	22.6	131.1	33.1	90.3	13.0	68.2	9.3
Rhode Island	135.8	20.1	104.8	28.1	74.2	†	70.1	†
South Carolina	125.9	21.1	125.1	29.2	92.8	12.8	83.1	†
South Dakota	128.0	20.9	†	†	†	†	†	†
Tennessee	120.7	21.2	126.2	33.9	72.4	†	80.3	†
Texas	124.2	21.1	120.3	33.7	88.5	16.1	64.8	9.7
Utah	115.9	21.7	108.6	†	96.9	10.7	87.1	†
Vermont	129.1	18.7	†	†	†	†	†	†
Virginia	127.8	21.6	129.8	31.7	77.2	12.0	76.6	9.9
Washington	139.6	21.3	127.3	25.0	96.1	8.7	93.7	11.8
West Virginia	111.5	22.7	115.5	26.6	†	†	65.4	†
Wisconsin	126.5	20.7	126.0	32.1	91.5	8.5	82.2	†
Wyoming	113.3	19.9	†	†	99.6	†	†	†
United States	128.1	21.9	124.3	31.0	91.9	14.5	88.3	11.4

*Rates are per 100,000 and age adjusted to 2000 US standard population. †Statistics not displayed due to fewer than 25 cases or deaths. ‡This state's registry did not achieve high-quality data standards for one or more years during 2008-2012, according to NAACCR data quality indicators and are not included in the overall US incidence rate.

Sources: Incidence: NAACCR, 2015. Mortality: US mortality data, National Center for Health Statistics, Centers for Disease Control and Prevention.

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Breast Cancer Occurrence

How many cases and deaths are estimated to occur in 2015?

- In 2015, an estimated 231,840 new cases of invasive breast cancer will be diagnosed among women, as well as an estimated 60,290 additional cases of in situ breast cancer (Table 1, page 1).
- In 2015, approximately 40,290 women are expected to die from breast cancer (Table 1, page 1). Only lung cancer accounts for more cancer deaths in women.
- In 2015, about 2,350 men will be diagnosed with breast cancer and 440 men will die from the disease.

How many women alive today have ever had breast cancer?

More than 3.1 million US women with a history of breast cancer were alive on January 1, 2014.[23] Some of these women were cancer-free, while others still had evidence of cancer and may have been undergoing treatment.

Who gets breast cancer?

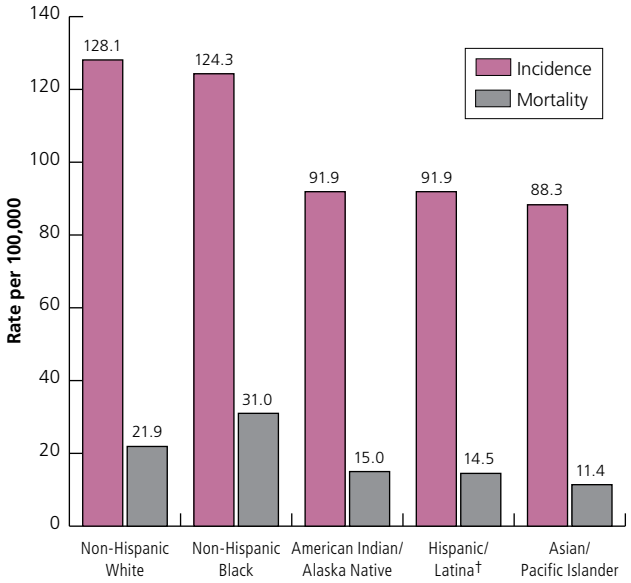
Sex

- Excluding cancers of the skin, breast cancer is the most common cancer among US women, accounting for 29% of newly diagnosed cancers.
- Men are generally at low risk for developing breast cancer; however, they should report any change in their breasts to a physician.

Age

- Breast cancer incidence and death rates generally increase with age (Figure 1, page 2). The decrease in incidence rates that occurs in women 80 years of age and older may reflect lower rates of screening, the detection of cancers by mammography before 80 years of age, and/or incomplete detection.
- During 2008-2012, the median age at the time of breast cancer diagnosis was 61.[24] This means that half of women who developed breast cancer were 61 years of age or younger at the time of diagnosis. The median age of diagnosis is younger for black women (58) than white women (62).[24]
- A woman living in the US has a 12.3%, or a 1 in 8, lifetime risk of being diagnosed with breast cancer. Conversely, 7 out of 8 women born today will not be diagnosed with breast cancer in their lifetimes. In the 1970s, the lifetime risk of being diagnosed with breast cancer was 1 in 11. This increase in risk over the past 4 decades is due to longer life expectancy, as well as increases in breast cancer incidence due in part to changes in reproductive patterns, menopausal hormone use, the rising prevalence of obesity, and increased detection through screening. Lifetime risk reflects an average woman's risk over an entire lifetime, including the possibility that she may die from another cause before she would have been diagnosed with breast cancer. Lifetime risk is often misinterpreted to apply only to women who live to a very old age.

Figure 2. Female Breast Cancer Incidence and Mortality Rates* by Race and Ethnicity, US, 2008-2012



*Rates are age adjusted to the 2000 US standard population.
†Persons of Hispanic origin may be any race.

Sources: Copeland et al.[25] Mortality: US mortality data, National Center for Health Statistics, Centers for Disease Control and Prevention.

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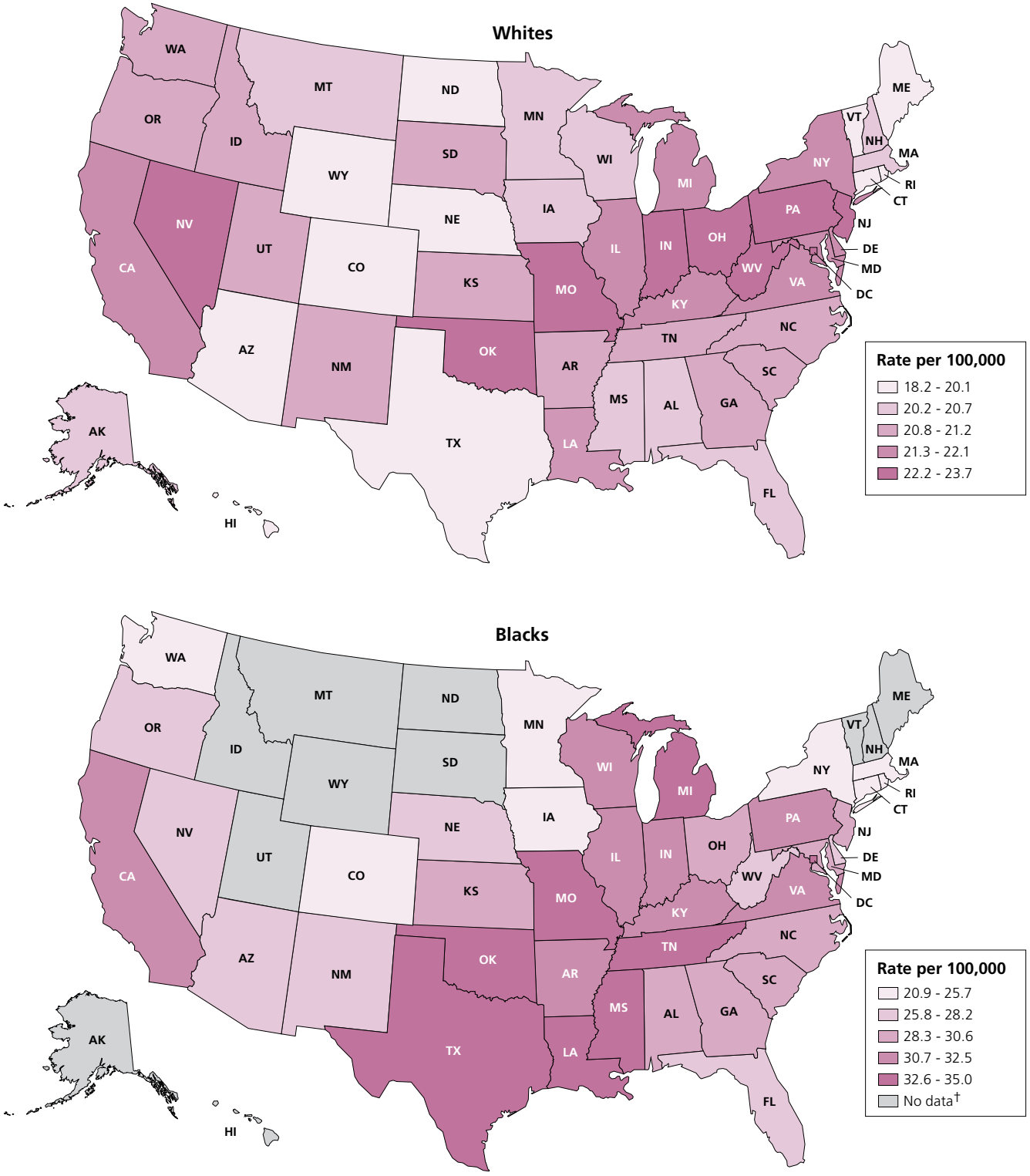
Race/Ethnicity

- Between the ages of 60 and 84, breast cancer incidence rates are markedly higher in white women than black women (Figure 1, page 2). However, black women have a higher incidence rate before age 45 and are more likely to die from breast cancer at every age.
- Figure 2 shows breast cancer incidence and death rates by race and ethnicity during the most recent time period (2008-2012).[24, 25] Incidence and death rates for breast cancer are lower among women of other racial and ethnic groups than among non-Hispanic white and black women. Asian/Pacific Islander (API) women have the lowest incidence and death rates.

Figure 3. Female Breast Cancer Death Rates* by Race, 2008-2012



*Per 100,000 females and age adjusted to the 2000 US standard population. †Statistics not displayed for states with fewer than 25 deaths.

Source: US mortality data, National Center for Health Statistics, Centers for Disease Control and Prevention.

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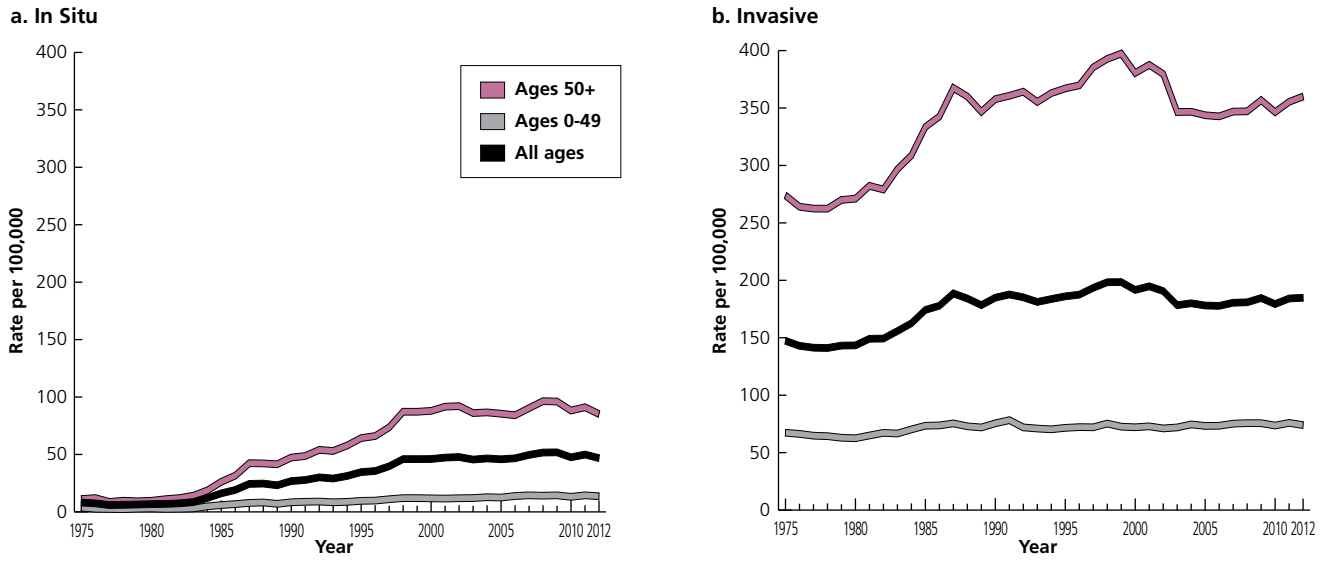
Figure 4. Trends in In Situ and Invasive Female Breast Cancer Incidence Rates* by Age, US, 1975-2012



*Rates are age adjusted to the 2000 US standard population within each age group.
Source: Surveillance, Epidemiology, and End Results (SEER) Program, SEER 9 Registries, National Cancer Institute.

American Cancer Society, Inc., Surveillance Research, 2015

Are there geographic differences in breast cancer rates?

Table 2, page 3 shows breast cancer incidence and death rates per 100,000 women by state for non-Hispanic white, black, Hispanic, and API women. Breast cancer incidence rates range from 107.7 (cases per 100,000 women) in Arkansas to 164.4 in the District of Columbia among white women; 94.0 in Minnesota to 141.7 in Alaska among black women; 44.3 in Mississippi to 134.5 in Montana among Hispanic women; and 43.0 in Mississippi to 125.0 in Hawaii among API women.[26] Incidence rates reflect disease occurrence, as well as how completely the population is routinely screened.

In every US state, breast cancer death rates are lower among non-Hispanic white women compared to black women. Death rates reflect both cancer incidence rates and survival. Breast cancer death rates range from 18.7 in Vermont to 25.4 in Nevada among white women and from 21.7 in Minnesota to 35.0 in Oklahoma among black women. Hispanic and API women have the lowest breast cancer death rates, ranging from 7.8 in Georgia to 18.3 in New Mexico and from 7.5 in North Carolina to 16.9 in Nevada, respectively.

Breast cancer mortality rates among white women tend to be highest in the North Central, Mid-Atlantic, and Western regions of the US. Among black women, the highest death rates are found in some of the South Central and Mid-Atlantic states, as well as California (Figure 3, page 5).

How has the occurrence of breast cancer changed over time?

Incidence trends – women

Figure 4 presents trends for in situ and invasive breast cancer incidence rates since 1975, when population-based cancer surveillance began in the nine oldest US cancer registries.

In situ breast cancer

Incidence rates of in situ breast cancer rose rapidly during the 1980s and 1990s (Figure 4a), largely because of increases in mammography screening. The increase in incidence was greater in women 50 years of age and older than in those younger than 50. Incidence rates of in situ breast cancer have stabilized since 2000 among women 50 and older and since 2007 among younger women. These trends likely reflect trends in mammography screening rates, which peaked in 2000 and then stabilized at a slightly lower rate after 2005.[27] It may also reflect a reduced pool of prevalent cases as a result of wide-spread screening.

Invasive breast cancer

Some of the historic increase in breast cancer incidence reflects changes in reproductive patterns, such as delayed childbearing and having fewer children, which are known risk factors for breast cancer. In addition, breast cancer incidence rates increased rapidly during the 1980s due largely to greater use of mammography screening, which can detect breast cancers earlier when they are too small to be felt. The widespread

uptake of mammography screening inflated the incidence rate because cancers were being diagnosed 1 to 3 years earlier than they would have in the absence of screening. Rates stabilized between 1987 and 1994, followed by a slower increase during the latter half of the 1990s (Figure 4b). This trend may reflect further increases in the prevalence of mammography screening, as well as rising rates of obesity and the use of menopausal hormones, both of which increase breast cancer risk. Between 2002 and 2003, breast cancer rates dropped sharply (nearly 7%), likely due to the decreased use of menopausal hormones following the 2002 publication of clinical trial results that found higher risk of breast cancer and heart disease among users.[28, 29] The decline in incidence occurred primarily in white women, in women 50 years of age and older, and for ER+ disease.[28, 30] This trend may also reflect declines in mammography screening. The percentage of women 40 years of age and older who reported having a mammogram within the past 2 years peaked in 2000, declined slightly, and has since stabilized.[27] From 2004 to 2012, overall breast cancer incidence rates remained stable.[24]

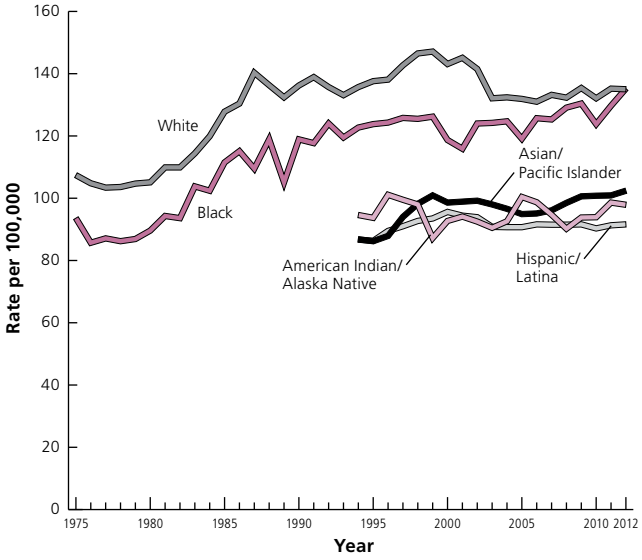
Race/Ethnicity: Figure 5a presents trends in invasive female breast cancer incidence rates by race and ethnicity. Incidence data are available for white and black women since 1975 and for women of other races and ethnicities since 1992. During 2008-2012 (the most recent 5 years of data available), overall breast cancer incidence rates increased among non-Hispanic black (0.4% per year) and API (1.5% per year) women, but were stable among non-Hispanic whites, Hispanics, or American Indians/Alaska Natives (AI/AN). Notably, breast cancer rates for whites and blacks have converged in 2012, reflecting the slow, but steady increase in incidence in black women and relatively stable rates in white women (Figure 5a).

Age: Trends for invasive breast cancer by age at diagnosis are shown in Figure 4b. Among women under age 50, breast cancer incidence rates were relatively stable during the most recent time period (2008-2012); however, rates increased 0.7% per year for women 50 years of age and older.[24] Trends by age at diagnosis also vary by race and ethnicity. Among younger women (<50), incidence rates slightly increased in whites (0.4% per year) and APIs (0.8%) during 2008-2012 and were stable in other racial/ethnic groups.[24] Among older women (50+), increasing trends were observed only in black (0.4%) and API (1.3%) women.[24]

Tumor size: Figure 6, page 8 describes trends in incidence rates by tumor size for women of all races combined. For smaller tumors (≤ 2.0 cm), incidence rates were stable during 2008-2012. In contrast, incidence rates increased for larger tumors, by 1.3% per year for 2.1-5.0 cm tumors and by 2.3% per year for tumors larger than 5.0 cm. Notably, there has been a consistent decline in the rate of tumors with unknown size since 1992.

Stage: Figure 7, page 8 presents incidence trends by race/ethnicity and stage at diagnosis. Incidence rates have increased during

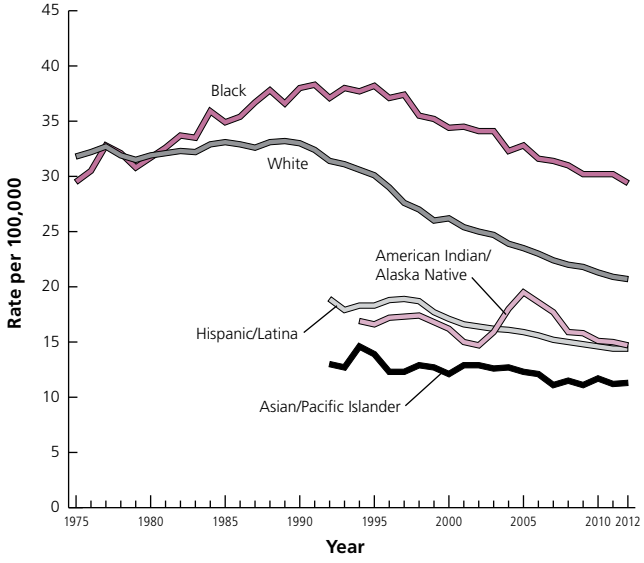
Figure 5a. Trends in Female Breast Cancer Incidence Rates* by Race and Ethnicity, US, 1975-2012



*Rates are age adjusted to the 2000 US standard population and adjusted for reporting delay.

Source: Data for whites and African Americans are from the 9 SEER registries. Data for other races/ethnicities are 3-year moving averages from the 13 SEER registries. For Hispanics, incidence data do not include cases from the Alaska Native Registry. Incidence data for American Indians/Alaska Natives are based on Contract Health Service Delivery Area (CHSDA) counties.

Figure 5b. Trends in Female Breast Cancer Death Rates* by Race and Ethnicity, US, 1975-2012



*Rates are age adjusted to the 2000 US standard population.

Source: US mortality data, National Center for Health Statistics, Centers for Disease Control and Prevention, as provided by the Surveillance, Epidemiology, and End Results Program, National Cancer Institute. Rates for American Indian/Alaska Native are based on CHSDA counties and are 3-year moving averages. Rates for Hispanics exclude deaths from New Hampshire and Oklahoma.

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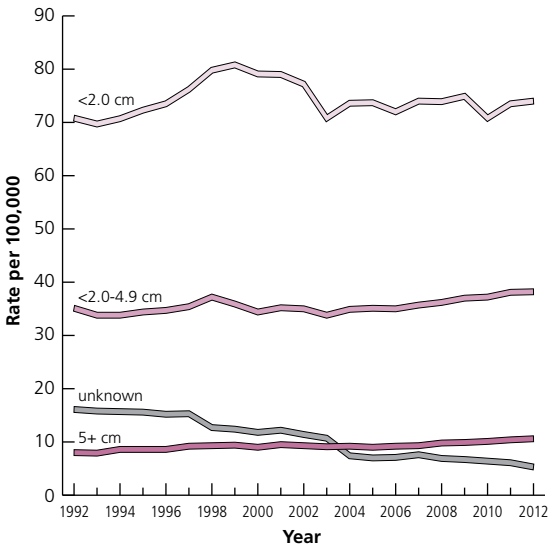
Figure 6. Trends in Female Breast Cancer Incidence Rates* by Tumor Size, US, 1992-2012



*Rates are age adjusted to the 2000 US Standard population and adjusted for reporting delay.

Source: 13 SEER Registries, National Cancer Institute.

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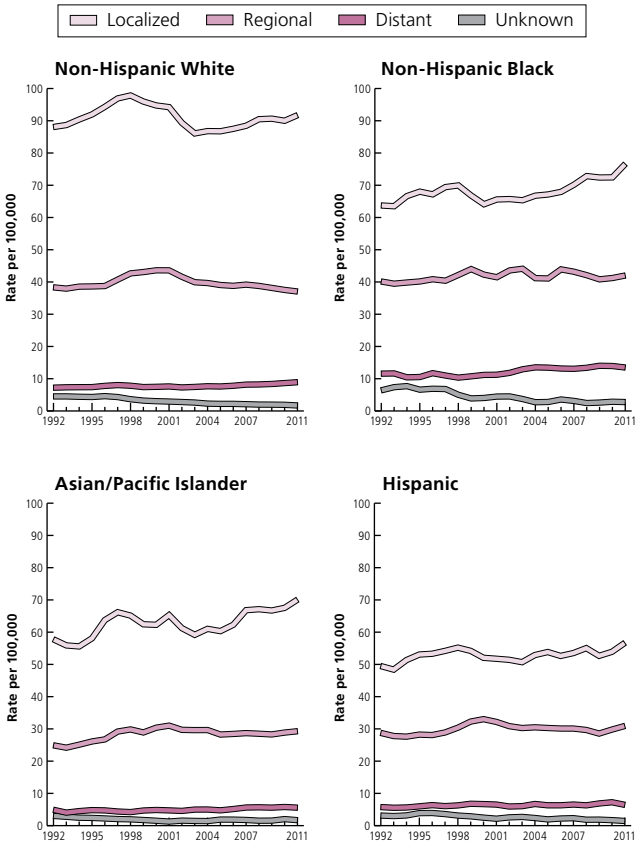
Figure 7. Trends in Female Breast Cancer Incidence Rates* by Stage and Race/Ethnicity, US, 1992-2012



*Rates are two-year moving averages, age adjusted to the 2000 US standard population, and adjusted for reporting delay.

Source: 13 SEER Registries, National Cancer Institute.

American Cancer Society, Inc., Surveillance Research, 2015

2008-2012 for localized breast cancers among white (0.9% per year), black (2.4%), and API (0.8%) women. On the other hand, rates for regional stage tumors have decreased in white women (1.3%) and were stable for blacks and APIs. Incidence rates for regional stage tumors also declined in Hispanics during 2000-2010 and have since stabilized. These trends may reflect a shift toward earlier stage at diagnosis in white and Hispanic women. Rates of distant-stage tumors increased in white, black, and API women, but not Hispanics; but in all four groups, rates of unstaged tumors declined sharply, which likely reflects more complete staging of advanced tumors.

Mortality trends – women

Overall breast cancer death rates decreased 36% from 1989 to 2012, after slowly increasing (0.4% per year) since 1975. The decrease occurred in both younger and older women, although since 2007, the breast cancer death rate has been level among women younger than 50.[24] From 2003 through 2012, breast cancer death rates declined annually by 1.8% in whites, 1.5% in Hispanics, 1.4% in blacks, and 1.0% in Asians/Pacific Islanders, but remained unchanged among American Indians/Alaska Natives.[24]

The decline in breast cancer mortality has been attributed to both improvements in breast cancer treatment and early detection.[31] However, not all segments of the population have benefited equally from these advances. A striking divergence in long-term breast cancer mortality trends between black and white women began in the early 1980s (Figure 5b, page 7). This mortality difference likely reflects a combination of factors, including differences in stage at diagnosis, obesity and comorbidities, and tumor characteristics, as well as access, adherence, and response to treatment.[32-34] The racial disparity may also reflect differences in mammography screening. Although findings from national surveys indicate current mammography screening rates are similar between black and white women, some studies suggest that these surveys may overestimate mammography rates, and more so for blacks than whites.[35-37] As treatment for breast cancers has improved, the racial disparity has widened; by 2012, breast cancer death rates were 42% higher in black than white women.

Trends in breast cancer death rates also vary by state. During 2003-2012, breast cancer death rates decreased in white women in all 50 states, but for black women in only 27 out of 30 states with sufficient data to analyze trends. In 3 states (Mississippi, Oklahoma, and Wisconsin), breast cancer death rates were stable for black women during 2003-2012. The lack of a decline in these states is likely related to variations in the prevalence and

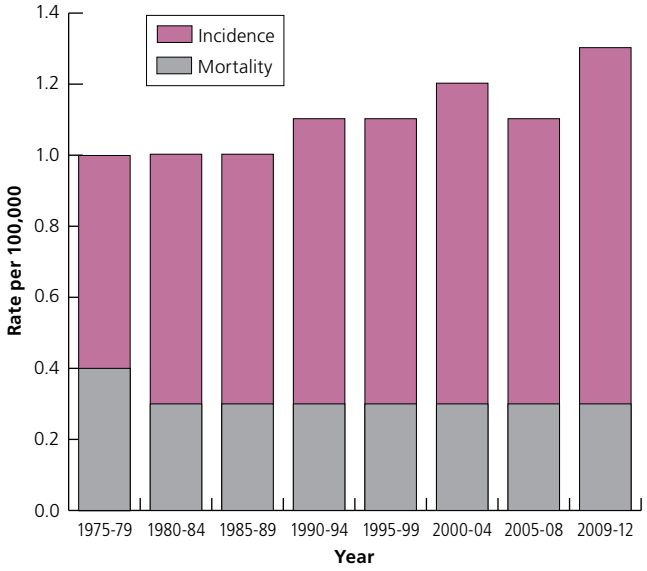
quality of mammography screening and access to high-quality medical treatment.

Incidence and mortality trends – men

Figure 8 presents incidence and mortality trends for male breast cancer. Breast cancer in men is rare, accounting for approximately 1% of breast cancer cases in the US.[38] However, since 1975, the incidence rate has increased 0.8% annually, from 1.0 case per 100,000 men during 1975-1979 to 1.3 cases per 100,000 men during 2008-2012. Men are more likely than women to be diagnosed with advanced-stage breast cancer, which likely reflects decreased awareness and delayed detection. Screening mammography is not recommended for men because of the rarity of the disease. Similar to female breast cancer, the incidence of male breast cancer increases with age; however, unlike female breast cancer, incidence rates are similar in blacks and whites.[39] The death rate for male breast cancer has decreased 1.8% per year from 2000 to 2012.

Due to the infrequency of male breast cancer, much less is known about the disease than female breast cancer. Risk factors include radiation exposure, *BRCA 1/2* gene mutations, Klinefelter syndrome, testicular disorders, family history of male or female breast cancer, diabetes, gynecomastia (enlarged breasts), and obesity.[40, 41]

Figure 8. Trends in Male Breast Cancer Incidence and Mortality Rates,* US, 1975-2012



*Rates are age adjusted to the 2000 US standard population.

Sources: Incidence: 9 SEER Registries, National Cancer Institute. Mortality: US mortality data, National Center for Health Statistics, Centers for Disease Control and Prevention.

American Cancer Society, Inc., Surveillance Research, 2015

Breast cancer survival and stage at diagnosis

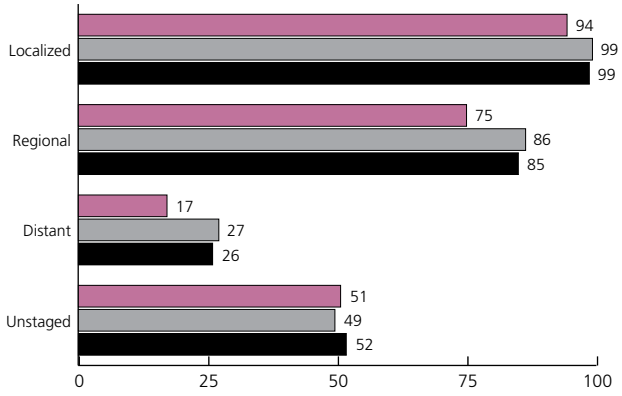
Relative survival rates are an estimate of the percentage of patients who will survive for a given period of time after a cancer diagnosis. It differs from observed survival in that it accounts for deaths from other causes by comparing survival among cancer patients to survival among people of the same age and race who have not been diagnosed with cancer.

Based on the most recent data, relative survival rates for women diagnosed with breast cancer are:

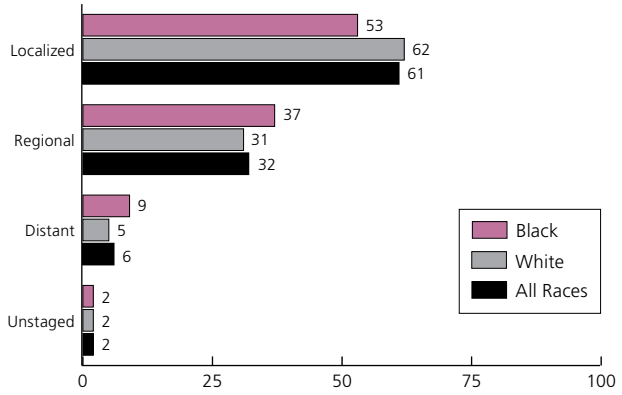
- 89% at 5 years after diagnosis
- 83% after 10 years
- 78% after 15 years

Figure 9. Female Breast Cancer Survival Rates* and Stage Distribution, US, 2005-2011

a. Five-year Relative Survival Rates (%) by Stage at Diagnosis and Race



b. Stage Distribution (%) by Race

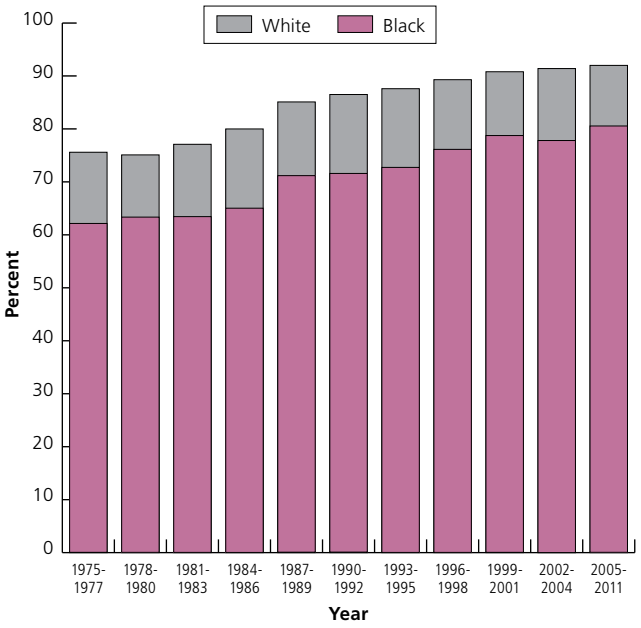


*Survival based on patients diagnosed between 2005-2011 and followed through 2012. Stage distribution percents may not sum to 100 due to rounding.

Source: Howlader et al.[24]

American Cancer Society, Inc., Surveillance Research, 2015

Figure 10. Trends in Female Breast Cancer 5-year Relative Survival Rates* by Race, 1975-2011



*Survival based patients diagnosed between 2007-2011 and followed through 2012.

Source: Howlader et al.[24]

American Cancer Society, Inc., Surveillance Research, 2015

Table 3. Five-year Cause-specific Breast Cancer Survival Rate* by Race/Ethnicity, 2005-2011

	Survival Rate (%)
Non-Hispanic White	89
Black	80
American Indian/Alaska Native	85
Asian	92
Asian Indian, Pakistani	91
Chinese	93
Filipino	90
Japanese	93
Korean	92
Vietnamese	91
Other Asian	93
Pacific Islander	87
Hawaiian	90
Other Pacific Islander	82
Hispanic	88

*Survival based on patients diagnosed between 2005-2011 and followed through 2012.

Source: Howlader et al.[24]

American Cancer Society, Inc., Surveillance Research, 2015

Relative survival rates should be interpreted with caution. First, they are based on the average experience of all women and do not predict individual prognosis because many patient and tumor characteristics that influence breast cancer survival are not taken into account. Second, long-term survival rates are based on the experience of women diagnosed and treated many years ago and do not reflect the most recent improvements in early detection and treatment.

Stage at diagnosis

Survival is lower among women with a more advanced stage at diagnosis (Figure 9a, page 9). Considering all races, 5-year relative survival is 99% for localized disease, 85% for regional disease, and 26% for distant-stage disease.[24] Larger tumor size at diagnosis is also associated with decreased survival. For example, among women with regional disease, the 5-year relative survival is 95% for tumors less than or equal to 2.0 cm, 84% for tumors 2.1-5.0 cm, and 70% for tumors greater than 5.0 cm.[42]

Race/ethnicity and socioeconomic factors

Since 1975, the breast cancer 5-year relative survival rate has increased significantly for both black and white women; nevertheless, there remains a substantial racial gap (Figure 10). In the most recent period, the 5-year relative survival rate was 81% for black women and 92% for white women.[24] The racial disparity in survival reflects both later stage at diagnosis and poorer stage-specific survival in black women (Figure 9, page 9).

Table 3 presents 5-year cause-specific breast cancer survival rates by race and ethnicity. Cause-specific survival instead of relative survival is used to describe the cancer experience of racial and ethnic minorities because estimates of life expectancy are not available for most racial groups. Cause-specific survival is the probability of not dying of breast cancer within 5 years of diagnosis. Chinese and Japanese women (among Asians of known origin) have the highest breast cancer survival rates. Black women have the lowest survival rate of any racial or ethnic group.

Poverty, less education, and a lack of health insurance are also associated with lower breast cancer survival.[43-45] Breast cancer patients who reside in lower-income areas have lower 5-year survival rates than those in higher-income areas at every stage of diagnosis.[46]

Breast Cancer Risk Factors

Many factors known to increase the risk of breast cancer (Table 4, page 12) are not modifiable, such as age, family history, early menarche, and late menopause. Factors that are modifiable include postmenopausal obesity, use of combined estrogen and progestin menopausal hormones, alcohol consumption, and breastfeeding. Many breast cancer risk factors affect lifetime exposure of breast tissue to hormones (early menarche, late menopause, obesity, and hormone use). Hormones are thought to influence breast cancer risk by increasing cell proliferation, thereby increasing the likelihood of DNA damage, as well as promoting cancer growth. Although breast cancer risk accumulates throughout a woman's life, research suggests that the time between menarche and first pregnancy may be particularly critical.[47] Many established risk factors for breast cancer are specifically associated with ER+/luminal breast cancer; less is known about risk factors for ER- or basal-like breast cancers.

Strategies that may help reduce the risk of breast cancer include avoiding weight gain and obesity, engaging in regular physical activity, and minimizing alcohol intake (see American Cancer Society guidelines, page 15).[48] The increased risk of breast cancer associated with the use of combined menopausal hormone therapy should be considered when evaluating treatment options for menopausal symptoms. Women who choose to breastfeed for an extended period of time (studies suggest a year or more) may also lower their breast cancer risk. Treatment with tamoxifen or raloxifene can also reduce the risk of breast cancer among women at high risk (see page 17 for section on chemoprevention). Factors associated with an increased or decreased risk of breast cancer are discussed below.

Personal and family history

Family history

Women (as well as men) with a family history of breast cancer, especially in a first-degree relative (mother, sister, daughter, father, brother, or son) are at increased risk of developing breast cancer; risk is higher with more than one affected first-degree relative. Compared to women without a family history, risk of breast cancer is about 2 times higher for women with one first-degree female relative who has been diagnosed, nearly 3 times higher for women with two relatives, and nearly 4 times higher for women with three or more relatives.[49] Risk is further increased when the affected relative was diagnosed at a young age. It is important to note that the majority of women with one or more affected first-degree relatives will never develop breast cancer and that most women who develop breast cancer do not have a family history of the disease.

A family history of ovarian cancer is also associated with increased breast cancer risk in both men and women. Women with a history of breast or ovarian cancer in their immediate family or in either parent's extended family should discuss this with their physician because it may signal the presence of a genetic predisposition to cancer.

Genetic predisposition

Inherited mutations (genetic alterations) in *BRCA1* and *BRCA2*, the most well-studied breast cancer susceptibility genes, account for 5%-10% of all female breast cancers, an estimated 5%-20% of male breast cancer, and 15%-20% of all familial breast cancers.[50, 51] These mutations are very rare (much less than 1%) in the general population, but occur slightly more often in certain ethnic or geographically isolated groups, such as those of Ashkenazi (Eastern European) Jewish descent (about 2%).[50, 52] Compared to women in the general population who have a 7% risk of developing breast cancer by 70 years of age, the average risk for *BRCA1* and *BRCA2* mutation carriers is estimated to be between 57%-65% and 45%-55%, respectively.[53-55] Mutations in *PALB2,* a different gene that works with *BRCA2*, appear to confer risk similar to *BRCA2* mutations.[56]

Other inherited conditions associated with a smaller increase in breast cancer risk include the Li-Fraumeni and Cowden syndromes and a number of more common genetic mutations.[51] In addition, low-risk variations in the genetic code may affect breast cancer risk. Scientists believe that much of the occurrence of breast cancer clustered in families results from the interaction between lifestyle factors and these low-risk variations.[57] Mutations and genetic variants can be inherited from either parent and by sons or daughters.

Molecular tests are commercially available to identify some of the *BRCA* mutations, as well as many of the family cancer syndromes responsible for inherited forms of breast cancer; however, the interpretation of these tests and treatment decisions is complex.[58] It is not yet possible to predict if or when women who carry a particular genetic abnormality will develop breast cancer. Furthermore, tests are not available for all of the genetic variants that affect breast cancer risk.

Recently updated recommendations from the US Preventive Services Task Force encourage primary care providers to routinely collect and update family history information and to screen women with a family history of breast, ovarian, tubal, or peritoneal cancer with one of several brief screening questionnaires to determine if there is a need for in-depth genetic counseling to consider *BRCA* testing.[59] Anyone who is considering testing is strongly encouraged to talk with a genetic counselor before making a decision so that the benefits and potential consequences can be understood and carefully considered. For more information, visit cancer.org to see the American Cancer Society document called *Genetic Testing: What You Need to Know.*

Table 4. Factors That Increase the Relative Risk for Breast Cancer in Women

Relative Risk	Factor
>4.0	• Age (65+ vs. <65 years, although risk increases across all ages until age 80) • Biopsy-confirmed atypical hyperplasia • Certain inherited genetic mutations for breast cancer (*BRCA1* and/or *BRCA2*) • Ductal carcinoma in situ • Lobular carcinoma in situ • Personal history of early-onset (<40 years) breast cancer • Two or more first-degree relatives with breast cancer diagnosed at an early age
2.1-4.0	• High endogenous estrogen or testosterone levels (postmenopausal) • High-dose radiation to chest • Mammographically extremely dense (>50%) breasts compared to less dense (11%-25%) • One first-degree relative with breast cancer
1.1-2.0	• Alcohol consumption • Ashkenazi Jewish heritage • Diethylstilbestrol exposure • Early menarche (<12 years) • Height (>5 feet 3 inches) • High socioeconomic status • Late age at first full-term pregnancy (>30 years) • Late menopause (>55 years) • Mammographically dense (26%-50%) breasts compared to less dense (11%-25%) • Non-atypical ductal hyperplasia or fibroadenoma • Never breastfed a child • No full-term pregnancies • Obesity (postmenopausal)/adult weight gain • Personal history of breast cancer (40+ years) • Personal history of endometrium, ovary, or colon cancer • Recent and long-term use of menopausal hormone therapy containing estrogen and progestin • Recent oral contraceptive use

Personal history of breast cancer

Compared to women who have never been diagnosed with breast cancer, women with a history of breast cancer are about 1.5 times more likely to develop a new breast cancer.[60] The risk is higher if the diagnosis was at a younger age. Women diagnosed with early onset breast cancer (age <40) have almost a 4.5-fold increased risk of subsequent breast cancer.[60] Genetic predisposition, such as mutations in *BRCA1* and *BRCA2* genes, contribute to some of the excess risk of subsequent breast cancers, particularly among women diagnosed at a young age.[61]

Ductal or lobular carcinoma in situ

DCIS is considered a precursor to invasive cancer, but also increases a woman's risk for developing a new invasive breast cancer. Women with a history of DCIS are 8 to 10 times more likely to be diagnosed with an invasive breast cancer than women without DCIS.[62]

Although LCIS seldom becomes invasive cancer, it is a strong risk factor. Women with LCIS are 7 to 12 times more likely to develop invasive cancer in either breast than women without LCIS.[63]

Benign breast disease

Some types of benign breast conditions are linked to breast cancer risk. Doctors often categorize these conditions into 3 general groups, reflecting the degree of risk: nonproliferative lesions, proliferative lesions without atypia (abnormal cells or patterns of cells), and proliferative lesions with atypia.

- Nonproliferative lesions are not associated with overgrowth of breast tissue and have little to no effect on breast cancer risk. Examples of nonproliferative lesions include fibrosis (also known as fibrocystic changes), simple cysts, and mild hyperplasia.
- Proliferative lesions without atypia are associated with a small increase in the risk of breast cancer (1.5 to 2 times the risk of those who do not have one of these lesions) and include non-atypical (or usual) ductal hyperplasia and fibroadenoma.[64]
- Proliferative lesions with atypia are associated with the greatest breast cancer risk – about 4 to 5 times higher than average risk.[64] These include atypical ductal hyperplasia (ADH) and atypical lobular hyperplasia (ALH).

Women should keep detailed records of any benign breast biopsy results, as that information is valuable for risk assessment, screening, and counseling for chemoprevention and other risk-reduction strategies.

Breast density

Breast tissue density (a mammographic indicator of the amount of the breast's glandular and connective tissue relative to its fatty tissue) has been shown to be a risk factor for the development of breast cancer, with risk increasing with the level of mammographic breast density.[65] Although breast density is influenced by genetics, it is also affected by a number of other factors. In most women, it will change over time, decreasing with age. It is further reduced by pregnancy and menopause.[65] Breast density is generally lower among women with higher body weight because of the higher proportion of fatty tissue.[66] Some drugs also affect breast density, including tamoxifen (decreases density) and combined menopausal hormone therapy (increases density).[67] Alcohol may also increase breast density.[68]

Many women have dense breasts. About 40%-50% of women undergoing screening mammography have heterogeneous or extremely dense (>50% density) breasts.[69] Compared to women with 11%-25% breast density, those with 26%-50% or >50% or greater breast density have about a 1.6 or 2.3 times, respectively, higher risk of breast cancer.[70] Perhaps more importantly, mammographic detection of breast cancer is impaired in areas of

dense breast tissue.[71] As of June 2015, 24 states have laws requiring that mammography reports include information about breast density.[69] Many states with these laws also require that women with dense breasts be told that they may benefit from supplemental imaging tests, such as ultrasound or MRI. However, at this time there is no expert consensus about what other tests, if any, should be done in addition to mammograms to screen for breast cancer in women with dense breasts.

Endogenous hormone levels

Postmenopausal women with naturally high levels of certain endogenous sex hormones have about twice the risk of developing breast cancer compared to women with the lowest levels.[72-74] High circulating hormone levels are associated with and may reflect the effects of other breast cancer risk factors, such as postmenopausal obesity and alcohol use.[75]

It is harder to study the relationship of hormones in premenopausal women because levels vary across the menstrual cycle; however, a recent large review found that high levels of circulating estrogens and androgens are also associated with a small increased risk of breast cancer in premenopausal women.[76]

Menstrual cycles

Breast cancer risk increases slightly for each year earlier menstruation begins (by about 5%) and for each year later menopause begins (by about 3%).[77] For example, breast cancer risk is about 20% higher among girls that begin menstruating before age 11 compared to those that begin at age 13.[77] Likewise, women who experience menopause at age 55 or older have about a 12% higher risk compared to those who do so between ages 50-54.[77] The increased risk may be due to longer lifetime exposure to reproductive hormones and has been more strongly linked to ER+ breast cancer than other subtypes.[78]

Bone mineral density

High bone mineral density in postmenopausal women has been associated with increased risk for breast cancer in many, but not all, studies; risk appears to be most strongly related to ER+ disease.[79-83] Bone density does not appear to be an independent risk factor for breast cancer, but a marker for cumulative estrogen exposure.[83] However, because bone density is routinely measured to identify women at increased risk for osteoporosis (high bone density indicates absence of osteoporosis), it also may be helpful for identifying women at increased risk for breast cancer.

Reproductive factors

Pregnancy

Not having children or having children later in life is associated with increased risk of breast cancer, whereas having a first child at a younger age and having a greater number of children is associated with decreased risk. For example, women who have a first child before 20 years of age have a 50% reduced lifetime risk of breast cancer compared to women who have not had children. There also appears to be a transient increase in breast cancer risk (lasting about 10 years) following a full-term pregnancy, particularly among women who are older at first birth.[84-86] Studies also suggest that women who have their first child after 35 years of age remain at higher risk of breast cancer compared to women have not had children.[87, 88] Reproductive risk factors seem to be more strongly related to ER+ breast cancers.[78]

Fertility drugs

A review of 23 studies found that use of fertility drugs, including clomiphene, gonadotropins, and gonadotropin-releasing hormones, was not associated with breast cancer risk.[89] Recently published results of a long-term follow-up study of women seen at 5 US fertility clinics also found no association with ever use of clomiphene or gonadotropins; however, risk of invasive breast cancer was increased among women who underwent more than 12 clomiphene treatment cycles compared to women who had never used fertility drugs.[90] More research is needed on the relationship between breast cancer risk and the long-term effects of ovulation-stimulating drugs.

Breastfeeding

Most studies suggest that breastfeeding for a year or more slightly reduces a woman's overall risk of breast cancer.[91] The protective effect may be stronger for or even limited to triple negative cancers.[91, 92] Breastfeeding for a longer duration is associated with greater risk reduction. In a review of 47 studies in 30 countries, the risk of breast cancer was reduced by 4% for every 12 months of breastfeeding.[93] One possible explanation for this effect may be that breastfeeding inhibits menstruation, thus reducing the lifetime number of menstrual cycles.[94] Another possible explanation relates to structural changes that occur in the breast following lactation and weaning.[91]

Hormonal birth control

Studies suggest that recent use of oral contraceptives (combined estrogen and progesterone pill) is associated with a small increase in breast cancer risk, particularly among women who begin use before 20 years of age or before first pregnancy.[95-99] Risk appears to diminish when women stop taking the pill, and after about 10 years, it is similar to those who have never taken oral contraceptives. Most of this research considered high-dose estrogen formulations, which were more commonly used in the past. It is less clear if newer, low-dose estrogen formulations increase breast cancer risk.

Some, but not all, studies have found recent use of the injectable progestin-only contraceptive depot-medroxyprogesterone acetate (Depo-Provera) to be associated with increased risk of breast cancer; however, no association has been found with prior use (5 or more years ago) of the drug.[100-102] Studies of the

levonorgestrel-releasing intrauterine device (Mirena) have also produced conflicting results.[103-105] Depo-Provera and Mirena have only been in use since the 1990s, thus more studies with additional years of follow-up data are needed to confirm if use of these drugs is associated with breast cancer risk. It is also important to note that the overall breast cancer risk is low in younger women and most studies suggest that any elevation in breast cancer risk is temporary and diminishes after discontinuation of hormonal birth control.

Postmenopausal hormones

Recent use of menopausal hormones (also referred to as hormone therapy or hormone replacement therapy) with combined estrogen and progestin increases the risk of developing breast cancer, with higher risk associated with longer use.[106, 107] Risk is also greater for women who start hormone therapy soon after the onset of menopause compared to those who begin use later.[108, 109] The increased risk appears to diminish within 5 years of discontinuation of hormone use.[108, 110, 111]

The effects of estrogen-only therapy on breast cancer risk is less clear. The US Preventive Services Task Force has concluded that the use of estrogen alone is associated with reduced risk of breast cancer based on results from the Women's Health Initiative randomized trial, which found that women who used estrogen-only therapy for an average of 6 years had a 23% lower risk of developing breast cancer.[112, 113] In contrast, however, some observational studies have found a slight increase in risk among estrogen therapy users, particularly among lean women and those who begin therapy soon after menopause.[108, 111, 114, 115] Conflicting results may reflect higher rates of screening in menopausal hormone users, which were not controlled for in the observational studies.[109]

Tobacco

Limited but accumulating research indicates that smoking may slightly increase breast cancer risk, particularly long-term, heavy smoking and among women who start smoking before their first pregnancy.[116-122] A recent review by American Cancer Society researchers found that women who initiated smoking before the birth of their first child had a 21% higher risk of breast cancer than did women who never smoked.[118] The 2014 US Surgeon General's report on smoking concluded that there is "suggestive but not sufficient" evidence that smoking increases the risk of breast cancer.[123]

The association between breast cancer and secondhand smoke is unclear. Most studies have not found a link between exposure to secondhand smoke and breast cancer risk.[124, 125] However, some studies suggest secondhand smoke may increase risk, particularly for premenopausal breast cancer.[116, 126, 127]

What is the difference between absolute, lifetime, and relative risks?

Absolute risk: Absolute risk is the likelihood of being diagnosed with cancer over a certain period of time. For example, the risk for a 50-year-old cancer-free woman of being diagnosed with breast cancer over the next 10 years is 2% (Table 5, page 17). Another way to say this is that 1 out of every 44 women who are 50 years old will be diagnosed with breast cancer by the age of 60.

Lifetime risk: Lifetime risk is the absolute risk of being diagnosed with cancer over the course of a lifetime from birth to death. Lifetime risk of breast cancer reflects the average probability of a female being diagnosed with breast cancer in the US. A woman living in the US has a 12% chance of being diagnosed with breast cancer in her lifetime (Table 5, page 17). Another way to say this is that 1 out of every 8 women will be diagnosed with breast cancer in her lifetime (Table 5, page 17).

Relative risk: Relative risk compares the absolute risk of disease among people with a particular risk factor to the risk among people without that risk factor. If the relative risk is above 1.0, then risk is higher among those with the risk factor than among those without the factor. Relative risks below 1.0 reflect an inverse association between the exposure and the disease, or a protective effect. For example, one study found current users of combined estrogen and progestin menopausal hormones have a relative risk of developing breast cancer of 1.26, or a 26% increased risk compared to women who have not used hormone therapy.[87] While relative risks are useful for comparisons, they do not provide information about the absolute amount of additional risk experienced by the exposed group. In this example, 38 breast cancers would be expected to be diagnosed among 10,000 women who use estrogen and progestin for 5.2 years (that is the absolute risk among this group). Among 10,000 women of the same ages who never used menopausal hormones, 30 cases would be expected over the same period. Therefore, the 26% increased relative risk results in a total of 8 additional breast cancer cases per 10,000 women over a period of 5.2 years.

Obesity, diet, and physical activity

Obesity and weight gain

Obesity increases the risk of postmenopausal breast cancer.[128] Risk is about 1.5 times higher in overweight women and about 2 times higher in obese women than in lean women.[129] Breast cancer risk associated with excess weight is likely due, in part, to high estrogen levels because fat tissue is the largest source of estrogen in postmenopausal women. This association might also be explained by the higher levels of insulin among obese women.

Obesity is a risk factor for type II diabetes, which has also been linked to increased risk for postmenopausal breast cancer.[130, 131] A recent review of 40 studies concluded that breast cancer risk was 16% higher in women with type II diabetes independent of obesity.[131]

In contrast, studies have found that obesity protects against developing breast cancer before menopause. A large meta-analysis found that among women between 40 and 49 years of age, the risk for developing breast cancer was about 14% lower in overweight women and about 26% lower in obese women compared to women who were normal weight.[95] The underlying mechanisms for this inverse relationship are not well understood, but the protective effect may be limited to ER+ breast cancers.[13, 132, 133]

Many studies have looked at whether the timing of weight gain influences breast cancer risk. A large meta-analysis recently concluded that each 5 kg (about 11 pounds) gained during adulthood increases the risk of postmenopausal breast cancer by 11%.[134] The increased risk was only observed among women who did not use menopausal hormones. Although some studies have found weight loss to be associated with reduced risk, results are inconsistent.[135-138] It is more difficult to examine the effect of weight loss on breast cancer because weight loss is often not sustained.

Physical activity

Growing evidence suggests that women who get regular physical activity have a 10%-25% lower risk of breast cancer compared to women who are inactive, with stronger evidence for postmenopausal than premenopausal women.[128, 139-141] An American Cancer Society study that included more than 73,000 postmenopausal women found that breast cancer risk was 14% lower among women who reported walking 7 or more hours per week compared to women who walked 3 or less hours per week.[140] The benefit may be due to the effects of physical activity on body mass, hormones, and energy balance.[142]

Diet

Numerous studies have examined the relationship between food consumption (including fat, fiber, soy, dairy, meat, and fruits and vegetables) and breast cancer with mixed results.[143-145] Early diet and breast cancer studies focused on fat intake. However, a recent meta-analysis of animal fat intake and breast cancer, which included more than 20,000 breast cancer cases, concluded there was no association.[146] Similarly, reducing dietary fat in postmenopausal women did not affect risk of breast cancer in the Women's Health Initiative dietary intervention. However, the timing of the exposure may be important, as findings from the Nurses' Health Study showed that a high-fat diet during adolescence was associated with a moderate increase in premenopausal breast cancer risk.[147] It has been suggested that soy consumption may reduce breast cancer risk, in part because of historically low breast cancer rates among Asian women. A meta-analysis showed that soy intake was inversely associated with breast cancer risk in Asian but not Western populations, perhaps because Asian women both consume more soy products and begin at an earlier age than women in Western populations.[148] There is growing evidence that high levels of fruit and vegetable consumption may reduce the risk of hormone receptor-negative breast cancer.[149] These findings are supported by studies linking lower breast cancer risk to higher blood levels of carotenoids (micronutrients found in fruit and vegetables).[150, 151] The effect of diet on breast cancer risk remains an active area of research, with studies particularly focusing on timing of exposure, specific dietary components, and whether risks differ by tumor hormone receptor status.

American Cancer Society Guidelines for Nutrition and Physical Activity for Cancer Prevention[48]

Achieve and maintain a healthy weight throughout life.

- Be as lean as possible throughout life without being underweight.
- Avoid excess weight gain at all ages. For those who are overweight or obese, losing even a small amount of weight has health benefits and is a good place to start.
- Get regular physical activity and limit intake of high-calorie foods and drinks.

Adopt a physically active lifestyle.

- Adults should get at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity activity each week, or an equivalent combination, preferably spread throughout the week.
- Children and adolescents should get at least 1 hour of moderate- or vigorous activity each day, with vigorous-intensity activity at least 3 days each week.
- Limit sedentary behavior such as sitting, lying down, watching television, and other forms of screen-based entertainment.
- Doing some physical activity above usual activities, no matter what the level of activity, can have many health benefits.

Consume a healthy diet, with an emphasis on plant foods.

- Choose foods and beverages in amounts that help achieve and maintain a healthy weight.
- Limit consumption of processed meat and red meat.
- Eat at least 2½ cups of vegetables and fruits each day.
- Choose whole grains instead of refined-grain products.

If you drink alcoholic beverages, limit consumption.

- Drink no more than 1 drink per day for women or 2 per day for men.

Alcohol

Numerous studies have confirmed that alcohol consumption increases the risk of breast cancer in women by about 7%-10% for each 10g (roughly one drink) of alcohol consumed per day on average.[47, 152-154] Women who have 2-3 alcoholic drinks per day have a 20% higher risk of breast cancer compared to non-drinkers. One of the mechanisms by which alcohol increases risk of breast cancer is by increasing estrogen and androgen levels.[155] Alcohol use has been more strongly related with increased risk for ER+ than ER- breast cancers.[156, 157]

Environmental and other risk factors

Radiation

The link between radiation exposure and breast cancer has been demonstrated in studies of atomic bomb survivors and women who have received high-dose radiation therapy to the chest, particularly those who were first exposed at younger ages.[158, 159] This may be because breast tissue is most susceptible to carcinogens before it is fully differentiated, which occurs with first childbirth.[160]

Girls and women treated with high-dose radiation to the chest between 10 and 30 years of age, such as for Hodgkin lymphoma are at increased risk for breast cancer.[161] Breast cancer risk among women with such exposure starts to rise about 8 years after radiation treatment and continues to be elevated for more than 25 years.[159]

Diethylstilbestrol exposure

From the 1940s through the 1960s, some pregnant women were given the drug diethylstilbestrol (DES) because it was thought to lower the risk of miscarriage. These women have an increased risk (about 30% higher) of developing breast cancer compared to women who have not taken DES.[162] Some studies also suggest that women whose mothers took DES during pregnancy have a slightly higher risk of breast cancer.[163]

Environmental pollutants

Some have suggested that rising breast cancer incidence in the latter half of the 20th century may have been caused by environmental pollutants such as organochlorine pesticides. However, studies to date have found no association between increased concentrations of organochlorines in blood and fat tissue and breast cancer risk.[164-167] Although animal studies have demonstrated that prolonged, high-dose exposure to many industrial chemicals can increase mammary tumor development, it is difficult to determine whether exposure to much lower concentrations of these chemicals in the general environment – which occurs alone or in combination, in air, drinking water, and consumer products – increases the risk of human breast cancer.[168] In general, epidemiological studies have not found clear relationships between environmental pollutants and breast cancer, although these studies have had limited capability to study effects on population subgroups or to quantify exposures at potentially critical periods of life, such as adolescence. An association between environmental exposures and breast cancer may be difficult to quantify because it may reflect an indirect pathway (e.g., an effect of these exposures on early onset puberty and menstruation).

Occupational exposures

A few occupations have been linked to breast cancer risk. One study found an increased risk among women employed in commercial sterilization facilities who were exposed to high levels of ethylene oxide.[169] This chemical has been shown to cause breast cancer in animal studies. Night shift work has also been associated with increased breast cancer risk. Most studies of nurses who work night shifts and flight attendants who experience circadian rhythm disruption caused by crossing multiple time zones have found increased risks of breast cancer associated with long-term employment.[170, 171] Exposure to light at night disrupts the production of melatonin, a hormone that regulates sleep. Experimental evidence suggests that melatonin may also inhibit the growth of small, established tumors and prevent new tumors from developing.[172] Based on the results of studies in humans and animals, the International Agency for Research on Cancer concluded in 2007 that shift work, particularly at night, was probably carcinogenic to humans.[173] A recent meta-analysis concluded that evidence from high-quality studies suggests that night shift work increases breast cancer risk by 40%.[170] Shift work at night is a common exposure, involving about 15% to 20% of workers in the US and Europe, and much of the population in industrialized countries is exposed to artificial light at night.

Factors that are not associated with breast cancer risk

Abortion

There are persistent claims that women who have had an abortion are at increased risk for developing breast cancer based on early studies that have since been deemed methodologically flawed by the American College of Obstetricians and Gynecology.[174] Indeed, a large body of solid scientific evidence, including a review by a panel of experts convened by the National Cancer Institute in 2003, confirms that there is no link between breast cancer and abortion (either spontaneous or induced).[175] For more information, visit cancer.org to see the American Cancer Society document called *Is Abortion Linked to Breast Cancer?*.

Hair dyes and antiperspirants

A combined analysis of 14 studies found no association between the use of permanent hair dyes and breast cancer.[176] Although antiperspirant use has been less well-studied, there is presently no convincing scientific evidence that links breast cancer risk to the use of antiperspirants.[177, 178]

Table 5. Age-specific Probabilities of Developing Invasive Female Breast Cancer*

If current age is …	The probability of developing breast cancer in the next 10 years is:†	or 1 in:
20	0.1%	1,674
30	0.4%	225
40	1.4%	69
50	2.3%	44
60	3.5%	29
70	3.9%	26
Lifetime risk	12.3%	8

*Among those free of cancer at beginning of age interval. Based on cases diagnosed 2010-2012. Percentages and "1 in" numbers may not be numerically equivalent due to rounding.

Source: 18 SEER Registries, National Cancer Institute. Probabilities derived using NCI DevCan Software, Version 6.7.3.

American Cancer Society, Inc., Surveillance Research, 2015

Breast implants

No association has been found between breast implants and risk of breast cancer; however, there is growing concern that women with implants may be at increased risk of a rare type of lymphoma.[179-181] Breast implants can also make it harder to see breast tissue by mammography. A woman with breast implants should inform the mammography facility about the implants when scheduling a mammogram. The use of additional x-ray pictures (called implant displacement views) may be used to allow for more complete breast imaging.

Chemoprevention and prophylactic surgery

Chemoprevention

The use of drugs to reduce the risk of disease is called chemoprevention. Currently, the US Food and Drug Administration (FDA) has approved two drugs for the prevention of breast cancer in high-risk women: tamoxifen and raloxifene.[182] Tamoxifen can be used by both premenopausal and postmenopausal women, but raloxifene is only approved for use in postmenopausal women. These drugs are classified as selective estrogen receptor modulators (or SERMs) because they block estrogen in some tissues of the body, but act like estrogen in others. A recent meta-analysis, including more than 83,000 high-risk women from 9 breast cancer prevention trials, found that taking a SERM reduced breast cancer risk by 38% over 10 years.[183] Although the benefit is limited to ER+ disease, these drugs lower the risk of both invasive breast cancer and ductal carcinoma in situ. However, SERMs are associated with some side effects, the most common of which is menopausal symptoms. Premenopausal women taking tamoxifen can also experience menstrual changes. Other more serious side effects are rare, but include blood clots and endometrial cancer.[183]

Clinical trials are also examining another class of drugs – aromatase inhibitors – to see if they may be effective for reducing breast cancer risk. Currently, these drugs are only approved to help treat women with breast cancer. Aromatase inhibitors target the enzyme that is responsible for producing estrogen in fat tissue; thus, they are only effective in women without functioning ovaries (such as postmenopausal women). Early clinical trial results are promising: breast cancer risk was reduced by more than half in high-risk women taking anastrozole or exemestane compared to placebo.[184, 185] Women taking aromatase inhibitors must be monitored for osteoporosis, as these medications can decrease bone density.

Prophylactic surgery

Women at very high risk of breast cancer (such as those with *BRCA* gene mutations) may elect prophylactic (preventive) mastectomy. This operation removes one or both breasts. Removing both breasts before cancer is diagnosed reduces the risk of breast cancer by 90% or more.[186-189] Prophylactic salpingo-oophorectomy (surgical removal of the fallopian tubes and ovaries) reduces the risk of both breast and ovarian cancers in women who carry *BRCA* mutations.[189, 190]

It is important to note that not all women who elect to have these surgeries would have developed cancer. A woman considering prophylactic surgery should discuss the benefits and limitations with her doctor and a second opinion is strongly recommended. See page 22 for further discussion of contralateral prophylactic mastectomy.

Breast Cancer Screening

American Cancer Society recommendations for the early detection of breast cancer vary depending on a woman's age and include mammography, as well as magnetic resonance imaging (MRI) for women at high risk. In 2015, the Society updated its breast cancer screening guideline for average-risk women, and the most recent guideline for MRI use for high-risk women was released in 2007.[191, 192]

Mammography

Mammography is a low-dose x-ray procedure that allows visualization of the internal structure of the breast. There are three main types of mammography: film, digital, and digital breast tomosynthesis. Film mammography uses general-purpose x-ray equipment to record images of the breast, whereas digital mammography uses more specialized computerized equipment and delivers lower doses of radiation. Film mammography has been largely replaced by digital mammography, which appears to be even more accurate for women younger than 50 years of age and for those with dense breast tissue.[193-195]

In 2011, the FDA approved the use of digital breast tomosynthesis or 3-dimensional (3-D) mammography, which constructs a 3-D image of the breast with multiple high-resolution x-rays, to be used in combination with a 2-D digital mammography image.[196] The benefits and risks of tomosynthesis in community practice are still being assessed. A recent study indicated the addition of breast tomosynthesis to digital mammography may reduce false positives and detect slightly more invasive cancers compared to digital mammography alone.[197] However, when the 2-D images are produced separately from the tomographic images, women receive about twice the radiation dose. Recently, the FDA approved the use of tomographic images to produce synthetic, conventional 2-D images, thus reducing the radiation dose to that similar to conventional digital mammography. This newer type of mammographic screening is not yet available in all communities or fully covered by health insurance.

The American Cancer Society recommends that average-risk women should undergo annual screening mammography beginning at 45 years of age; at age 55 women may transition to biennial screening, or continue with annual screening. Additionally, women 40 to 44 years should have the choice to begin annual screening. Women should continue screening as long as their overall health is good and they have a life expectancy of 10 years or more.

It is especially important that women are regularly screened to increase the chance that a breast cancer is detected early before it has spread. Recommended screening intervals are based on the duration of time a breast cancer is detectable before symptoms develop. Combined results from randomized controlled screening trials suggest that mammography reduces the risk of dying from breast cancer by about 20%, whereas studies of modern mammography screening programs in Europe and Canada found that the risk of breast cancer death among women exposed to screening was reduced by more than 40%.[198, 199] Early detection of breast cancer by mammography also leads to a greater range of treatment options, including less-extensive surgery (e.g., breast-conserving surgery like lumpectomy versus mastectomy) and the use of chemotherapy with fewer serious side effects, or even, in some cases, the option to forgo chemotherapy. However, mammography screening does have potential harms, which are described on the next page.

American Cancer Society Guideline for Breast Cancer Screening, 2015[191]

These recommendations represent guidance from the American Cancer Society for women at average risk of breast cancer, i.e., women without a personal history of breast cancer, a suspected or confirmed genetic mutation known to increase risk of breast cancer (e.g., *BRCA*), or a history of previous radiotherapy to the chest at a young age.

The Society recommends that all women should become familiar with the potential benefits, limitations, and harms associated with breast cancer screening.

Recommendations*:

1. Women with an average risk of breast cancer should undergo regular screening mammography starting at age 45 years (strong recommendation).
   - Women who are age 45 to 54 should be screened annually (qualified recommendation).
   - Women who are age 55 and older should transition to biennial screening or have the opportunity to continue screening annually (qualified recommendation).
   - Women should have the opportunity to begin annual screening between the ages of 40 and 44 (qualified recommendation).
2. Women should continue screening mammography as long as their overall health is good and they have a life expectancy of 10 years or more (qualified recommendation).
3. The Society does not recommend clinical breast examination for breast cancer screening among average-risk women at any age (qualified recommendation).

*A strong recommendation conveys the consensus that the benefits of adherence to that intervention outweigh the undesirable effects that may result from screening. Qualified recommendations indicate there is clear evidence of the benefit of screening but less certainty about either the balance of benefits and harms, or about patients' values and preferences, which could lead to different decisions about screening.

False-positive results

Mammography sometimes leads to follow-up examinations, including biopsies, when there is no cancer; these are referred to as false-positive test results. A false-positive is most likely following a woman's initial screening mammogram.[200] Other factors that increase the likelihood of a false positive include the use of postmenopausal hormone therapy and having more dense breast tissue.[200, 201] On average, 10% of women will be recalled from each screening examination for further testing (most often additional mammographic views of areas of suspicion), but only 5% of these women will have cancer.[202] According to one US study, over the course of 10 screening examinations, about one-half of women will experience a false-positive, and about 19% will undergo biopsy.[203]

Overdiagnosis

Mammography likely results in some overdiagnosis; that is, the detection of cancers that would not cause a woman any harm in her lifetime and that would not have progressed or otherwise been detected in the absence of screening. Since it is not currently possible to distinguish a nonprogressive cancer from a progressive one, overdiagnosis is estimated from long-term evaluation of observed versus expected cases in a screening program. Estimates of the rate of overdiagnosis are highly variable, ranging from <5% to more than 30%.[204-210]

Radiation exposure

Although many people are concerned about radiation exposure, the dose required for a mammogram is very small and the risk of harm is minimal.[211, 212]

Limitations of mammography

As with all screening tests, mammography is not 100% effective. Not all breast cancer will be detected by a mammogram, and some breast cancers that are screen-detected still have poor prognosis. Most women will never be diagnosed with breast cancer, but will undergo regular screening and may experience one or more "false alarms." In an effort to maximize the benefits and minimize the harms of screening, some scientists are attempting to determine which combinations of conventional and new risk factors could be used to individualize screening recommendations (e.g., determine which women could start screening at older ages and/or be screened less often.)[213]

Despite these limitations, mammography is the single most effective method of early detection since it can often identify cancer several years before physical symptoms develop. It is the position of the American Cancer Society that the balance of benefits to possible harms strongly supports the value of regular breast cancer screening in women for whom it is recommended.

According to the American Cancer Society guideline, there is no specific age at which mammography screening should be discontinued. Rather, the decision to stop regular mammography screening should be individualized based on the potential benefits and risks of screening within the context of overall health status and estimated longevity. As long as a woman is in good health and would be a candidate for breast cancer treatment, she should continue to be screened with mammography.

The Affordable Care Act requires that Medicare and all new health insurance plans fully cover screening mammograms without any out-of-pocket expense for patients. For help locating a free or low-cost screening mammogram in your area, contact the American Cancer Society at 1-800-227-2345.

Table 6. Mammography in the Past 2 Years (%), Women 45 and Older, US, 2013

Characteristic	%
Overall	**69**
Age	
45-64	69
65+	67
Race/Ethnicity	
Non-Hispanic White	69
Non-Hispanic Black	70
Asian American†	69
American Indian and Alaska Native	61
Hispanic/Latina	64
Education	
Some high school or less	56
High school diploma or GED	64
Some college/Assoc. degree	70
College graduate	78
Sexual orientation	
Gay/Lesbian‡	75
Straight§	68
Bisexual	#
Health insurance coverage	
No	39
Yes	72
Immigration	
Born in US	69
Born in US territory¶	64
In US fewer than 10 years	38
In US 10 or more years	69

GED = General Educational Development high school equivalency.
*Percentages are age adjusted to the 2000 US standard population. †Does not include Native Hawaiians or other Pacific Islanders. ‡Response option provided on the NHIS was "gay or lesbian." §Response option provided on the NHIS was "straight, that is not gay or lesbian." ¶Have been in the US for any length of time. #Estimate not provided due to instability.
Note: Mammography prevalence estimates do not distinguish between examinations for screening and diagnosis.
Source: Centers for Disease Control and Prevention. National Health Interview Survey, Public use data file, 2013.
American Cancer Society, Inc., Surveillance Research, 2015

Prevalence of mammography

According to the National Health Interview Survey, the percentage of women 45 years of age and older who reported having had a mammogram within the past 2 years was 69% in 2013 (Table 6, page 19).[214] Among women 40 years of age and older, mammography prevalence increased from 29% in 1987 to 70% in 2000, declined slightly from 2000 to 2005, and then stabilized.[27] Women who have less than a high school education, who have no health insurance coverage, or who are recent immigrants to the US are least likely to have had a recent mammogram. Efforts to increase screening should specifically target socioeconomically disadvantaged women and recent immigrants.

Table 7, shows the percentage of US women 45 years of age and older who have had a mammogram within the past 2 years by state, based on data from the 2012 Behavioral Risk Factor Surveillance System.[215] Among women of all races combined 45 years of age and older, reported rates of mammography range from 66% in Wyoming to 87% in Massachusetts.

The Centers for Disease Control and Prevention's National Breast and Cervical Cancer Early Detection Program (NBCCEDP) was established in 1990 to improve access to breast cancer screening and diagnostic services for low-income women and was recently shown to help save lives from breast cancer.[216] However, the CDC estimates that the program is currently only reaching about 11% of the women eligible to receive a screening mammogram, due in part to funding shortages.[217] The American Cancer Society is committed to helping protect and increase funding for NBCCEDP in order to expand the number of women who can be served through the program.

Magnetic resonance imaging (MRI)

An expert panel convened by the Society published recommendations for the use of MRI for screening women at increased risk for breast cancer in 2007.[218] The panel recommended annual MRI screening in addition to mammography for women at high lifetime risk (~20%-25% or greater) beginning at 30 years of age. Women at moderately increased risk (15%-20% lifetime risk) should talk with their doctors about the benefits and limitations of adding MRI screening to their yearly mammogram. See risk criteria for MRI screening (right). MRI screening is not recommended for women whose lifetime risk of breast cancer is less than 15%. A recent study indicates that while MRI use in community practice is increasing for high-risk women, it is often used in women who are not at high risk for breast cancer.[219]

MRI uses magnetic fields instead of x-rays to produce very detailed, cross-sectional images of the body. MRI exams for breast imaging use a contrast material (usually gadolinium DTPA) that is injected into a vein in the arm before or during the exam to improve the ability to capture detailed images of breast tissue. MRIs should supplement, but not replace, mammography screening.

American Cancer Society Risk Criteria for Breast MRI Screening as an Adjunct to Mammography[218]

Women at high lifetime risk (~20%-25% or greater) of breast cancer include those who:

- Have a known *BRCA1* or *BRCA2* gene mutation
- Have a first-degree relative (mother, father, brother, sister, or child) with a *BRCA1* or *BRCA2* gene mutation, but have not had genetic testing themselves
- Had radiation therapy to the chest when they were between 10 and 30 years of age
- Have Li-Fraumeni syndrome or Cowden syndrome, or have a first-degree relative with one of these syndromes

Women at moderately increased (15%-20% lifetime risk) risk include those who:

- Have a lifetime risk of breast cancer of 15% to 20%, according to risk assessment tools that are based mainly on family history
- Have a personal history of breast cancer, ductal carcinoma in situ (DCIS), lobular carcinoma in situ (LCIS), atypical ductal hyperplasia, or atypical lobular hyperplasia
- Have extremely dense breasts or unevenly dense breasts when viewed by mammograms

Just as mammography uses x-ray machines designed especially to image the breasts, breast MRI also requires special equipment. Higher-quality images are produced by dedicated breast MRI equipment than by machines designed for head, chest, or abdominal MRI scanning. However, many hospitals and imaging centers do not have dedicated breast MRI equipment available. It is important that screening MRIs are done at facilities that are capable of performing an MRI-guided breast biopsy in case abnormalities are found. Otherwise, the scan must be repeated at another facility if a biopsy is necessary. Although MRI is more expensive than mammography, most major insurance companies will cover some portion of the costs if a woman can be shown to be at high risk.

Breast ultrasound

Breast ultrasound is sometimes used to evaluate abnormal findings from a screening or diagnostic mammogram or physical exam. Studies have shown that ultrasound detects more cancer than mammography alone when screening women with dense breast tissue; however, it also increases the likelihood of false-positive results.[220] The use of ultrasound instead of mammograms for breast cancer screening is not recommended.

Table 7. Mammography in the Past 2 Years (%) by State, Women 45 and Older, 2012

	All races	NH Whites	NH Blacks	45 to 64 years	65 years and older	No usual source of medical care*	No health insurance†
Alabama	77	77	81	78	77	47	45
Alaska	72	70	‡	71	75	53	41
Arizona	73	74	‡	71	75	44	43
Arkansas	68	68	74	66	71	39	42
California	80	80	87	79	82	47	50
Colorado	71	73	68	70	72	36	42
Connecticut	81	81	83	83	79	38	56
Delaware	82	81	86	82	83	38	59
District of Columbia	84	80	86	84	82	57	§
Florida	75	75	72	72	78	46	43
Georgia	79	77	83	76	83	46	49
Hawaii	78	75	‡	79	76	46	54
Idaho	67	68	‡	66	69	34	36
Illinois	76	76	81	77	75	44	56
Indiana	70	70	75	69	70	30	41
Iowa	78	78	‡	79	77	46	47
Kansas	77	77	80	77	77	46	47
Kentucky	74	73	84	73	74	37	45
Louisiana	76	75	80	76	77	48	58
Maine	81	82	‡	82	81	33	51
Maryland	81	80	89	81	83	48	46
Massachusetts	87	86	88	89	83	56	67
Michigan	78	78	81	78	79	30	40
Minnesota	81	81	75	81	81	60	60
Mississippi	70	70	70	71	69	46	50
Missouri	75	75	84	74	78	39	39
Montana	68	68	‡	68	68	32	44
Nebraska	72	72	74	72	72	41	47
Nevada	71	72	78	69	76	51	40
New Hampshire	82	82	‡	82	81	35	51
New Jersey	78	77	85	79	76	55	63
New Mexico	71	70	‡	70	72	44	47
New York	79	78	78	78	79	61	57
North Carolina	78	78	80	77	80	48	48
North Dakota	75	77	‡	76	75	45	35
Ohio	77	76	82	76	77	48	41
Oklahoma	68	69	70	66	70	35	34
Oregon	73	74	‡	69	79	35	38
Pennsylvania	77	77	87	78	77	42	46
Rhode Island	83	84	‡	83	83	44	65
South Carolina	74	72	80	72	77	37	45
South Dakota	75	76	‡	76	74	46	47
Tennessee	76	76	81	75	78	43	47
Texas	71	72	78	68	75	36	38
Utah	71	71	‡	71	71	46	47
Vermont	78	79	‡	79	78	47	45
Virginia	79	79	80	79	80	56	57
Washington	75	75	87	73	77	41	42
West Virginia	75	75	86	76	75	37	54
Wisconsin	81	80	88	81	80	49	58
Wyoming	66	66	‡	65	67	43	36
United States (median)	76	76	81	76	77	44	47
Range	66 - 87	66 - 86	68 - 89	65 - 89	67 - 83	30 - 61	34 - 67

NH = non-Hispanic. *Among women 45 years and older with no personal doctor or healthcare provider. †Among women ages 45-64 years. ‡Sample is insufficient to provide a stable estimate.

Note: The mammography prevalence estimates do not distinguish between examinations for screening and diagnosis. BRFSS 2012 data results are not directly comparable to BRFSS data prior to 2011 because of the changes in weighting methodology and the addition of the cell phone sampling frame.

Source: Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System, Public use data file, 2012.

American Cancer Society, Inc., Surveillance Research, 2015

Clinical breast examination (CBE)

The American Cancer Society no longer recommends CBE for average-risk asymptomatic women based on lack of clear benefits for CBE in conjunction with screening mammography or alone. Compared to mammography alone, CBE plus mammography has been shown to detect only a small proportion of breast cancer tumors and increases the probability of false-positives.[221, 222] Given the time constraints of a clinical visit, the Society encourages clinicians to use this time to counsel women on the importance of being alert to breast changes and the potential benefits, harms, and limitations of screening mammography or to address other important aspects of preventive services.

Breast self-awareness

Although the American Cancer Society no longer recommends that all women perform monthly breast self-exams (BSE), all women should become familiar with both the appearance and feel of their breasts and report any changes promptly to their physician. Experts have concluded that self-awareness seems to be at least as effective for detecting breast cancer as structured BSE.[223-225] Women who detect their own breast cancer usually find it outside of a structured breast self-exam while bathing or getting dressed. If symptoms develop, women should contact a doctor immediately, even after a recent normal mammogram. However, most lumps are not abnormal, and for women who are still menstruating, they can appear and disappear with the menstrual cycle. Most breast lumps are not cancerous.

Breast Cancer Treatment

Treatment decisions are made jointly by the patient and the physician after consideration of the stage and biological characteristics of the cancer, the patient's age and preferences, and the risks and benefits associated with each option. Most women with early stage breast cancer will have some type of surgery, which is often combined with other treatments to reduce the risk of recurrence, such as radiation therapy, chemotherapy, hormonal (endocrine) therapy, and/or targeted therapy. Patients with metastatic disease are primarily treated with systemic therapies, which can include chemotherapy, targeted therapy, and hormonal therapy.

Surgery

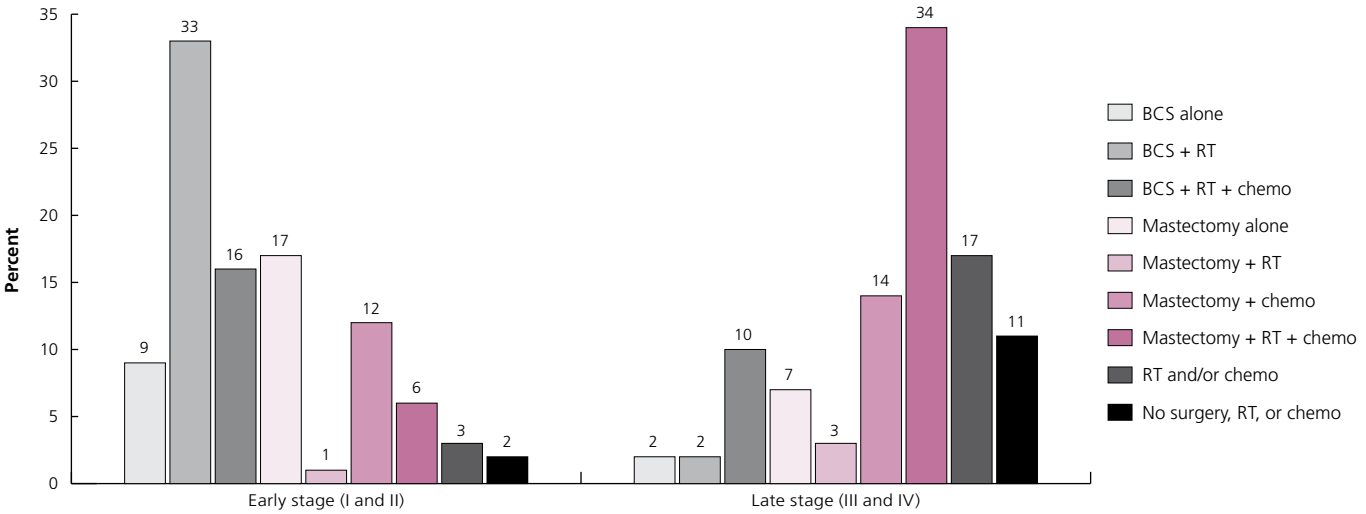
The primary goals of breast cancer surgery are to remove the cancer from the breast and to determine the stage of disease. Surgical treatment for breast cancer involves breast-conserving surgery (BCS) or mastectomy. With BCS (also known as partial mastectomy or lumpectomy), only cancerous tissue plus a rim of normal tissue (tumor margin) are removed. Simple or total mastectomy includes removal of the entire breast. Modified radical mastectomy includes removal of the entire breast plus lymph nodes under the arm, but does not include removal of the underlying chest wall muscle, as with a radical mastectomy. Radical mastectomy is rarely performed anymore because in most cases removal of the underlying chest muscles is not needed to remove all of the cancer.

Increasingly, although long-term outcomes are very similar for patients who have BCS and mastectomy, patients eligible for BCS are electing mastectomy. Reasons include reluctance to undergo radiation therapy after BCS and fear of recurrence.[226] Younger women (those under 40 years of age) and patients with larger and/or more aggressive tumors are also more likely to undergo mastectomy.[226, 227] Some women who are diagnosed with breast cancer in one breast choose to have the unaffected breast removed as well. This is known as contralateral prophylactic mastectomy (CPM) or bilateral mastectomy. Recent studies have shown marked increases in the rate of CPM for women diagnosed with invasive breast cancer, as well as DCIS.[228-231] Although CPM nearly eliminates the risk of developing a new breast cancer, it does not improve long-term breast cancer survival for the vast majority of women and it is also associated with a number of potential harms.[228, 229, 232-235]

Fifty-eight percent of women diagnosed with early stage (I or II) breast cancer have BCS, 36% have mastectomy, 3% have radiation or chemotherapy without surgery, and about 2% do not receive any treatment (Figure 11). In contrast, among women with more advanced breast cancer (stage III or IV), 14% undergo BCS, 58% have mastectomy, 17% receive radiation therapy and/or chemotherapy without surgery, and 11% do not receive any of these treatments (Figure 11).[23]

Both BCS and mastectomy are usually accompanied by removal of one or more regional lymph nodes from the armpit (or axilla) to determine if the disease has spread beyond the breast. This helps stage the cancer. The presence of any cancer cells in the lymph nodes will help determine the need for subsequent surgery, radiation, and medical treatments. Sentinel lymph node biopsy (SLNB), in which selected lymph nodes are removed and tested before any others are excised, reduces the need for full axillary lymph node dissection among most women – but the management of lymph nodes may vary for different situations.[236] Sentinel nodes are identified by injection of a radioactive tracer and/or a blue dye into the breast before surgery. Although traditionally cancer in sentinel lymph nodes was an indication for additional axillary lymph node surgery, new guidelines state that axillary lymph node dissection may be unnecessary if cancer cells are found only in one or two sentinel lymph nodes in

Figure 11. Female Breast Cancer Treatment Patterns (%), by Stage, 2012



BCS = breast conserving surgery; RT = radiation therapy; chemo = chemotherapy and includes targeted therapy and immunotherapy drugs.
Source: National Cancer Data Base, 2012.

American Cancer Society, Inc., Surveillance Research, 2015

patients who undergo BCS followed by whole breast radiotherapy.[237, 238] SLNB is not typically an option if one or more axillary lymph nodes are found to contain cancer prior to surgery. In that case, a full axillary lymph node dissection is often indicated. Patients should talk with their doctors to determine whether they intend to perform SLNB. If a woman is eligible for SLNB and wishes to have this procedure, her breast cancer surgery should be performed by a medical care team experienced with the technique. SLNB is widely available in the US.

Women who undergo mastectomy may have breast reconstruction, either with a saline or silicone implant, tissue from another part of the body, or a combination of the two. Although reported rates of breast reconstruction vary widely, a recent population-based study of women in Los Angeles and Detroit reported that 42% of patients having mastectomy underwent reconstructive surgery.[239] A woman considering breast reconstruction should discuss this option with her breast surgeon prior to the mastectomy. The surgeon performing the mastectomy and the plastic surgeon will work together to coordinate treatment plans. Some types of reconstruction can begin during the mastectomy itself (often called immediate reconstruction), and reconstruction influences the time spent in the hospital after a procedure, as well as the recovery time. Since 1999, the Women's Health and Cancer Rights Act (WHCRA) has required group health plans, insurance companies, and health maintenance organizations that offer mastectomy coverage to also pay for reconstructive surgery. Reconstruction is also covered by Medicare and Medicaid, though Medicaid benefits vary by state. Women who do not choose reconstruction prior to surgery can opt to undergo reconstruction at a later date (often called delayed reconstruction). The options for this type of reconstruction may differ from those done immediately. BCS may also result in an unsatisfactory appearance of asymmetry due to volume loss or scarring. Plastic surgeons may be able to correct these issues with reconstruction strategies such as fat grafting or scar revision.

Surgery (and radiation therapy) involving the axillary lymph nodes can lead to lymphedema, a serious swelling of the arm caused by retention of lymph fluid. It affects about 20% of women who undergo axillary lymph node dissection and 6% of patients who receive SLNB.[240] There are a number of effective therapies for lymphedema, and some evidence suggests that upper-body exercise and physical therapy may reduce the risk and lessen the severity of this condition.[241, 242]

Radiation therapy

Radiation therapy is the use of high-energy beams or particles to kill cancer cells. Radiation is often used after surgery to destroy cancer cells remaining in the breast, chest wall, or underarm area. BCS is almost always followed by radiation therapy because it has been shown to reduce the risk of breast cancer recurrence by about 50% and the relative risk of breast cancer death by about 20% in most patients.[243] Although there is a higher risk of local recurrence (cancer returning to the breast) with BCS than with mastectomy, clinical trials with more than 20 years of follow-up data have confirmed that a woman who chooses BCS and radiation will have the same expected long-term survival as if she had chosen mastectomy.[244-246] Some mastectomy-treated patients also benefit from radiation if their tumor is larger than 5 cm or if their cancer is found in the lymph nodes. Radiation can also be used to treat the symptoms of advanced breast cancer,

especially when it has spread to the central nervous system or bones.

Radiation therapy may be administered as external beam radiation or brachytherapy. Some patients are treated with both types of radiation in combination. The way the radiation therapy is given depends on the type, stage, and location of the tumor, patient characteristics, as well as doctor and patient preference. External beam radiation is the standard type of radiation for women with breast cancer. Radiation from a machine outside the body is focused on the area affected by cancer. This usually includes the whole breast, and, depending on the size and extent of the cancer, may include the chest wall and underarm area as well. Traditionally, external beam radiation therapy was administered daily over a period of 5 to 7 weeks, but studies suggest a 3-week course of therapy is equally as effective.[247]

Brachytherapy uses a radioactive source placed in one or more catheters that are put into the cavity left after BCS and is often an option for patients with early stage breast cancers. This intracavitary brachytherapy is considered a form of accelerated partial breast irradiation (APBI). Intracavitary brachytherapy is typically given daily for 5 days.[248, 249] However, a retrospective study reported that women who were treated with brachytherapy were more likely to have certain complications and receive a subsequent mastectomy than those treated with whole breast radiation therapy.[250] Additional follow-up data are needed to determine the long-term efficacy and risks associated with intracavitary brachytherapy and to identify which patients are the best candidates for this option.

Systemic therapy

Systemic therapy is treatment that travels through the bloodstream and can affect and treat all parts of the body, not just one area. For breast cancer, these cancer drugs are injected into a vein or given by mouth. Systemic therapy includes chemotherapy, hormonal therapy, and targeted therapy, all of which work through different mechanisms. For example, chemotherapy drugs generally work by attacking cells that grow quickly, such as cancer cells. Hormonal therapy works by either blocking the body's natural hormones or lowering the levels of those hormones, which sometimes act to promote cancer growth. Targeted drugs are newer and work by attacking specific molecules in or on cells that may be more common or active in cancer cells.

When systemic treatment is given to patients before surgery, it is called neoadjuvant or preoperative therapy. For larger breast tumors, it is often used to shrink the tumor enough to make surgical removal easier and less extensive (such as BCS in women who would otherwise have required mastectomy). Neoadjuvant systemic therapy has been found to be as effective as the same therapy given after surgery in terms of survival, disease progression, and distant recurrence.[251]

Systemic treatment given to patients after surgery is called adjuvant therapy. It is used to kill any undetected tumor cells (micrometastases) that may have migrated to other parts of the body. Micrometastases are generally cancer cells that are too small to be detected on body imaging, such as CT or bone scans. The use of adjuvant systemic therapy is therefore primarily determined by the tumor stage and histopathological characteristics (hormone receptor and HER2 status), although data from gene panels, such as Oncotype DX, can also play a role. Systemic therapy is the main treatment option for women with metastatic breast cancer, in whom surgery has not been found to be beneficial due to the distant spread of the disease.

Chemotherapy

The benefit of chemotherapy is dependent on multiple factors, including the size of the tumor, the number of lymph nodes involved, the presence of estrogen or progesterone receptors, and the amount of HER2 protein made by the cancer cells. Triple negative and HER2+ breast cancers tend to be more sensitive to chemotherapy, while ER+/PR+ tumors are generally less responsive.[252] There are also gene panels (such as Oncotype DX, PAM 50 ROR, and MammaPrint) that can help assess the risk of recurrence in women with early stage breast cancers and potentially identify those who would more likely benefit from chemotherapy. Clinical trials are currently underway to further evaluate the predictive value of these tests in women with intermediate risk scores and those with node positive disease.[253]

Research has established that combinations of drugs can be more effective than one drug alone for treatment of early stage breast cancer and several options exist when selecting a chemotherapy regimen. Depending on the combination of drugs used, adjuvant and neoadjuvant chemotherapy is usually given for 3 to 6 months. This treatment is most effective when the full dose and cycle of drugs are completed in a timely manner, without significant delays in starting treatment.

Hormonal therapy

Estrogen, a hormone produced by the ovaries in addition to other tissues, promotes the growth of ER+/PR+ breast cancers. Patients with ER+/PR+ breast cancer can be given hormonal therapy (also called endocrine therapy) to lower estrogen levels or to block the effects of estrogen on the growth of breast cancer cells. These drugs are different than postmenopausal hormone therapies, which actually increase the hormone levels in the body. Breast cancer in premenopausal and postmenopausal women may be treated differently.

Tamoxifen is a treatment that blocks the effects of estrogen and is routinely used to treat both premenopausal and postmenopausal cancers. Treatment of ER+ breast cancer with tamoxifen for at least 5 years has been shown to reduce the rate of recurrence by approximately 40%-50% throughout the first decade, and reduces breast cancer mortality by about one-third through-

out the first 15 years.[254] More recently, studies have shown that extended use of tamoxifen (10 years versus 5 years) further reduces the risk of breast cancer recurrence and mortality, so clinical practice guidelines now recommend consideration of adjuvant tamoxifen therapy for 10 years.[255-257]

Aromatase inhibitors (AIs), such as letrozole, anastrozole, and exemestane, are another class of drugs used to treat both early and advanced hormone receptor-positive breast cancer. AIs work by interfering with the body's ability to convert androgens produced in the adrenal glands to estrogen. They have no effect on the production of estrogen by the ovaries, and therefore do not affect estrogen levels in women with functioning ovaries (including premenopausal women). In premenopausal women, the use of AIs first requires treatment to halt ovarian estrogen production with medications or by removal of the ovaries. Clinical trials in postmenopausal women have demonstrated a small advantage to including an AI initially or over the course of treatment rather than 5 years of tamoxifen alone.[258] Treatment guidelines recommend AIs should usually be included in the treatment of postmenopausal women with hormone receptor-positive breast cancer.[259] Although AIs have fewer serious side effects than tamoxifen, they can cause osteoporosis (with resulting bone fractures), joint pain, and other musculoskeletal symptoms because they completely deplete postmenopausal women of estrogen. Clinical trials continue to assess the optimal timing and duration of these treatments.

The mainstay of treatment for premenopausal women with hormone-sensitive tumors is tamoxifen. However, some women may also benefit from the removal or suppression of the ovaries, which are the main source of estrogen prior to menopause. Permanent ovarian ablation can be done by surgically removing the ovaries (oophorectomy). More often, potentially reversible ovarian ablation is achieved with a class of drugs called luteinizing hormone-releasing hormone (LHRH) analogs (e.g., goserelin [Zoladex] or leuprolide [Lupron]). Adding ovarian suppression to tamoxifen has been shown to improve survival in women with advanced (metastatic) hormone receptor-positive breast cancer when compared to tamoxifen alone.[260] For women with earlier stage breast cancer, however, the benefit is less clear, and may be limited to certain subgroups of women.[261-263] Ovarian suppression can also allow the use of aromatase inhibitors in premenopausal women. The combination of LHRH analog and AIs has been used for some time in the treatment of metastatic disease. In addition, a recent study has shown that this combination reduced the risk of recurrence more than either tamoxifen alone or tamoxifen with ovarian suppression in women with earlier stage disease.[262]

Fulvestrant (Faslodex) is another treatment used to treat metastatic breast cancer. It is an anti-estrogen intramuscular injection that reduces the number of estrogen receptors as well as blocks estrogen binding.

Clinical trials

A clinical trial is an experiment that is used to assess the safety and efficacy of treatments or other interventions for human disease and health problems. Generally, participants receive either the state-of-the-art standard treatment or a new therapy that may offer improved survival and/or fewer side effects. Participation in clinical trials provides essential information on the effectiveness and risks of a new treatment. For more information about clinical trials, including how to enroll, visit cancer.org/clinicaltrials or call the American Cancer Society at 1-800-303-5691. Information can also be obtained by visiting the National Cancer Institute's website at cancer.gov/clinicaltrials or by calling 1-800-4-CANCER. Patients should consult their personal doctors and cancer specialists for detailed information about appropriate treatment options.

Targeted therapy

Therapy aimed at HER2

About 14% of breast cancers overproduce the growth-promoting protein HER2 and multiple medications are now approved for the treatment of this subtype. Trastuzumab (Herceptin) is a monoclonal antibody that directly targets the HER2 protein. The combined results of two large trials indicate that adding trastuzumab to standard chemotherapy for early stage HER2-positive breast cancer reduces the risk of recurrence and death by 52% and 33%, respectively, compared to chemotherapy alone.[264] This drug is also a standard part of the treatment for advanced HER2-positive breast cancer. All invasive breast cancers should be tested for the HER2 gene amplification or protein overexpression in order to identify women who would benefit from this therapy. In 2013, updated guidelines were released aimed at improving the accuracy of HER2 testing.[265]

Pertuzumab (Perjeta) is a more recently approved monoclonal antibody that seems to attach to a different location on the HER2 protein than trastuzumab. This drug can be used in combination with trastuzumab and chemotherapy to treat HER2-positive breast cancer in either the metastatic or preoperative setting. When given along with docetaxel (Taxotere) and trastuzumab to patients who have not yet received chemotherapy, it has been shown to prolong survival by over 15 months compared to docetaxel and trastuzumab alone.[266]

Another drug, ado-trastuzumab emtansine (Kadcyla, formerly called TDM-1), can be used to treat HER2-positive metastatic breast cancer, and has been shown to shrink tumors and extend survival. It is made up of the same monoclonal antibody found in trastuzumab attached to the chemotherapy drug DM-1. The antibody acts as a homing device, taking the chemotherapy drug directly to the cancer cells.[267]

Lapatinib (Tykerb) is another drug that has been found to be effective in delaying disease progression in women with HER2-positive advanced breast cancers that have become resistant to trastuzumab.[268]

Other targeted drugs

Everolimus (Afinitor) is a type of targeted therapy that blocks mTOR, a protein that promotes cell growth and division. By blocking this protein, everolimus can help stop cancer cells from growing. Everolimus may also stop tumors from developing new blood vessels, which can also limit growth. This drug seems to improve the effectiveness of hormone therapy drugs. Everolimus is approved in combination with exemestane to treat advanced, hormone receptor-positive, HER2-negative breast cancer in postmenopausal women. It is indicated in women whose cancers have grown while they were being treated with either letrozole or anastrozole. Everolimus is also being studied in combination with other hormone therapy drugs.[269, 270]

Palbociclib (Ibrance) is a drug that targets cyclin-dependent kinase (CDK) 4 and CDK6 that is used in combination with hormonal drugs to treat advanced breast cancer. In women with advanced breast cancer, palbociclib prolonged time to progression when added to letrozole or fulvestrant.[271, 272]

What is the American Cancer Society doing about breast cancer?

The American Cancer Society works relentlessly to help save lives from breast cancer – and all cancers – by helping people stay well and get well, by finding cures, and by fighting back against the disease. This section provides highlights and information on some of these efforts.

Stay Well and Get Well

The American Cancer Society helps women stay well by encouraging them to take steps to reduce their risk of breast cancer or detect it early, when there are more treatment options. For women who are diagnosed with breast cancer, the Society provides the information, day-to-day help, and emotional support to guide them through every step of their experience and to help them get well.

Information, 24 hours a day, seven days a week

The American Cancer Society is available 24 hours a day, seven days a week online at cancer.org and by calling the American Cancer Society at 1-800-227-2345. Callers are connected with a cancer information specialist who can help them locate a hospital, understand breast cancer and treatment options, learn what to expect and how to plan, address insurance concerns, find financial resources, find a local support group, and more. The Society can also help people who speak languages other than English or Spanish find the assistance they need, offering services in more than 200 languages.

People can visit cancer.org/breastcancer to find information on every aspect of the breast cancer experience, from prevention to survivorship. The Society also publishes a wide variety of pamphlets and books that cover a multitude of topics, from patient education, quality-of-life and caregiving issues to healthy living. Visit cancer.org/bookstore for a complete list of Society books that are available for order.

Day-to-day help and emotional support

The American Cancer Society offers patients and their families the resources they need to make decisions about the day-to-day challenges that can come from a breast cancer diagnosis, such as transportation to and from treatment, financial and insurance needs, and lodging when treatment is away from home.

Breast cancer support

The American Cancer Society Reach To Recovery® program matches trained volunteer breast cancer survivors to people facing or living with breast cancer. Our volunteers give cancer patients and their family members the opportunity to ask questions, talk about their fears and concerns, and express their feelings. The Society's Reach To Recovery volunteers have been there, and they offer understanding, support, and hope.

Help with appearance-related side effects of treatment

Look Good Feel Better® workshops help women with breast cancer manage the appearance-related side effects of treatment. Trained volunteer beauty professionals teach simple techniques on skin care, makeup, and nail care, and give practical tips on hair loss, wigs, and head coverings. Each registered program participant receives a complimentary beauty kit to use during the workshop and to take home. To learn more about the program, which is a collaboration of the American Cancer Society, the Personal Care Products Council Foundation, and the Professional Beauty Association, visit the Look Good Feel Better website at lookgoodfeelbetter.org or call 1-800-395-LOOK (1-800-395-5665).

Transportation to treatment

Having breast cancer is hard. Finding a ride to treatment shouldn't be. The American Cancer Society Road To Recovery® program provides free rides to cancer patients to and from treat-

ments and cancer-related appointments. Trained volunteer drivers donate their time and the use of their personal vehicles to help patients get to the treatments they need.

Lodging during treatment

The American Cancer Society Hope Lodge® program provides free overnight lodging to breast cancer patients and their caregivers who have to travel away from home for treatment. Not having to worry about where to stay or how to pay for it allows patients to focus on the most important thing: getting well. Through its Hotel Partners Program, the Society also partners with local hotels across the country to provide rooms for cancer patients and their caregivers to help ease some of the financial burdens that they face.

Finding hope and inspiration

Women with breast cancer and their loved ones do not have to face their experience alone. The American Cancer Society Cancer Survivors Network® is a free online community created by and for people living with cancer and their families. They can get and give support, connect with others, find resources, and tell their own story through personal expressions like music and art.

Hair-loss and mastectomy products

"tlc" Tender Loving Care® is an American Cancer Society publication that offers affordable hair loss and mastectomy products, as well as advice on how to use those products. Visit tlcdirect.org or call 1-800-850-9445 to learn more.

Cancer education materials

American Cancer Society I Can Cope® online cancer education classes are a quick and easy way for people to get the answers they need to help themselves or a loved one during and after breast cancer treatment. Classes are free and can be accessed at cancer.org/icancope anytime, day or night.

Support after treatment

The end of breast cancer treatment does not mean the end of a cancer journey. Cancer survivors may experience long-term or late effects resulting from the disease or its treatment. The *Life After Treatment: The Next Chapter in Your Survivorship Journey* guide may help cancer survivors as they begin the next phase of their journey. Visit cancer.org/survivorshipguide to download a free copy of the guide.

The Society has also recently published a follow-up care guideline for breast cancer survivors that builds upon available evidence, surveillance guidelines, and standard clinical practice and is designed to facilitate the provision of high-quality, standardized, clinical care by primary care providers.[273] The breast cancer guideline addresses the assessment and management of potential long-term and late effects, as well as recommendations for health promotion, surveillance for recurrence, screening for second primary cancers, and the coordination of care between specialists and primary care clinicians.

Find Cures

The American Cancer Society invests more in breast cancer research than any other cancer type. Society-funded research has led to the development of potentially lifesaving breast cancer drugs such as tamoxifen and Herceptin, as well as the discovery of genes linked to breast cancer (e.g., *BRCA1*). The Society is currently funding more than $86 million in breast cancer research through 204 research and training grants. These grants are awarded in multiple areas relevant to the disease, including genetics, etiology, diagnostics (imaging and biomarkers), drug development; and preclinical, clinical, and epidemiological studies in prevention, diagnosis, treatment, and quality of life.

Specific examples of ongoing breast cancer research being conducted by Society grantees include:

- Establishing an animal model for triple negative breast cancers that are resistant to chemotherapy in order to evaluate new targeted therapies
- Identifying the unmet needs of black breast cancer survivors in order to develop a program to support and assist in meeting those unique needs
- Exploring factors that trigger the development of metastatic tumors and evaluating methods to predict breast cancer's spread
- Evaluating psychosocial interventions aimed at supporting Latinas with breast cancer and their family partners in order to reduce distress and improve quality of life
- Exploring new therapies for the treatment of breast cancer that activate cells of the immune system and evaluating whether the immune system plays a role in inflammatory responses that promote cancer progression
- Evaluating factors that influence the accuracy of mammography interpretation by radiologists, developing a test set that identifies radiologists who could benefit from additional training, and creating a continuing medical education course that aims to reduce recall rates while maintaining or improving cancer detection. This project, co-funded by the National Cancer Institute, was designed in direct response to the Institute of Medicine's *Improving Breast Imaging Quality Standards* report, which highlighted the need to decrease variability in mammography interpretation in the US. The results of this research program were recently highlighted in a 2015 Institute of Medicine meeting, "Assessing and Improving Imaging Interpretation in Breast Cancer Screening."

Internally, the Society also conducts epidemiologic studies of breast cancer and performs surveillance research to monitor racial and socioeconomic disparities in breast cancer screening, incidence, survival, and mortality. Using information collected

from more than 600,000 women in Cancer Prevention Study-II (CPS-II), American Cancer Society epidemiologists study the influence of many risk factors, including alcohol consumption, diethylstilbestrol (DES), estrogen hormone use, family history of cancer, obesity, smoking, and spontaneous abortion on the risk of death from breast cancer. Recently published papers have also examined the effect of nutrients found predominantly in fruits and vegetables, body size, and common genetic variants on breast cancer risk.

In order to continue to explore the effects of changing exposures and to provide greater opportunity to integrate biological and genetic factors into studies of other risk factors, from 2006 to 2013, more than 304,000 men and women 30 to 65 years of age were enrolled in the American Cancer Society Cancer Prevention Study-3 (CPS-3), and nearly all provided a blood sample at the time of enrollment. Although over the past decade very large cohorts have been established in some European and Asian countries, CPS-3 is the only nationwide study of this magnitude in the US. The blood specimens and questionnaire data collected from CPS-3 participants will provide unique opportunities for research in the US.

American Cancer Society researchers have also studied the influence of mammography on breast cancer prognostic factors, conducted long-term follow-up of major breast cancer screening studies, modeled the cost-effectiveness of chemoprevention strategies, and recommended breast cancer surveillance strategies that can be applied at the local and national levels.

In order to examine the determinants of good quality of life in cancer survivors of 10 cancers, including breast cancer, the Society's Behavioral Research Center conducted the Study of Cancer Survivors. Specific areas of ongoing research include lifestyle behaviors (e.g., diet, physical activity, and smoking), body image issues, sexuality and intimacy, and overall quality of life among breast cancer survivors and their caregivers. One recent analysis of this survey found that although the majority of breast cancer survivors 70 years of age and older were reportedly doing well, a subset of survivors had ongoing concerns about symptoms, comorbidities, emotional health, and the lack of social support.

The Society's Surveillance and Health Services Research program recently published an overview of the latest data on international trends in breast cancer incidence and mortality. The program is also collaborating with researchers at Martin Luther University (Germany) and Addis Ababa University (Ethiopia) to create an electronic database for breast cancer patients seen at the Addis Ababa University's teaching hospital in order to examine demographic and tumor characteristics, treatment, and survival, and to enhance research capacity of residents and staff of the hospital's Oncology Department.

Fight Back

The American Cancer Society's nonprofit, nonpartisan advocacy affiliate, the American Cancer Society Cancer Action Network℠ (ACS CAN), advocates at the federal, state, and local levels to increase access to quality breast cancer screenings, diagnostic and treatment services, and care for all women; increase government funding for breast cancer research; and provide a voice for the concerns of breast cancer patients and survivors. Following are some of the efforts that ACS CAN has been involved with in the past few years to fight back against breast cancer – and all cancers:

- **Improving Access to Affordable Care through Health Care Reform:** The Affordable Care Act (ACA) was signed into law on March 23, 2010, giving cancer patients access to quality, affordable health care. All new health insurance plans, including those offered through state health insurance exchanges, and coverage provided to newly insured, low-income individuals are required to cover preventive services rated "A" or "B" by the US Preventive Services Task Force (USPSTF), including mammography screening, at no cost to patients. Additionally, the ACA removed cost-sharing for any preventive services covered by Medicare. ACS CAN advocates for clear, comprehensive coverage of these preventive services, including breast cancer screening, and encourages states to broaden access to health care coverage for all low-income Americans through state Medicaid programs.
- **The National Breast and Cervical Cancer Early Detection Program (NBCCEDP):** Protecting and increasing funding for the NBCCEDP is a high priority for ACS CAN at both the state and federal levels. This successful program provides community-based breast and cervical cancer screenings to low-income, uninsured, and underinsured women. More than 50 percent of the women screened are from racial/ethnic minority groups. While the ACA will continue to greatly improve insurance coverage, the NBCCEDP will remain an essential program for our nation's most vulnerable populations. Unfortunately, federal funding has been cut for the program. At current levels, the program can only reach one in 10 eligible women. ACS CAN is asking Congress to increase funding to the full $275 million the program was authorized for in 2007 to ensure that more women have access to cancer screening. Additionally, ACS CAN continues to urge state policy makers to adequately support their state BCCEDP by appropriating $1 in state funds for every $3 in federal funds received from the Centers for Disease Control and Prevention.
- **Protecting the Breast and Cervical Cancer Prevention and Treatment Act (BCCPTA):** In 2000, Congress passed the BCCPTA, ensuring that low-income women diagnosed with cancer through the NBCCEDP were provided a pathway to treatment services through their state Medicaid program. In recent years, a number of states have considered proposals to eliminate the treatment program due to misconceptions around coverage needs following implementation of the ACA.

While the ACA has significantly increased coverage rates, millions of women will continue to face barriers to care, insured and uninsured alike, and will rely on these programs. ACS CAN strongly opposes proposals to eliminate these programs and continues to advocate at the state level to protect eligibility and funding for this potentially lifesaving access to comprehensive treatment services through Medicaid.

- **The Breast Density and Mammography Reporting Act of 2015:** Mammography sensitivity is lower for women with mammographically dense breasts because dense breast tissue makes it harder for doctors to see cancer on mammograms. The federal Breast Density and Mammography Reporting Act directs an evidence-based process to inform women of the facts about breast density and risk and recommends that women who are found to have dense breast tissue have a follow-up conversation about next steps directly with their doctors. Additionally, this legislation encourages new research to support the creation of clinical guidelines and best practices for screening of and reports to women with mammographically dense breasts.
- **Patient Navigation:** Patient navigation is a critical component to reducing breast cancer deaths and improving quality of care, particularly in vulnerable populations. ACS CAN supports the federal Patient Navigation Assistance Act, which would create a coverage solution that incentivizes providers to use patient navigators; the end result will be better team-based care coordination for patients with cancer and other chronic illnesses. The organization also is working with Congress and federal agencies to help increase funding for patient navigation programs.
- **Funding for Cancer Research:** ACS CAN continues to work to increase government funding for cancer research at the National Institutes of Health, including the National Cancer Institute and the National Center on Minority Health and Health Disparities.

The American Cancer Society also rallies people to fight back against the disease through our Relay For Life® and Making Strides Against Breast Cancer® programs. The American Cancer Society Relay For Life movement is the world's largest fundraising event to end every cancer in every community. Rallying the passion of four million people worldwide, Relay For Life events raise critical funds that help fuel the mission of the Society, an organization whose reach touches so many lives – those who are currently battling cancer, those who may face a diagnosis in the future, and those who may avoid a diagnosis altogether thanks to education, prevention, and early detection. The Making Strides Against Breast Cancer walk is a powerful event to raise awareness and funds to end breast cancer. It is the largest network of breast cancer events in the nation, uniting nearly 300 communities to finish the fight. The walks raise critical funds that enable the Society to fund groundbreaking breast cancer research; provide free comprehensive information and services to patients, survivors, and caregivers; and improve access to mammograms.

Sources of Statistics

General information. Unless otherwise stated, the statistics and statements in this booklet refer to invasive (not in situ) female breast cancer.

Estimated new breast cancer cases. The overall estimated number of new in situ and invasive breast cancer cases diagnosed in the US in 2015 was projected using a spatiotemporal model based on incidence data from 49 states and the District of Columbia for the years 1995-2011 that met the North American Association of Central Cancer Registries' (NAACCR) high-quality data standard for incidence. This method considers geographic variations in sociodemographic and lifestyle factors, medical settings, and cancer screening behaviors as predictors of incidence, and also accounts for expected delays in case reporting. Estimates for specific age groups are based on the proportions of cases diagnosed in each age group in the NAACCR data during 2008-2012 applied to the overall 2015 estimate.

Incidence rates. Incidence rates are defined as the number of people per 100,000 who develop a disease during a given time period. All incidence rates in this publication are age adjusted to the 2000 US standard population to allow comparisons across populations with different age distributions. Breast cancer incidence rates for the US in the most recent time period were calculated using data on cancer cases collected by NAACCR and population data collected by the US Census Bureau. When referenced as such, NAACCR incidence data were made available on the NAACCR website (naaccr.org) and within the Cancer in North America publications.[25,26] Long-term incidence trends are based on American Cancer Society analysis of the SEER 9 Registries Public Use Dataset using SEER*Stat 8.2.1, a statistical software package from the National Cancer Institute.[274, 275] Short-term trends by race/ethnicity, age, tumor size, and stage at diagnosis are based on delay-adjusted incidence rates from the SEER 13 registries.[276] When referenced as such, US SEER incidence rates and trends were previously made available on SEER's website (seer.cancer.gov) and within the *SEER Cancer Statistics Review 1975-2012*.[24]

Note that because of delays in reporting newly diagnosed cancer cases to the cancer registries, cancer incidence rates for the most recent diagnosis years may be underestimated. Incidence rates adjusted for delays in reporting are used when available and are referenced as such.

Estimated breast cancer deaths. The overall estimated number of breast cancer deaths in the US is calculated by fitting the number of breast cancer deaths for 1997-2011 to a statistical model that forecasts the number of deaths expected to occur in 2015. Data on the number of deaths are obtained from the National Center for Health Statistics (NCHS) at the Centers for Disease Control and Prevention. Age-specific estimates were calculated using the proportions of deaths that occurred in each age group during 2008-2012 applied to the overall 2015 estimate.

Mortality rates. Similar to incidence rates, mortality rates are defined as the number of people per 100,000 who die from a disease during a given time period. Death rates used in this publication were previously made available by SEER on their website (seer.cancer.gov) and within the *SEER Cancer Statistics Review 1975-2012*.[24] Death rates were calculated using data on cancer deaths compiled by NCHS and population data collected by the US Census Bureau. All death rates in this publication were age adjusted to the 2000 US standard population.

Survival. Five-year survival statistics are based on cancer patients diagnosed during 2005-2011; 10-year survival rates are based on diagnoses during 1999-2011; and 15-year survival rates are based on diagnoses during 1994-2011. All patients were followed through 2012. Relative survival rates are used to adjust for normal life expectancy (and events such as death from heart disease, accidents, and diseases of old age). Relative survival is calculated by dividing the percentage of observed 5-year survival for cancer patients by the 5-year survival expected for people in the general population who are similar to the patient group with respect to age, sex, race, and calendar year of observation. Relative survival rates are not calculated for Hispanics, Asians/Pacific Islanders, and American Indians/Alaska Natives because reliable estimates of life expectancy are not available for these groups; therefore, cause-specific survival rates are presented. Cause-specific survival rates are the probability of not dying of breast cancer within 5 years after diagnosis. When referenced as such, 5-year survival statistics were originally published in *SEER Cancer Statistics Review, 1975-2012*.[24]

Probability of developing cancer. Probabilities of developing breast cancer were calculated using DevCan 6.7.3 (Probability of Developing Cancer Software), developed by the National Cancer Institute.[276] These probabilities reflect the average experience of women in the US and do not take into account individual behaviors and risk factors (e.g., utilization of mammography screening and family history of breast cancer).

Screening. Prevalence estimates of mammography by age and state were obtained through analysis of data from the Behavioral Risk Factor Surveillance System (BRFSS).[215] The BRFSS is an ongoing system of surveys conducted by the state health departments in cooperation with the Centers for Disease Control and Prevention. Prevalence estimates of mammography by race/ethnicity, poverty, and other demographic factors are from the National Health Interview Survey.[214]

Important note about estimated cases and deaths. The estimated numbers of new breast cancer cases and deaths in 2015 should be interpreted with caution. The projection method is model-based, so the estimated numbers may vary from previous years for reasons other than changes in cancer occurrence. Therefore, while 3-year-ahead projections provide a reasonably accurate estimate of the cancer burden in 2015, we strongly discourage the use of our estimates to track changes in cancer occurrence. Age-adjusted incidence and mortality rates reported by the SEER program and the NCHS, respectively, are the preferred statistics to track cancer trends in the US. Rates from state cancer registries are useful for tracking local trends.

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