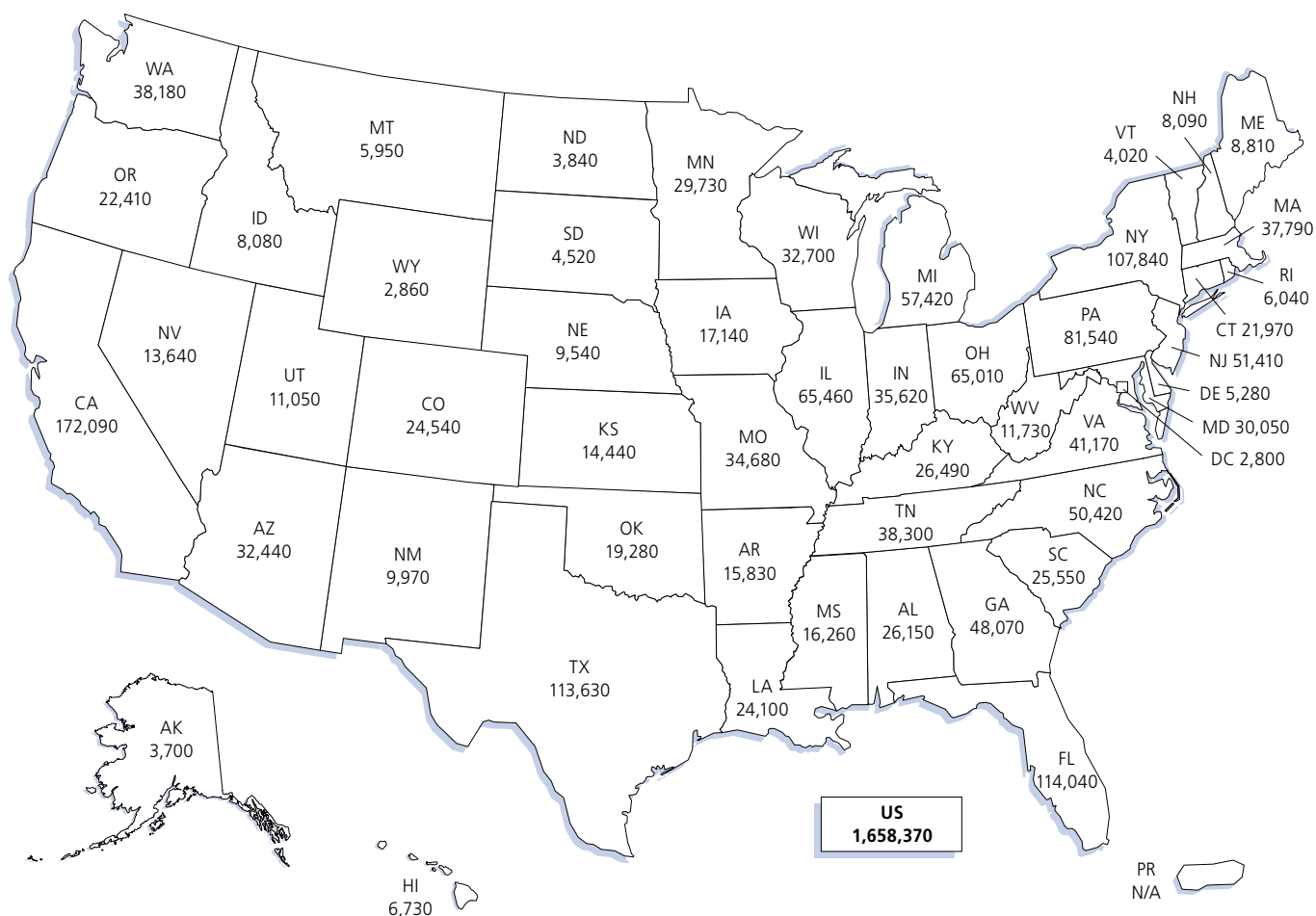


# 2015



Estimated numbers of new cancer cases for 2015, excluding basal cell and squamous cell skin cancers and in situ carcinomas except urinary bladder.

**Note:** State estimates are offered as a rough guide and should be interpreted with caution. State estimates may not add to US total due to rounding.

**Special Section:**  
**Breast Carcinoma In Situ**  
*see page 26*

# Contents

<b>Basic Cancer Facts</b> .....	<b>1</b>
Trends in Age-adjusted Cancer Death Rates by Site, Males, US, 1930-2011* .....	2
Trends in Age-adjusted Cancer Death Rates by Site, Females, US, 1930-2011* .....	3
Estimated Number of New Cancer Cases and Deaths by Sex, US, 2015* .....	4
Estimated Number of New Cases for Selected Cancers by State, US, 2015* .....	5
Estimated Number of Deaths for Selected Cancers by State, US, 2015* .....	6
Incidence Rates for Selected Cancers by State, US, 2007-2011* .....	7
Death Rates for Selected Cancers by State, US, 2007-2011* .....	8
<b>Selected Cancers</b> .....	<b>9</b>
Leading Sites of New Cancer Cases and Deaths – 2015 Estimates* .....	10
Probability (%) of Developing Invasive Cancer during Selected Age Intervals by Sex, US, 2009-2011* .....	14
Five-year Relative Survival Rates (%) by Stage at Diagnosis, US, 2004-2010* .....	17
Trends in 5-year Relative Survival Rates (%) by Race, US, 1975-2010* .....	18
<b>Special Section: Breast Carcinoma In Situ</b> .....	<b>26</b>
<b>Cancer Disparities</b> .....	<b>37</b>
Incidence and Death Rates for Selected Cancers by Race and Ethnicity, US, 2007-2011* .....	38
Geographic Patterns in Lung Cancer Death Rates by State, US, 2007-2011* .....	39
<b>The Global Fight against Cancer</b> .....	<b>40</b>
<b>The American Cancer Society</b> .....	<b>42</b>
<b>Sources of Statistics</b> .....	<b>50</b>
Screening Guidelines for the Early Detection of Cancer in Average-risk Asymptomatic People* .....	52

\*Indicates a figure or table

Corporate Center: American Cancer Society Inc.  
250 Williams Street, NW, Atlanta, GA 30303-1002  
(404) 320-3333

©2015, American Cancer Society, Inc. All rights reserved,  
including the right to reproduce this publication  
or portions thereof in any form.

For written permission, address the Legal department of  
the American Cancer Society, 250 Williams Street, NW,  
Atlanta, GA 30303-1002.

*This publication attempts to summarize current scientific information about cancer.  
Except when specified, it does not represent the official policy of the American Cancer Society.*

**Suggested citation:** American Cancer Society. *Cancer Facts & Figures 2015*. Atlanta: American Cancer Society; 2015.

# Basic Cancer Facts

## What Is Cancer?

Cancer is a group of diseases characterized by the uncontrolled growth and spread of abnormal cells. If the spread is not controlled, it can result in death. Cancer is caused by external factors, such as tobacco, infectious organisms, and an unhealthy diet, and internal factors, such as inherited genetic mutations, hormones, and immune conditions. These factors may act together or in sequence to cause cancer. Ten or more years often pass between exposure to external factors and detectable cancer. Treatments include surgery, radiation, chemotherapy, hormone therapy, immune therapy, and targeted therapy (drugs that specifically interfere with cancer cell growth).

## Can Cancer Be Prevented?

A substantial proportion of cancers could be prevented. All cancers caused by tobacco use and heavy alcohol consumption could be prevented completely. In 2015, almost 171,000 of the estimated 589,430 cancer deaths in the US will be caused by tobacco smoking. In addition, the World Cancer Research Fund has estimated that up to one-third of the cancer cases that occur in economically developed countries like the US are related to overweight or obesity, physical inactivity, and/or poor nutrition, and thus could also be prevented. Certain cancers are related to infectious agents, such as human papillomavirus (HPV), hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), and *Helicobacter pylori* (*H. pylori*). Many of these cancers could be avoided by preventing infection, either through behavioral changes or vaccination, or by treating the infection. Many of the more than 3 million skin cancer cases that are diagnosed annually could be prevented by protecting skin from excessive sun exposure and avoiding indoor tanning.

Screening can prevent colorectal and cervical cancers by allowing for the detection and removal of precancerous lesions. Screening also offers the opportunity to detect cancer early, before symptoms appear, which usually results in less extensive treatment and better outcomes. Screening is known to reduce mortality for cancers of the breast, colon, rectum, cervix, and lung (among long-term and/or heavy smokers). A heightened awareness of changes in the breast, skin, or testicles may also result in the early detection of cancer. For complete cancer screening guidelines, see page 52.

## Who Is at Risk of Developing Cancer?

Cancer most commonly develops in older people; 78% of all cancer diagnoses are in people 55 years of age or older. People who smoke, eat an unhealthy diet, or are physically inactive also have

a higher risk of cancer. Cancer researchers use the word “risk” in different ways, most commonly expressing risk as lifetime risk or relative risk. Lifetime risk refers to the probability that an individual will develop or die from cancer over the course of a lifetime. In the US, the lifetime risk of developing cancer is higher in men (slightly less than 1 in 2) than for women (a little more than 1 in 3). These probabilities are estimated based on the overall experience of the general population and may overestimate or underestimate individual risk because of differences in exposures (e.g., smoking), family history, and/or genetic susceptibility.

Relative risk is a measure of the strength of the relationship between a risk factor and cancer. It compares the risk of developing cancer in people with a certain exposure or trait to the risk in people who do not have this characteristic. For example, men and women who smoke are about 25 times more likely to develop lung cancer than nonsmokers, so their relative risk is 25. Most relative risks are not this large. For example, women who have one first-degree relative (mother, sister, or daughter) with a history of breast cancer are about twice as likely to develop breast cancer as women who do not have this family history; in other words, their relative risk is about 2. For most types of cancer, risk is higher with a family history of the disease. It is now thought that many familial cancers arise not exclusively from genetic makeup, but from the interplay between common gene variations and lifestyle and environmental risk factors. Only a small proportion of cancers are strongly hereditary, in that an inherited genetic alteration confers a very high risk.

## How Many People Alive Today Have Ever Had Cancer?

Nearly 14.5 million Americans with a history of cancer were alive on January 1, 2014. Some of these individuals were diagnosed recently and are actively undergoing treatment, while others were diagnosed many years ago with no current evidence of cancer.

## How Many New Cases Are Expected to Occur This Year?

About 1,658,370 new cancer cases are expected to be diagnosed in 2015. This estimate does not include carcinoma in situ (noninvasive cancer) of any site except urinary bladder, nor does it include basal cell or squamous cell skin cancers, which are not required to be reported to cancer registries.

## How Many People Are Expected to Die of Cancer This Year?

In 2015, about 589,430 Americans are expected to die of cancer, or about 1,620 people per day. Cancer is the second most common cause of death in the US, exceeded only by heart disease, and accounts for nearly 1 of every 4 deaths.

## What Percentage of People Survive Cancer?

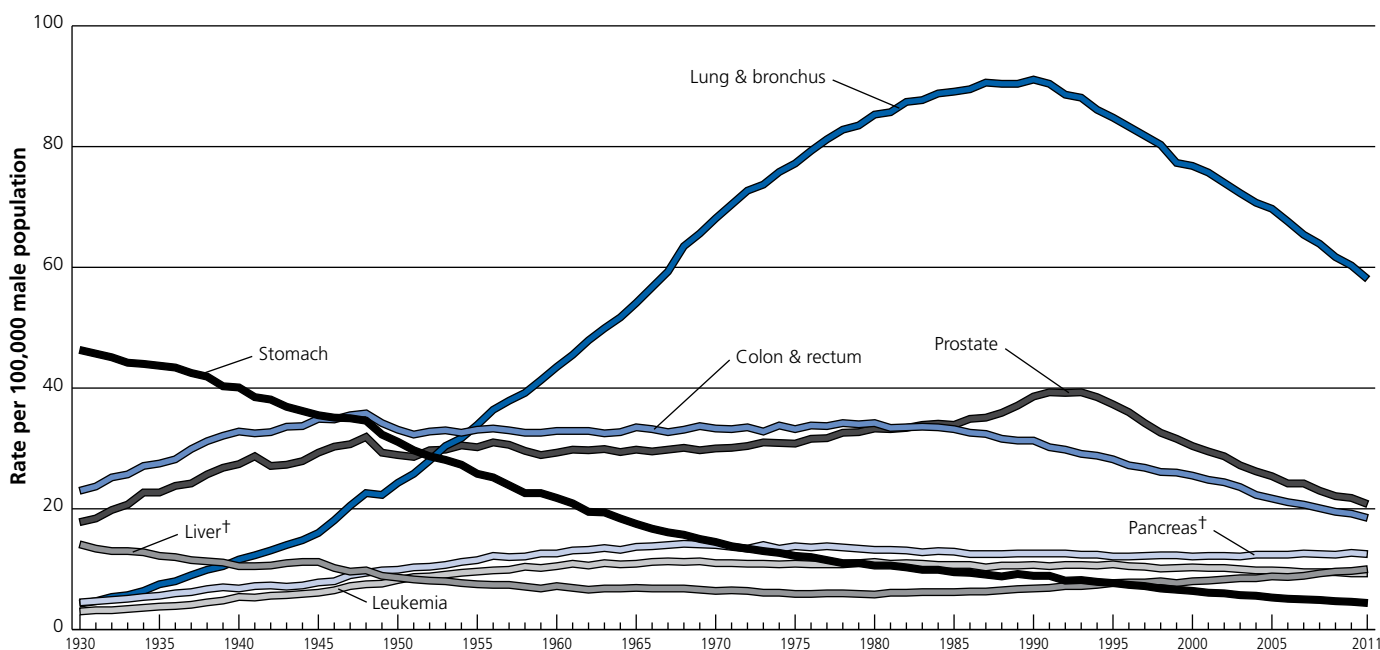
The 5-year relative survival rate for all cancers diagnosed in 2004-2010 was 68%, up from 49% in 1975-1977 (see page 18). The improvement in survival reflects both the earlier diagnosis of certain cancers and improvements in treatment. Survival statistics vary greatly by cancer type and stage at diagnosis. Relative survival is the percentage of people who are alive a designated time period after a cancer diagnosis (usually 5 years) divided by the percentage expected to be alive in the absence of cancer based on normal life expectancy. It does not distinguish between patients who have no evidence of cancer and those who have relapsed or are still in treatment. While 5-year relative survival is useful in monitoring progress in the early detection and treatment of cancer, it does not represent the proportion of people who are cured because cancer deaths can occur beyond 5 years after diagnosis. In addition, although relative survival provides some indication about the average survival experience of cancer patients in a given population, it may not predict individual prognosis and should be interpreted with caution. First, because 5-year relative survival rates for the most recent time period are based on patients who were diagnosed from 2004 to 2010, they do not reflect the most recent advances in detection and treatment. Second, factors that influence individual survival, such as treatment protocols, other illnesses, and biological

or behavioral differences in cancers or people, cannot be taken into account. Third, survival rates may be misleading for cancers detected before symptoms arise if early diagnosis does not extend lifespan. This occurs when cancer is diagnosed that would have gone undetected in the absence of screening (over-diagnosis) or when early diagnosis does not alter the course of disease. In other words, increased time living after a cancer diagnosis does not always translate into progress against cancer. For more information about survival rates, see “Sources of Statistics” on page 50.

## How Is Cancer Staged?

Staging describes the extent or spread of cancer at the time of diagnosis. Proper staging is essential in determining the choice of therapy and in assessing prognosis. A cancer’s stage is based on the size or extent of the primary tumor and whether it has spread to nearby lymph nodes or other areas of the body. A number of different staging systems are used to classify cancer. A system of summary staging is used for descriptive and statistical analysis of tumor registry data and is particularly useful for looking at trends over time. According to this system, if cancer cells are present only in the layer of cells where they developed and have not spread, the stage is in situ. If cancer cells have penetrated beyond the original layer of tissue, the cancer has

**Trends in Age-adjusted Cancer Death Rates\* by Site, Males, US, 1930-2011**



\*Per 100,000, age adjusted to the 2000 US standard population. †Mortality rates for pancreatic and liver cancers are increasing.

Note: Due to changes in ICD coding, numerator information has changed over time. Rates for cancer of the liver, lung and bronchus, and colon and rectum are affected by these coding changes.

Source: US Mortality Volumes 1930 to 1959 and US Mortality Data 1960 to 2011, National Center for Health Statistics, Centers for Disease Control and Prevention.

©2015, American Cancer Society, Inc., Surveillance Research

become invasive and is categorized as local, regional, or distant based on the extent of spread. (For a more detailed description of these categories, see the footnotes in the table “Five-year Relative Survival Rates (%) by Stage at Diagnosis, US, 2004-2010” on page 17.)

Clinicians use a different staging system, called TNM, for most cancers. The TNM system assesses cancer growth and spread in 3 ways: extent of the primary tumor (T), absence or presence of regional lymph node involvement (N), and absence or presence of distant metastases (M). Once the T, N, and M categories are determined, a stage of 0, I, II, III, or IV is assigned, with stage 0 being in situ, stage I being early, and stage IV being the most advanced disease. Some cancers (e.g., leukemia and lymphoma) have alternative staging systems. As the biology of cancer has become better understood, genetic features of tumors have been incorporated into treatment plans and/or stage for some cancer sites.

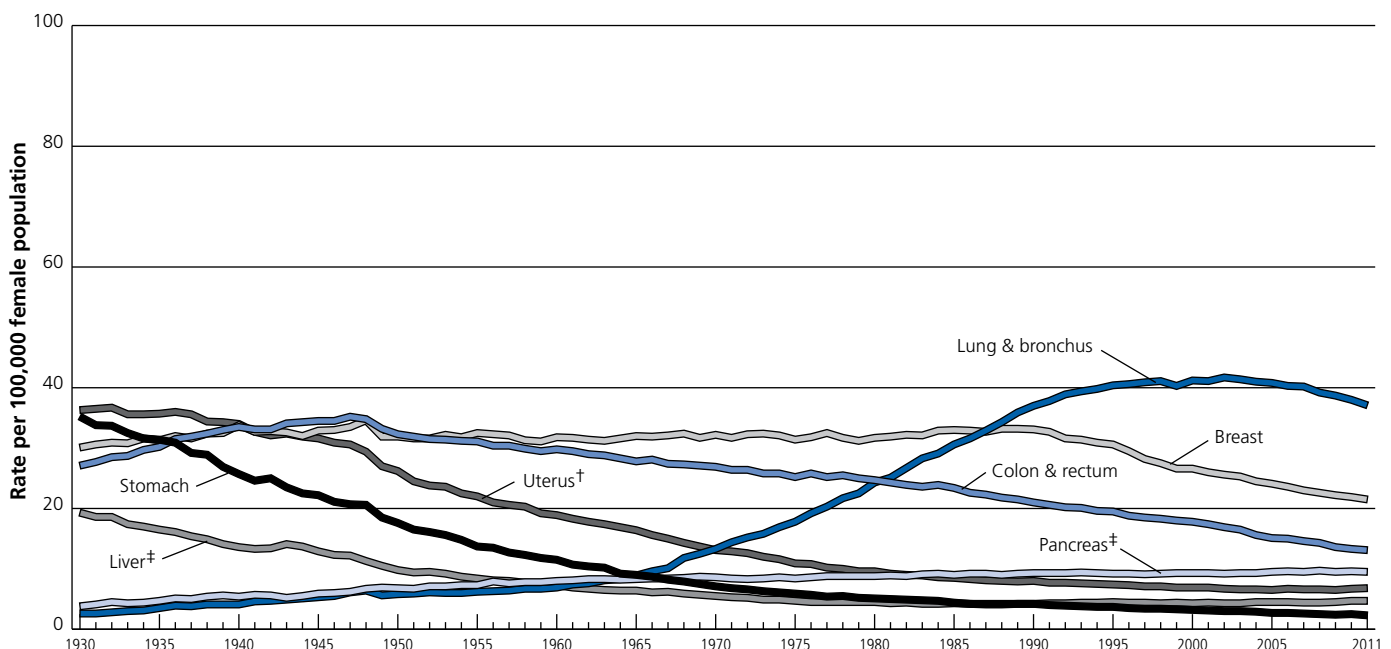
## What Are the Costs of Cancer?

The Agency for Healthcare Research and Quality (AHRQ) estimates that the direct medical costs (total of all health care expenditures) for cancer in the US in 2011 were \$88.7 billion. Half of this cost is for hospital outpatient or office-based provider

visits, 35% is inpatient hospital stays, and 11% is prescription medications. These estimates are based on a set of large-scale surveys of individuals and their medical providers called the Medical Expenditure Panel Survey (MEPS), the most complete, nationally representative data on health care use and expenditures. Estimates were accessed directly from the MEPS website ([meps.ahrq.gov/mepsweb/](http://meps.ahrq.gov/mepsweb/)) instead of from the National Heart, Lung, and Blood Institute Fact Book, as in previous years, because an updated fact book was not available.

Lack of health insurance and other barriers prevent many Americans from receiving optimal health care. According to the US Census Bureau, approximately 48 million Americans (15.4%) were uninsured in 2012, including 1 in 3 Hispanics and almost 1 in 10 children (18 years of age or younger). Uninsured patients and those from many ethnic minority groups are substantially more likely to be diagnosed with cancer at a later stage, when treatment is often more extensive, more costly, and less successful. The Affordable Care Act (ACA) is expected to substantially reduce the number of people who are uninsured and improve the health care system for cancer patients and others with pre-existing health conditions. A recent study estimated that 20 million Americans had potentially gained insurance coverage through the ACA as of May 1, 2014, including 8 million enrollees in individual private insurance marketplace plans. However, not

**Trends in Age-adjusted Cancer Death Rates\* by Site, Females, US, 1930-2011**



\*Per 100,000, age adjusted to the 2000 US standard population. †Uterus refers to uterine cervix and uterine corpus combined. ‡Mortality rates for pancreatic and liver cancers are increasing.

Note: Due to changes in ICD coding, numerator information has changed over time. Rates for cancer of the liver, lung and bronchus, and colon and rectum are affected by these coding changes.

Source: US Mortality Volumes 1930 to 1959 and US Mortality Data 1960 to 2011, National Center for Health Statistics, Centers for Disease Control and Prevention.

©2015, American Cancer Society, Inc., Surveillance Research

## Estimated Number\* of New Cancer Cases and Deaths by Sex, US, 2015

	Estimated New Cases			Estimated Deaths		
	Both Sexes	Male	Female	Both sexes	Male	Female
All Sites	1,658,370	848,200	810,170	589,430	312,150	277,280
Oral cavity & pharynx	45,780	32,670	13,110	8,650	6,010	2,640
Tongue	14,320	10,310	4,010	2,190	1,500	690
Mouth	12,920	7,750	5,170	2,120	1,200	920
Pharynx	15,520	12,380	3,140	2,660	2,010	650
Other oral cavity	3,020	2,230	790	1,680	1,300	380
Digestive system	291,150	163,050	128,100	149,300	86,540	62,760
Esophagus	16,980	13,570	3,410	15,590	12,600	2,990
Stomach	24,590	15,540	9,050	10,720	6,500	4,220
Small intestine	9,410	4,960	4,450	1,260	670	590
Colon†	93,090	45,890	47,200	49,700	26,100	23,600
Rectum	39,610	23,200	16,410			
Anus, anal canal, & anorectum	7,270	2,640	4,630	1,010	400	610
Liver & intrahepatic bile duct	35,660	25,510	10,150	24,550	17,030	7,520
Gallbladder & other biliary	10,910	4,990	5,920	3,700	1,660	2,040
Pancreas	48,960	24,840	24,120	40,560	20,710	19,850
Other digestive organs	4,670	1,910	2,760	2,210	870	1,340
Respiratory system	240,390	130,260	110,130	162,460	89,750	72,710
Larynx	13,560	10,720	2,840	3,640	2,890	750
Lung & bronchus	221,200	115,610	105,590	158,040	86,380	71,660
Other respiratory organs	5,630	3,930	1,700	780	480	300
Bones & joints	2,970	1,640	1,330	1,490	850	640
Soft tissue (including heart)	11,930	6,610	5,320	4,870	2,600	2,270
Skin (excluding basal & squamous)	80,100	46,610	33,490	13,340	9,120	4,220
Melanoma of skin	73,870	42,670	31,200	9,940	6,640	3,300
Other nonepithelial skin	6,230	3,940	2,290	3,400	2,480	920
Breast	234,190	2,350	231,840	40,730	440	40,290
Genital system	329,330	231,050	98,280	58,670	28,230	30,440
Uterine cervix	12,900		12,900	4,100		4,100
Uterine corpus	54,870		54,870	10,170		10,170
Ovary	21,290		21,290	14,180		14,180
Vulva	5,150		5,150	1,080		1,080
Vagina & other genital, female	4,070		4,070	910		910
Prostate	220,800	220,800		27,540	27,540	
Testis	8,430	8,430		380	380	
Penis & other genital, male	1,820	1,820		310	310	
Urinary system	138,710	96,580	42,130	30,970	21,110	9,860
Urinary bladder	74,000	56,320	17,680	16,000	11,510	4,490
Kidney & renal pelvis	61,560	38,270	23,290	14,080	9,070	5,010
Ureter & other urinary organs	3,150	1,990	1,160	890	530	360
Eye & orbit	2,580	1,360	1,220	270	140	130
Brain & other nervous system	22,850	12,900	9,950	15,320	8,940	6,380
Endocrine system	64,860	16,520	48,340	2,890	1,350	1,540
Thyroid	62,450	15,220	47,230	1,950	870	1,080
Other endocrine	2,410	1,300	1,110	940	480	460
Lymphoma	80,900	44,950	35,950	20,940	12,140	8,800
Hodgkin lymphoma	9,050	5,100	3,950	1,150	660	490
Non-Hodgkin lymphoma	71,850	39,850	32,000	19,790	11,480	8,310
Myeloma	26,850	14,090	12,760	11,240	6,240	5,000
Leukemia	54,270	30,900	23,370	24,450	14,210	10,240
Acute lymphocytic leukemia	6,250	3,100	3,150	1,450	800	650
Chronic lymphocytic leukemia	14,620	8,140	6,480	4,650	2,830	1,820
Acute myeloid leukemia	20,830	12,730	8,100	10,460	6,110	4,350
Chronic myeloid leukemia	6,660	3,530	3,130	1,140	590	550
Other leukemia‡	5,910	3,400	2,510	6,750	3,880	2,870
Other & unspecified primary sites‡	31,510	16,660	14,850	43,840	24,480	19,360

\*Rounded to the nearest 10; estimated new cases exclude basal cell and squamous cell skin cancer and in situ carcinoma except urinary bladder. About 60,290 carcinoma in situ of the female breast and 63,440 melanoma in situ will be newly diagnosed in 2015. †Estimated deaths for colon and rectal cancers are combined.

‡More deaths than cases may reflect lack of specificity in recording underlying cause of death on death certificates and/or an undercount in the case estimate.

**Source:** Estimated new cases are based on 1995-2011 incidence rates reported by the North American Association of Central Cancer Registries (NAACCR). Estimated deaths are based on 1997-2011 US mortality data, National Center for Health Statistics, Centers for Disease Control and Prevention.

©2015, American Cancer Society, Inc., Surveillance Research



## Estimated Number\* of New Cases for Selected Cancers by State, US, 2015

State	All Sites	Female Breast	Uterine Cervix	Colon & Rectum	Uterine Corpus	Leukemia	Lung & Bronchus	Melanoma of the Skin	Non-Hodgkin Lymphoma	Prostate	Urinary Bladder
Alabama	26,150	3,680	230	2,150	660	730	4,150	1,380	1,020	3,590	1,000
Alaska	3,700	470	†	290	100	110	420	100	140	490	180
Arizona	32,440	4,750	200	2,440	940	950	3,740	1,400	1,300	4,090	1,580
Arkansas	15,830	2,090	150	1,420	420	480	2,620	360	670	2,050	630
California	172,090	25,270	1,490	14,510	5,800	5,970	18,430	8,560	7,870	21,060	7,150
Colorado	24,540	3,640	170	1,800	740	870	2,560	1,400	1,090	3,600	1,080
Connecticut	21,970	3,190	130	1,580	810	660	2,870	780	920	3,170	1,140
Delaware	5,280	780	†	400	180	160	860	280	220	740	250
Dist. of Columbia	2,800	430	†	230	100	70	310	80	100	490	80
Florida	114,040	15,470	980	9,330	3,550	3,930	16,810	5,480	5,340	15,480	5,670
Georgia	48,070	7,170	430	3,820	1,330	1,430	6,460	2,350	1,870	7,450	1,720
Hawaii	6,730	1,140	50	720	280	230	890	420	310	710	220
Idaho	8,080	1,070	†	620	240	300	910	470	380	1,270	410
Illinois	65,460	9,570	550	5,720	2,470	2,200	8,920	2,380	2,890	8,140	2,970
Indiana	35,620	4,600	280	2,890	1,180	1,100	5,510	1,460	1,490	4,040	1,590
Iowa	17,140	2,390	100	1,490	640	640	2,440	1,070	830	2,170	800
Kansas	14,440	2,130	90	1,080	500	480	1,930	850	640	1,860	620
Kentucky	26,490	3,300	220	2,090	730	820	4,680	1,530	1,030	3,040	1,070
Louisiana	24,100	2,900	220	2,150	570	690	3,380	540	950	3,980	910
Maine	8,810	1,010	50	610	340	320	1,360	320	390	1,100	540
Maryland	30,050	4,730	230	2,360	1,080	780	3,980	1,410	1,230	4,620	1,250
Massachusetts	37,790	5,890	210	2,550	1,460	1,130	5,150	1,310	1,620	5,420	2,000
Michigan	57,420	7,780	350	4,190	2,090	1,870	8,350	2,630	2,500	8,110	2,870
Minnesota	29,730	3,900	130	2,140	990	1,120	3,250	1,190	1,330	3,740	1,270
Mississippi	16,260	2,050	140	1,460	390	450	2,340	540	550	2,150	500
Missouri	34,680	4,610	260	2,840	1,120	1,100	5,380	1,510	1,450	3,900	1,500
Montana	5,950	830	†	500	190	200	760	300	270	1,000	310
Nebraska	9,540	1,230	60	850	340	320	1,200	500	450	1,190	440
Nevada	13,640	1,690	120	1,110	350	440	1,770	470	530	1,640	660
New Hampshire	8,090	1,120	†	540	310	260	1,140	280	350	1,080	450
New Jersey	51,410	7,310	410	4,260	1,850	1,610	5,830	2,520	2,310	7,270	2,530
New Mexico	9,970	1,320	80	820	300	360	990	480	410	1,290	390
New York	107,840	14,900	870	8,010	4,250	3,630	13,180	4,270	4,800	14,850	5,200
North Carolina	50,420	7,820	390	3,980	1,630	1,660	7,750	2,600	2,150	7,210	2,170
North Dakota	3,840	510	†	350	110	140	440	180	170	490	190
Ohio	65,010	8,950	450	5,430	2,410	1,930	10,000	2,790	2,790	8,150	3,040
Oklahoma	19,280	2,770	170	1,690	540	670	3,220	480	840	2,480	830
Oregon	22,410	3,280	130	1,510	740	720	2,830	1,480	960	3,110	1,090
Pennsylvania	81,540	9,990	540	6,300	3,000	2,560	10,540	3,880	3,410	10,050	4,080
Rhode Island	6,040	730	†	470	230	180	880	180	250	760	330
South Carolina	25,550	3,820	220	2,130	780	820	4,040	1,420	1,070	3,870	1,090
South Dakota	4,520	600	†	360	150	170	570	210	210	550	220
Tennessee	38,300	4,770	320	3,060	1,000	1,110	6,200	1,940	1,500	4,410	1,510
Texas	113,630	16,510	1,240	10,050	3,240	4,360	13,650	2,410	5,080	15,020	4,080
Utah	11,050	1,460	70	670	360	390	660	800	510	1,750	430
Vermont	4,020	530	†	280	150	110	570	150	170	470	210
Virginia	41,170	6,090	320	2,970	1,340	1,100	5,740	2,230	1,680	6,120	1,670
Washington	38,180	5,480	230	2,700	1,250	1,300	4,790	2,460	1,770	5,430	1,790
West Virginia	11,730	1,430	90	1,080	400	380	2,080	550	480	1,370	550
Wisconsin	32,700	4,310	190	2,460	1,160	1,190	4,370	1,330	1,460	4,310	1,610
Wyoming	2,860	390	†	230	90	100	320	160	120	460	140
United States	1,658,370	231,840	12,900	132,700	54,870	54,270	221,200	73,870	71,850	220,800	74,000

\*Rounded to nearest 10. Excludes basal cell and squamous cell skin cancers and in situ carcinomas except urinary bladder. †Estimate is fewer than 50 cases.

These estimates are offered as a rough guide and should be interpreted with caution. State estimates may not sum to US total due to rounding and exclusion of state estimates fewer than 50 cases.

**Please note:** Estimated cases for additional cancer sites by state can be found in Supplemental Data at [cancer.org/research/cancerfactsstatistics/index](http://cancer.org/research/cancerfactsstatistics/index).

©2015, American Cancer Society, Inc., Surveillance Research

## Estimated Number\* of Deaths for Selected Cancers by State, US, 2015

State	All Sites	Brain/ Nervous System	Female Breast	Colon & Rectum	Leukemia	Liver†	Lung & Bronchus	Non- Hodgkin Lymphoma	Ovary	Pancreas	Prostate
Alabama	10,560	290	680	930	420	360	3,280	330	270	660	580
Alaska	1,040	†	70	90	†	50	290	†	†	70	50
Arizona	11,540	330	770	990	510	530	2,800	410	310	830	600
Arkansas	6,760	160	410	620	260	270	2,180	210	140	410	290
California	58,180	1,690	4,320	5,180	2,550	3,250	12,370	2,070	1,530	4,240	3,180
Colorado	7,590	260	540	650	330	350	1,710	250	240	530	430
Connecticut	6,840	190	460	440	300	270	1,730	220	170	540	360
Delaware	2,010	50	120	150	80	90	600	60	†	140	100
Dist. of Columbia	990	†	80	100	†	60	210	†	†	80	70
Florida	43,050	1,000	2,830	3,520	1,790	1,710	11,920	1,440	940	2,980	2,030
Georgia	16,460	430	1,240	1,500	630	660	4,640	470	430	1,040	750
Hawaii	2,470	†	130	230	100	140	580	90	60	220	110
Idaho	2,790	90	190	220	130	90	670	100	60	210	170
Illinois	23,940	570	1,640	2,090	990	860	6,550	810	560	1,640	1,080
Indiana	13,420	340	870	1,080	570	400	4,060	450	300	850	540
Iowa	6,440	190	390	570	270	210	1,770	250	170	410	300
Kansas	5,510	170	350	480	260	190	1,540	200	140	380	240
Kentucky	10,200	230	590	850	370	310	3,550	320	200	600	350
Louisiana	9,040	210	630	810	330	440	2,610	280	180	620	380
Maine	3,300	90	180	240	140	100	970	110	70	210	150
Maryland	10,470	260	810	860	400	440	2,700	320	250	780	500
Massachusetts	12,710	330	770	930	530	580	3,420	410	330	930	570
Michigan	20,920	580	1,410	1,670	890	730	6,010	740	470	1,480	810
Minnesota	9,820	270	620	760	490	370	2,450	380	240	660	510
Mississippi	6,360	140	410	640	250	260	1,950	170	110	390	300
Missouri	12,830	310	900	1,050	530	480	3,910	400	240	860	500
Montana	2,020	60	130	170	90	60	540	70	60	140	120
Nebraska	3,480	110	210	340	140	120	890	130	70	240	180
Nevada	4,880	150	380	470	190	220	1,410	150	110	370	260
New Hampshire	2,730	80	170	200	110	80	770	80	70	200	120
New Jersey	16,250	380	1,290	1,480	640	630	3,900	510	450	1,240	720
New Mexico	3,620	100	270	350	150	180	760	120	110	250	210
New York	34,600	840	2,420	2,890	1,470	1,520	8,740	1,300	900	2,590	1,640
North Carolina	19,310	460	1,340	1,490	750	730	5,780	590	430	1,200	860
North Dakota	1,280	†	80	130	60	†	320	†	†	90	70
Ohio	25,400	620	1,740	2,090	1,010	850	7,370	850	560	1,720	1,130
Oklahoma	8,100	220	520	680	320	310	2,460	260	180	490	350
Oregon	8,040	240	510	670	330	370	2,070	280	220	560	420
Pennsylvania	28,640	650	1,950	2,400	1,240	1,020	7,520	1,030	700	2,050	1,280
Rhode Island	2,120	50	130	160	90	90	570	60	†	120	100
South Carolina	10,130	240	690	840	350	380	2,970	300	230	640	460
South Dakota	1,630	50	110	140	80	50	450	50	†	100	90
Tennessee	14,370	360	890	1,220	540	550	4,600	450	290	840	580
Texas	38,520	1,010	2,710	3,470	1,620	2,260	9,580	1,260	930	2,550	1,570
Utah	2,900	120	270	240	140	120	460	120	90	240	200
Vermont	1,360	†	80	100	50	60	400	†	†	90	70
Virginia	14,830	370	1,090	1,180	580	570	4,070	480	380	1,040	670
Washington	12,700	400	830	990	540	590	3,220	440	350	900	690
West Virginia	4,710	110	270	410	190	130	1,460	160	100	250	170
Wisconsin	11,550	350	720	850	540	400	3,050	410	300	830	590
Wyoming	1,000	†	70	80	60	†	240	†	†	70	†
United States	589,430	15,320	40,290	49,700	24,450	24,550	158,040	19,790	14,180	40,560	27,540

\*Rounded to nearest 10. †Estimate is fewer than 50 deaths. ‡Includes intrahepatic bile duct.

These estimates are offered as a rough guide and should be interpreted with caution. State estimates may not sum to US total due to rounding and exclusion of state estimates fewer than 50 deaths.

**Please note:** Estimated deaths for additional cancer sites by state can be found in Supplemental Data at [cancer.org/research/cancerfactsstatistics/index](http://cancer.org/research/cancerfactsstatistics/index).

©2015, American Cancer Society, Inc., Surveillance Research



## Incidence Rates\* for Selected Cancers by State, US, 2007-2011

	All Sites		Breast	Colon & Rectum		Lung & Bronchus		Non-Hodgkin Lymphoma		Prostate	Urinary Bladder	
State	Male	Female	Female	Male	Female	Male	Female	Male	Female	Male	Male	Female
Alabama	568.8	396.5	118.4	55.6	38.7	100.6	54.8	19.7	13.7	153.7	33.4	7.8
Alaska	501.4	424.1	127.3	50.9	41.4	79.4	59.5	21.3	14.9	126.0	37.5	11.0
Arizona	432.8	373.5	111.6	41.1	31.4	60.7	47.7	18.7	13.6	100.9	32.7	8.4
Arkansas†‡	552.7	385.1	109.8	55.2	38.7	106.7	60.2	21.9	14.8	149.6	33.7	7.8
California	499.2	396.3	122.4	47.9	36.3	58.0	43.1	23.0	15.6	136.4	33.1	7.9
Colorado	490.7	397.2	125.3	41.8	32.8	54.7	44.0	22.5	15.9	147.6	32.8	8.4
Connecticut	567.4	455.7	136.6	49.4	37.4	74.3	58.2	25.3	17.4	152.4	47.1	12.3
Delaware	589.5	444.9	128.0	49.1	37.5	86.0	63.4	23.4	16.9	168.1	43.1	11.4
Dist. of Columbia	579.8	435.7	143.4	51.2	43.7	75.3	47.2	21.0	12.9	198.2	25.1	9.1
Florida	514.2	400.5	114.6	46.6	35.4	77.4	56.0	21.9	15.1	128.3	35.0	8.6
Georgia	564.4	407.8	123.8	50.8	37.6	91.0	54.8	22.1	14.8	161.0	34.2	7.9
Hawaii	477.9	398.1	126.0	56.5	37.4	62.6	38.4	21.3	14.4	113.9	24.5	6.1
Idaho	526.2	411.2	118.8	44.9	34.5	61.2	47.1	22.5	17.0	155.0	38.7	9.0
Illinois	560.6	441.3	127.4	57.2	41.9	84.9	60.4	23.9	16.6	149.4	39.3	9.8
Indiana	522.5	424.5	118.5	52.9	41.1	95.0	62.9	23.5	16.8	117.4	35.9	8.8
Iowa	552.1	438.9	124.8	55.8	42.1	83.0	54.7	27.0	18.7	133.3	41.1	8.7
Kansas	552.5	424.7	122.5	52.4	38.5	78.2	54.0	23.6	16.3	152.6	38.7	9.3
Kentucky	604.0	464.2	120.7	62.4	45.0	122.9	80.7	24.9	17.2	128.8	40.4	9.8
Louisiana	601.6	416.6	121.3	60.8	43.5	96.9	57.0	24.3	16.6	168.9	34.3	8.1
Maine	563.6	454.9	126.4	48.4	39.3	88.1	66.2	25.3	17.5	133.9	48.1	13.0
Maryland	526.8	420.7	130.3	46.2	35.9	72.2	54.9	21.5	15.2	152.1	33.7	9.2
Massachusetts	558.7	460.0	135.6	47.6	37.6	77.1	63.6	24.8	16.4	148.9	42.8	11.9
Michigan	567.4	432.3	120.7	48.9	37.5	83.6	61.2	24.6	17.4	161.5	41.2	10.6
Minnesota§	—	—	—	—	—	—	—	—	—	—	—	—
Mississippi	593.4	402.7	116.0	60.3	44.0	110.2	56.8	21.3	14.6	161.4	30.7	7.3
Missouri	519.8	423.3	122.6	53.2	39.4	93.0	63.7	22.1	15.9	121.8	34.0	8.5
Montana	519.6	425.3	125.8	48.6	38.5	68.8	54.7	23.0	15.3	147.2	37.6	10.1
Nebraska	513.6	421.4	121.8	54.9	42.9	72.2	50.8	23.7	17.8	136.6	35.0	8.5
Nevada†¶	494.8	394.5	112.7	50.2	35.8	72.2	61.3	19.7	15.0	133.9	36.8	10.6
New Hampshire	573.2	454.4	134.1	45.1	38.0	78.8	62.8	25.3	17.5	151.7	49.6	13.5
New Jersey	576.6	450.0	129.5	52.6	39.9	71.4	55.1	25.1	17.9	166.1	42.7	11.4
New Mexico	447.8	362.2	110.0	43.0	32.2	51.2	37.7	17.9	13.4	124.4	25.7	6.2
New York	580.6	451.2	128.5	51.6	39.8	75.4	55.6	26.4	18.1	163.3	41.9	10.6
North Carolina	560.9	417.9	126.6	48.4	35.7	94.4	56.7	22.7	15.6	149.1	36.9	9.0
North Dakota	524.8	411.1	121.8	57.2	41.1	68.9	44.3	23.2	18.5	149.0	37.8	9.3
Ohio	531.6	421.6	120.0	51.8	38.9	89.4	59.9	22.6	15.6	135.8	38.5	9.4
Oklahoma	539.1	414.8	120.4	51.5	39.5	93.5	61.1	22.1	16.2	142.7	34.0	8.2
Oregon	505.2	429.6	129.4	44.5	35.3	69.1	57.8	22.5	15.5	134.4	37.8	9.5
Pennsylvania	571.5	456.9	126.8	54.3	41.1	83.2	57.6	25.6	17.8	145.9	44.3	11.1
Rhode Island	559.0	455.8	130.1	47.1	38.9	82.7	63.1	23.3	17.6	143.1	46.4	14.0
South Carolina	544.6	402.9	123.0	48.2	36.7	92.5	53.8	20.1	13.4	146.7	31.6	8.5
South Dakota	501.8	411.7	122.0	55.9	41.4	70.9	49.1	22.4	16.3	142.0	34.2	8.8
Tennessee	562.5	417.9	119.7	51.7	38.9	101.0	61.4	22.4	16.1	143.7	35.3	8.1
Texas	504.7	387.1	113.7	49.7	34.6	75.7	47.4	22.1	15.6	126.9	28.8	6.8
Utah	492.1	361.1	112.0	38.1	30.4	34.2	23.3	24.9	15.7	170.6	31.3	5.6
Vermont	528.9	441.4	129.1	43.3	36.1	77.2	64.0	24.7	17.2	133.4	39.5	11.1
Virginia	508.6	398.1	125.0	45.0	35.1	79.7	53.1	21.3	14.6	143.2	33.0	8.3
Washington	534.9	438.8	132.5	44.6	35.5	70.1	56.1	25.9	17.2	144.3	38.0	9.4
West Virginia	555.1	437.2	110.5	57.5	42.5	104.7	68.8	23.2	16.8	126.3	39.1	10.8
Wisconsin	532.9	426.8	124.8	47.4	37.1	73.2	54.1	24.7	17.3	139.2	40.0	10.0
Wyoming	488.5	387.1	112.1	44.0	35.5	56.3	45.6	20.1	14.5	143.4	37.8	10.6
United States	535.8	419.1	122.8	50.0	37.8	78.6	54.6	23.2	16.1	142.1	36.7	9.1

\*Per 100,000, age adjusted to the 2000 US standard population. †This state's data are not included in US combined rates because they did not meet high-quality standards for one or more years during 2007-2011 according to the North American Association of Central Cancer Registries (NAACCR). ‡Rates are based on incidence data for 2007-2009. §This state's registry did not submit 2007-2011 cancer incidence data to NAACCR. ¶Rates are based on incidence data for 2007-2010.

**Source:** NAACCR, 2014. Data are collected by cancer registries participating in the National Cancer Institute's SEER program and the Centers for Disease Control and Prevention's National Program of Cancer Registries.

American Cancer Society, Inc., Surveillance Research, 2015

## Death Rates\* for Selected Cancers by State, US, 2007-2011

	All Sites		Breast	Colon & Rectum		Lung & Bronchus		Non-Hodgkin Lymphoma		Pancreas		Prostate
State	Male	Female	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Alabama	251.6	154.3	22.9	21.5	14.4	85.5	40.7	8.2	5.2	13.3	9.8	28.2
Alaska	215.4	155.0	22.7	19.6	13.9	62.8	45.3	8.2	4.7	13.4	9.2	22.6
Arizona	182.6	130.0	20.1	16.5	11.7	47.9	32.2	7.3	4.8	11.3	8.6	20.1
Arkansas	248.7	159.8	22.8	22.9	15.6	88.1	45.3	8.3	5.6	13.3	9.5	24.3
California	186.8	137.3	21.5	17.2	12.4	45.5	31.5	7.7	4.7	11.7	9.4	21.9
Colorado	177.7	130.5	19.3	15.8	12.0	42.8	30.3	7.4	4.3	10.8	9.1	22.8
Connecticut	195.7	141.3	20.8	15.3	11.4	51.3	37.2	7.3	4.8	13.8	9.9	21.5
Delaware	222.8	158.9	22.9	19.0	13.5	67.3	45.9	7.4	4.8	12.9	10.1	23.6
Dist. of Columbia	234.8	166.8	29.4	20.6	18.8	57.1	35.4	6.5	3.9	16.4	12.4	37.6
Florida	200.3	138.8	21.0	17.6	12.4	59.2	38.1	7.6	4.6	12.0	8.9	19.5
Georgia	222.9	146.3	23.1	19.8	13.5	70.1	38.1	7.5	4.3	12.3	9.1	26.0
Hawaii	175.8	115.6	15.2	17.6	10.7	46.7	25.5	7.4	4.3	12.8	9.7	15.6
Idaho	192.2	138.6	21.9	16.0	12.3	48.0	33.9	7.8	5.4	12.1	8.8	25.8
Illinois	218.9	156.4	23.4	20.7	14.8	64.2	41.6	8.3	5.1	13.0	10.0	23.3
Indiana	235.8	159.0	23.2	20.8	14.2	77.3	45.5	9.1	5.4	12.8	9.5	22.7
Iowa	211.1	147.1	20.7	20.0	14.8	63.2	38.1	8.8	5.3	12.3	8.9	21.7
Kansas	211.3	145.0	21.4	19.8	13.1	64.3	38.8	9.2	5.2	12.5	9.3	20.4
Kentucky	257.5	172.2	22.8	22.6	16.1	94.5	55.5	8.6	5.8	12.9	9.5	22.3
Louisiana	250.7	162.2	25.0	23.3	15.4	79.1	43.1	8.6	5.0	14.3	11.4	25.1
Maine	227.7	156.5	20.0	19.4	13.7	67.6	44.5	9.1	5.3	12.1	9.9	22.1
Maryland	211.8	150.2	23.9	19.6	13.2	58.9	39.7	7.5	4.5	13.2	10.1	23.7
Massachusetts	210.8	149.2	20.4	17.7	12.7	58.0	41.2	7.7	4.6	12.7	10.4	21.4
Michigan	219.4	157.1	23.5	19.1	13.7	66.5	43.5	8.9	5.6	13.8	10.0	21.1
Minnesota	201.1	143.0	20.7	17.2	12.1	51.9	36.1	9.4	5.2	12.0	9.2	23.4
Mississippi	264.7	157.0	24.2	24.6	16.5	92.0	41.3	8.0	4.6	13.8	10.0	29.6
Missouri	225.9	157.8	23.8	20.9	14.1	74.2	45.5	8.3	5.3	12.9	9.8	20.7
Montana	192.5	142.2	20.1	15.8	12.7	52.3	39.4	7.8	4.5	11.9	8.0	24.8
Nebraska	204.2	142.5	19.8	20.4	15.0	57.9	35.5	8.3	5.5	11.3	9.6	22.6
Nevada	206.9	151.7	23.5	21.0	14.3	58.0	45.2	6.9	4.4	12.8	9.6	22.8
New Hampshire	211.1	152.1	21.2	16.6	13.3	59.2	43.1	7.4	4.6	13.5	9.9	21.4
New Jersey	203.7	151.0	24.6	20.2	14.3	53.9	36.5	7.5	5.0	13.6	10.1	21.2
New Mexico	183.8	129.8	20.8	18.7	12.5	42.2	27.9	6.2	4.3	11.0	8.3	23.0
New York	196.6	143.4	22.0	18.5	13.3	52.9	35.8	7.7	4.8	12.9	9.9	21.4
North Carolina	227.7	147.2	22.7	18.8	12.7	74.4	39.9	7.5	4.8	11.8	9.4	24.6
North Dakota	200.0	133.1	21.1	20.8	13.1	52.7	31.4	6.7	4.6	12.8	8.1	22.6
Ohio	232.8	160.4	24.2	21.4	14.6	72.8	43.9	9.2	5.5	13.3	10.1	23.2
Oklahoma	238.2	159.7	23.5	22.1	14.3	78.4	46.2	8.8	5.6	12.3	9.2	23.1
Oregon	206.6	151.4	21.1	18.2	13.3	56.4	41.8	8.4	5.0	12.3	9.8	23.9
Pennsylvania	222.2	154.9	23.5	20.7	14.6	63.9	39.3	8.9	5.4	13.3	10.1	22.0
Rhode Island	217.5	147.5	20.6	18.1	13.4	63.9	42.6	7.7	4.2	12.3	8.7	21.3
South Carolina	236.1	150.0	23.5	19.9	13.7	74.9	39.0	7.7	4.6	13.1	10.0	26.3
South Dakota	201.4	143.9	21.1	18.9	13.6	60.0	35.0	7.6	5.1	10.4	9.7	22.1
Tennessee	251.1	158.1	22.7	21.7	15.3	86.5	45.7	8.9	5.1	13.1	9.6	24.0
Texas	205.2	139.7	21.3	19.4	12.8	58.6	34.5	7.8	4.7	11.8	8.9	20.4
Utah	154.6	109.1	20.8	14.0	10.3	26.5	16.2	7.3	4.6	10.3	8.0	24.6
Vermont	213.6	153.2	19.7	16.8	14.5	61.3	45.4	8.3	4.7	12.9	9.7	22.4
Virginia	216.7	149.1	23.5	18.3	13.5	64.7	39.1	8.2	4.7	12.7	9.6	23.9
Washington	205.7	149.7	21.1	16.7	12.6	55.6	41.0	8.6	5.1	12.8	10.1	23.4
West Virginia	246.1	167.8	22.5	23.7	15.6	82.3	49.8	8.4	6.2	11.9	7.8	20.7
Wisconsin	212.6	148.4	21.0	17.9	12.4	57.8	38.6	8.7	5.4	13.0	9.8	24.3
Wyoming	192.3	143.4	21.1	19.1	12.8	48.9	34.6	7.3	5.3	11.9	8.5	21.3
United States	211.6	147.4	22.2	19.1	13.5	61.6	38.5	8.1	5.0	12.5	9.6	22.3

\*Per 100,000, age adjusted to the 2000 US standard population.

Source: US Mortality Data, National Center for Health Statistics, Centers for Disease Control and Prevention.

American Cancer Society, Inc., Surveillance Research, 2015

all of these individuals were previously uninsured, and newly enrolled individuals must pay premiums to be insured. Many more people are expected to gain coverage during the second open enrollment November 2014 through February 2015. See *Cancer Facts & Figures 2008*, Special Section, available online at

[cancer.org/statistics](http://cancer.org/statistics), for more information on the relationship between health insurance and cancer. To learn more about how the Affordable Care Act supports the fight against cancer, see “Fighting Back” on page 48.

## Selected Cancers

This section provides basic information on risk factors, symptoms, early detection, and treatment, as well as statistics on incidence, mortality, and survival, for the most commonly diagnosed cancers. The information presented primarily applies to the more common subtypes within each site-specific category and may have limited relevance to rare subtypes.

### Invasive Breast

(For information about breast carcinoma in situ, see the special section on page 26.)

**New cases:** An estimated 231,840 new cases of invasive breast cancer are expected to be diagnosed among women in the US during 2015; about 2,350 new cases are expected in men. Excluding cancers of the skin, breast cancer is the most frequently diagnosed cancer in women. The breast cancer incidence rate decreased almost 7% among white women from 2002 to 2003. This dramatic decrease has been attributed to reductions in the use of menopausal hormone therapy (MHT), previously known as hormone replacement therapy, after it was reported in 2002 that the use of combined estrogen plus progestin MHT was associated with an increased risk of breast cancer and coronary heart disease. From 2007 to 2011, the most recent 5 years for which data are available, breast cancer incidence rates were stable in white women and increased slightly (by 0.3% per year) in black women.

**Deaths:** An estimated 40,730 breast cancer deaths (40,290 women, 440 men) are expected in 2015. Breast cancer ranks second as a cause of cancer death in women (after lung cancer). Death rates for breast cancer have steadily decreased in women since 1989, with larger decreases in younger than in older women and in white than in black women. From 2007 to 2011, rates among women younger than 50 decreased by 3.2% per year in whites and by 2.4% per year in blacks, while among women 50 and older, rates decreased by 1.8% per year in whites and by 1.1% per year in blacks. The decrease in breast cancer death rates represents improvements in both early detection and treatment.

**Signs and symptoms:** The most common symptom of breast cancer is a lump or mass in the breast, which is often painless. Less common symptoms include persistent changes to the breast, such as thickening, swelling, distortion, tenderness, skin irritation, redness, scaliness, or nipple abnormalities, such as

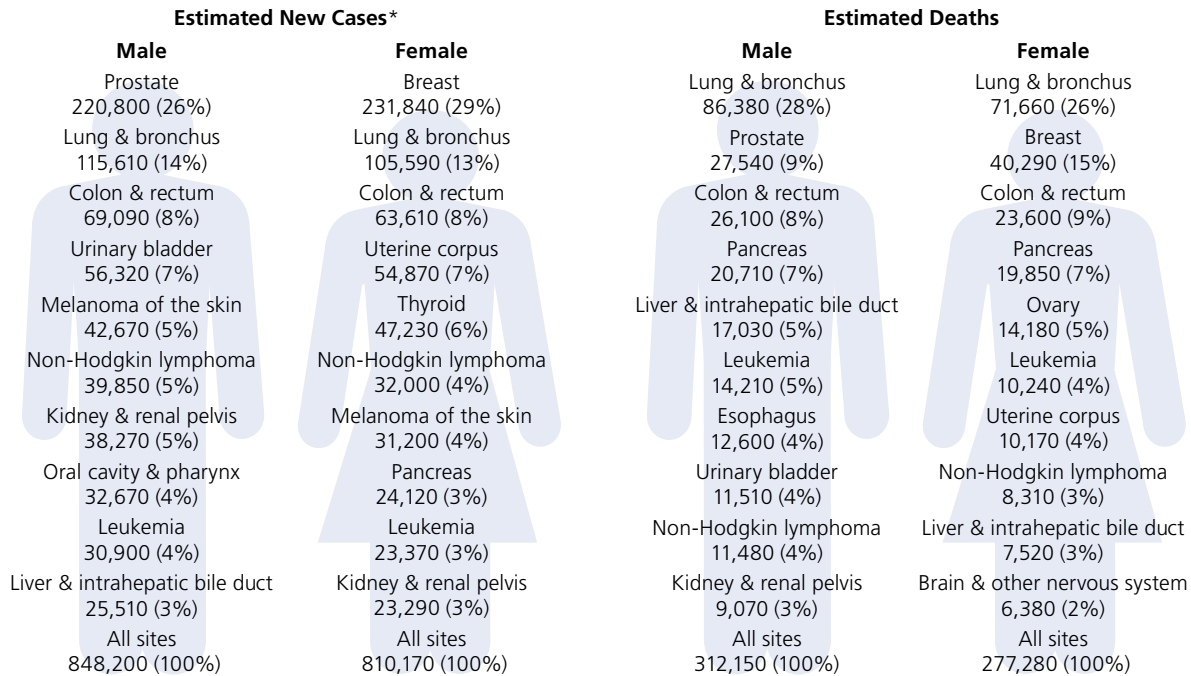
ulceration, retraction, or spontaneous discharge. Breast pain is more likely to be caused by benign conditions and is not a common symptom of breast cancer.

**Risk factors:** Potentially modifiable factors associated with increased breast cancer risk include weight gain after the age of 18 and/or being overweight or obese (for postmenopausal breast cancer), use of MHT (combined estrogen and progestin), physical inactivity, and alcohol consumption. In addition, recent research indicates that long-term, heavy smoking may also increase breast cancer risk, particularly among women who start smoking before their first pregnancy. The International Agency for Research on Cancer has concluded that shift work, particularly at night (i.e., that disrupts sleep patterns), may be associated with an increased risk of breast cancer.

Non-modifiable factors associated with increased breast cancer risk include high breast tissue density (the amount of glandular tissue relative to fatty tissue measured on a mammogram), high bone mineral density (evaluated during screening for osteoporosis), type 2 diabetes, certain benign breast conditions (such as atypical hyperplasia), ductal carcinoma in situ, and lobular carcinoma in situ. High-dose radiation to the chest for cancer treatment (e.g., for Hodgkin lymphoma) at a young age also increases risk. Reproductive factors that increase risk include a long menstrual history (menstrual periods that start early and/or end later in life), recent use of oral contraceptives or Depo-Provera®, never having children, and having one's first child after age 30.

Risk is also increased by a family history of breast cancer, particularly having one or more affected first-degree relatives. 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 cancers, and 15%-20% of familial breast cancers. However, these mutations are very rare in the general population (much less than 1%). Scientists now believe that most familial breast cancer is due to the interaction between lifestyle factors and more common variations in the genetic code that confer a small increase in breast cancer risk, although the usefulness of this information to distinguish high-risk women is still under investigation. Individuals with a strong family history of breast and/or certain other cancers, such as ovarian

## Leading Sites of New Cancer Cases and Deaths – 2015 Estimates



\*Excludes basal cell and squamous cell skin cancers and in situ carcinoma except urinary bladder.

©2015, American Cancer Society, Inc., Surveillance Research

cancer, should consider counseling to determine if genetic testing is appropriate. Prevention measures, such as surgery or chemoprevention drugs, may be possible for individuals with breast cancer susceptibility gene mutations, although not all women who have these mutations will develop breast cancer. Compared to women in the general population, who have a 7% risk of developing breast cancer by age 70, the average risk for *BRCA1* and *BRCA2* mutation carriers is estimated at 55%-65% and 45%-47%, respectively. Mutations in the *PALB2* gene appear to confer risk similar to *BRCA2* mutations.

Factors associated with a decreased risk of breast cancer include breastfeeding for at least one year, regular moderate or vigorous physical activity, and maintaining a healthy body weight. Two medications – tamoxifen and raloxifene – have been approved to reduce breast cancer risk in women at high risk. Raloxifene appears to have a lower risk of certain side effects, such as uterine cancer and blood clots; however, it is only approved for use in postmenopausal women.

**Early detection:** Breast cancer screening for women at average risk includes clinical breast exam and mammography. Mammography can often detect breast cancer at an early stage, when treatment is more effective. Numerous studies have shown that early detection with mammography saves lives and increases treatment options. Mammography will detect most breast can-

cers in women without symptoms, though the sensitivity is lower for younger women and women with dense breasts. Mammography also results in some overdiagnoses, which is the detection of cancer that would neither have caused harm nor been diagnosed in the absence of screening. Most (95%) of the 10% of women who have an abnormal mammogram do not have cancer. Lesions that remain suspicious after additional imaging are usually biopsied for a definitive diagnosis. For some women at high risk of breast cancer, annual screening using magnetic resonance imaging (MRI) in addition to mammography is recommended, typically starting at the age of 30. (See *Breast Cancer Facts & Figures* at [cancer.org/statistics](http://cancer.org/statistics) for more information.) Concerted efforts should be made to improve access to health care and encourage all women 40 and older to receive regular mammograms. For more information on the Society's recommendations for breast cancer screening, see page 52.

**Treatment:** Taking into account tumor characteristics, including size and extent of spread, as well as patient preference, treatment usually involves either breast-conserving surgery (surgical removal of the tumor and surrounding tissue) or mastectomy (surgical removal of the breast). Numerous studies have shown that for early breast cancer (without spread to the skin, chest wall, or distant organs), long-term survival is similar for women treated with breast-conserving surgery plus radiation therapy and those treated with mastectomy. Women undergo-

ing mastectomy who elect breast reconstruction have several options, including the tissue or materials used to restore the breast shape and the timing of the procedure.

Underarm lymph nodes are usually removed and evaluated during surgery to determine whether the tumor has spread beyond the breast. For early stage disease, sentinel lymph node biopsy, a procedure in which only the first lymph nodes to which cancer is likely to spread are removed, has a lower risk of long-term side effects (e.g., lymphedema, or arm swelling caused by the accumulation of lymph fluid) and is as effective as a full axillary node dissection, in which many nodes are removed.

Treatment may also involve radiation therapy, chemotherapy (before or after surgery), hormone therapy (e.g., selective estrogen receptor modifiers, aromatase inhibitors, ovarian ablation), and/or targeted therapy. Women with early stage breast cancer that tests positive for hormone receptors benefit from treatment with hormonal therapy for at least 5 years. For postmenopausal women, treatment with an aromatase inhibitor (e.g., letrozole, anastrozole, or exemestane) is preferred in addition to, or instead of, tamoxifen. For women whose cancer overexpresses the growth-promoting protein HER2, several targeted therapies are available.

**Survival:** Sixty-one percent of breast cancer cases are diagnosed at a localized stage (no spread to lymph nodes, nearby structures, or other locations outside the breast), for which the 5-year relative survival rate is 99%. If the cancer has spread to tissues or lymph nodes under the arm (regional stage), the survival rate is 85%. If the spread is to lymph nodes around the collarbone or to distant lymph nodes or organs (distant stage), the survival rate falls to 25%.

For all stages combined, the 5-, 10-, and 15-year relative survival rates for breast cancer are 89%, 83%, and 78%, respectively. Caution should be used when interpreting long-term survival rates because they represent patients who were diagnosed many years ago and do not reflect recent advances in detection and treatment. For example, 15-year relative survival is based on patients diagnosed as long ago as 1993.

Survival is lower for black than for white women at every stage of diagnosis. For all stages combined, the 5-year relative survival rate is 90% for white women and 79% for black women.

Many studies have shown that being overweight adversely affects survival for postmenopausal women with breast cancer. In addition, breast cancer survivors who are more physically active, particularly after diagnosis, are less likely to die from breast cancer, or other causes, than those who are inactive.

See the American Cancer Society's *Breast Cancer Facts & Figures*, available online at [cancer.org/statistics](http://cancer.org/statistics) for more information about breast cancer.

## Childhood Cancer (Ages 0-14 years)

**New cases:** An estimated 10,380 new cases are expected to occur among children 0 to 14 years of age in 2015, representing less than 1% of all new cancer diagnoses. Overall, childhood cancer incidence rates increased slightly by 0.6% per year from 2007 to 2011.

**Deaths:** An estimated 1,250 cancer deaths are expected to occur among children 0 to 14 years of age in 2015. Although uncommon, cancer is the second leading cause of death in children ages 1-14, exceeded only by accidents. Mortality rates for childhood cancer have declined by 67% over the past four decades, from 6.3 (per 100,000) in 1970 to 2.1 in 2011. The substantial progress in reducing childhood cancer mortality is largely attributable to improvements in treatment and high rates of participation in clinical trials.

**Signs and symptoms:** The early diagnosis of childhood cancer is often hampered by nonspecific symptoms that are similar to those of more common childhood diseases. Parents should ensure that children have regular medical checkups and be alert to any unusual, persistent symptoms. Signs and symptoms of childhood cancer include an unusual mass or swelling; unexplained paleness or loss of energy; a sudden increase in the tendency to bruise or bleed; a persistent, localized pain or limping; a prolonged, unexplained fever or illness; frequent headaches, often with vomiting; sudden eye or vision changes; and excessive, rapid weight loss. Major categories of pediatric cancer (including benign brain tumors) and more specific symptoms include:

- Leukemia (30% of all childhood cancers), which may be recognized by bone and joint pain, weakness, pale skin, bleeding or bruising easily, and fever or infection
- Brain and other central nervous system tumors (26%), which may cause headaches, nausea, vomiting, blurred or double vision, seizures, dizziness, and difficulty walking or handling objects
- Neuroblastoma (6%), a cancer of the nervous system that is most common in children younger than 5 years of age and usually appears as a swelling in the abdomen
- Wilms tumor (5%), a kidney cancer (also called nephroblastoma) that may be recognized by a swelling or lump in the abdomen
- Non-Hodgkin lymphoma (including Burkitt lymphoma) (5%) and Hodgkin lymphoma (3%), which are most common during adolescence, affect lymph nodes, but may also involve the bone marrow and other organs; may cause swelling of lymph nodes in the neck, armpit, or groin, as well as general weakness and fever
- Rhabdomyosarcoma (3%), a soft tissue sarcoma that can occur in the head and neck, genitourinary area, trunk, and extremities, and may cause pain and/or a mass or swelling



- Osteosarcoma (2%), a bone cancer that most often occurs in adolescents and commonly appears as sporadic pain in the affected bone that may worsen at night or with activity, with eventual progression to local swelling
- Retinoblastoma (2%), an eye cancer that usually occurs in children younger than 5 years of age and is typically recognized because the pupil appears white or pink instead of the normal red color in flash photographs or during examination with an ophthalmoscope
- Ewing sarcoma (1%), another type of cancer that usually arises in bone, is most common in adolescents, and typically appears as pain at the tumor site.

(Proportions are based on International Classification of Childhood Cancer groupings, including benign brain/central nervous system tumors; distribution may vary by race/ethnicity.)

**Treatment:** Childhood cancers can be treated by one or more therapies (surgery, radiation, and chemotherapy/targeted therapy), chosen based on the type and stage of cancer. Treatment is coordinated by a team of experts, including pediatric oncologists and nurses, social workers, psychologists, and others trained to assist children and their families. Outcomes are most successful when treatment is managed by specialists at a children's cancer center. If the child is eligible, placement in a clinical trial, which compares a new treatment to the best current treatment, should be considered.

**Survival:** Survival for all invasive childhood cancers combined has improved markedly over the past 30 years due to new and improved treatments. The 5-year relative survival rate increased from 58% in the mid-1970s to 83% in the most recent time period (2004-2010). However, rates vary considerably depending on cancer type, patient age, and other characteristics. The 5-year survival among children 0-14 years of age with retinoblastoma is 97%; Hodgkin lymphoma, 97%; Wilms tumor, 90%; non-Hodgkin lymphoma, 88%; leukemia, 85% (89% for lymphoid leukemia and 64% for acute myeloid leukemia); neuroblastoma, 79%; Ewing sarcoma, 75%; brain and other central nervous system tumors, 72%; osteosarcoma, 71%; and rhabdomyosarcoma, 68%. Pediatric cancer patients may experience treatment-related side effects long after active treatment. Late treatment effects can include impairment in the function of specific organs (e.g., cognitive defects) and secondary cancers. The Children's Oncology Group (COG) has developed long-term follow-up guidelines for screening and management of late effects in survivors of childhood cancer. See the COG website at [survivorshipguidelines.org](http://survivorshipguidelines.org) for more information. The Childhood Cancer Survivor Study, which has followed more than 14,000 long-term childhood cancer survivors, has also provided valuable information about the late effects of cancer treatment; visit [ccss.stjude.org](http://ccss.stjude.org) for more information.

## Colon and Rectum

**New cases:** An estimated 93,090 cases of colon cancer and 39,610 cases of rectal cancer are expected to be diagnosed in 2015. Colorectal cancer is the third most common cancer in both men and women. Incidence rates have been decreasing for most of the past two decades, which has been attributed to both changes in risk factors and the uptake of colorectal cancer screening among adults 50 years and older. Colorectal cancer screening tests allow for the detection and removal of colorectal polyps before they progress to cancer. From 2007 to 2011, incidence rates declined by 4.3% per year among adults 50 years of age and older, but increased by 1.8% per year among adults younger than age 50.

**Deaths:** An estimated 49,700 deaths from colorectal cancer are expected to occur in 2015. Colorectal cancer is the third leading cause of cancer death in both men and women and the second leading cause of cancer death when men and women are combined. Mortality rates for colorectal cancer have been declining since 1980 in men and since 1947 in women, with the decline accelerating in both sexes in the most recent time period. From 2007 to 2011, the overall death rate declined by 2.5% per year. This trend reflects declining incidence rates and improvements in early detection and treatment.

**Signs and symptoms:** Early stage colorectal cancer typically does not have symptoms, which is why screening is usually necessary to detect this cancer early. Symptoms may include rectal bleeding, blood in the stool, a change in bowel habits or stool shape (e.g., narrower than usual), the feeling that the bowel is not completely empty, cramping pain in the lower abdomen, decreased appetite, or weight loss. In some cases, blood loss from the cancer leads to anemia (low red blood cells), causing symptoms such as weakness and excessive fatigue. Timely evaluation of symptoms consistent with colorectal cancer is essential, even for adults younger than age 50, among whom colorectal cancer is rare, but increasing.

**Risk factors:** The risk of colorectal cancer increases with age; in 2011, 90% of cases were diagnosed in individuals 50 years of age and older. Modifiable factors associated with increased risk include obesity; physical inactivity; moderate to heavy alcohol consumption; long-term smoking; high consumption of red or processed meat; low calcium intake; and very low intake of whole-grain fiber, fruit, and vegetables. Hereditary and medical factors that increase risk include a personal or family history of colorectal cancer and/or polyps, a personal history of chronic inflammatory bowel disease (e.g., ulcerative colitis or Crohn disease), certain inherited genetic conditions (e.g., Lynch syndrome, also known as hereditary nonpolyposis colorectal cancer [HNPCC], and familial adenomatous polyposis [FAP]), and type 2 diabetes.



Regular use of nonsteroidal anti-inflammatory drugs, such as aspirin, also reduces risk. However, these drugs are not recommended for the prevention of colorectal cancer among individuals at average risk because they can have serious adverse health effects, such as stomach bleeding. Accumulating evidence suggests that use of menopausal hormone therapy (particularly combined estrogen and progesterone) also lowers risk. However, hormone therapy is not recommended for the prevention of colorectal cancer because it increases risk of breast cancer, stroke, heart attack, and blood clots.

**Early detection:** Beginning at the age of 50, men and women who are at average risk for developing colorectal cancer should begin screening. Screening can detect colorectal polyps, which can be removed before becoming cancerous, as well as cancer at an early stage, when treatment is usually less extensive and more successful. There are a number of recommended screening options, which differ with respect to the need for bowel preparation, test performance and limitations, how often they should be performed, and cost. For the Society's recommendations for colorectal cancer screening, see page 52.

**Treatment:** Surgery is the most common treatment for colorectal cancer. For cancers that have not spread, surgical removal of the tumor may be curative. A permanent colostomy (creation of an abdominal opening for elimination of body waste) is rarely needed for colon cancer and is infrequently required for rectal cancer. Chemotherapy alone, or in combination with radiation, is given before (neoadjuvant) or after (adjuvant) surgery to most patients whose cancer has penetrated the bowel wall deeply or spread to lymph nodes. For colon cancer in otherwise healthy patients age 70 or older, adjuvant chemotherapy is equally effective as in younger patients; toxicity in older patients can be limited by avoiding certain drugs (e.g., oxaliplatin). Several targeted therapies have been approved by the FDA to treat colorectal cancer that has spread to other parts of the body (metastatic colorectal cancer).

**Survival:** The 5- and 10-year relative survival rates for people with colorectal cancer are 65% and 58%, respectively. When colorectal cancer is detected at a localized stage, the 5-year survival is 90%; however, only 40% of colorectal cancers are diagnosed at this early stage, in part due to the underuse of screening. If the cancer has spread regionally, to involve nearby organs or lymph nodes, by the time of diagnosis, the 5-year survival drops to 71%. If the disease has spread to distant organs, the 5-year survival is 13%.

See *Colorectal Cancer Facts & Figures* at [cancer.org/statistics](http://cancer.org/statistics) for more information about colorectal cancer.

## Kidney

**New cases:** An estimated 61,560 new cases of kidney (renal) cancer are expected to be diagnosed in 2015. This estimate largely reflects renal cell carcinomas, which occur in the body of the kidney, but also includes cancers of the renal pelvis (5%), which behave more like bladder cancer, and Wilms tumor (1%), a childhood cancer that usually develops before the age of 5 (see "Childhood Cancer (Ages 0-14 years)" on page 11). Men are twice as likely as women to be diagnosed with kidney cancer. After increasing for several decades, in part due to incidental diagnoses during abdominal imaging, kidney cancer incidence rates stabilized from 2007 to 2011 in both men and women.

**Deaths:** An estimated 14,080 deaths from kidney cancer are expected to occur in 2015. Kidney cancer death rates decreased by 0.9% per year from 2007 to 2011.

**Signs and symptoms:** Early stage kidney cancer usually has no symptoms. As the tumor progresses, symptoms may include blood in the urine, a pain or lump in the lower back or abdomen, fatigue, weight loss, fever, or swelling in the legs and ankles.

**Risk factors:** Tobacco smoking is a strong risk factor for kidney cancer. Additional risk factors include obesity, which causes an estimated 30% of cases; high blood pressure; chronic renal failure; and occupational exposure to certain chemicals, such as trichloroethylene, an industrial agent used as a metal degreaser and chemical additive. Radiation exposure (such as for cancer treatment) slightly increases risk. A small proportion of renal cell cancers are the result of rare hereditary conditions (e.g., von Hippel-Lindau disease and hereditary papillary renal cell carcinoma). Physical activity decreases the risk of kidney cancer.

**Early detection:** There are no recommended screening tests for the early detection of kidney cancer among people at average risk.

**Treatment:** Active surveillance (observation), rather than immediate treatment, may be offered to some patients with small tumors. Surgery (traditional or laparoscopic, i.e., minimally invasive, performed through very small incisions) is the primary treatment for most kidney cancers. Patients who are not surgical candidates may be offered ablation therapy, a procedure that uses heat or cold to destroy the tumor. Kidney cancer tends to be resistant to both traditional chemotherapy and radiation therapy. Improved understanding of the biology of kidney cancer has led to the development of several targeted therapies that are currently used to treat metastatic disease. These drugs are also being assessed in clinical trials as adjuvant treatment to help prevent recurrence in earlier stage disease.

**Survival:** The 5- and 10-year relative survival rates for kidney cancer are 72% and 62%, respectively. Almost two-thirds of cases (64%) are diagnosed at a local stage, for which the 5-year relative survival rate is 92%. Five-year survival is lower for renal pelvis (49%) than for renal cell carcinoma (74%).

### Probability (%) of Developing Invasive Cancer during Selected Age Intervals by Sex, US, 2009-2011\*

		Birth to 49	50 to 59	60 to 69	70 and Older	Birth to Death
All sites†	Male	3.4 (1 in 29)	6.7 (1 in 15)	15.1 (1 in 7)	36.0 (1 in 3)	43.3 (1 in 2)
	Female	5.4 (1 in 19)	6.0 (1 in 17)	10.0 (1 in 10)	26.4 (1 in 4)	37.8 (1 in 3)
Breast	Female	1.9 (1 in 53)	2.3 (1 in 44)	3.5 (1 in 29)	6.7 (1 in 15)	12.3 (1 in 8)
Colon & rectum	Male	0.3 (1 in 300)	0.7 (1 in 148)	1.3 (1 in 80)	3.9 (1 in 26)	4.8 (1 in 21)
	Female	0.3 (1 in 326)	0.5 (1 in 193)	0.9 (1 in 112)	3.5 (1 in 28)	4.5 (1 in 22)
Kidney & renal pelvis	Male	0.2 (1 in 468)	0.3 (1 in 292)	0.6 (1 in 157)	1.3 (1 in 76)	2.0 (1 in 49)
	Female	0.1 (1 in 752)	0.2 (1 in 586)	0.3 (1 in 321)	0.7 (1 in 134)	1.2 (1 in 84)
Leukemia	Male	0.2 (1 in 419)	0.2 (1 in 598)	0.4 (1 in 271)	1.3 (1 in 75)	1.7 (1 in 59)
	Female	0.2 (1 in 516)	0.1 (1 in 968)	0.2 (1 in 464)	0.9 (1 in 117)	1.2 (1 in 84)
Lung & bronchus	Male	0.2 (1 in 578)	0.7 (1 in 140)	2.0 (1 in 49)	6.6 (1 in 15)	7.4 (1 in 13)
	Female	0.2 (1 in 541)	0.6 (1 in 173)	1.6 (1 in 64)	4.9 (1 in 20)	6.2 (1 in 16)
Melanoma of the skin‡	Male	0.3 (1 in 294)	0.4 (1 in 240)	0.8 (1 in 129)	2.1 (1 in 47)	3.0 (1 in 34)
	Female	0.5 (1 in 207)	0.3 (1 in 323)	0.4 (1 in 246)	0.9 (1 in 112)	1.9 (1 in 53)
Non-Hodgkin lymphoma	Male	0.3 (1 in 366)	0.3 (1 in 347)	0.6 (1 in 173)	1.8 (1 in 55)	2.4 (1 in 42)
	Female	0.2 (1 in 543)	0.2 (1 in 483)	0.4 (1 in 233)	1.4 (1 in 72)	1.9 (1 in 52)
Prostate	Male	0.3 (1 in 304)	2.3 (1 in 44)	6.3 (1 in 16)	10.9 (1 in 9)	15.0 (1 in 7)
Uterine cervix	Female	0.3 (1 in 358)	0.1 (1 in 840)	0.1 (1 in 842)	0.2 (1 in 565)	0.6 (1 in 154)
Uterine corpus	Female	0.3 (1 in 367)	0.6 (1 in 170)	0.9 (1 in 109)	1.3 (1 in 76)	2.7 (1 in 37)

\*For those who are free of cancer at the beginning of each age interval. †All sites excludes basal cell and squamous cell skin cancers and in situ cancers except urinary bladder. ‡Statistic is for whites.

**Source:** DevCan: Probability of Developing or Dying of Cancer Software, Version 6.7.1. Statistical Research and Applications Branch, National Cancer Institute, 2014. [srab.cancer.gov/devcan](http://srab.cancer.gov/devcan).

**Please note:** The probability of developing cancer for additional sites, as well as the probability of cancer death, can be found in Supplemental Data at [cancer.org/research/cancerfactsstatistics/index](http://cancer.org/research/cancerfactsstatistics/index).

American Cancer Society, Inc., Surveillance Research, 2015

## Leukemia

**New cases:** An estimated 54,270 new cases of leukemia are expected in 2015. Leukemia is a cancer of the bone marrow and blood and is classified into four main groups according to cell type and rate of growth: acute lymphocytic (ALL), chronic lymphocytic (CLL), acute myeloid (AML), and chronic myeloid (CML). The majority (91%) of leukemia cases are diagnosed in adults 20 years of age and older. Among adults, the most common types are CLL (36%) and AML (32%). In contrast, ALL is most common before age 20, accounting for 76% of cases. Overall leukemia incidence rates have been slowly increasing over the past few decades; from 2007 to 2011, rates increased by 1.6% per year in males and 0.6% per year in females.

**Deaths:** An estimated 24,450 deaths are expected to occur in 2015. In contrast to incidence, death rates for leukemia have been declining for the past several decades; from 2007 to 2011, rates decreased by about 1.0% per year in both sexes.

**Signs and symptoms:** Symptoms may include fatigue, paleness, weight loss, repeated infections, fever, bruising easily, and nosebleeds or other hemorrhages. In acute leukemia, these signs can appear suddenly. Chronic leukemia typically progresses slowly with few symptoms and is often diagnosed during routine blood tests. Patients with CML or CLL may experience pain or a sense of fullness in the upper left abdomen due to an enlarged spleen, while swollen lymph nodes can be seen in patients with CLL.

**Risk factors:** Exposure to ionizing radiation increases the risk of most types of leukemia (excluding CLL). Medical radiation, such as that used in cancer treatment, is one of the most common sources of radiation exposure. Leukemia may also occur as a side effect of chemotherapy. Children with Down syndrome and certain other genetic abnormalities are at increased risk of leukemia. Workers in the rubber-manufacturing industry also have an increased risk. Studies suggest that obesity increases the risk of leukemia.

Some risk factors are most closely associated with specific types of leukemia. For example, family history is a strong risk factor for CLL. Cigarette smoking is a risk factor for AML in adults, and there is accumulating evidence that parental smoking before and after childbirth may increase the risk of childhood leukemia. There is limited evidence that maternal exposure to paint fumes also increases the risk of childhood leukemia. Exposure to certain chemicals, such as formaldehyde and benzene (a component in cigarette smoke and gasoline that has become more regulated due to its carcinogenicity), increases the risk of AML. Infection with human T-cell leukemia virus type I (HTLV-I) can cause a rare type of leukemia called adult T-cell leukemia/lymphoma. The prevalence of HTLV-I infection is geographically localized and is most common in southern Japan and the Caribbean; infected individuals in the US tend to be immigrants from endemic regions or their descendants.

**Early detection:** There are no recommended screening tests for the early detection of leukemia. However, it is sometimes diagnosed early incidentally because of abnormal results on blood tests performed for other indications.

**Treatment:** Chemotherapy is used to treat most types of leukemia. Various anticancer drugs are used, either in combination or as single agents. Several targeted drugs (e.g., imatinib [Gleevec®]) are effective for treating CML because they attack cells with the Philadelphia chromosome, the genetic abnormality that is the hallmark of CML. Some of these drugs are also FDA-approved to treat a type of ALL involving a similar genetic defect. People diagnosed with CLL that is not progressing or causing symptoms may not require treatment. For CLL that does require treatment, newer targeted drugs such as ibrutinib (Imbruvica®) and idelalisib (Zydelig™) have been found to be very effective for some patients, even when other treatments are no longer working. Under appropriate conditions, high-dose chemotherapy followed by stem cell transplantation may be used to treat certain types of leukemia.

**Survival:** Survival rates vary substantially by leukemia subtype, ranging from a current 5-year relative survival of 25% for patients diagnosed with AML to 84% for those with CLL. Advances in treatment have resulted in a dramatic improvement in survival over the past three decades for most types of leukemia. For example, from 1975-1977 to 2004-2010, the overall 5-year relative survival rate for ALL increased from 41% to 70%. In large part due to the discovery of targeted cancer drugs like imatinib, the 5-year survival rate for CML has increased rapidly, from 31% in the early 1990s to 60% for patients diagnosed from 2004 to 2010.

## Liver

**New cases:** An estimated 35,660 new cases of liver cancer (including intrahepatic bile duct cancers) are expected to occur in the US during 2015, approximately three-fourths of which will be hepatocellular carcinoma (HCC). Liver cancer incidence rates are about 3 times higher in men than in women, and have doubled in each sex over the past two decades. From 2007 to 2011, the overall rate increased by 3.4% per year.

**Deaths:** An estimated 24,550 liver cancer deaths (7,520 women, 17,030 men) are expected in 2015. From 2007 to 2011, the death rate for liver cancer increased by 2.5% per year.

**Signs and symptoms:** Common symptoms, which do not usually appear until the cancer is advanced, include abdominal pain and/or swelling, weight loss, weakness, loss of appetite, jaundice (a yellowish discoloration of the skin and eyes), and fever. Enlargement of the liver is the most common physical sign.

**Risk factors:** The most important risk factors for liver cancer are obesity, diabetes, alcoholic liver disease, chronic infection with hepatitis B virus (HBV) and/or hepatitis C virus (HCV), and tobacco smoking. More than one-third of liver cancer cases in the US in recent decades are attributed to diabetes and/or obesity and about one-quarter of cases in men are due to alcohol-related disorders. Certain rare genetic disorders, such as hemochromatosis, also increase risk.

HCV and HBV infection are associated with less than one-third of liver cancer cases in the US, although they are the major risk factors for the disease worldwide. A vaccine that protects against HBV has been available since 1982, and is recommended for all infants at birth; for all children under 18 years of age who were not vaccinated at birth; and for adults in high-risk groups (e.g., health care workers, injection drug users, and those younger than 60 years of age who have been diagnosed with diabetes). There is no vaccine available to prevent HCV infection, although new antiviral therapies may prevent chronic infection among those with acute (new) infection. The Centers for Disease Control and Prevention (CDC) recommends one-time HCV testing for everyone born from 1945 to 1965 because people in this birth cohort account for about three-fourths of HCV-infected individuals and HCV-related deaths in the US. Preventive measures for HCV infection include screening of donated blood, organs, and tissues; adherence to infection control practices during medical and dental procedures; and needle-exchange programs for injection drug users. Visit the CDC website at [cdc.gov/hepatitis/](http://cdc.gov/hepatitis/) for more information on viral hepatitis, including who is at risk.

**Early detection:** Screening for liver cancer has not been shown to reduce mortality. Nonetheless, many doctors in the US screen individuals at high risk for the disease (e.g., those with cirrhosis) with ultrasound or blood tests.

**Treatment:** Early stage liver cancer can sometimes be treated successfully with surgery to remove part of the liver (partial hepatectomy); however, only a limited number of patients have sufficient healthy liver tissue for this to be an option. Liver transplantation may be an option for individuals with small tumors who are not candidates for partial hepatectomy. Other treatment options include ablation (tumor destruction) or embolization (blocking blood flow to the tumor).

Fewer treatment options exist for patients diagnosed at an advanced stage. Sorafenib (Nexavar®) is a targeted drug approved for the treatment of HCC in patients who are not candidates for surgery and do not have severe cirrhosis.

**Survival:** The 1- and 5-year relative survival rates for patients with liver cancer are 43% and 17%, respectively. Forty-two percent of patients are diagnosed at an early stage, for which 5-year survival is 30%. Survival decreases to 11% and 3% for patients who are diagnosed at regional and distant stages of disease, respectively.

## Lung and Bronchus

**New cases:** An estimated 221,200 new cases of lung cancer are expected in 2015, accounting for about 13% of all cancer diagnoses. The incidence rate has been declining since the mid-1980s in men, but only since the mid-2000s in women. From 2007 to 2011, lung cancer incidence rates decreased by 3.0% per year in men and by 2.2% per year in women.

**Deaths:** Lung cancer accounts for more deaths than any other cancer in both men and women. An estimated 158,040 deaths are expected to occur in 2015, accounting for about 27% of all cancer deaths. Death rates began declining in 1991 in men and in 2003 in women. From 2007 to 2011, rates decreased by 2.9% per year in men and by 1.9% per year in women. Gender differences in lung cancer mortality reflect historical differences in patterns of smoking uptake and cessation over the past several decades.

**Signs and symptoms:** Symptoms do not usually occur until the cancer is advanced, and may include persistent cough, sputum streaked with blood, chest pain, voice change, worsening shortness of breath, and recurrent pneumonia or bronchitis.

**Risk factors:** Cigarette smoking is by far the most important risk factor for lung cancer; risk increases with both quantity and duration of smoking. Cigar and pipe smoking also increase risk. Exposure to radon gas released from soil and building materials is estimated to be the second-leading cause of lung cancer in the US. Other risk factors include occupational or environmental exposure to secondhand smoke, asbestos (particularly among smokers), certain metals (chromium, cadmium, arsenic), some organic chemicals, radiation, air pollution, and diesel exhaust. Additional occupational exposures that increase risk include rubber manufacturing, paving, roofing, painting, and chimney sweeping. Risk is also probably increased among people with a medical history of tuberculosis. Genetic susceptibility plays a contributing role in the development of lung cancer, especially in those who develop the disease at a young age.

**Early detection:** Screening with spiral CT has been shown to reduce lung cancer deaths by 16% to 20% compared to standard chest x-ray among adults with a 30 pack-year smoking history who were current smokers or had quit within 15 years. In January 2013, the American Cancer Society issued guidelines for the early detection of lung cancer based on a systematic review of the evidence. These guidelines endorse a process of shared decision making between clinicians who have access to high-volume, high-quality lung cancer screening programs and current or former smokers who are 55 to 74 years of age, in good health, and with at least a 30 pack-year history of smoking. Shared decision making should include a discussion of the benefits, uncertainties, and harms associated with lung cancer screening. In December 2013, the US Preventive Services Task Force issued similar guidelines. For more information on lung cancer screening, see the American Cancer Society's screening guidelines on page 52.

**Treatment:** Lung cancer is classified as small cell (13%) or non-small cell (83%) for the purposes of treatment. Based on type and stage of cancer, as well as specific molecular characteristics of cancer cells, treatments include surgery, radiation therapy, chemotherapy, and/or targeted therapies. For early stage non-small cell lung cancers, surgery is usually the treatment of choice; chemotherapy (sometimes in combination with radiation therapy) may be given as well. Advanced-stage non-small cell lung cancer patients are usually treated with chemotherapy, targeted drugs, or some combination of the two. Chemotherapy alone or combined with radiation is the usual treatment for small cell lung cancer; on this regimen, a large percentage of patients experience remission, though the cancer often returns.

**Survival:** The 1- and 5-year relative survival rates for lung cancer are 44% and 17%, respectively. Only 15% of lung cancers are diagnosed at a localized stage, for which the 5-year survival rate is 54%. More than half (57%) are diagnosed at a distant stage, for which the 1- and 5-year survival is 26% and 4%, respectively. The 5-year survival for small cell lung cancer (6%) is lower than that for non-small cell (21%).

## Lymphoma

**New cases:** An estimated 80,900 new cases of lymphoma will be diagnosed in 2015. Lymphoma begins in certain immune system cells, and is classified as either Hodgkin (9,050 cases in 2015) or non-Hodgkin (NHL, 71,850 cases in 2015). From 2007 to 2011, incidence rates for Hodgkin lymphoma were stable in both men and women, while rates for NHL slightly increased among men (0.3% per year) and were stable among women. (Incidence patterns may vary for Hodgkin and NHL subtypes.)

**Deaths:** An estimated 20,940 deaths from lymphoma will occur in 2015, most of which will be NHL (19,790). Death rates for Hodgkin lymphoma have been decreasing for the past four decades; from 2007 to 2011, rates decreased by 2.2% per year among men and by 2.7% per year among women. Death rates for NHL began decreasing in the late 1990s; from 2007 to 2011, rates decreased by 1.8% per year among men and by 2.9% per year among women. Declines in lymphoma death rates reflect improvements in treatment.

**Signs and symptoms:** The most common symptoms of lymphoma are produced by swollen lymph nodes, which can cause lumps under the skin; chest pain and shortness of breath; and abdominal fullness and loss of appetite. Other symptoms include itching, night sweats, fatigue, unexplained weight loss, and intermittent fever.

**Risk factors:** Like most cancers, the risk of developing NHL increases with age. In contrast, the risk of Hodgkin lymphoma is highest during adolescence and early adulthood. Most of the few known risk factors for lymphoma are associated with altered immune function. Hodgkin and NHL risk is elevated in people



### Five-year Relative Survival Rates\* (%) by Stage at Diagnosis, US, 2004-2010

	All Stages	Local	Regional	Distant		All Stages	Local	Regional	Distant
Breast (female)	89	99	85	25	Ovary	45	92	72	27
Colon & rectum	65	90	71	13	Pancreas	7	26	10	2
Esophagus	18	40	21	4	Prostate	99	>99	>99	28
Kidney†	72	92	65	12	Stomach	28	64	29	4
Larynx	60	75	43	35	Testis	95	99	96	73
Liver‡	17	30	11	3	Thyroid	98	>99	98	55
Lung & bronchus	17	54	27	4	Urinary bladder§	77	69	34	6
Melanoma of the skin	91	98	63	16	Uterine cervix	68	91	57	16
Oral cavity & pharynx	63	83	61	37	Uterine corpus	82	95	68	18

\*Rates are adjusted for normal life expectancy and are based on cases diagnosed in the SEER 18 areas from 2004-2010, all followed through 2011. †Includes renal pelvis.

‡Includes intrahepatic bile duct. §Rate for in situ cases is 96%.

**Local:** an invasive malignant cancer confined entirely to the organ of origin. **Regional:** a malignant cancer that 1) has extended beyond the limits of the organ of origin directly into surrounding organs or tissues; 2) involves regional lymph nodes; or 3) has both regional extension and involvement of regional lymph nodes. **Distant:** a malignant cancer that has spread to parts of the body remote from the primary tumor either by direct extension or by discontinuous metastasis to distant organs, tissues, or via the lymphatic system to distant lymph nodes.

**Source:** Howlader N, Noone AM, Krapcho M, et al. (eds). SEER Cancer Statistics Review, 1975-2011, National Cancer Institute, Bethesda, MD, [http://seer.cancer.gov/csr/1975\\_2011/](http://seer.cancer.gov/csr/1975_2011/), based on November 2013 SEER data submission.

American Cancer Society, Inc., Surveillance Research, 2015

who receive immune suppressants to prevent organ transplant rejection and in people with severe autoimmune conditions. Epstein-Barr virus causes Burkitt lymphoma (an aggressive type of NHL that occurs most often in children and young adults), as well as a number of autoimmune-related NHLs, post-transplant lymphoproliferative disorders (PTLD, the most common cancer in children after organ transplant), and a subset of Hodgkin lymphoma. In addition, chronic infection with some other viruses (e.g., human immunodeficiency virus) and types of bacteria (e.g., *Helicobacter pylori*) that cause the immune system to be continuously active are associated with certain NHL subtypes. A family history of lymphoma confers increased risk of Hodgkin lymphoma and NHL uniformly across subtypes, and a growing number of confirmed common genetic variations are associated with modestly increased risk, including variations in the human leukocyte antigen (HLA) system. Studies indicate that excess body weight, working in the rubber manufacturing industry, and occupational and environmental exposure to certain chemicals (e.g., solvents such as dichloromethane) may also increase risk for some NHL subtypes.

**Treatment:** NHL patients are usually treated with chemotherapy; radiation, alone or in combination with chemotherapy, is used less often. Targeted drugs directed at lymphoma cells, such as rituximab (Rituxan®) and alemtuzumab (Campath®), are used for some types of NHL, as are antibodies linked to a radioactive atom, such as ibritumomab tiuxetan (Zevalin®). If NHL persists or recurs after standard treatment, stem cell transplantation (with high-dose or nonmyeloablative chemotherapy) may be an option.

Hodgkin lymphoma is usually treated with chemotherapy, radiation therapy, or a combination of the two, depending on disease stage and cell type. The monoclonal antibody rituximab may be used with chemotherapy to treat the subtype of Hodgkin lymphoma known as nodular lymphocyte predominant. Stem cell transplantation may be an option if other treatments are not effective. Patients with Hodgkin lymphoma (as well as those with a rare form of NHL) whose disease has failed to respond to treatment may be given the targeted drug brentuximab vedotin (Adcetris®) – a monoclonal antibody linked to a chemotherapy drug.

**Survival:** Survival varies widely by lymphoma subtype and stage of disease. For NHL, the overall 5- and 10-year relative survival rates are 69% and 59%, respectively. For Hodgkin lymphoma, the 5- and 10-year relative survival rates are 85% and 80%, respectively.

### Oral Cavity and Pharynx

**New cases:** An estimated 45,780 new cases of cancer of the oral cavity and pharynx (throat) are expected in 2015. Incidence rates are more than twice as high in men as in women. From 2007 to 2011, incidence rates among whites increased in men by 1.3% per year and were stable as is in women; in contrast, among blacks rates declined by 3.0% per year in men and by 1.4% per year in women. The increase among white men is driven by a subset of cancers in the oropharynx, including the base of the tongue and the tonsils, that are associated with human papillomavirus (HPV) infection.

**Deaths:** An estimated 8,650 deaths from oral cavity and pharynx cancer are expected in 2015. Death rates have been decreasing over the past three decades, partly due to the downturn in the

## Trends in 5-year Relative Survival Rates\* (%) by Race, US, 1975-2010

	All Races			White			Black		
	1975-77	1987-89	2004-10	1975-77	1987-89	2004-10	1975-77	1987-89	2004-10
All sites	49	55	68 <sup>†</sup>	50	57	69 <sup>†</sup>	39	43	62 <sup>†</sup>
Brain & other nervous system	22	29	35 <sup>†</sup>	22	28	33 <sup>†</sup>	25	32	42 <sup>†</sup>
Breast (female)	75	84	91 <sup>†</sup>	76	85	92 <sup>†</sup>	62	71	80 <sup>†</sup>
Colon	51	60	65 <sup>†</sup>	51	61	67 <sup>†</sup>	45	52	56 <sup>†</sup>
Esophagus	5	9	20 <sup>†</sup>	6	11	21 <sup>†</sup>	4	7	13 <sup>†</sup>
Hodgkin lymphoma	72	79	88 <sup>†</sup>	72	80	88 <sup>†</sup>	70	72	85 <sup>†</sup>
Kidney & renal pelvis	50	57	74 <sup>†</sup>	50	57	74 <sup>†</sup>	49	55	72 <sup>†</sup>
Larynx	66	66	63 <sup>†</sup>	67	67	64	58	56	52
Leukemia	34	43	60 <sup>†</sup>	35	44	61 <sup>†</sup>	33	35	54 <sup>†</sup>
Liver & intrahepatic bile duct	3	5	18 <sup>†</sup>	3	6	17 <sup>†</sup>	2	3	13 <sup>†</sup>
Lung & bronchus	12	13	18 <sup>†</sup>	12	13	18 <sup>†</sup>	11	11	15 <sup>†</sup>
Melanoma of the skin	82	88	93 <sup>†</sup>	82	88	93 <sup>†</sup>	57 <sup>‡</sup>	79 <sup>‡</sup>	75
Myeloma	25	27	47 <sup>†</sup>	24	27	47 <sup>†</sup>	30	30	47 <sup>†</sup>
Non-Hodgkin lymphoma	47	51	71 <sup>†</sup>	47	51	73 <sup>†</sup>	48	46	63 <sup>†</sup>
Oral cavity & pharynx	53	54	66 <sup>†</sup>	54	56	67 <sup>†</sup>	36	34	45 <sup>†</sup>
Ovary	36	38	45 <sup>†</sup>	35	38	44 <sup>†</sup>	42	34	36
Pancreas	3	4	7 <sup>†</sup>	3	3	7 <sup>†</sup>	2	6	7 <sup>†</sup>
Prostate	68	83	>99 <sup>†</sup>	69	84	>99 <sup>†</sup>	61	71	98 <sup>†</sup>
Rectum	48	58	68 <sup>†</sup>	48	59	68 <sup>†</sup>	44	52	63 <sup>†</sup>
Stomach	15	20	29 <sup>†</sup>	14	18	28 <sup>†</sup>	16	19	28 <sup>†</sup>
Testis	83	95	97 <sup>†</sup>	83	96	97 <sup>†</sup>	73 <sup>‡#</sup>	88 <sup>‡</sup>	90
Thyroid	92	94	98 <sup>†</sup>	92	94	98 <sup>†</sup>	90	92	96 <sup>†</sup>
Urinary bladder	72	79	79 <sup>†</sup>	73	80	80 <sup>†</sup>	50	63	64 <sup>†</sup>
Uterine cervix	69	70	70	70	73	71	65	57	62
Uterine corpus	87	82	83 <sup>†</sup>	88	84	85 <sup>†</sup>	60	57	65 <sup>†</sup>

\*Rates are adjusted for normal life expectancy and are based on cases diagnosed in the SEER 9 areas from 1975 to 1977, 1987 to 1989, and 2004 to 2010, all followed through 2011. †The difference in rates between 1975-1977 and 2004-2010 is statistically significant (p<0.05). ‡The standard error is between 5 and 10 percentage points. #Survival rate is for cases diagnosed from 1978 to 1980.

**Source:** Howlader N, Noone AM, Krapcho M, et al. (eds). SEER Cancer Statistics Review, 1975-2011, National Cancer Institute, Bethesda, MD, [http://seer.cancer.gov/csr/1975\\_2011/](http://seer.cancer.gov/csr/1975_2011/), based on November 2013 SEER data submission.

American Cancer Society, Inc., Surveillance Research, 2015

smoking epidemic. However, from 2007 to 2011, while rates continued to decrease in women (by 2.0% per year), they stabilized in men.

**Signs and symptoms:** Symptoms may include a lesion in the throat or mouth that bleeds easily and does not heal; a persistent red or white patch, lump, or thickening in the throat or mouth; ear pain; a neck mass; or coughing up blood. Difficulty chewing, swallowing, or moving the tongue or jaws are often late symptoms.

**Risk factors:** Known risk factors include tobacco use in any form (smoked and smokeless) and excessive alcohol consumption. Many studies have reported a synergistic relationship between smoking and alcohol that results in a 30-fold increased

risk for individuals who both smoke and drink heavily. HPV infection of the mouth and throat, believed to be transmitted through sexual contact, also increases risk.

**Early detection:** Cancer can affect any part of the oral cavity, including the lip, tongue, mouth, and throat. Visual inspection by dentists and physicians can often detect premalignant abnormalities and cancer at an early stage, when treatment may be less extensive and more successful.

**Treatment:** Radiation therapy and surgery, separately or in combination, are standard treatments; chemotherapy is added for advanced disease. Targeted therapy with cetuximab (Erbix<sup>®</sup>) may be combined with radiation in initial treatment or used to treat recurrent cancer.



**Survival:** The 5- and 10-year relative survival rates for people with cancer of the oral cavity or pharynx are 63% and 51%, respectively. Less than one-third (31%) of cases are diagnosed at a local stage, for which 5-year survival is 83%.

## Ovary

**New cases:** An estimated 21,290 new cases of ovarian cancer are expected in the US in 2015. Incidence has been slowly decreasing since the mid-1980s; from 2007 to 2011, the rate decreased by 0.9% per year.

**Deaths:** An estimated 14,180 deaths are expected in 2015. Ovarian cancer accounts for 5% of cancer deaths among women, causing more deaths than any other gynecologic cancer. From 2007 to 2011, the death rate decreased by 2.0% per year in white women and was stable in black women.

**Signs and symptoms:** Early ovarian cancer usually has no obvious symptoms. However, studies have indicated that some women experience persistent, nonspecific symptoms, such as bloating, pelvic or abdominal pain, difficulty eating or feeling full quickly, or urinary urgency or frequency. Women who experience such symptoms daily for more than a few weeks should seek prompt medical evaluation. The most common sign of ovarian cancer is swelling of the abdomen, which is caused by the accumulation of fluid. Abnormal vaginal bleeding is rarely a symptom of ovarian cancer, though it is a symptom of cervical and uterine cancers.

**Risk factors:** The most important risk factor is a strong family history of breast or ovarian cancer. Women who have had breast cancer or who have tested positive for inherited mutations in *BRCA1* or *BRCA2* genes are at increased risk. Studies indicate that preventive surgery to remove the ovaries and fallopian tubes in these women decreases the risk of ovarian cancer. Other medical conditions associated with increased risk include pelvic inflammatory disease and Lynch syndrome. The use of estrogen alone as menopausal hormone therapy has been shown to increase risk in several large studies. Tobacco smoking increases the risk of mucinous ovarian cancer. Heavier body weight may be associated with increased risk of ovarian cancer. Pregnancy, long-term use of oral contraceptives, and tubal ligation reduce risk. Hysterectomy (removal of the uterus) and salpingectomy (removal of fallopian tubes) may reduce risk.

**Early detection:** There is currently no sufficiently accurate screening test for the early detection of ovarian cancer in average-risk women. Pelvic examination only occasionally detects ovarian cancer, generally when the disease is advanced. However, for women who are at high risk, a thorough pelvic exam in combination with transvaginal ultrasound and a blood test for the tumor marker CA125 may be offered, although this strategy has not proven effective in detecting cancer early. A clinical trial in the US showed that these tests had no effect on ovarian cancer

mortality when used as a screening tool in average-risk women. Results are expected in 2015 from another large screening trial under way in the United Kingdom. A pelvic exam, sometimes in combination with a transvaginal ultrasound, may be used to evaluate women with symptoms.

**Treatment:** Treatment includes surgery and usually chemotherapy. Surgery usually involves removal of both ovaries and fallopian tubes (salpingo-oophorectomy), the uterus (hysterectomy), and the omentum (fatty tissue attached to some of the organs in the belly), along with biopsies of the peritoneum (lining of the abdominal cavity). In younger women with very early stage tumors who want to have children, only the involved ovary and fallopian tube may be removed. Among patients with early ovarian cancer, complete surgical staging has been associated with better outcomes. For women with advanced disease, surgical removal of all abdominal metastases larger than 1 centimeter (optimal debulking) enhances the effect of chemotherapy and helps improve survival. For women with stage III ovarian cancer that has been optimally debulked, studies have shown that chemotherapy administered both intravenously and directly into the abdomen (intraperitoneally) improves survival. Studies have also found that ovarian cancer patients whose surgery is performed by a gynecologic oncologist have more successful outcomes. Clinical trials are currently under way to test targeted drugs in the treatment of advanced ovarian cancer.

**Survival:** Overall, the 5- and 10-year relative survival rates for ovarian cancer patients are 45% and 35%, respectively. However, survival varies substantially by age; women younger than 65 are twice as likely to survive 5 years as women 65 and older (58% versus 27%). Overall, only 15% of cases are diagnosed at a local stage, for which 5-year survival is 92%. The majority of cases (61%) are diagnosed at a distant stage, for which the 5-year survival rate is 27%.

## Pancreas

**New cases:** An estimated 48,960 new cases of pancreatic cancer are expected to occur in the US in 2015. Most (96%) will be cancers of the exocrine pancreas, which produces enzymes to digest food. Endocrine carcinomas (4%) are more rare, have a better prognosis, and are often diagnosed at a younger age. From 2007 to 2011, overall pancreatic cancer incidence rates were stable after slowly increasing for most of the past decade.

**Deaths:** An estimated 40,560 deaths are expected to occur in 2015, about the same number in women (19,850) as in men (20,710). From 2007 to 2011, the death rate for pancreatic cancer increased slightly by 0.3% per year.

**Signs and symptoms:** Cancer of the pancreas usually develops without early symptoms. Symptoms may include weight loss, mild abdominal discomfort that may radiate to the back, and occasionally the development of diabetes. Tumors that develop

near the common bile duct may cause a blockage that leads to jaundice (yellowing of the skin and eyes), which can sometimes allow the tumor to be diagnosed at an early stage. Signs of advanced stage disease may include severe abdominal pain, nausea, and vomiting.

**Risk factors:** Approximately 20% of pancreatic cancers are attributable to cigarette smoking; incidence rates are about twice as high for smokers as for never smokers. Use of smokeless tobacco products also increases risk. Other risk factors include a family history of pancreatic cancer and a personal history of chronic pancreatitis, diabetes, obesity, and possibly high levels of alcohol consumption. Individuals with Lynch syndrome and certain other genetic syndromes, including *BRCA1* and *BRCA2* mutation carriers, are also at increased risk.

**Early detection:** There is currently no reliable method for the early detection of pancreatic cancer; however, this is an active area of research.

**Treatment:** Surgery, radiation therapy, and chemotherapy are treatment options that may extend survival and/or relieve symptoms in many patients, but seldom produce a cure. Less than 20% of patients are candidates for surgery because pancreatic cancer is usually detected after it has spread beyond the pancreas. Even among those patients who were thought to be surgical candidates, the cancer has often spread too extensively to be removed. For those who do undergo surgery, adjuvant treatment with the chemotherapy drug gemcitabine lengthens survival. For advanced disease, chemotherapy is often offered and may lengthen survival. The targeted anticancer drug erlotinib (Tarceva®) has demonstrated a slight improvement in advanced pancreatic cancer survival when used in combination with gemcitabine. Clinical trials with several new agents, combined with radiation and surgery, may offer improved survival.

**Survival:** For all stages combined, the 1- and 5-year relative survival rates are 28% and 7%, respectively. Even for the small percentage of people diagnosed with local disease (9%), the 5-year survival is only 26%. More than half (53%) of patients are diagnosed at a distant stage, for which 1- and 5-year survival is 15% and 2%, respectively.

## Prostate

**New cases:** An estimated 220,800 new cases of prostate cancer will occur in the US during 2015. Prostate cancer is the most frequently diagnosed cancer in men aside from skin cancer. For reasons that remain unclear, incidence rates are about 60% higher in blacks than non-Hispanic whites. In the late 1980s and early 1990s, incidence rates for prostate cancer spiked dramatically, in large part because of increased use of the prostate-specific antigen (PSA) blood test for screening. Rates have since been declining. From 2007 to 2011, incidence rates were stable in men younger than 65 and decreased by 2.8% per year in those 65 and older.

**Deaths:** With an estimated 27,540 deaths in 2015, prostate cancer is the second-leading cause of cancer death in men. Prostate cancer death rates have been decreasing since the early 1990s in men of all races/ethnicities, though they remain more than twice as high in blacks as in any other group (see table in the Cancer Disparities section on page 38). Overall, prostate cancer death rates decreased by 3.2% per year from 2007 to 2011.

**Signs and symptoms:** Early prostate cancer usually has no symptoms. With more advanced disease, men may experience weak or interrupted urine flow; the inability to urinate or difficulty starting or stopping the urine flow; the need to urinate frequently, especially at night; blood in the urine; or pain or burning with urination. Advanced prostate cancer commonly spreads to the bones, which can cause pain in the hips, spine, ribs, or other areas.

**Risk factors:** The only well-established risk factors for prostate cancer are increasing age, African ancestry, a family history of the disease, and certain inherited genetic conditions. About 56% of all prostate cancer cases are diagnosed in men 65 years of age and older, and 97% occur in men 50 and older. Black men and Caribbean men of African descent have the highest documented prostate cancer incidence rates in the world. Genetic studies suggest that strong familial predisposition may be responsible for 5%-10% of prostate cancers. Inherited conditions associated with increased risk include Lynch syndrome and *BRCA1* and *BRCA2* mutation phenotypes. Studies suggest that a diet high in processed meat or dairy foods may increase risk, that obesity increases the risk of aggressive prostate cancer, and that smoking is associated with prostate cancer death, but not incidence. There is some evidence that occupational exposures of firefighters (e.g., toxic combustion products) increase risk.

**Prevention:** The chemoprevention of prostate cancer is an active area of research. Two drugs of interest, finasteride and dutasteride, reduce the amount of certain male hormones in the body and are approved to treat the symptoms of benign prostate enlargement. Both drugs have been found to lower the risk of prostate cancer by 25% in large clinical trials and have similar potential side effects, including reduced libido and risk of erectile dysfunction. However, a study of long-term survival among participants in the finasteride trial reported that the drug had no effect on overall survival or survival after the diagnosis of prostate cancer. Neither finasteride nor dutasteride is approved for the prevention of prostate cancer at this time.

**Early detection:** Results from two large clinical trials designed to determine the efficacy of screening using PSA testing for the reduction of prostate cancer death were inconsistent. Given the significant potential for serious side effects associated with prostate cancer treatment, along with concerns about frequent overdiagnosis (the detection of slow-growing cancers that would never have caused harm), no organizations presently endorse routine prostate cancer screening for men at average risk. The

American Cancer Society recommends that beginning at age 50, men who are at average risk of prostate cancer and have a life expectancy of at least 10 years have a conversation with their health care provider about the benefits and limitations of PSA testing. Men should have an opportunity to make an informed decision about whether to be tested based on their personal values and preferences. Men at high risk of developing prostate cancer (black men or those with a close relative diagnosed with prostate cancer before the age of 65) should have this discussion with their health care provider beginning at 45. Men at even higher risk (because they have several close relatives diagnosed with prostate cancer at an early age) should have this discussion with their provider at age 40.

**Treatment:** Careful observation (called active surveillance) instead of immediate treatment is appropriate for many patients, particularly men with less aggressive tumors and for older men. Treatment options vary depending on age, stage, and grade of cancer, as well as other medical conditions. The grade assigned to the tumor, typically called the Gleason score, indicates the likely aggressiveness of the cancer. Although scores as low as 2 are theoretically possible, in practice most cancers are assigned scores ranging from 6 (low grade, less aggressive) to 10 (high grade, very aggressive).

Most patients are diagnosed with early stage disease, for which active surveillance can be a good option. Treatment options include surgery (open, laparoscopic, or robotic-assisted), external beam radiation, or radioactive seed implants (brachytherapy). Data show similar survival rates for patients with early stage disease treated with any of these methods, and there is no current evidence supporting a “best” treatment for prostate cancer. Hormonal therapy may be used along with surgery or radiation therapy in more advanced cases. Treatment often impacts a man’s quality of life due to side effects or complications, such as urinary and erectile difficulties, that may be short or long term. Current research is exploring new biologic markers for prostate cancer in order to improve the distinction between indolent and aggressive disease to minimize unnecessary treatment.

More advanced disease is treated with hormonal therapy, chemotherapy, radiation therapy, and/or other treatments. Hormone treatment may control advanced prostate cancer for long periods by shrinking the size or limiting the growth of the cancer, thus helping to relieve pain and other symptoms. An option for some men with advanced prostate cancer that is no longer responding to hormones is a cancer vaccine called sipuleucel-T (Provenge®). This treatment is designed to stimulate the patient’s immune system to specifically attack prostate cancer cells. Newer forms of hormone therapy, such as abiraterone (Zytiga®) and enzalutamide (Xtandi®), have been shown to be beneficial for the treatment of metastatic disease that is resistant to initial hormone therapy and/or chemotherapy. Radium-223 (Xofigo®) was recently approved to treat hormone-resistant prostate cancer that has spread to the bones.

**Survival:** The majority (93%) of prostate cancers are discovered at a local or regional stage, for which the 5-year relative survival rate approaches 100%. Over the past 25 years, the 5-year relative survival rate for all stages combined has increased from 68% to almost 100%. According to the most recent data, 10- and 15-year relative survival rates are 98% and 94%, respectively.

## Skin

**New cases:** Skin cancer is the most commonly diagnosed cancer in the United States. However, the actual number of the most common types – basal cell and squamous cell skin cancer (i.e., keratinocyte carcinoma), more commonly referred to as non-melanoma skin cancer (NMSC) – is very difficult to estimate because these cases are not required to be reported to cancer registries. The most recent study of NMSC occurrence estimated that in 2006, 3.5 million cases were diagnosed among 2.2 million people. NMSC is usually highly curable.

An estimated 73,870 new cases of melanoma will be diagnosed in 2015. Melanoma accounts for less than 2% of all skin cancer cases, but the vast majority of skin cancer deaths. It is most commonly diagnosed in non-Hispanic whites; the annual incidence rate is 1 (per 100,000) in blacks, 4 in Hispanics, and 25 in non-Hispanic whites. Incidence rates are higher in women than in men before age 50, but by age 65, they are twice as high in men as in women, and by age 80 they are triple. The differences in risk by age and sex primarily reflect differences in occupational and recreational sun exposure, which have changed over time. Overall, melanoma incidence rates rose rapidly over the past 30 years. However, trends vary by age and appear to be plateauing in younger age groups. From 2007 to 2011, incidence rates were stable in men and women younger than age 50, but increased by 2.6% per year in those 50 or older.

**Deaths:** An estimated 9,940 deaths from melanoma and 3,400 deaths from other types of skin cancer (not including NMSC) will occur in 2015. Similar to incidence, trends in melanoma death rates vary by age. From 2007 to 2011, rates decreased by 2.6% per year in individuals younger than 50, but increased by 0.6% per year among those 50 and older.

**Signs and symptoms:** Important warning signs of melanoma include changes in the size, shape, or color of a mole or other skin lesion, the appearance of a new growth on the skin, or a sore that doesn’t heal. Changes that progress over a month or more should be evaluated by a doctor. Basal cell carcinoma may appear as a growth that is flat, or as a small, raised pink or red translucent, shiny area that may bleed following minor injury. Squamous cell carcinoma may appear as a growing lump, often with a rough surface, or as a flat, reddish patch that grows slowly.

**Risk factors:** Risk factors vary for different types of skin cancer. For melanoma, major risk factors include a personal or family history of melanoma and the presence of atypical, large, or numerous (more than 50) moles. Risk factors for all types of skin



cancer include sun sensitivity (e.g., sunburning easily, difficulty tanning, or natural blond or red hair color); a history of excessive sun exposure, including sunburns; use of tanning beds; diseases or treatments that suppress the immune system; and a past history of skin cancer.

**Prevention:** Skin should be protected from intense sun exposure by wearing tightly woven clothing and a wide-brimmed hat, applying sunscreen that has a sun protection factor (SPF) of 30 or higher to unprotected skin, seeking shade (especially at midday, when the sun's rays are strongest), and avoiding sunbathing and indoor tanning. Sunglasses should be worn to protect the skin around the eyes. Children should be especially protected from the sun because severe sunburns in childhood may greatly increase the risk of melanoma. Tanning beds and sun lamps, which provide an additional source of UV radiation, can cause skin cancer and should be avoided. The International Agency for Research on Cancer has classified indoor tanning devices as "carcinogenic to humans" based on an extensive review of scientific evidence. In July 2014, the US Surgeon General released a Call to Action to Prevent Skin Cancer, citing the elevated and growing burden of this disease. The purpose of this initiative is to increase awareness and encourage all Americans to engage in behaviors that reduce the risk of skin cancer.

**Early detection:** The best way to detect skin cancer early is to recognize new or changing skin growths, particularly those that look different from other moles. All major areas of the skin should be examined regularly, and any new or unusual lesions, or a progressive change in a lesion's appearance (size, shape, or color, etc.), should be evaluated promptly by a physician. Melanomas often start as a small, mole-like growth that increases in size and may change color. A simple ABCD rule outlines warning signs of the most common type of melanoma: A is for asymmetry (one half of the mole does not match the other half); B is for border irregularity (the edges are ragged, notched, or blurred); C is for color (the pigmentation is not uniform, with variable degrees of tan, brown, or black); D is for diameter greater than 6 millimeters (about the size of a pencil eraser). Not all melanomas have these signs, so be alert for any new or changing skin growths or spots.

**Treatment:** Most early skin cancers are diagnosed and treated by removal and microscopic examination of the cells. Early stage basal cell and squamous cell cancers can be treated in most cases by one of several methods: surgical excision, electrodesiccation and curettage (tissue destruction by electric current and removal by scraping with a curette), or cryosurgery (tissue destruction by freezing). Radiation therapy and certain topical medications may be used in some cases. For malignant melanoma, the primary growth and surrounding normal tissue are removed and sometimes a sentinel lymph node is biopsied to determine stage. More extensive lymph node surgery may be

needed if the sentinel lymph nodes contain cancer. Melanomas with deep invasion or that have spread to lymph nodes may be treated with surgery, immunotherapy, chemotherapy, and/or radiation therapy. Advanced cases of melanoma are treated with palliative surgery, newer targeted or immunotherapy drugs, and sometimes chemotherapy and/or radiation therapy. The treatment of advanced melanoma has changed in recent years with the FDA approval of targeted drugs such as vemurafenib (Zelboraf®), dabrafenib (Tafinlar®), and trametinib (Mekinist™) and the immunotherapy drug ipilimumab (Yervoy®).

**Survival:** Almost all cases of basal cell and squamous cell skin cancer can be cured, especially if the cancer is detected and treated early. Although melanoma is also highly curable when detected in its earliest stages, it is more likely than NMSCs to spread to other parts of the body. The 5- and 10-year relative survival rates for people with melanoma are 91% and 89%, respectively. For localized melanoma (84% of cases), the 5-year survival rate is 98%; survival declines to 63% and 16% for regional and distant stage disease, respectively.

## Thyroid

**New cases:** An estimated 62,450 new cases of thyroid cancer are expected to be diagnosed in 2015 in the US, with 3 out of 4 cases occurring in women. Thyroid cancer has been increasing worldwide over the past few decades and is the most rapidly increasing cancer in the US. The rise is thought to be partly due to increased detection because of more sensitive diagnostic procedures, perhaps resulting in some overdiagnoses. In the US, rates increased by 4.4% per year from 2007 to 2011.

**Deaths:** An estimated 1,950 deaths from thyroid cancer are expected in 2015. From 2007 to 2011, death rates for thyroid cancer increased slightly by 0.9% per year.

**Signs and symptoms:** The most common symptom of thyroid cancer is a lump in the neck that is noticed by a patient or felt by a health care provider during a clinical exam. Other symptoms include a tight or full feeling in the neck, difficulty breathing or swallowing, hoarseness, swollen lymph nodes, and pain in the throat or neck that does not go away. Although most lumps in the thyroid gland are not cancerous, individuals who notice an abnormality should seek timely medical attention. Many thyroid cancers are diagnosed in people without symptoms because an abnormality is seen on an imaging test performed for another purpose.

**Risk factors:** Risk factors for thyroid cancer include being female, having a history of goiter (enlarged thyroid) or thyroid nodules, a family history of thyroid cancer, and radiation exposure early in life (e.g., as a result of medical treatment). People who test positive for a mutation in a gene called *RET*, which causes a hereditary form of thyroid cancer (familial medullary

thyroid carcinoma), can decrease the risk of developing the disease by having the thyroid gland surgically removed. Certain rare genetic syndromes, such as familial adenomatous polyposis (FAP), also increase risk. Unlike most other adult cancers, for which older age increases risk, 80% of newly diagnosed thyroid cancers are in patients younger than age 65.

**Early detection:** At present, there is no screening test recommended for the early detection of thyroid cancer. However, because symptoms usually develop early and many cancers are found incidentally, most thyroid cancers (68%) are diagnosed at an early stage.

**Treatment:** Most thyroid cancers are highly curable, though about 5% (medullary and anaplastic thyroid cancers) are more aggressive and more likely to spread to other organs. Treatment depends on the cell type, tumor size, and extent of disease. The first choice of treatment is usually surgery to partially or totally remove the thyroid gland (thyroidectomy), and sometimes nearby lymph nodes. Treatment with radioactive iodine (I-131) after complete thyroidectomy to destroy any remaining thyroid tissue may be recommended for large tumors or when cancer has spread outside the thyroid. Thyroid replacement hormone therapy is given after thyroidectomy to replace hormones normally produced by the thyroid gland and to prevent the body from making thyroid-stimulating hormone, decreasing the likelihood of recurrence.

**Survival:** The overall 5- and 10-year relative survival rates are 98% and 97%, respectively. However, survival varies by stage, age at diagnosis, and disease subtype. The 5-year survival rate approaches 100% for localized disease, is 98% for regional stage disease, and 55% for distant stage disease.

## Urinary Bladder

**New cases:** An estimated 74,000 new cases of bladder cancer are expected to occur in 2015. Bladder cancer incidence is about 4 times higher in men than in women and almost 2 times higher in white men than in black men. Bladder cancer incidence rates decreased from 2007 to 2011 by 1.6% per year in men and by 1.1% per year in women.

**Deaths:** An estimated 16,000 deaths will occur in 2015, 72% of which will be in men. From 2007 to 2011, death rates were stable in men and decreased slightly (0.4% per year) in women.

**Signs and symptoms:** Bladder cancer is usually detected early because of blood in the urine or other symptoms, including increased frequency or urgency of urination or pain or irritation during urination.

**Risk factors:** Smoking is the most well-established risk factor for bladder cancer. The risk of bladder cancer among smokers is approximately 4-fold that among nonsmokers. About half of all

bladder cancers in both men and women are attributed to smoking. Risk is also increased among workers in the dye, rubber, leather, and aluminum industries; painters; people who live in communities with high levels of arsenic in the drinking water; and people with certain bladder birth defects.

**Early detection:** There is currently no screening method recommended for people at average risk. Bladder cancer is diagnosed by microscopic examination of cells from urine or bladder tissue and examination of the bladder wall with a cystoscope, a slender tube fitted with a lens and light that is inserted through the urethra. These and other tests may be used to screen people at increased risk, as well as during follow-up after bladder cancer treatment to detect recurrent or new tumors.

**Treatment:** Surgery, alone or in combination with other treatments, is used in more than 90% of cases. Early stage cancers may be treated by removing the tumor and then administering immunotherapy or chemotherapy drugs directly into the bladder. More advanced cancers may require removal of the entire bladder (cystectomy). Patient outcomes are improved with the use of chemotherapy, alone or with radiation, before cystectomy. Timely follow-up care is extremely important because of the high rate of bladder cancer recurrence.

**Survival:** For all stages combined, the 5-year relative survival rate is 77%. Survival declines to 70% at 10 years and 65% at 15 years after diagnosis. Half of all bladder cancer patients are diagnosed while the tumor is in situ (noninvasive, present only in the layer of cells in which the cancer developed), for which the 5-year survival is 96%. For the 35% of patients with invasive tumors diagnosed at a localized stage, the 5-year survival rate is 69%. For patients diagnosed with regional and distant stage disease, 5-year survival is 34% and 6%, respectively.

## Uterine Cervix

**New cases:** An estimated 12,900 cases of invasive cervical cancer are expected to be diagnosed in 2015. Large declines in incidence rates over most of the past several decades have begun to taper off among young white women. From 2007 to 2011, rates in women younger than 50 years of age were stable among whites and decreased by 3.4% per year among blacks; in women 50 or older, rates declined by 2.5% per year in whites and by 3.8% per year in blacks.

**Deaths:** An estimated 4,100 deaths from cervical cancer are expected in 2015. Mortality rates declined rapidly in past decades due to prevention and early detection as a result of screening with the Pap test. However, similar to incidence, mortality rates have begun to level off in recent years, particularly among younger women. From 2007 to 2011, death rates were stable among women younger than 50, but decreased by 1.1% per year among those 50 years of age or older.

**Signs and symptoms:** Preinvasive cervical lesions often have no symptoms. Once abnormal cervical cells become cancerous and invade nearby tissue, the most common symptom is abnormal vaginal bleeding. Bleeding may start and stop between regular menstrual periods, or it may occur after sexual intercourse, douching, or a pelvic exam. Menstrual bleeding may last longer and be heavier than usual. Bleeding after menopause or increased vaginal discharge may also be symptoms.

**Risk factors:** Most cervical cancers are caused by persistent infection with certain types of human papillomavirus (HPV). While women who begin having sex at an early age or who have had many sexual partners are at increased risk for HPV infection and cervical cancer, a woman may be infected with HPV even if she has had only one sexual partner. In fact, HPV infections are common in healthy women and are usually cleared successfully by the immune system. Only rarely does the infection persist, increasing the risk of cervical cancer. Both the persistence of HPV infection and the progression to cancer may be influenced by many factors, including a suppressed immune system, a high number of childbirths, and cigarette smoking. Long-term use of oral contraceptives (birth control pills) is also associated with increased risk of cervical cancer.

**Prevention:** There are two vaccines (Gardasil® and Cervarix®) available for protection against the two types of HPV (types 16 and 18) that cause most (70%) cervical cancers. Vaccination is recommended for use in girls 11 to 12 years of age, but may be given as young as age 9 and up to age 26. HPV vaccines cannot protect against established infections, nor do they protect against all types of HPV that cause cervical cancer, which is why vaccinated women should still be screened for cervical cancer.

Screening can prevent cervical cancer by detecting precancerous lesions that can be treated so they do not progress to cancer. As screening has become more common, precancerous lesions of the cervix are detected far more frequently than invasive cancer. The Pap test is a simple procedure in which a small sample of cells is collected from the cervix and examined under a microscope. Pap tests are effective, but not perfect. Sometimes results are reported as normal when abnormal cells are present (false negative), and likewise, test results can be positive when there is no cancer or precancer (false positive). HPV tests, which detect HPV infections associated with cervical cancer, can forecast cervical cancer risk many years in the future and are currently recommended to be used in conjunction with the Pap test, either as an additional screening test or when Pap test results are uncertain. HPV tests can also detect a type of cervical cancer (adenocarcinoma) that is often missed by Pap tests. Most cervical precancers develop slowly, so cancer can usually be prevented if a woman is screened regularly. It is important for all women, even those who have received the HPV vaccine, to follow cervical cancer screening guidelines.

**Early detection:** In addition to preventing cervical cancer, screening can detect invasive cancer early, when treatment is most successful. Most cervical cancers are detected in women who have never or not recently been screened. The American Cancer Society, in collaboration with the American Society for Colposcopy and Cervical Pathology and the American Society for Clinical Pathology, issued new screening guidelines for the prevention and early detection of cervical cancer in 2012. The most important changes to the guidelines were the age range for which screening is appropriate and the emphasis on the incorporation of HPV testing in addition to the Pap test. Among women at average risk, screening is recommended for those 21 to 65 years of age, and the preferred screening method for women 30 to 65 is HPV and Pap “co-testing” every 5 years. For more detailed information on the American Cancer Society’s screening guidelines for the early detection of cervical cancer, see page 52.

**Treatment:** Precancerous cervical lesions may be treated with a loop electrosurgical excision procedure (LEEP), which removes abnormal tissue with a wire loop heated by electric current; cryotherapy (the destruction of cells by extreme cold); laser ablation (removal of tissue); or conization (the removal of a cone-shaped piece of tissue containing the abnormal tissue). Invasive cervical cancers are generally treated with surgery or radiation combined with chemotherapy. Chemotherapy alone is often used to treat advanced disease. However, for women with metastatic, recurrent, or persistent cervical cancer, the addition of the targeted drug bevacizumab (Avastin®) to standard chemotherapy has been shown to improve overall survival, and has recently been approved by the FDA for this use.

**Survival:** Five- and 10-year relative survival rates for cervical cancer patients are 68% and 64%, respectively. Almost half of patients (47%) are diagnosed when the cancer is localized, for which the 5-year survival is 91%. Cervical cancer is more often diagnosed at a localized stage in whites (48%) than in blacks (39%) and in women younger than 50 years of age (59%) than in women 50 or older (33%). Five-year survival rates for regional and distant stage disease are 57% and 16%, respectively.

## Uterine Corpus (Endometrium)

**New cases:** An estimated 54,870 cases of cancer of the uterine corpus (body of the uterus) are expected to be diagnosed in 2015. Cancer of the uterine corpus is often referred to as endometrial cancer because most cases (92%) occur in the endometrium (lining of the uterus). From 2007 to 2011, incidence rates increased by 2.4% per year.

**Deaths:** An estimated 10,170 deaths are expected in 2015. From 2007 to 2011, death rates for cancer of the uterine corpus increased by 1.9% per year.



**Signs and symptoms:** Abnormal uterine bleeding or spotting (especially in postmenopausal women) is a frequent early sign. Pain during urination, intercourse, or in the pelvic area can also be a symptom.

**Risk factors:** Obesity and abdominal fatness increase the risk of uterine cancer, most likely by increasing the amount of circulating estrogen, which is a strong risk factor. Other factors that increase estrogen exposure include menopausal estrogen therapy, late menopause, never having children, and a history of polycystic ovary syndrome. (Estrogen plus progestin menopausal hormone therapy does not appear to increase risk.) Tamoxifen, a drug used to reduce breast cancer risk, increases risk slightly because it has estrogen-like effects on the uterus. Medical conditions that increase risk include Lynch syndrome and diabetes. Pregnancy, use of oral contraceptives or intrauterine devices, and physical activity are associated with reduced risk.

**Early detection:** There is no standard or routine screening test for women at average risk. Most cases (68%) are diagnosed at an early stage because of postmenopausal bleeding. Women are encouraged to report any unexpected bleeding or spotting to their physicians. The American Cancer Society recommends that women with known or suspected Lynch syndrome be offered annual screening with endometrial biopsy and/or transvaginal ultrasound beginning at age 35.

**Treatment:** Uterine cancers are usually treated with surgery, radiation, hormones, and/or chemotherapy, depending on the stage of disease.

**Survival:** The 5- and 10-year relative survival rates for uterine cancer are 82% and 79%, respectively. The overall 5-year relative survival is 23 percentage points higher for whites (84%) than for blacks (61%). This is partly because white women are more likely than black women to be diagnosed with local stage disease (70% versus 54%, respectively). Higher body weight adversely affects survival, whereas physical activity is associated with improved survival.

## Special Section: Breast Carcinoma In Situ

An estimated 60,290 new cases of female breast carcinoma in situ are expected to be diagnosed in 2015, accounting for about 20% of all breast cancers in women. The vast majority (83%) will be ductal carcinoma in situ (DCIS), and 12% will be lobular carcinoma in situ (LCIS) (which is also called lobular neoplasia). The clinical significance of a breast carcinoma in situ diagnosis and optimal approaches to treatment are topics of uncertainty and concern for both patients and clinicians.<sup>1-3</sup> In this special section, we summarize what is known and not known about female DCIS and LCIS, present statistics on their occurrence and treatment, and highlight promising areas of research. Because DCIS and LCIS are quite distinct in their natural history and treatment, they are discussed separately.

### What is “carcinoma” and “carcinoma in situ”?

The term “carcinoma” is used to describe cancer arising in epithelial cells (cells that cover the surface of the body and the lining of “hollow” internal organs). This is why most cancers of the skin, mouth, throat, esophagus, stomach, intestines, reproductive system, and most other organs are classified as carcinomas. Although most people do not think of a breast as being hollow, its system of glands and ducts are, which is why most breast cancers are carcinomas. One of the most important features that distinguishes benign (non-cancerous) cells from those of carcinoma is that carcinoma cells can invade beyond the epithelium into nearby tissues. Thus, when examination of a biopsy sample shows abnormal epithelial cells that have spread from their origin into other tissues, this is a sign of carcinoma.

The term “carcinoma in situ” was coined long ago to describe abnormal epithelial cells that have not invaded nearby tissues, but that look very similar to cells of invasive carcinoma when viewed under a microscope. For many years, it was assumed that

these cells could become invasive in the absence of treatment. More recent research indicates that the transition from normal tissue to carcinoma in situ to invasive carcinoma involves a series of molecular changes that are more complex and subtle than the older view based on microscopic appearances. Long-term follow-up studies of patients with carcinoma in situ also find that even without treatment, not all patients develop invasive cancer.<sup>4</sup>

Adding to this complexity, abnormal yet noninvasive epithelial cells in different organs are often given various names (such as carcinoma in situ, high-grade dysplasia, high-grade intraepithelial neoplasia), and doctors still disagree about the best way to classify these conditions. The clinical consequences of this uncertainty are perhaps most evident and controversial in breast cancer. For this reason, a review of carcinoma in situ of the breast is particularly timely and important.

### What is DCIS?

DCIS refers to abnormal cells that replace the normal epithelial cells of breast ducts, but are still within the tissue layer of origin; under a microscope, these cells appear similar to those of invasive breast cancers. Although DCIS can present as a palpable mass, it is most often detected by a mammogram, where it commonly is identified by the appearance of microcalcifications (tiny bits of calcium that appear as clustered white dots). The microcalcifications are harmless but indicate the possible presence of in situ or invasive cancer.

Because the abnormal DCIS cells are contained within the layer of cells where they originated, they cannot spread to other organs and cause serious illness or death. However, if left untreated, DCIS has the potential to evolve into invasive cancer and is considered a true cancer precursor. The main goal of treatment for DCIS is to prevent progression to invasive cancer.

**Table 1. Ductal carcinoma in situ incidence rates\* by race, ethnicity and age group, US, 2007-2011**

Age	All races	Non-Hispanic White	Non-Hispanic Black	Asian and Pacific Islander	American Indian and Alaska Native†	Hispanic/Latina
<b>All ages</b>	<b>25.8</b>	<b>26.6</b>	<b>26.5</b>	<b>23.9</b>	<b>14.4</b>	<b>17.9</b>
20-39 years	3.4	3.7	3.5	3.4	1.9	2.1
40-49 years	37.9	40.7	32.8	42.1	20.5	25.9
50-59 years	57.9	59.8	56.9	57.0	33.4	41.7
60-69 years	81.8	82.9	91.3	70.1	49.6	58.2
70-79 years	84.3	85.8	94.6	66.8	46.3	57.2
≥80 years	47.4	47.6	55.8	33.2	19.4	32.2

Hispanic origin is not mutually exclusive from Asian/Pacific Islander or American Indian/Alaska Native. \*Per 100,000 females and age adjusted to the 2000 US standard population. †Data based on Indian Health Service Contract Health Service Delivery Areas. Rates exclude data from Kansas.

**Source:** North American Association of Central Cancer Registries (NAACCR), 2014.

American Cancer Society, Inc., Surveillance Research, 2015

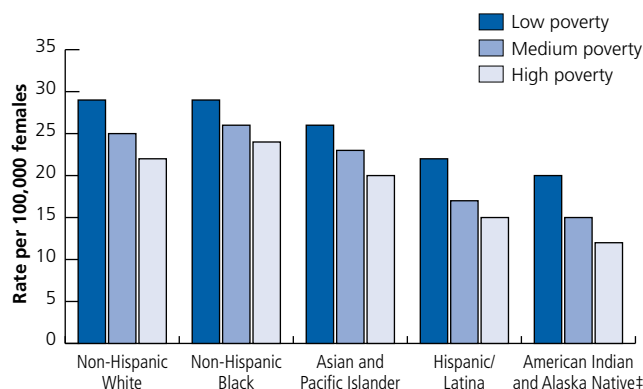
There is some uncertainty and debate about the benefits and harms of detecting and treating DCIS. Data are very limited about the proportion of detected DCIS lesions that will progress to invasive cancer because almost all women receive some treatment. Long-term follow-up studies of women whose DCIS was untreated because it was originally misclassified as benign found that 20-53% were diagnosed with an invasive cancer over the course of 10 years or more.<sup>5-9</sup> These studies suggest that untreated DCIS has the potential to eventually become invasive. On the other hand, it also follows that some women treated for DCIS might not have developed an invasive breast cancer in the absence of treatment.

Overdiagnosis and overtreatment of DCIS (terms that are used to describe diagnosis and treatment of diseases that would have gone undetected in the absence of screening) are of concern because the diagnosis, treatment, and follow-up can affect long-term health and quality of life. Overdiagnosis of DCIS does not mean that the patient had a benign condition that was mistakenly classified as DCIS. Rather, it means that some cases of DCIS would not progress to invasive carcinoma, and that current diagnostic methods are not yet accurate enough to reliably distinguish these cases from DCIS cases that should be treated to avoid progression to invasive cancer.

Like invasive breast cancers, DCIS lesions are diverse in many ways, some of which may influence the likelihood of progression to invasive cancer or recurrence. Factors that are measured to estimate the likelihood of progression or recurrence are referred to as “prognostic factors,” while those that indicate responsiveness to a particular treatment are referred to as “predictive factors.” Prognostic and predictive factors that are measured for DCIS include nuclear grade, histology, size, and estrogen receptor status.<sup>10</sup> Many of these factors also influence the risk of a DCIS lesion containing or bordering an area of invasive cancer.

- **Nuclear grade** describes how different the nuclei of tumor cells (the central part of cells that contains their DNA) look compared to those of normal cells. Higher-grade tumors have more cells with abnormal-looking nuclei and have a greater probability of progression and recurrence.
- **Histology** identifies subtypes of DCIS based on how the cells are arranged when viewed under a microscope. DCIS is generally classified as papillary, solid, comedo, micropapillary, or cribriform. The comedo type of DCIS typically has more aggressive characteristics, such as high nuclear grade and high proliferation (growth) rate.<sup>11</sup>
- **Size** of the DCIS lesion can be difficult to measure because, rather than being a solid mass, the lesion often follows the branching structure along several milk ducts. The size of the DCIS is associated with recurrence, in part because it is more difficult to ensure complete removal of widespread branching lesions. The extent of breast tissue harboring DCIS is also

**Figure 1. Ductal carcinoma in situ incidence rates\* by race, ethnicity, and county-level poverty†, US, 2007-2011**



Hispanic origin is not mutually exclusive from Asian/Pacific Islander or American Indian/Alaska Native. \*Per 100,000 females and age adjusted to the 2000 US standard population. †Low poverty: county poverty rate <10%; medium poverty: county poverty rate 10.0% - 19.9%; high poverty: county poverty rate ≥20.0%. ‡Data based on Indian Health Service Contract Health Service Delivery Areas. Rates exclude data from Kansas.

Source: NAACCR, 2014.

American Cancer Society, Inc., Surveillance Research, 2015

associated with the likelihood of having a microscopic component of invasive cancer within the affected breast.

- **Estrogen receptor status** influences the recommendation for hormonal therapy. Like invasive breast cancers, DCIS tumors may contain estrogen receptors (ER). Treatment guidelines recommend that ER status be measured for DCIS because tamoxifen therapy may be recommended for women with ER positive (ER+) tumors in order to decrease the risk of recurrence or reduce the risk of new breast cancers developing.

Other tumor characteristics that are routinely measured for invasive breast cancers may also be measured in DCIS lesions, but are not considered clinically relevant for DCIS because they do not influence treatment, include progesterone receptor (PR) status and human epidermal growth factor receptor 2 (HER2) status.

## DCIS incidence in the most recent time period (2007-2011)

Diagnosis of DCIS rarely occurs among women younger than 40, the age at which it is recommended for women of average risk of breast cancer to begin mammography screening.<sup>12</sup> In general, DCIS incidence rates increase with age and peak at ages 70-79 (Table 1). Overall incidence rates are similar for non-Hispanic white, non-Hispanic black, and Asian/Pacific Islander women; lower among Hispanic women; and lowest for American Indian/Alaska Native women (Table 1). Lower incidence rates of DCIS in Hispanic and American Indian/Alaska Native women may be in part because of inaccurate identification of race and ethnicity for these populations, as well as lower access to and utilization

of mammography. Within each racial and ethnic subgroup, DCIS rates vary consistently with county poverty level. The highest DCIS incidence rates are observed in low poverty areas (county poverty rate <10%), and the lowest incidence rates are observed for high poverty areas (county poverty rate of 20% or higher) (Figure 1, page 27). Patterns of DCIS incidence by county poverty level may largely reflect lower prevalence of mammography in low-income and uninsured women.<sup>13</sup>

The incidence rate for DCIS also varies by state. Among women 40 and older, the average annual age-adjusted incidence rates from 2007 to 2011 were lowest in New Mexico (38.1 per 100,000 women), West Virginia (42.5), and Wyoming (43.2), and were highest in Connecticut (80.1), Massachusetts (76.3), and Hawaii (73.0). This more than 2-fold variation reflects differences in screening prevalence, as well as the racial and ethnic makeup of US states. Incidence of DCIS by state is strongly associated ( $r=0.72$ ) with prevalence of mammography screening (Figure 2).

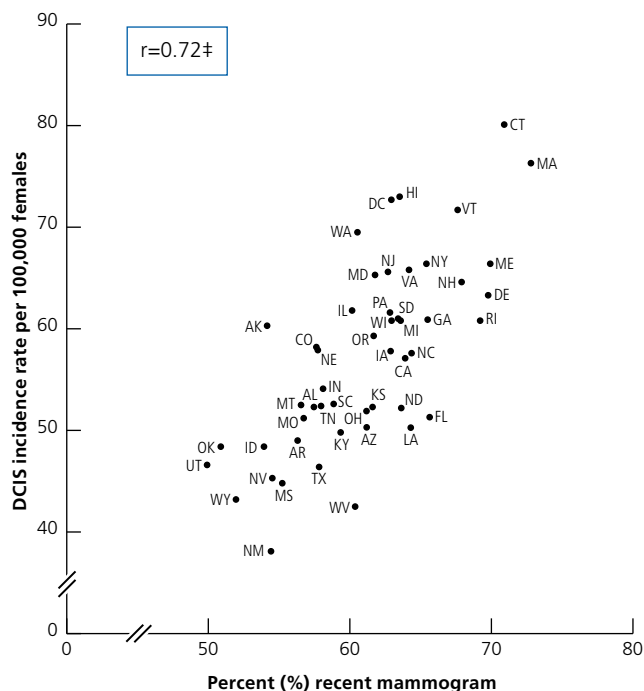
Table 2 shows the distribution of prognostic factors among DCIS lesions diagnosed in the most recent time period. The majority are small (< 2cm: 51%), higher grade (70% are grade II or higher) or have unspecified histologic type (DCIS, NOS: 68%). Similar to invasive breast cancer, most DCIS lesions are ER+ (72% versus 74% of invasive breast cancers). The distribution of ER status does not differ markedly by race, which is unlike invasive breast cancer, for which non-Hispanic black women have a notably higher percentage of ER- tumors than women of other race/ethnicities (28% versus 15-19%, respectively). Invasive ER- breast tumors tend to be more aggressive and are more difficult to treat because there are no targeted therapies available.

## DCIS incidence trends

The incidence of DCIS increased rapidly following the introduction of mammography as a population screening tool in the US from the late 1980s until about 1998, after which it increased at a much slower rate.<sup>14-16</sup> From 2007 to 2011, the DCIS incidence rate for all ages combined increased 0.8% per year on average. Figure 3 shows trends in incidence rates from 1992-2011 for 3 age groups of women. All 3 groups show rapidly increasing trends through the late 1990s, followed by a slower rate of increase for women ages 40-49 and 70-79 and stable rates for women ages 50-69. This pattern is likely explained by the leveling-off of mammography screening in the early 2000s.<sup>13</sup>

Declines in invasive breast cancer rates were observed when many women stopped taking combined menopausal hormone therapy (MHT) after the 2002 release of the Women's Health Initiative findings of an increased risk of invasive breast cancer among users.<sup>17</sup> Although the statistical model (Joinpoint) used to detect changes in trend does not find a significant change in incidence rates of DCIS beginning in 2002 for any of the 3 age groups of women displayed in Figure 3, the data points suggest a

**Figure 2. Association between state-level prevalence of mammography screening\* (2008) and incidence rates† of ductal carcinoma in situ (2007-2011) among women ≥40 years**



DCIS: ductal carcinoma in situ. \*Percent of women ≥40 years who reported having a mammogram within the past year. †Rates are per 100,000 females and age adjusted to the 2000 US standard population. ‡Pearson correlation coefficient.

**Source:** Mammography screening prevalence – Behavior Risk Factor Surveillance System 2008, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, 2010. Incidence – NAACCR, 2014. Not all states met high-quality standards for all years according to NAACCR. DCIS incidence rate for Arkansas is based on incidence data for the years 2007-2009; for Nevada, the rate is based on incidence data for the years 2007-2010. Minnesota did not submit 2007-2011 incidence data to NAACCR and is not included.

American Cancer Society, Inc., Surveillance Research, 2015

drop in DCIS incidence from 2002 to 2006 for women ages 50 to 79. This decline is supported by the results of a study conducted in a regularly screened population of women within the Breast Cancer Screening Consortium (BCSC), which found that the incidence of DCIS declined significantly in women ages 50 to 79 from 2002 to 2006.<sup>18</sup> The BCSC study also found that MHT use among women 50 to 69 declined from a steady state of 4,800 per 10,000 screening mammograms from 1997 to 2001 to approximately 1,300 per 10,000 screening mammograms in 2006.

When incidence rates from 1992 to 2011 are examined by race and ethnicity, it appears that the rise and plateau in incidence of DCIS in US women occurred earlier in non-Hispanic whites than in non-Hispanic blacks and Asians/Pacific Islanders, although their incidence rates and trends have been similar in recent years (Figure 4, page 30). DCIS incidence rates rose much more

**Table 2. Distribution of prognostic characteristics among ductal carcinoma in situ cases by race and ethnicity, US, 2007-2011**

Prognostic characteristic	All races	Non-Hispanic White	Non-Hispanic Black	Asian and Pacific Islander	American Indian and Alaska Native*	Hispanic/Latina
<b>Estrogen receptor (ER) status<sup>†</sup></b>						
ER+	72%	71%	75%	75%	66%	70%
ER-	13%	13%	11%	12%	14%	11%
Missing	16%	15%	15%	14%	20%	19%
<b>Grade<sup>‡</sup></b>						
Grade I	14%	14%	15%	13%	16%	14%
Grade II	34%	33%	36%	40%	31%	34%
Grade III/IV	36%	37%	31%	36%	34%	34%
Missing	16%	16%	18%	12%	19%	18%
<b>Histologic subtype</b>						
DCIS, NOS	68%	68%	68%	68%	66%	69%
Comedocarcinoma	10%	10%	9%	9%	13%	9%
Papillary	4%	4%	6%	4%	4%	5%
Cribriform	10%	10%	10%	11%	10%	10%
Solid	8%	8%	7%	7%	7%	7%
<b>Size (cm)</b>						
<2.0	51%	52%	46%	53%	53%	48%
2.0-4.9	13%	12%	14%	18%	12%	14%
≥5.0	4%	4%	6%	4%	4%	4%
Missing	33%	33%	34%	24%	31%	34%

DCIS, NOS: ductal carcinoma in situ, not otherwise specified. ER+ includes borderline status. Hispanic origin is not mutually exclusive from Asian/Pacific Islander or American Indian/Alaska Native. \*Data based on Indian Health Service Contract Health Service Delivery Areas and exclude cases from Kansas. †Based on cases diagnosed between 2009-2011 with more complete data. ‡Although nuclear grade for DCIS is usually reported on a scale of 1-3, cancer registry data are reported on a scale of I-IV.

Source: NAACCR, 2014.

American Cancer Society, Inc., Surveillance Research, 2015

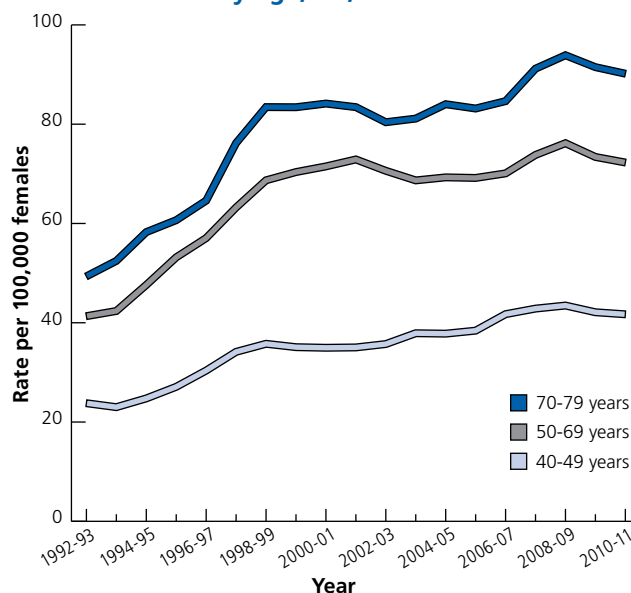
slowly among Hispanics and American Indians/Alaska Natives, likely due to slower rates of mammography uptake, as well as potential misclassification of race and ethnicity. Incidence trends for DCIS also showed variation by county poverty level, similarly reflecting slower mammography screening uptake among low-income women (Figure 5, page 31).

## Risk factors for DCIS

Mammography screening can be considered a risk factor for DCIS because the incidence is much lower in women who are not screened. However, while mammography screening results in the detection of DCIS lesions, it does not actually cause the disease. Until recently, there has been little information about the risk factors for DCIS, as many epidemiologic studies of breast cancer risk factors either exclude women with DCIS, or have relatively small numbers of women with DCIS. However, in recent years greater clarity about DCIS risk factors has begun to emerge.

In general, studies suggest that DCIS and invasive breast cancer share many similar risk factors.<sup>15,19-21</sup> Results from one of these recent studies are summarized in Table 3 (page 32).<sup>19</sup> In this study, which included 1.2 million women living in the United Kingdom, the risk of DCIS was higher for women who had fewer

**Figure 3. Trends in ductal carcinoma in situ incidence rates\* by age, US, 1992-2011**



\*Per 100,000 females, two-year moving averages, age adjusted to the 2000 US standard population, and adjusted for reporting delay.

Source: Surveillance, Epidemiology, and End Results (SEER) Program, 13 SEER registries, National Cancer Institute, 2014.

American Cancer Society, Inc., Surveillance Research, 2015



or no children, were older at the time of first birth, or reached menopause after age 50. DCIS incidence was not associated with age at menarche in this study; however, this study also found no association between earlier age at menarche and invasive breast cancer unlike most other studies (Table 3, page 32). With respect to nonreproductive risk factors, the study found no association between DCIS and body mass index (BMI) or alcohol consumption, but risk was increased among women with a family history of breast cancer and current and past users of MHT.

The Women's Health Initiative (WHI) study, which documented the association between MHT use and invasive breast cancer, also reported on associations between MHT use and DCIS.<sup>22</sup> While not statistically significant, the results for DCIS were in the same direction as the results for invasive breast cancer, suggesting that estrogen plus progestin use may be associated with an increased risk of DCIS, while use of estrogen alone may be associated with a decreased risk.<sup>22</sup> An important feature of this study was that all participants had regular screening mammography, which ensured that hormone and non-hormone users had equal probability of DCIS detection.

High breast density is a risk factor for invasive breast cancer and may also increase risk for DCIS. A pooled analysis of six studies including more than 10,000 women found that the association between breast density and DCIS risk was largest for women younger than age 55.<sup>23</sup> In this age group, higher mammographic density was associated with about a 2-fold increased risk for DCIS as compared to women with lower breast density. For women ages 55-64, high density was associated with about a 1½-fold increased risk.

Breast density is also a risk factor for the development of contralateral breast cancer (i.e., breast cancer in the unaffected breast) after DCIS treatment. In one prospective study of women treated with lumpectomy for DCIS between 1993 and 2005, high breast density was associated with about a 3-fold increased risk of invasive breast cancer in the contralateral breast as compared to women with low and average breast density.<sup>24</sup>

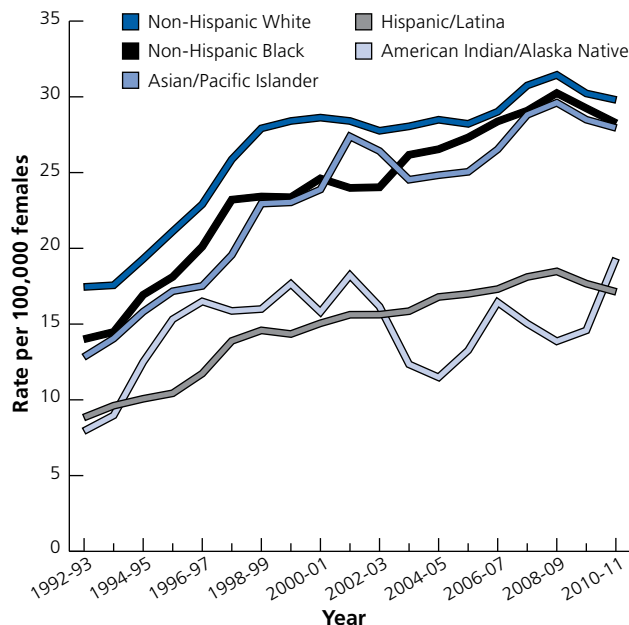
The use of drugs to reduce the risk of disease is called chemoprevention. Clinical trials of chemoprevention agents for women at high risk of breast cancer have found decreased incidence of DCIS among women receiving tamoxifen or raloxifene.<sup>25</sup>

## Treatment for DCIS

Treatment for DCIS usually involves either breast-conserving surgery (BCS) with radiation therapy or mastectomy.

BCS removes a part of the affected breast, including the area where DCIS is found, along with a margin of healthy tissue. If the removed tissue is later found to also contain invasive cancer, staging of the axillary (underarm) lymph nodes is needed. This is most often done using a minimally invasive staging procedure called a sentinel lymph node biopsy.

**Figure 4. Trends in ductal carcinoma in situ incidence rates\* by race and ethnicity, US, 1992-2011**



Hispanic origin is not mutually exclusive from Asian/Pacific Islander or American Indian/Alaska Native. \*Per 100,000 females, two-year moving averages, age adjusted to the 2000 US standard population, and adjusted for reporting delay. †Data based on Indian Health Service Contract Health Service Delivery Areas.

**Source:** SEER Program, 13 SEER registries, National Cancer Institute, 2014.

American Cancer Society, Inc., Surveillance Research, 2015

Radiation therapy is recommended for most women who have BCS because randomized trials show strong and consistent evidence that radiation therapy after BCS approximately halves the rate of recurrence in the affected breast. A recent combined analysis of four clinical trials found that at 5 years after treatment, 18% of women who had BCS alone had experienced a recurrence, compared to 8% of women who had BCS plus radiation therapy.<sup>26</sup> After 10 years of follow-up, 28% of women who received BCS alone had experienced a recurrence, compared to 13% of women who received BCS plus radiation therapy. In both treatment groups, about half of the recurrences were DCIS and half were invasive breast cancer.

Although radiation therapy has a clear benefit in reducing the risk of recurrence among DCIS patients who receive BCS, there are some drawbacks and risks. Radiation is delivered to the whole breast and requires a commitment to daily treatment for six weeks. Patients receiving radiation therapy may experience short-term side effects including fatigue and skin toxicity, as well as a slightly increased risk of secondary cancers.<sup>27,28</sup>

A number of studies have tried to identify patients with DCIS who have a low enough risk of recurrence that they can safely be treated by BCS alone. While some studies have demonstrated radiation therapy can be safely omitted in carefully selected low-risk patients (based on Van Nuys Prognostic Index), others have



found similar rates of recurrence across risk groups.<sup>29-31</sup> The National Comprehensive Cancer Network (NCCN) treatment guidelines suggest that BCS followed by observation is a reasonable option for some women with low-risk disease.<sup>32</sup>

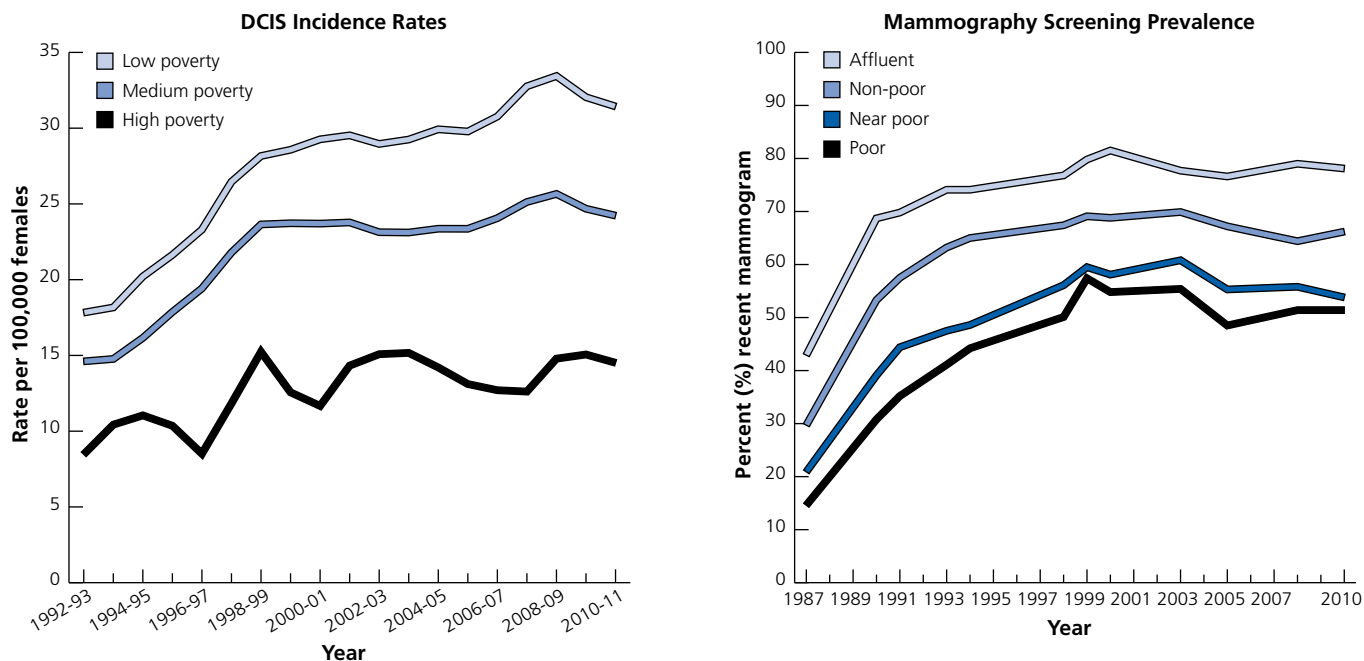
Mastectomy, removal of the entire breast, is the most common alternative to BCS plus radiation for the treatment of DCIS. Because a lesion thought to be DCIS can contain an area of invasive cancer, mastectomy for DCIS may be accompanied by a sentinel lymph node biopsy. Until the early 1990s, mastectomy was the standard treatment for DCIS. The evolution of BCS and radiation therapy as the standard treatment was brought about by increased detection of asymptomatic DCIS diagnosed in the mammography era, the acceptance of BCS plus radiation therapy as standard therapy for invasive cancers, and the publication of the National Surgical Adjuvant Breast and Bowel Project (NSABP) B-17 trial, which reported that the addition of radiation to BCS reduced the risk of local recurrence.<sup>33</sup> As a result, mastectomy rates among DCIS patients decreased from 46% in 1991 to 25% in 2005.<sup>34</sup>

While it is no longer the standard treatment for DCIS, mastectomy remains an acceptable option and is the recommended treatment for some women, including patients with DCIS involving 4-5 cm of disease or more than one area of the breast, those

with a large tumor-to-breast ratio, those who should not receive radiation due to certain medical conditions or have received prior radiation therapy, and those for whom negative margins could not be achieved with BCS.<sup>35</sup> Women who have a mastectomy for DCIS have a very low probability of recurrence in the treated breast, but remain at increased risk of developing DCIS or invasive breast cancer in the untreated (contralateral) breast. A study of 18,845 patients diagnosed with DCIS in 1973-1996 found that the cumulative risk of contralateral invasive or in situ breast cancer was 3% at 5 years, 6% at 10 years, 9% at 15 years, and 11% at 20 years.<sup>36</sup> Women treated with unilateral mastectomy are followed with clinical breast examination and mammography to screen for DCIS or invasive cancers in the contralateral breast. Magnetic resonance imaging (MRI) of the breast may also be an option for women with a history of DCIS who are at high risk due to certain other risk factors.<sup>37</sup>

Some women with unilateral DCIS choose to have bilateral mastectomy to prevent cancer in the unaffected breast.<sup>38</sup> This is more common in younger women. Studies suggest that the decision to have a bilateral mastectomy may be influenced by the presence of other breast cancer risk factors, including a family history. However, some women make this decision primarily based on worry about recurrence.<sup>39</sup>

**Figure 5. Trends in ductal carcinoma in situ incidence rates\* (1992-2011) by county-level poverty† (left) and mammography screening‡ prevalence (1987-2010) by individual-level poverty§ (right), US**



\*Per 100,000 females, two-year moving averages, age adjusted to the 2000 US standard population, and adjusted for reporting delay. †Low poverty: county poverty rate <10%; medium poverty: county poverty rate 10.0% - 19.9%; high poverty: county poverty rate ≥20.0%. ‡Screening mammogram within the past 2 years. §Poor: below federal poverty level; near poor: 100% to 199% of federal poverty level; non-poor: 200%-399%; affluent: 400% or more.

**Source:** Incidence – SEER Program, 13 SEER registries, National Cancer Institute, 2014. Mammography screening prevalence – National Center for Health Statistics, Health, United States, 2013: With Special Feature on Prescription Drugs. Hyattsville, MD; 2014.

American Cancer Society, Inc., Surveillance Research, 2015

**Table 3. Risk factors for in situ and invasive ductal breast cancer among postmenopausal women**

	In Situ Disease Relative Risk*	Invasive Disease Relative Risk*
<b>Reproductive risk factors</b>		
Age at menarche		
<12 years	1.02	1.03
12-13 years	1.00 (ref.)	1.00 (ref.)
≥14 years	0.99	0.98
Number of children		
0	1.00 (ref.)	1.00 (ref.)
1	0.81 <sup>†</sup>	0.87 <sup>†</sup>
2	0.76 <sup>†</sup>	0.81 <sup>†</sup>
≥3	0.66 <sup>†</sup>	0.71 <sup>†</sup>
Age at first birth		
<20 years	1.00 (ref.)	1.00 (ref.)
20-24 years	1.07 <sup>†</sup>	1.01
25-29 years	1.15 <sup>†</sup>	1.11 <sup>†</sup>
≥30 years	1.31 <sup>†</sup>	1.24 <sup>†</sup>
Age at menopause <sup>‡</sup>		
<45 years	0.64 <sup>†</sup>	0.76 <sup>†</sup>
45-49 years	0.77 <sup>†</sup>	0.88 <sup>†</sup>
50-54 years	1.00 (ref.)	1.00 (ref.)
≥55 years	1.08	1.24 <sup>†</sup>
<b>Nonreproductive risk factors</b>		
BMI (kg/m <sup>2</sup> ) <sup>‡</sup>		
<25	0.98	0.82
25-29.9	1.00 (ref.)	1.00 (ref.)
≥30	0.99	1.18
Family history of breast cancer		
Yes	1.57 <sup>†</sup>	1.60 <sup>†</sup>
No	1.00 (ref.)	1.00 (ref.)
Alcohol intake (units/day)		
Non-drinkers	0.97	1.00
<0.3	1.00 (ref.)	1.00 (ref.)
0.3-0.9	0.96	1.05 <sup>†</sup>
1.0-2.0	0.97	1.12 <sup>†</sup>
>2.0	1.11	1.28 <sup>†</sup>
MHT use		
Never	1.00 (ref.)	1.00 (ref.)
Past	1.14 <sup>†</sup>	1.07 <sup>†</sup>
Current	1.51 <sup>†</sup>	1.67 <sup>†</sup>

BMI: body mass index; MHT: menopausal hormone therapy. \*Relative risk compares the risk of disease among people with a particular "exposure" to the risk among people without that exposure. If the relative risk is more than 1.00, then the risk is higher among exposed than unexposed. Relative risks less than 1.00 indicate a protective effect. <sup>†</sup>Relative risk is significant (p<0.05). <sup>‡</sup>Among never users of MHT.

**Source:** Adapted with permission from Reeves GK, Pirie K, Green J, et al. Comparison of the effects of genetic and environmental risk factors on in situ and invasive ductal breast cancer. *Int J Cancer*. 2012; 131(4):930-7.

American Cancer Society, Inc., Surveillance Research, 2015

Women who undergo mastectomy for DCIS may also elect to have breast reconstruction. In a population-based study of DCIS patients in Southern California who were treated with mastectomy between 2003 and 2007, nearly half (46%) had immediate reconstruction, with higher utilization of reconstruction among younger women, non-Hispanic white women, and privately insured women.<sup>40</sup>

For women with ER+ DCIS, hormonal therapy with tamoxifen is associated with a significantly decreased risk of invasive cancer and DCIS in either breast.<sup>41, 42</sup> Treatment guidelines in the US recommend tamoxifen as an option for women with ER+ DCIS treated with either BCS or unilateral mastectomy to reduce their risk of developing another DCIS lesion or invasive breast cancer as long as they do not have specific contraindications (e.g., history of deep vein thrombosis, pulmonary embolism, or uterine cancer).<sup>43</sup> Clinical trials are currently underway to determine whether medications called aromatase inhibitors can be used as an alternative to tamoxifen in postmenopausal patients.<sup>44</sup>

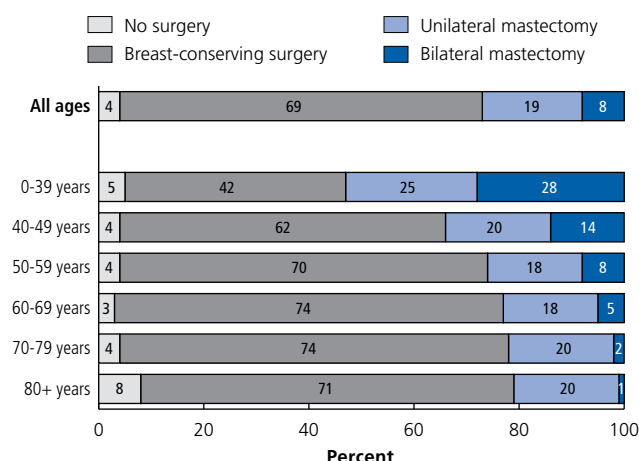
Several initiatives are underway to identify additional biomarkers that can improve prediction of the risk of recurrence to better tailor treatment to risk. For example, the Oncotype DCIS Score, which measures the expression of a group of cancer genes in the tumor tissue, has been developed and validated as a predictor of recurrence in selected patients treated with BCS without radiation.<sup>45</sup> So far, however, it has not been studied to see how well it predicts the benefit of radiation. Although HER2 status is not routinely measured, a clinical trial is currently evaluating whether treatment with trastuzumab in addition to BCS and radiation therapy is beneficial for high-risk HER2+ DCIS patients.<sup>46</sup>

## Treatment patterns for DCIS

Among women of all ages diagnosed with a primary DCIS in the US from 2007 to 2011, the most common surgical treatment was BCS (69%), followed by unilateral mastectomy (19%), bilateral mastectomy (8%), and no surgery (4%) (Figure 6). Patterns of surgical treatment showed only modest variation by race/ethnicity (data not shown). The majority of women (68%) who received BCS also received radiation therapy (Table 4). The percentage of women who had breast reconstruction was 33% for those who had unilateral mastectomy and 62% for those with bilateral mastectomy. Only 39% of patients with ER+DCIS were noted to have received hormonal therapy (e.g., tamoxifen) in registry records (Table 4). However, cancer registry data are less complete for chemotherapy and hormonal treatment than for other forms of therapy, so the actual proportion may be higher.

Age at diagnosis was strongly associated with the type of treatment received (Figure 6). Younger women were substantially more likely to undergo mastectomy. In fact, the majority of breast cancer patients younger than 40 underwent mastectomy (53%), opting for bilateral mastectomy slightly more often than

**Figure 6. Treatment patterns for primary ductal carcinoma in situ patients by age at diagnosis, US, 2007-2011**



Based on patients with known treatment information and excludes treatment coded Surgery, not otherwise specified (NOS).

Source: NAACCR, 2014.

American Cancer Society, Inc., Surveillance Research, 2015

unilateral mastectomy (28% versus 25%, respectively). The proportion of DCIS patients undergoing bilateral mastectomy has increased over the past 2 decades, from 2% of patients in 1998 to 8% in 2011. Women ages 40-69 were most likely to receive radiation therapy after BCS and hormone therapy for ER+ breast cancer (Table 4).

Although NCCN treatment guidelines do not formally stratify by age, it is one of the factors considered in the University of Southern California/Van Nuys Prognostic Index, which is used to predict local recurrences for women with DCIS.<sup>47</sup> Clinical trials and population studies of DCIS outcomes generally find higher recurrence rates for younger women (younger than age 50) compared to older women.<sup>48</sup> In addition, younger women have a longer life expectancy and, therefore, a longer opportunity to experience a second breast event and/or multiple diagnostic mammograms and biopsies, which may influence preferences for mastectomy over BCS for younger women.<sup>49</sup>

## What is LCIS?

Lobular carcinoma in situ (LCIS) refers to cells that look like cancer cells growing within the walls of the lobules, the milk-producing glands of the breast. LCIS is not generally thought to be a precursor of invasive cancer. Instead, it is considered a marker for increased risk of developing invasive breast cancer. The exception is a relatively uncommon variant of LCIS known as pleomorphic LCIS, in which the cells look more atypical under the microscope. Pleomorphic LCIS is linked to a higher risk of invasive cancer and is often treated as though it is a cancer precursor.<sup>50</sup>

The strongest evidence that LCIS is more of a risk indicator than a direct cancer precursor comes from registry-based studies. One study of women diagnosed with LCIS from 1973 to 1998 and treated with BCS found that 7% of women developed invasive breast cancer within 10 years, with the increased risk of invasive disease equally distributed between both breasts.<sup>51</sup> Care for women with LCIS emphasizes medical surveillance and risk reduction strategies for both breasts rather than local treatment, such as BCS plus radiation therapy, as is recommended for DCIS patients.

## LCIS incidence and trends

The incidence rate of LCIS was 3.9 per 100,000 women during 2007-2011 (Table 5, page 34), about one-seventh the rate of DCIS. The incidence of LCIS peaks in women ages 50-59 and is higher for non-Hispanic white women compared to other racial and ethnic groups (Table 5, page 34). LCIS is not easily detectable by mammography, but is often detected in biopsies performed to investigate mammographic abnormalities. Thus, like the incidence of DCIS, the incidence of LCIS increased in conjunction with increasing use of mammography from 1992 to 2000. LCIS incidence rates among women ages 50-69 show a pronounced decline beginning around 2002, although the trend is not significant (Figure 7, page 34). This finding is notable because for invasive breast cancer, studies have shown stronger associations between MHT use and lobular than ductal tumors.<sup>52</sup>

## Treatment for LCIS

If LCIS is found when a mammographically suspicious lesion is biopsied, the entire suspicious area is often removed as part of the diagnostic workup. This is usually done to rule out the presence of DCIS or invasive cancer. Generally, however, no attempt is made to remove all of the LCIS. There is some debate about

**Table 4. Use of radiation therapy (RT) and hormone therapy among primary ductal carcinoma in situ patients by age at diagnosis, US, 2007-2011**

	RT among patients receiving BCS	Hormone therapy among patients with ER+ DCIS*
<b>All ages</b>	<b>68%</b>	<b>39%</b>
0-39 years	67%	34%
40-49 years	73%	43%
50-59 years	73%	44%
60-69 years	71%	41%
70-79 years	61%	32%
≥80 years	37%	19%

BCS: breast-conserving surgery; ER+: Estrogen receptor positive. \*Excludes patients with bilateral mastectomy.

Source: NAACCR, 2014.

American Cancer Society, Inc., Surveillance Research, 2015

**Table 5. Lobular carcinoma in situ incidence rates\* by race, ethnicity, and age group, 2007-2011**

Age	All races	Non-Hispanic White	Non-Hispanic Black	Asian and Pacific Islander	Hispanic/Latina
<b>All ages</b>	<b>3.9</b>	<b>4.4</b>	<b>2.6</b>	<b>2.1</b>	<b>2.7</b>
20-39 years	0.6	0.7	0.4	0.5	0.4
40-49 years	9.4	10.8	5.5	6.0	6.6
50-59 years	11.2	12.7	7.2	5.5	7.4
60-69 years	8.6	9.3	6.4	3.5	6.3
70-79 years	6.0	6.5	5.1	2.2	3.6
≥80 years	2.4	2.6	2.0	1.3	1.5

Hispanic origin is not mutually exclusive from Asian/Pacific Islander. Rates for American Indian/Alaska Natives not shown due to sparse data. \*Per 100,000 females and age adjusted to the 2000 US standard population.

Source: NAACCR, 2014.

American Cancer Society, Inc., Surveillance Research, 2015

whether a surgical biopsy is necessary for all women diagnosed with LCIS on core biopsy.<sup>32</sup> Since pure LCIS will not cause any clinical findings, such as a lump or a mammographic abnormality, a follow-up surgical biopsy may be necessary to ensure that the lesion prompting the biopsy has been adequately investigated. Complete removal with negative margins is considered important for the more histologically aggressive pleomorphic LCIS.<sup>32</sup>

Guidelines do not recommend unilateral mastectomy as a standard treatment for LCIS because risk of future breast cancer is equal for both breasts. Bilateral mastectomy may be considered as a risk reduction strategy, especially for women with LCIS and a strong family history of breast cancer. Among US women with a primary LCIS diagnosed during 2007 to 2011, 81% underwent BCS\*\*, 9% had mastectomy (4% unilateral, 5% bilateral), and 11% did not receive surgical treatment (Figure 8). Mastectomy was most common among women younger than age 40, with 9% of LCIS

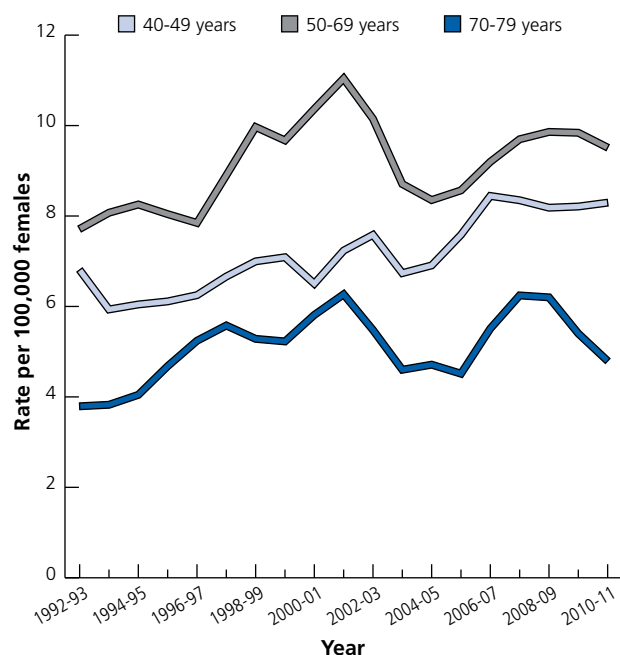
patients in this age group undergoing bilateral mastectomy and 4% undergoing unilateral mastectomy (Figure 8). The proportion of women with LCIS who received mastectomy has increased significantly over time, from 12% in 2000 to 18% in 2009.<sup>53</sup>

Medical surveillance recommendations from the NCCN for women with LCIS include annual mammography and clinical breast exam every 6-12 months.<sup>54</sup> Although the lifetime risk of invasive breast cancer for a woman with LCIS may exceed 20% (depending on the age at diagnosis), the American Cancer Society guidelines do not support routine use of MRI screening for surveillance of women with LCIS because the evidence for its effectiveness as an addition to mammography has not been demonstrated.<sup>37</sup> Both the American Society of Clinical Oncology (ASCO) and NCCN recommend discussing chemoprevention therapy with LCIS patients; tamoxifen is the only option for premenopausal women, and tamoxifen or raloxifene may be recommended for postmenopausal women, depending on other health conditions.<sup>41, 43</sup> ASCO also lists exemestane, an aromatase inhibitor, as an option in postmenopausal women; however, this is not an FDA-approved indication for this drug.

## Conclusion

Although carcinoma in situ is a relatively common diagnosis, it is not as widely known or understood as invasive breast cancer. Many patients may find it difficult to understand the implications of the diagnosis for their health and the advantages and

**Figure 7. Trends in lobular carcinoma in situ incidence rates\* by age, US, 1992-2011**



\*Per 100,000 females, two-year moving averages, age adjusted to the 2000 US standard population, and adjusted for reporting delay.

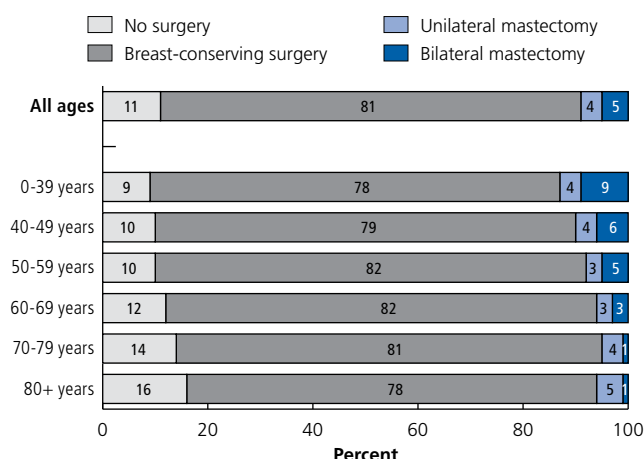
Source: SEER Program, 13 SEER registries, National Cancer Institute, 2014.

American Cancer Society, Inc., Surveillance Research, 2015

\* Coding of surgical procedures includes surgical removal of the involved segment of a breast in the code for "excision or BCS." Although women with DCIS and LCIS are both treated with "excision or BCS," there are some differences in the approach to the two lesions. For DCIS, the presence of negative margins is considered essential, while for LCIS it is not. Thus, women with DCIS may have to have another resection if their surgical margins are not considered adequate. Re-excision is uncommon for LCIS as the primary purpose of the excision is diagnostic rather than therapeutic.



**Figure 8. Treatment patterns for primary lobular carcinoma in situ patients by age at diagnosis, US, 2007-2011**



Based on patients with known treatment information and excludes treatment coded Surgery, NOS. Percents may not sum to 100 due to rounding.

**Source:** Source: NAACCR, 2014.

American Cancer Society, Inc., Surveillance Research, 2015

disadvantages of different treatment options. We hope that this information will be useful to patients who are facing the disease, as well as to friends, family, and others who can provide support and perspective for women who are newly diagnosed and those living after a diagnosis of DCIS or LCIS.

Please see page 9 for information on invasive breast cancer. Additional information can be found in *Breast Cancer Facts & Figures* available at [cancer.org/statistics](http://cancer.org/statistics).

## References

1. Partridge AH, Elmore JG, Saslow D, McCaskill-Stevens W, Schnitt SJ. Challenges in ductal carcinoma in situ risk communication and decision-making: report from an American Cancer Society and National Cancer Institute workshop. *CA Cancer J Clin.* 2012;62: 203-210.
2. Elmore JG, Fenton JJ. Ductal carcinoma in situ (DCIS): raising signposts on an ill-marked treatment path. *J Natl Cancer Inst.* 2012;104: 569-571.
3. Allegra CJ, Aberle DR, Ganschow P, et al. NIH state-of-the-science conference statement: diagnosis and management of ductal carcinoma in situ (DCIS). *NIH Consens State Sci Statements.* 2009;26: 1-27.
4. Rohan TE, Henson DE, Franco EL, Albores-Saavedra J. Cancer Precursors. In: Schottenfeld D, Fraumeni JF, Jr., editors. *Cancer Prevention and Early Detection Third Edition*. New York: Oxford University Press, 2006:21-46.
5. Eusebi V, Feudale E, Foschini MP, et al. Long-term follow-up of in situ carcinoma of the breast. *Seminars in Diagn Path.* 1994;11: 223-235.
6. Erbas B, Provenzano E, Armes J, Gertig D. The natural history of ductal carcinoma in situ of the breast: a review. *Breast Cancer Res Treat.* 2006;97: 135-144.
7. Sanders ME, Schuyler PA, Dupont WD, Page DL. The natural history of low-grade ductal carcinoma in situ of the breast in women treated by biopsy only revealed over 30 years of long-term follow-up. *Cancer.* 2005;103: 2481-2484.

8. Collins LC, Tamimi RM, Baer HJ, Connolly JL, Colditz GA, Schnitt SJ. Outcome of patients with ductal carcinoma in situ untreated after diagnostic biopsy: results from the Nurses' Health Study. *Cancer.* 2005;103: 1778-1784.
9. Allred DC. Ductal carcinoma in situ: terminology, classification, and natural history. *J Natl Cancer Inst Monogr.* 2010;2010: 134-138.
10. Wang SY, Shamliyan T, Virnig BA, Kane R. Tumor characteristics as predictors of local recurrence after treatment of ductal carcinoma in situ: a meta-analysis. *Breast Cancer Res Treat.* 2011;127: 1-14.
11. Bland KI. William Hunter Harridge Lecture: Contemporary management of pre-invasive and early breast cancer. *Am J Surg.* 2011;201: 279-289.
12. Smith RA, Saslow D, Sawyer KA, et al. American Cancer Society guidelines for breast cancer screening: update 2003. *CA Cancer J Clin.* 2003;53: 141-169.
13. Breen N, Gentleman JF, Schiller JS. Update on mammography trends: comparisons of rates in 2000, 2005, and 2008. *Cancer.* 2011;117: 2209-2218.
14. Joslyn SA. Ductal carcinoma in situ: trends in geographic, temporal, and demographic patterns of care and survival. *Breast J.* 2006;12: 20-27.
15. Kerlikowske K. Epidemiology of ductal carcinoma in situ. *J Natl Cancer Inst Monogr.* 2010;2010: 139-141.
16. Virnig BA, Tuttle TM, Shamliyan T, Kane RL. Ductal carcinoma in situ of the breast: a systematic review of incidence, treatment, and outcomes. *J Natl Cancer Inst.* 2010;102: 170-178.
17. Ravdin PM, Cronin KA, Howlader N, et al. The decrease in breast-cancer incidence in 2003 in the United States. *N Engl J Med.* 2007;356: 1670-1674.
18. Farhat GN, Walker R, Buist DS, Onega T, Kerlikowske K. Changes in invasive breast cancer and ductal carcinoma in situ rates in relation to the decline in hormone therapy use. *J Clin Oncol.* 2010;28: 5140-5146.
19. Reeves GK, Pirie K, Green J, Bull D, Beral V. Comparison of the effects of genetic and environmental risk factors on in situ and invasive ductal breast cancer. *Int J Cancer.* 2012;131: 930-937.
20. Claus EB, Stowe M, Carter D. Breast carcinoma in situ: risk factors and screening patterns. *J Natl Cancer Inst.* 2001;93: 1811-1817.
21. Kerlikowske K, Barclay J, Grady D, Sickles EA, Ernster V. Comparison of risk factors for ductal carcinoma in situ and invasive breast cancer. *J Natl Cancer Inst.* 1997;89: 76-82.
22. Luo J, Cochrane BB, Wactawski-Wende J, Hunt JR, Ockene JK, Margolis KL. Effects of menopausal hormone therapy on ductal carcinoma in situ of the breast. *Breast Cancer Res Treat.* 2013;137: 915-925.
23. Bertrand KA, Tamimi RM, Scott CG, et al. Mammographic density and risk of breast cancer by age and tumor characteristics. *Breast Cancer Res.* 2013;15: R104.
24. Hwang ES, Miglioretti DL, Ballard-Barbash R, Weaver DL, Kerlikowske K. Association between breast density and subsequent breast cancer following treatment for ductal carcinoma in situ. *Cancer Epidemiol Biomarkers Prev.* 2007;16: 2587-2593.
25. Vogel VG, Costantino JP, Wickerham DL, et al. Carcinoma in situ outcomes in National Surgical Adjuvant Breast and Bowel Project Breast Cancer Chemoprevention Trials. *J Natl Cancer Inst Monogr.* 2010;2010: 181-186.
26. Correa C, McGale P, Taylor C, et al. Overview of the randomized trials of radiotherapy in ductal carcinoma in situ of the breast. *J Natl Cancer Inst Monogr.* 2010;2010: 162-177.
27. Punglia RS, Burstein HJ, Weeks JC. Radiation therapy for ductal carcinoma in situ: a decision analysis. *Cancer.* 2012;118: 603-611.

28. Clarke M, Collins R, Darby S, et al. Effects of radiotherapy and of differences in the extent of surgery for early breast cancer on local recurrence and 15-year survival: an overview of the randomised trials. *Lancet*. 2005;366: 2087-2106.
29. Gilleard O, Goodman A, Cooper M, Davies M, Dunn J. The significance of the Van Nuys prognostic index in the management of ductal carcinoma in situ. *World J of Surg Oncol*. 2008;6: 61.
30. Kim T, Park HK, Lee KH, et al. Is radiotherapy necessary for intermediate risk ductal carcinoma in situ after breast conserving surgery? *SpringerPlus*. 2014;3: 405.
31. MacAusland SG, Hepel JT, Chong FK, et al. An attempt to independently verify the utility of the Van Nuys Prognostic Index for ductal carcinoma in situ. *Cancer*. 2007;110: 2648-2653.
32. National Comprehensive Cancer Network. Breast Cancer (Version 3.2014). Available from URL: [http://www.nccn.org/professionals/physician\\_gls/pdf/breast.pdf](http://www.nccn.org/professionals/physician_gls/pdf/breast.pdf) Accessed October 1, 2014.
33. Fisher B, Costantino J, Redmond C, et al. Lumpectomy compared with lumpectomy and radiation therapy for the treatment of intraductal breast cancer. *N Engl J Med*. 1993;328: 1581-1586.
34. Zujewski JA, Harlan LC, Morrell DM, Stevens JL. Ductal carcinoma in situ: trends in treatment over time in the US. *Breast Cancer Res Treat*. 2011;127: 251-257.
35. Hwang ES. The impact of surgery on ductal carcinoma in situ outcomes: the use of mastectomy. *J Natl Cancer Inst Monogr*. 2010;2010: 197-199.
36. Gao X, Fisher SG, Emami B. Risk of second primary cancer in the contralateral breast in women treated for early-stage breast cancer: a population-based study. *Int J Radiat Oncol Biol Phys*. 2003;56: 1038-1045.
37. Saslow D, Boetes C, Burke W, et al. American Cancer Society guidelines for breast screening with MRI as an adjunct to mammography. *CA Cancer J Clin*. 2007;57: 75-89.
38. Tuttle TM, Jarosek S, Habermann EB, et al. Increasing rates of contralateral prophylactic mastectomy among patients with ductal carcinoma in situ. *J Clin Oncol*. 2009;27: 1362-1367.
39. Hawley ST, Jagsi R, Morrow M, et al. Social and clinical determinants of contralateral prophylactic mastectomy. *JAMA Surgery*. 2014; doi 10.
40. Kruper L, Xu X, Henderson K, Bernstein L. Disparities in reconstruction rates after mastectomy for ductal carcinoma in situ (DCIS): patterns of care and factors associated with the use of breast reconstruction for DCIS compared with invasive cancer. *Ann Surg Oncol*. 2011;18: 3210-3219.
41. Allred DC, Anderson SJ, Paik S, et al. Adjuvant tamoxifen reduces subsequent breast cancer in women with estrogen receptor-positive ductal carcinoma in situ: a study based on NSABP protocol B-24. *J Clin Oncol*. 2012;30: 1268-1273.
42. Eng-Wong J, Costantino JP, Swain SM. The impact of systemic therapy following ductal carcinoma in situ. *J Natl Cancer Inst Monogr*. 2010;2010: 200-203.
43. Visvanathan K, Hurley P, Bantug E, et al. Use of pharmacologic interventions for breast cancer risk reduction: American Society of Clinical Oncology clinical practice guideline. *J Clin Oncol*. 2013;31: 2942-2962.
44. Dixon JM, Jane Macaskill E. Endocrine therapy in DCIS: how do we proceed? *Breast J*. 2012;18: 295-298.
45. Solin LJ, Gray R, Baehner FL, et al. A multigene expression assay to predict local recurrence risk for ductal carcinoma in situ of the breast. *J Natl Cancer Inst*. 2013;105: 701-710.
46. Siziopikou KP, Anderson SJ, Cobleigh MA, et al. Preliminary results of centralized HER2 testing in ductal carcinoma in situ (DCIS): NSABP B-43. *Breast Cancer Res Treat*. 2013;142: 415-421.
47. Silverstein MJ, Lagios MD. Choosing treatment for patients with ductal carcinoma in situ: fine tuning the University of Southern California/Van Nuys Prognostic Index. *J Natl Cancer Inst Monogr*. 2010;2010: 193-196.
48. Shamliyan T, Wang SY, Virnig BA, Tuttle TM, Kane RL. Association between patient and tumor characteristics with clinical outcomes in women with ductal carcinoma in situ. *J Natl Cancer Inst Monogr*. 2010;2010: 121-129.
49. Nekhlyudov L, Habel LA, Achacoso N, et al. Ten-year risk of diagnostic mammograms and invasive breast procedures after breast-conserving surgery for DCIS. *J Natl Cancer Inst*. 2012;104: 614-621.
50. Pieri A, Harvey J, Bundred N. Pleomorphic lobular carcinoma in situ of the breast: Can the evidence guide practice? *World J of Clin Onco*. 2014;5: 546-553.
51. Chuba PJ, Hamre MR, Yap J, et al. Bilateral risk for subsequent breast cancer after lobular carcinoma-in-situ: analysis of Surveillance, Epidemiology, and End Results data. *J Clin Oncol*. 2005;23: 5534-5541.
52. Li CI, Daling JR, Haugen KL, Tang MT, Porter PL, Malone KE. Use of menopausal hormone therapy and risk of ductal and lobular breast cancer among women 55-74 years of age. *Breast Cancer Res Treat*. 2014;145: 481-489.
53. Portschoy PR, Marmor S, Nzara R, Virnig BA, Tuttle TM. Trends in incidence and management of lobular carcinoma in situ: a population-based analysis. *Ann Surg Oncol*. 2013;20: 3240-3246.
54. National Comprehensive Cancer Network. Breast Cancer Screening and Diagnosis (Version 1.2014). Available from URL: [http://www.nccn.org/professionals/physician\\_gls/pdf/breast-screening.pdf](http://www.nccn.org/professionals/physician_gls/pdf/breast-screening.pdf). Accessed October 1, 2014.

# Cancer Disparities

An overarching goal of the American Cancer Society is to eliminate disparities in the cancer burden among different segments of the US population, defined in terms of socioeconomic status (income, education, insurance status, etc.), race/ethnicity, geographic location, sex, and sexual orientation. The causes of health disparities within each of these groups are complex and include interrelated social, economic, cultural, environmental, and health system factors. However, disparities predominantly arise from inequities in work, wealth, education, housing, and overall standard of living, as well as social barriers to high-quality cancer prevention, early detection, and treatment services.

## Socioeconomic Status

People with lower socioeconomic status (SES) have disproportionately higher cancer death rates than those with higher SES, regardless of demographic factors such as race/ethnicity. For example, cancer mortality rates among both black and non-Hispanic white men with 12 or fewer years of education are almost 3 times higher than those of college graduates for all cancers combined and 4–5 times higher for lung cancer.

People with lower SES have higher cancer incidence rates because they are more likely to engage in behaviors that increase cancer risk, such as using tobacco, not being physically active, and having an unhealthy diet. This is largely because of marketing strategies that target these populations, but environmental and/or community factors that provide few opportunities for physical activity and access to fresh fruits and vegetables also contribute. In addition to a higher burden of disease, these patients are less likely to survive after a cancer diagnosis because the disease is often detected at an advanced stage and because they are less likely to receive standard treatment. Barriers to preventive care, early detection, and optimal treatment include inadequate health insurance; financial, structural, and personal barriers to health care; and low literacy rates. For example, stage II colorectal cancer patients with private insurance have better survival rates than stage I patients who are uninsured. Progress in reducing cancer death rates has been slower in people with lower SES because of the delay in the dissemination of improved early detection and treatment in this marginalized population. See the Special Sections in *Cancer Facts & Figures 2011* and *Cancer Facts & Figures 2008*, available online at [cancer.org](http://cancer.org), for more information about the relationship between SES and cancer.

## Racial and Ethnic Minorities

Disparities in the cancer burden among racial and ethnic minorities largely reflect obstacles to receiving health care services related to cancer prevention, early detection, and high-quality

treatment, with poverty as the overriding factor. According to the US Census Bureau, in 2012, 27% of blacks and 26% of Hispanics/Latinos lived below the poverty line, compared to 10% of non-Hispanic whites. Moreover, 19% of blacks and 29% of Hispanics/Latinos were uninsured, compared to 11% of non-Hispanic whites.

Discrimination is another factor that contributes to racial/ethnic disparities in cancer mortality. Racial and ethnic minorities tend to receive lower-quality health care than whites even when insurance status, age, severity of disease, and health status are comparable. Social inequalities, including communication barriers and provider assumptions, can affect interactions between patients and physicians and contribute to miscommunication and/or delivery of substandard care.

In addition to poverty and social discrimination, cancer occurrence in a population may also be influenced by cultural and/or inherited factors that decrease or increase risk. For example, Hispanic women have a lower risk of breast cancer, in part because they tend to begin having children at a younger age, which decreases breast cancer risk. Individuals who maintain a primarily plant-based diet or do not use tobacco because of cultural or religious beliefs have a lower risk of many cancers. Populations that include a large number of recent immigrants, such as Hispanics and Asians, have higher rates of cancers related to infectious agents (e.g., stomach, liver) because of higher prevalence of infection in immigrant countries of origin. Genetic factors may also explain some differences in cancer incidence. For example, women from population groups with a higher frequency of mutations in the breast cancer susceptibility genes *BRCA1* and *BRCA2*, such as women of Ashkenazi Jewish descent, have an increased risk of breast and ovarian cancer. Genetic factors may also play a role in the elevated risk of prostate cancer among black men and the incidence of more aggressive forms of breast cancer in black women. However, genetic differences associated with race or ethnicity make only a minor contribution to the disparate cancer burden between populations.

The following is a brief overview of the cancer burden for the four major minority groups in the US. It is important to note that although cancer data in the US are primarily reported in terms of broad racial and ethnic categories, these populations are very heterogeneous with substantial variation in the cancer burden within each group. For example, a recent study of Asian American populations found that incidence rates for lung cancer in Vietnamese women were 2½-fold higher than those in Asian Indian and Pakistani women. Similarly, overall cancer death rates among American Indian/Alaska Native men are more than 2-fold higher in the Northern Plains than in the Southwest.

**Non-Hispanic Black:** Non-Hispanic black (henceforth black) men and women are more likely to die from cancer than any racial or ethnic group. Compared to Asian/Pacific Islanders,

## Incidence and Death Rates\* for Selected Cancers by Race and Ethnicity, US, 2007-2011

Incidence	Non-Hispanic White	Non-Hispanic Black	Asian and Pacific Islander	American Indian and Alaska Native <sup>†</sup>	Hispanic/Latino
All sites					
Male	540.8	606.2	322.3	432.2	420.9
Female	435.8	406.3	283.7	368.3	330.1
Breast (female)	127.6	123.0	86.0	91.7	91.6
Colon & rectum					
Male	49.2	61.9	39.9	50.9	45.9
Female	37.4	45.6	30.0	41.1	31.6
Kidney & renal pelvis					
Male	21.6	24.1	10.7	30.1	20.6
Female	11.3	12.9	5.0	17.8	11.6
Liver & intrahepatic bile duct					
Male	8.9	16.0	21.2	18.4	19.1
Female	3.0	4.6	8.0	8.6	6.9
Lung & bronchus					
Male	81.3	95.4	48.0	68.5	45.0
Female	59.3	51.7	28.0	52.5	26.3
Prostate	133.2	219.8	72.5	97.9	120.2
Stomach					
Male	7.8	15.4	15.3	12.0	13.8
Female	3.5	8.1	8.6	6.5	7.9
Uterine cervix	7.1	10.2	6.4	9.5	10.5
<b>Mortality</b>					
All sites					
Male	214.0	275.5	131.0	190.0	150.1
Female	151.2	173.0	91.5	135.2	99.9
Breast (female)	22.2	31.4	11.3	15.2	14.5
Colon & rectum					
Male	18.7	28.4	13.1	19.2	15.8
Female	13.2	18.9	9.5	15.6	9.9
Kidney & renal pelvis					
Male	5.9	5.8	3.0	9.5	5.1
Female	2.6	2.7	1.3	4.4	2.3
Liver & intrahepatic bile duct					
Male	7.3	12.4	14.5	13.8	12.6
Female	3.0	4.3	6.0	6.0	5.5
Lung & bronchus					
Male	63.9	77.5	34.7	50.0	30.5
Female	42.1	37.4	18.4	32.4	14.0
Prostate	20.7	49.8	10.0	21.2	18.5
Stomach					
Male	3.8	9.8	8.3	7.0	7.5
Female	1.9	4.6	4.8	3.8	4.2
Uterine cervix	2.0	4.2	1.8	3.4	2.8

Hispanic origin is not mutually exclusive from Asian/Pacific Islander or American Indian/Alaska Native. \*Rates are per 100,000 population and age adjusted to the 2000 US standard population. †Data based on Indian Health Service Contract Health Service Delivery Area (CHSDA) counties. Incidence rates exclude data from Kansas.

**Source:** Incidence – North American Association of Central Cancer Registries, 2014. Mortality – US mortality data, National Center for Health Statistics, Centers for Disease Control and Prevention.

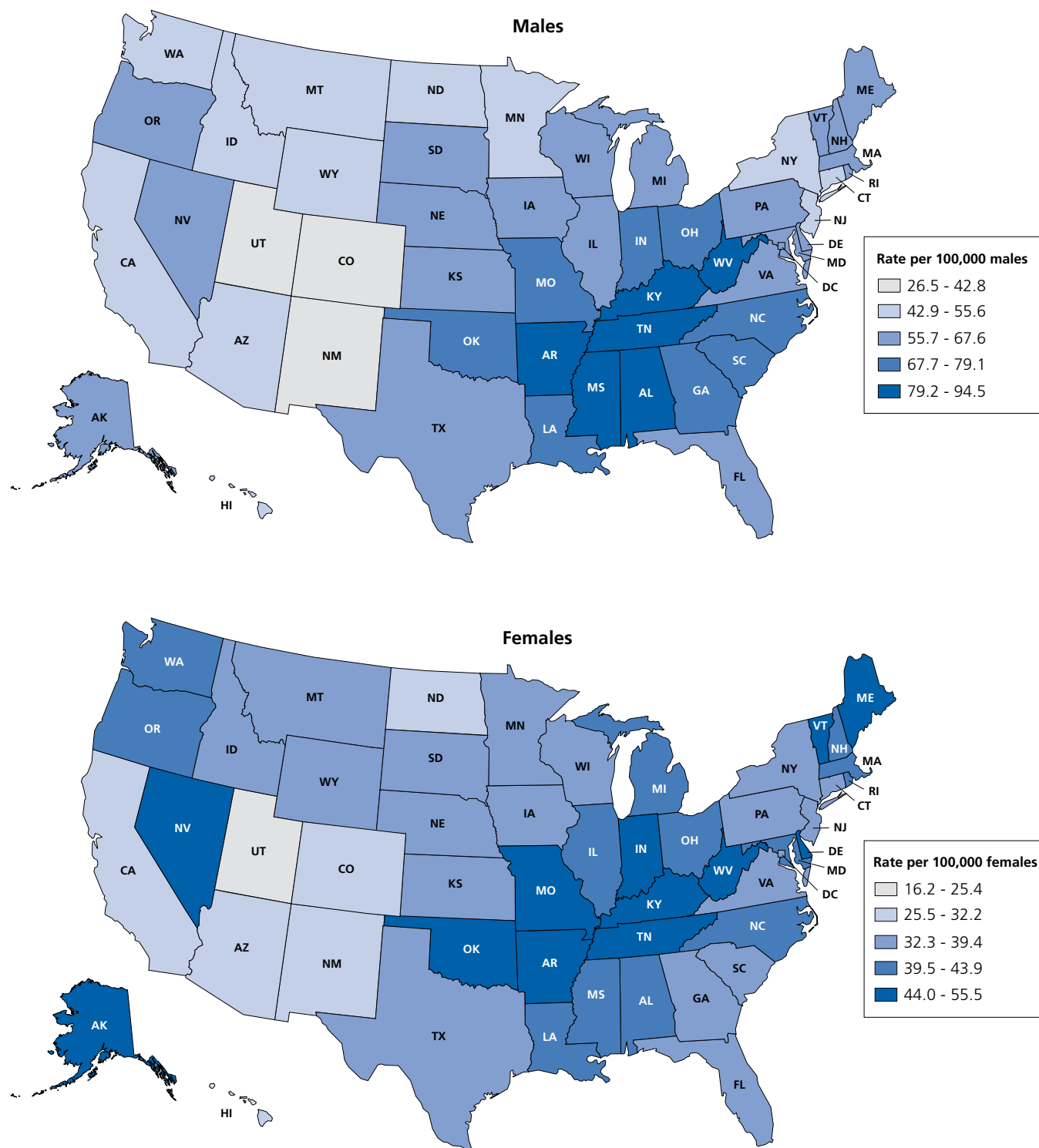
American Cancer Society, Inc., Surveillance Research, 2015

who are least likely to die from cancer, the death rate in blacks is about double. Compared to non-Hispanic whites, the death rate for cancer among blacks is 29% higher in men and 14% higher in

women. Black men have higher incidence and death rates than non-Hispanic whites for every cancer type in the table above except for kidney cancer mortality. The largest disparity is for



## Geographic Patterns in Lung Cancer Death Rates\* by State, US, 2007-2011



\*Rates adjusted to the 2000 US standard population.

**Source:** US Mortality Data, National Center for Health Statistics, Centers for Disease Control and Prevention.

American Cancer Society, Surveillance Research, 2015

stomach and prostate cancers, for which death rates are about 2½-fold higher in blacks. In addition, the death rate for cervical cancer in black women is double that in non-Hispanic white women. Notably, black women have a lower breast cancer incidence rate, but a higher breast cancer death rate, than non-Hispanic white women. See *Cancer Facts & Figures for African Americans*, available online at [cancer.org/statistics](http://cancer.org/statistics), for more information on cancer in black Americans.

**Hispanic:** Hispanics have the lowest rates of tobacco-related cancers, such as lung and oral cavity, because of historically low smoking prevalence, but among the highest rates for cancers associated with infection, such as liver, stomach, and uterine cervix. For example, cervical cancer incidence rates among Hispanic women are the highest of any racial/ethnic group, 50% higher than those among non-Hispanic whites. Incidence rates of liver and stomach cancers are about twice as high in Hispanics as in non-Hispanic whites. These disparities reflect a higher prevalence of infection with human papillomavirus (cervical cancer), hepatitis B virus (liver cancer), and the bacterium *H. pylori* (stomach cancer) in immigrant countries of origin. See *Cancer Facts & Figures for Hispanics/Latinos*, available online at [cancer.org/statistics](http://cancer.org/statistics), for more information about cancer in Hispanics.

**Asian and Pacific Islander:** Compared to other racial/ethnic groups, Asian and Pacific Islanders (APIs) have the lowest overall cancer incidence and mortality rates, as shown in the table on page 38. However, similar to Hispanics, this population has among the highest rates for cancers of the liver and stomach due to a higher prevalence of infection with hepatitis B virus and *H. pylori*, respectively. Liver cancer incidence rates among APIs are about 2½-fold higher than those among non-Hispanic whites, while death rates are about double. In contrast to Hispanics, APIs overall have the lowest cervical cancer incidence and mortality rates of all major racial/ethnic groups. However, Laotian and Kampuchean (Cambodian) women have very high rates of cervical cancer, approximately 2½ times higher than non-Hispanic white women and 50% higher than Hispanic women, illustrating the substantial heterogeneity within broad ethnic groups.

**American Indian and Alaska Native:** American Indians and Alaska Natives (AIANs) have the highest kidney cancer incidence and death rates of any racial or ethnic population by far – 3 times higher than those among APIs and about 50% higher than those among the remaining subpopulations in the table (page 38). Rates are highest among AIAN populations in the Northern and Southern Plains, while they are more similar to whites in the East and the Pacific Coast region. Differences in the prevalence of smoking, obesity, and hypertension likely contribute to this disparity. Cancer information for American Indians and Alaska Natives is known to be incomplete because of racial misclassification in medical and death records. Although efforts have been made to collect more accurate information through linkage with the Indian Health Service records, available statistics probably do not represent the true cancer burden in this population.

## Geographic Variability

Cancer rates in the US vary by geographic area, with larger differences for some cancer sites than others. Lung cancer, for example, shows the most striking variation by state (figure, page 39). Lung cancer death rates are more than 3-fold higher in Kentucky (95 and 56 per 100,000 in men and women, respectively) – the state with the highest rates – than in Utah (27 and 16 per 100,000 in men and women, respectively), which has the lowest rates. These differences reflect the substantial historic variation in smoking prevalence among states, which continues today. For example, smoking prevalence in 2013 ranged from 13% in California to 27% in West Virginia. Some of this difference reflects state tobacco control policies. Geographic variations in cancer occurrence also reflect differences in environmental exposures, socioeconomic factors related to population demographics, and screening behaviors.

See *Cancer Facts & Figures 2011*, Special Section, available online at [cancer.org](http://cancer.org), for information about cancer disparities. For information about American Cancer Society advocacy efforts dedicated to reducing the cancer burden among minority and medically underserved populations, see “Fighting Back” on page 48 of this report.

## The Global Fight against Cancer

The ultimate mission of the American Cancer Society is to eliminate cancer as a major health problem. Because cancer knows no boundaries, this mission extends around the world. Cancer is an enormous global health burden, touching every region and socioeconomic level. Today, cancer accounts for about 1 in every 7 deaths worldwide – more than HIV/AIDS, tuberculosis, and malaria combined. In 2012, there were an estimated 14.1 million

cases of cancer diagnosed around the world and 8.2 million cancer deaths. More than 60% of cancer deaths occur in low- and middle-income countries, many of which lack the medical resources and health systems to support the disease burden. Moreover, the global cancer burden is growing at an alarming pace; in 2030 alone, about 21.7 million new cancer cases and 13.0 million cancer deaths are expected to occur, simply due to the

growth and aging of the population. The future burden may be further increased by the adoption of behaviors and lifestyles associated with economic development and urbanization (e.g., smoking, poor diet, physical inactivity, and reproductive patterns) in low- and middle-income countries. Tobacco use is a major cause of the increasing global burden of cancer as the number of smokers worldwide continues to grow.

## Worldwide Tobacco Use

Tobacco-related diseases are the most preventable cause of death worldwide, responsible for the deaths of approximately half of all long-term tobacco users.

- Tobacco use killed 100 million people in the 20th century and will kill 1 billion people in the 21st century if current trends continue.
- Each year, tobacco use is responsible for almost 6 million premature deaths, 80% of which are in low- and middle-income countries; by 2030, this number is expected to increase to 8 million.
- Between 2002 and 2030, tobacco-attributable deaths are expected to decrease by 9% in high-income countries, while increasing by 100% (from 3.4 million to 6.8 million) in low- and middle-income countries.
- In 2012, an estimated 1.6 million people worldwide died from lung cancer, which is primarily caused by tobacco smoking.
- In addition to lung cancer, tobacco use causes cancers of the oral cavity and pharynx, esophagus, stomach, colorectum, liver, pancreas, larynx, uterine cervix, ovary, urinary bladder, and kidney, as well as myeloid leukemia.

The first global public health treaty, the Framework Convention on Tobacco Control (FCTC), was unanimously adopted by the World Health Assembly on May 21, 2003, and subsequently entered into force as a legally binding accord for all ratifying states on February 27, 2005. The purpose of the treaty is to fight the devastating health and economic effects of tobacco on a global scale by requiring parties to adopt a comprehensive range of tobacco control measures. These include increases in cigarette excise taxes, banning smoking in public places, and adding warning labels with the health hazards of smoking on cigarette packages. As of August 2014, 179 out of 196 eligible countries have ratified or acceded to the treaty, representing approximately 89% of the world's population.

## The Role of the American Cancer Society

With more than a century of experience in cancer control, the American Cancer Society is uniquely positioned to help in leading the global fight against cancer and tobacco by assisting and empowering the world's cancer societies and anti-tobacco advocates. The Society's Global Health and Intramural Research

departments are raising awareness about the growing global cancer burden and promoting evidence-based cancer and tobacco control programs.

The Society has established key focus areas to help reduce the global burden of cancer, including global grassroots policy and awareness, tobacco control, cancer screening and vaccination for women and girls, access to pain relief, and the support of cancer registration in low- and middle-income countries.

### **Make cancer control a political and public health priority.**

Noncommunicable diseases (NCDs) such as cancer, heart disease, and diabetes account for about 65% of the world's deaths. Although 67% of these deaths occur in low- and middle-income countries, less than 3% of private and public health funding is allocated to prevent and control NCDs in these areas. In September 2011, world leaders gathered at a special United Nations High-level Meeting and adopted a Political Declaration that elevates cancer and other NCDs on the global health and development agenda and includes key commitments to address these diseases. In 2012, the decision-making body of the WHO approved a resolution calling for a 25% reduction in premature deaths from NCDs by 2025 (also known as 25 by 25). This ambitious goal set the stage for the adoption of a comprehensive framework aimed at monitoring NCD risk factors (e.g., smoking prevalence) and indicators of increased access to breast and cervical cancer screening, palliative care, and vaccination coverage. To maintain the momentum for making cancer and other NCDs a global priority, the Society collaborates with key partners, including the NCD Alliance, the Union for International Cancer Control (UICC), the American Heart Association, and the American Diabetes Association.

### **Reduce tobacco use, with a particular focus on sub-Saharan Africa.**

Through an \$8 million (USD) grant received from the Bill & Melinda Gates Foundation in 2010, the Society and its partners, the Africa Tobacco Control Alliance, the Framework Convention Alliance, the Campaign for Tobacco-Free Kids, and the International Union Against Tuberculosis and Lung Disease, support and assist national governments and civil societies in Africa to implement tobacco control policies such as advertising bans, tobacco tax increases, graphic warning labels, and the promotion of smoke-free environments.

### **Increase awareness about the global cancer burden.**

The Society continues to work with global partners to increase awareness about the growing global cancer and tobacco burdens and their impact on low- and middle-income countries. In addition to print publications, the Society provides cancer information to millions of individuals throughout the world on its cancer.org website. In 2014, 40% of visits to the website came from outside the US. Information is currently available in English, Spanish, Chinese, Bengali, Hindi, Korean, Urdu, and Vietnamese. For more information on the global cancer burden,

visit the Society's Global Health program website at [cancer.org/international](http://cancer.org/international) and [global.cancer.org](http://global.cancer.org) and see the following Intramural Research program publications available on [cancer.org](http://cancer.org) and [tobaccoatlas.org](http://tobaccoatlas.org):

*Global Cancer Facts & Figures*

*The Tobacco Atlas, Fourth Edition*

*The Cancer Atlas, Second Edition*

## The American Cancer Society

In 1913, 10 physicians and 5 laypeople founded the American Society for the Control of Cancer. Its purpose was to raise awareness about cancer symptoms, treatment, and prevention; to investigate the causes of cancer; and to compile cancer statistics. Later renamed the American Cancer Society, Inc., the organization now works with its nearly 3 million volunteers to save lives and create a world with less cancer by helping people stay well and get well, by finding cures, and by fighting back against the disease. More than a century later, the Society is making remarkable progress in cancer prevention, early detection, treatment, and patient quality of life. The overall cancer death rate has dropped 22% since the early 1990s, and the 5-year survival rate is now 68%, up from 49% in the 1970s.

### How the American Cancer Society is Organized

The American Cancer Society, Inc., is a 501(c)(3) nonprofit corporation governed by a Board of Directors that sets policy, develops and approves an enterprise-wide strategic plan and related resource allocation, and is responsible for the performance of the organization as a whole, with the advice and support of regionally based volunteer boards.

The Society's structure includes a central corporate office in Atlanta, Georgia, regional offices supporting 11 geographic Divisions, and more than 900 local offices in those regions. The corporate office is responsible for overall strategic planning; corporate support services such as human resources, financial management, IT, etc.; development and implementation of global and nationwide endeavors such as our groundbreaking research program, our global program, and our 24-hour call center; and provides technical support and materials to regional and local offices for local delivery.

With a presence in more than 5,000 communities, the American Cancer Society fights for every life threatened by every cancer in every community. Our regional and local offices are organized to engage communities in the cancer fight, delivering lifesaving programs and services and raising money at the local level. Offices are strategically located around the country in an effort to maximize the impact of our efforts and be as efficient as possible with the money donated to the Society to fight cancer and save lives.

### Volunteers

As a global grassroots force, the Society relies on the strength of nearly 3 million dedicated volunteers. From leadership volunteers who set strategy and policy to members of the community who organize special events, patient support, and education programs, Society volunteers, supported by professional staff, drive every part of our mission. The Society's vast array of volunteer opportunities empowers people from every community to play a role in saving lives, while they fulfill their own.

### How the American Cancer Society Saves Lives

The American Cancer Society is working relentlessly to save lives from cancer by helping people stay well and get well, by finding cures, and by fighting back against the disease.

### Helping People Stay Well

The American Cancer Society provides information that empowers people to take steps that help them prevent cancer or find it early, when it is most treatable.

### Prevention

The **Quit For Life**® Program is the nation's leading tobacco cessation program, offered by 27 states and more than 675 employers and health plans throughout the US. A collaboration between the American Cancer Society and Alere Wellbeing, the program is built on the organizations' more than 35 years of combined experience in tobacco cessation. The Quit For Life Program employs an evidence-based combination of physical, psychological, and behavioral strategies to enable participants to take responsibility for and overcome their addiction to tobacco. A critical mix of medication support, phone-based cognitive behavioral coaching, text messaging, web-based learning, and support tools produces an average quit rate of 46%, making the program 9 times more effective than quitting without support.

More than 3 million new cases of skin cancer will be diagnosed in the US this year. That's why the American Cancer Society and other members of the National Council on Skin Cancer Prevention have designated the Friday before Memorial Day as Don't Fry Day. The Society promotes skin cancer prevention and awareness educational messages in support of Don't Fry Day and year-round.



The Society also offers many products to employers and other systems to help their employees stay well and reduce their cancer risk, too. These include:

- The **FreshStart**® group-based tobacco cessation counseling program, which is designed to help employees plan a successful quit attempt by providing essential information, skills for coping with cravings, and social support
- **The content subscription service**, a free electronic toolkit subscription offered by the Society to employers that support the health and wellness needs of employees with information about cancer prevention and early detection, as well as support services and resources for those facing the disease
- **Healthy Living**, a monthly electronic newsletter produced by the American Cancer Society that teaches the importance of making healthy lifestyle choices. The e-newsletter focuses on exercising, eating better, and maintaining a healthy weight. *Healthy Living* is available in both English and Spanish, and the content has been edited by the Society's scientific staff to ensure that the most up-to-date and accurate information is being provided.
- **Assessment and consulting**, which surveys a company's health and wellness policies and practices and recommends evidence-based strategies that help build a healthier workforce by providing a combination of health care benefits, proactive company policies, and wellness-oriented programs
- The 10-week **Active For Life**™ online program, which uses evidence-based practices like individual goal-setting, social support, and frequent logging of activity to help employees become more physically active on a regular basis
- **Tobacco Policy Planner**, a free online assessment of company policies, benefits, and programs related to tobacco control. Following the completion of the survey, the company receives a detailed report that includes information needed to help create new – or enhance existing – workplace tobacco policies, programs, and benefits. The resource can assist employers in creating a safe, tobacco-free environment that enhances employee well-being while improving the company's bottom line.

For the majority of Americans who do not smoke, the most important ways to reduce cancer risk are to maintain a healthy weight, be physically active on a regular basis, and eat a mostly plant-based diet, consisting of a variety of vegetables and fruit, whole grains, and limited amounts of red and processed meats. The Society publishes guidelines on nutrition and physical activity for cancer prevention in order to review the accumulating scientific evidence on diet and cancer; to synthesize this evidence into clear, informative recommendations for the general public; to promote healthy individual behaviors and environments that support healthy eating and physical activity; and, ultimately, to reduce cancer risk. These guidelines form the foundation for the Society's communication, worksite, school,

and community strategies designed to encourage and support people in making healthy lifestyle behavior choices.

## Early Detection

Finding cancer at its earliest, most treatable stage gives patients the greatest chance of survival. To help the public and health care providers make informed decisions about cancer screening, the American Cancer Society publishes a variety of early detection guidelines. These guidelines are assessed regularly to ensure that recommendations are based on the most current scientific evidence.

The Society currently provides screening guidelines for cancers of the breast, cervix, colorectum, endometrium, lung, and prostate, and general recommendations for a cancer-related component of a periodic checkup to examine the thyroid, oral cavity, skin, lymph nodes, testicles, and ovaries.

Throughout its history, the Society has implemented a number of aggressive awareness campaigns targeting the public and health care professionals. Campaigns to increase usage of Pap testing and mammography have contributed to a 70% decrease in cervical cancer death rates since 1969 and a 35% decline in breast cancer death rates since 1989. Building on previous and ongoing colorectal cancer prevention and early detection efforts, the Society joined the National Colorectal Cancer Roundtable in its 80% by 2018 initiative in 2013. The bold goal of this campaign is to increase the rate of regular colorectal cancer screening among adults 50 and older to 80% by 2018, with an emphasis on economically disadvantaged individuals, who are least likely to be tested. The Society also continues to encourage the early detection of breast cancer through public awareness and other efforts targeting poor and underserved communities.

## Helping People Get Well

For the more than 1.6 million cancer patients diagnosed this year and the 14.5 million US cancer survivors, the American Cancer Society is available anytime, day or night, to offer free information, programs, services, and community referrals to patients, survivors, and caregivers to help them make decisions through every step of a cancer experience. These resources are designed to help people facing cancer on their journey to getting well.

## Information, 24 Hours a Day, 7 Days a Week

The American Cancer Society is available 24 hours a day, 7 days a week online at cancer.org and by calling 1-800-227-2345. Callers are connected with a cancer information specialist who can help them locate a hospital, understand 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 170 languages.

Information on every aspect of the cancer experience, from prevention to survivorship, is also available through cancer.org, the Society's website. The site contains in-depth information on every major cancer type, as well as on treatments, side effects, caregiving, and coping.

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](http://cancer.org/bookstore) for a complete list of Society books that are available to order.

The Society publishes three peer-reviewed journals for health care providers and researchers: *Cancer*, *Cancer Cytopathology*, and *CA: A Cancer Journal for Clinicians*. Visit [acsjournals.com](http://acsjournals.com) to learn about the journals and their content.

### **Day-to-day Help and Emotional Support**

The American Cancer Society can help cancer patients and their families find the resources they need to make decisions about the day-to-day challenges that can come from a cancer diagnosis, such as transportation to and from treatment, financial and insurance needs, and lodging when treatment is away from home. The Society also connects people with others who have been through similar experiences to offer emotional support.

**Help navigating the health care system:** Learning how to navigate the cancer journey and the health care system can be overwhelming for anyone, but it is particularly difficult for those who are medically underserved, those who experience language or health literacy barriers, and those with limited resources. The American Cancer Society Patient Navigator Program was designed to reach those most in need. The largest oncology-focused patient navigator program in the country, it has specially trained patient navigators at 121 sites across the nation. Patient navigators can help: find transportation to and from cancer-related appointments; assist with medical financial issues, including insurance navigation; identify community resources; and provide information on a patient's cancer diagnosis and treatment process. In 2013, more than 77,000 people relied on the Patient Navigator Program to help them through their diagnosis and treatment. The Society collaborates with a variety of organizations, including the National Cancer Institute's Center to Reduce Cancer Health Disparities, the Center for Medicare and Medicaid Services, numerous cancer treatment centers, and others to implement and evaluate this program.

**Transportation to treatment:** Cancer patients cite transportation to and from their treatments and appointments as a critical need, second only to direct financial assistance. The American Cancer Society Road To Recovery® program matches patients who don't have a ride or are unable to drive themselves with specially trained volunteer drivers who donate their time and the use of their personal vehicles so patients can receive the treatment they need. This program offers patients an additional key

benefit of companionship and moral support during the drive to medical appointments. In 2013, the American Cancer Society provided more than 283,000 rides to cancer patients.

**Lodging during treatment:** When someone diagnosed with cancer must travel away from home for the best treatment, where to stay and how to afford accommodations are immediate concerns and can sometimes affect treatment decisions. American Cancer Society Hope Lodge® communities provide free overnight lodging for patients and their caregivers close to treatment centers, so they can focus on what's important: getting well. In 2013, the 31 Hope Lodge locations provided more than 265,000 nights of free lodging to nearly 43,000 patients and caregivers – saving them nearly \$38 million in hotel expenses. Through its Hotel Partners Program, the Society also partners with local hotels across the country to provide free or discounted lodging to patients and their caregivers in communities without a Hope Lodge facility.

**Breast cancer support:** Through the American Cancer Society Reach To Recovery® program, trained breast cancer survivor volunteers provide one-on-one support, information, and resource referrals to people facing breast cancer. Patients are matched with a volunteer who has had a similar breast cancer experience as well as other similar characteristics. These volunteers will meet one-on-one, either in person, by telephone, or via email, with women to help them cope with their disease, treatment, or long-term survivorship issues so they can focus on their clinical needs.

**Cancer education classes:** The I Can Cope® online educational program is available free to people facing cancer and their families and friends. The program consists of self-paced classes that can be taken anytime, day or night. People are welcome to take as few or as many classes as they like. Among the topics offered are information about cancer, managing treatments and side effects, healthy eating during and after treatment, communicating with family and friends, finding resources, and more. Visit [cancer.org/icancope](http://cancer.org/icancope) to learn more about the classes that are available.

**Hair-loss and mastectomy products:** Some women wear wigs, hats, breast forms, and special bras to help cope with the effects of a mastectomy and hair loss. The American Cancer Society "tlc" *Tender Loving Care*® publication offers informative articles and a line of products to help women who are facing cancer restore their appearance and self-esteem. The "tlc" products and catalogs may be ordered online at [tlcdirect.org](http://tlcdirect.org) or by calling 1-800-850-9445. All proceeds from product sales go back into the Society's programs and services for patients and survivors.

**Help with appearance-related side effects of treatment:** The Look Good Feel Better® program is a collaboration of the American Cancer Society, the Personal Care Products Council Foundation, and the Professional Beauty Association that helps women with cancer manage the appearance-related side effects

of treatment. This free program engages certified, licensed beauty professionals trained as Look Good Feel Better volunteers to teach simple techniques on skin care, makeup, and nail care, and give practical tips on hair loss, wigs, and head coverings. Information and materials are also available for men and teens. To learn more, visit the Look Good Feel Better website at [lookgoodfeelbetter.org](http://lookgoodfeelbetter.org) or call 1-800-395-LOOK (1-800-395-5665).

**Finding hope and inspiration:** People with cancer and their loved ones do not have to face their cancer 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. At [csn.cancer.org](http://csn.cancer.org), they can get and give support, connect with others, find resources, and tell their own story through personal expressions like music and art.

## Finding Cures

Research is at the heart of the American Cancer Society's mission. For nearly 70 years, the Society has been finding answers that save lives – from changes in lifestyle to new approaches in therapies to improving cancer patients' quality of life. No single nongovernmental, not-for-profit organization in the US has invested more to find the causes and cures of cancer than the Society. We relentlessly pursue the answers that help us understand how to prevent, detect, and treat all cancer types. We combine the world's best and brightest researchers with the world's largest, oldest, and most effective community-based anticancer organization to put answers into action.

The Society's comprehensive research program consists of extramural grants, as well as intramural programs in epidemiology, surveillance and health services research, behavioral research, economic and health policy research, and statistics and evaluation. Intramural research programs are led by the Society's own staff scientists.

## Extramural Research

The American Cancer Society's extramural grants program supports research and training in a wide range of cancer-related disciplines at more than 230 institutions. As of August 11, 2014, the Society is funding 830 research and training grants totaling approximately \$437 million. Grant applications are solicited through a nationwide competition and are subjected to a rigorous external peer-review process, ensuring that only the most promising research is funded. The Society primarily funds investigators early in their research careers, thus giving the best and the brightest a chance to explore cutting-edge ideas at a time when they might not find funding elsewhere. The Extramural Research department is comprised of six programs that span areas from the most basic research to public policy.

**Molecular Genetics and Biochemistry of Cancer:** This research grant program focuses on the genes involved in cancer and how alterations in those genes (mutations, deletions, and

amplifications) play a role in the cancer process. Also of interest is the examination of molecules involved in cancer (proteins, nucleic acids, lipids, and carbohydrates) and how alterations in those molecules affect the disease. This program highlights potential targets for new cancer treatments.

**Cancer Cell Biology and Metastasis:** The primary goal of this grant program is to provide an understanding of the nature of cancer cells so they can be more effectively treated and eliminated. Emphases include understanding the fundamental controls of both normal cells and cancer cells, with a focus on how cells regulate when to grow, when to divide and when to die; how cells create an identity; how cells relate to the local environment and to other cells; and how cells regulate when and how to move from one site to another. To reach the program goal, a wide variety of cells are utilized so that all aspects of cell biology can be examined.

**Preclinical and Translational Cancer Research:** This research grant program focuses on the interface between laboratory investigations and human testing. The scope of the program includes investigations of the role of infectious diseases in cancer, the synthesis and discovery of cancer drugs, the creation and use of cancer animal models, and the role of individual or groups of genes in different types of cancer.

**Clinical Cancer Research and Immunology:** This grant program focuses on increasing clinical research derived from advances in basic biomedical and epidemiologic research. Goals are to: pursue clinical trials of new imaging agents and modalities monitoring cancer development, progression and response to therapy; improve understanding of cancer-related inflammatory responses, immunosurveillance and immunotherapy; foster increased use of the immune system for cancer prevention; aid integration of immunotherapy into combination therapies for cancer; and increase fundamental knowledge of the effects of the environment and nutrition on cancer prevention, initiation, and progression.

**Cancer Control and Prevention Research:** This research grant program focuses on the study of behaviors (of individuals, health care professionals, or health care systems) and how interventions to change these behaviors or systems can reduce cancer risk, help detect cancer early, better inform treatment decisions, or improve the quality of life of patients and families. Special emphasis is placed on reducing disparities in disadvantaged groups.

**Health Professional Training in Cancer Control:** The goals of this program are to encourage highly qualified individuals to enter careers in cancer prevention and control practice and to accelerate the application of research findings in this area. Toward that end, this program provides grants in support of nurses, physicians, and social workers to pursue training in cancer prevention and control programs that meet high standards for excellence.



In addition to funding across the continuum of cancer research and training, from basic science to clinical and quality-of-life research, the Society also focuses on needs that are unmet by other funding organizations. For instance, for 10 years, the Society supported a targeted research program to address the causes of higher cancer mortality in the poor and medically underserved. To date, 47 Nobel Prize winners have received grant support from the Society early in their careers, a number unmatched in the nonprofit sector and proof that the organization's approach to funding young researchers truly helps launch high-quality scientific careers.

### Intramural Research

In 1946, under the direction of E. Cuyler Hammond, ScD, a small research group was created at the American Cancer Society. Since that time, the Society's Intramural Research program has grown into 5 programs that conduct and publish high-quality research to advance the understanding of cancer and evaluate Society programs to ensure that they are effective, high-quality, and reaching the cancer patients that are most in need.

**Epidemiology:** The Epidemiology Research program seeks to reduce the cancer burden by conducting large, nationwide prospective studies that advance our understanding of cancer etiology and survival to inform cancer prevention and control programs, policies, and guidelines. To accomplish this work, in 1952 Hammond pioneered working with the extensive network of Society volunteers nationwide to enroll and follow large cohorts to provide insights into the causes of cancer. The first cohort, known as the Hammond-Horn Study, was conducted from 1952 through 1955 and provided the first US prospective evidence to confirm the association between cigarette smoking and death from lung cancer, cardiovascular disease, and other conditions in men. The success of this early study established the foundation on which the Society invested in a series of large prospective studies – the Cancer Prevention Studies – and in the creation and growth of the Epidemiology Research program. Indeed, with help from more than 150,000 Society volunteers to enroll and collect information from more than 2.2 million US men and women, findings from the Hammond-Horn Study, Cancer Prevention Study-I (CPS-I, 1959-1972), and CPS-II (1982-ongoing) have played a major role in cancer prevention initiatives at the Society, as well as in other national and international efforts. For example:

- The Hammond-Horn Study, which linked smoking to lung cancer and higher overall death rates, contributed to the Surgeon General's landmark 1964 conclusion that smoking causes lung cancer and helped drive a decline in adult smoking rates to less than 20% today. American Cancer Society epidemiologic studies continue to document the ongoing health impact of smoking. In 2014, the Surgeon General used our results to show that more than 480,000 Americans die each year from smoking cigarettes.

- CPS-I provided the first epidemiologic evidence that obesity increases risk of premature death, and subsequent studies from CPS-II helped to establish the link between obesity and death from breast, colorectal, and other cancers.
- In the early 1990s, CPS-II was the first prospective study to find a link between regular aspirin use and lower risk of colorectal cancer, a finding confirmed by many later studies. These results opened the door to ongoing studies in the US and internationally to find out if aspirin might lower the risk of other cancers and to better understand the overall risks and benefits of aspirin use.
- Our studies showing that high red and processed meat and alcohol intake, low physical activity, and longer sitting time increase the risk of cancer or mortality have contributed to the scientific evidence used to develop the Society's Guidelines on Nutrition and Physical Activity for Cancer Prevention. Moreover, findings from CPS-II were used to demonstrate the lifesaving potential of a lifestyle consistent with our guidelines.
- Findings from CPS-II contributed substantially to the scientific evidence associating increasing levels of specific types of air pollution with higher deaths rates from cardiovascular disease and lung cancer. These studies are cited prominently by both the Environmental Protection Agency and World Health Organization in policies and recommendations for US and worldwide air pollution limits.
- CPS-II data and biospecimens have been included in the identification or validation of nearly every confirmed breast, prostate, and pancreatic cancer genetic susceptibility variant known to date. This work has led to a better understanding of the heritable component of these cancers.

While landmark findings from the CPS-II cohort have informed multiple areas of public health policy and clinical practice, this cohort is aging and a new cohort is essential to continue exploring the effects of changing exposures and to provide greater opportunity to integrate biological and genetic factors into studies of other cancer risk factors. Therefore, following on the long history of partnering with Society volunteers and supporters, CPS-3 was established. From 2006 through 2013, more than 304,000 men and women, ages 30 to 65, were enrolled in 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 United States.

**Surveillance & Health Services Research:** The Surveillance & Health Services Research (SHSR) program analyzes and disseminates data on cancer occurrence, risk factors, prevention, early detection, treatment, and outcomes to strengthen the scientific



basis for cancer prevention and control nationally and globally. Researchers in the SHSR program produce *Cancer Facts & Figures*, published since 1952, and the accompanying Cancer Statistics article, published in *CA: A Cancer Journal for Clinicians* (caonline.amcancersoc.org) since 1967. These publications are the most widely cited sources for cancer statistics and are available on the Society's website at cancer.org/statistics and in hard copy from Society Division offices.

In addition, SHSR staff produce seven supplemental *Cancer Facts & Figures* reports with accompanying Cancer Statistics articles. Some of these publications focus on a specific cancer site (e.g., breast) or subpopulation (e.g., Hispanics). *Cancer Prevention & Early Detection Facts & Figures* presents trends in cancer risk factors and screening, along with Society recommendations, policy initiatives, and evidence-based cancer control programs. In addition, program staff collaborate with the International Agency for Research on Cancer (IARC) to publish *Global Cancer Facts & Figures*.

Surveillance epidemiologists also conduct and publish high-quality epidemiologic research in order to advance the understanding of cancer. Since 1998, Society epidemiologists have collaborated with the National Cancer Institute, the Centers for Disease Control and Prevention, the National Center for Health Statistics, and the North American Association of Central Cancer Registries to produce the Annual Report to the Nation on the Status of Cancer, a peer-reviewed journal article that reports current information related to cancer rates and trends in the US. Other research topics include exploring socioeconomic, racial, and geographic cancer disparities; describing global cancer trends; and demonstrating the association between public health interventions, such as tobacco control, and cancer incidence and mortality. Recent surveillance studies include overviews of child and adolescent cancer statistics; colorectal cancer statistics; global trends in bladder, head and neck, and female lung cancers; and the association between cigarette smoking and underutilization of cancer screening tests.

Health Services Research (HSR) activities began in the late 1990s with the primary objective of performing high-quality, high-impact research to evaluate disparities in cancer treatment and outcomes in support of the Society's mission to reduce health care inequalities. Researchers in the HSR program use secondary data sources such as the National Cancer Data Base (NCDB), a hospital-based cancer registry jointly sponsored by the American Cancer Society and the American College of Surgeons. The NCDB has been key to the program's research on the impact of insurance on cancer diagnosis, treatment, and outcome, as well as for broader cancer treatment patterns. Other data sources include the SEER-Medicare database, a linkage of population-based cancer registry data with Medicare claims data, and the Medical Expenditure Panel Survey Data linked with National Health Interview Survey Data. The findings from the Health Ser-

vices Research group have been instrumental in the Society's and ACS CAN's support of the Affordable Care Act (ACA). Recent studies include the effect of the ACA on access to care and receipt of preventive services.

**Economic and Health Policy Research:** The predecessor of the Economic and Health Policy Research (EHPR) program, the International Tobacco Control Research (ITCR) program, was created in 2006 to support collaborative tobacco control efforts involving the Society and numerous international organizations and academic institutions such as the WHO Tobacco Free Initiative, the Centers for Disease Control and Prevention (CDC), the Campaign for Tobacco-Free Kids, Johns Hopkins University, and the University of Illinois, among others. The ITCR program focused on economic and policy research in tobacco control and research capacity building for the collection and analysis of economic data to provide the evidence base for tobacco control in primarily low- and middle-income countries. This was an important investment by the Society because not only do economic factors contribute greatly to the global tobacco epidemic, but economic solutions – such as taxation and better investment policies – are among the most effective and least expensive solutions. Major donors in global health, such as the Bloomberg Philanthropies, the Bill & Melinda Gates Foundation, and the National Institutes of Health, supported this effort by granting the ITCR program additional funding.

Due to the high demand for the type of economic and policy analysis generated by the ITCR program, the Society's leadership made a strategic decision in early 2013 to expand the program to the areas of nutrition and physical activity, and change its name to the EHPR program. Moreover, the team is increasingly applying its expertise to a number of cancer-related challenges, including the economic and policy aspects of additional risk factors and patient access to lifesaving medicines, and the direct and indirect costs of cancer and its treatment.

The most important service publication of the EHPR program is *The Tobacco Atlas*, which is produced in collaboration with the Society's Global Health department and the World Lung Foundation. *The Tobacco Atlas, Fourth Edition* (tobaccoatlas.org) was released at the 15th World Conference on Tobacco or Health (WCTOH) in 2012 in Singapore and has been translated to four other languages – French, Spanish, Mandarin, and Arabic. The newest edition will be launched with these same partners in Abu Dhabi at the 16th WCTOH in March 2015.

**Behavioral Research Center:** The American Cancer Society was one of the first organizations to recognize the importance of behavioral and psychosocial factors in the prevention and control of cancer and to fund extramural research in this area. In 1995, the Society established the Behavioral Research Center (BRC) within the Intramural Research department. The BRC's work currently focuses on cancer survivorship, quality of life, tobacco control, and health disparities. The BRC's ongoing projects include:

- Studies of the quality of life of cancer survivors, which include the American Cancer Society Study of Cancer Survivors-I (SCS-I), a nationwide longitudinal study of a cohort of more than 3,000 cancer survivors that explores the physical and psychosocial adjustment to cancer and identifies factors affecting quality of life. Results from this research have informed the Society's informational materials and support programs for cancer patients, survivors, and their loved ones.
- Studies of family caregivers, which include a nationwide longitudinal study of a cohort of more than 1,500 cancer caregivers that explores the impact of the family's involvement in cancer care on the quality of life of the cancer survivor and the caregiver
- A study of side effects of cancer treatment, such as pain, fatigue, or depression, which often go underreported and/or undertreated. Data from this collaboration between the Society, the National Cancer Institute, and the American College of Surgeons could play an important role in improving symptom control, which would ultimately lead to improvements in quality of life, functioning, and treatment adherence.
- Studies to identify and prioritize gaps in information and resources for cancer survivors as they transition from active treatment under the care of the oncology team back to the community care setting. Research results will inform interventions by the Society and others by describing the issues cancer survivors continue to face after their treatment ends, the key variables that interventions should target, and the best time to intervene.
- Studies investigating how social, psychological, and other factors impact smokers' motivation and ability to quit in order to improve existing Society programs for smoking cessation (e.g., the FreshStart program and the Great American Smokeout® initiative) or to develop new technology-based interventions for smokers who seek cessation assistance
- Contributions to the development of a National Cancer Survivorship Resource Center ([cancer.org/survivorshipcenter](http://cancer.org/survivorshipcenter)) meant to advance survivorship as a distinct phase of cancer care, promote healthy behaviors to reduce long-term and late effects of cancer and its treatment, and improve surveillance and screening practices to detect the return of cancer
- Studies to better understand cancer prevention and control behavior in underserved populations and identify effective strategies for connecting these groups to cancer information, programs, and services
- Research to identify, test, and disseminate evidence-based behavioral interventions that are appropriate and effective for underserved populations to help achieve cancer health equity

**Statistics & Evaluation Center:** The mission of the Statistics and Evaluation Center (SEC) is to deliver valid, reliable, accu-

rate, and timely information to American Cancer Society staff for evidence-based decision making that ensures the Society continues to provide effective, high-quality programs. Staffed by professional statisticians and evaluators, the SEC has 3 main responsibilities: 1) to provide leadership on evaluations of Society mission and income delivery programs, including study design, data analysis, and report preparation; 2) to provide operational support for surveys and other data collection related to Society constituents and consumers; and 3) to support the broader Society mission through information integration, including mapping and return on investment studies. SEC expertise and assistance are available to Society staff at the Corporate Center in Atlanta, Georgia, and across the Divisions.

SEC staff design and conduct process and outcome evaluations of Society programs, projects, and initiatives using focus groups, structured and semistructured interviews, and online surveys. The SEC continues to be engaged in evaluations of the Society's externally funded community-based cancer prevention initiatives, its Cancer Survivors Network online community, and an online self-help program for cancer survivors. The SEC is currently beginning an evaluation of the Society's preclinical and translational research grant programs. The SEC also partners with the Behavioral Research Center and the Society's Health Promotions department in the systematic evaluation of all Society survivorship and quality-of-life programs, in the development of guidelines for support of cancer survivors who have completed their cancer treatments, and in developing and evaluating fundraising activities in support of these programs. The SEC has partnered with the Surveillance & Health Services Research program to further analyze the geographical distribution of cancer and the needs of cancer patients with the goal of providing information in support of American Cancer Society mission and advocacy programming.

## Fighting Back

Conquering cancer is as much a matter of public policy as scientific discovery. Lawmakers play a critical role in determining how much progress we make as a country to defeat cancer – whether it's advocating for quality, affordable health care for all Americans, increasing funding for cancer research and programs, improving quality of life for patients and their families, or enacting laws and policies that help communities to promote good health. The American Cancer Society Cancer Action Network<sup>SM</sup> (ACS CAN), the Society's nonprofit, nonpartisan advocacy affiliate, uses applied policy analysis, direct lobbying, grassroots action, and media advocacy to ensure elected officials nationwide pass and effectively implement laws that help save lives from cancer.

Created in 2001, ACS CAN is the force behind a powerful grassroots movement uniting and empowering cancer patients, survivors, caregivers, and their families to fight back against

cancer. As the nation's leading voice advocating for public policies that are helping to defeat cancer, ACS CAN works to encourage elected officials and candidates to make the fight against cancer a top national priority. In recent years, ACS CAN has successfully worked to pass and implement laws at the federal, state, and local levels that: increase funding for groundbreaking cancer research; improve access to prevention and early detection measures, treatment, and follow-up care; and improve quality of life for cancer patients.

Some of ACS CAN's recent advocacy accomplishments on behalf of cancer patients are outlined in the following sections.

### **Access to Care**

ACS CAN successfully advocated for numerous coverage provisions of the Affordable Care Act (ACA) that help people with cancer and their families access lifesaving care, including removing barriers to health insurance for those with pre-existing conditions, eliminating lifetime and annual limits on coverage, providing preventive services with no cost-sharing, standardizing the benefits provided by health plans, and ensuring coverage of routine care for participants in clinical trials. The organization continues to monitor the implementation of this important law to ensure that cancer patients have access to the treatment they need at a cost they can afford. Specifically, ACS CAN is focused on:

- Advocating for the Prevention and Public Health Fund, which was designed to support successful prevention programs in communities nationwide
- Supporting legislative and administrative efforts to expand access to Medicaid in all states
- Advocating for state legislation to ensure cost-sharing for chemotherapy and other vital treatment options are affordable
- Supporting state and federal policy makers to increase the availability of health plan information for consumers shopping for health coverage
- Protecting federal funding for community health centers, which are essential for achieving that goal because they are focused on providing community-oriented primary care in areas that are underserved or do not have access to other health care services

### **Prevention and Early Detection**

ACS CAN is supporting legislation that focuses on the prevention and early detection of cancer by:

- Helping pass the law giving the FDA authority to regulate the production and marketing of tobacco products. ACS CAN is now working to support full implementation of the law, including the regulation for new and emerging products.
- Leading efforts to pass comprehensive smoke-free laws – covering about half of the US population – in 24 states, the

District of Columbia, Puerto Rico, the US Virgin Islands, and countless local jurisdictions requiring all workplaces, restaurants, and bars to be smoke-free

- Helping increase taxes on tobacco products to an average state cigarette tax of \$1.54 per pack and defending against tax rollbacks
- Helping increase and protect state funding for tobacco control programs
- Continuing its role as an intervener in the US government's lawsuit against the tobacco industry, in which manufacturers have been convicted as racketeers for decades of fraud associated with marketing of tobacco products
- Continuing the implementation of the Healthy, Hunger-Free Kids Act of 2010, strong legislation to reauthorize the federal child nutrition programs and strengthen school nutrition
- Advocating for state and local requirements to increase the quality and quantity of physical education in K-12 schools
- Supporting the federal government's development of the 2015 edition of the Dietary Guidelines for Americans, which form the basis of all federal nutrition policies and programs, and advocating for science-based updates to the Nutrition Facts label that appears on most packaged foods and beverages
- Working with 9 state governments to pass laws prohibiting tanning bed use for everyone under the age of 18
- Advocating for coverage of cancer screenings and other recommended preventive services without financial barriers in private insurance and also for Medicare and Medicaid beneficiaries
- Advocating for full funding for the National Breast and Cervical Cancer Early Detection Program (NBCCEDP) and the Colorectal Cancer Control Program (CRCCP), which provides free evidence-based cancer screenings and treatment to low-income, uninsured, and medically underserved men and women
- Supporting a federal bill that would eliminate cost-sharing for Medicare beneficiaries receiving a colonoscopy, even if a polyp is removed. Under current Medicare coding rules, a colonoscopy is reclassified from a screening to a therapeutic procedure when a polyp is removed during the course of the colonoscopy.

### **Quality of Life**

- ACS CAN has advocated for balanced pain policies in multiple states and at the federal level to ensure patients and survivors have continued access to the treatments that promote better pain management and improved quality of life.
- ACS CAN has advanced a new quality-of-life legislative platform that addresses the need for better patient access to palliative care services that help patients and their families



manage the pain, symptoms, and stress that begin with a cancer diagnosis and are provided alongside curative treatment. The platform also stresses the importance of expanding research funding in this area and building the workforce of the health professions needed to provide patients with serious illnesses better patient-centered, coordinated care.

- ACS CAN has increased public awareness of the increasingly urgent cancer drug shortage problem and advocated for solutions to the complex, multiple causes of cancer drug shortages. Some efforts in the fight against cancer are more visible than others, but each successful battle is an important contribution to what will ultimately be victory over the disease. The organization is making sure the voice of the cancer community is heard in the halls of government and is empowering communities everywhere to fight back.

The Society is also rallying people to fight back against the disease through our Relay For Life® and Making Strides Against Breast Cancer® programs. As the world's largest fundraising

event to end cancer, Relay For Life events unite communities across the globe to fight back against the disease. Teams camp out at local schools, parks, or fairgrounds and take turns walking around a track or path. Symbolizing the battle waged around the clock by those facing cancer, the overnight event lasts up to 24 hours and empowers communities and individuals to take a stand. Funds raised by the 4 million Relay participants in more than 20 countries help the Society save lives by supporting education and prevention efforts, funding groundbreaking cancer research, and providing free information and services for people with cancer who need them. 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 ensure access to mammograms for women who need them so more lives are saved.

## Sources of Statistics

**Estimated new cancer cases in 2015.** The number of new cancer cases 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. (For more information on the estimation of new invasive cases, see "A" in Additional information.)

The numbers of female breast carcinoma in situ and melanoma in situ cases were calculated by using the average annual percent change in the estimated number of cases during the most recent 10 years of data (2002-2011) to project cases in 2015. The annual number of cases from 2002 through 2011 was estimated by applying age-specific incidence rates from 44 states that met NAACCR high-quality data standards for each year to population counts. Female breast carcinoma in situ cases were adjusted for reporting delays; this adjustment was not available for melanoma in situ.

**Incidence rates.** Incidence rates are defined as the number of people who are diagnosed with cancer during a given time period divided by the number of people who were at risk for the disease in the population. Incidence rates in this publication are presented per 100,000 people and are age adjusted to the 2000 US standard population to allow comparisons across populations with different age distributions. State-, race-, and ethnicity-

specific incidence rates were previously published in NAACCR's publication *Cancer Incidence in North America, 2007-2011*. (See "B" in Additional information for full reference.)

Trends in cancer incidence rates provided in this publication (except childhood cancer) represent the average annual percent change (AAPC) during the most recent 5 data years based on cancer cases reported to the 13 oldest Surveillance, Epidemiology, and End Results (SEER) registries, representing approximately 14% of the US population, and were adjusted for delays in reporting. Delay-adjustment accounts for delays and error corrections that occur in the reporting of cancer cases. These trends were originally published in the *SEER Cancer Statistics Review (CSR) 1975-2011*. (See "C" in Additional information for full reference.) Delay-adjustment is not available for some cancer types, including childhood cancer. Childhood cancer incidence trends reflect the 5-year AAPC based on NAACCR data for 2002-2011.

**Estimated cancer deaths in 2015.** The estimated number of US cancer deaths in the US was calculated by fitting the number of cancer deaths from 1997 to 2011 to a statistical model that forecasts the number of deaths expected to occur in 2015. The estimated number of cancer deaths for each state is calculated similarly, using state-level data. For both US and state estimates, data on the number of deaths are obtained from the National Center for Health Statistics (NCHS) at the Centers for Disease Control and Prevention. (For more information on this method, see "D" in Additional information.)



**Mortality rates.** Mortality rates, or death rates, are defined as the number of people who die from cancer during a given year divided by the number of people at risk in the population. In this publication, mortality rates are based on counts of cancer deaths compiled by NCHS and population data from the US Census Bureau. Death rates in this publication are presented per 100,000 people and are age adjusted to the 2000 US standard population to allow comparisons across populations with different age distributions. These rates should be compared only to other statistics that are age adjusted to the US 2000 standard population. Trends in cancer mortality rates provided for selected cancer sites were based on mortality data from 1992 to 2011 and were first published in the *CSR 1975-2011*. (See “C” in Additional information for full reference.)

**Important note about estimated cancer cases and deaths for the current year.** The projection of new cancer cases and deaths in the current year is model-based, and the calculation method varies over time as we continually strive to achieve the most accurate estimates. For these reasons, the numbers may vary considerably from year to year for reasons other than changes in cancer occurrence and should be interpreted with caution. The purpose for generating the 4-year ahead projections is solely to provide a reasonably accurate estimate of the cancer burden in the current year. We strongly discourage the use of our estimates to track year-to-year 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.

**Survival.** This report presents relative survival rates to describe cancer survival. Relative survival adjusts for normal life expectancy by comparing survival among cancer patients to that of people not diagnosed with cancer who are of the same age, race, and sex. Five-year survival statistics presented in this publication were originally published in *CSR 1975-2011* and are for diagnosis years 2004 to 2010, with all patients followed through 2011. In addition to 5-year relative survival rates, 1-, 10-, and 15-year survival rates are presented for selected cancer sites. These survival statistics are generated using the National Cancer Institute’s SEER 18 database and SEER\*Stat software version 8.1.5. (See “E” in Additional information for full references.) One-year survival rates were based on cancer patients diagnosed from 2007 to 2010, 10-year survival rates were based on diagnoses from 1998 to 2010, and 15-year survival rates were based on diagnoses from 1993 to 2010; all patients were followed through 2011.

**Probability of developing cancer.** Probabilities of developing cancer were calculated using DevCan (Probability of Developing Cancer) software version 6.7.1, developed by the National Cancer Institute. (See “F” in Additional information for full reference.)

These probabilities reflect the average experience of people in the US and do not take into account individual behaviors and risk factors. For example, the estimate of 1 man in 13 developing lung cancer in a lifetime underestimates the risk for smokers and overestimates the risk for nonsmokers.

**Additional information.** More information on the methods used to generate the statistics for this report can be found in the following publications:

A. Zhu L, Pickle LW, Naishadham D, et al. Predicting US and state-level cancer counts for the current calendar year: part II – evaluation of spatio-temporal projection methods for incidence. *Cancer* 2012;118(4): 1100-9.

B. Copeland G, Lake A, Firth R, et al. (eds). *Cancer in North America: 2007-2011. Volume Two: Registry-specific Cancer Incidence in the United States and Canada*. Springfield, IL: North American Association of Central Cancer Registries, Inc. May 2014. Available at [naaccr.org/Dataand-Publications/CINAPubs.aspx](http://naaccr.org/Dataand-Publications/CINAPubs.aspx).

C. Howlader N, Noone AM, Krapcho M, et al. (eds). *SEER Cancer Statistics Review, 1975-2011*. National Cancer Institute. Bethesda, MD, 2014. Available at [seer.cancer.gov](http://seer.cancer.gov).

D. Chen HS, Portier K, Ghosh K, et al. Predicting US and State-level counts for the current calendar year: part I – evaluation of temporal projection methods for mortality. *Cancer* 2012; 118(4):1091-9.

E. SEER 18 database: Surveillance, Epidemiology, and End Results (SEER) Program ([www.seer.cancer.gov](http://www.seer.cancer.gov)) SEER\*Stat Database: Incidence – SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2013 Sub (1973-2011 varying) – Linked To County Attributes – Total U.S., 1969-2012 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2014, based on the November 2013 submission. SEER\*Stat software: Surveillance Research Program, National Cancer Institute SEER\*Stat software ([www.seer.cancer.gov/seerstat](http://www.seer.cancer.gov/seerstat)) version 8.1.5.

F. DevCan: Probability of Developing or Dying of Cancer Software, Version 6.7.1; Statistical Research and Applications Branch, National Cancer Institute, August 2014. <http://srab.cancer.gov/devcan>.

## Screening Guidelines for the Early Detection of Cancer in Average-risk Asymptomatic People

Cancer Site	Population	Test or Procedure	Frequency
Breast	Women, ages 20+	Breast self-examination (BSE)	It is acceptable for women to choose not to do BSE or to do BSE regularly (monthly) or irregularly. Beginning in their early 20s, women should be told about the benefits and limitations of BSE. Whether or not a woman ever performs BSE, the importance of prompt reporting of any new breast symptoms to a health professional should be emphasized. Women who choose to do BSE should receive instruction and have their technique reviewed on the occasion of a periodic health examination.
		Clinical breast examination (CBE)	For women in their 20s and 30s, it is recommended that CBE be part of a periodic health examination, preferably at least every 3 years. Asymptomatic women ages 40 and over should continue to receive a CBE as part of a periodic health examination, preferably annually.
		Mammography	Begin annual mammography at age 40.*
Cervix	Women, ages 21-65	Pap test & HPV DNA test	Cervical cancer screening should begin at age 21. For women ages 21-29, screening should be done every 3 years with conventional or liquid-based Pap tests. For women ages 30-65, screening should be done every 5 years with both the HPV test and the Pap test (preferred), or every 3 years with the Pap test alone (acceptable). Women ages 65+ who have had ≥3 consecutive negative Pap tests or ≥2 consecutive negative HPV and Pap tests within the past 10 years, with the most recent test occurring within 5 years, and women who have had a total hysterectomy should stop cervical cancer screening. Women should not be screened annually by any method at any age.
Colorectal	Men and women, ages 50+	Fecal occult blood test (FOBT) with at least 50% test sensitivity for cancer, or fecal immunochemical test (FIT) with at least 50% test sensitivity for cancer, <b>or</b>	Annual, starting at age 50. Testing at home with adherence to manufacturer's recommendation for collection techniques and number of samples is recommended. FOBT with the single stool sample collected on the clinician's fingertip during a digital rectal examination is not recommended. Guaiac-based toilet bowl FOBT tests also are not recommended. In comparison with guaiac-based tests for the detection of occult blood, immunochemical tests are more patient-friendly, and are likely to be equal or better in sensitivity and specificity. There is no justification for repeating FOBT in response to an initial positive finding.
		Stool DNA test, <b>or</b>	Every 3 years, starting at age 50
		Flexible sigmoidoscopy (FSIG), <b>or</b>	Every 5 years, starting at age 50. FSIG can be performed alone, or consideration can be given to combining FSIG performed every 5 years with a highly sensitive gFOBT or FIT performed annually.
		Double-contrast barium enema (DCBE), <b>or</b>	Every 5 years, starting at age 50
		Colonoscopy	Every 10 years, starting at age 50
		CT Colonography	Every 5 years, starting at age 50
Endometrial	Women, at menopause	At the time of menopause, women at average risk should be informed about risks and symptoms of endometrial cancer and strongly encouraged to report any unexpected bleeding or spotting to their physicians.	
Lung	Current or former smokers ages 55-74 in good health with at least a 30 pack-year history	Low-dose helical CT (LDCT)	Clinicians with access to high-volume, high-quality lung cancer screening and treatment centers should initiate a discussion about lung cancer screening with apparently healthy patients ages 55-74 who have at least a 30 pack-year smoking history, and who currently smoke or have quit within the past 15 years. A process of informed and shared decision making with a clinician related to the potential benefits, limitations, and harms associated with screening for lung cancer with LDCT should occur before any decision is made to initiate lung cancer screening. Smoking cessation counseling remains a high priority for clinical attention in discussions with current smokers, who should be informed of their continuing risk of lung cancer. Screening should not be viewed as an alternative to smoking cessation.
Prostate	Men, ages 50+	Digital rectal examination (DRE) and prostate-specific antigen test (PSA)	Men who have at least a 10-year life expectancy should have an opportunity to make an informed decision with their health care provider about whether to be screened for prostate cancer, after receiving information about the potential benefits, risks, and uncertainties associated with prostate cancer screening. Prostate cancer screening should not occur without an informed decision-making process.
Cancer-related checkup	Men and women, ages 20+	On the occasion of a periodic health examination, the cancer-related checkup should include examination for cancers of the thyroid, testicles, ovaries, lymph nodes, oral cavity, and skin, as well as health counseling about tobacco, sun exposure, diet and nutrition, risk factors, sexual practices, and environmental and occupational exposures.	

\*Beginning at age 40, annual clinical breast examination should be performed prior to mammography.

## Geographic Divisions of the American Cancer Society, Inc.

### **California Division**

1710 Webster Street  
Oakland, CA 94612-3412  
(510) 893-7900

### **East Central Division (OH, PA)**

Route 422 and Sipe Avenue  
PO Box 897  
Hershey, PA 17033-0897  
(717) 533-6144

### **Eastern Division (NJ, NY)**

6725 Lyons Street  
East Syracuse, NY 13057-9332  
(315) 433-5603

### **Florida Division (including Puerto Rico operations)**

3709 West Jetton Avenue  
Tampa, FL 33629-5146  
(813) 253-0541

#### **Puerto Rico**

Calle Cabo Alverio #577  
Esquina Sargento Medina  
Hato Rey, PR 00918  
(787) 764-2295

### **Great West Division**

(AK, AZ, CO, ID, MT, ND, NM,  
NV, OR, UT, WA, WY)  
2120 First Avenue North  
Seattle, WA 98109-1140  
(206) 283-1153

**High Plains Division  
(including Hawaii operations,  
KS, MO, NE, OK, TX)**  
2433 Ridgpoint Drive  
Austin, TX 78754-5231  
(512) 919-1900

#### **Hawaii Pacific Division**

2370 Nuuanu Avenue  
Honolulu, HI 96817-1778  
(808) 595-7500

### **Lakeshore Division (IL, IN, MI)**

1755 Abbey Road  
East Lansing, MI 48823-1907  
(517) 332-2222

### **Mid-South Division (AL, AR, KY, LA, MS, TN)**

1100 Ireland Way  
Suite 300  
Birmingham, AL 35205-7014  
(205) 930-8860

### **Midwest Division (IA, MN, SD, WI)**

2520 Pilot Knob Road  
Suite 150  
Mendota Heights, MN 55120-1158  
(615) 255-8100

### **New England Division (CT, ME, MA, NH, RI, VT)**

30 Speen Street  
Framingham, MA 01701-9376  
(508) 270-4698

### **South Atlantic Division (DE, GA, MD, NC, SC, VA, Washington, DC, WV)**

250 Williams Street  
Atlanta, GA 30303-1002  
(404) 816-7800

## Acknowledgments

The production of this report would not have been possible without the efforts of: Rick Alteri, MD; Tracie Bertaut, APR; Durado Brooks, MD, MPH; William Chambers, PhD; Ellen Chang, ScD; Carol DeSantis, MPH; Ted Gansler, MD, MBA; Susan Gapstur, PhD; Mia Gaudet, PhD; Kerri Gober; Gery Guy, PhD, MPH; Eric Jacobs, PhD; Joan Kramer, MD; Joannie Lortet-Tieulent, MSc; Lisa A. Newman, MD, MPH; Anthony Piercy; Melissa Maitin-Shepard, MPP; Kim Miller, MPH; Ken Portier, PhD; Carolyn Runowicz, MD; Debbie Saslow, PhD; Mona Shah, MPH; Scott Simpson; Robert Smith, PhD; Kevin Stein, PhD; Lindsey Torre, MPH; Dana Wagner; Sophia Wang, PhD; Elizabeth Ward, PhD; Martin Weinstock, MD; and Joe Zou.

*Cancer Facts & Figures* is an annual publication of the American Cancer Society, Atlanta, Georgia.

#### **For more information, contact:**

Rebecca Siegel, MPH; Ahmedin Jemal, DVM, PhD  
Surveillance & Health Services Research Program



We **save lives** and create more birthdays  
by helping you stay well, helping you get well,  
by finding cures, and by fighting back.

[cancer.org](http://cancer.org) | 1.800.227.2345



The American Cancer Society, Inc.  
adheres to the Better Business Bureau's  
strong standards for charitable giving.



National Health Council  
Standards of Excellence  
Certification Program®