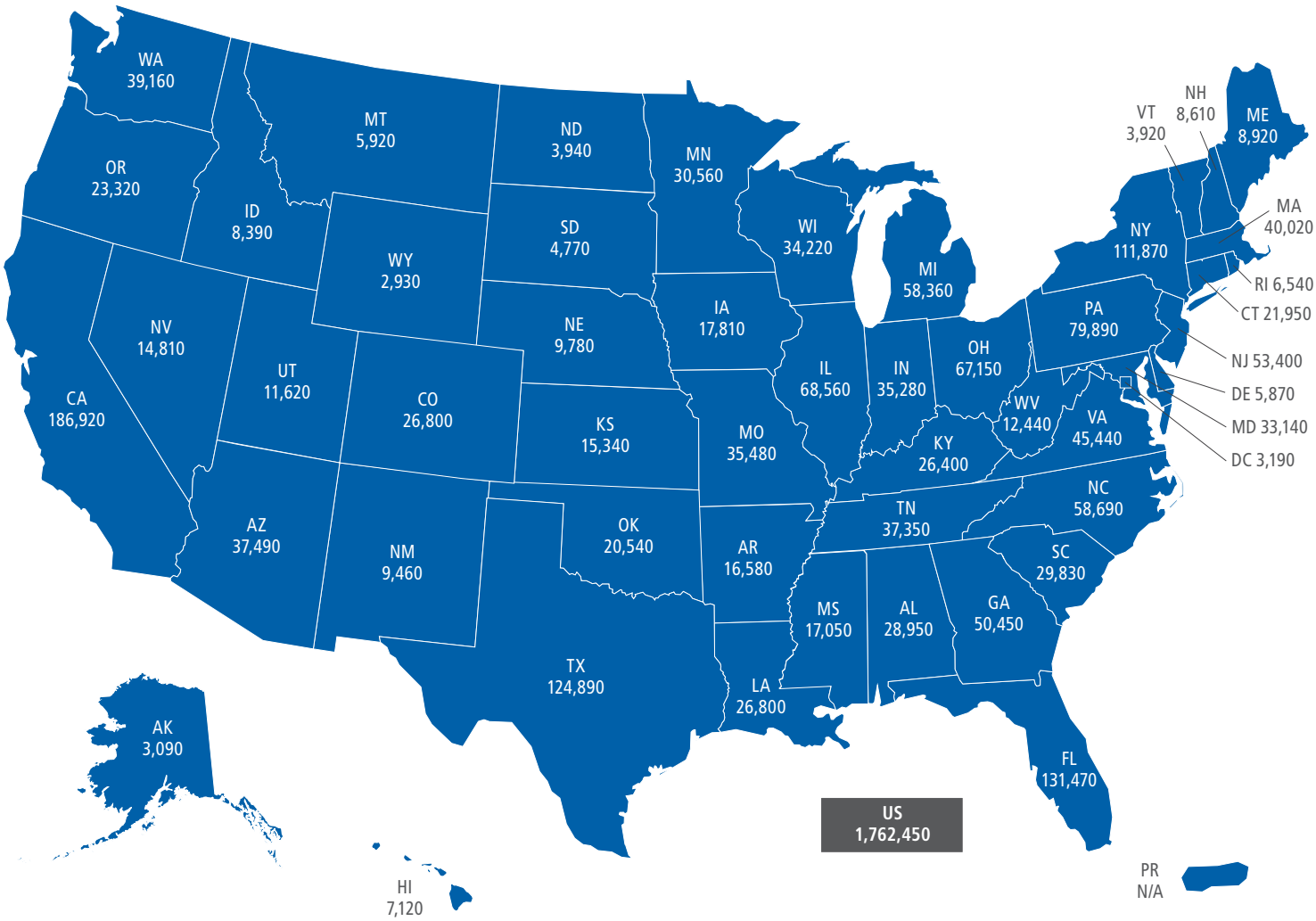
American Cancer Society®

Cancer Facts & Figures 2019



Estimated numbers of new cancer cases for 2019, excluding basal cell and squamous cell skin cancers and in situ carcinomas except urinary bladder. Estimates are not available for Puerto Rico.
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.

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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 2019.* Atlanta: American Cancer Society; 2019.

Global Headquarters: American Cancer Society Inc.
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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. Although the causes of cancer are not completely understood, numerous factors are known to increase the disease's occurrence, including many that are modifiable (e.g., tobacco use and excess body weight) and those that are not (e.g., inherited genetic mutations and immune conditions). These risk factors may act simultaneously or in sequence to initiate and/or promote cancer growth.

Can Cancer Be Prevented?

A substantial proportion of cancers could be prevented, including all cancers caused by tobacco use and other unhealthy behaviors. According to a recent study by American Cancer Society researchers, at least 42% of newly diagnosed cancers in the US – about 740,000 cases in 2019 – are potentially avoidable, including the 19% of all cancers that are caused by smoking and the 18% that are caused by a combination of excess body weight, physical inactivity, excess alcohol consumption, and poor nutrition. Certain cancers caused by infectious agents, such as human papillomavirus (HPV), hepatitis B virus (HBV), hepatitis C virus (HCV), and *Helicobacter pylori* (*H. pylori*), could be prevented through behavioral changes or vaccination to avoid the infection, or treatment of the infection. Many of the more than 5 million skin cancer cases that are diagnosed annually could be prevented by protecting skin from excessive sun exposure and not using indoor tanning devices.

Screening can help prevent colorectal and cervical cancers by detecting precancerous lesions that can be removed. It can also detect some cancers early, when treatment is more often successful. Screening is known to help reduce mortality for cancers of the breast, colon, rectum, cervix, prostate, and lung (among current or former heavy smokers). In addition, a heightened awareness of changes in certain parts of the body, such as the breast, skin, mouth, eyes, or genitalia, may also result in the early detection of cancer. For complete cancer screening guidelines, see page 71.

How Many People Alive Today Have Ever Had Cancer?

More than 15.5 million Americans with a history of cancer were alive on January 1, 2016, most of whom were diagnosed many years ago and have no current evidence of cancer.

How Many New Cases and Deaths Are Expected to Occur in 2019?

More than 1.7 million new cancer cases are expected to be diagnosed in 2019 (Table 1). 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 because these are not required to be reported to cancer registries. Table 2 provides estimated new cancer cases in 2019 by state.

About 606,880 Americans are expected to die of cancer in 2019 (Table 1), which translates to about 1,660 deaths per day. Cancer is the second most common cause of death in the US, exceeded only by heart disease. Table 3 provides estimated cancer deaths by state in 2019.

How Much Progress Has Been Made against Cancer?

Cancer death rates are the best measure of progress against the disease because they are less affected by detection practices than incidence and survival. The overall age-adjusted cancer death rate rose during most of the 20th century, peaking in 1991 at 215 cancer deaths per 100,000 people, mainly because of the tobacco epidemic. As of 2016, the rate had dropped to 156 per 100,000 (a decline of 27%) because of reductions in smoking, as well as improvements in early detection and treatment. This decline translates into more than 2.6 million fewer cancer deaths from 1991 to 2016, progress that has been driven by steady declines in death rates for the four most common cancer types – lung, colorectal, breast, and prostate (Figure 1 and Figure 2).

Do Cancer Incidence and Death Rates Vary by State?

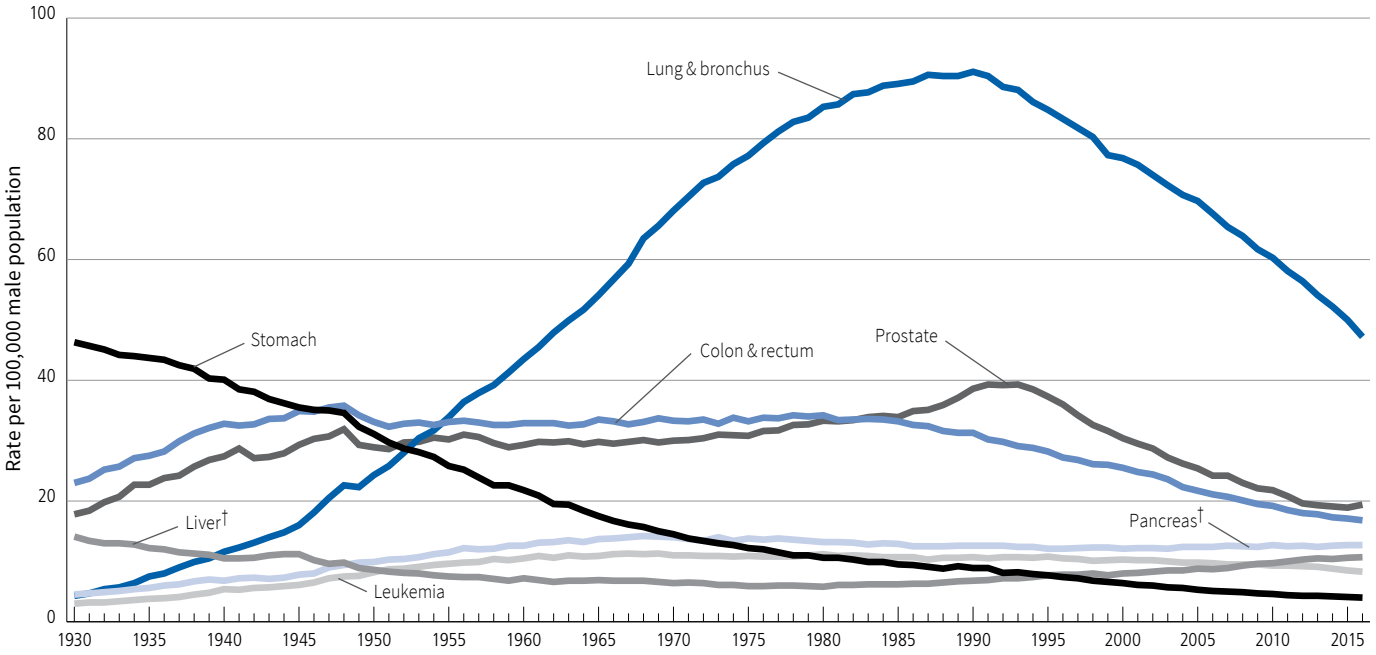
Table 4 and Table 5 provide average annual incidence (new diagnoses) and death rates for selected cancer types by state. Lung cancer rates vary the most by state, reflecting historical differences in smoking prevalence that continue today.

Who Is at Risk of Developing Cancer?

Cancer usually develops in older people; 80% of all cancers in the United States are diagnosed in people 55 years of age or older. Certain behaviors also increase risk, such as smoking, having excess body weight, and drinking alcohol. In the US, approximately 39 out of 100 men and 38 out of 100 women will develop cancer during their lifetime (Table 6). These probabilities are estimated based on cancer occurrence in the general population and may overestimate or underestimate individual risk because of differences in exposures (e.g., smoking), family history, and/or genetic susceptibility. For most types of cancer, risk is higher with a family history of the disease. This is thought to result primarily from the inheritance of genetic variations that confer low or moderate risk and/or similar exposures to lifestyle/environmental risk factors among family members, as opposed to inheritance of genetic alterations that confer a very high risk, which occurs much more rarely.

Relative risk is the strength of the relationship between exposure to a given risk factor and cancer. It is measured by comparing cancer occurrence in people with a certain exposure or trait to cancer occurrence in people without this characteristic. For example, men and women who smoke are about 25 times more likely to develop lung cancer than nonsmokers, so the relative risk of lung cancer among smokers is 25. Most relative risks are not this large. For example, women who have a 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.

Figure 1. Trends in Age-adjusted Cancer Death Rates* by Site, Males, US, 1930-2016



*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 cancers of the liver, lung and bronchus, and colon and rectum are affected by these coding changes.

Source: US Mortality Volumes 1930 to 1959, US Mortality Data 1960 to 2016, National Center for Health Statistics, Centers for Disease Control and Prevention.

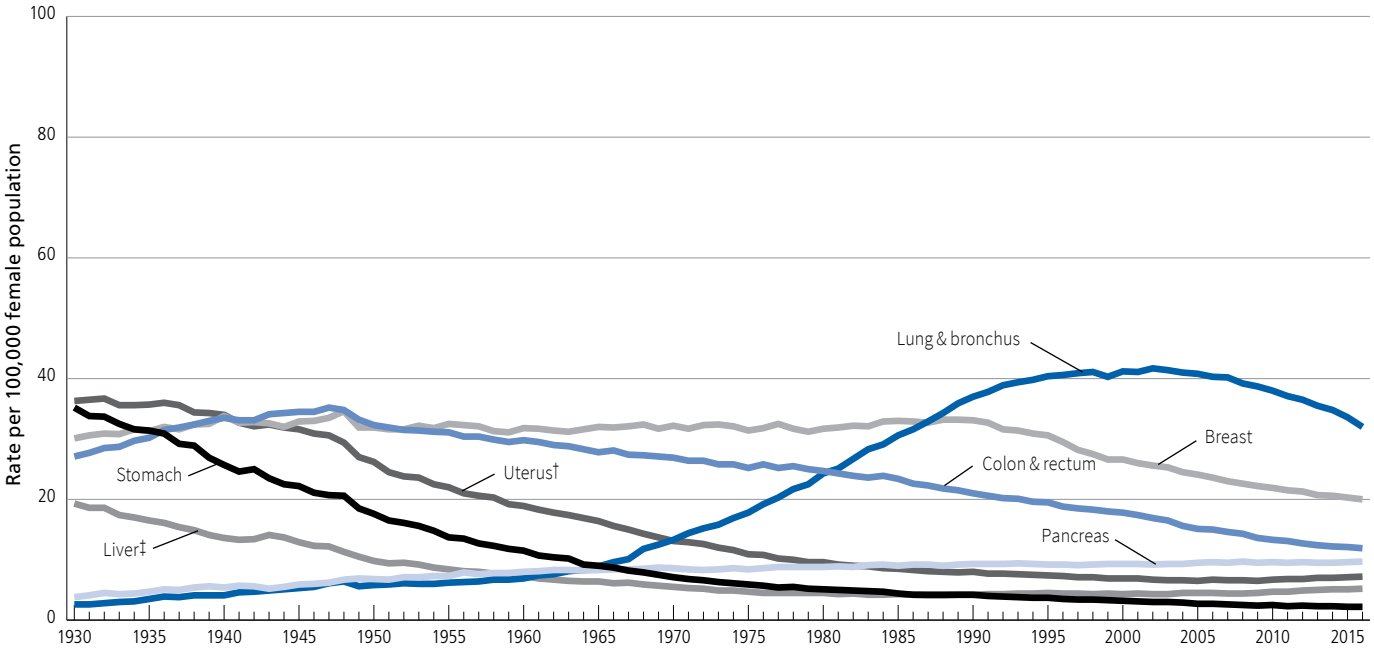
What Percentage of People Survive Cancer?

The 5-year relative survival rate for all cancers combined has increased substantially since the early 1960s, from 39% to 70% among whites and from 27% to 63% among blacks. Improvements in survival (Table 7) reflect advances in treatment, as well as earlier diagnosis for some cancers. Survival varies greatly by cancer type, as well as stage and age at diagnosis (Table 8).

Relative survival is the proportion of people who are alive for a designated time (usually 5 years) after a cancer diagnosis divided by the proportion of people of similar age, race, etc. expected to be alive in the absence of cancer based on normal life expectancy. Relative survival does not distinguish between patients who have no evidence of cancer and those who have relapsed or are still in treatment; nor does it represent the proportion of people who are cured, because cancer death can occur beyond 5 years after diagnosis. For information about how survival rates were calculated for this report, see Sources of Statistics on page 69.

Although relative survival rates provide some indication about the average experience of cancer patients, they should be interpreted with caution for several reasons. First, 5-year survival rates do not reflect the most recent advances in detection and treatment because they are based on patients who were diagnosed at least several years in the past. Second, they do not account for many factors that influence individual survival, such as access to treatment, other illnesses, and biological or behavioral differences. Third, improvements in survival rates over time do not always indicate progress against cancer. For example, increases in average survival rates occur when screening results in the detection of cancers that would never have caused harm if left undetected (overdiagnosis).

Figure 2. Trends in Age-adjusted Cancer Death Rates* by Site, Females, US, 1930-2016



*Per 100,000, age adjusted to the 2000 US standard population. Rates exclude deaths in Puerto Rico and other US territories. †Uterus refers to uterine cervix and uterine corpus combined. ‡The mortality rate for liver cancer is increasing.

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

Source: US Mortality Volumes 1930 to 1959, US Mortality Data 1960 to 2016, National Center for Health Statistics, Centers for Disease Control and Prevention.

Table 1. Estimated Number* of New Cancer Cases and Deaths by Sex, US, 2019

	Estimated New Cases			Estimated Deaths		
	Both sexes	**Male**	**Female**	**Both sexes**	**Male**	**Female**
All sites	1,762,450	870,970	891,480	606,880	321,670	285,210
Oral cavity & pharynx	53,000	38,140	14,860	10,860	7,970	2,890
Tongue	17,060	12,550	4,510	3,020	2,220	800
Mouth	14,310	8,430	5,880	2,740	1,800	940
Pharynx	17,870	14,450	3,420	3,450	2,660	790
Other oral cavity	3,760	2,710	1,050	1,650	1,290	360
Digestive system	328,030	186,080	141,950	165,460	97,110	68,350
Esophagus	17,650	13,750	3,900	16,080	13,020	3,060
Stomach	27,510	17,230	10,280	11,140	6,800	4,340
Small intestine	10,590	5,610	4,980	1,590	890	700
Colon†	101,420	51,690	49,730	51,020	27,640	23,380
Rectum	44,180	26,810	17,370			
Anus, anal canal, & anorectum	8,300	2,770	5,530	1,280	520	760
Liver & intrahepatic bile duct	42,030	29,480	12,550	31,780	21,600	10,180
Gallbladder & other biliary	12,360	5,810	6,550	3,960	1,610	2,350
Pancreas	56,770	29,940	26,830	45,750	23,800	21,950
Other digestive organs	7,220	2,990	4,230	2,860	1,230	1,630
Respiratory system	246,440	130,370	116,070	147,510	80,380	67,130
Larynx	12,410	9,860	2,550	3,760	3,010	750
Lung & bronchus	228,150	116,440	111,710	142,670	76,650	66,020
Other respiratory organs	5,880	4,070	1,810	1,080	720	360
Bones & joints	3,500	2,030	1,470	1,660	960	700
Soft tissue (including heart)	12,750	7,240	5,510	5,270	2,840	2,430
Skin (excluding basal & squamous)	104,350	62,320	42,030	11,650	8,030	3,620
Melanoma of the skin	96,480	57,220	39,260	7,230	4,740	2,490
Other nonepithelial skin	7,870	5,100	2,770	4,420	3,290	1,130
Breast	271,270	2,670	268,600	42,260	500	41,760
Genital system	295,290	186,290	109,000	65,540	32,440	33,100
Uterine cervix	13,170		13,170	4,250		4,250
Uterine corpus	61,880		61,880	12,160		12,160
Ovary	22,530		22,530	13,980		13,980
Vulva	6,070		6,070	1,280		1,280
Vagina & other genital, female	5,350		5,350	1,430		1,430
Prostate	174,650	174,650		31,620	31,620	
Testis	9,560	9,560		410	410	
Penis & other genital, male	2,080	2,080		410	410	
Urinary system	158,220	108,450	49,770	33,420	23,290	10,130
Urinary bladder	80,470	61,700	18,770	17,670	12,870	4,800
Kidney & renal pelvis	73,820	44,120	29,700	14,770	9,820	4,950
Ureter & other urinary organs	3,930	2,630	1,300	980	600	380
Eye & orbit	3,360	1,860	1,500	370	200	170
Brain & other nervous system	23,820	13,410	10,410	17,760	9,910	7,850
Endocrine system	54,740	15,650	39,090	3,210	1,560	1,650
Thyroid	52,070	14,260	37,810	2,170	1,020	1,150
Other endocrine	2,670	1,390	1,280	1,040	540	500
Lymphoma	82,310	45,660	36,650	20,970	12,100	8,870
Hodgkin lymphoma	8,110	4,570	3,540	1,000	590	410
Non-Hodgkin lymphoma	74,200	41,090	33,110	19,970	11,510	8,460
Myeloma	32,110	18,130	13,980	12,960	6,990	5,970
Leukemia	61,780	35,920	25,860	22,840	13,150	9,690
Acute lymphocytic leukemia	5,930	3,280	2,650	1,500	850	650
Chronic lymphocytic leukemia	20,720	12,880	7,840	3,930	2,220	1,710
Acute myeloid leukemia	21,450	11,650	9,800	10,920	6,290	4,630
Chronic myeloid leukemia	8,990	5,250	3,740	1,140	660	480
Other leukemia‡	4,690	2,860	1,830	5,350	3,130	2,220
Other & unspecified primary sites‡	31,480	16,750	14,730	45,140	24,240	20,900

*Rounded to the nearest 10; cases exclude basal cell and squamous cell skin cancer and in situ carcinoma except urinary bladder. About 62,930 cases of carcinoma in situ of the female breast and 95,830 cases of melanoma in situ will be diagnosed in 2019. †Deaths for colon and rectal cancers are combined because a large number of deaths from rectal cancer are misclassified as colon. ‡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 2001-2015 incidence data reported by the North American Association of Central Cancer Registries (NAACCR). Estimated deaths are based on 2002-2016 US mortality data, National Center for Health Statistics, Centers for Disease Control and Prevention.

Table 2. Estimated Number* of New Cases for Selected Cancers by State, US, 2019

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	28,950	4,240	240	2,330	760	840	4,150	1,420	990	4,060	1,100
Alaska	3,090	470	†	290	110	90	400	120	130	460	150
Arizona	37,490	5,630	250	2,840	1,200	1,110	4,290	2,340	1,420	2,800	1,780
Arkansas	16,580	2,210	140	1,440	510	560	2,690	760	640	2,680	740
California	186,920	27,700	1,590	15,360	6,230	6,030	18,990	10,710	8,230	24,550	7,780
Colorado	26,800	4,180	170	1,940	830	810	2,690	1,830	1,130	2,270	1,210
Connecticut	21,950	3,490	120	1,560	720	670	2,580	930	950	1,980	1,160
Delaware	5,870	930	†	440	220	210	840	400	240	700	300
Dist. of Columbia	3,190	510	†	260	120	80	340	80	120	300	80
Florida	131,470	19,130	1,040	11,310	4,520	4,980	18,560	8,360	5,420	11,860	6,450
Georgia	50,450	8,000	440	4,450	1,640	1,800	7,070	3,050	2,030	5,400	2,040
Hawaii	7,120	1,280	50	620	310	200	860	490	280	680	280
Idaho	8,390	1,340	50	630	310	340	1,030	670	380	1,370	460
Illinois	68,560	11,560	510	6,030	2,700	2,380	9,130	3,750	2,890	6,990	3,240
Indiana	35,280	5,820	270	3,360	1,330	1,230	5,500	2,120	1,550	2,530	1,710
Iowa	17,810	2,730	100	1,540	660	730	2,410	1,070	830	1,720	890
Kansas	15,340	2,420	110	1,290	520	590	2,000	870	650	2,070	640
Kentucky	26,400	3,670	200	2,320	890	940	4,960	1,310	1,050	2,190	1,130
Louisiana	26,800	3,770	230	2,340	700	830	3,810	1,020	1,060	3,380	1,050
Maine	8,920	1,390	50	670	320	310	1,400	510	400	660	560
Maryland	33,140	5,290	230	2,620	1,280	960	4,040	1,750	1,280	3,810	1,390
Massachusetts	40,020	6,610	210	2,840	1,380	1,140	5,150	1,640	1,720	2,710	2,130
Michigan	58,360	9,310	360	5,040	2,200	1,930	8,070	3,300	2,530	4,580	2,930
Minnesota	30,560	4,740	140	2,300	1,080	1,360	3,600	1,640	1,360	1,970	1,400
Mississippi	17,050	2,370	150	1,680	450	520	2,520	650	570	1,930	630
Missouri	35,480	5,350	260	3,110	1,180	1,240	5,490	1,800	1,430	3,290	1,570
Montana	5,920	890	†	470	220	240	820	390	260	600	340
Nebraska	9,780	1,580	70	900	360	420	1,290	580	460	750	470
Nevada	14,810	2,190	140	1,340	420	530	1,880	850	600	1,180	770
New Hampshire	8,610	1,330	†	590	300	260	1,140	450	370	1,030	500
New Jersey	53,400	8,340	410	4,250	2,130	2,070	6,070	2,850	2,330	5,710	2,580
New Mexico	9,460	1,440	80	830	370	360	1,070	630	400	520	410
New York	111,870	17,490	880	9,150	4,500	4,540	13,380	5,150	5,030	9,700	5,410
North Carolina	58,690	8,870	410	4,310	1,960	1,960	8,010	3,550	2,220	7,490	2,490
North Dakota	3,940	590	†	350	130	170	430	230	180	360	190
Ohio	67,150	10,240	430	6,200	2,600	2,100	9,680	3,750	2,850	5,340	3,210
Oklahoma	20,540	2,980	170	1,840	630	780	3,220	860	850	1,800	910
Oregon	23,320	3,390	150	1,620	810	670	2,900	1,780	1,010	1,950	1,140
Pennsylvania	79,890	12,070	540	6,520	3,280	3,040	10,380	4,340	3,430	7,470	4,230
Rhode Island	6,540	1,010	†	470	210	190	940	310	270	550	360
South Carolina	29,830	4,470	210	2,370	930	1,040	4,360	1,810	1,100	3,130	1,270
South Dakota	4,770	750	†	430	160	200	580	250	210	400	240
Tennessee	37,350	5,580	310	3,290	1,210	1,280	6,210	2,070	1,550	3,160	1,670
Texas	124,890	18,750	1,290	10,950	4,090	4,820	14,750	4,270	5,430	10,660	4,470
Utah	11,620	1,660	70	770	420	480	780	1,160	550	1,080	450
Vermont	3,920	620	†	280	130	130	510	250	170	210	230
Virginia	45,440	7,120	310	3,540	1,650	1,400	5,950	2,810	1,760	5,440	2,010
Washington	39,160	5,840	230	2,800	1,400	1,370	4,770	2,790	1,800	2,470	1,910
West Virginia	12,440	1,540	80	980	450	410	2,010	650	470	1,010	630
Wisconsin	34,220	5,270	190	2,450	1,290	1,320	4,150	1,940	1,480	5,260	1,710
Wyoming	2,930	440	†	250	100	110	310	210	130	430	150
United States	**1,762,450**	**268,600**	**13,170**	**145,600**	**61,880**	**61,780**	**228,150**	**96,480**	**74,200**	**174,650**	**80,470**

*Rounded to the nearest 10. Excludes basal and squamous cell skin cancers and in situ carcinomas except urinary bladder. Estimates for Puerto Rico are unavailable.
†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/statistics or via the Cancer Statistics Center at cancerstatisticscenter.cancer.org.

Table 3. Estimated Number* of Deaths for Selected Cancers by State, US, 2019

State	All sites	Brain/ nervous system	Female breast	Colon & rectum	Leukemia	Liver‡	Lung & bronchus	Non-Hodgkin lymphoma	Ovary	Pancreas	Prostate
Alabama	10,630	350	690	930	380	540	2,760	290	240	770	510
Alaska	1,120	†	70	110	†	60	260	†	†	90	50
Arizona	12,470	400	890	1,050	510	710	2,630	410	320	1,040	900
Arkansas	6,800	190	410	600	240	310	1,960	200	140	440	280
California	60,590	1,970	4,560	5,290	2,400	4,070	10,970	2,110	1,580	4,720	4,470
Colorado	8,120	290	610	660	330	430	1,500	250	220	600	540
Connecticut	6,470	210	430	470	270	320	1,440	230	160	520	320
Delaware	2,140	60	150	150	80	110	540	80	50	180	90
Dist. of Columbia	1,020	†	100	100	†	90	180	†	†	90	70
Florida	45,000	1,240	3,000	3,700	1,740	2,300	10,880	1,500	980	3,490	2,290
Georgia	17,880	530	1,350	1,630	590	940	4,340	530	410	1,260	920
Hawaii	2,560	50	160	230	80	190	550	90	†	230	120
Idaho	3,040	110	220	250	110	160	620	120	90	240	200
Illinois	24,410	670	1,720	2,070	900	1,150	5,940	770	560	1,740	1,480
Indiana	13,690	360	870	1,110	510	580	3,690	460	290	950	610
Iowa	6,480	200	380	560	240	270	1,600	240	150	480	310
Kansas	5,550	170	350	470	240	260	1,370	190	110	420	270
Kentucky	10,580	290	610	820	370	460	3,290	320	190	670	400
Louisiana	9,260	230	620	830	320	580	2,390	290	160	740	410
Maine	3,310	100	180	230	110	120	890	110	60	230	170
Maryland	10,780	300	830	880	390	600	2,380	340	260	870	550
Massachusetts	12,420	400	750	870	480	690	2,920	380	310	990	620
Michigan	21,150	600	1,410	1,650	770	920	5,410	740	490	1,650	980
Minnesota	10,020	320	640	790	420	440	2,260	380	220	780	530
Mississippi	6,720	190	440	650	210	340	1,810	170	110	500	320
Missouri	13,080	340	860	1,050	480	580	3,650	370	250	920	560
Montana	2,100	70	140	180	80	100	480	70	50	160	140
Nebraska	3,520	120	230	310	150	130	840	120	70	270	180
Nevada	5,390	200	400	540	200	250	1,280	160	150	380	290
New Hampshire	2,820	90	180	200	100	120	730	110	60	200	130
New Jersey	15,860	470	1,250	1,410	590	750	3,390	570	380	1,290	780
New Mexico	3,720	100	270	340	130	250	700	120	120	270	210
New York	35,010	940	2,460	2,890	1,370	1,740	7,790	1,210	890	2,830	1,730
North Carolina	20,410	550	1,390	1,580	720	1,110	5,370	610	420	1,450	960
North Dakota	1,280	†	80	120	50	†	300	50	†	90	70
Ohio	25,440	680	1,710	2,110	920	1,100	6,690	860	560	1,880	1,130
Oklahoma	8,420	220	540	760	340	420	2,270	270	180	560	410
Oregon	8,270	250	560	650	300	500	1,820	280	230	650	470
Pennsylvania	28,170	770	1,900	2,380	1,080	1,320	6,730	960	660	2,220	1,320
Rhode Island	2,140	60	130	160	80	120	560	70	†	170	100
South Carolina	10,720	300	740	870	380	530	2,710	320	220	790	540
South Dakota	1,680	60	110	170	70	70	410	60	†	130	90
Tennessee	14,840	360	950	1,220	520	730	4,190	470	310	980	620
Texas	41,300	1,300	2,980	3,850	1,580	2,810	8,640	1,350	920	3,030	1,900
Utah	3,310	140	280	280	160	170	440	130	110	280	230
Vermont	1,440	50	80	110	50	50	370	50	†	110	70
Virginia	15,200	440	1,120	1,340	520	770	3,590	490	360	1,140	730
Washington	13,010	430	890	1,000	480	730	2,830	450	340	970	710
West Virginia	4,820	120	290	440	190	190	1,360	150	90	300	190
Wisconsin	11,730	380	740	900	490	480	2,770	400	260	930	620
Wyoming	980	†	70	80	50	60	200	†	†	70	50
United States	**606,880**	**17,760**	**41,760**	**51,020**	**22,840**	**31,780**	**142,670**	**19,970**	**13,980**	**45,750**	**31,620**

*Rounded to the nearest 10. †Estimate is fewer than 50 deaths. ‡Liver 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. Estimates are not available for Puerto Rico.

Please note: Estimated deaths for additional cancer sites by state can be found in Supplemental Data at cancer.org/statistics or via the Cancer Statistics Center at cancerstatisticscenter.cancer.org.

Table 4. Incidence Rates* for Selected Cancers by State, US, 2011-2015

	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	518.5	392.8	120.9	51.5	37.1	89.0	51.6	19.7	13.6	123.4	33.4	7.5
Alaska	420.2	401.2	124.1	45.7	38.6	65.3	50.1	20.9	13.5	79.6	34.6	9.7
Arizona	403.6	368.6	112.9	38.6	29.1	54.7	45.0	18.3	13.3	78.6	32.3	7.9
Arkansas	520.6	401.2	114.7	50.8	37.5	98.7	61.6	20.9	14.6	115.9	34.6	7.4
California	438.2	382.2	121.6	41.5	31.8	49.2	39.0	22.6	15.2	101.2	30.5	7.2
Colorado	424.4	380.7	123.5	37.8	30.3	46.9	40.7	20.9	14.2	101.0	32.1	7.9
Connecticut	507.6	448.5	140.2	42.9	33.4	67.9	56.2	26.1	17.3	112.8	46.6	12.0
Delaware	552.2	451.8	133.8	42.7	32.8	82.7	62.8	24.8	17.5	136.1	43.2	10.4
Dist. of Columbia†‡	527.8	444.3	144.6	50.1	38.7	65.4	49.5	22.6	12.9	154.1	23.2	8.5
Florida	462.2	389.9	116.0	42.3	32.1	69.3	51.9	20.9	14.5	97.4	32.9	8.1
Georgia	519.5	409.8	125.2	49.3	35.9	82.9	51.7	22.3	14.7	123.3	32.7	7.7
Hawaii	429.2	399.5	136.1	49.8	35.7	56.8	37.6	21.3	14.0	86.9	23.6	5.7
Idaho	463.0	408.6	122.2	39.6	33.2	56.2	46.5	22.4	15.7	112.2	36.4	8.9
Illinois	508.1	435.7	131.7	51.6	37.6	77.8	57.5	23.6	16.3	114.9	37.5	9.6
Indiana	485.4	423.1	121.7	48.3	38.3	88.1	61.4	22.6	16.0	92.7	37.6	9.2
Iowa	513.0	433.3	123.4	51.2	39.3	77.1	53.4	26.5	17.8	108.0	38.3	8.7
Kansas†	–	–	–	–	–	–	–	–	–	–	–	–
Kentucky	570.2	468.8	125.0	58.0	42.4	112.8	79.0	24.5	16.5	108.8	39.5	10.2
Louisiana	557.2	415.6	124.1	54.9	40.0	87.6	54.4	23.9	16.6	137.4	32.9	7.6
Maine	496.6	448.4	125.7	41.5	33.9	82.5	64.8	23.2	17.7	93.6	47.1	11.9
Maryland	488.4	418.6	131.7	42.0	33.2	65.2	51.8	20.4	14.7	125.7	37.5	9.3
Massachusetts	485.3	445.1	137.6	41.9	33.1	69.3	60.2	23.4	16.3	106.4	40.4	11.2
Michigan	492.8	419.7	123.4	42.8	33.5	75.2	58.5	24.1	16.6	117.6	38.6	10.0
Minnesota†	507.5	438.7	131.5	43.0	34.1	61.6	50.5	26.9	17.9	113.8	37.9	9.5
Mississippi	543.4	401.6	116.0	57.5	41.1	99.8	56.3	20.3	14.3	130.6	30.8	7.0
Missouri	489.7	424.0	128.2	48.8	35.9	87.9	63.9	22.7	15.3	98.0	33.9	8.4
Montana	467.4	415.3	123.2	43.8	33.0	58.6	53.7	21.8	16.4	111.1	35.8	10.2
Nebraska	493.3	415.4	124.1	49.5	37.4	70.6	50.1	24.7	16.8	114.3	36.4	8.7
Nevada†	412.2	377.7	109.4	42.5	32.7	59.0	53.8	17.2	12.6	91.7	32.7	9.2
New Hampshire	511.4	459.2	143.9	42.5	33.9	70.6	62.9	24.8	17.5	116.1	47.0	12.2
New Jersey	525.2	447.6	133.4	47.9	37.0	64.3	52.6	26.0	18.2	134.7	41.7	10.5
New Mexico†	394.1	364.3	112.4	38.2	28.9	46.1	35.6	17.2	13.6	82.4	25.8	6.3
New York	528.1	445.5	131.3	46.0	35.0	69.1	54.1	26.5	17.8	131.7	41.1	10.6
North Carolina	514.6	418.4	131.0	43.3	32.9	86.3	56.5	21.3	14.3	120.9	35.0	8.8
North Dakota	492.8	412.6	123.7	53.0	38.9	68.4	50.7	21.7	17.0	121.0	36.3	8.1
Ohio	497.9	429.5	126.2	48.3	36.4	82.7	59.4	23.1	15.6	108.0	38.7	9.3
Oklahoma	489.8	409.8	118.4	48.1	36.9	85.7	58.7	22.0	15.1	101.1	33.8	7.8
Oregon	453.8	412.4	124.9	39.8	30.4	61.3	52.4	21.8	15.6	95.4	37.1	8.9
Pennsylvania	524.3	455.2	131.0	49.5	37.0	76.5	56.3	25.9	17.9	111.1	43.2	10.9
Rhode Island	505.5	458.1	135.3	40.4	32.5	78.2	64.2	27.0	18.3	104.1	45.6	12.7
South Carolina	512.3	407.5	128.3	44.6	33.7	84.4	53.5	20.2	13.9	119.4	34.6	8.5
South Dakota	484.6	422.2	134.3	48.9	36.8	67.4	51.7	23.6	15.4	114.6	35.3	9.1
Tennessee	514.8	415.2	122.2	46.3	35.6	94.3	61.7	21.6	14.5	114.4	34.2	8.1
Texas	445.9	370.5	111.7	45.7	31.8	65.5	43.5	21.3	14.6	95.4	26.9	6.2
Utah	439.1	371.4	115.1	34.2	27.6	32.4	23.7	22.6	14.9	121.0	29.6	6.1
Vermont	472.4	434.8	130.4	38.7	33.5	69.9	58.3	26.2	18.4	92.0	37.7	10.7
Virginia	444.4	395.6	127.9	40.3	32.3	69.8	50.6	20.4	14.2	102.8	31.1	8.1
Washington	476.5	425.7	135.3	40.0	32.0	62.8	52.1	24.9	16.3	106.8	37.2	9.1
West Virginia	511.0	442.5	116.3	53.2	41.6	98.4	66.2	22.0	15.9	94.7	39.4	10.6
Wisconsin	497.0	430.7	129.7	42.6	33.1	68.0	54.1	25.5	17.2	111.6	39.7	9.9
Wyoming	428.1	375.1	112.6	39.2	27.9	46.6	43.3	19.8	13.9	103.0	36.8	9.7
Puerto Rico§	404.9	319.3	93.2	52.5	35.1	24.7	12.3	17.0	12.8	146.6	16.9	4.7
United States	**494.8**	**419.3**	**124.7**	**45.2**	**34.3**	**71.3**	**52.3**	**22.8**	**15.6**	**109.2**	**35.5**	**8.8**

– Data unavailable. *Per 100,000, age adjusted to the 2000 US standard population. †Data for these states are not included in US combined rates because either the registry did not consent or high-quality incidence data were not available for all years during 2011-2015 according to the North American Association of Central Cancer Registries (NAACCR). ‡Rates are based on cases diagnosed during 2011-2014. §Data for Puerto Rico are not included in US combined rates for comparability to previously published US rates.

Source: NAACCR, 2018. 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.

Table 5. Death Rates* for Selected Cancers by State, US, 2012-2016

	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	226.0	144.9	21.8	19.8	13.0	70.7	37.7	6.9	4.4	13.4	9.9	21.7
Alaska	189.5	145.9	19.6	17.2	14.1	50.7	37.9	6.4	4.1	11.2	11.1	18.3
Arizona	167.8	122.8	19.3	15.1	10.6	39.7	29.2	6.3	4.0	11.8	8.8	17.7
Arkansas	229.4	151.5	21.6	20.5	13.7	75.5	43.0	7.2	4.3	12.4	9.6	19.3
California	171.0	126.5	19.8	15.1	11.1	36.4	26.4	6.8	4.2	11.8	9.1	19.7
Colorado	162.6	120.8	19.0	14.0	10.5	32.4	26.7	6.4	3.7	10.8	8.2	21.4
Connecticut	175.3	128.4	18.1	13.5	10.0	42.0	32.0	7.1	4.1	12.1	9.7	17.7
Delaware	202.1	145.9	21.4	16.6	10.7	57.1	39.8	8.3	4.7	14.2	9.7	17.5
Dist. of Columbia	200.2	155.6	28.3	18.4	13.5	44.3	30.7	6.3	3.3	15.8	11.8	31.0
Florida	182.0	128.5	19.4	15.7	11.0	49.7	33.2	6.8	4.1	12.2	8.9	16.7
Georgia	206.6	137.0	21.9	19.1	12.1	59.8	33.3	7.0	4.1	12.7	9.1	22.2
Hawaii	162.3	113.0	16.2	15.7	10.6	39.6	23.9	6.3	3.5	12.4	9.9	13.9
Idaho	180.1	132.7	20.4	15.4	10.9	40.1	30.1	7.7	5.1	12.9	9.5	23.2
Illinois	203.0	146.7	21.9	18.7	12.8	55.2	37.6	7.4	4.4	13.0	9.6	20.4
Indiana	217.8	150.2	21.1	18.2	13.1	66.7	41.6	8.4	4.9	13.4	9.7	20.0
Iowa	200.9	139.7	19.1	17.4	13.1	55.7	35.9	8.4	4.8	12.9	9.5	19.6
Kansas	194.4	141.7	20.3	17.5	12.4	53.3	37.3	7.1	4.9	12.8	10.2	18.4
Kentucky	243.7	165.0	21.6	20.2	13.9	84.5	52.2	8.8	4.6	12.8	10.0	19.9
Louisiana	227.6	151.2	23.2	21.0	14.2	67.6	39.3	8.2	4.5	15.1	11.2	21.1
Maine	207.8	148.7	18.4	15.0	11.7	61.6	41.8	7.5	5.0	11.8	10.7	20.1
Maryland	190.7	140.0	22.2	16.9	11.9	48.6	34.3	6.8	4.1	13.6	10.0	20.2
Massachusetts	187.2	135.4	18.0	14.4	10.9	47.6	35.7	6.6	4.2	12.8	9.9	18.7
Michigan	202.4	147.8	21.3	16.8	12.1	56.6	39.8	8.4	4.9	13.5	10.6	19.0
Minnesota	181.2	132.8	18.1	14.4	11.2	44.0	33.3	7.9	4.7	12.5	9.2	19.5
Mississippi	245.5	155.8	23.4	23.1	15.3	78.3	39.9	7.1	4.0	15.6	11.2	24.7
Missouri	210.8	150.2	21.7	18.2	12.7	65.1	43.2	7.0	4.2	12.8	9.7	17.8
Montana	176.5	135.4	20.0	16.2	11.1	41.5	36.1	7.0	4.3	10.9	9.3	21.0
Nebraska	190.1	136.9	20.3	17.6	13.1	50.4	34.3	7.4	4.3	12.8	9.3	18.9
Nevada	184.3	142.9	21.9	19.4	14.0	47.6	39.6	6.5	3.8	11.4	9.0	20.2
New Hampshire	192.0	141.1	19.5	13.9	11.9	50.3	39.9	7.1	4.5	12.3	9.0	19.3
New Jersey	181.4	136.9	21.8	17.5	12.2	43.6	32.0	7.3	4.2	12.6	10.1	18.2
New Mexico	170.4	122.6	18.8	16.5	10.9	35.1	25.7	5.8	4.0	10.9	8.5	19.8
New York	180.5	133.8	19.9	15.9	11.5	45.6	31.7	7.1	4.2	12.9	9.9	18.3
North Carolina	206.0	138.9	20.9	16.7	11.5	62.4	36.5	7.1	4.2	12.9	9.5	20.3
North Dakota	178.8	128.0	17.5	16.2	11.9	47.3	31.2	6.8	4.7	11.3	8.4	17.8
Ohio	212.9	151.9	22.5	18.9	13.2	62.7	41.1	8.0	4.8	13.2	10.4	19.0
Oklahoma	221.5	154.6	22.6	20.9	14.2	67.0	43.3	8.0	4.9	12.5	9.7	20.4
Oregon	189.4	140.9	20.4	15.6	11.4	46.1	35.9	7.9	4.6	13.2	9.7	20.8
Pennsylvania	203.6	145.0	21.6	18.2	13.0	55.2	35.6	7.8	4.7	13.8	10.1	18.9
Rhode Island	201.0	140.4	18.2	15.9	11.3	56.4	40.4	6.5	4.5	13.3	9.8	17.6
South Carolina	213.9	141.3	21.8	17.7	12.2	61.9	35.5	6.8	4.3	13.1	9.8	22.2
South Dakota	192.8	132.7	19.2	19.9	13.2	51.7	33.5	6.9	4.0	12.3	9.4	19.3
Tennessee	227.7	151.5	22.1	19.1	13.2	73.1	42.6	8.2	4.8	12.7	9.7	19.8
Texas	187.0	129.1	20.0	17.8	11.4	47.5	29.4	7.0	4.3	11.7	9.0	17.9
Utah	148.5	109.5	20.1	13.1	9.6	23.4	15.6	6.7	4.3	10.9	8.7	20.5
Vermont	194.0	141.6	18.1	16.2	12.6	49.8	38.1	7.9	4.6	12.5	9.9	19.2
Virginia	194.0	137.4	21.4	16.8	11.5	53.0	34.0	6.9	4.3	12.8	9.5	19.9
Washington	183.6	135.9	19.6	14.5	10.6	44.9	34.1	7.9	4.5	12.2	9.3	20.0
West Virginia	227.1	161.7	21.9	20.9	16.0	72.6	45.1	7.8	4.9	12.0	9.4	17.4
Wisconsin	193.9	139.1	19.5	15.5	11.5	49.6	34.8	7.8	4.4	13.3	10.2	20.6
Wyoming	166.2	128.2	18.1	15.5	10.3	37.3	31.1	7.0	4.4	10.5	9.2	16.5
Puerto Rico†	152.7	94.6	17.9	19.7	12.2	19.8	8.9	4.7	2.6	7.9	5.8	26.7
United States	**193.1**	**137.7**	**20.6**	**16.9**	**11.9**	**51.6**	**34.4**	**7.3**	**4.4**	**12.6**	**9.6**	**19.2**

*Per 100,000, age adjusted to the 2000 US standard population. †Rates for Puerto Rico are for 2011-2015 and are not included in overall US combined rates.

Source: US Mortality Data, National Center for Health Statistics, Centers for Disease Control and Prevention, 2018.

How Is Cancer Staged?

Stage describes the extent or spread of cancer at the time of diagnosis. Proper staging is essential for optimizing therapy and assessing prognosis. For most cancers, stage is based on the size or extent of the primary tumor and whether the cancer has spread to nearby lymph nodes or other areas of the body. Several staging systems are used to classify cancer. A system of summary staging is used for descriptive and statistical analysis of population-based 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 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 Table 8.)

Clinicians mainly use a different staging system, called TNM. The TNM system assesses cancer growth and spread in 3 ways: size/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. However, some cancers do not have a stage IV (e.g., testis) and others (e.g., lymphoma) have alternative staging systems. As the biology of cancer has become better understood, additional tumor-specific features have been incorporated into treatment plans and/or staging for some cancers.

What Are the Costs of Cancer?

The Agency for Healthcare Research and Quality estimates that the direct medical costs (total of all health care expenditures) for cancer in the US in 2015 were $80.2 billion. Fifty-two percent of those costs were for hospital outpatient or office-based provider visits, and 38% were for inpatient hospital stays. These estimates are based on a set of large-scale surveys of individuals and their medical providers called the Medical Expenditure Panel Survey, the most complete, nationally representative data on health care and expenditures. Visit meps.ahrq.gov/mepsweb/ for more information.

Lack of health insurance and other barriers prevents many Americans from receiving optimal cancer prevention, early detection, and treatment. According to the US Census Bureau, 28.5 million Americans (9%) were uninsured during the entire 2017 calendar year, down more than 13 million from 2013 because of the implementation in January 2014 of several new provisions of the Affordable Care Act (ACA). The largest increase in health insurance coverage was among those with the lowest education and income. Hispanics and blacks continue to be the most likely to be uninsured, 16% and 11%, respectively, compared to 6% of non-Hispanic whites. The percentage of uninsured ranged from 3% in Massachusetts to 17% in Texas. 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, costlier, and less successful. To learn more about how the ACA helps save lives from cancer, see Advocacy on page 66.

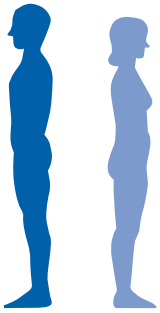
Selected Cancers

This section provides information on occurrence, risk factors, symptoms, early detection, and treatment for the most commonly diagnosed cancers, and may have limited relevance to rarer cancers or cancer subtypes. (For information on rare cancers, see the Special Section in *Cancer Facts & Figures 2017* on cancer.org/statistics.) Cancer incidence trends are based on data through 2015 from the National Cancer Institute's 9 oldest Surveillance, Epidemiology, and End Results (SEER) registries; mortality trends are based on deaths through 2016 reported by the National Center for Health Statistics. Generally, trends are described based on the average annual percent change in the most recent 5 or 10 years as appropriate. See Sources of Statistics on page 69 for more information.

Figure 3. Leading Sites of New Cancer Cases and Deaths – 2019 Estimates

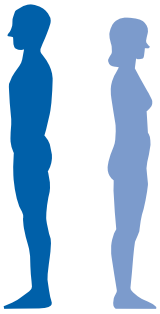
Estimated New Cases

Male			Female		
Prostate	174,650	20%	Breast	268,600	30%
Lung & bronchus	116,440	13%	Lung & bronchus	111,710	13%
Colon & rectum	78,500	9%	Colon & rectum	67,100	7%
Urinary bladder	61,700	7%	Uterine corpus	61,880	7%
Melanoma of the skin	57,220	7%	Melanoma of the skin	39,260	5%
Kidney & renal pelvis	44,120	5%	Thyroid	37,810	4%
Non-Hodgkin lymphoma	41,090	5%	Non-Hodgkin lymphoma	33,110	4%
Oral cavity & pharynx	38,140	4%	Kidney & renal pelvis	29,700	3%
Leukemia	35,920	4%	Pancreas	26,830	3%
Pancreas	29,940	3%	Leukemia	25,860	3%
All sites	**870,970**		**All sites**	**891,480**	



Estimated Deaths

Male			Female		
Lung & bronchus	76,650	24%	Lung & bronchus	66,020	23%
Prostate	31,620	10%	Breast	41,760	15%
Colon & rectum	27,640	9%	Colon & rectum	23,380	8%
Pancreas	23,800	7%	Pancreas	21,950	8%
Liver & intrahepatic bile duct	21,600	7%	Ovary	13,980	5%
Leukemia	13,150	4%	Uterine corpus	12,160	4%
Esophagus	13,020	4%	Liver & intrahepatic bile duct	10,180	4%
Urinary bladder	12,870	4%	Leukemia	9,690	3%
Non-Hodgkin lymphoma	11,510	4%	Non-Hodgkin lymphoma	8,460	3%
Brain & other nervous system	9,910	3%	Brain & other nervous system	7,850	3%
All sites	**321,670**		**All sites**	**285,210**	



Estimates are rounded to the nearest 10, and cases exclude basal cell and squamous cell skin cancers and in situ carcinoma except urinary bladder. Estimates do not include Puerto Rico or other US territories. Ranking is based on modeled projections and may differ from the most recent observed data.

Breast

New cases: In the US in 2019, there will be an estimated 268,600 new cases of invasive breast cancer diagnosed in women (Figure 3); 2,670 cases diagnosed in men; and an additional 62,930 cases of in situ breast lesions (ductal carcinoma in situ [DCIS] or lobular carcinoma in situ [LCIS]) diagnosed in women (Table 1).

Incidence trends: From 2006 to 2015, invasive female breast cancer incidence rates increased slightly, by 0.4% per year.

Deaths: An estimated 42,260 breast cancer deaths (41,760 women, 500 men) will occur in 2019.

Mortality trends: The female breast cancer death rate peaked at 33.2 (per 100,000) in 1989, then declined by 40% to 20.0 in 2016. This progress reflects improvements in early detection (through screening, as well as increased awareness of symptoms) and treatment, and translates to an estimated 348,800 fewer breast cancer deaths than would have been expected if the death rate had remained at its peak. From 2007 to 2016, the breast cancer death rate declined by 1.8% per year.

Risk factors: Older age and being a woman are the strongest risk factors for breast cancer. Potentially modifiable factors that increase risk include weight gain after the age of 18 and/or being overweight or obese (for postmenopausal breast cancer); menopausal hormone therapy (combined estrogen and progestin); alcohol consumption; and physical inactivity. Breastfeeding for at least one year decreases risk. Non-modifiable factors that increase risk include a personal or family history of breast or ovarian cancer; inherited mutations (genetic alterations) in breast cancer susceptibility genes (e.g., *BRCA1* or *BRCA2*); certain benign breast conditions, such as atypical hyperplasia; a history of ductal carcinoma in situ (DCIS) or lobular carcinoma in situ (LCIS); high breast tissue density (the amount of glandular tissue relative to fatty tissue measured on a mammogram); and high-dose radiation to the chest at a young age (e.g., for treatment of lymphoma). Reproductive factors that

increase risk include a long menstrual history (menstrual periods that start early and/or end late in life); not having children or having children after age 30; high natural levels of sex hormones; and recent use of oral contraceptives.

Early detection: Mammography is a low-dose x-ray procedure used to detect breast cancer at an early stage. Early diagnosis reduces the risk of dying from breast cancer and provides more treatment options. However, like any screening tool, mammography is not perfect. It can miss cancer (false negative) or appear abnormal in the absence of cancer (false positive); about 1 in 10 women who are screened have an abnormal mammogram, but only about 5% of these women have cancer. Other potential harms include detection of cancers and in situ lesions (e.g., DCIS) that would never have progressed or caused harm (i.e., overdiagnoses), and cumulative radiation exposure, which increases breast cancer risk. For women at average risk of breast cancer, the American Cancer Society recommends that those 40 to 44 years of age have the option to begin annual mammography; those 45 to 54 undergo annual mammography; and those 55 years of age and older may transition to biennial mammography or continue annual mammography. Women should continue mammography as long as overall health is good and life expectancy is 10 or more years. For some women at high risk of breast cancer, annual magnetic resonance imaging (MRI) is recommended to accompany mammography, typically starting at age 30. For more information on breast cancer screening, see the American Cancer Society's screening guidelines on page 71.

Signs and symptoms: Early breast cancer usually has no symptoms and is most often diagnosed through mammography screening. When symptoms occur, the most common is a lump or mass in the breast. Other symptoms may include persistent changes to the breast, such as thickening, swelling, distortion, tenderness, skin irritation, redness, scaliness, and nipple abnormalities or spontaneous nipple discharge.

Treatment: Treatment usually involves either breast-conserving surgery (surgical removal of the tumor and surrounding tissue, sometimes called a lumpectomy) or mastectomy (surgical removal of the breast), depending on tumor characteristics (e.g., size and extent of spread) and patient preference. Radiation to the breast is recommended for most patients having breast-conserving surgery. For women with early-stage breast cancer (without spread to the skin, chest wall, or distant organs), studies indicate that breast-conserving surgery plus radiation therapy results in long-term outcomes equivalent to, and possibly even better than, mastectomy. Although most patients undergoing mastectomy do not need radiation, it is sometimes recommended when the tumor is large or lymph nodes are involved. One or more underarm lymph nodes are usually evaluated during surgery to determine whether the tumor has spread beyond the breast. Women undergoing mastectomy who elect breast reconstruction have several options, including the type of tissue or implant used to restore breast shape. Reconstruction may be performed at the time of mastectomy (also called immediate reconstruction) or as a second procedure (delayed reconstruction), but often requires more than one surgery.

Treatment may also involve chemotherapy (before or after surgery), hormone (anti-estrogen) therapy, and/or targeted therapy, depending on cancer stage, subtype, and the anticipated benefits of each treatment component. Women with early-stage breast cancer who test positive for hormone receptors benefit from treatment with hormone therapy for 5 or more years.

Survival: The 5- and 10-year relative survival rates for women with invasive breast cancer are 90% and 83%, respectively. Sixty-two percent of 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 survival is 99% (Table 8). Survival rates have improved over time for both white and black women, but remain about 10% lower (in absolute terms) for black women (Table 7). Continuing disparities in outcomes for black women are an area of national focus.

See *Breast Cancer Facts & Figures* at cancer.org/statistics for more information on breast cancer.

Childhood Cancer (Ages 0-14 years)

New cases: An estimated 11,060 new cancer cases will be diagnosed among children ages 0 to 14 years in the US in 2019. (This number excludes benign and borderline malignant brain tumors.)

Incidence trends: Childhood cancer incidence rates have increased by 0.6% per year on average since 1975.

Deaths: An estimated 1,190 cancer deaths will occur among children in 2019. Cancer is the second-leading cause of death among children ages 1-14 years (after accidents).

Mortality trends: The death rate for cancer in children ages 0-14 years declined by two-thirds from 1970 (6.3 per 100,000) to 2016 (2.2 per 100,000), largely due to improvements in treatment and high rates of participation in clinical trials. However, the pace of decline slowed from about 3% annually during the 1970s and 1980s to 1.3% annually since the mid-1990s.

Risk factors: There are few known risk factors for childhood cancer. Most cancers in children are believed to arise spontaneously due to random mutations inside cells, with no external cause. Exposure to ionizing radiation increases the risk of childhood leukemia and possibly other cancers. Solid organ transplant recipients are at increased risk for non-Hodgkin lymphoma, largely because of drugs that suppress the immune system to prevent organ rejection. Cancer risk is also increased in children with certain genetic syndromes (e.g., Down syndrome, Li-Fraumeni syndrome, and Beckwith-Wiedemann syndrome).

Signs and symptoms: Early diagnosis of childhood cancer is often hampered by nonspecific symptoms shared by common childhood conditions. Parents should ensure that children have regular medical checkups and be alert to unusual, persistent symptoms, including 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.

Following are more specific symptoms for the major categories of pediatric cancer according to the International Classification of Childhood Cancer (ICCC); the distribution of each cancer type provided in parentheses is among all cancers in children ages 0 to 14 years, including benign and borderline malignant brain tumors and cancers not classified by the ICCC.

- Leukemia (28% of all childhood cancers) may cause bone and joint pain, fatigue, weakness, pale skin, bleeding or bruising easily, fever, or infection.
- Brain and other central nervous system tumors (26%) may cause headaches, nausea, vomiting, blurred or double vision, seizures, dizziness, and difficulty walking or handling objects.
- Neuroblastoma (6%), a cancer of the peripheral nervous system that is most common in children younger than 5 years of age, usually appears as a swelling in the abdomen.
- Wilms tumor (5%), also called nephroblastoma, is a kidney cancer that may appear as swelling or a lump in the abdomen.
- Non-Hodgkin lymphoma, including Burkitt lymphoma, (5%) and Hodgkin lymphoma (3%), often causes lymph nodes to swell and appear as a lump in the neck, armpit, or groin; other symptoms include fatigue, weight loss, and fever.
- Rhabdomyosarcoma (3%), a soft tissue sarcoma that can occur in the head and neck, genitourinary area, trunk, and extremities, may cause pain and/or a mass or swelling.
- Retinoblastoma (2%), an eye cancer that usually occurs in children younger than 5 years of age, is often recognized because the pupil appears white or pink instead of the normal red color in flash photographs or during an eye examination.
- Osteosarcoma (2%), a bone cancer that most often occurs in adolescents, commonly appears as sporadic pain in the affected bone that may worsen at night or with activity and eventually progresses to local swelling.

- Ewing sarcoma (1%), another cancer usually arising in the bone in adolescents, typically appears as pain at the tumor site.

Treatment: Childhood cancers are treated with surgery, radiation, and/or chemotherapy/targeted therapy/immunotherapy 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 currently available treatment, should be considered.

Survival: Overall, childhood cancer survival has improved markedly over the past 30 years due to new and improved treatments. The 5-year relative survival for all ICCC groups combined during the most recent time period (2008-2014) is 83%, although rates vary considerably depending on cancer type and stage, patient age, and other characteristics. For example, the 5-year survival for Hodgkin lymphoma is 98%; for retinoblastoma it is 95%; Wilms tumor, 93%; non-Hodgkin lymphoma, 90%; leukemia, 87% (91% for acute lymphocytic leukemia and 66% for acute myeloid leukemia); neuroblastoma, 80%; Ewing sarcoma, 78%; brain and other central nervous system tumors (excluding benign brain tumors), 73%; osteosarcoma, 70%; and rhabdomyosarcoma, 70%. Pediatric cancer survivors may experience treatment-related side effects long after active treatment, including impairment in organ function (e.g., cognitive defects) and secondary cancers. The Children's Oncology Group (COG) has developed guidelines for screening for and managing late effects in survivors of childhood cancer. See the COG website at survivorshipguidelines.org for more information.

See the *Cancer Facts & Figures 2014* Special Section: Childhood & Adolescent Cancers at cancer.org/statistics and the Childhood Cancer Research Landscape Report at cancer.org for more information on childhood cancer.

Colon and Rectum

New cases: An estimated 101,420 cases of colon cancer and 44,180 cases of rectal cancer will be diagnosed in the US in 2019 (Table 1).

Incidence trends: Colorectal cancer incidence has been declining for several decades due to changes in risk factor exposures and the uptake of screening. However, the overall trend is driven by older adults (who have the highest rates) and masks increasing incidence in younger age groups. From 2006 to 2015, incidence rates declined by 3.7% annually among adults 55 years of age and older, but increased by 1.8% annually among those younger than age 55.

Deaths: An estimated 51,020 deaths from colorectal cancer will occur in 2019. Unfortunately, accurate statistics on colon and rectal cancer deaths separately are not available because many deaths from rectal cancer are misclassified as colon cancer on death certificates. The substantial misclassification has been attributed largely to the widespread use of the term "colon cancer" to refer to both colon and rectal cancers in educational messaging.

Mortality trends: Overall, the colorectal cancer death rate in 2016 (13.7 per 100,000) was less than half of that in 1970 (29.2 per 100,000) because of changing patterns in risk factors, increased screening, and improvements in treatment. From 2007 to 2016, the death rate declined by 2.7% per year among individuals ages 55 and older and increased by 1% per year among adults younger than age 55.

Risk factors: Based on a study by American Cancer Society researchers, more than half (55%) of colorectal cancers in the US are attributable to potentially modifiable risk factors. Modifiable factors that increase risk include obesity, physical inactivity, long-term smoking, high consumption of red or processed meat, low calcium intake, moderate to heavy alcohol consumption, and very low intake of fruits and vegetables and whole-grain fiber. Hereditary and medical factors that increase risk include a personal or family history of

Table 6. Probability (%) of Developing Invasive Cancer during Selected Age Intervals by Sex, US, 2013-2015*

		Birth to 49	50 to 59	60 to 69	70 and older	Birth to death
All sites†	Male	3.4 (1 in 30)	6.1 (1 in 16)	13.2 (1 in 8)	31.9 (1 in 3)	39.3 (1 in 3)
	Female	5.6 (1 in 18)	6.2 (1 in 16)	10.0 (1 in 10)	26.0 (1 in 4)	37.7 (1 in 3)
Breast	Female	2.0 (1 in 51)	2.3 (1 in 43)	3.5 (1 in 29)	6.7 (1 in 15)	12.4 (1 in 8)
Colon & rectum	Male	0.4 (1 in 272)	0.7 (1 in 143)	1.2 (1 in 87)	3.3 (1 in 30)	4.4 (1 in 23)
	Female	0.3 (1 in 292)	0.5 (1 in 190)	0.8 (1 in 123)	3.0 (1 in 33)	4.1 (1 in 25)
Kidney & renal pelvis	Male	0.2 (1 in 440)	0.4 (1 in 280)	0.6 (1 in 155)	1.4 (1 in 73)	2.1 (1 in 47)
	Female	0.2 (1 in 665)	0.2 (1 in 575)	0.3 (1 in 319)	0.7 (1 in 135)	1.2 (1 in 82)
Leukemia	Male	0.3 (1 in 396)	0.2 (1 in 570)	0.4 (1 in 259)	1.4 (1 in 72)	1.8 (1 in 56)
	Female	0.2 (1 in 508)	0.1 (1 in 876)	0.2 (1 in 434)	0.9 (1 in 112)	1.3 (1 in 80)
Lung & bronchus	Male	0.1 (1 in 719)	0.6 (1 in 158)	1.8 (1 in 56)	6.0 (1 in 17)	6.7 (1 in 15)
	Female	0.1 (1 in 673)	0.6 (1 in 178)	1.4 (1 in 72)	4.7 (1 in 21)	5.9 (1 in 17)
Melanoma of the skin‡	Male	0.5 (1 in 215)	0.5 (1 in 186)	1.0 (1 in 104)	2.7 (1 in 37)	3.7 (1 in 27)
	Female	0.7 (1 in 150)	0.4 (1 in 238)	0.5 (1 in 191)	1.1 (1 in 87)	2.5 (1 in 40)
Non-Hodgkin lymphoma	Male	0.3 (1 in 382)	0.3 (1 in 350)	0.6 (1 in 176)	1.8 (1 in 54)	2.4 (1 in 42)
	Female	0.2 (1 in 548)	0.2 (1 in 484)	0.4 (1 in 247)	1.4 (1 in 74)	1.9 (1 in 54)
Prostate	Male	0.2 (1 in 437)	1.7 (1 in 59)	4.6 (1 in 22)	7.9 (1 in 13)	11.2 (1 in 9)
Thyroid	Male	0.2 (1 in 513)	0.1 (1 in 764)	0.2 (1 in 584)	0.2 (1 in 417)	0.6 (1 in 156)
	Female	0.8 (1 in 122)	0.4 (1 in 268)	0.3 (1 in 286)	0.4 (1 in 262)	1.8 (1 in 55)
Uterine cervix	Female	0.3 (1 in 366)	0.1 (1 in 835)	0.1 (1 in 938)	0.2 (1 in 628)	0.6 (1 in 162)
Uterine corpus	Female	0.3 (1 in 333)	0.6 (1 in 164)	1.0 (1 in 102)	1.3 (1 in 75)	2.9 (1 in 35)

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

Source: DevCan: Probability of Developing or Dying of Cancer Software, Version 6.7.6. Statistical Research and Applications Branch, National Cancer Institute, 2018. 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.

colorectal cancer and/or polyps (adenomatous), certain inherited genetic conditions (e.g., Lynch syndrome), a personal history of chronic inflammatory bowel disease (ulcerative colitis or Crohn's disease), and type 2 diabetes.

Regular long-term use of nonsteroidal anti-inflammatory drugs, such as aspirin, reduces risk, but these drugs can have serious adverse health effects, such as stomach bleeding. Decision making about aspirin use should include a conversation with your health care provider.

Early detection: Screening can prevent colorectal cancer through the detection and removal of precancerous growths, as well as detect cancer at an early stage, when treatment is usually less extensive and more successful. Regular adherence to either of the two types of testing (stool or structural exams) over a lifetime of screening results in a similar reduction in premature colorectal cancer death. New guidelines from the American Cancer Society recommend that men and women at average risk for colorectal cancer begin screening at 45 years of age and continue up to age 85 depending on health status/life expectancy, with more individualized decision making from ages 76 to 85 based on patient preferences and prior screening history. For more information on the American Cancer Society's recommendations for colorectal cancer screening, see page 71.

Signs and symptoms: Symptoms 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, abdominal cramping or pain, decreased appetite, and weight loss. In some cases, the cancer causes blood loss that leads to anemia (low number of red blood cells), resulting in symptoms such as weakness and fatigue. Increasing incidence of colorectal cancer in young individuals, who are often diagnosed with advanced disease, reinforces the need for timely evaluation of persistent symptoms in all patients. Early-stage colorectal cancer typically does not have symptoms, which is why screening is usually necessary to detect this cancer early.

Treatment: Surgery is the most common treatment for colorectal cancer that has not spread. A permanent colostomy (creation of an abdominal opening for elimination of body waste) is rarely necessary for colon cancer and not usually required for rectal cancer. For most patients whose cancer has penetrated the bowel wall deeply or spread to lymph nodes, chemotherapy is given after surgery for colon cancer, and before and/or after surgery, alone or in combination with radiation, for rectal cancer. For colorectal cancer that has spread to other parts of the body (metastatic colorectal cancer), treatments typically include chemotherapy and/or targeted therapy. Immunotherapy is a newer option for some advanced cancers.

Survival: The 5-year relative survival rate for colorectal cancer is 65%. Only 39% of patients are diagnosed with localized disease, for which 5-year survival is 90% (Table 8).

See *Colorectal Cancer Facts & Figures* at cancer.org/statistics for more information on colorectal cancer.

Kidney and Renal Pelvis

New cases: An estimated 73,820 new cases of kidney (renal) cancer will be diagnosed in the US in 2019 (Table 1). These are primarily renal cell carcinomas, which occur in the body of the kidney, but also include 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 on page 12). Men are twice as likely as women to be diagnosed with kidney cancer.

Incidence trends: The increase in kidney cancer incidence rates since at least 1975 appears to have slowed in recent years. The rise, mostly due to localized stage diagnoses, is partly attributed to incidental detection of asymptomatic tumors because of the increased use of medical imaging. From 2006 to 2015, the rate increased by about 1% per year.

Deaths: An estimated 14,770 deaths from kidney cancer will occur in 2019.

Mortality trends: In contrast to incidence, kidney cancer mortality has been declining since about 1995; from 2007 to 2016, the death rate decreased by about 1% per year.

Risk factors: About half of kidney cancers could potentially be prevented with the elimination of excess body weight and tobacco smoking, which are the strong risk factors. Additional risk factors include high blood pressure; chronic renal failure; and occupational exposure to certain chemicals, such as trichloroethylene. Radiation exposure (e.g., 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).

Signs and symptoms: Symptoms include blood in the urine, a pain or lump in the lower back or abdomen, fatigue, weight loss, fever, and swelling in the legs and ankles.

Treatment: Surgery is the primary treatment for most kidney cancers, although active surveillance (observation) may be an option for some patients with small tumors. Patients who are not surgical candidates may be offered ablation therapy, a procedure that uses extreme temperature to destroy the tumor. Adjuvant treatment after surgery, with either targeted therapy or immunotherapy, is now being studied. For metastatic disease, immunotherapy and targeted therapies are typically the main treatment options, sometimes along with removal of the kidney.

Survival: The 5-year relative survival rate for kidney and renal pelvis cancer is 75%. Two-thirds of cases are diagnosed at a local stage, for which the 5-year relative survival rate is 93% (Table 8).

Leukemia

New cases: An estimated 61,780 new cases of leukemia will be diagnosed in the US in 2019 (Table 1). Although most cases occur in older adults, it is the most common cancer in childhood. Leukemia is a cancer of the bone marrow and blood that is classified into four main groups based on cell type and rate of growth: acute lymphocytic leukemia (ALL), acute myeloid leukemia

(AML), chronic myeloid leukemia (CML), and chronic lymphocytic leukemia (CLL). (Although CLL is included with leukemia in this report to enable description of temporal trends, it is now recognized as a variation of a type of lymphoma called small lymphocytic lymphoma (SLL), and the disease is commonly known as CLL/SLL.) Among adults (20 years of age and older), the most common types of leukemia are CLL (37%) and AML (32%), while in children and adolescents (0 to 19 years), ALL is most common, accounting for 74% of cases. (See page 12 for information about childhood cancer.)

Incidence trends: From 2006 to 2015, the incidence rate was stable for CLL and increased by 0.7% per year for ALL; 1.8% per year for CML; and 3.7% per year for AML.

Deaths: An estimated 22,840 leukemia deaths will occur in 2019.

Mortality trends: In contrast to incidence, the death rate from 2007 to 2016 was stable for AML and decreased by about 1% per year for ALL and CML and by about 3% per year for CLL.

Risk factors: Exposure to ionizing radiation increases the risk of most types of leukemia. One of the most common sources of radiation is that used in cancer treatment. Chemotherapy also increases risk for some types of leukemia. Risk is increased in people with certain genetic abnormalities and in workers exposed to certain chemicals, such as benzene (e.g., during oil refining or rubber manufacturing). Cigarette smoking is a risk factor for AML in adults, and there is accumulating evidence that parental smoking before and after childbirth may increase acute leukemia risk in children. Studies suggest that obesity may increase risk of some leukemia subtypes.

Signs and symptoms: Symptoms of leukemia, which can appear suddenly for acute subtypes, include fatigue, paleness, weight loss, repeated infections, fever, bleeding or bruising easily, bone or joint pain, and swelling in the lymph nodes or abdomen. Chronic leukemia typically progresses slowly with few symptoms.

Treatment: Chemotherapy, sometimes in combination with targeted drugs, is used to treat most acute leukemias. Various anticancer drugs are used, either in combination or as single agents. Several targeted drugs are effective for treating CML because they attack cells with the Philadelphia chromosome, a genetic abnormality that is the hallmark of the disease. Some of these drugs are also used to treat a type of ALL involving a similar genetic defect. CLL that is not progressing or causing symptoms may not require treatment right away, but these patients need to be closely monitored. More aggressive CLL is treated with chemotherapy and/or targeted drugs. Certain types of leukemia may be treated with high-dose chemotherapy, followed by stem cell transplantation under appropriate conditions. Newer experimental treatments that boost the body's immune system, like CAR T-cell therapy, have shown much promise, even against some hard-to-treat leukemias.

Survival: Survival varies substantially by age and leukemia subtype. The current (2008-2014) 5-year relative survival rate for adults (ages 20 and older) is 24% for AML; 35% for ALL; 67% for CML; and 84% for CLL. For patients 0-19 years, it is 67% for AML and 89% for ALL. Advances in treatment have resulted in large improvements in survival for most types of leukemia. For example, 5-year relative survival for CML has more than tripled, up from 22% in the mid-1970s, in large part due to the discovery and use of targeted drugs over the past two decades.

Liver

New cases: An estimated 42,030 new cases of liver cancer (including intrahepatic bile duct cancers) will be diagnosed in the US during 2019 (Table 1), approximately three-fourths of which will be hepatocellular carcinoma (HCC). Liver cancer is about 3 times more common in men than in women.

Incidence trends: Liver cancer is the most rapidly increasing cancer in both men and women, with incidence rates more than tripling since 1980; from 2006 to 2015, the rate increased by about 3% per year.

Deaths: An estimated 31,780 liver cancer deaths will occur in 2019.

Mortality trends: The death rate for liver cancer has more than doubled, from 2.8 (per 100,000) in 1980 to 6.7 in 2016, with an increase of 2.4% per year from 2007 to 2016.

Risk factors: Approximately 70% of liver cancer cases in the US could potentially be prevented through the elimination of exposure to risk factors, the most important of which are excess body weight, type 2 diabetes, chronic infection with hepatitis B virus (HBV) and/or hepatitis C virus (HCV), heavy alcohol consumption, and tobacco smoking. Risk may also be increased by eating food contaminated with aflatoxin (poison from a fungus that can grow on improperly stored foods, such as nuts and grains). Accumulating evidence suggests that coffee drinking may reduce risk.

Prevention: A vaccine that protects against HBV has been available since 1982. There is no vaccine available to prevent HCV infection, although new combination antiviral therapies can often clear the infection and substantially reduce cancer risk among those already infected. The Centers for Disease Control and Prevention (CDC) recommends one-time HCV testing for everyone born from 1945 to 1965 (i.e., baby boomers) because this group accounts for about three-fourths of HCV-infected individuals in the US. However, fewer than 1 in 8 baby boomers have been tested. Preventive measures for HBV and HCV infection include screening of donated blood, organs, and tissues; adherence to infection control practices during medical and dental procedures; needle-exchange programs for injection drug users; and using safer sex practices. Visit the CDC website at cdc.gov/hepatitis/ for more information on viral hepatitis.

Early detection: Although screening for liver cancer has not been shown to reduce mortality, many health care providers in the US test individuals at high risk (e.g., those with cirrhosis) with ultrasound or blood tests.

Signs and symptoms: 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.

Treatment: Early-stage liver cancer can sometimes be treated successfully with surgery to remove part of the liver (few patients have sufficient healthy liver tissue for this option) or liver transplantation. Other treatment options include tumor ablation (destruction) or embolization (blocking blood flow). Patients diagnosed at an advanced stage may be offered targeted therapies, immunotherapy, or chemotherapy.

Survival: The 5-year relative survival rate is 18%, up from 3% four decades ago. Forty-four percent of patients are diagnosed with localized stage disease, for which 5-year survival is still only 31% (Table 8).

Lung and Bronchus

New cases: An estimated 228,150 new cases of lung cancer will be diagnosed in the US in 2019 (Table 1).

Incidence trends: The incidence rate has been declining since the mid-1980s in men, but only since the mid-2000s in women because of gender differences in historical patterns of smoking uptake and cessation. The decline has gained momentum in the past decade, with rates decreasing from 2011 to 2015 by almost 3% per year in men and 1.5% per year in women.

Deaths: An estimated 142,670 deaths from lung cancer will occur in 2019.

Mortality trends: The lung cancer death rate has declined by 48% since 1990 in men and by 23% since 2002 in women due to reductions in smoking, with the pace accelerating in recent years consistent with incidence trends; from 2012 to 2016, the rate decreased by about 4% per year in men and 3% per year in women.

Risk factors: Cigarette smoking is by far the most important risk factor for lung cancer; 81% of lung cancer deaths in the US are still caused by smoking. Risk increases with both quantity and duration of smoking. Cigar and pipe smoking also increase risk. Exposure to radon gas, which is released from soil and can accumulate in indoor air, is thought to be the second-leading cause of lung cancer in the US. Other risk factors include exposure to secondhand smoke, asbestos

Table 7. Trends in 5-year Relative Survival Rates* (%) by Race, US, 1975-2014

	All races			White			Black		
	1975-77	1987-89	2008-14	1975-77	1987-89	2008-14	1975-77	1987-89	2008-14
All sites	49	55	69	50	57	70	39	43	63
Brain & other nervous system	23	29	35	22	28	33	25	32	41
Breast (female)	75	84	91	76	85	92	62	71	83
Colon & rectum	50	60	66	50	60	67	45	52	58
Colon	51	60	65	51	61	66	45	52	55
Rectum	48	58	69	48	59	69	44	52	66
Esophagus	5	9	21	6	11	22	4	7	13
Hodgkin lymphoma	72	79	88	72	80	89	70	72	86
Kidney & renal pelvis	50	57	75	50	57	75	49	55	77
Larynx	66	66	62	67	67	64	58	56	51
Leukemia	34	43	65	35	44	66	33	35	58
Liver & intrahepatic bile duct	3	5	19	3	6	18	2	3	15
Lung & bronchus	12	13	20	12	13	20	11	11	18
Melanoma of the skin	82	88	94	82	88	94	57†	79†	66†
Myeloma	25	27	52	24	27	52	29	30	54
Non-Hodgkin lymphoma	47	51	74	47	51	75	49	46	69
Oral cavity & pharynx	53	54	68	54	56	70	36	34	50
Ovary	36	38	48	35	38	47	42	34	39
Pancreas	3	4	9	3	3	9	2	6	9
Prostate	68	83	99	69	84	99	61	71	97
Stomach	15	20	32	14	18	31	16	19	33
Testis	83	95	97	83	96	97	73†‡	88†	92
Thyroid	92	94	98	92	94	99	90	92	97
Urinary bladder	72	79	78	73	80	79	50	63	64
Uterine cervix	69	70	69	70	73	71	65	57	57
Uterine corpus	87	82	83	88	84	85	60	57	63

*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 2008 to 2014, all followed through 2015. †The standard error is between 5 and 10 percentage points. ‡Survival rate is for cases diagnosed from 1978 to 1980.

NOTE: This table provides historical trends based on the 9 oldest SEER registries. Contemporary survival rates presented throughout this report and in Table 8 may differ because they are based on more complete population coverage.

Source: Noone AM, Howlader N, Krapcho M, et al. (eds). *SEER Cancer Statistics Review, 1975-2015*, National Cancer Institute, Bethesda, MD, www.seer.cancer.gov/csr/1975_2015/, based on November 2017 SEER data submission, posted to the SEER website April 2018.

(particularly among smokers), certain metals (chromium, cadmium, arsenic), some organic chemicals, radiation, air pollution, and diesel exhaust. Specific occupational exposures that increase risk include rubber manufacturing, paving, roofing, painting, and chimney sweeping.

Early detection: Screening with low-dose spiral computed tomography (LDCT) has been shown to reduce lung cancer mortality by about 20% compared to standard chest x-ray among current or former (quit within 15 years) heavy smokers. The American Cancer Society recommends annual screening for lung cancer with LDCT in adults 55 to 74 years of age who are current or former heavy smokers and in relatively good health who have received evidence-based smoking-cessation counseling (if they are current smokers) and have undergone a process of informed/shared decision making that included a description of the potential benefits, limitations, and harms associated with lung cancer screening. For more information on lung cancer screening, see the American Cancer Society's screening guidelines on page 71.

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

Treatment: Appropriate treatment for lung cancer is based on whether the tumor is small cell (13%) or non-small cell (84%), as well as the stage and molecular

characteristics. For early-stage non-small cell lung cancer, surgery is the usual treatment, sometimes with chemotherapy, alone or in combination with radiation therapy. Advanced-stage non-small cell lung cancer is usually treated with chemotherapy, targeted drugs (or a combination of the two), or immunotherapy. Small cell lung cancer is usually treated with chemotherapy, alone or combined with radiation; a large percentage of patients on this regimen briefly experience remission, although the cancer often returns.

Survival: The 5-year relative survival rate for lung cancer is 19% (16% for men and 22% for women) and is higher for non-small cell (23%) than small cell tumors (6%). Only 16% of lung cancers are diagnosed at a localized stage, for which the 5-year survival rate is 56% (Table 8).

Lymphoma

New cases: An estimated 82,310 new cases of lymphoma will be diagnosed in the US in 2019 (Table 1). This cancer begins in certain immune system cells and can occur almost anywhere in the body. Lymphomas are broadly classified as either Hodgkin lymphoma (8,110 cases) or non-Hodgkin lymphoma (NHL, 74,200 cases), and are further classified based on the type of cell in which the cancer starts and many other characteristics. (Although chronic lymphocytic leukemia and multiple myeloma are now classified as subtypes of NHL, statistics for NHL herein are based on historical classification for the purpose of describing trends and do not include these cancers.)

Incidence trends: Incidence patterns for Hodgkin lymphoma vary by sex. Rates in men have been decreasing gradually (by 0.4% per year) since at least 1975, while rates in women increased slowly until the mid-2000s, then declined by 1.7% per year from 2006 to 2015. In contrast, NHL incidence trends are similar in men and women, with a slow decline in recent years (by 0.6% per year from 2011 to 2015) following decades of increase. However, patterns vary by subtype (see onlinelibrary.wiley.com/doi/10.3322/caac.21357/abstract).

Deaths: In 2019, there will be an estimated 1,000 deaths from Hodgkin lymphoma and 19,970 deaths from NHL.

Mortality trends: Due mainly to improvements in treatment, the death rate has been declining in both men and women since at least 1975 for Hodgkin lymphoma and since 1997 for NHL. For NHL, reductions in incidence and improvements in survival for human immunodeficiency virus (HIV)-associated subtypes have also contributed to the mortality decline. From 2007 to 2016, the death rate decreased by 4% per year for Hodgkin lymphoma and by about 2% per year for NHL.

Risk factors: Typical of most cancers, the risk of NHL increases with age. In contrast, Hodgkin lymphoma incidence peaks twice during adolescence/early adulthood and in later life. Most known risk factors are associated with severely altered immune function. For example, risk is elevated in people who receive immune suppressants to prevent organ transplant rejection and who have autoimmune disorders (e.g., Sjogren syndrome, lupus, and rheumatoid arthritis). Certain infectious agents (e.g., Epstein Barr virus) increase the risk of some lymphoma subtypes directly, whereas others increase risk indirectly by weakening (e.g., HIV) or continuously activating (e.g., *Helicobacter pylori* and hepatitis C virus) the immune system. Studies also suggest that certain behavioral risk factors (e.g., body weight) and environmental exposures influence risk for some subtypes.

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

Treatment: NHL patients are usually treated with chemotherapy; radiation, alone or in combination with chemotherapy, is also sometimes used. Targeted or immunotherapy drugs directed at lymphoma cells are used for some NHL subtypes. If NHL persists or recurs after standard treatment, stem cell transplantation may be an option. Newer therapies that boost the body's immune system (e.g., CAR T-cell therapy) have shown promising results for some hard-to-treat lymphomas.

Hodgkin lymphoma is usually treated with chemotherapy and/or radiation therapy, depending on

disease stage and cell type. If these treatments are ineffective, options may include stem cell transplantation and/or treatment with a monoclonal antibody linked to a chemotherapy drug, as well as immunotherapy.

Survival: Survival varies widely by lymphoma subtype and stage of disease; overall 5-year relative survival is 87% for Hodgkin lymphoma and 71% for NHL.

Oral Cavity and Pharynx

New cases: An estimated 53,000 new cases of cancer of the oral cavity and pharynx (throat) will be diagnosed in the US in 2019 (Table 1). Incidence rates are more than twice as high in men as in women.

Incidence trends: From 2006 to 2015, incidence rates decreased by 2.3% per year among blacks, but increased by 1.2% per year among whites, largely driven by rising rates for a subset of cancers associated with human papillomavirus (HPV) infection that arise in the oropharynx (part of the throat behind the oral cavity, including the back one-third of the tongue, soft palate, and tonsils).

Deaths: An estimated 10,860 deaths from cancers of the oral cavity and pharynx will occur in 2019.

Mortality trends: After a long-term decline, the death rate for cancers of the oral cavity and pharynx increased by almost 1% per year from 2012 to 2016.

Risk factors: Known risk factors include any form of tobacco use and excessive alcohol consumption, with a synergistic relationship conferring 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.

Prevention: HPV vaccines have primarily been evaluated against genital diseases, but will likely prevent most HPV-associated oral cancers as well. Unfortunately, immunization rates are much lower than for other disease-preventing vaccines, with only 49% of adolescents ages 13-17 years (44% of boys and 53% of girls) up to date with HPV vaccination in 2017.

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 jaw are often late symptoms.

Treatment: Radiation therapy and/or surgery are standard treatments; chemotherapy is often added for high-risk or advanced disease. Chemotherapy or targeted therapy may be combined with radiation as initial treatment in some cases. Immunotherapy is a newer option for advanced or recurrent cancer.

Survival: The 5-year relative survival rate for cancers of the oral cavity and pharynx combined is 65%, but is much lower in blacks (48%) than in whites (66%). Studies indicate better survival for patients with cancer who test positive for HPV. Only 29% of cases are diagnosed at a local stage, for which 5-year survival is 84%.

Ovary

New cases: An estimated 22,530 new cases of ovarian cancer will be diagnosed in the US in 2019 (Table 1). Most (90%) are epithelial ovarian cancers, the most common of which is serous carcinoma (52%).

Incidence trends: Ovarian cancer incidence rates have decreased by about 1% per year since at least the mid-1970s among women younger than age 65, but only since the early 1990s in older women.

Deaths: An estimated 13,980 ovarian cancer deaths will occur in 2019. Ovarian cancer accounts for 5% of cancer deaths among women, more than any other gynecologic cancer.

Mortality trends: Ovarian cancer mortality patterns generally mirror those for incidence. From 2007 to 2016, the death rate decreased by about 2% per year.

Table 8. Five-year Relative Survival Rates* (%) by Stage at Diagnosis, US, 2008-2014

	All stages	Local	Regional	Distant		All stages	Local	Regional	Distant
Breast (female)	90	99	85	27	Oral cavity & pharynx	65	84	65	39
Colon & rectum	65	90	71	14	Ovary	47	92	75	29
Colon	64	90	71	14	Pancreas	9	34	12	3
Rectum	67	89	70	15	Prostate	98	>99	>99	30
Esophagus	19	45	24	5	Stomach	31	68	31	5
Kidney†	75	93	69	12	Testis	95	99	96	74
Larynx	61	78	46	34	Thyroid	98	>99	98	56
Liver‡	18	31	11	2	Urinary bladder§	77	69	35	5
Lung & bronchus	19	56	30	5	Uterine cervix	66	92	56	17
Melanoma of the skin	92	98	64	23	Uterine corpus	81	95	69	16

*Rates are adjusted for normal life expectancy and are based on cases diagnosed in the SEER 18 areas from 2008-2014, all followed through 2015. †Includes renal pelvis. ‡Includes intrahepatic bile duct. §Rate for in situ cases is 95%.

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: Noone AM, Howlader N, Krapcho M, et al. (eds). *SEER Cancer Statistics Review, 1975-2015, National Cancer Institute*, Bethesda, MD, http://seer.cancer.gov/csr/1975_2015/, based on November 2017 SEER data submission, posted to the SEER website April 2018.

Risk factors: The most important risk factor other than age is a strong family history of breast or ovarian cancer. Women who have tested positive for inherited mutations in cancer susceptibility genes, such as *BRCA1* or *BRCA2*, are at increased risk. Other medical conditions associated with increased risk include a personal history of breast cancer, pelvic inflammatory disease, and Lynch syndrome. Modifiable factors associated with increased risk include excess body weight, menopausal hormone therapy (estrogen alone or combined with progesterone), and cigarette smoking, which is associated with a rare subtype (mucinous). Factors associated with lower risk include pregnancy, fallopian tube ligation or removal (salpingectomy), and use of oral contraceptives (OCs), with risk reductions of 40% among long-term (10+ years) OC users. It is unclear whether genital talc-based powder use increases the risk of ovarian cancer, in part because most of the evidence is from case-control studies, which are especially prone to bias, and because the type of body powder (i.e., with or without talc) women in the studies were using was not always clear.

Early detection: Currently there is no recommended screening test for ovarian cancer, although clinical trials to identify effective strategies are underway. Women who are at high risk or have symptoms may be offered a thorough pelvic exam in combination with transvaginal ultrasound and a blood test for the tumor marker CA125, although this strategy has not proven effective in reducing ovarian cancer mortality.

Signs and symptoms: Early ovarian cancer usually has no obvious symptoms. However, studies indicate that some women experience persistent, nonspecific symptoms, such as back pain, bloating, pelvic or abdominal pain, difficulty eating or feeling full quickly, or urinary urgency or frequency in the months before diagnosis. 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.

Treatment: Treatment includes surgery and often chemotherapy and targeted therapy. The goal of surgery is to stage the cancer and remove as much of the tumor as possible, referred to as debulking. It usually involves removal of both ovaries and fallopian tubes (bilateral 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). Additional abdominal organs may be removed in women with advanced disease, whereas only the involved ovary and fallopian tube may be removed in younger women with very early-stage tumors who want to preserve fertility. Among

patients with early ovarian cancer, more accurate surgical staging (microscopic examination of tissue from different parts of the pelvis and abdomen) has been associated with better outcomes. For advanced disease, chemotherapy administered directly into the abdomen improves survival, although the risk for side effects is high. Targeted drugs can sometimes be used after other treatments to shrink tumors or slow growth of advanced cancers.

Survival: The 5-year relative survival rate for ovarian cancer is only 47% because most patients (59%) are diagnosed with distant-stage disease, for which survival is 29%. For the 15% of patients diagnosed with localized disease, 5-year survival is 92%, which is why there is an urgent need to develop effective screening. Five-year survival is twice as high in women younger than age 65 (60%) as in those 65 and older (30%).

Pancreas

New cases: An estimated 56,770 new cases of pancreatic cancer will be diagnosed in the US in 2019 (Table 1). Most (93%) will develop in the exocrine tissue of the pancreas, which produces enzymes to digest food. Endocrine tumors (7%), commonly referred to as pancreatic neuroendocrine tumors (NETs), develop in hormone-producing cells and have a younger median age at diagnosis and better prognosis.

Incidence trends: From 2006 to 2015, pancreatic cancer incidence rates increased by about 1% per year.

Deaths: An estimated 45,750 deaths from pancreatic cancer will occur in 2019.

Mortality trends: From 2007 to 2016, the death rate for pancreatic cancer increased slightly by 0.3% per year.

Risk factors: Cigarette smokers have about twice the risk of pancreatic cancer as never smokers. Use of smokeless tobacco also increases risk. Other risk factors include type 2 diabetes, excess body weight, a family history of pancreatic cancer, and a personal history of chronic pancreatitis. Heavy alcohol consumption may increase risk. Individuals with Lynch syndrome and certain other genetic syndromes, as well as *BRCA1* and *BRCA2* mutation carriers, are also at increased risk.

Signs and symptoms: Symptoms for pancreatic cancer, which usually do not appear until the disease is advanced, include weight loss, abdominal discomfort that may radiate to the back, and occasionally the development of type 2 diabetes. Tumors sometimes cause jaundice (yellowing of the skin and eyes), which can facilitate earlier diagnosis. Signs of advanced-stage disease may include severe abdominal pain, nausea, and vomiting.

Treatment: Surgery, radiation therapy, and chemotherapy are treatment options that may extend survival and/or relieve symptoms, but seldom produce a cure. Less than 20% of patients are candidates for surgery because the cancer has usually spread beyond the pancreas by the time it is diagnosed. For those who undergo surgery, adjuvant treatment with chemotherapy (and sometimes radiation) may lower the risk of recurrence. For advanced disease, chemotherapy (sometimes along with a targeted therapy drug) may lengthen survival. Clinical trials are testing several new targeted agents and immunotherapies.

Survival: For all stages combined, the 5-year relative survival rate is 9%. Even for the small percentage of people diagnosed with local disease (10%), the 5-year survival is only 34%. About half (52%) of patients are diagnosed at a distant stage, for which 5-year survival is 3%.

Prostate

New cases: An estimated 174,650 new cases of prostate cancer will be diagnosed in the US during 2019 (Table 1). The incidence of prostate cancer is about 60% higher in blacks than in whites for reasons that remain unclear.

Incidence trends: In the late 1980s and early 1990s, incidence rates for prostate cancer spiked dramatically, in large part because of a surge in screening with the prostate-specific antigen (PSA) blood test. The decline in rates since around 2000 has accelerated in recent years, likely due to reduced PSA screening. From 2011 to 2015, the rate decreased by about 7% per year.

Deaths: An estimated 31,620 deaths from prostate cancer will occur in 2019.

Mortality trends: The prostate cancer death rate has declined by 51%, from a peak of 39.3 (per 100,000) in 1993 to 19.4 in 2016, although it appears to have stabilized in recent years. The rapid reduction in prostate cancer mortality is attributed to earlier detection, through PSA testing, and advances in treatment.

Risk factors: Well-established risk factors for prostate cancer are increasing age, African ancestry, a family history of the disease, and certain inherited genetic conditions (e.g., Lynch syndrome and *BRCA1* and *BRCA2* mutations). Black men in the US and the Caribbean 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. There is accumulating evidence that smoking increases the risk of fatal prostate cancer and excess body weight increases risk of aggressive and fatal prostate cancer.

Early detection: No organizations presently endorse routine prostate cancer screening for men at average risk because of concerns about the high rate of overdiagnosis (detecting disease that would never have caused symptoms or harm), along with the high potential for serious side effects associated with prostate cancer treatment. Rather, many organizations recommend an "informed decision-making" approach whereby men are educated about screening and encouraged to make a personal choice. 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 and 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 and those with a close relative diagnosed with prostate cancer before the age of 65) should have this discussion beginning at age 45, and men at even higher risk (those with several close relatives diagnosed at an early age) should have this discussion beginning at 40.

Signs and symptoms: Early-stage prostate cancer usually has no symptoms. More advanced disease shares symptoms with benign prostate conditions, including weak or interrupted urine flow; difficulty starting or stopping urine flow; the need to urinate frequently, especially at night; blood in the urine; or pain or burning with urination. Late-stage prostate cancer commonly spreads to the bones, which can cause pain in the hips, spine, ribs, or other areas.

Treatment: Treatment decisions should be based on clinician recommendations and patient values and preferences. Recent changes in the grading system for prostate cancer have improved tumor characterization and disease management. Careful monitoring of disease progression (called active surveillance) instead of immediate treatment is appropriate for many patients, particularly men who are diagnosed at an early stage, have less aggressive tumors, and are older. Treatment options include surgery, external beam radiation, or radioactive seed implants (brachytherapy). Hormonal therapy may be used along with surgery or radiation 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, which may be temporary or long term. Current research is exploring new biologic markers for prostate cancer to minimize unnecessary treatment by improving the distinction between indolent and aggressive disease.

Prostate cancer that has spread to distant sites is treated with hormonal therapy, chemotherapy, radiation therapy, and/or other treatments. Hormone treatment may control advanced prostate cancer for long periods of time by shrinking the size or limiting the growth of the cancer, thus helping to relieve pain and other symptoms. Chemotherapy may be given along with hormone therapy, or it may be used if hormone treatments are no longer effective. An option for some men with advanced prostate cancer that is no longer responding to hormones is a cancer vaccine designed to stimulate the patient's immune system to attack prostate cancer cells specifically. Newer forms of hormone therapy have been shown to be beneficial for treating advanced disease. Other types of drugs can be used to treat prostate cancer that has spread to the bones.

Survival: The majority (90%) of prostate cancers are discovered at a local or regional stage, for which the 5-year relative survival rate approaches 100%. The 5-year survival for disease diagnosed at a distant stage is 30%. The 10-year survival rate for all stages combined is 98%.

Skin

New cases: Skin cancer is the most commonly diagnosed cancer in the US. However, the actual number of the most common types – basal cell and squamous cell (i.e., keratinocyte carcinoma or KC), also referred to as nonmelanoma skin cancer – is difficult to estimate because cases are not required to be reported to cancer registries. The most recent study of KC occurrence estimated that in 2012, 5.4 million cases were diagnosed among 3.3 million people.

Invasive melanoma accounts for about 1% of all skin cancer cases, but the vast majority of skin cancer deaths. An estimated 96,480 new cases of melanoma will be diagnosed in the US in 2019 (Table 1). It is most commonly diagnosed in non-Hispanic whites, with an annual incidence rate of 27 (per 100,000), compared to 5 in Hispanics and 1 in blacks and Asians/Pacific Islanders. Overall, incidence rates are higher in women than in men before age 50, but by age 65, rates in men are double those in women, and by age 80 they are triple. This pattern reflects age and sex differences in occupational and recreational exposure to ultraviolet radiation (including the use of indoor tanning), and perhaps early detection practices and use of health care.

Incidence trends: The incidence of melanoma of the skin has risen rapidly over the past 30 years, although current trends differ by age. From 2006 to 2015, the rate increased by 3% per year among men and women ages 50 and older, but was stable among those younger than age 50.

Deaths: In 2019, an estimated 7,230 deaths from melanoma will occur.

Mortality trends: From 2007 to 2016, the death rate for melanoma declined by about 2% per year in adults 50 years of age and older and by about 4% per year in those younger than 50.

Risk factors: 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. Heavy exposure to ultraviolet (UV) radiation, from sunlight or the use of indoor tanning, is a risk factor for all types of skin cancer, and indoor tanning devices are classified as carcinogenic by the International Agency for Research on Cancer. Risk is also increased for people who are sun-sensitive (e.g., sunburn easily or have natural blond or red hair color) and those who have a history of excessive sun exposure (including sunburns) or skin cancer. People with a weakened immune system are also at increased risk for skin cancer.

Prevention: According to a recent study by American Cancer Society researchers, most melanoma cases and deaths are potentially preventable. Exposure to intense UV radiation can be minimized by wearing protective clothing (e.g., long sleeves, a wide-brimmed hat, etc.); wearing sunglasses that block ultraviolet rays; applying broad-spectrum sunscreen that has a sun protection factor (SPF) of at least 30 to unprotected skin; seeking shade; and not sunbathing or indoor tanning. Children should be especially protected from the sun (and indoor tanning) because severe sunburns in childhood may particularly increase risk of melanoma. In 2014, the US surgeon general released a Call to Action to Prevent Skin Cancer because of the growing burden of this largely preventable 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. See surgeongeneral.gov/library/calls/prevent-skin-cancer/call-to-action-prevent-skin-cancer.pdf for more information.

Early detection: The best way to detect skin cancer early is to be aware of new or changing skin growths, particularly those that look unusual. Any new lesions, or a progressive change in a lesion's appearance (size, shape, or color, etc.), should be evaluated promptly by a physician.

Signs and symptoms: Warning signs of all skin cancers 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 health

care provider. 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. The ABCDE 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); D is for diameter greater than 6 millimeters (about the size of a pencil eraser); and E is for evolution, meaning a change in the mole's appearance over time. 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. Most cases of KC are cured by removing the lesion through minor surgery or other techniques (e.g., destruction by freezing). Radiation therapy and certain topical medications may be used. For 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. The treatment of advanced melanoma has changed greatly in recent years with FDA approval of several new immunotherapy and targeted drugs. Chemotherapy may be used, but is usually much less effective than newer treatments.

Survival: Almost all cases of KC 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 KC to spread to other parts of the body. The 5-year relative survival rate for melanoma is 92%. Eighty-four percent of cases are diagnosed at a localized stage, for which the 5-year survival rate is 98% (Table 8).

Thyroid

New cases: An estimated 52,070 new cases of thyroid cancer will be diagnosed in the US in 2019 (Table 1). The incidence rate is 3 times higher in women than in men.

Incidence trends: Until recently, thyroid cancer was the most rapidly increasing cancer in the US, largely due to increased detection (probably including some overdiagnosis) because of more sensitive diagnostic procedures. However, the increase slowed from almost 7% per year during the 2000s to 1.5% per year from 2011 to 2015, likely due in part to the adoption of more conservative diagnostic criteria by clinicians.

Deaths: An estimated 2,170 deaths from thyroid cancer will occur in 2019.

Mortality trends: The death rate for thyroid cancer has increased slightly in recent years, from 0.50 (per 100,000) in 2007 to 0.54 in 2016.

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, radiation exposure early in life (e.g., during cancer treatment), obesity, and certain rare genetic syndromes, such as familial adenomatous polyposis (FAP). 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 lower their risk of developing the disease by having the thyroid gland surgically removed before cancer develops.

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 clinician during an 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. Many thyroid cancers are diagnosed incidentally in people without symptoms because an abnormality is seen on an imaging test.

Treatment: Most thyroid cancers are highly curable, but about 5% (medullary and anaplastic thyroid cancers) are

more aggressive and more likely to spread to other organs. Treatment depends on patient age, tumor size and cell type, 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 hormone replacement therapy is given after thyroidectomy to replace hormones normally made by the thyroid gland and to prevent the pituitary gland from producing thyroid-stimulating hormone, decreasing the likelihood of recurrence. For some types of advanced thyroid cancer, targeted drugs, known as tyrosine kinase inhibitors, can be used to help shrink or slow tumor growth.

Survival: The 5-year relative survival rate is 98%, largely because two-thirds of cases are diagnosed at a local stage, but also because treatment is usually successful; more than half of patients diagnosed with distant-stage disease survive at least five years (Table 8).

Urinary Bladder

New cases: An estimated 80,470 new cases of bladder cancer will be diagnosed in the US in 2019 (Table 1). Bladder cancer incidence is about 4 times higher in men than in women and 2 times higher in white men than in black men.

Incidence trends: After decades of slowly increasing, bladder cancer incidence rates declined from 2006 to 2015 by about 1% per year in both men and women.

Deaths: An estimated 17,670 deaths from bladder cancer will occur in 2019.

Mortality trends: The death rate for urinary bladder cancer from 2007 to 2016 was stable in men and decreased by 0.4% per year in women.

Risk factors: Smoking is the most well-established risk factor for bladder cancer, accounting for almost half (47%) of all cases in the US. 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 or long-term urinary catheters.

Early detection: There is currently no screening method recommended for people at average risk. People at increased risk may be screened by examination of the bladder wall with a cystoscope (slender tube fitted with a camera lens and light that is inserted through the urethra), microscopic examination of cells from urine or bladder tissue, or other tests.

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.

Treatment: Surgery, alone or in combination with other treatments, is used in more than 90% of cases, and timely follow-up care is extremely important because of the high rate of bladder cancer recurrence. Early-stage cancers may be treated by removing the tumor and then administering immunotherapy (BCG-bacillus Calmette-Guérin) or chemotherapy drugs directly into the bladder (intravesical therapy). More advanced cancers may require removal of the entire bladder (cystectomy). Patient outcomes are improved with the use of chemotherapy before cystectomy. Distant-stage cancers are typically treated with chemotherapy, sometimes along with radiation. Intravenous immunotherapy (immune checkpoint inhibitors) is a newer option if chemotherapy cannot be used or is no longer working.

Survival: The 5-year relative survival rate for bladder cancer is 77%. Half (51%) of all cases are diagnosed before the tumor has spread beyond the layer of cells in which it developed (in situ), for which the 5-year survival is 95%.

Uterine Cervix

New cases: An estimated 13,170 cases of invasive cervical cancer will be diagnosed in the US in 2019 (Table 1).

Incidence trends: Cervical cancer incidence rates declined by more than half between 1975 (14.8 per

100,000) and 2015 (6.8 per 100,000), largely due to the widespread uptake of screening with the Pap test (described below). However, declines have slowed in recent years, especially among women younger than age 50, and overall incidence from 2006 to 2015 was stable.

Deaths: An estimated 4,250 deaths from cervical cancer will occur in 2019.

Mortality trends: The cervical cancer death rate in 2016 (2.2 per 100,000) was less than half that in 1975 (5.6 per 100,000) due to declines in incidence and the early detection of cancer through screening, but like incidence, the pace of the reduction has slowed. From 2007 to 2016, the death rate decreased by about 1% per year in women 50 years of age and older, but was stable in those younger than age 50.

Risk factors: Almost all cervical cancers are caused by persistent infection with certain types of human papillomavirus (HPV). HPV infections are common in healthy women and only rarely cause cervical cancer. Although 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. Several factors are known to increase the risk of both persistent HPV infection and progression to cancer, including a suppressed immune system, a high number of childbirths, and cigarette smoking. Long-term use of oral contraceptives is also associated with increased risk that gradually declines after cessation.

Prevention: Vaccines that protect against the types of HPV that cause 90% of cervical cancers, as well as several other diseases and cancers, are routinely recommended for children ages 11 to 12. While the vaccines are available for use in ages 9 to 26, the CDC recommends vaccinating all boys and girls by age 13. In October 2016, the CDC reduced the recommended number of vaccine doses from three to two when the first dose was given before age 15, while three doses are required for full protection when the first dose was given after the 15th birthday. Unfortunately, the immunization rate remains low in the US; in 2017, 53% of girls and 44% of boys 13-17 years of age were up to date with the HPV vaccination series.

HPV vaccines cannot protect against established infections; nor do they protect against all types of HPV, which is why vaccinated women should still be screened for cervical cancer. Screening can also prevent cervical cancer through detection and treatment of precancerous lesions, which are now 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. The HPV test, which detects HPV infections associated with cervical cancer, can forecast cervical cancer risk many years into the future and is currently recommended for use in conjunction with the Pap test in women ages 30 to 65, or when Pap test results are uncertain. The HPV test can also identify women at risk for a type of cervical cancer (adenocarcinoma) that is often missed by Pap tests and accounts for 29% of cases.

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 more successful. Most women diagnosed with cervical cancer have not been screened recently. The American Cancer Society, in collaboration with the American Society for Colposcopy and Cervical Pathology and the American Society for Clinical Pathology, recommends screening for women ages 21 to 65, with an emphasis on the incorporation of HPV testing in addition to the Pap test for ages 30 to 65. For more detailed information on the American Cancer Society's screening guideline for the early detection of cervical cancer, see page 71.

Signs and symptoms: Preinvasive cervical lesions often have no symptoms. Once abnormal cells become cancerous and invade nearby tissue, the most common symptom is abnormal vaginal bleeding, which may start and stop between regular menstrual periods or cause menstrual bleeding to last longer or be heavier than usual. Bleeding may also occur after sexual intercourse,

douching, a pelvic exam, or menopause. Increased vaginal discharge may also be a symptom.

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 (destruction of tissue using a laser beam); 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 targeted therapy to standard chemotherapy has been shown to improve overall survival. Immunotherapy may be another option for metastatic or recurrent cancer.

Survival: The 5-year relative survival rate for cervical cancer overall is 66%, but ranges from 78% for white women younger than age 50 to 47% for black women 50 and older. Five-year survival is 92% for the 45% of patients diagnosed with localized stage.

Uterine Corpus (Endometrium)

New cases: An estimated 61,880 cases of cancer of the uterine corpus (body of the uterus) will be diagnosed in the US in 2019 (Table 1). Cancer of the uterine corpus is often referred to as endometrial cancer because more than 90% of cases occurs in the endometrium (lining of the uterus).

Incidence trends: From 2006 to 2015, the incidence rate increased by about 1% per year among white women and by about 2% per year among black women.

Deaths: An estimated 12,160 deaths from uterine corpus cancer will occur in 2019.

Mortality trends: From 2007 to 2016, the death rate for cancer of the uterine corpus increased by about 2% per year among both white women and black women.

Risk factors: According to American Cancer Society research, an estimated 70% of uterine corpus cancers are attributable to excess body weight and insufficient physical activity, and thus potentially preventable. 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 the use of postmenopausal estrogen (estrogen plus progestin does not appear to increase risk), late menopause, never having children, and a history of polycystic ovary syndrome. Tamoxifen, a drug used to prevent breast cancer, increases risk slightly because it has estrogen-like effects on the uterus. Medical conditions that increase risk include Lynch syndrome and type 2 diabetes. Pregnancy, use of oral contraceptives or intrauterine devices, and physical activity are associated with reduced risk.

Early detection: There is no recommended screening test for women at average risk; however, most cases (67%) 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.

Signs and symptoms: The most common symptom is abnormal uterine bleeding or spotting, especially in postmenopausal women. Pain during urination, intercourse, or in the pelvic area and non-bloody vaginal discharge can also be symptoms.

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

Survival: The 5-year relative survival rate for uterine cancer is 83% for white women and 62% for black women, partly because white women are more likely to be diagnosed with early-stage disease (69% versus 54%); however, survival is substantially lower for black women for every stage of diagnosis.

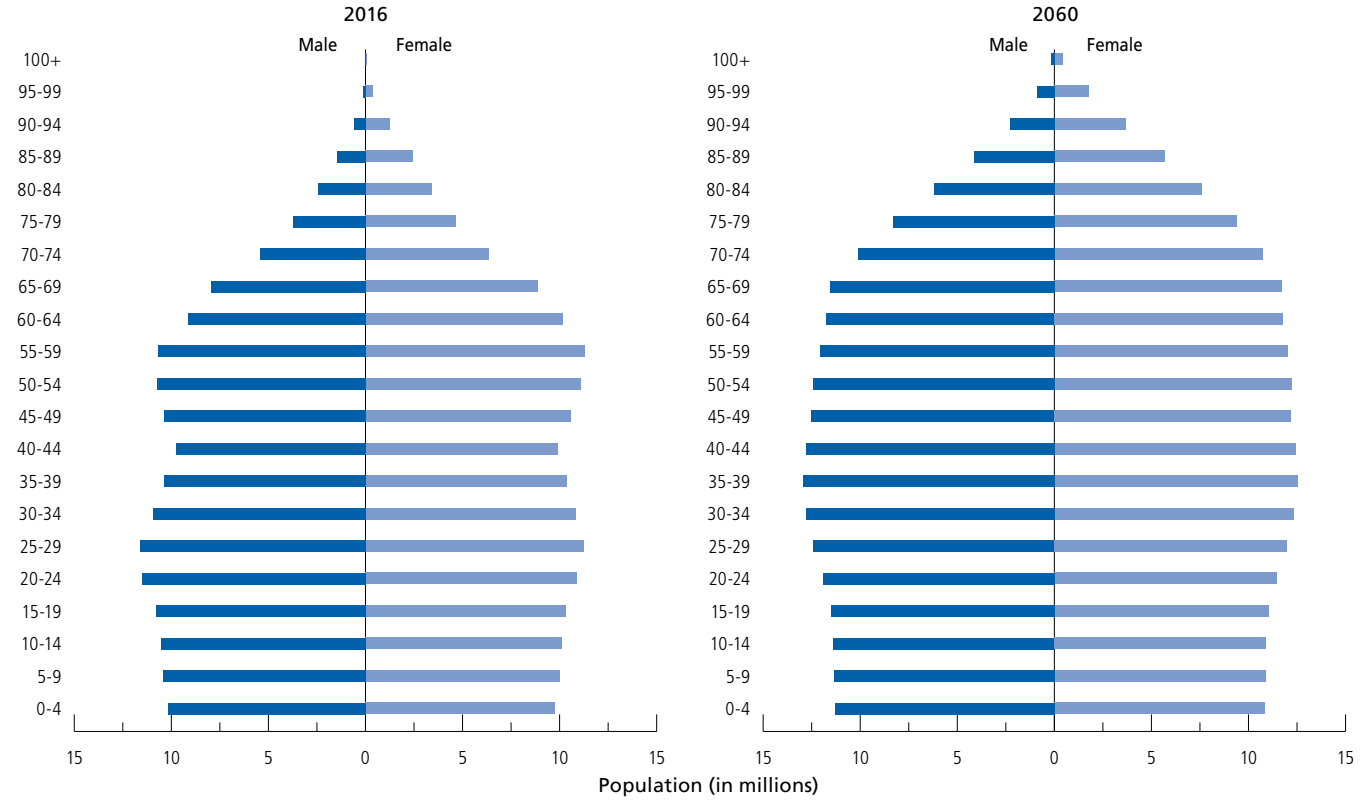
Special Section: Cancer in the Oldest Old

Introduction

Adults ages 85 and older are the fastest-growing population group in the US. Sometimes referred to as the "oldest old," the number of adults ages 85+ is expected to nearly triple from 6.4 million in 2016 to 19.0 million by 2060 (Figure S1).[1] The growth of the older population is primarily fueled by increasing life expectancy because of declines in all cause mortality due to less smoking and improvements in treatment. However, the obesity epidemic and persistent socioeconomic inequalities threaten to slow this progress.[2-4] In addition, the delay in smoking cessation among women is expected to narrow the current gender gap. For example, by 2030, remaining life expectancy at age 65 is projected to increase to 20 and 22 years in men and women, respectively, up from 18 and 21 years in 2010.[4] As a result of the longer life expectancy in women than men, women outnumber men in the oldest age group. In 2016, there were 4.2 million women compared to 2.2 million men ages 85 and older, or 186 women for every 100 men.

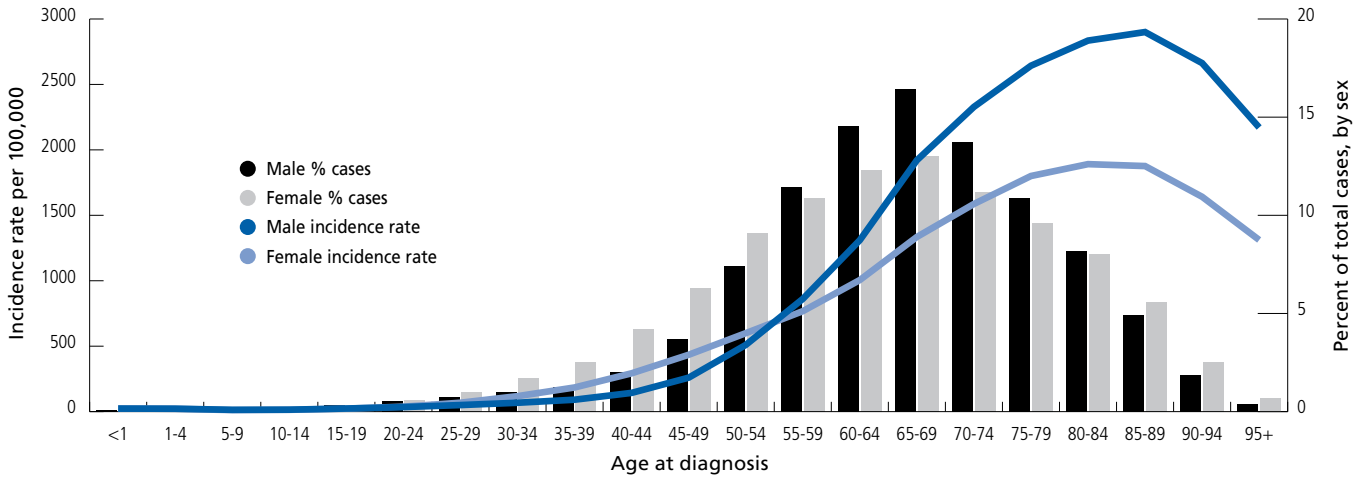
Cancer risk increases with age, peaking in men and women in their 80s (Figure S2). The rapidly growing older population will increase demand for cancer care in this population, which will have a substantial impact on health care resource allocation. Diagnosis and treatment of cancer at older ages are often complicated by preexisting medical conditions (comorbidities), cognitive impairment, frailty, and other factors.[5] Screening is not recommended because current evidence suggests that the harms outweigh the benefits for adults older than 75 years of age. As a result, cancers in this age group are often more advanced than those diagnosed at earlier ages. Relatively little is known about the complex health

Figure S1. Age Distribution of US Population in Millions: 2016 versus 2060



Source: US Census Bureau, Population Progections 2017-2060.[1]

Figure S2. Average Annual Incidence Rates and Case Distribution by Age, US, 2011-2015



Sources: Surveillance, Epidemiology, and End Results (SEER) program, 18 SEER registries, custom data (2000-2015).

care needs of older cancer patients due to the limited representation of this population in clinical research.[6,7] This special section profiles cancer in the oldest old in the US, including data on incidence, mortality, survival, and treatment, and discusses some of the unique challenges affecting these patients.

How many new cases and deaths are expected to occur among persons 85 and older in 2019?

People ages 85 and older represent 8% of all new cancer diagnoses, translating to about 140,690 cases in 2019 (61,830 male and 78,860 female). Cancer is the second-leading cause of death, following heart disease, in this population, with about 103,250 cancer deaths expected in 2019 (49,040 male and 54,210 female), accounting for 17% of all cancer deaths.

How many cancer survivors are ages 85 and older?

As of January 1, 2019, an estimated 1,944,280 adults ages 85 and older were alive with a history of cancer, representing one-third of all men and one-fourth of all women in this age group in the United States.[8] The oldest old are the fastest-growing group of cancer survivors, with nearly 4.7 million cancer survivors ages 85 and older expected by 2040.[8]

What is the risk of developing or dying of cancer at age 85?

Among adults age 85 without a history of a cancer, the risk of a cancer diagnosis in their remaining lifetime is 16.4%, or 1-in-6, for men and 12.8%, or 1-in-8, for women. The remaining lifetime risk of cancer death for all adults age 85 is 14.4% (or 1-in-7) for men and 9.6% (or 1-in-10) for women.

Overall cancer risk increases with age until approximately ages 80-84 in women and 85-89 in men (Figure S2), reflecting lifetime accumulation of exposures (e.g., cigarette smoking, excess body weight, alcohol consumption) and genetic mutations.[9,10] Reasons for the subsequent decline in risk are unclear,[11-13] but may reflect lower genetic susceptibility or exposure to carcinogens, as well as consequences of the natural aging process that inhibit tumor growth.[14-17] For example, one theory suggests that cellular senescence, a stage associated with aging when cells (including cancer cells) lose their ability to divide, may protect against cancer formation.[10,14] Another theory is that the age-dependent reshaping of the immune system (increases in certain T-cells and natural killer cells) creates a hostile environment for cancer growth.[17] However, lower incidence rates in the oldest age groups may also be the result of undetected cancer related to less intensive use of screening and diagnostic testing,

Table S1. Leading Cancer Sites of New Cancer Cases and Deaths, Ages 85+, US

	Male	Estimated cases, 2019 N	%	Rate, 2011-2015	Female	Estimated cases, 2019 N	%	Rate, 2011-2015
Incidence	Lung & bronchus	9,800	16%	450.6	Breast	14,800	19%	332.8
	Prostate	7,960	13%	366.0	Colon & rectum	11,200	14%	252.0
	Urinary bladder	7,870	13%	361.7	Lung & bronchus	10,870	14%	244.4
	Colon & rectum	6,640	11%	305.2	Pancreas	4,150	5%	93.4
	Melanoma of the skin	4,000	6%	183.9	Non-Hodgkin lymphoma	3,710	5%	83.5
	Non-Hodgkin lymphoma	3,090	5%	142.1	Urinary bladder	3,360	4%	75.5
	Leukemia	2,740	4%	126.0	Leukemia	3,000	4%	67.6
	Pancreas	2,270	4%	104.1	Melanoma of the skin	2,510	3%	56.5
	Kidney & renal pelvis	1,730	3%	79.6	Uterine corpus	2,310	3%	51.9
	Stomach	1,390	2%	63.8	Ovary	1,900	2%	42.7
	All sites	**61,830**			**All sites**	**78,860**		

	Male	Estimated deaths, 2019 N	%	Rate, 2012-2016	Female	Estimated deaths, 2019 N	%	Rate, 2012-2016
Mortality	Prostate	9,860	20%	452.9	Lung & bronchus	10,200	19%	247.8
	Lung & bronchus	9,700	20%	445.6	Breast	7,150	13%	173.7
	Colon & rectum	4,380	9%	201.1	Colon & rectum	6,740	12%	163.7
	Urinary bladder	3,410	7%	156.9	Pancreas	4,210	8%	102.2
	Leukemia	2,590	5%	119.2	Leukemia	2,630	5%	63.8
	Pancreas	2,530	5%	116.4	Non-Hodgkin lymphoma	2,570	5%	62.4
	Non-Hodgkin lymphoma	2,160	4%	99.4	Ovary	2,060	4%	50.1
	Liver & intrahepatic bile duct	1,230	3%	56.6	Urinary bladder	1,680	3%	40.7
	Kidney & renal pelvis	1,200	2%	55.1	Liver & intrahepatic bile duct	1,380	3%	33.4
	Esophagus	1,120	2%	51.4	Uterine corpus	1,330	2%	32.4
	All sites	**49,040**			**All sites**	**54,210**		

Note: Estimated cases and deaths for 85+ are based on proportions of cases/deaths in that age group for each cancer in the NAACCR (2011-2015) and NCHS (2012-2016) data applied to the overall estimates for 2019.

Sources: Incidence rates - North American Association of Central Cancer Registries (NAACCR), 2018. Mortality rates - National Center for Health Statistics (NCHS), 2018.

given that autopsy studies often report undiagnosed cancer in this age group.[18] Nevertheless, for some cancers, including those of the colorectum, pancreas, stomach, and urinary bladder, as well as leukemia and skin melanoma, incidence rates continue to increase with age among adults in their 90s.[19, 20]

What kinds of cancers are most common among persons 85 and older?

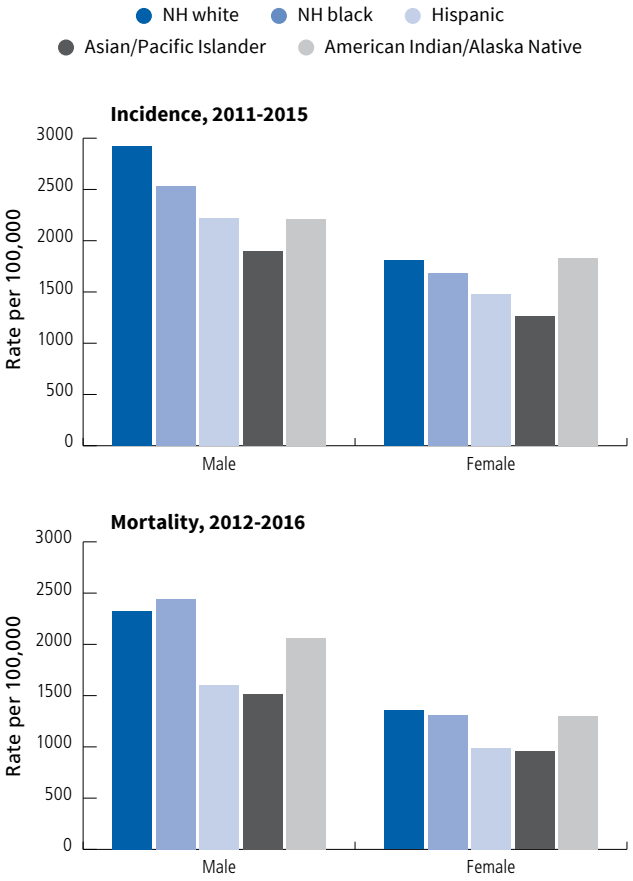
The most commonly diagnosed cancers are lung (16%), prostate (13%), and urinary bladder (13%) in older men and breast (19%), colorectal (14%), and lung (14%) in older women (Table S1). The top 10 cancers in older men and women are similar to those for all ages combined (Figure 3). The few exceptions include cancers of the stomach in men and urinary bladder and ovaries in women.

The leading causes of cancer death in the oldest old parallel those for all ages. Among men 85 and older, prostate and lung cancer are the most common causes of cancer death, together representing 40% of cancer deaths. Among women, lung cancer is the leading cause of cancer death (19%) followed by breast cancer (13%). For men and women, colorectal cancer is the third-leading cause of cancer death, representing 9% and 12% of cancer deaths, respectively.

How do cancer rates vary by race/ethnicity in persons ages 85 and older?

Among the oldest men, cancer incidence rates are highest in non-Hispanic (NH) whites and lowest among Asians/Pacific Islanders (APIs) (Figure S3). The overall cancer incidence rate is 16% higher in NH white men than in non-Hispanic black (black) men, largely driven by higher rates of urinary bladder cancer, melanoma, and non-

Figure S3. Cancer Incidence and Mortality Rates among Adults 85+ by Race/Ethnicity, US, 2011-2016



NH: Non-Hispanic. Asians/Pacific Islanders and American Indians/Alaska Natives exclude persons of Hispanic ethnicity. Rates for American Indians/Alaska Natives based on cases/deaths in Contract Health Service Delivery Area counties.

Sources: Incidence – NAACCR, 2018. Mortality – NCHS, 2018.

Hodgkin lymphoma. This is in contrast to younger men and men of all ages combined, among whom rates are higher in blacks than whites. For example, compared to NH white men, rates among black men are 30% higher in ages 50-64. Among the oldest women, American Indians/Alaska Natives (AIANs) have the highest cancer incidence rate, reflecting their high burden of lung and colorectal cancers.

Cancer mortality patterns differ from those for incidence, especially in men. Despite a lower incidence rate than white men, black men have a 5% higher cancer mortality rate (Figure S3). Recent studies have demonstrated that racial/ethnic disparities in stage at diagnosis and survival persist for older cancer patients.[21, 22] Although racial differences in stage at diagnosis are generally smaller than observed in the general population, survival differences are striking. For example, 5-year relative survival for both local- and regional-stage lung cancer patients ages 85 years and older was 3 times higher in whites compared to blacks.[22] This disparity may reflect inequalities in access to and receipt of quality health care, as well as differences in the burden of comorbidities.[23-25] Despite universal access to health care, some costs of cancer care are not fully covered by Medicare and can be burdensome for older cancer patients with limited, fixed income.[26] Importantly, racial/ethnic minority population growth will lead to increasing diversity in the 85 and older age group over the next several decades, with the proportion of NH whites declining from 84% in 2012 to 61% in 2060.[27, 28]

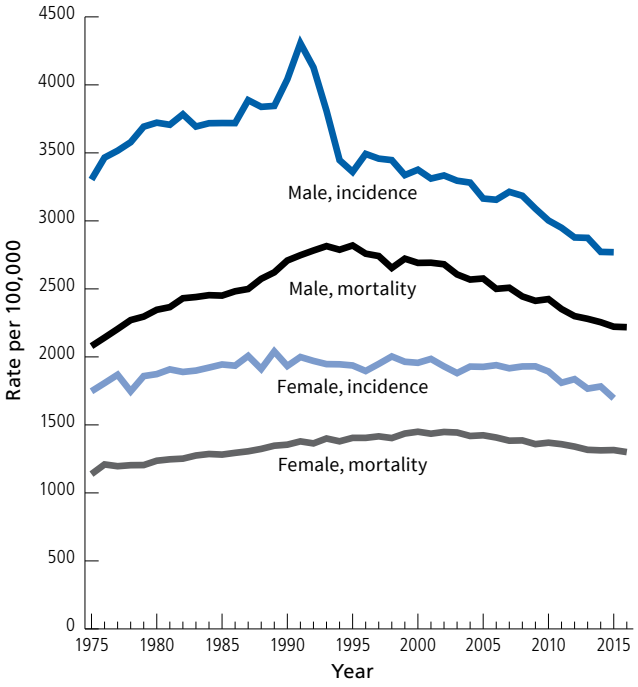
How has the occurrence of cancer in ages 85 and older varied over time?

Incidence trends

Overall cancer incidence rates have decreased in the oldest men since about 1990 (Figure S4), with an acceleration in the decline since 2007, largely reflecting the sharp declines in cancers of the prostate and colorectum, and more recently, lung (Figure S5, Table S2). The lung cancer pattern differs in older men compared to younger men; incidence rates peaked in the 2000s among men 85+ compared to a peak in the 1980s among men ages 65 to 84. The delayed decline in the oldest men reflects generational differences in smoking patterns. The generation of men born in 1920 (who entered the 85+ age group in 2005) had the highest smoking rate of any birth cohort, with peak smoking prevalence exceeding 70% during the 1950s.[29] As younger generations with lower smoking rates enter the oldest age group, lung cancer rates in this age group will continue to decline.

In contrast, the decline in prostate cancer incidence rates has been more rapid in men 85+ compared to younger men. Prior to 2009, prostate cancer was the most common cancer in men 85 and older, but rates are now similar to urinary bladder cancer, the third-leading cancer in this age group. This is because of rapid declines in prostate cancer incidence, likely reflecting a shift toward detection at earlier ages through PSA testing.

Figure S4. Trends in Cancer Incidence and Death Rates by Sex, Ages 85+, US, 1975 to 2016



Sources: Incidence – SEER 9 registries, 2018. Mortality – NCHS, 2018.

The decrease in colorectal cancer incidence rates since 2000 has been similar among men 65 to 84 years of age and those ages 85 and older. Melanoma incidence rates, on the other hand, have increased more rapidly over the past several decades in the oldest men (4.3% per year during 2002-2015), which is thought to be due to excessive sun exposure among children during the first half of the 20th century.[30] Melanoma is predicted to become the second most commonly diagnosed cancer among men 85 and older by 2030.[31]

Among women 85 and older, overall cancer incidence rates peaked around 1990 before subsequently decreasing (Figure S4), with an acceleration in the decline in 2009 largely reflecting declines in breast and colorectal cancers (Figure S5, Table S2). Although breast cancer rates have increased slightly among women ages 65 to 84 years since 2004, rates have continued to decline in the oldest age group (2.1% per year since 2009). Breast cancer surpassed colorectal cancer in 2005 as the most commonly diagnosed cancer in the oldest women due to faster declines in colorectal cancer rates. Lung cancer incidence rates increased more rapidly in older versus younger women from 1995 to the mid-2000s but are now declining at a similar pace in both groups. Although pancreatic cancer rates continue to increase in women ages 65 to 84, rates have leveled off in women 85+ since 2008. Similar to men, melanoma rates have increased rapidly (3.7% per year during 1995-2015) among the oldest women.

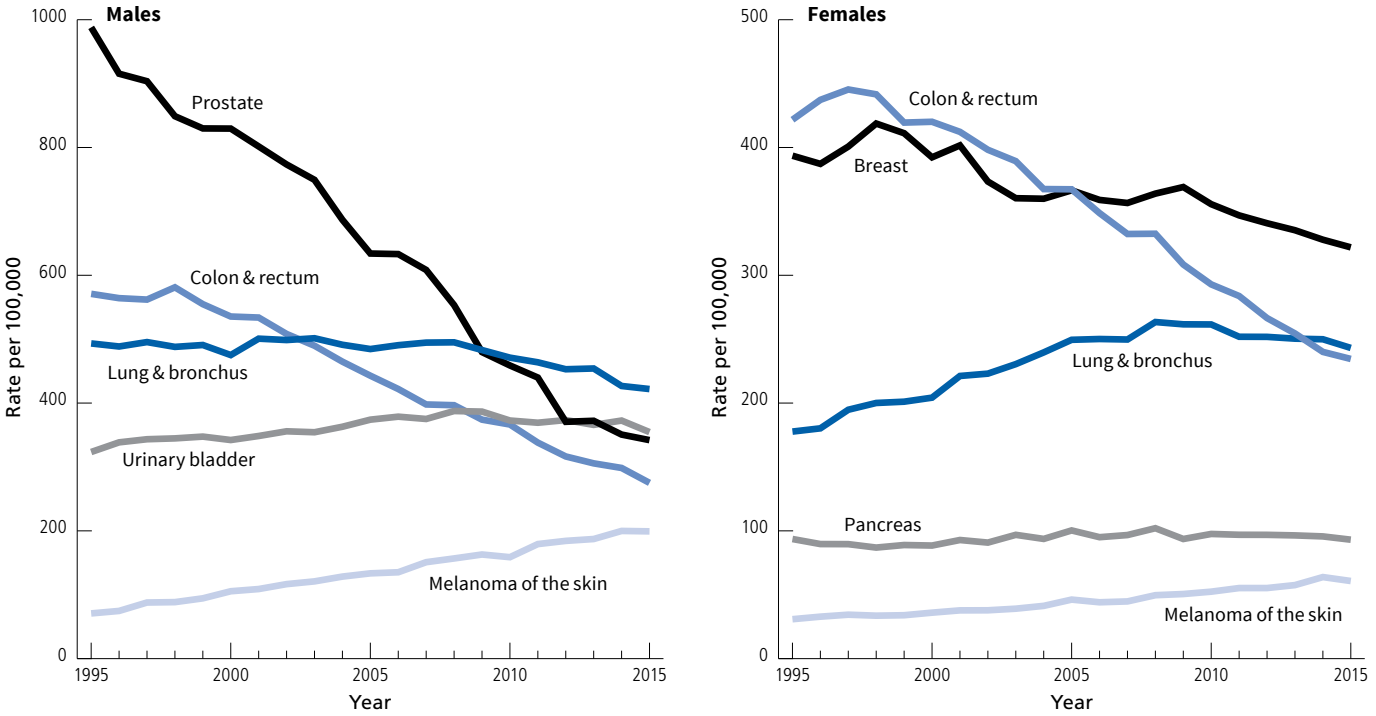
Mortality trends

Cancer death rates peaked in men 85+ in the mid-1990s and have declined by 1.4% per over the past decade (Figure S4). The spike and subsequent decline in overall mortality rates largely reflect trends in prostate cancer (Figure S6). The prostate cancer death rate in men increased sharply until 1993, then dropped precipitously until plateauing during 2014-2016 at a slightly lower rate than observed in 1975. Among men 65 to 84 years, the increase was much smaller, but the subsequent decline was larger, and as a result, rates are now much lower than they were in 1975. Reasons for the sharp increase in prostate cancer death rates in the oldest men are not known, but are thought to be due to mislabeling of deaths from other causes as prostate cancer on death certificates because of the rapid rise in disease prevalence following the introduction of widespread PSA testing.[32] The subsequent decline in rates may result from earlier detection and improvements in treatment for advanced disease, but it remains unclear why rates have recently plateaued.[33]

Declines in death rates for lung and colorectal cancers are similar to incidence patterns over the past 2 decades (Figure S5). Notably, urinary bladder cancer death rates have increased in the oldest men by 1% per year from 2000 to 2016, whereas rates have declined in men ages 65 to 84 since the late 1970s. Reasons for the divergent pattern are not known, but may reflect increasing incidence rates through 2008 that were limited to the oldest men. Death rates have also increased for pancreatic cancer (0.3% per year since 1975), while melanoma rates increased by 3.3% annually until stabilizing in 2009.

Among the oldest women, death rates increased until the early 2000s and have subsequently declined by 0.8% per year (Figure S4). The overall pattern reflects decreasing

Figure S5. Trends in Cancer Incidence Rates for Selected Sites, Ages 85+, US, 1995-2015



Note: Rates have been adjusted for reporting delays using delay ratios from the SEER 18 registries.
Sources: NAACCR, 2018.

death rates for cancers of the colorectum and breast that until the mid-2000s were offset by increasing death rates for lung cancer (Figure S6). Lung cancer death rates in the oldest women increased nearly 4-fold from 1975 to 2006 and stabilized thereafter. In contrast, among women ages 65 to 84, lung cancer death rates have decreased since the mid-2000s. Historically, colorectal cancer was the leading cause of cancer death in the oldest women. However, colorectal death rates dropped nearly 50% from a peak of 297 deaths per 100,000 in 1984 to 156 per 100,000 in 2016. As a result, colorectal cancer is now the third-leading cause of cancer death among women 85 and older. Breast cancer death rates have also declined by about 0.9% per year since their peak in the mid-1990s. In contrast, death rates increased for melanoma and pancreatic cancer, similar to the trends in older men.

Can cancer be detected early in older adults?

Cancer patients ages 85 and older are less likely to be diagnosed at an early stage than younger patients. For example, 57% of the oldest breast cancer patients and 41% of the oldest prostate cancer patients are diagnosed at a local stage, compared to 68% and 77% of patients ages 65-84, respectively (Figure S7). Later stage at diagnosis among the oldest cancer patients, in part, reflects less screening. Notably, the oldest cancer patients are two to

Joinpoint trends

Table S2 describes trends in incidence rates based on Joinpoint analyses. This method involves fitting a series of joined straight lines on a logarithmic scale to the trends in annual rates, with each junction or "joinpoint" of two lines denoting a statistically significant change in trend. The direction and magnitude of the resulting trends over the 1995-2015 period are described as the annual percent change (APC). If the program detects no change during the period, then only a single APC will be given. If the program detects multiple trends, then the magnitude, direction, and applicable years for each will be listed separately.

Table S2. Joinpoint Trends in Cancer Incidence Rates for Selected Sites in Two Age Groups, US, 1995-2015

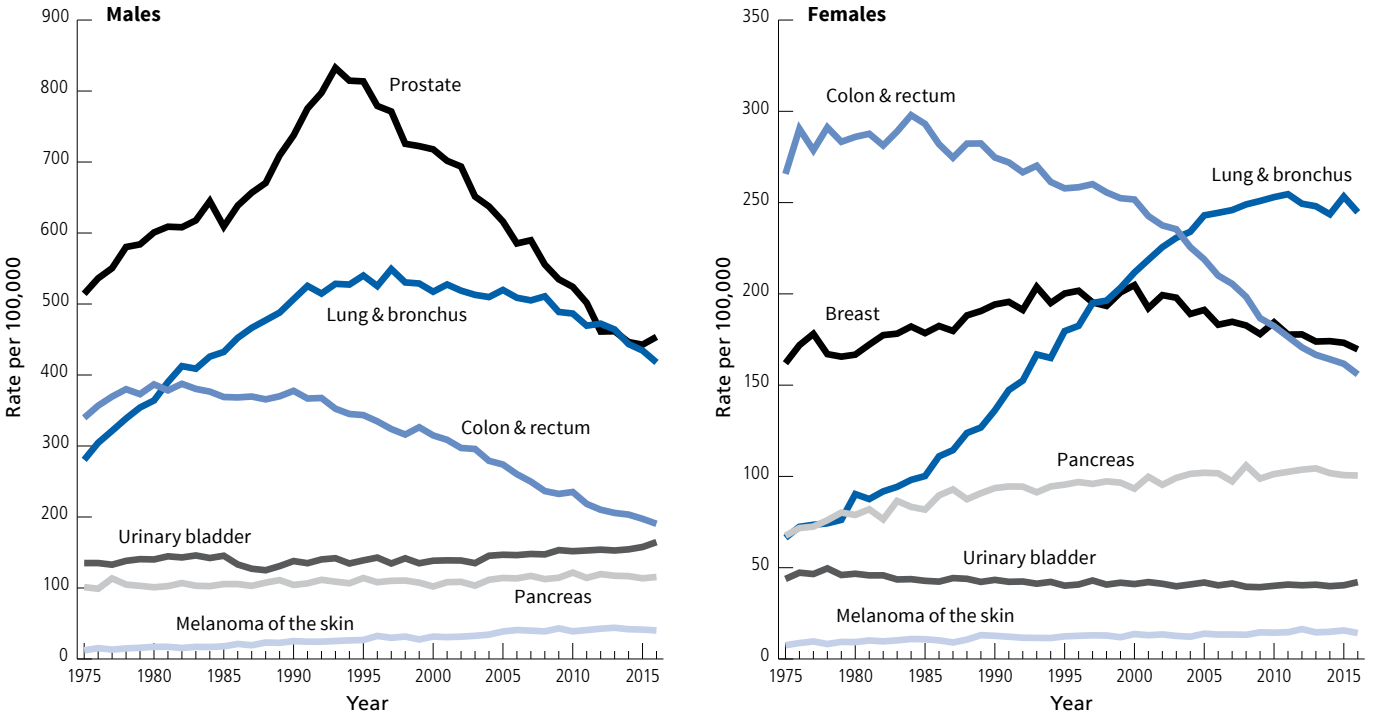
	Trend 1		Trend 2		Trend 3		Trend 4	
	Years	APC	Years	APC	Years	APC	Years	APC
MALES								
Colon & rectum								
65-84	1995-2000	0.0	2000-2015	-4.2*				
85+	1995-2000	-0.5	2000-2015	-4.4*				
Lung & bronchus								
65-84	1995-2008	-1.2*	2008-2015	-2.8*				
85+	1995-2008	0.0	2008-2015	-2.1*				
Melanoma of the skin								
65-84	1995-2000	5.5*	2000-2015	3.4*				
85+	1995-2002	7.4*	2002-2015	4.3*				
Prostate								
65-84	1995-2001	0.9	2001-2004	-5.7	2004-2007	2.0	2007-2015	-6.7*
85+	1995-2003	-3.0*	2003-2015	-6.7*				
Urinary bladder								
65-84	1995-1998	1.9*	1998-2005	0.2	2005-2013	-0.9*	2013-2015	-3.3*
85+	1995-2008	1.2*	2008-2015	-0.9*				
FEMALES								
Breast								
65-84	1995-1999	1.6*	1999-2004	-2.7*	2004-2015	0.8*		
85+	1995-1999	1.9*	1999-2003	-3.6*	2003-2009	0.1	2009-2015	-2.1*
Colon & rectum								
65-84	1995-1998	1.5*	1998-2005	-2.7*	2005-2015	-4.3*		
85+	1995-1998	1.7	1998-2008	-3.0*	2008-2015	-5.0*		
Lung & bronchus								
65-84	1995-1997	2.4*	1997-2007	1.1*	2007-2015	-1.2*		
85+	1995-2008	3.0*	2008-2015	-1.2*				
Melanoma of the skin								
65-84	1995-2000	5.1*	2000-2015	3.1*				
85+	1995-2015	3.7*						
Pancreas								
65-84	1995-2015	0.8*						
85+	1995-2008	0.8*	2008-2015	-0.7				

*Indicates trend is significantly different from zero, p<0.05. Note: Rates have been adjusted for reporting delays using delay ratios from the SEER 18 registries.
Source: NAACCR, 2018.

four times more likely to be diagnosed with unstaged cancer than patients ages 65-84 (Figure S7). This may be due to the inability or undesirability of some older patients to undergo complete diagnostic testing due to other health conditions. However, staging information is important for the provision of appropriate treatment.

Routine cancer screening is generally not recommended for those ages 85+ due to the higher prevalence of serious medical conditions, diminished life expectancy, and limited evidence of benefit, partly because this population has not been included in clinical trials evaluating screening. For most in this age group, the small potential benefit of extending life is likely to be outweighed by the possible harms of screening, which are more common with increasing age. Harms include the need for additional tests; emotional stress; overdiagnosis, which may lead to overtreatment; and procedure-related risks.[34,35] Older adults are more likely to experience overdiagnosis due to higher rates of indolent tumors and competing mortality risks.[36] In addition, one study found that following a screening colonoscopy, adults 85+ were more than twice as likely to experience a serious gastrointestinal event, such as perforation or bleeding,

Figure S6. Trends in Cancer Death Rates for Selected Sites, Ages 85+, US, 1975-2016



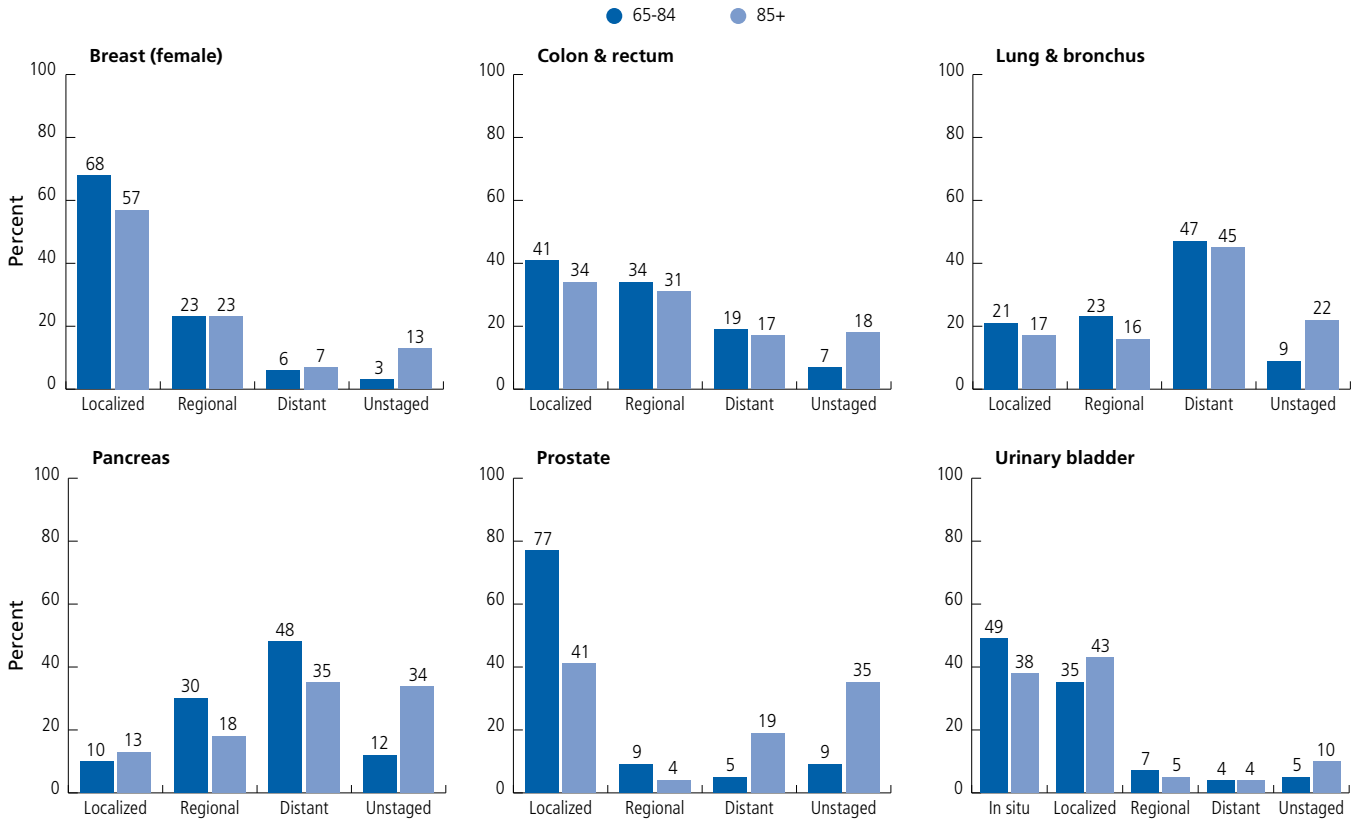
Sources: NCHS, 2018.

compared to adults ages 66-69 (12 versus 5 events per 1,000 colonoscopies, respectively).[37] Moreover, the benefits of screening are accrued over time. It is estimated that there is a 10-year delay to save 1 life per 1,000 people screened for breast or colorectal cancer, and an even greater delay for prostate cancer.[34, 38] As a result, the benefit of screening is substantially reduced in those with limited life expectancy.

While most guidelines generally recommend against cancer screening in those with less than a 10-year life expectancy, differences across organizations can complicate decisions for patients and their providers. For breast cancer screening, the American Cancer Society recommends mammography for all women with a life expectancy of at least 10 years.[39] The US Preventive Services Task Force (USPSTF) also endorses individualized breast cancer screening decisions, but highlights the lack of evidence for screening in women over 75.[40, 41] Both of these organizations recommend against screening for colorectal cancer after age 75.[39, 42] While the American Cancer Society guidelines recommend an informed decision-making process to guide prostate cancer testing in men with at least a 10-year life expectancy, the USPSTF recommends against PSA testing in men 70 and older.[43] Cervical cancer screening is not recommended after age 65 in women who have adequate prior screening, and the upper age limit for lung cancer screening among heavy and former longtime smokers is age 80.[44, 45] The American Geriatrics Society, on the other hand, has a general recommendation to consider life expectancy and the risks of testing, overdiagnosis, and overtreatment in screening decisions of older patients.[46] In addition, Medicare generally covers cancer screenings without an upper age limit or other restrictions.

Although research has shown that the benefit of screening is dependent on sufficient life expectancy, accurately assessing life expectancy and communicating this information to patients can be challenging. Mortality indexes that incorporate comorbid conditions and functional status along with age can help clinicians estimate life expectancy.[47] However, a recent study of adults ages 65 and older reported that although older

Figure S7. Stage Distribution (%) for Selected Cancers in Two Age Groups, US, 2008-2014



Note: Cases reported through autopsy only were excluded.
Source: NAACCR, 2018.

adults were amenable to using age and health status in the context of discussing screening cessation, there were concerns with discussions focused on life expectancy.[48] Another study found that patients prefer clinicians to frame the decision to stop screening in terms of prioritizing other health issues.[49]

Nevertheless, data from the National Health Interview Survey indicate unexpectedly high rates of screening in adults ages 85 and older (Table S3). In 2015, more than one-third of women 85 and older reported receiving a mammogram in the previous two years and 18% reported receiving recent cervical cancer screening tests. More than half of adults ages 85+ reported receiving either a stool screening test in the past year or a sigmoidoscopy or colonoscopy in the past five or 10 years, respectively. Nearly 30% of men in this age group reported receiving a PSA test in the past year.

What percentage of people ages 85 and older survive cancer?

Cancer survival rates decline with age, and patients 85 and older have the lowest relative survival of any age group.[50] Relative survival is the proportion of people who are alive for a designated time after a cancer diagnosis divided by the proportion of people of similar age, race, etc. expected to be alive in the absence of cancer based on normal life expectancy. Five-year relative survival rates for the top five cancers in men and women ages 85+ and 65-84 are shown in Figure S8. In both age groups, relative survival approaches 100% for early-stage breast and prostate cancers, and is 95% for in situ urinary bladder cancer. However survival is 35% lower (in absolute terms) in adults 85+ than in ages 65-84 for regional-stage prostate cancer and 20-23% lower for local-stage lung and bladder cancers. For breast and colorectal cancers, age-related disparities are largest for

Table S3. Screening Prevalence (%) among Adults 85+, US, 2015

Breast	Mammography in the past 2 years	34
Cervix	Pap test within the past 3 years	18
Colon & rectum	Stool test or endoscopy*	52
	Men	60
	Women	47
Prostate	PSA test† in the past 1 year	29

Note: Estimates do not distinguish between examinations for screening and diagnosis. PSA: prostate-specific antigen test. *Either a fecal occult blood test or fecal immunochemical test within the past year, sigmoidoscopy within the past five years, or a colonoscopy within the past 10 years. †Among those with no reported prior diagnosis of prostate cancer.

Source: NCHS, National Health Interview Survey, 2015.

local- and regional-stage disease. Poorer survival in the oldest cancer patients in part reflects the numerous treatment challenges (discussed in the next section). In addition, research suggests that older adults may be less willing to sacrifice quality of life and tolerate treatment toxicities to extend survival.[51] Studies suggest that older patients have benefited less than younger patients from recent advances in cancer treatment.[52] One recent study found smaller improvements in survival for older cancer patients from 1990 to 2009 for six leading cancers has resulted in widening age-related disparities.[52]

How is cancer treated in adults 85 and older?

The oldest old cancer patients are less likely to receive surgical treatment than patients ages 65-84 for each of the most common cancers (Figure S9). The most striking difference is observed for breast cancer; 89% of patients 65-84 years of age receive surgery, compared to just 65% of those 85+. Other studies have found that older breast cancer patients are less likely to receive guideline concordant care, even after accounting for patient comorbidities.[53, 54]

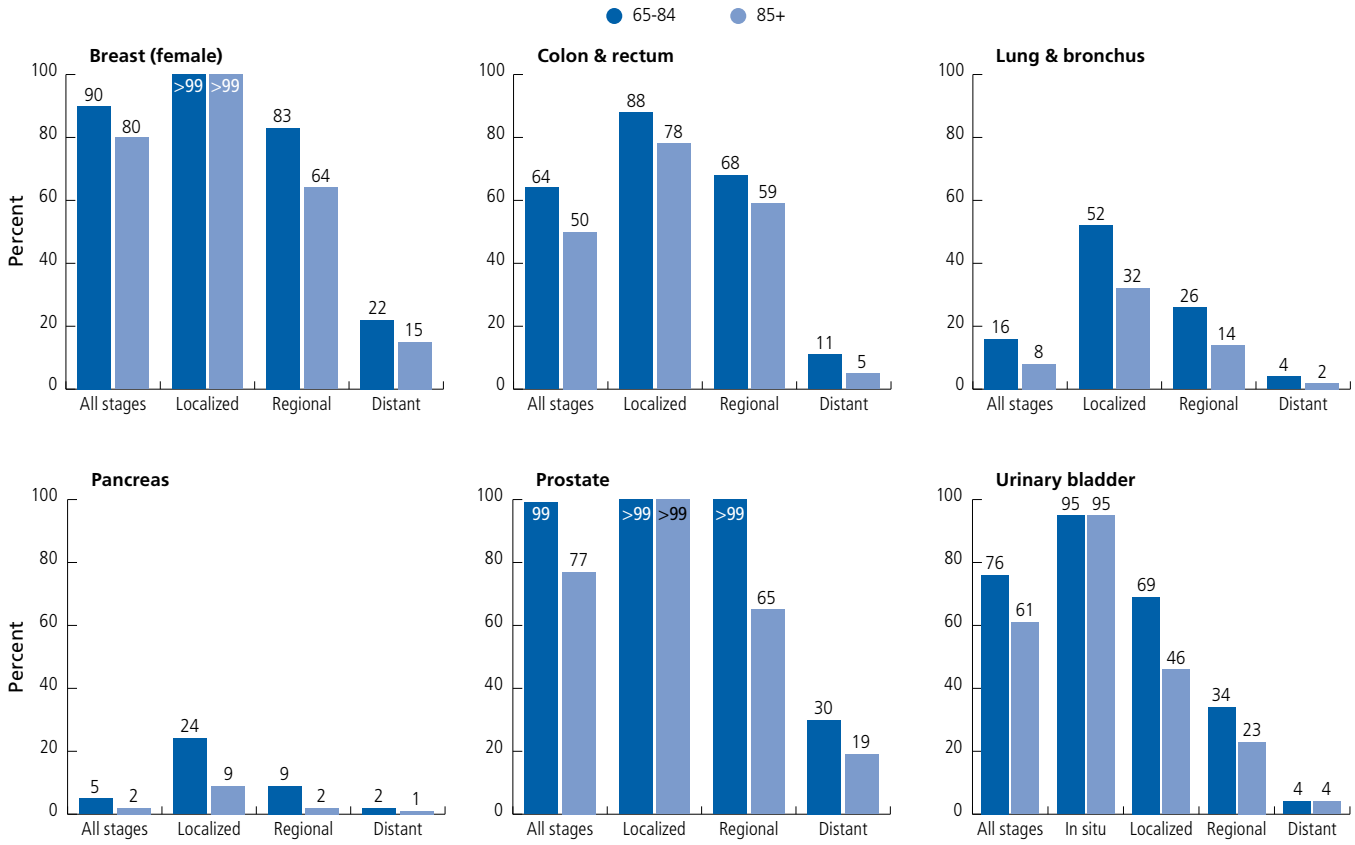
Although National Comprehensive Cancer Network guidelines do not recommend less intensive therapy for any patient with potentially curable cancer, studies have shown that older patients often receive little or no treatment.[36, 55, 56] This is partly because cancer-directed therapy is not appropriate for some older patients because the benefit of prolonged survival does not outweigh potential adverse effects and impact on quality of life. In addition, for many older patients, death may be more likely to occur from other causes.[57, 58]

Age alone does not predict life expectancy, physical function, or the ability to tolerate treatment. A large body of research is currently focused on developing tools that will enable clinicians to evaluate the functional age of patients as part of the treatment decision-making process. The Geriatric Assessment (GA) is a multidimensional, multidisciplinary tool that can be used to evaluate medical, psychosocial, and functional capabilities in older adults. Studies have shown that the GA can identify previously unknown health problems and predict treatment toxicities and overall survival in cancer patients.[59] Although the GA can help guide appropriate treatment, it requires significant time and resources to implement.[60, 61] A panel of geriatric oncology experts recommended the use of the GA in cancer patients 75 years of age and older, and more recently, the American Society of Clinical Oncology recommended use of the GA in patients 65 and older who are receiving chemotherapy.[62, 63] Nevertheless, additional research is needed to determine effectiveness and best practices for the use of the GA in older cancer patients.[60]

Biomarkers, including markers of chronic inflammation (e.g. C-reactive protein and plasma interleukin 6 levels) and coagulation (e.g. d-dimer, sVCAM), as well as commonly measured laboratory blood values (hemoglobin and albumin) are being investigated for their potential to aid in the assessment of functional age and frailty, and their ability to predict mortality.[61, 64, 65] Although these markers are easily obtained through routine bloodwork, they require careful interpretation because they can be produced by cancer itself and thus may be most useful in patients who have had their tumor surgically removed. Potential age-related biomarkers under investigation that are not produced by tumors, including telomere length and p16 levels, are associated with cellular senescence (when cells stop dividing) and require more specialized analysis.[64]

Treating cancer patients ages 85+ is complex due to the higher likelihood of other health conditions, declines in health associated with aging, and the dearth of data

Figure S8. Five-year Relative Survival for Selected Cancers in Two Age Groups, US, 2008-2014



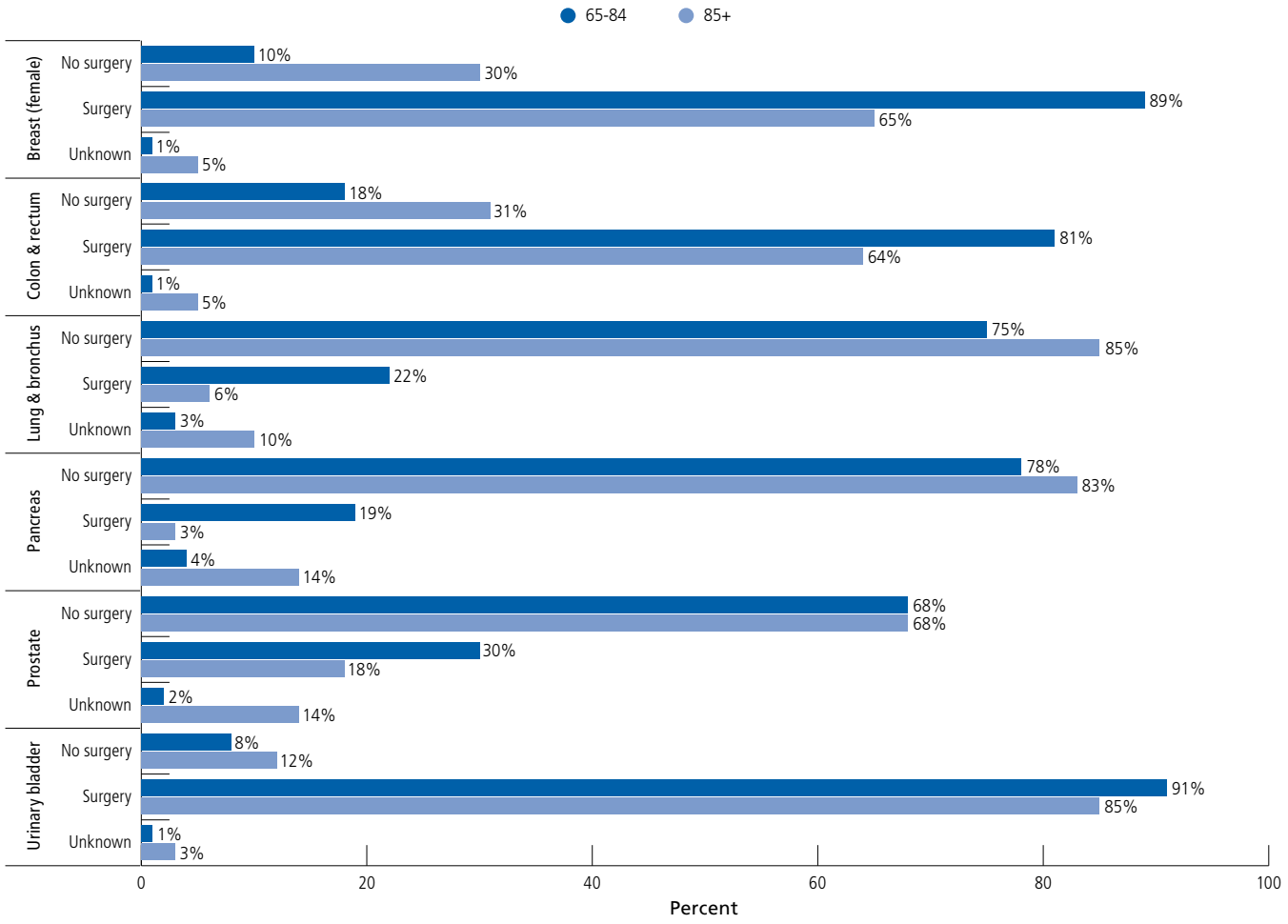
Source: SEER 18 registries, 2018.

about cancer treatment in this age group. Nearly half (47%) of cancer patients 85 and older have serious medical conditions that would require adjustment of cancer treatment.[8] Most studies have found that cancer patients with comorbidities are less likely to receive curative treatment.[66] This in part reflects concerns about increased risks of death from these other health issues as well as treatment side effects, including exacerbating coexisting conditions and drug interactions. One study found that 39% of cancer patients over 80 were taking five or more medications including their cancer drugs.[67] In addition, age-associated physiologic changes, such as declines in liver and kidney function, can affect drug metabolism and influence therapeutic benefit and risk of adverse effects.[68, 69] Much remains unknown about the intersection of side effects of cancer therapies and age-related declines, such as cognitive impairment, in older patients.[70, 71] Finally, clinicians have inadequate evidence on which to base treatment decisions in older cancer patients because of extremely limited representation in clinical trials.[72, 73] As a result, it is difficult to predict tolerance and response to therapies, as well as their influence on other health conditions or medications.[7] The Institute of Medicine report, *Delivering High-Quality Cancer Care: Charting a New Course for a System in Crisis*, highlighted the critical need of improving the evidence-base for treating older adults with cancer.[74] Although several recent trials focusing on older patients have been successful, accrual rates remain low.

What unique challenges do older people with cancer face?

Although research on the cancer survivor experience in the oldest old population is limited, some studies suggest higher rates of depression, distress, and anxiety.[75, 76] Furthermore, cancer and its treatment often accelerate the aging process by further reducing physical

Figure S9. Receipt of Surgical Treatment for Selected Cancers in Two Age Groups, US, 2011-2015



Source: SEER 18 registries, 2018.

functioning, especially among older survivors with multiple additional chronic conditions.[77] Nevertheless, some survivors in this age group remain resilient. Physical activity, maintaining a healthy weight, and subjective happiness serve as protective factors against physical functioning decline among older cancer survivors.[77] Recommendations for physical activity in the oldest old should be individualized to optimize participation, safety, and efficacy. Older cancer survivors can also benefit from programs that encourage smoking cessation, weight management, and social support.[78]

Resources

American Federation for Aging Research
www.afar.org

The mission of this national nonprofit organization is to support and advance healthy aging through biomedical research.

American Society of Clinical Oncology (ASCO)
www.asco.org/practice-guidelines/cancer-care-initiatives/geriatric-oncology

ASCO has compiled the most practice-changing, cutting-edge research and clinical guidelines in geriatric oncology, along with effective tools, assessments, and other resources for clinicians, patients, and caregivers.

Cancer and Resource Aging Group
www.mycarg.org

The Cancer and Aging Research Group aims to improve the care of older adults with cancer through research collaborations and clinical trials. Their website also provides a wealth of information and resources for older adults including guidance on nutrition, safety, and emotional support.

International Society of Geriatric Oncology
www.siog.org

The International Society of Geriatric Oncology is a multidisciplinary team of oncology and geriatrics physicians, along with allied health professionals, collaborating to address the rising public health challenges related to aging and cancer to foster the development of health professionals in the field of geriatric oncology and optimize treatment for older adults with cancer worldwide.

National Institute on Aging (NIA)
www.nia.nih.gov

As one of the 27 institutes and centers of the National Institutes of Health, the National Institute on Aging leads the federal government in conducting and supporting research on aging and the health and well-being of older people by seeking to understand the nature of aging and the aging process, and diseases and conditions associated with growing older, in order to extend healthy, active years of life.

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Tobacco Use

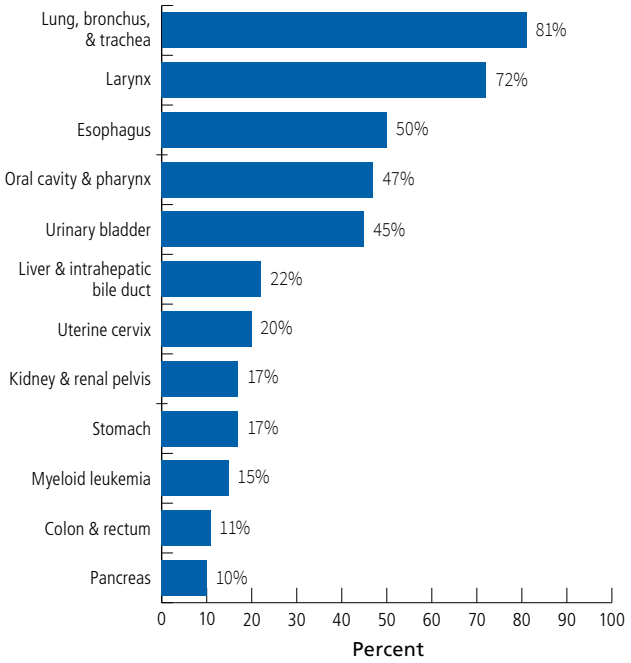
Tobacco use remains the most preventable cause of death in the US. Despite decades of declines in cigarette smoking prevalence, about 30% of all cancer deaths,[1,2] and as much as 40% of those in men in some Southern states,[3] are still caused by smoking. This is partly because smoking rates remain high in many segments of the population.[4]

Cigarette Smoking

Cigarette smoking increases the risk of at least 12 cancers: oral cavity and pharynx, larynx, lung, esophagus, pancreas, uterine cervix, kidney, bladder, stomach, colorectum, liver, and myeloid leukemia (Figure 4).[5] Evidence suggests that smoking may also increase risk of fatal prostate cancer, as well as a rare type of ovarian cancer.[5-7] Health consequences increase with both duration of smoking and number of cigarettes smoked.

- The prevalence of current cigarette smoking among adults ages 18 and older declined from 42% in 1965 to 14% in 2017.[8,9]
- More than 34 million American adults were current smokers in 2017.[9]
- The gender gap in smoking prevalence has narrowed among non-Hispanic whites (17% in men versus 15% in women), but remains large among Hispanics (13% versus 7%), non-Hispanic blacks (19% versus 12%), and non-Hispanic Asians (11% versus 4%).9
- Smoking prevalence is highest, and has declined most slowly, among those with low levels of education; among adults ages 25 and older in 2017, 25% of those with less than a high school diploma and 36% among those with a GED (General Educational Development) were current smokers, compared to 4% in those with graduate degrees.[9]
- State-level adult smoking prevalence in 2017 ranged from 9% in Utah to 26% in West Virginia.[10]
- Among US high school students, current cigarette smoking (at least once in the past 30 days) decreased from 29% in 1999 to 8% in 2017.[11,12]

Figure 4. Proportion of Cancer Deaths Attributable to Cigarette Smoking in Adults 30 Years and Older, US, 2014



Source: Islami F, Goding Sauer A, Miller KD, et al. *CA Cancer J Clin.* Nov 2017.

- Current cigarette smoking among high school students was the same in boys (8%) and girls (8%) overall, but much higher in non-Hispanic whites (10%) than in Hispanics (6%) or non-Hispanic blacks (3%).[12]

Other Combustible Tobacco Products

In addition to cigarettes, tobacco is used in other combustible forms such as cigars, pipes, waterpipes (also known as hookahs or shishas), and roll-your-own products. Regular cigar smokers have an increased risk of cancers of the lung, oral cavity, larynx, and esophagus, and have 4 to 10 times the risk of dying from these cancers compared to never smokers.[13-15] The most common types of cigars in the US are large cigars, cigarillos, and small cigars, which resemble cigarettes in size and shape, but are taxed at a lower rate, leading some smokers to switch from cigarettes to small cigars.[16] Furthermore, cigars are often sold as singles and some include flavorings,[17] both of which are particularly appealing to youth. Waterpipe smoking, which often occurs in a social setting (e.g., in a hookah bar), has rapidly gained popularity in the US, especially near

college campuses, and is considered more socially acceptable than cigarettes.[18] Although waterpipe users also perceive it to be less harmful than smoking cigarettes because the smoke moves through water prior to inhalation, it delivers the same or higher levels of toxins[19] and has many of the same adverse health effects.[20-23]

- In 2017, 4% of adults (men: 7%, women: 1%) reported smoking cigars every day or some days.[9]
- Cigar smoking was more common in non-Hispanic blacks (6%), American Indians/Alaska Natives (5%), and non-Hispanic whites (4%) than in Hispanics (2%).[9]
- Among high school students in 2017, 8% (boys: 9%, girls: 6%) had smoked cigars at least once in the past 30 days, down from 15% in 1999.[11, 12]
- The prevalence of waterpipe smoking among 12th grade students in 2017 was 10%.[24]

E-cigarettes (Vaping Devices)

A new category of devices emerged in the mid-to-late 2000s that aerosolizes a liquid nicotine solution, referred to by researchers as electronic nicotine delivery systems (ENDS) and known colloquially as "e-cigarettes" or "vaporizers." More recently, JUUL brand products have quickly become the largest selling e-cigarettes in traditional retail outlets. These battery-powered devices allow the user to inhale aerosol produced from cartridges or tanks filled with a liquid that typically contains nicotine, propylene glycol (PG) and/or vegetable glycerin (VG), and flavoring. They are promoted as high-tech alternatives to traditional cigarettes and/or a way to bypass some smoke-free laws. While evidence suggests that current-generation e-cigarettes are less harmful than conventional cigarettes, risks associated with long-term use are not clear.[25, 26] Metals and other hazardous chemicals can seep into the inhaled aerosol through contact with heating coils or wicks upon activation, and some commonly used flavoring components (e.g., diacetyl) are hazardous to the lungs. When present, concentrations of these hazardous chemicals are typically far below those of tobacco smoke, but they have been observed at sufficient levels to warrant health concerns, especially in conditions of improper use or faulty manufacturing. In addition, little is known about the long-term effects of inhaling PG/VG or using nicotine absent tobacco. E-cigarettes are addictive, and they may be a gateway to combustible tobacco products among individuals who would otherwise have been nonsmokers. Research indicates adolescent and young adults who use e-cigarettes are 2-4 times more likely than nonusers to begin using combustible tobacco products .[27-29] E-cigarette use has risen rapidly in the US, particularly among youth and young adults, and more high school students have reported using e-cigarettes than tobacco cigarettes every year since 2014.

- In 2017, 3% of adults reported current (every day or some days) e-cigarette use, ranging from about 1% in people ages 65 and older to 5% in people ages 18 to 24.[9]
- Among high school students, current e-cigarette use (at least once in the past 30 days) increased rapidly from 2% in 2011 to 16% in 2015, then declined to 12% in 2017.[12]
- E-cigarette use in 2017 was more common in non-Hispanic white (14%) and Hispanic (10%) high school students than in non-Hispanic blacks (5%).[12]

Smokeless Tobacco Products

Smokeless tobacco includes products such as moist snuff, chewing tobacco, snus (a "spitless," moist powder tobacco, often in a pouch), and a variety of other tobacco-containing products that are not smoked. These products can cause oral, esophageal, and pancreatic cancers, as well as precancerous lesions of the mouth.[30] Switching from combustible to smokeless tobacco products has been shown to result in a higher risk of tobacco-related death than complete tobacco cessation.[31] The tobacco industry continues to market smokeless tobacco as a cigarette alternative in smoke-free settings and develop new smokeless products, many of which have specific appeal to youth.

- Smokeless tobacco use among adults in the US has remained stable since 2003;[32] in 2017, 4% of men and <1% of women were current (every day or some days) users of smokeless tobacco products.[9]

- State-level adult smokeless tobacco use in 2017 ranged from 1% in the District of Columbia and Puerto Rico to 9% in West Virginia and Wyoming.[10]
- In 2017, 8% of high school boys and 3% of girls used smokeless tobacco in the past 30 days.[12]

Secondhand Smoke

There is no safe level of exposure to secondhand smoke (SHS), which contains more than 5,300 compounds and 70 carcinogens.[33] Nonsmokers who are exposed to SHS are at increased risk of lung diseases (including cancer), heart disease, and respiratory illnesses.[34-37] Laws that prohibit smoking in public places and create smoke-free environments are the most effective approach to prevent exposure to SHS. In addition, there is strong evidence that smoke-free policies decrease the prevalence of both adult and youth smoking.[36, 38] Since 1990, smoke-free laws have become increasingly common and more comprehensive.

- In 2014, an estimated 5,840 nonsmoking adults in the US were diagnosed with lung cancer as a result of breathing SHS.[2]
- Nationwide, SHS exposure among nonsmokers declined from 84% in 1988-1994[39] to 25% in 2011-2012,[40] but remains substantially higher among individuals with low income.[4, 40]
- Approximately 10% of nonsmokers (12.6 million adults) were exposed to SHS in the workplace in 2015, a rate that has remained unchanged since 2010.[41]
- As of October 2018, more than 1,000 municipalities and 25 states, the District of Columbia, Puerto Rico, and the US Virgin Islands had comprehensive laws requiring all non-hospitality workplaces, restaurants, and bars to be 100% smoke-free, covering almost 60% of the US population.[42]
- Additionally, as of July 31, 2018, all US Department of Housing and Urban Development public housing was required to be smoke-free.[43]
- As of October 2018, more than 1,900 college/university campuses were 100% tobacco-free (including e-cigarette for most campuses).[42]

Smoking Cessation

Smokers who quit, regardless of age, increase their longevity; those who quit by age 30 live an average of 10 years longer than if they had continued to smoke.[44] Smoking cessation reduces the risk of developing cancer and other smoking-related diseases, and also improves outcomes for cancer survivors.[5]

- In 2017, 62% (55.2 million) of the 89.5 million Americans who had ever smoked at least 100 cigarettes were former smokers.[9]
- In 2017, 49% of current smokers reported having attempted to quit for at least one day in the previous year.[9]
- Although effective cessation treatments (i.e., counseling and medication) can double or triple a smoker's chances of long-term abstinence, only about one-third of people who try to quit use these aids, with no change since 2005.[45]

Reducing Tobacco Use and Exposure

Numerous federal, state, and local tobacco control policies have been enacted since the 1964 Surgeon General's Report on Smoking and Health, including increased cigarette prices; improved cessation treatment; enforced worksite, bar, and restaurant restrictions; improved health warnings; and restricted advertising.[5] These policies helped reduce smoking and avert almost 2 million smoking-related deaths through 2014.[46]

Expanding federal initiatives in tobacco control holds promise for further reducing tobacco use. The Family Smoking Prevention and Tobacco Control Act of 2009 granted the US Food and Drug Administration (FDA) authority to regulate the manufacturing, selling, and marketing of tobacco products. Key provisions of the act include the prohibition of fruit and candy cigarette flavorings and misleading descriptors, such as light, low, or mild, on tobacco product labels. The FDA broadened its regulatory authority in 2016 to cover all tobacco products (e.g., e-cigarettes, cigars, and loose tobacco), and in 2017 announced a new harm-reduction strategy focused on making cigarettes less addictive by reducing nicotine levels, potentially further reducing tobacco-

related deaths.[47] Additionally, provisions in the Affordable Care Act require most private and some public health insurance plans to provide at least minimum coverage of evidence-based cessation treatments, although for many smokers, minimum coverage falls short of what is needed for long-term cessation.

State tobacco control programs also have a critical role to play in reducing tobacco use, but often lack resources. The US surgeon general's goals for state tobacco control programs focus on preventing smoking initiation, promoting cessation, eliminating exposure to SHS, and eliminating disparities in tobacco use,[48] and the Centers for Disease Control and Prevention (CDC) recommends funding levels for these programs. However, in fiscal year 2018, only North Dakota (54%), Alaska (93%), and California (94%) funded tobacco control programs at >50% of recommended levels, while Connecticut, Georgia, Missouri, New Hampshire, New Jersey, and West Virginia funded at <1% of recommended levels.[49] Further, although there have been improvements in Medicaid coverage for tobacco cessation, as of June 30, 2017, only 10 states covered individual counseling, group counseling, and the seven FDA-approved cessation medications.[50]

Conclusion

Since the 1964 surgeon general's report, smoking prevalence has declined by about two-thirds and millions of premature deaths have been averted. Nevertheless, much more can be done to further reduce the health and economic burden of tobacco, particularly among specific populations with high smoking rates. Numerous studies confirm that comprehensive tobacco control, including higher taxes, 100% smoke-free environments, coverage for tobacco dependence treatment, plain standardized cigarette packaging, and tobacco marketing restrictions, can successfully reduce deaths, disabilities, and economic disruption from tobacco use.

For more information about tobacco control, visit cancer.org/statistics to view the most recent edition of *Cancer Prevention & Early Detection Facts & Figures* and tobaccoatlas.org for a comprehensive presentation of tobacco-related problems and solutions.

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Excess Body Weight, Alcohol, Diet & Physical Activity

Aside from avoiding tobacco use, maintaining a healthy weight and limiting alcohol consumption are the most effective strategies for reducing the risk of cancer.[1] An estimated 18% of cancer cases are attributable to the combined effects of excess body weight, alcohol consumption, physical inactivity, and an unhealthy diet.[2] The American Cancer Society's 2012 nutrition and physical activity guidelines (see sidebar) provide a framework to help individuals adopt healthy behaviors. Adults who most closely follow these recommendations are 10%-20% less likely to be diagnosed with cancer and 25% less likely to die from the disease.[3] Community action strategies are included in the guidelines because of the strong influence of environment on individual food and activity choices.

Excess Body Weight

An estimated 5% of cancers in men and 11% in women can be attributed to excess body weight.[2] The International Agency for Research on Cancer has concluded that excess body fatness, i.e., being overweight or obese, is associated with an increased risk of developing 13 cancers: uterine corpus, esophagus (adenocarcinoma), liver, stomach (gastric cardia), kidney (renal cell), brain (meningioma), multiple myeloma, pancreas, colorectum, gallbladder, ovary, female breast (postmenopausal), and thyroid.[4] More limited evidence suggests that it may also increase the risk of non-Hodgkin lymphoma (diffuse large B-cell lymphoma), male breast cancer, and fatal prostate cancer, and negatively impact survival for breast cancer, whereas for other cancers the evidence is sparse or inconsistent. Evidence is growing about the adverse health consequences of cumulative exposure to excess body fat over the life course as a result of excessive weight gain that begins during childhood.[5, 6]

- The proportion of men (about 40%) and women (about 25%-30%) classified as overweight has remained relatively stable since the early 1960s.[7] However, obesity prevalence has markedly increased; in 1960-1962, 11% of men and 16% of women were classified as obese, and by 2015-2016, approximately 38% of men and 41% of women were obese.[8]
- In 2015-2016, obesity prevalence among men was highest in Hispanics (43%), followed by non-Hispanic whites (38%) and non-Hispanic blacks (37%), while among women, it was highest among non-Hispanic blacks (55%), followed by Hispanics (51%) and non-Hispanic whites (38%).[8]
- Among youth (ages 2-19), the proportion classified as overweight increased from 10% in the early 1970s to about 17% in 2015-16. The prevalence of obesity has risen more sharply from 5% in the early 1970s to about 19% in 2015-16.[9, 10]
- In 2015-16, excess body fatness (overweight or obese) was prevalent in 26% of children ages 2-5; 34% of children ages 6-11; and 40% of adolescents ages 12-19.[10]
- Obesity prevalence in youth ages 2-19 was highest in Hispanic boys (28%) and non-Hispanic black girls (25%) and lowest in non-Hispanic Asian boys (12%) and girls (10%).[8]

The American Cancer Society's nutrition and physical activity guidelines[1]

Individual choices:

- Achieve and maintain a healthy weight* throughout life.
- Adopt a physically active lifestyle.
- Consume a healthy diet with an emphasis on plant sources.
- Limit alcohol consumption.

Community action:

- Increase access to affordable, healthy foods.
- Provide safe, enjoyable, and accessible environments for physical activity.

*Weight recommendations are often determined by body mass index (BMI), which is a function of weight to height squared. BMI categories for adults: healthy weight=18.5 to 24.9 kg/m^2, overweight=25.0 to 29.9 kg/m^2, obese=30.0 kg/m^2 or higher. BMI categories for children are based on percentile rankings and growth charts.

Alcohol

An estimated 6% of cancer cases can be attributed to alcohol consumption.[2] Alcohol consumption increases risk for cancers of the mouth, pharynx, larynx, esophagus, liver, colorectum, and female breast.[11] Heavy drinking (approximately ≥3 drinks daily) may also increase risk of stomach and pancreatic cancer.[11, 12] Cancer risk increases with alcohol volume, and even a few drinks per week may be associated with a slightly increased risk of female breast cancer.[13] Combined with tobacco use, alcohol consumption increases the risk of cancers of the mouth, pharynx, larynx, and esophagus far more than the independent effect of either drinking or smoking alone.[14]

- In 2017, 67% of adults reported current alcohol consumption (12+ drinks in lifetime and ≥1 drink in past year). About 5% reported heavier drinking (12+ drinks in lifetime and [male] >14 drinks/week in past year or [female] >7 drinks/week in past year), ranging from 2% in non-Hispanic Asians to 6% in non-Hispanic whites.[15]
- About 30% of high school students in 2017 reported current (past month) alcohol consumption.[16]

Diet

Approximately 4% to 5% of all cancer cases and deaths can be attributed to dietary factors.[2] Healthy dietary patterns and regular physical activity are both important for maintaining a healthy body weight and reducing cancer risk. Studies show that diet patterns high in red and processed meat, starchy foods, refined carbohydrates, and sugary drinks are associated with a higher risk of developing cancer (predominantly colon),[17] whereas those with an emphasis on a variety of fruits and vegetables, whole grains, legumes, and fish or poultry and fewer red and processed meats are associated with lower risk.[18, 19] One review found that individuals who have the healthiest diet have an 11%-24% lower risk of cancer death than those with the least healthy diet.[20] In addition, improving diet quality over time is associated with an overall reduced risk of death.[21]

- Among adults, 33% reported eating two or more servings of fruits per day and 16% consumed vegetables three or more times per day in 2017.[22]
- In 2017, 31% of high school students reported consuming 100% fruit juice or fruit two or more times per day and only 14% reported consuming vegetables three or more times per day.[16]

Physical Activity

An estimated 3% of cancer cases can be attributed to physical inactivity.[2] There is convincing evidence that physical activity decreases the risk of colon (but not rectal) cancer, and probably also decreases risk of endometrial and postmenopausal breast cancer.[23] Accumulating evidence suggests that physical activity may also reduce the risk of other cancers, including (but not limited to) esophageal, liver, and premenopausal breast cancers.[23, 24] Furthermore, mounting evidence suggests greater time spent in sedentary behavior may increase risk of colon and endometrial cancers.[25] Studies further suggest that cancer patients who are physically active are less likely to have adverse effects and to die from their cancer than those who are inactive.[26] Even low amounts of physical activity appear to reduce cancer mortality.[27, 28] Extended leisure-time sitting has also been associated with increased risk of cancer death,[29] although 60-75 minutes per day of moderate-intensity activity may offset this excess risk.[30]

- In 2017, 26% of adults reported no leisure-time activity (women: 28%, men: 24%), with a higher proportion of blacks (35%) and Hispanics (36%) reporting inactivity than whites (22%).[15]
- Among adults, 54% reported meeting recommended levels of aerobic activity in 2017, up from 40% in 1998.[15, 31]
- In 2017, only 26% of high school students (35% and 18% in boys and girls, respectively) engaged in at least 60 minutes of physical activity per day in the previous seven days.[16]

Type 2 Diabetes

Type 2 diabetes, a chronic condition in which the body loses its ability to respond to insulin, shares several modifiable risk factors with cancer, including excess body weight, poor diet, and lack of physical activity. Growing evidence suggests that type 2 diabetes independently increases risk for several cancers, including liver, endometrium, pancreas, colorectum, kidney, bladder, breast, and perhaps ovary.[32-34] The biology underlying the association between type 2 diabetes and cancer is not yet completely understood, but may involve abnormal glucose control and related factors, including inflammation.

- In 2015, an estimated 27 to 29 million Americans had type 2 diabetes, which represents 90% to 95% of all diabetes cases in the US.[35]
- In 2013-2015, the prevalence of diabetes was higher among American Indians/Alaska Natives (15%), non-Hispanic blacks (13%), and Hispanics (12%) than among Asians (8%) and non-Hispanic whites (7%).[35]
- However, 1 in 2 Asians with diabetes is unaware of their disease, compared to 1 in 4 people nationwide, partly because Asians are more likely to develop the disease at a normal body weight.[36]

Conclusion

Almost one in five cancers is caused by excess body fat, alcohol consumption, poor nutrition, and a sedentary lifestyle. However, many Americans encounter substantial barriers to consuming a healthy diet and engaging in regular physical activity. The tobacco control experience has shown that policy and environmental interventions across national, state, and local levels are critical to achieving changes in individual behavior. Similar purposeful efforts in public policy and community environments, as well as creative new strategies, are needed to facilitate healthier lifestyles to curtail the future cancer burden.

Visit https://www.cancer.org/healthy/eat-healthy-get-active/acs-guidelines-nutrition-physical-activity-cancer-prevention.html for more information on the American Cancer Society's nutrition and physical activity guidelines, and review *Cancer Prevention & Early Detection Facts & Figures* at cancer.org/statistics for additional information about how healthy behaviors influence cancer risk.

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Cancer Disparities

Eliminating disparities in the cancer burden, defined in terms of socioeconomic status (income, education, insurance status, etc.), race/ethnicity, geographic location, sex, and sexual orientation, is an overarching goal of the American Cancer Society. The causes of health disparities 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 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 (NHW) men with 12 or fewer years of education are almost 3 times higher than those of college graduates for all cancers combined. This is partly because incidence rates are higher in people with lower SES for many cancers because many factors that increase cancer risk are more prevalent. For example, people with lower SES are more likely to smoke and to be

obese, partly because of targeted marketing to this population by tobacco companies and fast food chains. Moreover, community factors often limit opportunities for physical activity and access to fresh fruits and vegetables. Additional factors include a higher prevalence of cancer-causing infections and harmful exposures in the workplace and other environments.

Disparities in cancer mortality among impoverished individuals also stem from lower survival rates because of a higher likelihood of advanced-stage cancer diagnosis and a lower likelihood of standard treatment. Barriers to preventive care, early detection, and optimal treatment in underserved populations include inadequate health insurance; financial, structural, and personal obstacles to health care; low health literacy rates; and delays in the dissemination of advances in early detection and treatment.

Racial and Ethnic Minorities

Racial and ethnic disparities in the cancer burden largely reflect disproportionate poverty. According to the US Census Bureau, in 2017, 21% of blacks and 18% of Hispanics/Latinos lived below the poverty line, compared to 9% of NHWs and 10% of Asians. In addition, 11% of blacks and 16% of Hispanics/Latinos were uninsured, compared to 6% of NHWs and 7% of Asians. Discrimination also contributes to cancer disparities, as racial and ethnic minorities tend to receive lower-quality health care than NHWs even when insurance status, age, severity of disease, and health status are comparable. Social inequalities, including communication barriers and provider/patient assumptions, can affect interactions between patients and physicians and contribute to miscommunication and/or delivery of substandard care.

Cancer occurrence in racial/ethnic minorities is also influenced by cultural factors that affect risk factor behaviors. For example, Hispanics and Asians overall have lower rates of lung cancer than NHWs (Table 9) because they have a history of lower smoking prevalence. Conversely, because a relatively large proportion of Hispanics and Asians are recent immigrants, they have higher rates of certain cancers related to infectious agents (e.g., stomach), reflecting higher infection prevalence in their native countries. Inherited genetic factors contribute minimally to overall cancer disparities, but explain some differences in cancer incidence for certain high-risk groups. For example, women of Ashkenazi Jewish descent have higher breast cancer incidence because of a higher frequency of mutations in breast cancer susceptibility genes *BRCA1* and *BRCA2*.

Following is a brief overview of the cancer burden for four major racial and ethnic minority groups in the US. However, it is important to note that these populations are very heterogeneous, with substantial variation in the cancer burden within each group. In addition, cancer rates for several racial and ethnic groups, especially American Indians and Alaska Natives (AIANs), are known to be underestimated due to misclassification on medical and death records.

Non-Hispanic Blacks: Although there is substantial variation within the non-Hispanic black (henceforth black) population, black males overall have the highest cancer incidence (549 per 100,000) and death (240) rates of the major racial/ethnic groups, 9% and 22% higher, respectively, than NHW males (506 and 197) (Table 9). Cancer mortality in black males is twice that in Asian and Pacific Islanders (APIs, 119), who have the lowest rates. Prostate cancer death rates in blacks are more than double those of every other group in Table 9. Black females have 13% higher cancer death rates than NHW females despite 7% lower incidence rates. See *Cancer Facts & Figures for African Americans*, available online at cancer.org/statistics, for more information.

Hispanics/Latinos: As an aggregate group, US Hispanics have lower rates for the most common cancers (female breast, colorectum, lung, and prostate), but among the highest rates for cancers associated with infectious agents, reflecting the risk profile in immigrant countries of origin. For example, Hispanics have cervical cancer incidence rates that are nearly 40% higher than those in NHWs, and liver and stomach cancer incidence rates that are about double (Table 9). However, incidence rates vary substantially by country of origin, generation, and duration of residence due to acculturation and other factors. For example,

Table 9. Incidence and Mortality Rates* for Selected Cancers by Race and Ethnicity, US, 2011-2016

Incidence, 2011-2015	All races	Non-Hispanic white	Non-Hispanic black	Asian/ Pacific Islander	American Indian/ Alaska Native†	Hispanic/ Latino
All sites	449.8	465.3	463.9	291.7	398.5	346.6
Male	494.8	505.5	549.1	298.9	418.4	377.6
Female	419.3	438.4	407.0	290.3	386.9	329.9
Breast (female)	124.7	130.1	126.5	92.9	100.9	93.0
Colon & rectum	39.3	39.0	46.6	30.7	44.4	34.4
Male	45.2	44.6	55.2	36.1	49.8	41.7
Female	34.3	34.2	40.7	26.4	40.1	28.8
Kidney & renal pelvis	16.4	16.6	18.4	7.8	23.2	16.2
Male	22.2	22.5	25.4	11.1	29.9	21.1
Female	11.4	11.4	13.1	5.1	17.4	12.2
Liver & intrahepatic bile duct	8.1	6.7	10.7	13.0	14.8	13.3
Male	12.5	10.3	17.6	19.9	20.9	19.7
Female	4.3	3.6	5.2	7.4	9.5	7.8
Lung & bronchus	60.5	64.7	63.8	34.9	61.5	30.7
Male	71.3	74.3	85.4	44.5	69.3	39.2
Female	52.3	57.4	49.2	27.8	55.7	24.6
Prostate	109.2	101.7	179.2	56.0	73.1	91.6
Stomach	6.6	5.4	10.3	10.5	8.4	9.7
Male	9.1	7.8	14.1	13.7	11.2	12.5
Female	4.6	3.5	7.7	8.0	6.1	7.7
Uterine cervix	7.6	7.1	9.2	6.0	9.2	9.6
Mortality, 2012-2016						
All sites	161.0	165.4	190.6	100.4	148.8	113.6
Male	193.1	197.3	239.8	119.1	178.8	138.2
Female	137.7	141.8	160.4	87.0	126.8	96.4
Breast (female)	20.6	20.6	28.9	11.3	14.5	14.3
Colon & rectum	14.2	14.0	19.4	9.9	15.9	11.2
Male	16.9	16.6	24.5	11.7	19.5	14.4
Female	11.9	11.9	16.0	8.4	13.1	8.8
Kidney & renal pelvis	3.8	3.9	3.7	1.8	5.8	3.5
Male	5.5	5.7	5.6	2.7	8.2	5.0
Female	2.3	2.4	2.3	1.1	3.8	2.3
Liver & intrahepatic bile duct	6.5	5.7	8.6	9.4	10.8	9.3
Male	9.6	8.3	13.6	13.9	14.6	13.3
Female	3.9	3.4	4.8	5.8	7.5	6.0
Lung & bronchus	41.9	45.0	45.6	22.8	35.4	18.3
Male	51.6	54.1	63.9	30.3	42.7	25.3
Female	34.4	37.9	33.3	17.4	29.9	13.1
Prostate	19.2	18.1	39.8	8.6	19.1	15.9
Stomach	3.1	2.4	5.7	5.3	5.2	5.1
Male	4.2	3.3	8.4	6.8	7.0	6.5
Female	2.3	1.7	3.9	4.2	3.7	4.0
Uterine cervix	2.3	2.1	3.6	1.7	2.8	2.6

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 and exclude data from Puerto Rico. †Data based on Indian Health Service Contract Health Service Delivery Areas.

Source: Incidence – North American Association of Central Cancer Registries, 2018. Mortality – National Center for Health Statistics, Centers for Disease Control and Prevention, 2018.

colorectal cancer incidence rates in men are almost 10% lower in Hispanics than in NHWs overall (Table 9), but are almost 20% higher in those residing in the US territory of Puerto Rico, which is 99% Hispanic (Table 4). See *Cancer Facts & Figures for Hispanics/Latinos*, available online at cancer.org/statistics, for more information.

Asian and Pacific Islanders (APIs): As a group, APIs have the lowest overall cancer incidence and mortality, but among the highest liver and stomach cancer rates, about double those among NHWs (Table 9). Like Hispanics, lung cancer rates in APIs are about half those in NHWs because of historically low smoking prevalence.

However, some API populations with higher historical smoking prevalence, such as Native Hawaiians, have lung cancer rates that approach those of NHWs. The variation in cancer occurrence within the API population reflects its diversity in terms of geographic origin, language, acculturation, and socioeconomic status. Unfortunately, contemporary cancer data are largely unavailable for minority subpopulations. See the *Cancer Facts & Figures 2016* Special Section on Cancer in Asian Americans, Native Hawaiians, and Pacific Islanders, available online at cancer.org/statistics, for more information.

American Indians and Alaska Natives (AIANs): AIANs have the highest kidney cancer incidence and death rates of any racial or ethnic population – nearly 3 times those among APIs, who have the lowest rates (Table 9). However, like other broad racial and ethnic groups, cancer rates vary greatly within the AIAN population because of differences in behaviors that influence disease risk. For example, kidney cancer death rates are twofold higher among AIAN men living in the Northern and Southern Plains than in those living in the East and Pacific Coast regions, likely because of differences in the prevalence of smoking, excess body weight, and hypertension. Likewise, variations in smoking patterns among AIAN men contribute to large differences in lung cancer rates, which are about 50% higher than NHWs for those living in the Northern Plains or Alaska, but less than half those in NHWs for AIAN men living in the Southwest. Notably, Alaska Natives have the highest colorectal cancer incidence in the US (89 per 100,000 during 2011-2015), more than double those in NHWs and American Indians (39 and 42, respectively) and about 90% higher than in blacks (47).

For information about American Cancer Society advocacy efforts dedicated to reducing the cancer burden among minority and medically underserved populations, see Advocacy on page 66.

The Global Cancer Burden

The ultimate mission of the American Cancer Society is to lead the fight for a world without cancer. Today, cancer accounts for about 1 in every 6 deaths worldwide – more than HIV/AIDS, tuberculosis, and malaria combined.[1] In 2018, there were an estimated 17.0 million cases of cancer diagnosed around the world and 9.5 million cancer deaths.[2] About 20% of cancer cases occurred in low- and medium-Human Development Index countries, many of which lack the medical resources and health systems to support the disease burden. By 2040, the global burden is expected to reach 27.5 million new cancer cases and 16.3 million cancer deaths solely due to the growth and aging of the population. However, these projections may be underestimates given the adoption of unhealthy behaviors and lifestyles associated with rapid income growth (e.g., smoking, poor diet, and physical inactivity) and changes in reproductive patterns (e.g., fewer children, later age at first childbirth) in economically transitioning countries.

Worldwide Tobacco Use

Tobacco use is a major contributor to the global burden of disease, responsible for more than 20% of cancer deaths worldwide[3] and more than two-thirds of all deaths among long-term tobacco users.[4, 5]

- Tobacco was responsible for more than 7 million deaths in 2016, including 884,000 deaths from secondhand smoke exposure among nonsmokers.[3] More than 75% of tobacco-attributable deaths are in low- and middle-income countries (LMICs).[1]
- Between 1990 and 2016, annual tobacco-attributable deaths remained at 1.6 million in high-income countries, but increased from 4.3 million to 5.5 million in LMICs.[3]
- The tobacco industry has been aggressively pursuing legal challenges to tobacco control interventions around the globe and promoting falsehoods about illicit trade and the livelihoods of smallholder tobacco farmers in order to further promote tobacco use.

The first global public health treaty under the auspices of the World Health Organization, the Framework Convention on Tobacco Control (WHO FCTC), was unanimously adopted by the World Health Assembly in 2003 and subsequently became a legally binding accord for all ratifying states in 2005. The purpose of the treaty is to fight the devastating health, environmental, and economic effects of tobacco on a global scale by requiring parties to adopt a comprehensive range of tobacco control measures. A number of major tobacco-producing nations, including Argentina, Indonesia, Malawi, and the United States, are among the few nations that have not yet ratified the treaty.

- About 63% of the world's population was covered by at least one comprehensive tobacco control measure in 2016, up from about 15% in 2008.
- The WHO estimates that 20% of the world's population lives in smoke-free environments and only 10% is covered by tobacco tax policy that is effective for tobacco control purposes.

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 save lives from cancer and tobacco globally by assisting and empowering the world's cancer societies and antitobacco advocates. The American Cancer Society Global Cancer Control and Intramural Research departments are raising awareness about the growing global cancer burden and promoting evidence-based cancer and tobacco control programs with a focus on LMICs.

Make cancer control a political and public health priority. Noncommunicable diseases (NCDs) such as cancer, heart disease, and diabetes account for about 70% of the world's deaths.[1] Although 76% of these deaths occur in LMICs,[3] less than 3% of private and public health funding is allocated to prevent and control NCDs in these areas.[6] The American Cancer Society helps make cancer and other NCDs a global public health priority by collaborating with key partners, including the NCD Alliance, the Union for International Cancer Control, the World Health Organization (WHO), the International Agency for Research on Cancer, the United Nations Development Programme, the International Union Against Tuberculosis and Lung Disease, the NCD Roundtable, and the Taskforce on Women and Non-Communicable Diseases. An example of recent progress in this effort occurred in 2017 when the World Health Assembly passed a resolution reaffirming cancer control as a critical health and development priority. In 2018, the WHO director general made a global call for action toward the elimination of cervical cancer.

Develop civil society capacity in cancer control globally. Many governments in LMICs are ill-prepared to adequately address the increasing burden of cancer. In many cases, civil society actors (nongovernmental organizations, institutions, and individuals) are also not yet fully engaged or coordinated in their cancer control efforts. The American Cancer Society Strengthening Organizations for a United Response to the Cancer Epidemic (SOURCE) Program is designed to strengthen the civil society response to cancer across the continuum from prevention through end-of-life care in focus countries around the world. This program provides intensive culturally appropriate training, technical assistance, mentoring, and practicum opportunities to cancer-focused organizations in LMICs focused on building and sustaining their capacity across seven key domains of organizational development: governance, financial management, financial sustainability, operations and administration, human resources management, program management, and external relations and partnerships. The program also facilitates the establishment of national cancer umbrella organizations to coordinate the civil society response and elevate the voice of all organizations, big and small, in the cancer fight.

Help improve tobacco control worldwide. The American Cancer Society Global Cancer Control department and the Economic and Health Policy Research (EHPR) program in the Intramural Research department are working to end the worldwide tobacco epidemic through research and programs. In 2016, the two teams launched a global tobacco taxation initiative that promotes the Sustainable Development Goal of a

30% reduction in smoking prevalence by 2025. This program actively seeks to engage specific cancer organizations, most of which have not been previously involved in this area, particularly in LMICs, and also provides capacity building and technical assistance to interested organizations and governments. Further, because issues around illicit trade in tobacco products have been closely tied to tobacco taxation, the initiative takes advantage of the EHPR's knowledge and experience to help governments navigate the challenges around implementing tobacco taxation successfully amid tobacco industry opposition. The EHPR team is also leading a multiyear program – with support from the US National Institutes of Health, the Bloomberg Philanthropies, and the World Bank – to examine the livelihoods of tobacco farmers in Indonesia, Kenya, Malawi, the Philippines, and Zambia to dispel the tobacco industry's myth that tobacco control harms smallholder tobacco farmers.

Make effective pain treatment available to all in need. Moderate to severe pain, which is experienced by about 80% of people with advanced cancer, is commonly untreated in resource-limited settings. Improved access to essential pain medicines is arguably the easiest and least expensive need to meet in LMICs. The American Cancer Society leads projects in Nigeria, Ethiopia, Kenya, Uganda, and Swaziland to improve access to essential pain medicines and also supports national morphine production programs that have dramatically reduced the cost of and increased access to pain relief. The American Cancer Society is also training health workers in more than 30 teaching and referral hospitals across the 5 countries through the Pain-Free Hospital Initiative, a 1-year hospital-wide quality improvement initiative designed to change clinical practice by integrating effective, high-quality pain treatment into hospital-based services. In 2018, the Ethiopian Health Ministry committed its own resources to extend the Pain-Free Hospital Initiative to 360 hospitals across the country.

Increase awareness about the global cancer burden. The American Cancer Society works with global collaborators to increase awareness about the growing cancer and tobacco burdens and their disproportionate impact on LMICs. For example, the American Cancer Society partnered with the International Agency for Research on Cancer and the Union for International Cancer Control to produce *The Cancer Atlas, Second Edition* and its interactive website (canceratlas.cancer.org). The *Atlas*, which is available in 10 languages, highlights the complex nature of the global cancer landscape while pointing to strategies governments can use to reduce their cancer burden. Similarly, *The Tobacco Atlas, Sixth Edition* (tobaccoatlas.org), a collaboration with Vital Strategies, is the most comprehensive resource on the evolving worldwide tobacco epidemic. It is available in six languages, and not only elucidates the complexities of the harms caused by tobacco use, but also systematically lays out the steps that governments and societies can take to address this epidemic. Tobaccoatlas.org, an accompanying interactive website, receives more than 30,000 visitors each month, about two-thirds of whom are outside the US. The American Cancer Society Intramural Research department also publishes *Global Cancer Facts & Figures* (cancer.org/statistics), which along with an accompanying statistics article in *CA: A Cancer Journal for Clinicians*, provides up-to-date data on cancer incidence, mortality, and survival worldwide. In addition to its print publications, the American Cancer Society's website, cancer.org, provides cancer information to millions of individuals throughout the world. In 2017, approximately 49% of visitors to the website were outside the US. Information is currently available in English, Spanish, Chinese, Bengali, Hindi, Korean, Urdu, and Vietnamese.

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The American Cancer Society

The American Cancer Society was founded in 1913 as the American Society for the Control of Cancer by 15 prominent physicians and business leaders in New York City. The organization's aim was to bring cancer into the mainstream of public disclosure through education campaigns, working to inform both health practitioners and the public about the disease. More than 100 years later, the American Cancer Society works with 1.5 million volunteers to lead the fight for a world without cancer.

We are *activists* – convening powerful leaders who work tirelessly to create awareness and impact. We deliver *breakthroughs* – launching innovative research and developing game-changing approaches. We build *communities* – coming together to support those affected by cancer and to help ensure access to treatment. We provide *direction* – empowering people with information and answers.

Thanks in part to our contributions, more than 2.6 million cancer deaths have been averted in the US in the past two decades.

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 composed entirely of volunteers from the medical and lay communities. The Board is responsible for setting policy, establishing long-term goals, monitoring general operations, and approving organizational outcomes and the allocation of resources. The organization is comprised of local offices in 6 geographic Regions and a global headquarters in Atlanta, Georgia. The headquarters 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 cancer control program, and our 24/7 cancer helpline; and providing technical support and materials for Regions and local offices for local delivery. Our Regions and local offices are organized to engage communities in helping to save lives from cancer, delivering potentially 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 while being as efficient as possible with donor dollars. In 2017, we implemented a new volunteer leadership model. This new model, comprising 47 new Area Boards in 46 Areas, is empowering leaders at a local level to make an even greater difference in their communities across the country.

The American Cancer Society also works closely with our nonprofit, nonpartisan advocacy affiliate, the American Cancer Society Cancer Action Network℠ (ACS CAN). As the nation's leading cancer advocacy organization, ACS CAN is working every day to make cancer issues a top national priority. With volunteers and staff in all 50 states and the District of Columbia, ACS CAN 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.

Volunteers

The American Cancer Society relies on the strength of 1.5 million dedicated volunteers. Supported by professional staff, these volunteers drive every part of our mission. They raise funds to support innovative research, provide cancer patients rides to treatment, and give one-on-one support to those facing a cancer diagnosis – and that's just the beginning.

How the American Cancer Society Saves Lives

With a dedicated team of volunteers and staff, the American Cancer Society is leading the fight for a world without cancer.

Prevention and Early Detection

Smoking still causes about 30% of all cancer deaths in the US, including more than 80% of lung cancer deaths. The American Cancer Society continues our long history of work to reduce tobacco use through research (see page 62), education, and advocacy (see page 66). Our Center for Tobacco Control is working toward the adoption and implementation of smoke- and tobacco-free policies in all workplaces, public places, and other important venues such as multiunit residential settings. In addition, we're taking an increasingly proactive role in addressing the changing landscape related to rapidly emerging tobacco-related markets, including for electronic smoking products such as e-cigarettes.

For Americans who do not smoke, the most important way to reduce cancer risk is to maintain a healthy, active lifestyle. The American Cancer Society regularly performs a formal review of the current scientific evidence on diet and cancer and synthesizes it into clear, informative recommendations for the general public to promote healthy individual behaviors and environments that support healthy eating and physical activity to reduce cancer risk. These nutrition and physical activity guidelines form the foundation for our communication, worksite, school, and community strategies designed to encourage and support people in making healthy lifestyle behavior choices.

Finding cancer at its earliest, most treatable stage gives patients the greatest chance of survival. Moreover, screening tests for cervical and colorectal cancer can detect precancers, allowing for cancer prevention. To help the public and health care providers make informed decisions about cancer screening, the American Cancer Society publishes early-detection guidelines based on the most current scientific evidence for cancers of the breast, cervix, colorectum, endometrium, lung, and prostate. In addition, the American Cancer Society has a history of implementing aggressive campaigns to increase awareness among the public and health care professionals of the value of cancer screening. Campaigns to increase use of Pap testing and mammography have helped contribute to a 71% decrease in cervical cancer mortality since 1969 and a 40% decline in breast cancer mortality since 1989. Building on these successes, the American Cancer Society and the National Colorectal Cancer Roundtable (NCCRT) launched an initiative in 2014 to increase colorectal cancer screening in adults 50 and older to 80% by 2018. The campaign engaged over 1,700 partners and has coincided with an increase in colorectal cancer screening rates in most states that resulted in an additional 3.3 million people screened between 2014 and 2016.

Similarly, seeing the need to reduce the incidence of and mortality from human papillomavirus (HPV)-associated cancers, we provide guidelines for HPV vaccination and established the National HPV Vaccination Roundtable, which is working with health care professionals nationwide to increase HPV vaccination rates in adolescents. With a variety of programs such as the NCCRT, the National HPV Vaccination Roundtable, and the Community Health Advocates implementing Nationwide Grants for Empowerment and Equity (CHANGE) program, we work with community health partners and corporations across the nation to increase access to preventive care and improve health equity. Together in 2017, we contributed to more than 109,000 low- or no-cost screening exams in underserved communities. By helping local facilities provide cancer education and screening for more underserved patients, we are helping to reduce death rates from breast, cervical, and colorectal cancers.

Through our Vaccinate Adolescent Programs, Cancer Control staff have implemented structured HPV vaccination interventions and Maintenance of Certification intervention projects in 91 federally qualified health care centers. Our staff have trained over 10,000 providers on HPV vaccination as cancer prevention. Clinics have seen an average HPV series initiation rate increase of 16% over the course of our year-long intervention projects.

More than 5 million new cases of skin cancer will be diagnosed in the US in 2019. 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. We promote skin cancer prevention and awareness educational messages in support of Don't Fry Day and year-round.

The American Cancer Society also works with companies across the US to help their employees learn more about taking action to help reduce their cancer risk. We work alongside employers to strengthen a culture of health and provide employee-focused resources and information.

Some products we offer include:

- The **Quit For Life® Program:** This is the nation's leading tobacco cessation program, offered by 25 states and territories, including Guam and Washington, DC, and more than 700 employers and health plans throughout the US. Operated and managed by Optum, the program is built on the organizations' more than 35 years of combined experience in tobacco cessation. It employs an evidence-based combination of physical, psychological, and behavioral strategies to enable participants to 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 a higher-than-average quit rate.
- The **Freshstart®** group-based tobacco cessation 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 program is delivered through hospital systems, employers, military bases, universities/colleges, community health organizations, and other systems.
- The **80% Pledge for Colorectal Cancer – Employers –** Detailed guide including steps to follow to increase colorectal cancer screening in the workplace, including making the commitment; working with health plans and wellness staff to ensure coverage is understood, promoted, and designed effectively; capturing data to show progress; and sharing effective strategies with the public
- The **Content Subscription Service**, an electronic toolkit subscription offered by the American Cancer Society to employers who support the health and wellness needs of employees with information about cancer prevention and early detection
- ***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 our scientific staff to ensure that the most up-to-date and accurate information is being provided.

Patient and Caregiver Services

The American Cancer Society provides patients and caregivers with resources that can help improve – and even – save lives. From free rides to treatment and other cancer-related appointments, places to stay when treatment is far from home, and our 24/7 helpline, we're here for everyone with cancer questions and concerns, when and where they need us.

Cancer Information

Caring, trained American Cancer Society staff connect people to answers about a cancer diagnosis, health insurance assistance, American Cancer Society programs and services, and referrals to other services at our 24/7 helpline at 1-800-227-2345. Our website, cancer.org, offers reliable and accurate cancer information and news, including current information on treatments and side effects for every major cancer type, and programs and services nearby. We also help people who speak languages other than English or Spanish find the assistance they need at cancer.org/easyreading or cancer.org/cancer-information-in-other-languages

The American Cancer Society also publishes brochures and books that cover a multitude of topics, from patient education, quality of life, and caregiving issues to healthy living. Visit cancer.org/bookstore for a list of books that are available to order. All of our books are also available from all major book retailers such as Amazon and Barnes & Noble. Call 1-800-227-2345 or visit cancer.org for brochures. We also publish three peer-reviewed scientific journals for health care providers and researchers: *Cancer*, *Cancer Cytopathology*, and *CA: A Cancer Journal for Clinicians*. Visit cancer.org/health-care-professionals/resources-for-professionals.html to learn about the journals and their content.

Programs and Services

Survivorship: American Cancer Society survivorship work aims to help people living with and beyond cancer from diagnosis through long-term survivorship to the end of life. Efforts focus on helping survivors understand and access treatment; manage their ongoing physical, psychosocial, and functional problems; and engage in healthy behaviors to optimize their wellness. Our posttreatment survivorship care guidelines are designed to promote survivor healthiness and quality of life by facilitating the delivery of high-quality, comprehensive, coordinated clinical follow-up care. Our survivorship research efforts focus on understanding the impact of cancer on multiple facets of survivors' lives and on developing and testing interventions to help survivors actively engage in their health care and improve their health and well-being through and beyond treatment. Through the National Cancer Survivorship Resource Center, a collaboration between the American Cancer Society and the George Washington University Cancer funded by the Centers for Disease Control and Prevention, we created the Cancer Survivorship E-Learning Series for Primary Care Providers. The free e-learning program is designed to teach clinicians how to care for survivors of adult-onset cancers.

Support for caregivers: Approximately 7% of the US population is made up of family caregivers of a loved one with cancer, and we are committed to meeting their information, education, and support needs. Approximately 4% of the US population is surviving cancer, meaning the ratio of family caregivers to cancer survivors is nearly double, supporting the notion that cancer is not isolated only to the individual diagnosed but rather impacts an entire family unit and network of close friends. One of the informational tools we offer caregivers is our *Caregiver Resource Guide*, which can help them: learn to care for themselves as a caregiver, better understand what their loved one is going through, develop skills for coping and caring, and take steps to help protect their own health and well-being.

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 reaches those most in need. It has specially trained patient navigators across the country who can help: find transportation to treatment and other 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 2017, more than 40,000 people relied on the program to help them through their diagnosis and treatment.

Transportation to treatment: One of the biggest roadblocks to treatment can be the lack of transportation. That's why the American Cancer Society started the Road To Recovery® program. It's at the very heart of our work of removing barriers to quality health care by providing patients transportation to treatment through volunteer drivers, partners, or community organizations. In 2017, we provided more than 340,000 rides to more than 20,000 cancer patients. Other transportation programs are also available in certain areas.

Lodging during treatment: The American Cancer Society Hope Lodge® program provides a free home away from home for cancer patients and their caregivers. More than just a roof over their heads, it's a nurturing community that helps patients access the care they need. In 2017, more than 30 Hope Lodge locations provided nearly 452,000 nights of free lodging to more than 25,000 patients and caregivers – saving them approximately $45 million in hotel expenses. Through our Hotel Partners Program, we also partner with local hotels to provide free or discounted lodging for patients who are not able to make frequent trips for treatment appointments.

Breast cancer support: Through the American Cancer Society Reach To Recovery® program, breast cancer patients are paired with trained volunteers who have had similar diagnoses and treatment plans to provide peer-to-peer support on everything from practical and emotional issues to helping them cope with their disease, treatment, and long-term survivorship issues. In 2017, the program provided more than 9,000 services.

Hair-loss and mastectomy products: The American Cancer Society *"tlc" Tender Loving Care*® publication offers affordable hair loss and mastectomy products for women coping with cancer, as well as advice on how to use them. Products include wigs, hairpieces, hats, turbans, breast forms, and mastectomy bras, camisoles, and swimwear. The *"tlc"*™ products and catalogs are available online at tlcdirect.org or by calling 1-800-850-9445.

Finding hope and inspiration: The American Cancer Society Cancer Survivors Network® provides a safe online connection where cancer patients can find others with similar experiences and interests. At csn.cancer.org, members can join chat rooms and build their own support network from among the members. Other online resources, including MyLifeLine and Springboard Beyond Cancer, provide additional support for patients, survivors, and caregivers and allow them to better communicate to receive the help they need during and after cancer.

Research

Research is at the heart of the American Cancer Society's mission. We have invested more than $4.8 billion in research since 1946, all to find the causes, preventions, and better treatments for cancer, as well as ways to help people thrive during and after treatment. The top-tier facilities and programs we fund study everything from nutrition to genetics to environmental and behavioral factors to find answers that lead to understanding, resulting in more effective treatments.

The American Cancer 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 staffed by our own research scientists.

Extramural Research

The American Cancer Society Extramural Research program currently supports research and training in a wide range of cancer-related disciplines at more than 200 institutions. As of August 1, 2018, we are funding 746 research and training grants totaling more than $410 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 American Cancer 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. In addition, the Extramural Research program focuses on needs that are unmet by other funding organizations, such as coordinating with the National Palliative Care Research Center to augment research in palliative care for cancer patients and partnering with Melanoma Research Alliance (MRA) to support research that maximizes outcomes and minimizes toxicity for patients treated with checkpoint inhibitors by finding ways to better predict and prevent side effects of this game-changing treatment. The American Cancer Society is honored to have given funding to 47 investigators who went on to win the Nobel Prize, the highest accolade any scientist can receive, which is a tribute to our research program and the strength of its peer-review process.

The Extramural Research department is comprised of six grant programs that support innovative cancer research with high relevancy across a wide range of disciplines to meet critical needs in cancer control.

Molecular Genetics and Biochemistry of Cancer: This program, directed by Michael Melner, PhD, highlights potential targets for new cancer treatments by focusing on the role of genes and their alterations (mutations, deletions, and amplifications) in the process of cancer development. 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.

Cancer Cell Biology and Metastasis: The primary goal of this program, directed by Charles (Karl) Saxe, PhD, is to improve understanding of cancer cells so the disease can be more effectively treated. Emphases include understanding the fundamental controls of normal and cancer cells with a focus on the regulation of cell growth, division, and death; how cells create an identity and relate to their local environment and to other cells; and

regulation of when and how cells move from one site to another. To most completely reach the program goal, a wide variety of cells are used so all aspects of cell biology can be examined.

Translational Cancer Research: This program, directed by Lynne Elmore, PhD, focuses on the interface between laboratory investigations and human testing and includes investigations of the role of infectious diseases in cancer, the synthesis and discovery of cancer drugs, the creation and use of animal models, and the role of individual or groups of genes in different cancer types.

Clinical Cancer Research, Nutrition, and Immunology: This grant program, directed by Susanna Greer, PhD, focuses on cancer therapies and includes basic, preclinical, clinical, and epidemiological investigations of immunotherapy, inflammatory responses, immunosurveillance, and innate and adaptive immune responses. Emphases include development and application of new imaging and bioanalytical tools and techniques, how the exposome, nutrition, physical activity, and environment impact cancer prevention, initiation, progression, and treatment.

Cancer Control and Prevention Research: This program, directed by Elvan Daniels, MD, MPH, focuses on the development and testing of interventions to influence health behaviors and health care delivery. Research projects focus on cancer risk reduction and delivery of high-quality health promotion, screening, early detection, and treatment services. Projects are also directed at health services, outcomes, and policy research to assess the effectiveness of interventions and impact of polices on access to and quality and cost of cancer care. Special emphasis is placed on health equity research addressing disparities in disadvantaged groups and social determinants of health that drive inequities.

Health Professional Training in Cancer Control: This program, directed by Virginia Krawiec, MPA, provides grants to nurses, physicians, and social workers to pursue training in outstanding cancer prevention and control programs that meet high standards for excellence. The goal of the program is to increase the number of health professionals with expertise in and a career commitment to cancer control.

Intramural Research

In 1946, under the direction of E. Cuyler Hammond, ScD, a small research group was created at the American Cancer Society that focused on investigating the causes of cancer and improving the quality and availability of cancer data. Since then, our Intramural Research program has grown into 5 programs that conduct and publish high-quality research to advance the understanding of cancer, monitor trends in cancer risk factors and occurrence, improve the lives of cancer survivors, and evaluate American Cancer Society programs to ensure that they are effective and reach cancer patients most in need.

Behavioral and Epidemiology Research Group: The Behavioral and Epidemiology Research Group (BERG) conducts studies that increase knowledge of the factors associated with cancer incidence, mortality, survival, and survivorship. The overarching goals of this research are to reduce the burden imposed by cancer, improve cancer outcomes and quality of life, and reduce cancer disparities.

This work began in 1952, when Hammond engaged the American Cancer Society's nationwide network of volunteers to initiate a large cohort of study participants to provide insights into the causes of cancer. The first cohort, the Hammond-Horn Study (followed from 1952 to 1955), included only men and provided the first US prospective evidence confirming the association between cigarette smoking and premature death from lung cancer and other diseases. This work established the foundation for a series of subsequent, large cohort studies of men and women called the Cancer Prevention Studies (CPS). For nearly 66 years, results from these studies have contributed extensively to the science on cancer risk associated with modifiable and non-modifiable factors, and have informed the American Cancer Society's and international guidelines for cancer prevention.

In 1994, the American Cancer Society's leadership recognized the need for more research directed at understanding and improving the social, emotional, and economic impact of cancer and its treatment, and a Blue Ribbon Advisory Committee recommended that the American Cancer Society "should increase its emphasis on psychosocial and behavioral research to fulfill unmet needs." Thus, in 1995, the Behavioral Research Center was formed with a focus on outcomes and quality of life among cancer patients and survivors and was subsequently expanded to include issues faced by caregivers, cancer risk behaviors such as tobacco use, and cancer disparities. Behavioral research findings, including those from the landmark Studies of Cancer Survivors, have improved understanding of how people adjust to life after cancer and helped to inform the development of clinical interventions and American Cancer Society recommendations for cancer survivors.

In 2017, the Behavioral and Epidemiology Research programs were merged to form the BERG, creating new opportunities for innovative, interdisciplinary research. Contributions from the BERG ultimately inform our evidence-based programs and recommendations focused on enhancing cancer prevention, improving outcomes, and reducing disparities. Today, BERG staff focus their efforts on questions that leverage the strength of existing resources to address the following broad research objectives:

- **Epidemiology of modifiable risk factors:** Fill in gaps in knowledge about factors related to cancer etiology, survival and long-term survivorship, including genetic and other predictors of smoking prevalence and health consequences; physical and sedentary activity, diet, alcohol, and excess body weight; medical conditions and common medications; and environmental exposures (e.g., circadian rhythm disruption, radon, pollutants).
- **Molecular epidemiology:** Improve understanding of the molecular epidemiology of cancer, with a focus on breast, gastrointestinal, hematologic and prostate cancers, through studies of circulating biomarkers; genetic factors and gene-environmental interactions; and tumor heterogeneity.
- **Survivorship and quality of life:** Identify factors associated with optimal physical, emotional, and social well-being among cancer patients, survivors, and caregivers to improve their quality of life; assist American Cancer Society program staff in the design and enhancement of interventions and services for cancer survivors and their loved ones; and supporting the addition of patient-reported outcomes to population health reporting systems.
- **Health behaviors:** Identify behaviors and related predictors associated with cancer prevention, with a primary focus on tobacco control, healthy eating, and active living, as well as their effects on cancer survivors' psychological adjustment and quality of life, in order enhance the efficacy of behavioral interventions and inform American Cancer Society programs, practices, and policies.
- **Cancer disparities and health equity:** Develop approaches and methods for cancer disparities/health equity research, examine exposures and outcomes in medically vulnerable populations, and identify effective strategies to help eliminate cancer disparities from prevention to survivorship.

Surveillance and Health Services Research: The Surveillance and 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 and promote cancer control nationally and globally. Information is disseminated via educational publications for a lay audience and peer-reviewed journal articles for a scientific audience. The SHSR program has produced *Cancer Facts & Figures* annually since 1951, and the accompanying Cancer Statistics article, published in *CA: A Cancer Journal for Clinicians* (cacancerjournal.com), since 1967. These two publications are the most widely cited sources for cancer statistics in the world and are available on our website at cancer.org/statistics and in hard copy from American Cancer Society offices and through our National Cancer Information Center (1-800-227-2345). Seven supplemental *Cancer Facts & Figures* focus on a specific topic (e.g., breast cancer, cancer risk factors) or subpopulation (e.g., Hispanics), including *Global Cancer Facts & Figures*, which is a collaboration with the

International Agency for Research on Cancer (IARC). IARC, along with the Union for International Cancer Control (UICC), also collaborates on the production of *The Cancer Atlas*, a one-stop resource for global cancer data and in-depth insights into the cancer burden, major risk factors, and ways leaders worldwide can facilitate cancer control. *The Cancer Atlas* is available in nine languages other than English and is accompanied by an award-winning interactive website (canceratlas.cancer.org). SHSR staff also provide customizable cancer statistics specifically for the US on a mobile-friendly interactive website, the Cancer Statistics Center (cancerstatisticscenter.cancer.org), that provides national and state-level data on cancer occurrence and risk factors to 2,000 users daily.

Surveillance epidemiologists also conduct and publish high-quality epidemiologic research to help advance the understanding of cancer. Major research topics include socioeconomic, racial, and geographic disparities in cancer occurrence, risk factors, and screening and generating scientific evidence to support American Cancer Society priority areas. For example, the American Cancer Society's 2018 colorectal cancer screening guidelines, which lowered the age for screening initiation from 50 to 45 years for those at average risk, were strongly influenced by a series of high-profile studies published by SHSR staff that demonstrated increasing rates of colorectal cancer incidence and mortality in individuals <55 years of age. In addition, since 1998, surveillance staff 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 highly cited, peer-reviewed journal article that reports current information related to cancer rates and trends in the US.

Health Services Research (HSR) activities began in the late 1990s with a primary objective of performing high-quality, high-impact research to evaluate disparities in cancer treatment and outcomes in support of the American Cancer Society's mission to reduce health care inequalities. Researchers in the HSR program use secondary data sources such as the National Cancer Data Base, a hospital-based cancer registry jointly sponsored by the American Cancer Society and the American College of Surgeons; the SEER-Medicare database, a linkage of population-based cancer registry data with Medicare claims data; and the Medical Expenditure Panel Survey, which is linked with the National Health Interview Survey. Findings from HSR researchers have been instrumental in the American Cancer Society's and the American Cancer Society Cancer Action Network's (ACS CAN) support of the Affordable Care Act (ACA) and its effect on public health. For example, HSR researchers found that following the ACA's implementation, the proportion of low-income, nonelderly cancer patients who were uninsured at diagnosis declined by more than half in states that expanded Medicaid (from 9.6% during 2011-2013 to 3.6% in late 2014) but only slightly decreased in nonexpansion states (14.7% to 13.3%). In a separate analysis, HSR researchers reinforced the importance of health care coverage by reporting that nearly one-third of the survival disparity for early-stage breast cancer between nonelderly black and white women was due to differences in insurance status.

Economic and Health Policy Research: The Economic and Health Policy Research (EHPR) program focuses on the economic and policy aspects of most major cancer risk factors – including tobacco use, poor nutrition, physical inactivity, and alcohol misuse – as well as other major cancer-related challenges, including patient access to potentially lifesaving medicines and the direct and indirect costs of cancer and its treatment. The dissemination of this research comes in multiple forms, including publications in high-impact, peer-reviewed scientific journals; the release of public scientific reports; and local, national, and international capacity-building programs with governments, international governmental organizations, and civil society.

For more than a decade, a key emphasis of the EHPR program has been vigorous collaboration on tobacco control efforts, particularly in low- and middle-income countries, with numerous international organizations and academic institutions such as the Secretariat and Parties of the WHO Framework Convention on Tobacco Control, the World Bank, Johns Hopkins University, and the Pan-American Health Organization, among others. This continues to be an important investment by the American Cancer Society because economic factors

contribute greatly to the global tobacco epidemic, and economic solutions, such as tobacco taxation and better health-related trade and investment policies, are also among the most successful and cost-effective policy interventions. Major global health donors, including the Bloomberg Philanthropies and the US National Institutes of Health, continue to support these efforts through project funding. The team continues to be a leading global voice on tobacco taxation, affordability of tobacco products, and issues around illicit trade in these goods. The team is also one of the principal research institutions examining the economics of tobacco farming globally. Using rigorous empirical research, the American Cancer Society has been working with global partners to counter the tobacco industry's false narrative that tobacco control hurts the economic livelihoods of tobacco farmers. Finally, the EHPR program is actively involved in helping governments to resolve tensions between public health and economic policies.

The flagship service publication of the EHPR program is *The Tobacco Atlas*, a comprehensive, accessible guide to tobacco control, produced in collaboration with the American Cancer Society Global Cancer Control department and Vital Strategies. The sixth edition and its corresponding website, tobaccoatlas.org, were released in March 2018 at the World Conference on Tobacco or Health in South Africa, and soon will be available in five other languages – French, Spanish, Portuguese, Chinese, and Arabic. Each month, the website has tens of thousands of visitors from nearly every country in the world.

Statistics & Evaluation Center: Founded in 2005, the Statistics and Evaluation Center's (SEC) mission is to deliver accurate, reliable, and timely evidence-based information to American Cancer Society leadership and staff to inform decisions at all levels of the organization. Expertise in the social, behavioral, statistical, geospatial, health, and epidemiological sciences allows SEC staff to collaborate effectively with colleagues across the American Cancer Society, as well as with our advocacy affiliate, ACS CAN. SEC staff have implemented innovative and collaborative research approaches that have greatly improved the American Cancer Society's ability to deliver efficient, high-quality programs and services; identify barriers; and provide better access to quality health care to those most in need. The SEC also conducts community- and health systems-based collaborative evaluations for cancer prevention, control, and survivorship programs in order to build the evidence base for these initiatives.

The SEC achieves its mission by: 1) providing leadership and expertise on evaluation of mission and income-delivery programs in all its aspects, including study design, qualitative, and quantitative data collection and analysis, dissemination, and provision of strategic recommendations; 2) developing and implementing web-based surveys for evaluation efforts; and 3) providing leadership, expertise, and operational support related to geospatial science, data, and analysis within research and for decision making across the American Cancer Society.

Advocacy

Saving lives from cancer is as much a matter of public policy as scientific discovery. Lawmakers at the local, state, and federal level play a critical role in enacting policies that help save lives – from quality, affordable health care for all Americans; increasing funding for cancer research and programs; and improving quality of life for patients and their families, to helping communities prevent cancer and promote good health. The American Cancer Society Cancer Action Network (ACS CAN), the nonprofit, nonpartisan advocacy affiliate of the American Cancer Society, works with federal, state, and local policy makers to achieve these goals.

Created in 2001, ACS CAN is the force behind a powerful grassroots movement uniting and empowering cancer patients, survivors, caregivers, and their families to save lives from cancer. As the nation's leading voice advocating for public policies that help to defeat cancer, ACS CAN works to encourage elected officials and candidates to make 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 assure cancer patients access to adequate and affordable health insurance coverage; 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.

ACS CAN's recent advocacy accomplishments on behalf of cancer patients and their families are outlined in the following sections. **Please note:** Descriptions of the Patient Protection and Affordable Care Act (ACA) provisions and other federal laws and guidance were current as of August 2018 and do not take into account any potential changes to health care being considered by Congress and the administration.

Access to Care

ACS CAN continues to advocate to protect key patient protections enacted as part of the ACA, including eliminating insurance coverage exclusions, preventing preexisting condition exclusions, eliminating annual and lifetime benefit caps, and removing copays for key cancer prevention and early detection services like mammography and colonoscopy. The organization is actively working with states to expand eligibility for Medicaid programs, allowing millions of low-income individuals and families to gain access to comprehensive and affordable health care coverage. Additionally, ACS CAN urges policy makers to advance and support policies that protect and improve low-income Americans' access to health care to improve health outcomes and reduce the burden of cancer.

ACS CAN is also advocating for other important patient protections, including:

- The prohibition of short-term limited-duration plans, association health plans, and other plans that do not cover comprehensive benefits or protect patients against high needs and costs
- Market stabilization measures, including state individual mandates for insurance coverage
- Full federal funding for community health centers, which provide community-oriented primary care in underserved areas
- Access to preventive services without cost sharing
- Continuation of the Prevention and Public Health Fund

Research Funding and Drug Development

ACS CAN is a leader in the effort to ensure full funding for the nation's public cancer research institutions, including the National Institutes of Health and its National Cancer Institute. Each year, nearly $5 billion in grant funding for cancer research is distributed to investigators working in cancer centers, universities, and labs in every state of the country. Federal budget pressures threaten this funding every year, and ACS CAN views this driver of the research pipeline to be of prime importance in the search for cures, and fights not only to protect this funding, but also to expand it.

In addition to advocating for cancer research funding, ACS CAN works to increase cancer patient access to innovative therapies by improving clinical trial enrollment. Clinical trials are the key step in advancing potential new cancer treatments from the research setting to the cancer care clinic, and patient participation in trials is crucial to their success. Around 20% of cancer clinical trials fail due to insufficient patient enrollment. To improve enrollment, ACS CAN, in collaboration with other cancer stakeholders, identified and is working on a set of consensus recommendations to improve clinical trial enrollment.

Prevention and Early Detection

ACS CAN is supporting policies that focus on the prevention and early detection of cancer by:

- Working to expedite and defend the full implementation of the Family Smoking Prevention and Tobacco Control Act, including the regulation of new products
- Leading efforts to pass comprehensive smoke-free laws requiring all workplaces, restaurants, and bars to be smoke-free. In 2017, Fort Worth, Texas, the 16th largest city in the US, joined the list of smoke-free cities in Texas.
- Working to increase the price of tobacco products via federal and state taxes on all tobacco products and defending against tax rollbacks. The average state tax rate for cigarettes rose to $1.75 per pack (as of June 25, 2018).
- Working to increase and protect state funding for tobacco control programs
- Continuing as an intervener in the long-pending tobacco industry appeal of the federal government's

lawsuit against the industry, in which specific manufacturers were found to be in violation of the Racketeer Influenced and Corrupt Organizations statute for engaging in decades of fraudulent practices aimed at addicting generations of smokers to their deadly products

- Advocating for coverage of cancer screenings and other recommended preventive services without financial barriers in private insurance, Medicare, and Medicaid
- Advocating for full funding for the National Breast and Cervical Cancer Early Detection Program, which provides low-income, uninsured, and medically underserved women access to cancer screenings, as well as diagnostic, patient navigation, and treatment services. For the first time in 20 years, Nevada passed legislation dedicating $1 million in state funding to its program.
- Urging policy makers to invest federal and state funds in colorectal cancer control programs
- Supporting federal legislation to eliminate a glitch in the law that imposes substantial patient out-of-pocket costs on Medicare beneficiaries who have a polyp removed during colonoscopy
- Supporting efforts to help increase human papillomavirus (HPV) vaccination uptake
- Advocating for evidence-based child nutrition programs and for state and local requirements to increase the quality and quantity of physical education and physical activity in K-12 schools
- Supporting the implementation of menu labeling in restaurants and other food retail establishments and of the updated Nutrition Facts label that appears on most packaged foods and beverages
- Urging federal regulation of indoor tanning devices and working with states to pass legislation prohibiting minors from accessing indoor tanning devices

Quality of Life

ACS CAN supports balanced pain policies at the federal and state levels that ensure continued patient and survivor access to pain treatments. The organization also supports the enactment of legislation to assure that cancer patients have full access to palliative care services, along with curative treatment, from the point of diagnosis through treatment and survivorship or end of life as needed. The legislation provides for increased training and professional development in palliative care, a nationwide public and provider education campaign to disseminate information about the benefits of palliative care, and additional research on pain and symptom management with the intent of improving patient care.

Central to ACS CAN's success is the sophisticated and effective volunteer structure. Across the country, volunteers in every congressional district work closely with ACS CAN to organize and execute advocacy campaigns. Together, these committed volunteers recruit and support other volunteers dedicated to the most critical components of successful advocacy campaigns: grassroots mobilization, media outreach, fundraising, and integrating advocacy into the American Cancer Society Relay For Life®, Making Strides Against Breast Cancer®, and Coaches vs. Cancer® signature programs and events.

Sources of Statistics

Estimated new cancer cases. The number of cancer cases diagnosed in 2019 was estimated using a spatiotemporal model and time series projection based on incidence during 2001-2015 from 48 states and the District of Columbia (DC) that provided consent and met the North American Association of Central Cancer Registries' (NAACCR) high-quality data standard. NAACCR is an umbrella organization that sets standards and collects and disseminates incidence data from cancer registries in the National Cancer Institute's (NCI) Surveillance, Epidemiology, and End Results (SEER) program and/or the Centers for Disease Control and Prevention's National Program of Cancer Registries. The method for estimating incidence prior to projection considers geographic variations in sociodemographic and lifestyle factors, medical settings, and cancer screening behaviors, and also accounts for expected delays in case reporting. (For more information on this method, see "A" in Additional information on the next page.)

The numbers of in situ cases of female breast carcinoma and melanoma diagnosed in 2019 were estimated by 1) approximating the actual number of cases in the 10 most recent data years (2006-2015) by applying annual age-specific incidence rates (based on 46 states) to corresponding population estimates for the overall US; 2) calculating the average annual percent change (AAPC) in cases over this time period; and 3) using the AAPC to project the number of cases four years ahead. These estimates were also partially adjusted for expected reporting delays using invasive factors.

Incidence rates. Incidence rates are defined as the number of people who are diagnosed with cancer divided by the number of people who are at risk for the disease in the population during a given time period. 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-specific incidence rates were previously published in NAACCR's publication *Cancer Incidence in North America, 2011-2015*. National rates presented herein may differ slightly from those previously published by NAACCR due to the exclusion of Puerto Rico and Minnesota. (See "B" in Additional information on the next page for full reference.)

Trends in cancer incidence rates provided in the text of this publication are based on delay-adjusted incidence rates from the 9 oldest SEER registries. Delay-adjustment accounts for delays and error corrections that occur in the reporting of cancer cases, which is substantial for some sites, particularly those less often diagnosed in a hospital, such as leukemia. Delay-adjustment is not available for some cancer types. Trends were originally published in the *SEER Cancer Statistics Review (CSR) 1975-2015*. (See "C" in Additional information on the next page for full reference.)

Estimated cancer deaths. The number of cancer deaths in the US in 2019 is estimated by fitting the number of cancer deaths from 2002 to 2016 to a statistical model and then using the most recent trend (APC) to forecast the number in 2018. Data on the number of deaths were 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 on the next page.)

Mortality rates. Mortality rates, or death rates, are defined as the number of people who die from cancer divided by the number of people at risk in the population during a given time period. Mortality rates in this publication are based on cancer death counts compiled by the NCHS and presented per 100,000 people and are age adjusted to the 2000 US standard population. Trends in cancer mortality rates provided in the text are based on mortality data from 1975 to 2016.

Important note about estimated cancer cases and deaths for the current year. While these estimates provide a reasonably accurate portrayal of the current cancer burden in the absence of actual data, they should be interpreted with caution because they are model-based

projections that may vary from year to year for reasons other than changes in cancer occurrence. In addition, they are not informative for tracking cancer trends. Trends in cancer occurrence are analyzed using age-adjusted incidence rates reported by population-based cancer registries and mortality rates reported by the NCHS.

Survival. This report describes survival in terms of 5-year relative survival rates, which are adjusted for normal life expectancy by comparing survival among cancer patients to survival in people of the same age, race, and sex who were not diagnosed with cancer. Cause-specific survival, which is used to describe survival by race/ethnicity in the special section on ovarian cancer, is the percentage of people who have not died from a specific disease within a certain time (usually 5 years). Many of the survival rates presented in this publication were previously published in the *CSR 1975-2015*. Trends in 5-year survival are based on data from the 9 oldest SEER registries, which go back to 1975, whereas contemporary 5-year survival rates are based on data from all 18 SEER registries, which provide greater population coverage. In addition to 5-year relative survival rates, 10-year survival rates are presented for selected cancers using data from patients diagnosed during 2000-2014, all followed through 2015. These rates were generated using the NCI's SEER 18 database and SEER*Stat software version 8.3.4. (See "E" in Additional information on the next page for full reference.)

Probability of developing cancer. Probabilities of developing cancer were calculated using DevCan (Probability of Developing Cancer) software version 6.7.6, developed by the NCI. (See "F" in Additional information on the next page 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 15 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, Green D, Firth R, et al. (eds). Cancer in North America: 2011-2015. Volume Two: Registry-specific Cancer Incidence in the United States and Canada. Springfield, IL: North American Association of Central Cancer Registries, Inc. June 2018. Available at https://www.naaccr.org/cancer-in-north-america-cina-volumes/#Vol2

C Noone Howlader N, AM, Krapcho M, et al. (eds). SEER Cancer Statistics Review, 1975-2015. National Cancer Institute. Bethesda, MD, 2018. Available at 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 Surveillance, Epidemiology, and End Results (SEER) Program (seer.cancer.gov) SEER*Stat Database: Incidence – SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2017 Sub (1973-2015 varying) – Linked To County Attributes – Total U.S., 1969-2016 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released April 2018, based on the November 2017 submission.

F DevCan: Probability of Developing or Dying of Cancer Software, Version 6.7.6; Statistical Research and Applications Branch, National Cancer Institute, 2018. https://surveillance.cancer.gov/devcan/.

American Cancer Society Recommendations for the Early Detection of Cancer in Average-risk Asymptomatic People*

Cancer Site	Population	Test or Procedure	Recommendation
Breast	Women, ages 40-54	Mammography	Women should have the opportunity to begin annual screening between the ages of 40 and 44. Women should undergo regular screening mammography starting at age 45. Women ages 45 to 54 should be screened annually.
	Women, ages 55+		Transition to biennial screening, or have the opportunity to continue annual screening. Continue screening as long as overall health is good and life expectancy is 10+ years.
Cervix	Women, ages 21-29	Pap test	Screening should be done every 3 years with conventional or liquid-based Pap tests.
	Women, ages 30-65	Pap test & HPV DNA test	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 66+	Pap test & HPV DNA test	Women ages 66+ 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 in the past 5 years should stop cervical cancer screening.
	Women who have had a total hysterectomy		Stop cervical cancer screening.
Colorectal†	Men and women, ages 45+	Guaiac-based fecal occult blood test (gFOBT) with at least 50% sensitivity or fecal immunochemical test (FIT) with at least 50% sensitivity, **OR**	Annual testing of spontaneously passed stool specimens. Single stool testing during a clinician office visit is not recommended, nor are "throw in the toilet bowl" tests. 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.
		Multi-target stool DNA test, **OR**	Every 3 years
		Flexible sigmoidoscopy (FSIG), **OR**	Every 5 years alone, or consideration can be given to combining FSIG performed every 5 years with a highly sensitive gFOBT or FIT performed annually.
		Colonoscopy, **OR**	Every 10 years
		CT Colonography	Every 5 years
Endometrial	Women at menopause		Women should be informed about risks and symptoms of endometrial cancer and encouraged to report unexpected bleeding to a physician.
Lung	Current or former smokers ages 55-74 in good health with 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 annual 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+	Prostate-specific antigen test with or without digital rectal examination	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. African American men should have this conversation with their provider beginning at age 45.

CT-Computed tomography. *All individuals should become familiar with the potential benefits, limitations, and harms associated with cancer screening.
†All positive tests (other than colonoscopy) should be followed up with colonoscopy.

Acknowledgments

The production of this report would not have been possible without the efforts of: Rick Alteri, MD; Kimberly Andrews; Cammie Barnes, MBA; Shirley Bluethmann, PhD, MPH; Durado Brooks, MD, MPH; Zachary Cahn, PhD, MA; Ellen Chang, ScD; Sally Cowal, MPA; Keri Daniels; Carol DeSantis, MPH; Michelle DelFavero, MOT, MPH; Jeffrey Drope, PhD; Stacey Fedewa, MPH; Mark Fleury, PhD; Rachel Freedman, MD, MPH; Ted Gansler, MD, MBA; Susan Gapstur, PhD; Mia Gaudet, PhD; Ann Goding-Sauer, MSPH; Anna Howard; Eric Jacobs, PhD; Mamta Kalidas, MD; TJ Koerner, PhD; Corinne Leach, MPH, MS, PhD; J. Leonard Lichtenfeld, MD, MACP; Angela Mariotto, PhD; Kristie McComb, MPH; Marji McCullough, SCD, RD; Catherine McMahon, MPH; Meg O'Brien, PhD; Alpa Patel, PhD; Cheri Richard, MS; Liora Sahar, PhD, GISP; Debbie Saslow, PhD; Scott Simpson; Jennifer Singleterry; Kirsten Sloan; Robert Smith, PhD; Lauren Teras, PhD; Lindsey Torre, MSPH; Dana Wagner; Martin Weinstock, MD, PhD; Tanya Wildes, MD; Mandi Yu, PhD; Shelley Yu, MPH; and Joe Zou, MS.

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

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