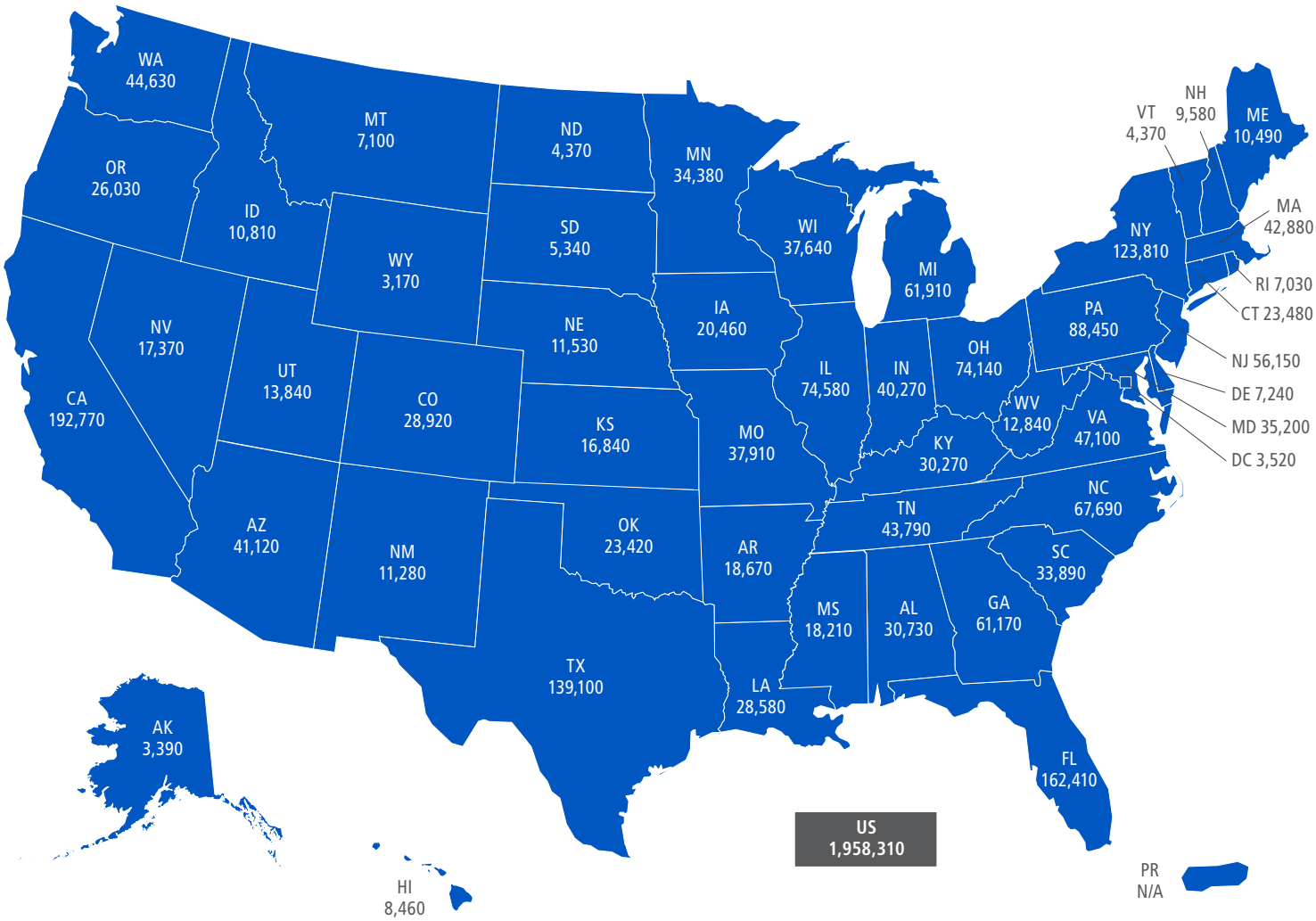
American Cancer Society®

Cancer Facts & Figures 2023



Estimated number of new cancer cases for 2023, excluding basal cell and squamous cell skin cancers and in situ carcinoma except urinary bladder. Estimates are not available for Puerto Rico.
Note: Incidence counts are model-based projections and should be interpreted with caution. State estimates may not equal US total due to rounding.

Special Section: Lung Cancer
see page 31

Contents

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 2023.* Atlanta: American Cancer Society; 2023.

©2023, American Cancer Society, Inc. All rights reserved, including the right to reproduce this publication or portions thereof in any form.

For permission, email the American Cancer Society Legal department at permissionrequest@cancer.org.

Basic Cancer Facts

What Is Cancer?

Cancer is a group of diseases characterized by the uncontrolled growth and spread of abnormal cells that can result in death if not treated. Although the causes of cancer development are not completely understood, numerous factors are known to increase risk, including many that are potentially modifiable (e.g., tobacco use and excess body weight) and others that are not (e.g., inherited genetic mutations). 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. Excluding non-melanoma skin cancer, at least 42% of newly diagnosed cancers in the US – about 820,000 cases in 2023 – are potentially avoidable, including the 19% of cancers caused by smoking and at least 18% caused by a combination of excess body weight, alcohol consumption, poor nutrition, and physical inactivity. 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 prevent infection, or by treating the infection. Many of the more than 5 million skin cancers 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 and removing precancers in the colon, rectum, and uterine cervix. Screening can also reduce mortality for these cancers and for cancers of the breast, lung (among people with a history of heavy smoking), and prostate by detecting cancer early, when treatment is often less intensive and more successful. In addition, being aware of changes in the body (such as a new mole or lump under the skin) and bringing these to the attention of a health care professional can result in the earlier detection of cancer. For complete cancer screening guidelines, see page 81.

How Many People Alive Today Have Ever Had Cancer?

More than 18 million Americans with a history of invasive cancer were alive on January 1, 2022, most of whom were diagnosed many years ago and have no current evidence of the disease.

How Many New Cases and Deaths Are Expected to Occur in 2023?

A little over 1.9 million new cancer cases are expected to be diagnosed in the US in 2023 (Table 1). This estimate excludes basal cell and squamous cell skin cancers, which are not required to be reported to cancer registries, and carcinoma in situ (noninvasive cancer) except for urinary bladder. Table 2 provides estimated new cancer cases in 2023 by state.

Approximately 609,820 deaths from cancer are expected in the US in 2023 (Table 1), which is about 1,670 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 2023.

Importantly, the calculation of these estimates is based on reported cancer incidence and mortality through 2019 and 2020, respectively. Thus, projected cancer cases in 2023 do not account for the impact of the coronavirus disease 2019 (COVID-19) pandemic on cancer diagnoses, and the projected cancer deaths in 2023 only account for the first year. However, it already is clear that the disruption of health services resulted in millions of missed or postponed appointments for cancer screening, as well as follow-up of abnormal results and symptoms. Additionally, patients who were already diagnosed experienced treatment delays and/or modifications. The consequences of this interruption in care will become evident in our cancer statistics over the next several years.

How Much Progress Has Been Made Against Cancer?

Substantial progress has been made against cancer in recent decades. The best measure of this progress is the change in cancer death rates (also referred to as mortality rates) because they are less affected by changes in detection practices than incidence (new diagnoses) and survival rates. The overall age-adjusted cancer death rate rose during most of the 20th century, peaking in 1991 at 215.1 cancer deaths per 100,000 people, mainly because of the smoking epidemic. As of 2020 the rate had dropped to 143.8 per 100,000 – a decline of 33% – mostly because of reductions in smoking and advances in treatment, as well as early detection for some cancers. The decline in the death rate translates into 3.8 million fewer cancer deaths from 1991 to 2020, largely driven by progress against the four most common cancer types – lung, colorectal, breast, and prostate (Figure 3).

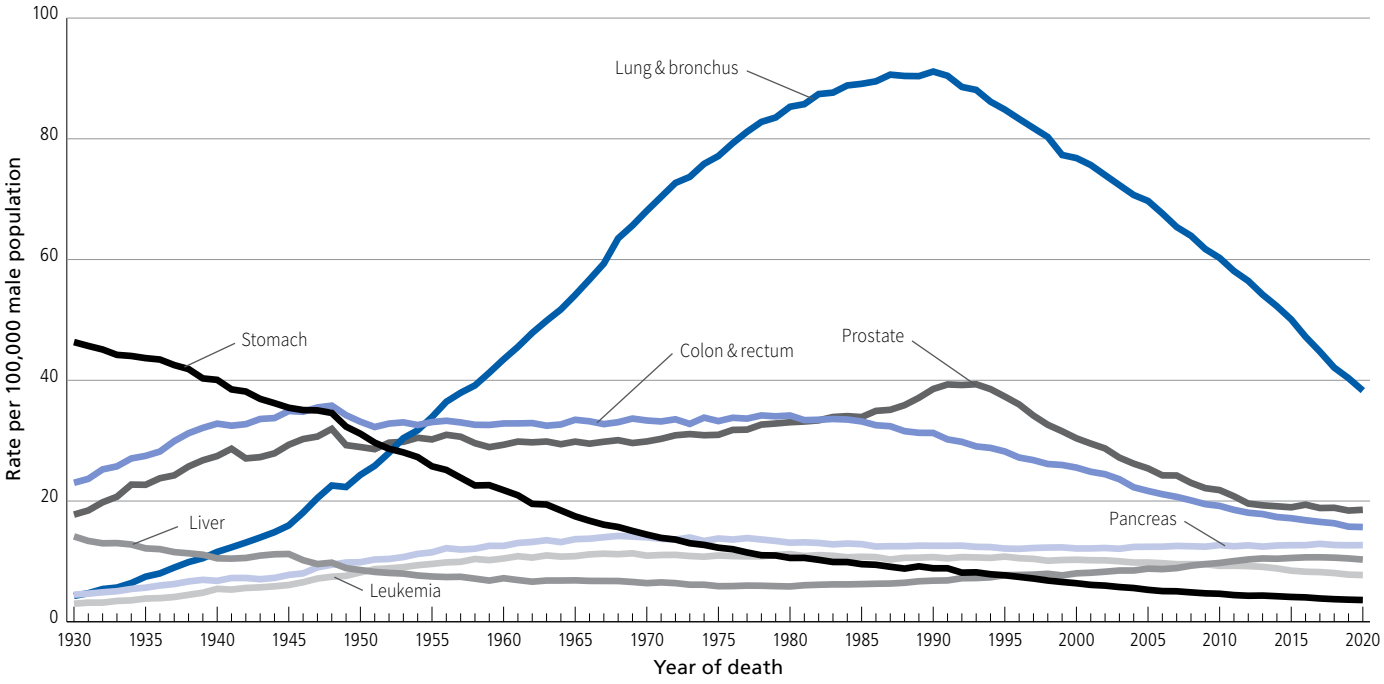
Do Cancer Incidence and Death Rates Vary by State?

Variations in cancer rates among states differ by cancer type, with the largest for lung cancer, reflecting vast historical and continuing differences in smoking prevalence. Table 4 and Table 5 provide average annual incidence and death rates for selected cancer types by state.

Who Is at Risk of Developing Cancer?

Everyone is at risk of developing cancer, although incidence increases greatly with age; 88% of people diagnosed with cancer in the US are 50 years of age or older and 57% are 65 or older. Risk is also increased by certain behaviors and other modifiable factors, such as smoking, having excess body weight, drinking alcohol, and eating an unhealthy diet. In the US, an estimated 41 out of 100 men and 39 out of 100 women will develop cancer during their lifetime (Table 6). However, these probabilities are based on cancer occurrence in the

Figure 1. Trends in Age-adjusted Cancer Death Rates* by Site, Males, US, 1930-2020



*Age adjusted to the 2000 US standard population. Rates exclude deaths in Puerto Rico and other US territories. Note: Due to changes in ICD coding, numerator information has changed over time for cancers of the liver, lung and bronchus, and colon and rectum.

Source: US Mortality Volumes 1930 to 1959, US Mortality Data 1960 to 2020, National Center for Health Statistics, Centers for Disease Control and Prevention.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

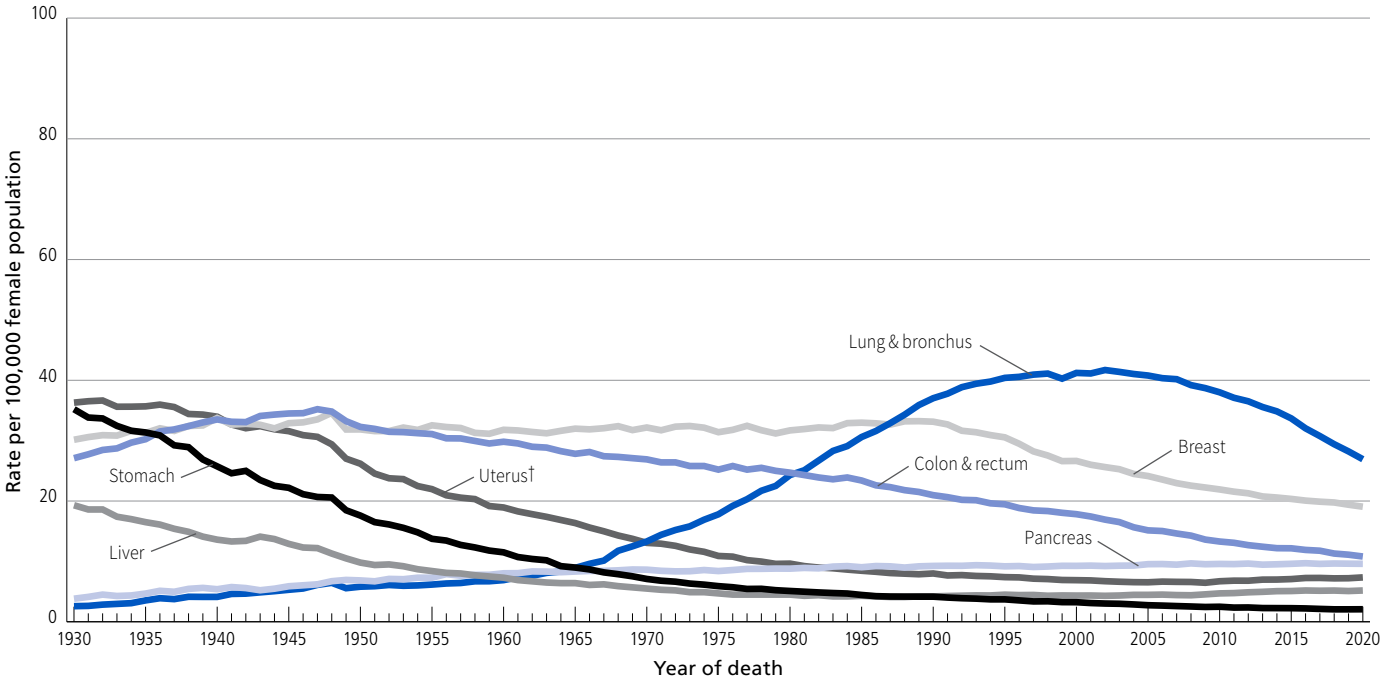
general population and may differ in individuals because of variations in exposures (e.g., smoking), family history, and/or genetic susceptibility. A family history of cancer is thought primarily to reflect the combination of inherited genetic variations that confer slight-to-moderate increased risk alongside similar lifestyle/environmental exposures. Inheritance of genetic alterations that confer a very high risk occurs much less frequently.

Relative risk is the strength of the relationship between exposure to a given risk factor and cancer. It is measured by comparing the rate of cancer in a group of people with a certain exposure or trait to the rate in a group of people without this characteristic. For example, individuals who smoke cigarettes are about 25 times more likely to develop lung cancer than people who never smoked, so the relative risk of lung cancer among people who smoke is 25. Most relative risks are not this large; for example, the relative risk of breast cancer among women who have a mother, sister, or daughter with a history of breast cancer is about 2. However, even exposures associated with a relatively small excess risk can have a large influence on the number of cancers diagnosed in the population if they are common (e.g., excess body weight).

What Percentage of People Survive Cancer?

Cancer survival is typically described in terms of relative survival, which is a measure of life expectancy among cancer patients compared to that among the general population of the same age, race, and sex. The 5-year relative survival rate for all cancers combined has increased substantially since the early 1960s, from 39% to 69% among White people and from 27% to 64% among Black people. Improvements in survival (Table 7) reflect advances in treatment, as well as earlier diagnosis for some cancers. Survival varies greatly by cancer type and stage (Table 8), as well as age at diagnosis.

Figure 2. Trends in Age-adjusted Cancer Death Rates* by Site, Females, US, 1930-2020



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

Source: US Mortality Volumes 1930 to 1959, US Mortality Data 1960 to 2020, National Center for Health Statistics, Centers for Disease Control and Prevention.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

Table 1. Estimated Number* of New Cancer Cases and Deaths by Sex, US, 2023

	Estimated New Cases			Estimated Deaths		
	Both sexes	**Male**	**Female**	**Both sexes**	**Male**	**Female**
All sites	1,958,310	1,010,310	948,000	609,820	322,080	287,740
Oral cavity & pharynx	54,540	39,290	15,250	11,580	8,140	3,440
Tongue	18,040	13,180	4,860	2,940	1,950	990
Mouth	14,820	8,680	6,140	3,090	1,870	1,220
Pharynx	20,070	16,340	3,730	4,140	3,260	880
Other oral cavity	1,610	1,090	520	1,410	1,060	350
Digestive system	348,840	194,980	153,860	172,010	99,350	72,660
Esophagus	21,560	17,030	4,530	16,120	12,920	3,200
Stomach	26,500	15,930	10,570	11,130	6,690	4,440
Small intestine	12,070	6,580	5,490	2,070	1,170	900
Colon & rectum†	153,020	81,860	71,160	52,550	28,470	24,080
Colon	106,970	54,420	52,550			
Rectum	46,050	27,440	18,610			
Anus, anal canal, & anorectum	9,760	3,180	6,580	1,870	860	1,010
Liver & intrahepatic bile duct	41,210	27,980	13,230	29,380	19,000	10,380
Gallbladder & other biliary	12,220	5,750	6,470	4,510	1,900	2,610
Pancreas	64,050	33,130	30,920	50,550	26,620	23,930
Other digestive organs	8,450	3,540	4,910	3,830	1,720	2,110
Respiratory system	256,290	131,150	125,140	132,330	71,170	61,160
Larynx	12,380	9,900	2,480	3,820	3,070	750
Lung & bronchus	238,340	117,550	120,790	127,070	67,160	59,910
Other respiratory organs	5,570	3,700	1,870	1,440	940	500
Bones & joints	3,970	2,160	1,810	2,140	1,200	940
Soft tissue (including heart)	13,400	7,400	6,000	5,140	2,720	2,420
Skin (excluding basal & squamous)	104,930	62,810	42,120	12,470	8,480	3,990
Melanoma of the skin	97,610	58,120	39,490	7,990	5,420	2,570
Other nonepithelial skin	7,320	4,690	2,630	4,480	3,060	1,420
Breast	300,590	2,800	297,790	43,700	530	43,170
Genital system	414,350	299,540	114,810	69,660	35,640	34,020
Uterine cervix	13,960		13,960	4,310		4,310
Uterine corpus	66,200		66,200	13,030		13,030
Ovary	19,710		19,710	13,270		13,270
Vulva	6,470		6,470	1,670		1,670
Vagina & other genital, female	8,470		8,470	1,740		1,740
Prostate	288,300	288,300		34,700	34,700	
Testis	9,190	9,190		470	470	
Penis & other genital, male	2,050	2,050		470	470	
Urinary system	168,560	117,590	50,970	32,590	22,680	9,910
Urinary bladder	82,290	62,420	19,870	16,710	12,160	4,550
Kidney & renal pelvis	81,800	52,360	29,440	14,890	9,920	4,970
Ureter & other urinary organs	4,470	2,810	1,660	990	600	390
Eye & orbit	3,490	1,900	1,590	430	240	190
Brain & other nervous system	24,810	14,280	10,530	18,990	11,020	7,970
Endocrine system	47,230	14,340	32,890	3,240	1,560	1,680
Thyroid	43,720	12,540	31,180	2,120	970	1,150
Other endocrine	3,510	1,800	1,710	1,120	590	530
Lymphoma	89,380	49,730	39,650	21,080	12,320	8,760
Hodgkin lymphoma	8,830	4,850	3,980	900	540	360
Non-Hodgkin lymphoma	80,550	44,880	35,670	20,180	11,780	8,400
Myeloma	35,730	19,860	15,870	12,590	7,000	5,590
Leukemia	59,610	35,670	23,940	23,710	13,900	9,810
Acute lymphocytic leukemia	6,540	3,660	2,880	1,390	700	690
Chronic lymphocytic leukemia	18,740	12,130	6,610	4,490	2,830	1,660
Acute myeloid leukemia	20,380	11,410	8,970	11,310	6,440	4,870
Chronic myeloid leukemia	8,930	5,190	3,740	1,310	780	530
Other leukemia‡	5,020	3,280	1,740	5,210	3,150	2,060
Other & unspecified primary sites‡	32,590	16,810	15,780	48,160	26,130	22,030

*Rounded to the nearest 10; cases exclude basal cell and squamous cell skin cancer and in situ carcinoma except urinary bladder. About 55,720 cases of female breast ductal carcinoma in situ and 89,070 cases of melanoma in situ will be diagnosed in 2023. †Cases and deaths for colon cancer include appendix. 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 2005-2019 incidence data reported by the North American Association of Central Cancer Registries (NAACCR). Estimated deaths are based on 2006-2020 US mortality data, National Center for Health Statistics, Centers for Disease Control and Prevention.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

Table 2. Estimated Number* of New Cases for Selected Cancers by State, US, 2023

State	All sites	Female breast	Colon & rectum	Leukemia	Lung & bronchus	Melanoma of the skin	Non-Hodgkin lymphoma	Prostate	Urinary bladder	Uterine cervix	Uterine corpus
Alabama	30,730	4,500	2,570	780	4,280	1,510	1,030	5,320	1,180	240	830
Alaska	3,390	520	330	90	450	100	140	470	160	†	110
Arizona	41,120	6,240	3,220	1,190	4,450	2,800	1,710	5,060	1,960	280	1,260
Arkansas	18,670	2,510	1,630	520	2,950	1,080	720	2,500	750	160	520
California	192,770	32,020	16,420	5,510	17,040	10,950	8,280	26,970	7,250	1,610	7,050
Colorado	28,920	4,910	2,120	870	2,600	2,000	1,150	4,220	1,220	200	920
Connecticut	23,480	3,620	1,560	810	2,750	830	1,020	3,990	1,160	120	800
Delaware	7,240	1,050	500	200	920	350	310	1,330	350	50	250
Dist. of Columbia	3,520	570	240	60	350	80	120	540	110	†	130
Florida	162,410	22,670	11,750	6,080	19,340	9,640	8,200	24,000	7,210	1,200	5,050
Georgia	61,170	9,440	4,880	1,700	7,610	3,310	2,090	9,140	2,160	470	1,760
Hawaii	8,460	1,480	770	210	930	520	330	1,190	300	50	340
Idaho	10,810	1,560	810	380	1,080	760	440	1,700	540	70	350
Illinois	74,580	11,530	6,200	2,090	9,670	3,380	2,990	10,580	3,160	520	2,770
Indiana	40,270	5,810	3,430	1,230	6,020	2,180	1,580	5,580	1,780	280	1,340
Iowa	20,460	2,810	1,630	740	2,680	1,310	860	2,970	940	120	690
Kansas	16,840	2,470	1,430	500	2,240	640	680	2,680	720	120	550
Kentucky	30,270	4,030	2,640	850	5,170	1,490	1,120	3,520	1,240	230	830
Louisiana	28,580	4,050	2,560	820	3,850	1,260	1,040	4,970	1,060	230	820
Maine	10,490	1,450	690	340	1,550	490	450	1,210	580	†	390
Maryland	35,200	5,760	2,560	1,050	4,290	1,840	1,380	5,980	1,340	230	1,320
Massachusetts	42,880	6,770	2,880	1,280	5,790	1,540	1,750	6,430	1,890	210	1,470
Michigan	61,910	8,980	4,630	1,820	8,690	2,680	2,580	8,360	2,980	380	2,420
Minnesota	34,380	5,220	2,430	1,200	3,970	1,140	1,510	4,880	1,530	150	1,190
Mississippi	18,210	2,610	1,750	460	2,830	720	600	2,790	620	150	530
Missouri	37,910	5,700	3,030	1,190	5,760	1,610	1,500	5,000	1,570	280	1,320
Montana	7,100	1,030	540	220	720	550	290	1,370	350	†	220
Nebraska	11,530	1,670	950	380	1,340	640	470	2,180	470	60	370
Nevada	17,370	2,620	1,490	540	2,030	800	720	2,180	820	150	550
New Hampshire	9,580	1,390	650	290	1,280	560	410	1,410	520	†	360
New Jersey	56,150	8,580	4,220	1,790	5,920	2,250	2,420	9,460	2,540	350	2,120
New Mexico	11,280	1,730	940	350	960	610	470	1,680	410	100	360
New York	123,810	18,780	8,970	3,560	14,150	4,000	5,150	20,390	5,440	850	4,620
North Carolina	67,690	10,730	4,740	2,100	8,810	3,950	2,560	10,040	2,760	420	2,180
North Dakota	4,370	610	370	160	530	290	170	740	200	†	120
Ohio	74,140	11,200	5,910	1,980	10,680	3,880	2,900	10,980	3,400	510	2,570
Oklahoma	23,420	3,330	1,950	710	3,390	1,220	890	3,100	920	200	700
Oregon	26,030	4,220	1,840	680	3,030	1,540	1,090	3,400	1,210	140	830
Pennsylvania	88,450	12,830	6,610	2,600	11,320	3,630	3,690	13,210	4,270	510	3,330
Rhode Island	7,030	1,050	470	220	940	290	310	1,030	340	†	260
South Carolina	33,890	5,430	2,550	890	4,650	1,800	1,230	5,770	1,390	240	1,040
South Dakota	5,340	760	440	190	690	310	220	1,040	240	†	170
Tennessee	43,790	6,210	3,450	1,200	6,580	1,990	1,600	6,280	1,730	320	1,320
Texas	139,100	22,280	12,220	4,780	14,510	5,530	5,540	17,230	4,490	1,510	4,460
Utah	13,840	2,030	940	440	800	1,550	510	2,500	500	90	470
Vermont	4,370	630	300	130	590	230	210	630	200	†	150
Virginia	47,100	7,810	3,630	1,230	6,010	2,360	1,910	7,580	1,830	310	1,590
Washington	44,630	7,050	3,160	1,360	5,030	2,680	1,900	6,450	1,940	270	1,430
West Virginia	12,840	1,620	1,120	390	2,170	560	550	1,780	620	90	450
Wisconsin	37,640	5,460	2,650	1,320	4,630	1,970	1,630	5,800	1,780	180	1,390
Wyoming	3,170	460	260	90	330	210	110	690	170	†	110
United States	**1,958,310**	**297,790**	**153,020**	**59,610**	**238,340**	**97,610**	**80,550**	**288,300**	**82,290**	**13,960**	**66,200**

*Rounded to 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 of 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 (cancerstatisticscenter.cancer.org).

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

Table 3. Estimated Number* of Deaths for Selected Cancers by State, US, 2023

State	All sites	Brain/ nervous system	Female breast	Colon & rectum	Leukemia	Liver‡	Lung & bronchus	Non-Hodgkin lymphoma	Ovary	Pancreas	Prostate
Alabama	10,640	330	720	900	370	520	2,610	290	200	840	540
Alaska	1,150	†	60	110	†	70	220	†	†	90	60
Arizona	13,460	420	920	1,300	530	690	2,290	430	320	1,140	850
Arkansas	6,340	190	390	550	200	310	1,680	190	120	460	340
California	59,830	2,180	4,680	5,530	2,290	3,450	9,380	2,180	1,450	4,970	4,090
Colorado	8,650	310	690	740	340	430	1,450	280	210	790	740
Connecticut	6,440	230	480	550	290	320	1,320	230	160	540	400
Delaware	2,230	60	160	170	90	90	500	80	50	210	100
Dist. of Columbia	990	†	60	90	†	80	160	†	†	100	70
Florida	47,410	1,450	3,170	3,810	1,970	2,230	10,230	1,580	1,060	3,910	2,650
Georgia	18,510	590	1,400	1,640	660	820	4,060	500	430	1,520	1,020
Hawaii	2,620	60	180	240	90	170	480	90	50	240	150
Idaho	3,120	100	160	270	140	170	580	120	80	280	200
Illinois	23,380	680	1,720	2,110	910	1,080	5,000	780	550	2,080	1,270
Indiana	13,660	330	930	1,170	510	650	3,250	460	260	1,170	760
Iowa	6,310	190	380	540	260	230	1,410	200	140	460	370
Kansas	5,690	190	370	500	240	250	1,330	190	120	410	280
Kentucky	10,090	280	790	890	400	380	2,710	320	160	740	410
Louisiana	9,420	250	690	870	390	530	2,240	290	170	730	470
Maine	3,500	110	190	270	120	120	870	120	70	270	170
Maryland	11,090	320	850	980	420	510	1,950	350	260	910	680
Massachusetts	12,420	450	760	880	490	530	2,570	350	300	1,120	680
Michigan	21,380	620	1,370	1,740	800	920	4,930	760	460	1,810	1,210
Minnesota	10,280	320	640	830	450	380	2,090	400	210	870	630
Mississippi	6,690	190	470	640	230	300	1,740	170	110	440	370
Missouri	13,090	370	810	940	470	590	3,210	420	250	1,010	650
Montana	2,200	80	150	170	80	160	380	70	†	170	140
Nebraska	3,540	130	270	320	160	100	630	110	70	300	170
Nevada	5,850	190	440	470	200	300	1,260	220	120	450	440
New Hampshire	2,910	100	180	190	100	140	560	100	†	320	170
New Jersey	15,230	520	1,200	1,360	640	600	2,800	530	350	1,410	730
New Mexico	3,840	120	300	290	130	300	560	130	70	310	280
New York	31,320	950	2,440	2,770	1,200	1,210	6,330	1,000	850	2,940	1,650
North Carolina	20,400	560	1,450	1,640	760	1,010	4,660	640	370	1,630	1,150
North Dakota	1,320	†	70	110	70	50	290	50	†	110	70
Ohio	24,770	720	1,670	2,120	1,060	1,010	5,730	830	470	2,080	1,310
Oklahoma	8,660	250	580	800	340	460	2,090	290	190	590	400
Oregon	8,430	270	570	640	330	470	1,650	310	150	710	500
Pennsylvania	27,460	740	1,870	2,280	1,140	1,260	5,720	950	610	2,340	1,440
Rhode Island	2,150	80	130	160	80	130	470	70	†	190	110
South Carolina	11,250	360	800	910	410	500	2,630	310	190	900	640
South Dakota	1,760	60	110	170	130	90	380	60	†	150	80
Tennessee	14,590	420	1,030	1,240	520	620	3,700	460	330	1,090	740
Texas	44,140	1,330	3,340	4,350	1,590	2,750	8,330	1,440	950	3,510	2,290
Utah	3,710	200	320	310	160	180	460	140	110	310	340
Vermont	1,460	60	80	120	50	80	280	50	†	110	90
Virginia	15,800	500	1,150	1,410	590	680	3,320	510	350	1,320	960
Washington	13,350	490	960	1,050	510	680	2,630	480	320	1,100	840
West Virginia	4,610	120	230	440	180	220	1,290	150	90	330	190
Wisconsin	11,670	380	720	880	480	510	2,460	410	220	1,020	730
Wyoming	1,020	50	70	110	†	60	200	†	†	90	80
United States	**609,820**	**18,990**	**43,170**	**52,550**	**23,710**	**29,380**	**127,070**	**20,180**	**13,270**	**50,550**	**34,700**

*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 of 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 (cancerstatisticscenter.cancer.org).

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

Table 4. Incidence Rates for Selected Cancers by State, US, 2015-2019

	All sites		Breast	Colon & rectum*		Lung & bronchus		Non-Hodgkin lymphoma		Prostate	Uterine cervix
State	**Male**	**Female**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Alabama	514.5	406.1	122.8	47.1	35.2	79.5	49.3	19.6	12.8	124.0	9.5
Alaska	435.0	406.0	122.0	42.5	36.4	59.4	49.2	21.1	14.6	92.0	7.7
Arizona	404.5	367.2	114.6	34.5	26.1	47.3	40.6	18.3	12.0	77.6	6.5
Arkansas	547.3	436.3	122.3	49.8	36.1	91.8	62.4	22.9	15.0	118.5	9.5
California	427.9	387.7	123.1	37.9	28.9	43.8	36.0	21.7	14.9	95.2	7.4
Colorado	414.1	387.8	130.4	34.3	26.9	41.5	38.1	20.8	13.9	93.2	6.2
Connecticut	511.0	445.6	141.1	38.0	28.0	61.9	54.2	25.9	17.6	123.2	5.6
Delaware	520.0	442.0	136.1	40.7	30.2	68.8	56.2	22.6	15.2	125.9	7.7
Dist. of Columbia	447.7	400.6	136.3	37.4	30.6	48.6	40.8	17.8	11.8	131.3	7.8
Florida	498.2	433.1	122.3	39.7	30.0	63.6	49.9	26.6	19.0	97.9	9.2
Georgia	531.8	423.6	129.1	45.6	32.8	72.9	49.8	22.0	14.7	132.6	8.0
Hawaii	442.2	402.2	140.2	43.9	32.0	52.9	35.5	18.4	12.4	100.3	6.8
Idaho	487.0	418.2	129.4	38.0	28.9	51.6	45.2	23.0	15.9	115.5	7.4
Illinois	501.4	443.0	134.0	46.0	33.9	69.1	55.6	23.2	16.2	113.3	7.5
Indiana	497.8	430.3	124.3	45.4	34.1	80.5	60.7	22.1	15.1	99.9	8.4
Iowa	535.8	460.2	135.1	45.5	35.1	72.2	54.8	25.8	17.4	119.0	7.7
Kansas	496.1	435.5	133.1	43.4	32.7	61.5	49.5	23.6	15.5	114.0	8.1
Kentucky	564.0	484.5	128.3	52.4	38.4	100.9	76.7	23.1	16.7	108.0	9.8
Louisiana	557.3	429.7	128.4	51.1	36.7	78.2	51.9	22.6	15.6	138.5	9.2
Maine	506.6	457.3	128.2	37.6	30.3	76.0	66.3	26.2	15.6	97.0	5.4
Maryland	494.9	427.5	133.6	38.6	30.8	59.2	50.1	21.7	14.8	132.7	6.7
Massachusetts	484.9	437.6	137.6	36.7	27.9	63.2	58.2	23.4	15.5	111.6	5.3
Michigan	485.1	420.2	124.2	39.8	31.0	68.7	56.3	23.5	16.1	110.6	6.9
Minnesota	508.2	447.2	135.6	39.8	30.2	60.2	52.1	26.5	17.1	113.2	5.6
Mississippi	552.0	419.9	123.3	54.8	39.6	92.9	57.5	20.6	14.0	135.6	9.3
Missouri	484.6	433.2	131.9	43.5	32.9	79.8	62.0	22.1	15.4	95.6	8.4
Montana	503.9	435.7	136.8	42.0	28.9	50.4	49.9	21.3	14.7	130.7	7.0
Nebraska	510.1	442.6	131.6	44.2	35.8	61.2	49.8	23.7	17.2	127.9	7.7
Nevada†	394.4	367.2	109.4	38.6	29.8	46.9	46.2	17.5	11.9	86.4	8.5
New Hampshire	517.1	459.9	142.1	38.9	28.9	65.4	60.8	25.0	17.8	114.1	5.3
New Jersey	536.3	458.8	138.8	44.1	32.8	58.5	50.1	26.6	18.2	140.1	7.7
New Mexico	389.7	365.2	114.4	36.4	27.9	40.5	32.5	17.0	12.5	84.2	8.4
New York	529.4	456.6	135.7	41.7	31.1	63.7	53.4	25.8	18.1	130.7	7.7
North Carolina	522.0	434.2	137.7	39.8	30.0	77.8	55.4	21.7	14.6	122.9	7.0
North Dakota	487.0	433.2	135.2	44.7	33.8	61.6	53.5	22.1	15.1	121.6	5.9
Ohio	510.8	446.2	130.6	44.6	33.6	77.1	58.8	23.5	15.9	112.5	7.9
Oklahoma	490.4	423.7	124.2	45.9	34.1	76.5	57.2	20.3	15.0	100.4	9.7
Oregon	449.2	415.8	130.6	36.2	28.2	54.7	48.7	22.1	14.8	96.4	6.8
Pennsylvania	513.6	454.4	132.0	43.7	33.0	69.9	55.6	24.2	17.3	109.2	7.4
Rhode Island	511.7	456.0	142.2	36.0	27.2	74.5	63.7	23.4	15.7	114.9	6.9
South Carolina	494.0	407.1	130.9	41.5	30.4	74.6	50.7	20.0	12.9	113.3	7.9
South Dakota	487.5	428.3	125.4	44.4	32.9	60.7	53.2	22.3	15.5	120.3	6.3
Tennessee	524.2	424.7	123.8	44.6	32.8	87.3	61.9	21.7	14.5	117.2	8.1
Texas	458.9	384.9	117.0	44.0	30.2	57.6	41.0	20.9	14.3	102.7	9.4
Utah	445.9	378.3	115.8	30.2	24.1	30.2	23.0	22.2	14.8	117.2	5.5
Vermont	479.1	444.6	132.6	37.8	27.9	64.2	54.2	22.7	16.1	98.6	4.8
Virginia	437.9	391.3	126.1	37.6	28.9	61.3	47.7	20.0	13.9	100.3	6.0
Washington	467.7	425.7	133.3	37.0	28.8	54.9	49.1	23.3	15.9	100.0	6.7
West Virginia	517.7	467.5	121.7	49.8	38.0	89.1	69.2	23.4	16.9	98.3	9.4
Wisconsin	512.2	441.9	135.1	38.6	29.9	65.3	53.4	25.6	17.3	118.3	6.5
Wyoming	433.1	384.8	113.0	36.0	28.8	43.2	40.8	19.9	13.9	113.6	8.2
Puerto Rico‡	411.7	337.5	98.5	47.7	32.6	21.7	11.4	17.3	12.5	148.6	12.6
United States	**488.2**	**423.3**	**128.1**	**41.5**	**31.2**	**64.1**	**50.3**	**22.9**	**15.7**	**109.9**	**7.7**

Rates are per 100,000, age adjusted to the 2000 US standard population. *Colorectal cancer incidence rates exclude appendix, with the exception of NV. †Data for this state are not included in US combined rates because incidence data did not meet inclusion standards for all years during 2015-2019 according to the North American Association of Central Cancer Registries (NAACCR). Rates for this state are based on data published in NAACCR's Cancer in North America, Volume II. ‡Data for Puerto Rico are not included in US combined rates for comparability to previously published US rates. PR incidence data for 2017 reflect diagnoses that occurred January through June only.

Source: NAACCR, 2022. 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.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

Table 5. Death Rates for Selected Cancers by State, US, 2016-2020

	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	207.4	137.2	20.9	18.1	12.0	59.6	33.1	6.7	3.5	14.0	10.1	20.2
Alaska	170.3	127.2	17.1	16.0	13.8	36.8	29.1	6.3	4.6	12.2	8.8	19.6
Arizona	154.8	113.6	18.0	14.6	10.0	31.9	24.2	5.8	3.3	11.8	8.8	17.1
Arkansas	206.5	141.7	19.5	17.9	12.4	61.0	38.5	6.8	3.8	13.0	9.5	18.6
California	158.3	118.2	18.8	14.2	10.3	29.8	21.6	6.4	3.8	11.7	9.1	19.8
Colorado	152.8	113.1	18.7	13.1	9.8	27.0	22.0	6.0	3.3	10.9	8.6	21.9
Connecticut	162.2	118.2	17.5	12.6	8.5	34.9	26.9	6.5	3.7	12.4	9.6	18.1
Delaware	190.4	133.8	20.8	15.6	10.8	45.8	33.1	7.5	3.9	14.7	10.4	17.7
Dist. of Columbia	171.5	136.3	23.5	15.9	12.4	33.2	22.4	5.3	3.3	14.0	12.2	26.9
Florida	166.5	121.2	18.5	14.8	10.3	40.6	28.4	6.1	3.7	12.2	8.9	16.1
Georgia	186.7	129.5	20.8	17.1	11.6	48.2	28.9	6.1	3.6	12.7	9.5	21.2
Hawaii	151.4	105.5	15.9	14.1	9.8	33.6	20.8	5.8	3.5	12.2	9.4	14.9
Idaho	169.7	126.7	20.0	14.4	10.9	32.4	25.5	6.6	4.7	12.6	9.3	21.1
Illinois	183.3	135.7	20.5	16.8	11.7	44.7	31.8	6.8	4.0	13.5	10.1	19.5
Indiana	201.3	142.2	20.4	17.4	12.4	55.3	36.9	7.6	4.5	13.9	10.3	19.5
Iowa	185.3	131.4	18.1	16.2	11.4	45.8	31.8	7.5	4.2	12.6	9.7	20.3
Kansas	183.7	134.9	19.8	16.8	11.9	44.7	32.9	7.1	4.4	13.0	9.4	18.1
Kentucky	220.3	155.3	21.6	19.2	13.6	67.0	45.3	7.7	4.6	13.0	10.2	18.3
Louisiana	205.6	140.6	22.4	19.2	12.8	56.4	33.5	7.0	4.0	13.8	10.8	19.9
Maine	196.4	140.8	17.7	14.6	11.5	50.0	38.8	7.4	4.1	12.9	10.0	19.0
Maryland	175.4	130.6	21.0	15.7	11.3	39.1	29.3	6.6	3.5	13.1	9.8	20.1
Massachusetts	172.6	123.1	16.5	13.1	9.3	38.4	30.2	6.5	3.8	13.5	9.9	18.2
Michigan	189.4	139.6	20.2	15.7	11.5	48.0	35.0	7.6	4.6	14.1	10.9	18.6
Minnesota	169.9	125.0	17.4	14.0	9.9	36.1	28.7	7.8	4.0	12.6	9.7	19.6
Mississippi	225.9	148.5	23.5	21.9	14.0	67.0	36.3	6.5	3.6	14.3	11.0	24.3
Missouri	195.7	139.0	19.8	16.7	11.3	53.8	37.3	7.0	4.1	13.7	9.5	17.8
Montana	167.9	125.6	18.3	14.4	9.8	32.8	28.8	6.4	3.5	11.4	9.2	22.3
Nebraska	175.6	132.2	20.4	16.8	12.2	39.6	29.3	7.1	3.7	13.9	10.1	18.1
Nevada	171.1	133.6	21.8	17.1	12.4	37.3	32.8	6.5	3.9	11.8	9.3	19.4
New Hampshire	178.5	130.0	18.0	14.7	10.1	41.2	34.0	6.4	4.1	12.6	9.7	19.2
New Jersey	162.7	126.4	20.3	15.3	11.1	35.0	26.8	6.4	3.7	12.8	10.1	16.7
New Mexico	159.1	116.2	19.9	15.3	10.2	28.4	19.8	5.6	3.4	11.4	8.2	19.3
New York	159.8	121.7	18.6	14.0	10.2	35.7	26.0	6.4	3.7	12.6	9.7	16.8
North Carolina	187.5	131.0	20.0	14.9	10.7	50.7	31.9	6.7	3.6	12.5	9.6	19.7
North Dakota	167.8	122.8	17.2	16.3	10.4	39.4	28.1	6.5	3.5	12.1	9.0	17.7
Ohio	199.6	142.0	21.0	17.4	12.2	53.1	35.2	7.5	4.3	14.0	10.6	19.3
Oklahoma	209.2	149.6	22.4	19.6	13.5	57.0	38.2	7.7	4.7	12.8	9.7	20.0
Oregon	174.0	132.6	19.3	14.2	10.6	36.7	30.4	7.3	4.3	12.9	10.0	20.3
Pennsylvania	187.7	135.9	20.3	16.5	11.5	45.3	31.2	7.3	4.4	14.0	10.4	18.4
Rhode Island	182.6	130.9	17.3	12.6	10.9	43.3	33.5	7.1	3.9	14.7	9.4	18.4
South Carolina	193.7	132.4	21.5	16.8	10.7	50.7	30.3	6.0	3.9	13.5	9.8	20.8
South Dakota	181.4	132.4	18.9	16.9	12.2	41.4	32.6	7.5	4.3	12.9	9.9	19.1
Tennessee	207.7	142.7	21.6	17.9	12.2	59.5	37.3	7.4	4.2	12.8	9.8	19.5
Texas	173.8	122.5	19.7	17.1	11.0	39.1	25.1	6.6	3.8	12.0	9.1	17.6
Utah	140.5	104.7	19.8	11.9	9.4	19.8	13.8	6.5	3.5	11.1	8.2	21.8
Vermont	185.0	134.3	16.4	15.9	12.7	41.5	32.2	7.5	4.4	11.9	10.3	21.1
Virginia	179.8	127.9	20.6	15.9	10.9	44.0	28.7	6.6	3.8	13.0	9.6	20.0
Washington	170.0	127.5	19.2	14.0	9.9	35.8	28.7	6.9	4.1	12.2	9.7	20.0
West Virginia	211.3	151.4	21.2	20.0	13.7	60.6	41.0	7.9	4.3	12.6	9.6	17.0
Wisconsin	181.5	131.2	18.4	14.2	10.4	41.1	31.2	7.5	4.2	13.7	10.0	20.8
Wyoming	159.8	120.3	18.6	13.6	10.9	32.4	26.2	6.2	4.0	12.6	8.6	18.4
Puerto Rico*	132.1	86.4	17.0	17.7	10.7	14.8	7.2	4.3	2.6	7.9	5.2	21.4
United States	**177.5**	**128.7**	**19.6**	**15.7**	**11.0**	**42.2**	**29.3**	**6.7**	**3.9**	**12.7**	**9.6**	**18.8**

Rates are per 100,000, age adjusted to the 2000 US standard population. *Rates for Puerto Rico are not included in overall US combined rates.

Source: US Mortality Data, National Center for Health Statistics, Centers for Disease Control and Prevention, 2022.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

Relative survival provides some indication about the average experience of cancer patients, but rates should be interpreted with caution for several reasons. First, they do not reflect the most recent advances in detection and treatment because they must be based on cancer diagnosis several years in the past in order to allow time for follow-up (i.e., 2012-2018 for 5-year survival rates presented in this report). Second, they do not account for many factors that influence an individual's survival, including the social determinants of health, such as access to safe housing, healthy food, and high-quality cancer treatment, as well as biological or behavioral differences. Third, improvements in survival rates over time do not always indicate progress against cancer. For example, earlier diagnosis through screening increases average survival rates but does not always result in extended life. In other words, a person may live longer with a cancer diagnosis because screening detected the disease before symptoms arose, even if their overall life span remains unchanged (lead-time bias). Survival rates also become artificially elevated when screening detects cancers that would never have caused harm if left undetected (overdiagnosis). For more information about how survival was calculated for this report, see Sources of Statistics on page 78.

How Is Cancer Staged?

Stage describes the extent or spread of cancer and is assigned at the time of diagnosis, but also sometimes after treatment has begun. 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. This report uses a system of summary staging that is standard for descriptive analyses of population-based cancer registry data and particularly useful for tracking trends. According to this system, if cancer is confined to the layer of cells where it began growing and has 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.) Some cancers (such as leukemia and brain tumors) cannot be staged using this system, so stage distribution for all cancers combined is unavailable.

Another staging system that is used more often by clinicians is called TNM (tumor size, nodes involved, and presence of metastasis). TNM similarly assesses cancer growth and spread and assigns a stage from 0 (in situ) for the earliest stage up to I, II, III, or IV for more advanced disease. However, some cancers do not have a stage 0 (e.g., sarcomas), some 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 staging for some cancers. See https://www.cancer.org/treatment/understanding-your-diagnosis/staging.html for more information on cancer staging.

What Are the Costs of Cancer?

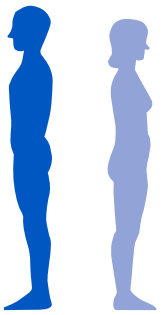
The costs of cancer are estimated in several ways, including direct medical costs (total of all health care expenditures), as well as indirect costs, such as lost earnings due to missed work from illness or premature death. The National Cancer Institute estimated that cancer-related medical costs in the US were $208.9 billion in 2020, which is likely an underestimate because it does not account for the growing cost of treatment; for example, the list price for many prescription medicines is now more than $100,000 annually. Cancer-related costs to patients are estimated at $21.1 billion, including $16.2 billion in total out-of-pocket costs and $4.9 billion in patient time costs (travel to/from treatment and waiting for and receiving care).

Lack of health insurance coverage is strongly associated with medical financial hardship and prevents many people from receiving optimal cancer care across the continuum, from prevention to early detection and treatment. Despite gains in health insurance coverage following the implementation of the Affordable Care Act (ACA), 17% of adults under 65 years of age were uninsured for at least part of 2021 based on National Health Interview Survey estimates, with the highest

Figure 3. Leading Sites of New Cancer Cases and Deaths – 2023 Estimates

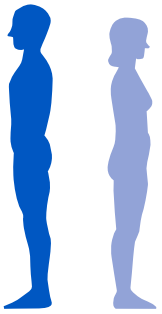
Estimated New Cases

Male			Female		
Prostate	288,300	29%	Breast	297,790	31%
Lung & bronchus	117,550	12%	Lung & bronchus	120,790	13%
Colon & rectum	81,860	8%	Colon & rectum	71,160	8%
Urinary bladder	62,420	6%	Uterine corpus	66,200	7%
Melanoma of the skin	58,120	6%	Melanoma of the skin	39,490	4%
Kidney & renal pelvis	52,360	5%	Non-Hodgkin lymphoma	35,670	4%
Non-Hodgkin lymphoma	44,880	4%	Thyroid	31,180	3%
Oral cavity & pharynx	39,290	4%	Pancreas	30,920	3%
Leukemia	35,670	4%	Kidney & renal pelvis	29,440	3%
Pancreas	33,130	3%	Leukemia	23,940	3%
All sites	**1,010,310**		**All sites**	**948,000**	



Estimated Deaths

Male			Female		
Lung & bronchus	67,160	21%	Lung & bronchus	59,910	21%
Prostate	34,700	11%	Breast	43,170	15%
Colon & rectum	28,470	9%	Colon & rectum	24,080	8%
Pancreas	26,620	8%	Pancreas	23,930	8%
Liver & intrahepatic bile duct	19,000	6%	Ovary	13,270	5%
Leukemia	13,900	4%	Uterine corpus	13,030	5%
Esophagus	12,920	4%	Liver & intrahepatic bile duct	10,380	4%
Urinary bladder	12,160	4%	Leukemia	9,810	3%
Non-Hodgkin lymphoma	11,780	4%	Non-Hodgkin lymphoma	8,400	3%
Brain & other nervous system	11,020	3%	Brain & other nervous system	7,970	3%
All sites	**322,080**		**All sites**	**287,740**	



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.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

prevalence among Hispanic (34%), Native Hawaiian or other Pacific Islander (31%), American Indian or Alaska Native (29%), and Black (19%) individuals. Uninsured individuals and those from other marginalized populations are much more likely to be diagnosed with cancer at a late stage, when treatment is often more involved, costlier, and less successful. To learn more about how the ACA helps save lives from cancer, see the Advocacy section on page 71.

Importantly, medical financial hardship and lost income due to cancer diagnosis, treatment, and recovery are not limited to those without health insurance. Many insured individuals, especially those who are younger and/or low-income, report difficulty paying medical bills, anxiety about treatment cost, and delayed or forgone medical care due to cost.

Selected Cancers

This section provides information on the occurrence, risk factors, symptoms, early detection, and treatment for the most commonly diagnosed cancers, and therefore may have limited relevance for specific cancer subtypes. (See the Special Section in *Cancer Facts & Figures 2017* at cancer.org/statistics for information on rare cancers.) Cancer trends are based on incidence data from US population-based cancer registries for cases diagnosed through 2019 that have been adjusted for delays in reporting, and on mortality data through 2020 from the National Vital Statistics System. See Sources of Statistics on page 78 for more information.

Breast

New cases and deaths: In the US in 2023, invasive breast cancer will be diagnosed in an estimated 297,790 women and 2,800 men, with an additional 55,720 cases of ductal carcinoma in situ (DCIS) diagnosed in women (Table 1; Figure 3). An estimated 43,700 breast cancer deaths (43,170 in women, 530 in men) will occur in 2023.

Incidence trends: Invasive female breast cancer incidence rates have been increasing by about 0.5% per year since the mid-2000s, likely due at least in part to increased prevalence of excess body weight and reproductive trends (decreasing fertility rate and increasing age at first birth).

Mortality trends: The breast cancer death rate among females peaked in 1989 and has since declined by 43% as of 2020, mainly because of earlier detection through screening mammography, as well as increased breast cancer awareness and improved treatment. This decrease translates to approximately 460,000 fewer breast cancer deaths during this time period than would have been expected in the absence of this progress. However, mortality rates in Black women remain about 40% higher than in White women, despite lower incidence.

Risk factors: Increasing age and being born female are the strongest risk factors for breast cancer. Potentially modifiable factors associated with increased risk include weight gain after the age of 18 and/or having excess body weight (for postmenopausal breast cancer); menopausal hormone therapy (combined estrogen and progestin), previously referred to as hormone replacement therapy; 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 cancer, especially when due to inherited genetic mutations in breast cancer susceptibility genes (e.g., *BRCA1* or *BRCA2*). *BRCA1* or *BRCA2* mutations are most common among people with a family history of breast, ovarian, and/or some other cancers. Additional medical risk factors include certain benign breast conditions, such as atypical hyperplasia, a history of DCIS or lobular carcinoma in situ (LCIS), high breast tissue density (the amount of glandular and connective tissue relative to fatty tissue measured on a mammogram), and high-dose radiation to the chest before 30 years of age (e.g., for treatment of lymphoma). Reproductive and hormonal 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 estrogen or testosterone, and recent use of hormonal contraceptives.

Prevention: Some women at high risk because of a strong family history or inherited genetic mutations may consider medicines (e.g., tamoxifen) to lower breast cancer risk or preventive surgery (prophylactic mastectomy) to remove the breasts, which greatly reduces risk. Women taking tamoxifen should be made aware of the risks of uterine cancer and report any occurrence of abnormal vaginal bleeding, discharge, or spotting to their clinician immediately.

Early detection: Early diagnosis reduces the risk of death from breast cancer and increases treatment options. Mammography is a low-dose x-ray procedure used to detect breast cancer before it becomes symptomatic. However, like any screening test, mammography is not perfect. It can sometimes miss cancer (a false-negative result) or appear abnormal in the absence of cancer (a false-positive result); about 12% of women who are screened have abnormal results that require further testing, but only 4% of women with an abnormal mammogram have cancer. Follow-up testing may cause anxiety and additional costs (e.g., medical and transportation). Other potential harms of screening include detection and treatment of breast cancers and in situ lesions (e.g., DCIS) that would never have progressed or caused harm (i.e., overdiagnosis and overtreatment). Although radiation exposure from mammograms is cumulative over time, it does not meaningfully increase breast cancer risk. The American Cancer Society recommends that women at average risk of developing breast cancer undergo annual mammography beginning at age 45 with the option to transition to biennial mammography beginning at age

55; women ages 40 to 44 should have the option to begin annual mammography. In general, mammographic screening should continue while overall health is good and life expectancy is 10 or more years. For some women at high risk, annual breast magnetic resonance imaging (MRI) is recommended along with mammography, often starting before age 40. For more information on breast cancer screening, see the American Cancer Society's screening guidelines on page 81.

Signs and symptoms: The most common signs/symptoms of breast cancer are a lump or mass in the breast; persistent changes to the breast, including skin thickening, breast swelling, or skin redness; and nipple abnormalities, such as spontaneous discharge (especially if bloody), scaliness, or retraction (drawing back within itself). Early-stage breast cancer often causes no signs or symptoms, which is why screening is important.

Treatment: There are two general aspects of treatment for breast cancer – local therapy (surgical and radiation treatments to the breast and/or nearby lymph nodes and chest) and systemic therapy (e.g., chemotherapy). Treatment to the breast usually involves either breast-conserving surgery (surgical removal of the tumor and a rim of surrounding normal tissue) with radiation or mastectomy (surgical removal of the entire breast). One or more underarm lymph nodes are usually evaluated to determine whether the tumor has spread beyond the breast. For early-stage breast cancer (no spread to the skin, chest wall, or distant organs), breast-conserving surgery plus radiation therapy results in long-term survival that is equivalent to mastectomy. Patients undergoing mastectomy may also need radiation if the tumor is large or there is lymph node involvement. 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 or later, but often requires more than one surgery. Depending on cancer stage, subtype, and sometimes other test results, such as tumor gene expression profiling (e.g., Oncotype DX), treatment may also involve chemotherapy (before and/or after surgery), hormone (anti-estrogen) therapy, targeted therapy, and/or immunotherapy (e.g., checkpoint inhibitors).

Survival: The 5- and 10-year relative survival rates are 91% and 85%, respectively, for invasive breast cancer, mostly because two-thirds of women are diagnosed with localized-stage disease. Although survival has improved over time, large inequalities remain, especially for Black women. For example, the 5-year survival rate is 9% lower (in absolute terms) for Black women (83%) than for White women (92%; Table 7), partly reflecting lower likelihood of localized-stage diagnosis (57% versus 68%). Reducing this and other disparities is a focus of the American Cancer Society and many other national cancer organizations.

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

Cancer in Children and Adolescents

New cases and deaths: In 2023, an estimated 9,910 children (ages 0 to 14 years) and 5,280 adolescents (ages 15-19 years) will be diagnosed with cancer and 1,040 children and 550 adolescents will die from the disease. Cancer is the leading disease-related cause of death among both children and adolescents. The most commonly diagnosed cancers in children and adolescents are leukemia (28% and 13%, respectively); brain, including benign and borderline malignant tumors (26% and 21%); and lymphoma (12% and 19%).

Incidence trends: Overall, incidence rates from 2010 through 2019 stabilized in children after increasing since at least 1975, but continued to rise in adolescents by 1% per year, although trends vary by cancer type.

Mortality trends: The death rate for cancer has declined by more than half from 1970 to 2020 in both children (from 6.3 per 100,000 to 1.9) and adolescents (from 7.2 to 2.6), largely due to improvements in treatment and high participation in clinical trials for the most common cancers (e.g., leukemia), especially among children. However, progress lags for some rare cancer types, such as diffuse midline glioma, a type of

brain cancer. Recent reclassification of brain and other central nervous system tumors according to genetic and molecular characteristics has increased biologic understanding and is hoped to facilitate precision treatment and better outcomes.

Risk factors: Cancers that occur during childhood or adolescence have few established risk factors, and most are thought to be due to random cell mutations without an external cause. Exposure to ionizing radiation, such as that from prior radiation therapy, increases the risk of leukemia, brain tumors, and possibly other neoplasms. Prior chemotherapy also increases the risk of leukemia. Solid organ transplant recipients are at increased risk for non-Hodgkin lymphoma, largely due to drugs that suppress the immune system to prevent organ rejection. Infection with Epstein-Barr virus (EBV) is associated with some types of non-Hodgkin lymphoma, such as Burkitt lymphoma. Cancer risk is also increased in children and adolescents with certain genetic syndromes (e.g., Down syndrome, Li-Fraumeni syndrome, and Beckwith-Wiedemann syndrome) or a family history of certain childhood cancers (e.g., hereditary retinoblastoma).

Signs and symptoms: Many early signs and symptoms of childhood and adolescent cancer include nonspecific symptoms shared by common childhood conditions, which can challenge timely diagnosis. Parents or other caregivers should ensure 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; persistent, localized pain or limping; 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):

- Leukemia may cause bone and joint pain, fatigue, weakness, pale skin, bleeding or bruising easily, fever, or infection.
- Brain and other central nervous system tumors may cause headaches, nausea, vomiting, blurred or double vision, seizures, dizziness, and difficulty walking or handling objects.
- Lymphoma often causes lymph nodes to swell, which can appear as a lump in the neck, armpit, or groin; other symptoms can include fatigue, swelling or pain in the abdomen, weight loss, sweating (especially at night), and fever.
- Neuroblastoma, a cancer of immature nerve cells that is most common in children under 5 years of age, often appears as a swelling in the abdomen, sometimes accompanied by loss of appetite. However, neuroblastoma can develop anywhere in the body where groups of nerve cells are found.
- Wilms tumor, also called nephroblastoma, is a kidney cancer that may appear as swelling or a lump in the abdomen, sometimes with blood in the urine.
- Rhabdomyosarcoma is a soft tissue sarcoma that occurs in muscle tissue, most often in the head or neck, genitourinary area, or extremities, and may cause pain and/or a mass or swelling at the tumor site.
- Retinoblastoma, an eye cancer that usually occurs in children under 5 years of age, may cause vision problems and 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, 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, another cancer usually arising in the bone in adolescents, typically appears as pain or swelling at the tumor site.
- Gonadal germ cell tumors occur in the ovaries in girls and can be difficult to detect because symptoms, such as abdominal pain, often do not

Table 6. Probability (%) of Developing Invasive Cancer During Selected Age Intervals by Sex, US, 2017-2019*

Site	Sex	0 to 49	50 to 59	60 to 69	70 and older	Birth to death
All sites†	Male	3.5 (1 in 29)	6.2 (1 in 16)	13.8 (1 in 7)	34.0 (1 in 3)	40.9 (1 in 2)
	Female	5.8 (1 in 17)	6.4 (1 in 16)	10.4 (1 in 10)	27.2 (1 in 4)	39.1 (1 in 3)
Breast	Female	2.1 (1 in 48)	2.4 (1 in 41)	3.5 (1 in 28)	7.0 (1 in 14)	12.9 (1 in 8)
Colon & rectum	Male	0.4 (1 in 241)	0.7 (1 in 138)	1.1 (1 in 90)	3.1 (1 in 33)	4.3 (1 in 23)
	Female	0.4 (1 in 267)	0.5 (1 in 191)	0.8 (1 in 130)	2.8 (1 in 36)	3.9 (1 in 26)
Kidney & renal pelvis	Male	0.3 (1 in 389)	0.4 (1 in 250)	0.7 (1 in 144)	1.4 (1 in 69)	2.3 (1 in 44)
	Female	0.2 (1 in 609)	0.2 (1 in 504)	0.3 (1 in 292)	0.8 (1 in 124)	1.3 (1 in 75)
Leukemia	Male	0.3 (1 in 380)	0.2 (1 in 538)	0.4 (1 in 263)	1.4 (1 in 69)	1.8 (1 in 55)
	Female	0.2 (1 in 495)	0.1 (1 in 820)	0.2 (1 in 425)	0.9 (1 in 111)	1.3 (1 in 78)
Lung & bronchus	Male	0.1 (1 in 848)	0.6 (1 in 178)	1.7 (1 in 59)	5.6 (1 in 18)	6.2 (1 in 16)
	Female	0.1 (1 in 746)	0.5 (1 in 183)	1.4 (1 in 72)	4.7 (1 in 21)	5.8 (1 in 17)
Melanoma of the skin‡	Male	0.4 (1 in 246)	0.5 (1 in 205)	0.9 (1 in 114)	2.6 (1 in 38)	3.5 (1 in 28)
	Female	0.6 (1 in 162)	0.4 (1 in 247)	0.5 (1 in 191)	1.1 (1 in 88)	2.4 (1 in 41)
Non-Hodgkin lymphoma	Male	0.3 (1 in 400)	0.3 (1 in 354)	0.6 (1 in 181)	1.8 (1 in 55)	2.3 (1 in 43)
	Female	0.2 (1 in 535)	0.2 (1 in 473)	0.4 (1 in 250)	1.3 (1 in 74)	1.9 (1 in 53)
Prostate	Male	0.2 (1 in 457)	1.8 (1 in 55)	5.2 (1 in 19)	9.2 (1 in 11)	12.6 (1 in 8)
Thyroid	Male	0.2 (1 in 487)	0.1 (1 in 767)	0.2 (1 in 599)	0.2 (1 in 416)	0.6 (1 in 155)
	Female	0.8 (1 in 125)	0.3 (1 in 290)	0.3 (1 in 318)	0.4 (1 in 276)	1.7 (1 in 59)
Uterine cervix	Female	0.3 (1 in 340)	0.1 (1 in 803)	0.1 (1 in 934)	0.2 (1 in 593)	0.7 (1 in 153)
Uterine corpus	Female	0.3 (1 in 305)	0.6 (1 in 161)	1.0 (1 in 97)	1.5 (1 in 68)	3.1 (1 in 33)

*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 6.8.0. Statistical Research and Applications Branch, National Cancer Institute, 2022. surveillance.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.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

present until the tumor is advanced; in boys, these tumors occur in the testes and are often visible and may cause pain at an early stage.

Treatment: Treatment is based on type and stage of cancer and is typically coordinated by a team of experts, including pediatric oncologists and nurses, social workers, psychologists, and others trained to assist young patients and their families. Outcomes are generally most successful when treatment is managed by specialists at a children's cancer center. Adolescents may be treated in the pediatric or adult oncology setting depending on cancer type and preference, although superior outcomes in the pediatric setting have been reported for some cancers (e.g., acute lymphocytic leukemia). If the child or adolescent is eligible, participation in a clinical trial, which usually compares a new treatment with the best available standard treatment, should be considered.

Survival: Excluding benign and borderline malignant brain tumors, for which 5-year relative survival is >97% in children and adolescents, the 5-year relative survival rate during 2012 to 2018 for all cancers combined classified by the ICCC was 85% among children and 86% among adolescents. However, rates vary considerably depending on cancer type, patient age, and other factors. The overall survival rate among adolescents is heavily influenced by high survival for thyroid cancer (>99%) and Hodgkin lymphoma (98%), masking lower survival than children for several other cancers, including acute lymphocytic leukemia (77% versus 92%) and Ewing sarcoma (64% versus 78%). (See the Cancer Statistics Center for more childhood and adolescent survival rates.) Some treatment-related side effects may persist, or even begin, long after treatment ends, including impaired organ function (e.g., memory or heart problems) and new cancers at the same or different sites. The burden of these and other chronic health conditions among childhood cancer survivors is

nearly double that of the general population by age 50. 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.

For more information on cancer in children and adolescents, see the *Cancer Facts & Figures 2014* Special Section: Cancer in Children & Adolescents and *Cancer Facts & Figures 2020* Special Section: Cancer in Adolescents & Young Adults at cancer.org/statistics, and visit cancer.org to see the Childhood Cancer Research Landscape Report.

Colon and Rectum

New cases and deaths: In 2023, an estimated 106,970 cases of colon cancer and 46,050 cases of rectal cancer will be diagnosed in the US, and a total of 52,550 people will die from these cancers (Table 1). Unfortunately, accurate statistics on deaths from colon versus rectal cancers are not available because many deaths from rectal cancer are misclassified as colon cancer on death certificates. The misclassification is largely attributed to historically widespread use of "colon cancer" to refer to colon and rectal cancer in educational messaging because of cultural reluctance to use the term "rectum."

Incidence trends: Colorectal cancer incidence rates have generally declined since the mid-1980s, with the pace accelerating to 3%-4% annually during the 2000s due to widespread screening uptake among adults ages 50 and older, then slowing to 1% from 2011 to 2019. However, incidence rates have increased by 1%-2% per year in individuals younger than 50 years of age since the mid-1990s for unknown reasons. Colorectal cancer incidence rates and trends typically include appendiceal tumors; however, they are excluded from the incidence data presented herein because they are increasingly understood to be biologically distinct from colorectal cancer and their rates are increasing steeply because of incidental diagnosis (e.g., during appendectomy or imaging), as well as a newly reportable common subtype (carcinoid) that is often indolent (not aggressive).

Mortality trends: Colorectal cancer mortality rates have dropped by 57%, from 29.2 (per 100,000) in 1970 to 12.6 in 2020, mostly due to earlier detection through screening and improvements in treatment; the death rate has declined steadily by about 2% per year from 2012 to 2020. Similar to incidence rates, however, this progress contrasts with rising mortality rates in adults under 55 years of age since the mid-2000s.

Risk factors: More than half (55%) of colorectal cancers in the US are attributable to potentially modifiable risk factors, including excess body weight, physical inactivity, long-term smoking, high consumption of red or processed meat, low calcium intake, heavy alcohol consumption, and very low intake of fruits and vegetables and whole-grain fiber. Hereditary/genetic and medical factors that increase risk include a personal or family history of colorectal cancer or adenomatous polyps, certain inherited genetic syndromes (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 can have serious adverse health effects, primarily gastrointestinal bleeding.

Prevention and early detection: Screening can prevent colorectal cancer through the detection and removal of precancerous growths (polyps), and it can often detect cancer at an early stage, when treatment is usually more successful. Regular adherence to screening with either stool testing (fecal immunochemical tests [FIT], highly sensitive guaiac-based tests [hsFOBT], or a multi-target stool DNA test [mtsDNA]) or structural exams (e.g., colonoscopy, flexible sigmoidoscopy, or computed tomography colonography) reduces the risk of colorectal cancer death. The American Cancer Society and the US Preventive Services Task Force recommend that individuals at average risk for colorectal cancer begin screening at age 45 and continue through age 75, with more individualized decision-making from ages 76 to 85 based on health status, life expectancy, patient preferences, and prior screening history. For more information on colorectal

cancer screening, see the American Cancer Society's screening guidelines on page 81. People at increased risk because of a family history of the disease or for other reasons should talk to their doctor about screening earlier.

Signs and symptoms: The most common signs and symptoms are rectal bleeding, blood in the stool, changes in bowel habits (e.g., constipation or diarrhea) 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 is not noticeable but results in anemia (low red blood cell count) that may be detected on a blood test and/or because of symptoms such as weakness, fatigue, or shortness of breath. 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 patients of all ages. Early-stage colorectal cancer typically does not cause symptoms, which is why screening according to patient risk is so important.

Treatment: Surgery is the most common treatment for colorectal cancer that has not spread to distant sites. 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. When cancer has penetrated the bowel wall deeply or spread to lymph nodes, colon cancer patients typically receive chemotherapy after surgery, whereas rectal cancer patients may receive chemotherapy before and/or after surgery, alone or in combination with radiation. 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 that can be highly effective for a select group of advanced cancers.

Survival: The 5-year relative survival rate for colorectal cancer is 65% overall, but ranges from 91% for localized-stage to 73% for regional-stage and 14% for distant-stage disease (Table 8). Only 1 in 3 new cases is localized at the time of diagnosis.

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

Kidney and Renal Pelvis

New cases and deaths: In 2023, an estimated 81,800 new cases of kidney (renal) cancer will be diagnosed in the US and 14,890 people will die from the disease (Table 1). Most kidney cancers are renal cell carcinomas; other types include cancer of the renal pelvis (5%), which behaves more like bladder cancer, and Wilms tumor (1%), a childhood cancer that usually develops before the age of 5. (See Cancer in Children and Adolescents on page 12.) Men are twice as likely as women to be diagnosed with kidney cancer.

Incidence trends: The long-term increase in kidney cancer incidence, largely for localized-stage diagnoses, is partly attributed to incidental detection of asymptomatic tumors through increased medical imaging. Incidence rates increased from 2010 to 2019 by 1% per year.

Mortality trends: In contrast to incidence trends, kidney cancer mortality rates have been declining since the mid-1990s, with the pace accelerating to about 2% per year from 2013 through 2020.

Risk factors: About half of kidney cancers could potentially be prevented by eliminating strong risk factors like excess body weight and smoking. Risk is also increased by chronic high blood pressure, chronic renal failure, and occupational exposure to certain chemicals, such as trichloroethylene. A small proportion of kidney cancers are the result of rare hereditary conditions (e.g., von Hippel-Lindau disease). Moderate alcohol consumption (up to about 2 drinks per day) is associated with a reduced risk of renal cell carcinoma, although the increased risk of other diseases, including several cancers, far outweighs this benefit.

Signs and symptoms: Signs and symptoms of kidney cancer can include blood in the urine, pain or a lump in the lower back or abdomen, fatigue, weight loss, fever, and anemia.

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 heat or cold to destroy the tumor. Adjuvant treatment (after surgery) with an immunotherapy or targeted therapy drug may be an option for certain patients at high risk for cancer recurrence. For metastatic disease, immunotherapy and targeted drug therapies are 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 77% (Table 8), largely because two-thirds of cases are diagnosed at a local stage.

Leukemia

New cases and deaths: In 2023, an estimated 59,610 new cases of leukemia will be diagnosed in the US and 23,710 people will die from the disease (Table 1). 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 information and statistics are included with leukemia in this report to enable description of trends over time, it is now recognized as a type of non-Hodgkin lymphoma called small lymphocytic lymphoma [SLL] and referred to collectively as CLL/SLL.) The most common types of leukemia among adults (20 years of age and older) are CLL (38%) and AML (31%) and among children and adolescents (ages 0 to 19 years) are ALL (75%) and AML (17%). (See page 12 for information about cancer in children and adolescents.)

Incidence trends: Although trends vary by subtype, the overall leukemia incidence rate has increased in children and adolescents by about 1% per year since at least 1975 for reasons that remain unknown; in adults ages 20 and older, rates were stable from 2013 through 2019 after increasing by 1.5% per year on average since the late 1990s. Trends are strikingly similar by sex.

Mortality trends: In contrast to incidence, the leukemia death rate declined from 2011 to 2020 by about 2% per year in adults (double the pace of the decline during the 2000s) and 3% per year in children and adolescents, again with some variation by subtype.

Risk factors: The risk of most types of leukemia is increased among individuals exposed to high-level ionizing radiation, most commonly from prior cancer treatment. Some types of chemotherapy also increase risk. In addition, 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 increases risk for AML in adults, and there is accumulating evidence that parental smoking before and after childbirth may increase risk of acute leukemia in children.

Signs and symptoms: Symptoms of leukemia, which can appear suddenly for acute subtypes, may include fatigue, paleness, weight loss, repeated infections, fever, bleeding or bruising easily, bone or joint pain, and swelling. Chronic leukemia typically progresses slowly with few symptoms during early stages, but sometimes with signs of abnormal blood cell counts.

Treatment: Chemotherapy, sometimes in combination with targeted drugs, is used to treat most acute leukemias. Several targeted drugs are effective for treating CML because they attack cells with the Philadelphia chromosome, the acquired genetic abnormality that is the hallmark of the disease. Some of these drugs are also used to treat a type of ALL with a similar genetic defect. Patients with CLL that is not progressing or causing symptoms may not require treatment right away but should be closely monitored. More aggressive CLL is typically treated with targeted drugs and/or chemotherapy. Certain types of leukemia may be treated with high-dose chemotherapy followed by stem cell transplantation under appropriate conditions.

Table 7. Trends in 5-year Relative Survival Rates* (%) by Race, US, 1975-2018

	All races			White			Black		
	1975-77	1995-97	2012-18	1975-77	1995-97	2012-18	1975-77	1995-97	2012-18
All sites	49	63	68	50	64	69	39	54	64
Brain & other nervous system	23	32	33	22	31	29	25	39	40
Breast (female)	75	87	91	76	89	92	62	75	83
Colon & rectum	50	61	65	50	62	65	45	54	60
Colon	51	61	63	51	62	64	45	54	58
Rectum	48	62	68	48	62	67	44	55	65
Esophagus	5	13	21	6	14	22	4	9	15
Hodgkin lymphoma	72	84	89	72	85	90	70	82	87
Kidney & renal pelvis	50	62	77	50	62	76	49	62	77
Larynx	66	66	61	67	68	62	58	52	53
Leukemia	34	48	66	35	50	67	33	42	62
Liver & intrahepatic bile duct	3	7	21	3	7	20	2	4	19
Lung & bronchus	12	15	23	12	15	23	11	13	21
Melanoma of the skin	82	91	94	82	91	94	57†	76†	70
Myeloma	25	32	58	24	32	57	29	32	60
Non-Hodgkin lymphoma	47	56	74	47	57	75	49	49	70
Oral cavity & pharynx	53	58	68	54	60	70	36	38	52
Ovary	36	43	50	35	43	49	42	36	41
Pancreas	3	4	12	3	4	11	2	4	11
Prostate	68	97	97	69	97	97	61	94	97
Stomach	15	22	33	14	20	33	16	22	34
Testis	83	96	95	83	96	96	73‡†	86†	92
Thyroid	92	95	98	92	96	99	90	95	97
Urinary bladder	72	80	77	73	81	78	50	63	65
Uterine cervix	69	73	67	70	74	67	65	66	56
Uterine corpus	87	84	81	88	86	84	60	62	64

*Rates are adjusted for normal life expectancy and are based on cases diagnosed in the SEER 9 areas for 1975 to 1977 and 1995 to 1997, and in SEER 17 areas for 2012-2018; all cases were followed through 2019. Rates for White and Black patients diagnosed during 2012-2018 are exclusive of Hispanic ethnicity. †The standard error is between 5 and 10 percentage points. ‡Survival rate is for cases diagnosed from 1978 to 1980.

Sources: 2012-2018 survival – SEER*Explorer, National Cancer Institute, 2022. Available from https://seer.cancer.gov/explorer/. Colon & rectal cancer – SEER*Stat software (version 8.4.0.1), National Cancer Institute, 2022. Historical survival was previously calculated using SEER*Stat version 8.3.9 (2021),

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

Newer treatments that boost the body's immune system, such as CAR T-cell therapy, have shown much promise, even against some hard-to-treat leukemias.

Survival: Five-year relative survival varies substantially by age and leukemia subtype; among adults ages 20 and older the rate is 28% for AML, 43% for ALL, 70% for CML, and 88% for CLL, whereas among youth ages 0 to 19 years it is 69% for AML and 90% for ALL. Age-related differences in part reflect a large variation in cancer biology in children versus adults. Treatment advances such as the development of targeted drugs have resulted in large survival improvements for most types of leukemia; for example, the current 5-year relative survival rate for CML is four-fold higher than it was in the mid-1970s (22%).

Liver

New cases and deaths: In 2023, an estimated 41,210 new cases of liver cancer will be diagnosed in the US and 29,380 people will die from the disease (Table 1). The most common types of liver cancer are hepatocellular carcinoma (HCC; 72%) and intrahepatic bile duct cancer (cholangiocarcinoma; 19%). Liver cancer incidence is about 3 times higher in men than in women.

Incidence trends: Liver cancer incidence rates tripled over the past four decades, but since 2014-2015 the increase has slowed in women and rates have stabilized in men.

Mortality trends: Liver cancer is often fatal, so mortality patterns parallel incidence; the steep increase in death

rates in recent decades has stabilized over the past five data years (2016-2020) in both men and women.

Risk factors: At least 70% of liver cancers in the US could potentially be prevented through the elimination of risk factors, such as excess body weight, hepatitis C virus (HCV) and/or hepatitis B virus (HBV) infection, smoking, heavy alcohol consumption (three or more drinks per day), and type 2 diabetes. Risk is also increased by eating food contaminated with aflatoxin (poison from a fungus that can grow on improperly stored foods, such as nuts and grains). Reduced risk is probably associated with caffeinated coffee consumption and may be associated with low-dose aspirin usage.

Prevention: A vaccine that protects against HBV infection has been available since 1982. There is no vaccine available to prevent HCV infection, although newer antiviral therapies can often clear established infections and reduce cancer risk. The Centers for Disease Control and Prevention (CDC) and the US Preventive Services Task Force recommend one-time HCV testing of adults 18 years of age and older; testing of all women during every pregnancy; and regular testing of people at high risk, such as those who have ever injected drugs. 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 people who inject drugs; and safer sex. Visit the CDC website at cdc.gov/hepatitis for more information on viral hepatitis.

Early detection: Although there is no recommended screening test for liver cancer, many health care providers in the US test individuals at high risk (e.g., those with cirrhosis) with ultrasound and/or blood tests.

Signs and symptoms: Symptoms, which do not usually appear until the cancer is advanced, can include abdominal pain and/or swelling, weight loss, nausea, loss of appetite, jaundice (a yellowish discoloration of the skin and white areas of the 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 (although few patients have enough healthy liver for this option) or liver transplantation. Other local treatments include tumor ablation (destruction), embolization (blocking blood flow), or radiation therapy. Some patients diagnosed at an advanced stage may be offered targeted drug therapies or immunotherapy.

Survival: The 5-year relative survival rate for liver cancer is 21%, up from 3% four decades ago (Table 7). Even for the 43% of patients diagnosed with localized-stage disease, 5-year survival is only 36% (Table 8).

Lung and Bronchus

Please see the Special Section on page 31 for information about lung cancer.

Lymphoma

New cases and deaths: In 2023, an estimated 89,380 new cases of lymphoma will be diagnosed in the US and 21,080 people will die from the disease (Table 1). This cancer begins in immune system cells and can occur almost anywhere in the body. Lymphomas are broadly grouped as Hodgkin lymphoma (8,830 cases and 900 deaths in 2023) or non-Hodgkin lymphoma (NHL, 80,550 cases and 20,180 deaths) and are further classified based on cell composition and characteristics such as cell-surface markers and anatomic site. (Although chronic lymphocytic leukemia [CLL], which occurs in the blood and bone marrow, is now understood to be the same disease as small lymphocytic lymphoma, a type of NHL that occurs in the lymph nodes, statistics for NHL herein exclude CLL for the purpose of describing historical trends.)

Incidence trends: Incidence rates have declined by about 1% per year for Hodgkin lymphoma since the mid-2000s and for NHL since 2015.

Mortality trends: The death rate has been declining since at least 1975 for Hodgkin lymphoma and since 1997 for NHL due to reductions in incidence, advances in treatment, and improved survival for human

immunodeficiency virus (HIV)-associated lymphoma. From 2011 to 2020, the death rate decreased by 4% per year for Hodgkin lymphoma and 2% per year for NHL.

Risk factors: Typical of most cancers, the overall risk of NHL increases with age. In contrast, Hodgkin lymphoma incidence peaks first during adolescence/early adulthood and then again in later life. Most known risk factors for lymphoma are associated with severely altered immune function. For example, risk is elevated in people who receive immune suppressants to prevent organ transplant rejection and those who have certain autoimmune disorders (e.g., Sjögren syndrome, systemic 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 the immune system (e.g., HIV) or continuously activating it (e.g., *Helicobacter pylori* and hepatitis C virus). Excess body weight and certain environmental exposures may also increase risk for some lymphoma subtypes.

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

Treatment: NHL patients are usually treated with chemotherapy, although targeted drugs, immunotherapy, and/or radiation might also be part of treatment for some stages and subtypes. If NHL persists or recurs after standard treatment, stem cell transplantation may be an option. Newer therapies that help the body's immune system recognize and attack lymphoma cells (e.g., CAR T-cell therapy) have shown promising results for some hard-to-treat or recurrent 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 other immunotherapies.

Survival: Survival varies widely by lymphoma subtype, stage of disease, and age at diagnosis; overall 5-year relative survival is 89% for Hodgkin lymphoma and 74% for NHL (Table 7).

Oral Cavity and Pharynx

New cases and deaths: In 2023, an estimated 54,540 new cases of cancer of the oral cavity (mouth) and pharynx (throat) will be diagnosed in the US and 11,580 people will die from the disease (Table 1). Incidence rates are more than twice as high in men as in women. The distribution of oral cavity cancers has changed over time, with the proportion of cases occurring on the tongue or tonsils doubling from 1 in 4 during the late 1970s to 1 in 2 during 2015-2019.

Incidence trends: Incidence rates continued to increase by less than 1% per year in women but stabilized in men during 2015 to 2019 overall; however, cancers occurring in the oropharynx (the part of the throat behind the oral cavity that includes the back one-third of the tongue, soft palate, and tonsils) associated with human papillomavirus (HPV) infection continued a steady increase of 1.3% and 2.8% annually in women and men, respectively, during that time period.

Mortality trends: Mirroring incidence, the mortality rate for cancers of the oral cavity and pharynx has increased by 0.4% per year from 2009 through 2020 after decades of decline, mainly because of an increase in oropharyngeal cancer mortality of almost 2% per year during that time period.

Risk factors: Known risk factors include any form of tobacco use and alcohol consumption, with 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: In 2020, the FDA added oral cancer prevention as an indication for the HPV vaccine,

Table 8. Five-year Relative Survival Rates* (%) by Stage at Diagnosis, US, 2012-2018

	All stages	Local	Regional	Distant		All stages	Local	Regional	Distant
Breast (female)	91	99	86	30	Non-Hodgkin lymphoma	74	86	77	67
Colon & rectum†	65	91	73	14	Oral cavity & pharynx	68	86	69	40
Colon	63	91	72	13	Ovary	50	93	74	31
Rectum	68	90	74	17	Pancreas	12	44	15	3
Esophagus	21	47	26	6	Prostate	97	>99	>99	32
Kidney & renal pelvis	77	93	72	15	Stomach	33	72	33	6
Larynx	61	78	46	34	Thyroid	98	>99	98	53
Liver‡	21	36	13	3	Urinary bladder§	77	70	39	8
Lung & bronchus	23	61	34	7	Uterine cervix	67	92	59	17
Melanoma of the skin	94	>99	71	32	Uterine corpus	81	95	70	18

*Rates are adjusted for normal life expectancy and are based on cases diagnosed in the SEER 17 areas from 2012-2018, all followed through 2019. Rates by stage reflect Combined Summary Stage (2004+). †Excludes appendix. ‡Includes intrahepatic bile duct. §Rate for in situ cases is 96%.

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

Source: SEER*Explorer, National Cancer Institute, 2022. Available from https://seer.cancer.gov/explorer/. Colon & rectal cancer – SEER*Stat software (version 8.4.0.1), National Cancer Institute, 2022.

©2023 American Cancer Society, Inc., Surveillance and Health Equity Science

originally introduced for cervical cancer prevention. Unfortunately, immunization rates are much lower than for other vaccines, with only 62% of adolescents ages 13 to 17 years (60% of boys and 64% of girls) up to date with HPV vaccination in 2021.

Signs and symptoms: Symptoms may include a sore 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: Treatment is based largely on the stage of oropharyngeal cancer and whether it is caused by an HPV infection and/or p16-positive, but other factors can also be important. Surgery and/or radiation therapy are standard treatments; chemotherapy is often added for high-risk or advanced disease. Chemotherapy or targeted drug therapy may be combined with radiation as initial treatment in some cases. Immunotherapy with or without chemotherapy is a newer option for advanced or recurrent cancer.

Survival: The 5-year relative survival rate for cancers of the oral cavity and pharynx is 68% overall (Table 8) but is much lower in Black people (52%) than in White people (70%; Table 7). Although this may partly reflect the higher proportion in Whites of HPV-associated cancers, which generally have better outcomes, the survival disparity persists regardless of tumor HPV status.

Ovary

New cases and deaths: In 2023, an estimated 19,710 new cases of ovarian cancer will be diagnosed in the US and 13,270 women will die from the disease (Table 1). About 90% of cases are epithelial ovarian cancer, the majority of which are high-grade serous tumors, which have the fewest established risk factors and worst prognosis.

Incidence trends: The ovarian cancer incidence rate declined by 1% to 2% per year from 1990 to the mid-2010s and by almost 3% per year from 2015 to 2019. This trend is likely due at least in part to increased oral contraceptive use in the latter half of the past century and decreased menopausal hormone therapy use during the 2000s, both of which can lower risk.

Mortality trends: Similar to incidence, the pace of the decline in ovarian cancer mortality has accelerated from 2% annually during the 2000s and early 2010s to more than 3% annually from 2016 to 2020, reflecting both decreased incidence and improved treatment.

Risk factors: The most important risk factor other than age is a strong family history of breast or ovarian cancer, some of which is related to certain inherited mutations (e.g., *BRCA1* or *BRCA2* or those related to Lynch syndrome). Other medical conditions and characteristics associated with increased risk include a personal history of breast cancer, endometriosis, or pelvic inflammatory disease, and tall adult height. Modifiable factors associated with increased risk include use of menopausal hormone therapy (estrogen alone or combined with progesterone), previously referred to as hormone replacement therapy or HRT, and excess body weight. Cigarette smoking is associated with a rare subtype (mucinous). Factors associated with lower risk include pregnancy/higher number of children, later age at menarche, earlier age at menopause, fallopian tube ligation or removal (salpingectomy), and use of hormonal contraceptives. Accumulating evidence suggests that risk is also reduced with frequent aspirin use, although this can have serious adverse health effects, so aspirin use for cancer prevention should only occur in consultation with a health care provider. The weight of the evidence does not support an association between ovarian cancer and genital exposure to talc-based powder.

Prevention: Some women at high risk because of a strong family history or inherited genetic mutations may consider preventive surgery (prophylactic bilateral salpingo-oophorectomy) to remove both ovaries and fallopian tubes, which greatly reduces the risk of ovarian cancer. Women at average risk who are having pelvic surgery for other reasons (e.g., hysterectomy) may choose to reduce ovarian cancer risk by having their fallopian tubes removed (opportunistic salpingectomy).

Early detection: Currently, there are no recommended screening tests for ovarian cancer. Women who are at high risk because of inherited genetic mutations may be offered a thorough pelvic exam in combination with transvaginal ultrasound and a blood test for the CA125 tumor marker; however, this strategy has not been proven to reduce ovarian cancer mortality and is associated with serious harms, including surgery in many cases when no cancer is present (false-positive). The US Preventive Services Task Force recommends against screening asymptomatic women for ovarian cancer.

Signs and symptoms: Early ovarian cancer usually causes no obvious symptoms. However, 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 caused by fluid accumulation (ascites) when the disease is advanced, when most women are diagnosed.

Treatment: Treatment includes surgery and often chemotherapy and targeted therapy. Surgery 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 abdomen), 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. The goals of surgery are to remove as much of the tumor as possible, referred to as debulking, and accurately stage the cancer. Some women with advanced disease are candidates for chemotherapy administered directly into the abdomen (intraperitoneal). Targeted drugs can sometimes be used after other treatments to slow growth of advanced cancers or as maintenance treatment to keep the cancer from recurring after chemotherapy.

Survival: The 5-year relative survival rate for ovarian cancer is 50% overall, but ranges from 41% among Black women to 58% among Asian American/Pacific Islander women. For the 1 in 5 women who are diagnosed with localized disease, the 5-year survival rate is 93% (Table 8), spurring continued efforts to develop an effective early-detection test.

Pancreas

New cases and deaths: In 2023, an estimated 64,050 new cases of pancreatic cancer will be diagnosed in the US and 50,550 people will die from the disease (Table 1). More than 90% of cases develop in the exocrine tissue of the pancreas, which makes enzymes to digest food. The less common endocrine tumors, 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: The incidence rate for pancreatic cancer has increased by about 1% per year since the late 1990s in both men and women.

Mortality trends: The death rate for pancreatic cancer has increased slightly (by 0.2% per year) since the late 1990s in men but remained stable in women.

Risk factors: People who smoke have about twice the risk of pancreatic cancer as never smokers, and the 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. Risk is also increased among people with certain genetic syndromes (e.g., Lynch syndrome) and inherited mutations (e.g., in *BRCA1* or *BRCA2* genes). Heavy alcohol consumption may increase risk.

Early detection: Studies with long-term follow-up suggest that individuals at high risk for pancreatic cancer because of genetic predisposition or a strong family history can benefit from annual surveillance with endoscopic ultrasound and/or magnetic resonance imaging. However, the US Preventive Services Task Force recommends against screening asymptomatic individuals for pancreatic cancer.

Signs and symptoms: Signs and symptoms of pancreatic cancer, which usually do not appear until the disease is advanced, can include weight loss, abdominal discomfort that may radiate to the back, jaundice (yellowing of the skin and whites of the eyes), 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. Fewer than 20% of patients are candidates for surgery because the cancer has usually spread beyond the pancreas at diagnosis. For those who do undergo surgery, adjuvant treatment with chemotherapy (and sometimes radiation) may lower the risk of recurrence and might help people live longer. For advanced disease, chemotherapy, sometimes along with a targeted therapy drug, may be used; a small number of cases are eligible for immunotherapy.

Survival: For all stages combined, the 5-year relative survival rate is 12%. Even for the small percentage (15%) of people diagnosed with localized disease, the 5-year survival rate is only 44% (Table 8).

Prostate

New cases and deaths: In 2023, an estimated 288,300 new cases of prostate cancer will be diagnosed in the US and 34,700 men will die from the disease (Table 1). The incidence of prostate cancer is more than 70% higher in Black men than in White men for reasons that remain unclear.

Incidence trends: Changes in prostate cancer incidence rates largely reflect screening with the prostate-specific antigen (PSA) blood test, which mostly detects localized-stage disease. Overall incidence declined sharply from 2007 to 2014, coinciding with less PSA testing because of changes in screening recommendations from the US Preventive Services Task Force; since 2014, however, the rate has increased by 3% per year overall and by about 5% per year for advanced-stage diagnoses.

Mortality trends: The prostate cancer death rate declined by half from its peak in 1993 (39.3 per 100,000 men) to 2013 (19.3 per 100,000 men) due to earlier detection through PSA testing and advances in treatment. Since then, however, the pace of decline has slowed, likely

reflecting the uptick in advanced-stage diagnoses; from 2016 to 2020, the rate decreased by 0.6% per year, from 19.4 to 18.5 per 100,000 men.

Risk factors: The only well-established risk factors for prostate cancer are increasing age, African ancestry, a family history of the disease, and certain inherited genetic conditions (e.g., Lynch syndrome and *BRCA1* and *BRCA2* mutations). Black men in the US and Caribbean have the highest documented prostate cancer incidence rates in the world. Smoking and excess body weight may increase risk of aggressive and/or fatal disease.

Early detection: No major medical organization presently endorses routine 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. However, because prostate cancer is a leading cause of cancer death in men, many organizations recommend "shared decision-making," 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. 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 (several close relatives diagnosed at an early age and *BRCA* mutation carriers) should have this discussion beginning at age 40. For men who elect to participate in PSA testing, biomarkers and imaging are increasingly used to limit unnecessary prostate biopsies and the detection of indolent disease.

Signs and symptoms: Early-stage prostate cancer usually causes no symptoms. More advanced disease shares symptoms with benign prostate conditions, including weak or interrupted urine flow; difficulty starting or stopping urination; frequent urination, 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: Recent changes in the grading system for prostate cancer have improved tumor characterization and disease management. Careful monitoring of disease (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. The main treatment options for early-stage disease include surgery, external beam radiation, or radioactive seed implants (brachytherapy). Focal therapies, in which only part of the prostate is treated, are being studied as well. Hormone therapy may be used along with surgery or radiation in locally advanced cases. Treatment often impacts a man's quality of life due to temporary or long-term side effects or complications, such as urinary and erectile difficulties. Current research is exploring new biologic markers for prostate cancer that could be used to minimize unnecessary treatment by distinguishing early-stage cancers that are more likely to progress if left untreated from those that are less likely to progress.

Late-stage prostate cancer treatment options include hormonal therapy, chemotherapy, and/or radiation therapy. 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. 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. Targeted drugs (PARP inhibitors) can be used for men with *BRCA* mutations, and other types of drugs can be used to treat prostate cancer that has spread to the bones.

Survival: The 5-year relative survival rate approaches 100% for the vast majority of men diagnosed with localized- (70% of cases) or regional-stage prostate

cancer (13% of cases), but it drops to 32% for those diagnosed with distant-stage disease (Table 8). The 10-year survival rate for all stages combined is 98%.

Skin

New cases and deaths: 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) – is unknown 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. In 2023, an estimated 97,610 new cases of invasive and 89,070 cases of in situ melanoma will be diagnosed in the US, while 7,990 people will die from the disease (Table 1). Incidence rates are higher in women than in men before age 50, but thereafter are increasingly higher in men, largely reflecting age differences in historical occupational and recreational exposure to ultraviolet (UV) radiation, as well as use of indoor tanning among young women. Differences in early-detection practices and use of health care may also contribute.

Incidence trends: Invasive melanoma incidence trends vary by age and sex; rates among individuals younger than age 50 have stabilized in women and declined by about 1% per year in men since the early 2000s, whereas in adults ages 50 and older, rates continue to increase in women by about 1% per year from 2015 to 2019 but have stabilized in men.

Mortality trends: In contrast to incidence, melanoma mortality rates declined rapidly over the past decade (2011 to 2020) because of advances in treatment, by about 5% per year in adults younger than age 50 and 3% per year in those 50 and older.

Risk factors: A major risk factor for all types of skin cancer is light skin color, with melanoma incidence varying by about 4-fold among White individuals (e.g., rates are 3 times lower in those who are Hispanic versus non-Hispanic) and by almost 30-fold between White and Black or Asian/Pacific Islander individuals. Excess exposure to UV radiation from sunlight or use of indoor tanning also increases risk for all skin cancer types, as does a personal history of the disease. Risk of squamous cell carcinoma (SCC) is increased with a history of actinic keratosis (a common precancerous lesion caused by chronic sun exposure) or a weakened immune system, which also increases risk of melanoma. Additional melanoma risk factors include advanced age; a family history of the disease; and the presence of atypical, large, or numerous (more than 50) moles.

Prevention: Most skin cancer cases and deaths are caused by exposure to UV radiation, and thus are potentially preventable. Exposure to intense UV radiation can be minimized by wearing protective clothing (e.g., long sleeves, a wide-brimmed hat, etc.) and sunglasses that block UV rays; avoiding the sun at peak hours; applying broad-spectrum sunscreen that has a sun protection factor (SPF) of at least 30 to unprotected skin as directed; seeking shade; and not sunbathing or tanning indoors. Children and adolescents should be especially protected from excessive sun exposure (and indoor tanning), as severe sunburns early in life may particularly increase risk of melanoma. Communities can help prevent skin cancer through educational interventions in schools and providing shade in communities and at schools, recreational sites, and occupational settings. 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. Additionally, people who have a high incidence of actinic keratosis may reduce risk of SCC with the use of medicated cream.

Early detection: The best way to detect skin cancer early is to be aware of new or changing skin spots or growths, particularly those that look unusual. Any new lesions,

or a progressive change in a lesion's appearance (size, shape, color, new bleeding, etc.), should be evaluated promptly by a clinician. Periodic skin examination, preferably monthly and with the help of a partner for areas that are hard to see, may help identify changes.

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 skin growth; or a sore that does not heal. Changes that progress over a month or more should be evaluated by a clinician. 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 cases of KC are cured by removing the lesion through minor surgery or other techniques (e.g., freezing). Radiation therapy and/or certain topical medications may also be used. For more advanced cancers (which are uncommon), immunotherapy or targeted drugs might be options. For melanoma, the primary growth and surrounding normal tissue are surgically removed, and sometimes a nearby lymph node is biopsied to determine stage; if these nodes contain cancer, more extensive surgery may be needed. Melanomas with deep invasion or that have spread to lymph nodes may be treated with surgery, immunotherapy, targeted drug therapy, and/or radiation therapy. The treatment of advanced melanoma has changed greatly in recent years with the development of several new immunotherapy and targeted drugs that can be very effective. Traditional chemotherapy may be used but is usually much less effective than newer treatments.

Survival: Almost all cases of KC can be cured, especially if 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 overall is 94%, ranging from >99% for cases diagnosed at a localized stage (78% of cases) to 32% for distant-stage disease (5% of cases) (Table 8); distant-stage disease survival has doubled since 2004 (15%) due to major advances in treatment.

Thyroid

New cases and deaths: In 2023, there will be an estimated 43,720 new cases of thyroid cancer diagnosed in the US and 2,120 people will die from the disease (Table 1). The incidence rate is about 3 times higher in women than in men and 70% higher in White people than in Black people, who have the lowest rate.

Incidence trends: Until recently, thyroid cancer was the most rapidly increasing cancer in the US, largely due to increased incidental detection, including some overdiagnosis, of small papillary tumors (the most common subtype) because of increased imaging and more sensitive diagnostic procedures. However, due in part to the adoption of more conservative diagnostic criteria, the incidence rate has declined by about 2% per year since 2014.

Mortality trends: The death rate for thyroid cancer was stable from 2011 to 2020 in both men and women.

Risk factors: Risk factors for thyroid cancer include being female; having a history of goiter (enlarged thyroid), thyroid nodules, or a family history of thyroid cancer; radiation exposure early in life (e.g., during cancer treatment); excess body weight; and certain rare genetic syndromes, such as familial adenomatous polyposis (FAP). People who test positive for a mutation in the RET gene, 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.

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 can 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 when an abnormality is seen on an imaging test done for another reason.

Treatment: Most thyroid cancers are highly curable, but about 3% (medullary and anaplastic thyroid cancers) are more aggressive and likely to spread to other organs. Treatment depends on patient age, tumor size and cell type, and extent of disease. Treatment is usually surgery to partially or totally remove the thyroid gland (thyroidectomy) and sometimes nearby lymph nodes. Radioactive iodine (I-131) treatment may be recommended after complete thyroidectomy for large tumors or when cancer has spread outside the thyroid to destroy any remaining thyroid tissue. Thyroid hormone replacement therapy is given after thyroidectomy to replace hormones normally made by the thyroid gland, and to lower the likelihood of recurrence by preventing the pituitary gland from producing excess thyroid-stimulating hormone. For some types of advanced thyroid cancer, targeted drugs can be used to help shrink or slow tumor growth.

Survival: The 5-year relative survival rate for thyroid cancer overall is 98% (Table 8), largely because two-thirds of cases are diagnosed at a local stage, but also because treatment is usually successful for the more common tumor types; survival is likely to be lower for medullary thyroid cancer and anaplastic cancers. Unlike most other cancers, the probability of localized-stage diagnosis is highest among Black people (76%) followed by White people (68%).

Urinary Bladder

New cases and deaths: In 2023, an estimated 82,290 new cases of bladder cancer will be diagnosed in the US and 16,710 people will die from the disease (Table 1). The incidence rate is 4 times higher in men than in women and 2 times higher in White men than in Black, Hispanic, or Asian/Pacific Islander men.

Incidence trends: Bladder cancer incidence increased slowly from the mid-1970s until the mid-2000s but has since declined by <1% annually from 2004 to 2015 and by almost 2% annually from 2015 to 2019.

Mortality trends: In contrast to incidence, bladder cancer mortality has trended downward since the 1970s, with an accelerated slope in recent years; from 2016 to 2020 the rate declined by more than 2% per year.

Risk factors: Smoking is the most well-established risk factor for bladder cancer, accounting for almost half (Figure 4) of all cases in the US. Risk is also increased among workers in the dye, rubber, leather, and aluminum industries; painters and firefighters; 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 biomarker tests.

Signs and symptoms: Bladder cancer is usually detected 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. Early-stage cancers may be treated by removing the tumor and then administering immunotherapy (BCG, or bacillus Calmette-Guérin) or chemotherapy drugs

directly into the bladder (intravesical therapy). More advanced cancers may require removal of the entire bladder (cystectomy). This might be followed by systemic immunotherapy, especially in people at higher risk for recurrence. Patient outcomes are improved with the use of chemotherapy before cystectomy. Distant-stage cancers are typically treated with chemotherapy, sometimes along with radiation. Systemic immunotherapy and targeted therapy drugs are newer options, mainly when chemotherapy cannot be used or is no longer working. Timely follow-up care after treatment is extremely important for all patients because of the high likelihood of cancer recurrence or a subsequent bladder cancer. An estimated 70% of individuals with metastatic bladder cancer were originally diagnosed with early-stage disease.

Survival: The 5-year relative survival rate for bladder cancer is 77%, largely because half of all cases are diagnosed before the tumor has spread beyond the layer of cells in which it developed (in situ), for which 5-year survival is 96% (Table 8).

Uterine Cervix

New cases and deaths: In 2023, an estimated 13,960 cases of invasive cervical cancer will be diagnosed in the US and about 4,310 women will die from the disease (Table 1).

Incidence trends: Cervical cancer incidence rates decreased by more than half from the mid-1970s to the mid-2000s, largely due to the widespread uptake of screening. Since around 2012 rates have stabilized overall, but dropped off steeply (by 11% per year) among women ages 20-24 years, likely reflecting the first signs of cancer prevention because of HPV vaccination.

Mortality trends: Cervical cancer mortality rates have also dropped by more than half since the mid-1970s because of prevention and early detection through screening; however, despite similar self-reported screening prevalence, the rate is 65% higher in Black women than in White women. Since the early 2000s, the pace of the overall decline has slowed to 0.7% per year.

Risk factors: Almost all cervical cancers are caused by persistent infection with certain types of human papillomavirus (HPV). HPV infections are common in healthy people, but usually resolve before becoming chronic and only rarely cause cancer. Individuals who begin having sex at an early age or have had many sexual partners or have male partners who have had many sexual partners are at increased risk for HPV infection, although infection can occur with 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: HPV vaccination protects against the types of HPV that cause 90% of cervical cancers, as well as several other cancers and diseases. A population-based study recently demonstrated that the vaccine substantially reduces the risk of invasive cervical cancer, especially among women who were immunized before age 17. The American Cancer Society recommends routine vaccination between ages 9 and 12, with catch-up vaccination for all persons through age 26 who are not adequately vaccinated. Unfortunately, the immunization rate remains low in the US; in 2021, 64% of girls and 60% of boys 13 to 17 years of age were up to date with the HPV vaccination series. HPV vaccination cannot protect against established infections or all types of HPV, which is why it is important for all people with a cervix, even those who have been vaccinated, to follow cervical cancer screening guidelines.

Screening can prevent cervical cancer through detection and treatment of precancerous lesions, which are detected far more frequently than invasive cancer. Cancer can usually be prevented if an individual is screened regularly because most cervical precancers develop slowly. Historically, the only screening option was the Pap test, which is a simple procedure in which a small sample of cells is collected from the cervix and examined under a microscope. The newer HPV test also uses a cervical cell sample to detect cervical

cancer and precancer by detecting the infection that precedes cancer occurrence. The HPV test can also identify individuals at risk for a type of cervical cancer called adenocarcinoma, which accounts for about 30% of cases and is more often missed by Pap tests than other subtypes.

Early detection: In addition to preventing cervical cancer, screening can detect invasive cancer early, when treatment is usually less intensive and more successful. Half of those diagnosed with cervical cancer have never been screened. The American Cancer Society recommends cervical cancer screening with a primary HPV test every 5 years for individuals ages 25 through 65 who have a cervix and are at average risk of cervical cancer; only certain HPV tests are approved by the FDA for use as a primary test. If a primary HPV test is unavailable, co-testing (HPV testing in combination with Pap test) every 5 years or screening with a Pap test alone every 3 years is acceptable. Individuals ages 65 and older should continue screening if they have not had regular screening with normal results over the past 10 years or have a history of cervical precancer (cervical intraepithelial neoplasia) or a more serious diagnosis within the past 25 years. For more detailed information on the American Cancer Society's screening guidelines for the early detection of cervical cancer, see page 81.

Signs and symptoms: Preinvasive cervical lesions usually cause 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). Early-stage cervical cancers are generally treated with surgery and/or radiation, sometimes combined with chemotherapy. Minimally invasive surgery (laparoscopy) is not often used because it is associated with worse survival than open surgery. 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 is 67% overall and in White women, but 56% in Black women (Table 7). Survival is also lower for older women: 46% for those 65 years of age and older versus 61% for women ages 50-64 and 77% for women under 50.

Uterine Corpus (Endometrium)

New cases and deaths: In 2023, an estimated 66,200 cases of cancer of the uterine corpus (body of the uterus) will be diagnosed in the US and 13,030 women will die from the disease (Table 1). Cancer of the uterine corpus is often referred to as endometrial cancer because more than 90% of cases occur in the endometrium (inner lining of the uterus).

Incidence trends: Incidence rates for all races combined continue to increase by almost 2% per year in women younger than 50 and by 1% per year in older women.

Mortality trends: Mortality rates for uterine corpus cancer have risen since the mid-1990s, with an increase of 0.7% annually from 2016 to 2020.

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 are potentially preventable. Overall excess body weight and abdominal fatness each substantially increase the risk of uterine cancer, partly by increasing the amount of circulating estrogen, which

is a strong risk factor. Other factors that increase estrogen exposure or contribute to a hormonal imbalance include the use of postmenopausal estrogen alone, late menopause, and a history of polycystic ovary syndrome. Tamoxifen, a drug used to treat/prevent breast cancer, increases risk because of estrogen-like effects on the uterus. Medical conditions that increase risk include Lynch syndrome and type 2 diabetes. Pregnancy and use of hormonal contraceptives and postmenopausal continuous estrogen plus progestin are associated with reduced risk.

Early detection: There are no recommended screening tests for women at average risk; however, most cases (69%) are diagnosed at an early stage because of postmenopausal bleeding. Women are encouraged to report any unexpected bleeding or spotting to a clinician. 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 (e.g., hysterectomy), radiation, hormones, and/or chemotherapy, depending on the stage of disease. Immunotherapy and targeted therapy drugs might be options in certain situations.

Survival: The 5-year relative survival rate for uterine corpus cancer is 84% for White women but only 64% for Black women (Table 7), partly because Black women are much more likely to have advanced (regional- or distant-stage) or unstaged disease (44% versus 29%). Survival is lower for Black women for every stage at diagnosis.

Special Section: Lung Cancer

Introduction

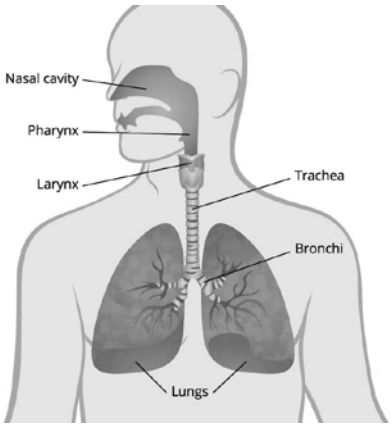
Lung cancer is the second most commonly diagnosed cancer in both men and women but the most common cause of cancer death, leading to more deaths in 2020 than breast, colorectal, and prostate cancers combined. This burden disproportionately affects people with lower socioeconomic status. Although approximately 80% of lung cancers are caused by cigarette smoking,[1] the toll among people who have never smoked is substantial, ranking among the top 10 causes of cancer death when categorized separately.[2]

Lung cancer is usually fatal because most cases are diagnosed at a late stage and treatment has generally been ineffective. However, over the past two decades, advances in the understanding of tumor biology and the development of targeted treatment, coupled with the introduction of screening, have led to exciting improvements in survival. This special section provides an overview of lung cancer occurrence in the US, including information about risk factors, prevention, and early detection, as well as what the American Cancer Society is doing to reduce the burden.

Lung Anatomy

The lungs are a pair of large, spongy, cone-shaped organs in the chest that are part of the respiratory system, which also includes the trachea (windpipe) and the muscles of the chest wall and diaphragm (Figure S1). The lungs are separated from one another by a cavity called the mediastinum, which houses the heart, trachea, esophagus, and many lymph nodes. The right lung is made up of three lobes and is slightly larger than the left lung, which has two lobes. The main function of the lungs is to facilitate respiration by moving air and transferring oxygen into the bloodstream while clearing the body of carbon dioxide and other waste gases. Air enters the lungs through the trachea during inhalation and passes into bronchi (branch-like air passages) that subdivide into tiny bronchioles ending in air sacs called alveoli, where gas transfer occurs. Carbon dioxide and other waste gases are expelled through the trachea during exhalation. The lungs also serve a vital role in the defense of the body by filtering inhaled, potentially harmful particles, such as dust, mold, viruses, and bacteria. However, some inhaled toxins contribute to lung cancer occurrence.

Figure S1. Anatomy of the Respiratory System

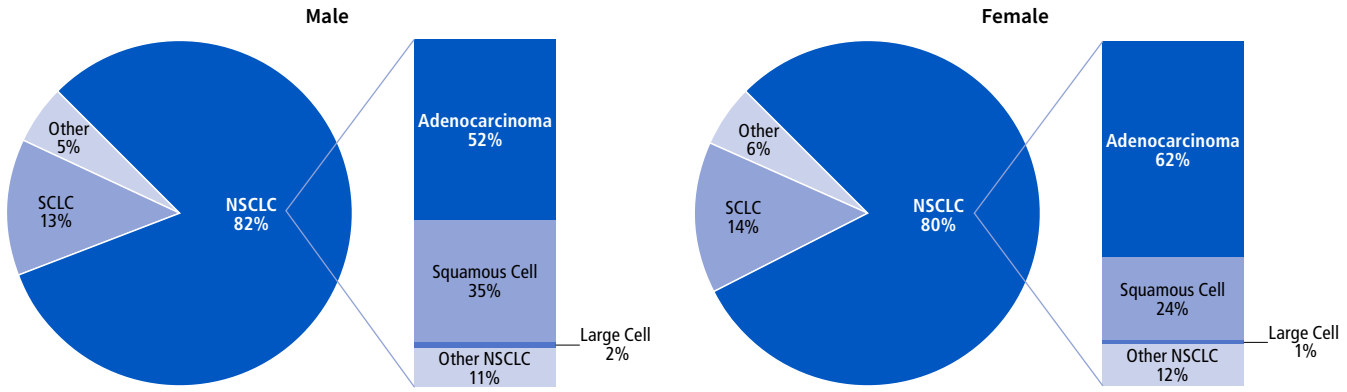


Source: https://www.cdc.gov/cancer/lung/basic_info/what-is-lung-cancer.htm.

What Are the Different Types of Lung Cancer?

Lung cancer encompasses a variety of biologically distinct tumors.[3] The two primary types of lung cancer are non-small cell lung cancer (NSCLC), which accounts for 81% of cases, and small cell lung cancer (SCLC), which accounts for 14% of cases. NSCLC is further categorized as adenocarcinoma, which is slightly more common in women, followed by squamous cell carcinoma and large cell carcinoma (Figure S2).[4] Squamous cell carcinoma was the most common subtype prior to the 1960s and the introduction of filtered cigarettes, which are thought to contribute to increased incidence of adenocarcinoma via deeper inhalation and increased exposure to smoke toxicants.[5] Adenocarcinoma originates in the glands that secrete mucus. It is generally more treatable than other subtypes because it is more likely to be located in the

Figure S2. The Distribution of Lung Cancer by Histologic Subtype (%), US, 2015-2019



SCLC: Small cell lung cancer; NSCLC: Non-small cell lung cancer. Percentages for NSCLC subtypes represent the proportion of total NSCLC cases. Percentages may not total 100% because of rounding.

Source: North American Association of Central Cancer Registries, 2022.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

lung periphery and to have mutations that can be targeted by treatment.[6-8] (For more information, see page 36.) Squamous cell carcinoma is more aggressive than adenocarcinoma and originates in cells that line the lung airways.[9] Large cell carcinoma can originate in any portion of the lung and is more aggressive than the other two NSCLC subtypes.

SCLC is named for the small, round appearance of the cells under a microscope. The most common subtype is small cell carcinoma (oat cell cancer), followed by combined small cell carcinoma. SCLC is slightly more common in women (14%) than in men (13%) and is generally more aggressive than NSCLC. Consequently, SCLC patients are more likely than NSCLC patients to have disease that has spread beyond the lungs at the time of diagnosis (94% versus 70%),[10] making treatment difficult.[11] Even for those patients who successfully undergo chemotherapy, which is the primary treatment, only a limited number achieve long-term disease control.

How Many Lung Cancer Cases and Deaths Are Expected to Occur in 2023?

In 2023, an estimated 238,340 people (117,550 men and 120,790 women) will be diagnosed with lung cancer, and 127,070 people will die from the disease (Table 1).

How Many People Alive Today Have a History of Lung Cancer?

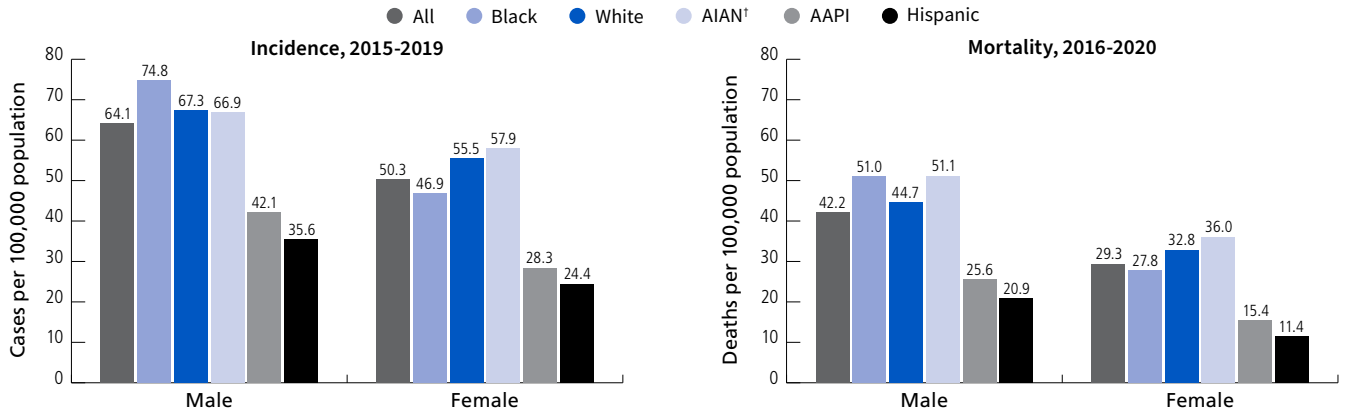
As of January 1, 2022, there were 654,620 men and women in the US with a history of lung cancer,[12] many of whom were living with metastatic disease.[13] About 80% of these individuals were 65 years of age or older, reflecting the advanced median age of diagnosis (71 years).[14] More than half (55%) of lung cancer survivors were diagnosed within the past 5 years because of the low survival.[12] (See page 36.)

What Is the Risk of Developing Lung Cancer?

The lifetime risk of developing lung cancer is approximately 6.2% among men and 5.8% among women, or 1 in 16 men and 1 in 17 women during their lifetime (Table 6). However, these probabilities are based on lung cancer occurrence in the general population so the risk is substantially higher for those with a history of smoking.[15]

The risk of lung cancer also increases with age, partly because the disease grows for many decades before symptoms develop. More than half (53%) of cases are diagnosed at age 70 or older, and 83% of cases are diagnosed at ages 65 and older. However, the age distribution varies by histologic subtype and race and

Figure S3. Lung Cancer Incidence and Mortality Rates* by Sex, Race, and Ethnicity, US



AAPI: Asian American and Pacific Islander individuals; AIAN: American Indian and Alaska Native individuals. *Age adjusted to the 2000 US standard population. †For AIAN individuals, incidence data are restricted to Purchased/Referred Care Delivery Area counties, and mortality data are adjusted for misclassification on death certificates. All racial groups are exclusive of individuals identifying as Hispanic.

Sources: Incidence, North American Association of Central Cancer Registries 2022; Mortality, National Center for Health Statistics 2022.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

ethnicity. For example, NSCLC incidence peaks in ages 80-84 for men but in ages 75-79 for women,[16] likely reflecting sex differences in smoking. (See page 37.) For SCLC, incidence peaks in ages 75-79 among both men and women. Incidence among Black men peaks about 5 years earlier than among White men for both NSCLC and SCLC.

How Does Lung Cancer Risk Vary Between Different Population Groups?

Sex

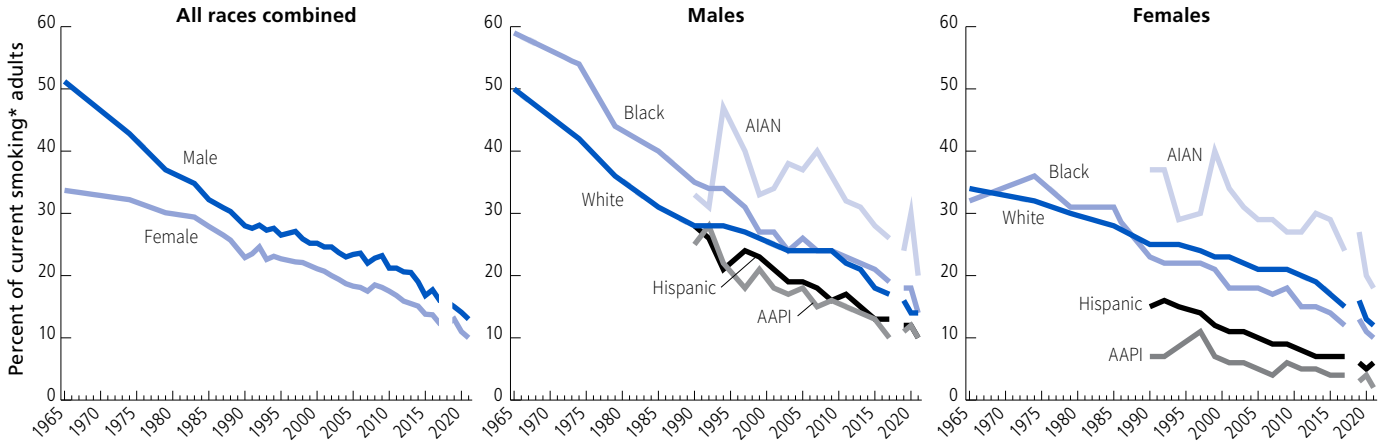
Lung cancer incidence during 2015-2019 was 27% higher among men (64.1 per 100,000) than women (50.3 per 100,000; Figure S3), largely due to historically higher smoking prevalence in men (Figure S4). However, this pattern varies by age and racial and ethnic group. For example, young non-Hispanic White (hereafter White) and Hispanic women have higher lung cancer rates than their male counterparts.[17, 18] Notably, this reversal in risk is not fully explained by smoking patterns. The sex gap for mortality is wider than for incidence, with death rates in men (42.2 per 100,000 during 2016-2020) 44% higher than those in women (29.3 per 100,000). This is due in part to differences in the distribution of subtypes and lower survival in men. (See information on lung cancer survival on page 36.)

Race & Ethnicity

Lung cancer incidence is highest among Black men, whereas mortality is highest among both Black and American Indian and Alaska Native (AIAN) men (Figure S3). AIAN men and women have had the highest smoking prevalence by far since at least the early 1990s, when data first became available (Figure S4). In some regions, including the East, Northern Plains, and Pacific Coast, lung cancer incidence among AIAN women is similar to or higher than among their male counterparts.[19] AIAN women have the highest mortality of any racial or ethnic group, 10% higher than White women, who rank second (Figure S3).

Lung cancer incidence and mortality among Asian American and Pacific Islander (AAPI) and Hispanic individuals is lower than that among other racial and ethnic groups (Figure S3) due to historically lower smoking prevalence (Figure S4). However, data for broadly defined racial and ethnic groups mask large differences within these heterogeneous populations, of which there are many examples.[20] Although lung cancer incidence in AAPI men overall is about 40% lower than in White men, one study found that it is 40% higher among Samoan men.[21] Another study reported that among never-smoking women in California and Hawaii, lung cancer was higher in AAPI women than in White women, and was highest in Chinese American

Figure S4. Trends in Smoking Prevalence by Sex, Race, and Ethnicity, US, 1965-2021



AAPI: Asian American and Pacific Islander individuals; AIAN: American Indian and Alaska Native individuals. *Ever smoked 100 cigarettes in lifetime and now smoke every day or some days. All racial groups are exclusive of individuals identifying as Hispanic beginning in 1990. All estimates are age adjusted. Due to changes in National Health Interview Survey (NHIS) survey design, estimates from 2019 onward are not directly comparable to prior years and are separated from the trend line.

Sources: Adult cigarette smoking prevalence 1965-2018, Health United States: 2019; NHIS 1990-2021.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

women.[22] Similarly, among Hispanic individuals in Florida, lung cancer mortality rates among Cuban men were more than 50% higher than in Puerto Rican men and double those in men of other Hispanic origin groups, although rates were still lower than those in Whites.[23]

Socioeconomic Status

The risk of lung cancer is greater in persons with lower socioeconomic status (SES).[24] For example, lung cancer death rates in individuals ages 25-74 with ≤12 years of education are nearly 5 times higher in men and 4 times higher in women compared to those in persons with ≥16 years of education.[25] This disparity reflects historical differences in smoking prevalence that remain today. In 2021, for example, 21% of individuals without a high school diploma and 31% of individuals with a GED smoked cigarettes compared to 3% of individuals with a graduate degree. (See page 55.) Persons with low SES are also more likely to be diagnosed with advanced-stage disease[26] and lack access to high-quality cancer care.[27, 28]

Place of Residence

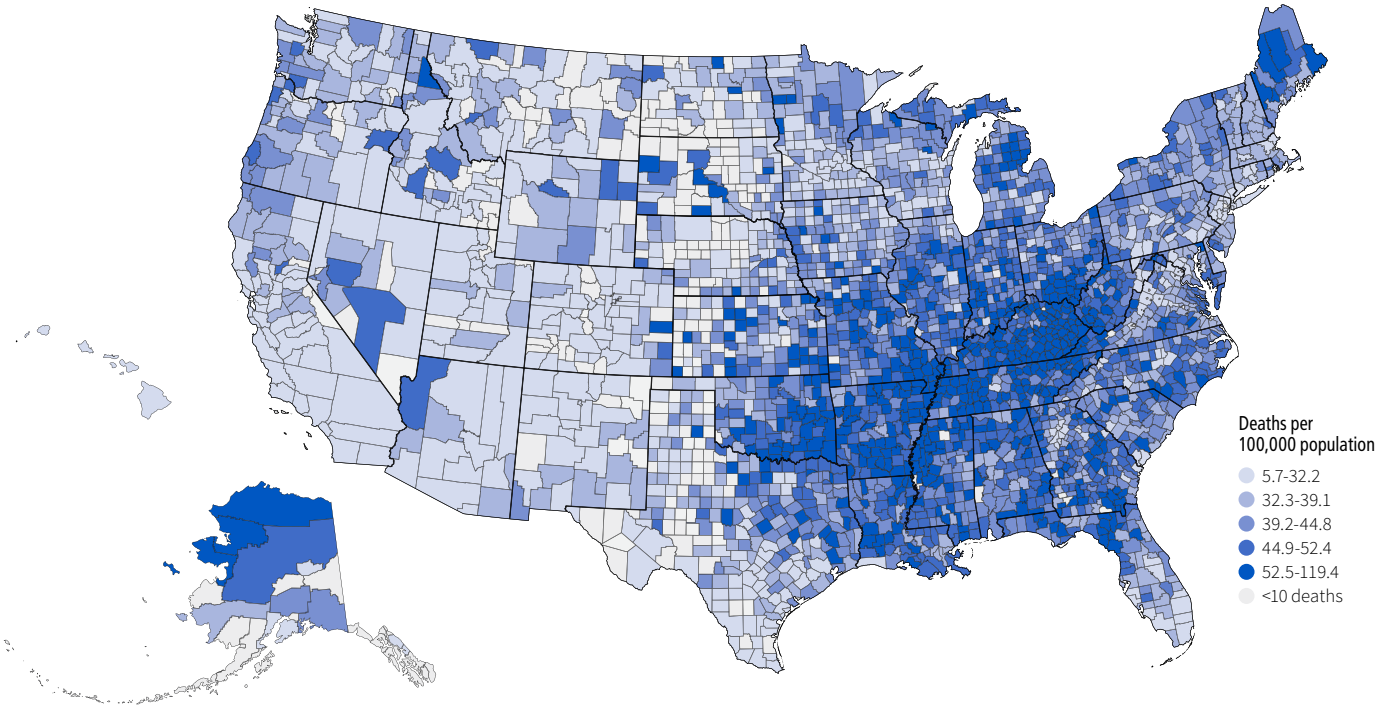
The states with the highest lung cancer mortality rates are Kentucky, West Virginia, Mississippi, and Arkansas (Table 5), all of which have the highest historical and current smoking prevalence.[29] However, there are also pockets of high lung cancer mortality in other states, including in the South and Appalachia (Figure S5). Among AIAN individuals, incidence for those living in the Northern Plains is nearly 5 times higher than for those living in the Southwest, where rates are 64% lower than White individuals living in the region.[19]

How Has Lung Cancer Occurrence Changed Over Time?

Lung cancer incidence and mortality trends closely mirror the tobacco epidemic with a lag of several decades.[30] As a result, lung cancer patterns differ by sex because women started smoking in large numbers later than men and were also much slower to begin quitting.[15] Lung cancer mortality rates rose from 3 to 4 per 100,000 in 1930, peaked at 91 per 100,000 men in 1990 and 42 per 100,000 women in 2002 before declining by 58% (38 per 100,000) and 36% (27 per 100,000), respectively, through 2020 (Figure S6). Reductions in mortality began several decades after the release of the first US Surgeon General's Report on Smoking and Health in 1964, which motivated people to quit smoking.[31]

Continued reductions in smoking are reflected in steady declines in lung cancer incidence of 2.6% per

Figure S5. Lung Cancer Mortality Rates* by County, 2016-2020



*Age adjusted to the 2000 US standard population.
Source: National Center for Health Statistics, 2022.

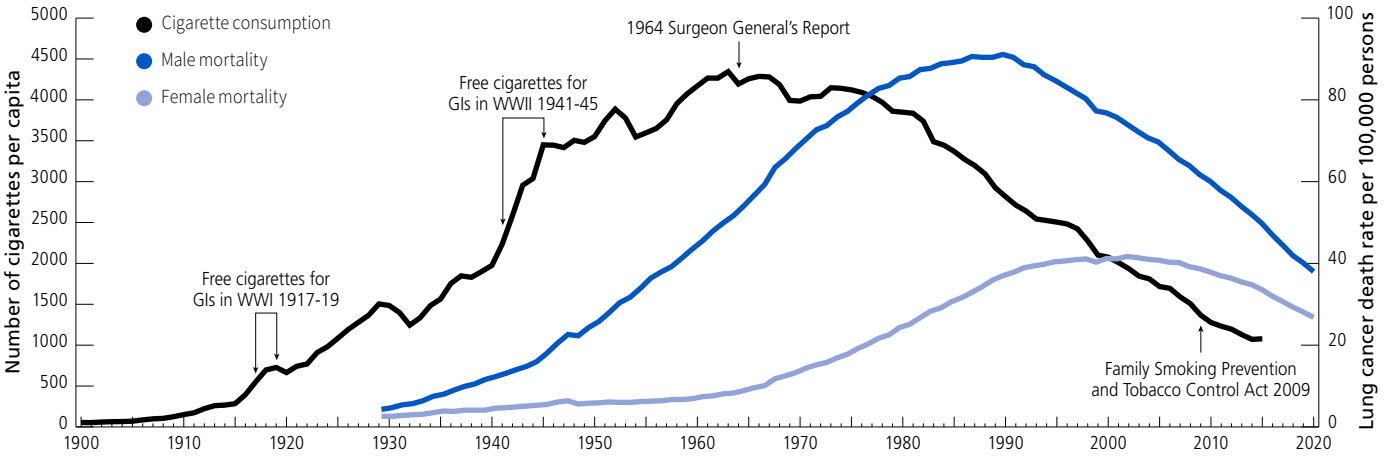
year in men and 1.1% per year in women since around 2006. However, an increase in the incidence of localized-stage disease of 4.5% per year from 2014 through 2018[32] suggests that people are being diagnosed earlier. This is probably at least in part due to the uptake of screening, which was first recommended for people at high risk of lung cancer in 2013,[33] as well as increased access to care through the Affordable Care Act. At the same time, the decline in mortality has accelerated from 3% per year in men and 2% per year in women during 2005 to 2014 to 5% and 4% per year, respectively, during 2014 to 2020.[2] This progress outpaces declines in incidence and likely reflects recent advances in treatment,[34, 35] as well as earlier detection.[36]

Differences by Race and Ethnicity

Among men, lung cancer mortality rates have been declining since at least 1990 in each racial and ethnic group, with the steepest drop among Black men (Figure S7). The more favorable trend in Black men likely reflects rapid historic declines in cigarette smoking prevalence (Figure S4) driven by steeper reductions in adolescent cigarette smoking initiation compared to other racial and ethnic groups.[37-41] As a result, the disparity in lung cancer mortality among Black versus White men dropped from 40% higher in the early 1990s to 14% higher during 2016-2020 (Figure S3).

Among women, lung cancer mortality rates continued to increase until the early or late 2000s in all racial and ethnic groups, with the steepest rise in AIAN women (Figure S7). Consequently, lung cancer mortality in AIAN women surpassed that in Black and White women circa 2000, reflecting their high smoking prevalence (Figure S4). Since the early to late 2000s, mortality has declined among women in all racial and ethnic groups, with the fastest pace among Black women. As a result, the lung cancer mortality rate in Black women was 4% lower than White women in 1990 but 17% lower in 2020. Like Black men, the more favorable lung cancer mortality trend in Black women reflects steeper declines in smoking prevalence.[37-41]

Figure S6. Trends in Tobacco Consumption and Lung Cancer Mortality Rates* by Sex, 1900-2020



*Age adjusted to the 2000 US standard population. Rates exclude deaths in Puerto Rico and other US territories. Note: Due to changes in ICD coding, numerator information for mortality rates has changed over time.

Source: Death rates: US Mortality Data, 1960-2020, US Mortality Volumes, 1930-1959, National Center for Health Statistics. Cigarette consumption: 1900-1999: US Department of Agriculture. 2000-2015: Consumption of Cigarettes and Combustible Tobacco – United States, 2000-2015. *MMWR Weekly Rep* 2016; 65(48);1357-1363.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

Mortality rates among Hispanic individuals have consistently been lower than any other racial and ethnic group (Figure S7), largely due to their low smoking prevalence (Figure S4) and intensity of smoking. Hispanic smokers are more likely to be light (≤10 cigarettes/day) or intermittent smokers than any other racial or ethnic group.[42, 43]

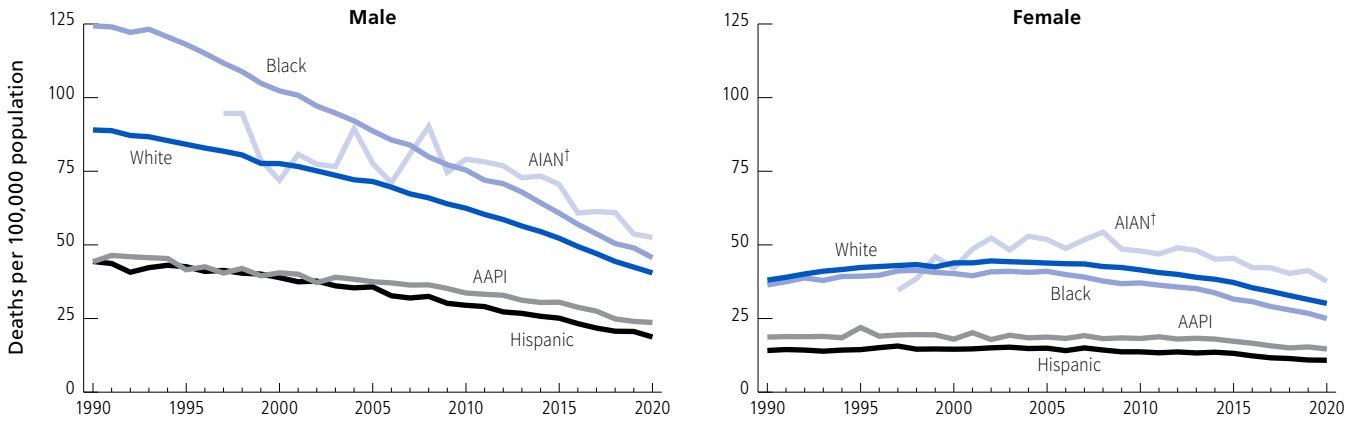
Lung Cancer Survival

After decades of little improvement, recent advancements in treatment have led to longer survival for lung cancer patients.[8, 35] Progress is mostly confined to NSCLC and is more evident in 2-year versus 5-year relative survival rates. For example, among women, 2-year relative survival for NSCLC increased slightly from 32% in 1975-1976 to 36% in 1997-1998, then rose to 54% in 2017-2018 (Figure S8). Increases were similar in men, from 25% to 28% to 43%, respectively. Advances in treatment that have likely contributed to this progress include molecular therapies targeting important mutations, such as in the epidermal growth factor receptor *(EGFR)* and anaplastic lymphoma kinase *(ALK)* genes;[44] immune checkpoint inhibitors, which boost patient immune response;[45, 46] improvements in staging;[47] and video-assisted surgery.[34] In contrast, 2-year relative survival for SCLC has increased little in absolute terms but doubled in relative terms, from 10% and 8% among women and men, respectively in 1975-1976, to 15% and 13% in 1997-1998 and 19% and 16% in 2017-2018 (Figure S8).

Lung cancer survival rates are higher among women than men (Figure S9), partly reflecting earlier-stage diagnosis and differences in subtype distribution. For example, 28% of women are diagnosed at a localized stage compared to 23% of men (Figure S10). However, 5-year survival rates are higher among women at every stage of diagnosis, albeit mostly confined to NSCLC (Figure S11). Reasons for higher survival in women are unclear but may reflect differences in tumor characteristics and hormones that influence treatment response.[48, 49] Female lung cancer patients are also more likely to have tumors with genetic mutations, such as in the *EGFR* gene, that are amenable to targeted therapies.[50]

Survival rates also vary by race and ethnicity, ranging from 26% among AAPI individuals to 19% among AIAN individuals (Figure S9), in part because of higher frequency of *EGFR* mutations among AAPI individuals diagnosed with lung cancer.[50] However, White individuals are most likely to be diagnosed with localized-stage disease among both men and women (Figure S10). Lower survival in some groups likely reflects less access to early detection, curative-intent surgery, and new therapies.[51-53] Survival

Figure S7. Trends in Lung Cancer Mortality Rates* by Sex, Race, and Ethnicity, US, 1990-2020



AAPI: Asian American and Pacific Islander individuals; AIAN: American Indian and Alaska Native individuals. *Age adjusted to the 2000 US standard population. †Data for AIAN individuals begin with 1997 to include Oklahoma and are adjusted for racial misclassification on death certificates. All racial groups are exclusive of individuals identifying as Hispanic.

Source: National Center for Health Statistics, 2022.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

data for AAPI, Hispanic, and AIAN people should be interpreted with caution due to potential loss to follow-up and racial misclassification.[54]

What Are the Risk Factors for Lung Cancer?

The primary risk factor for lung cancer is cigarette smoking, which accounts for about 80% of lung cancer cases and deaths (Figure 4).[1] Cigarette smoking increases the risk of lung cancer 25-fold in both men and women compared to people who never smoked.[15] Other exposures that increase risk include secondhand smoke, radon, asbestos and some other occupational exposures, air pollution, and arsenic in drinking water. Low fruit and vegetable intake may increase risk although evidence is still accumulating.[55]

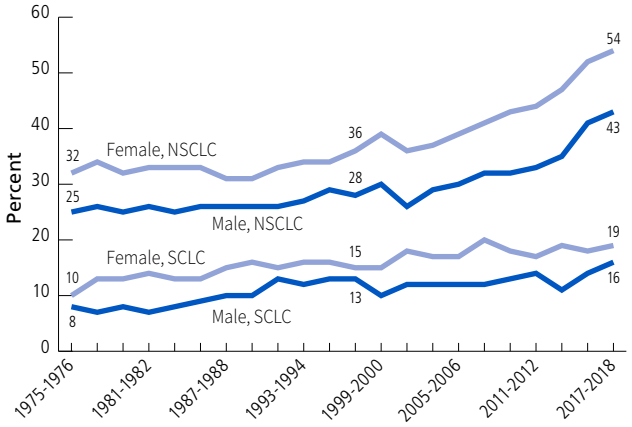
Tobacco Use

Cigarette Smoking

Cigarette smoking began to increase in the early 20th century among men, and after World War II among women,[56-58] peaking in the mid-1960s with adult smoking prevalence in 1965 at 51% among men and 34% among women (Figure S4, and Figure S6). While consumption cannot be differentiated by sex before 1965, studies suggest that the decline among men began in the mid-1950s, with increases in consumption among women outweighing the decline among men until the 1960s.[30] The pace of the decline in smoking prevalence has been steeper in men than in women because of differences in cessation and transient upticks in female smoking.[17] In 2021, adult cigarette smoking was 13% in men and 10% in women,[43] a 75% and 70% relative reduction, respectively, since 1965 because of increased awareness about the health hazards of cigarette smoking, increased excise taxes on cigarette products, prohibiting smoking in public places, and counteradvertising among other tobacco control policies. (See Tobacco Control Policies section, page 40.)

Historically, smoking prevalence was much higher among Black men than White men, but the gap has narrowed since around 1990 and been eliminated as of 2021 (Figure S4). In contrast, smoking prevalence among Black women was similar to White women prior to 1990 but has since been several percentage points lower. According to data from the National Health Interview Survey, current adult cigarette smoking prevalence in 2021 was 14% in both Black and White men, but 10% and 12% in Black and White women, respectively. The favorable trends in Black individuals are largely due to the sharp decline in smoking initiation among Black adolescents beginning in the late 1970s.[37] Additionally,

Figure S8. Trends in 2-year Relative Survival Rates for Lung Cancer by Sex and Subtype, US, 1975-2018



NSCLC: Non-small cell lung cancer; SCLC: Small cell lung cancer. Survival is based on patients diagnosed during 1975 through 2018, followed through 2019.

Source: Surveillance, Epidemiology, and End Results 8 Registries, 2022.

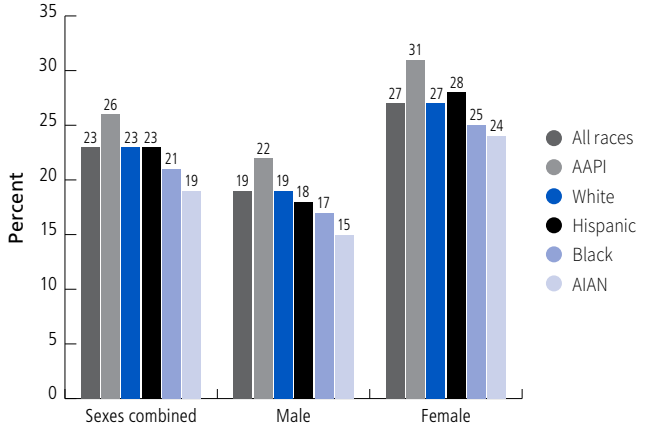
©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

compared to White people, Black people are more likely to smoke lightly or intermittently.[42] A majority (80%) of Black people who smoke consume menthol cigarettes compared to 34% of White people who smoke.[59] While it has been hypothesized that menthol cigarette smoking may contribute to elevated lung cancer burden among Black men, research findings have not generally supported this hypothesis.[60-62] Research does suggest that Black people are more susceptible to smoking-related lung cancer compared to White people.[63]

AIAN individuals have the highest smoking prevalence of any racial or ethnic group, with 25% of AIAN adults currently smoking cigarettes in 2020.[29] Unlike most racial and ethnic groups, smoking prevalence among AIAN women has been similar to men since the early 1990s, when data first became available (Figure S3). However, smoking varies by region, with the highest reported prevalence in the Northern Plains (42% in both men and women) and the lowest in the Southwest (19% in men and 15% in women).[64] Higher prevalence of smoking is largely due to historical and ongoing structural racism that has contributed to lower education and income levels[65] and inadequate access to quality health care,[66, 67] as well as targeted deceptive tobacco product advertising.[68-70] There is also a lack of tailored smoking-cessation programs[71] that recognize the cultural importance of traditional tobacco use in some regions.[72] As a result, AIAN individuals have fewer quit attempts and slower cessation compared to other racial and ethnic groups.[29]

Cigarette smoking varies considerably by country of origin and nativity. For example, among the Hispanic population, smoking prevalence is higher among US-born versus foreign-born women and among Puerto Rican individuals (17% in men and 16% in women in 2017-2019) than Cuban individuals (7% and 12%, respectively), though Cuban individuals are more likely to smoke heavily.[73] Similarly, cigarette smoking prevalence among AAPI individuals is higher among Filipino (12%) individuals than Chinese (7%) or Asian Indian (6%) individuals.[21] Smoking prevalence among Native Hawaiian individuals is higher than any other AAPI group, similar to that among AIAN individuals, with 19.6% of Native Hawaiians living in Hawaii reporting current cigarette smoking during 2018 to 2020.[74] Native Hawaiian individuals, along with Black individuals, have a higher smoking-related risk of lung cancer compared to White, Japanese American, or Hispanic individuals.[59]

Figure S9. 5-year Relative Survival Rates for Lung Cancer by Sex, Race, and Ethnicity, US, 2012-2018

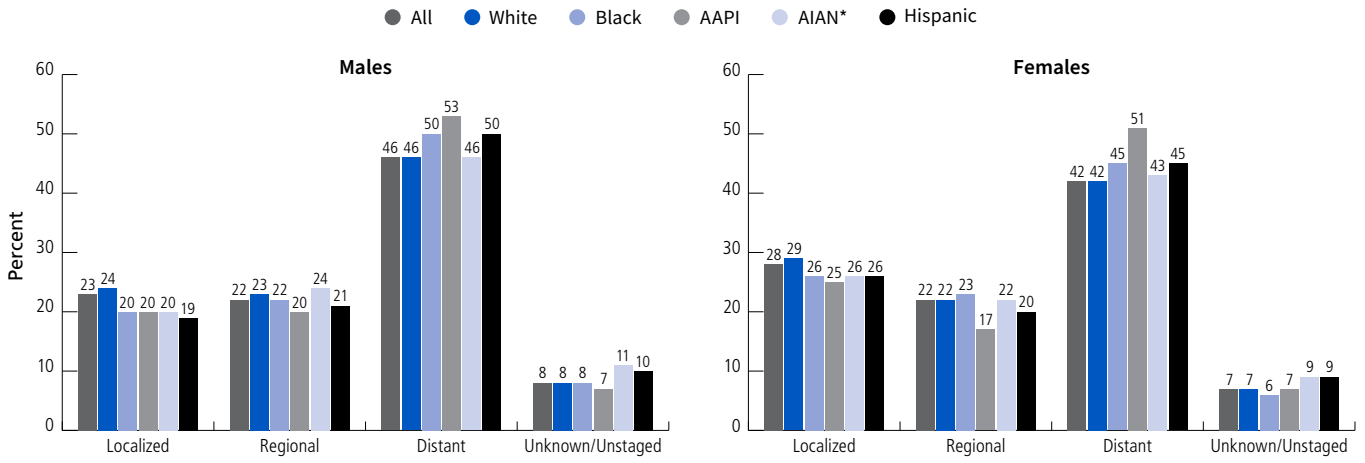


AAPI: Asian American and Pacific Islander individuals; AIAN: American Indian and Alaska Native individuals. Survival rates are for patients diagnosed during 2012-2018, all followed through 2019. All racial groups exclude individuals identifying as Hispanic.

Source: Surveillance, Epidemiology, and End Results 17 Registries, 2022.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

Figure S10. Stage at Diagnosis by Sex, Race, and Ethnicity, US, 2015-2019



AAPI: Asian American and Pacific Islander individuals; AIAN: American Indian and Alaska Native individuals. *Data for AIAN individuals are restricted to Purchased/Referred Care Delivery Area counties. All racial groups are exclusive of individuals identifying as Hispanic.

Source: North American Association of Central Cancer Registries, 2022.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

Other Combustible Tobacco Products

Other forms of combustible tobacco products associated with an increased risk of lung cancer include cigars, pipes, and waterpipes. Current cigar users are more than three times as likely to die from lung cancer compared to individuals who have never smoked any combustible tobacco product.[75] Compared to White people, Black people are more than twice as likely to smoke cigars.[76] In contrast to patterns of cigarette use, waterpipe use is more prevalent among younger individuals and individuals with higher educational attainment.[77] For more information about other combustible tobacco products, see page 55.

Secondhand Smoke

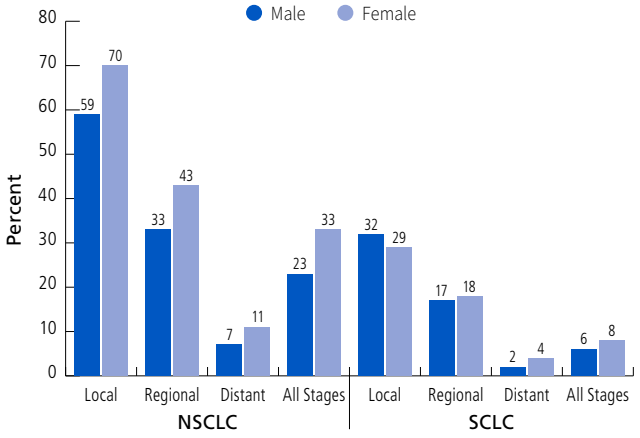
Secondhand smoke, or involuntary exposure to tobacco smoke, is the third most common cause of lung cancer in the US,[78] with a disproportionate influence on Black individuals and families with lower income.[79] Secondhand smoke contains numerous toxic chemicals, including at least 50 known carcinogens,[80] and is associated with the greatest risk for small cell lung cancer.[81] For more information about secondhand smoke, see page 56.

Personal and Family History

A history of lung disease, including asthma, chronic bronchitis, COPD, emphysema, pneumonia, and tuberculosis, is associated with increased risk of lung cancer.[82, 83] These diseases are thought to influence cancer risk through chronic inflammation of lung tissue.[84-87] The estimated excess lung cancer risk ranges from 16% among those with a history of asthma to 2.5-fold among those with a history of COPD.[88]

In addition, some people are at increased risk because of genetic predisposition.[89] Knowledge of inherited lung cancer dates to the 1960s, when excess mortality was noted among relatives of 270 lung cancer patients.[90] The International Lung Cancer Consortium estimates that individuals with a first-degree relative with lung cancer are at a 50% increased risk of the disease, with the strongest association for a diagnosed sibling (82%).[91] Specific genetic syndromes and mutations that have been associated with excess risk include Li-Fraumeni syndrome (variants in the *TP53* tumor-suppressor gene),[92] *EGFR* pathogenic variants,[93, 94] and possibly *BRCA2*, which has been associated with earlier onset of lung cancer by about 12 years[95] and risk among women.[96]

Figure S11. 5-year Relative Survival Rates for Lung Cancer by Subtype, Stage at Diagnosis, and Sex, US, 2012-2018



NSCLC: Non-small cell lung cancer; SCLC: Small cell lung cancer. Survival rates are for patients diagnosed during 2012-2018, all followed through 2019.

Source: Surveillance, Epidemiology, and End Results 17 Registries, 2022.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

Environmental Exposures

Radon

Radon gas is a direct by-product of the radioactive decay of radium-226, part of a lengthy chain of radioactive decay for uranium-238, which is present naturally in rocks and soils.[97] Radon is thought to be the second-leading cause of lung cancer after cigarette smoking,[98] with the greatest risk for people who smoke.[99, 100] Individuals can lower their risk of radon exposure by having their home tested for the gas, regardless of where they live, and taking recommended steps to mitigate exposure when necessary (cdc.gov/radon/radon-action.html).[101, 102]

Asbestos and Other Occupational Exposures

Occupational exposures associated with increased lung cancer risk include chemical mixtures, such as soot and coal-tar pitch, and compounds such as nickel, chromium, and asbestos.[103] In addition, people who work in aluminum production, painting, and steel founding have elevated risk. Work that involves heavy asbestos exposure increases the risk of lung cancer by approximately 70%,[104] with exposure to longer and thinner fibers associated with stronger risk.[105] Studies of the effectiveness of workplace interventions to limit exposure and mitigate risk remain scarce.

Air Pollution

Air pollution is estimated to account for about 1%-2% of lung cancer deaths in the US.[106] Outdoor air pollution is made up of a variety of pollutants from many sources, including power generation, transportation, and industrial and agricultural emissions.[107, 108] Inhaling particulate matter, a microscopic mixture of solid and liquid pollutants, is linked to an 8%-9% increased risk of lung cancer.[108-110] Levels of particulate matter are highest in the Eastern US, but are generally low compared to other parts of the world, such as Asia, North Africa, and the Middle East. Sources of indoor air pollution include coal use in homes,[111, 112] burning of biomass for cooking and heating,[113] and cooking oil fumes.[114, 115] The use of electricity or natural gas for heating and cooking, as well as improved home ventilation, can help prevent increased lung cancer risk due to poor indoor air quality.

Arsenic

High levels of arsenic in drinking water (at least several hundred micrograms per liter) have been strongly associated with lung cancer in Chile and Taiwan,[116-118] but the risk for lower levels, as found in the US, is less clear.[116, 119-122] Only a few US counties, mostly in the Southwest, have mean concentrations exceeding 10 µg/L, the Environmental Protection Agency's maximum concentration limit.[122, 123]

Tobacco Control Policies

Since the publication of the landmark 1964 Surgeon General's Report on the health hazards of cigarette smoking, tobacco control has led to dramatic declines in cigarette consumption (Figure S6) and, consequently, lung cancer incidence and mortality. Some of the most important tobacco control measures include insurance coverage of tobacco cessation, tobacco excise taxes, laws against smoking in public places, counteradvertising, increasing the tobacco sales age to 21, federal regulation, and funding for evidence-based tobacco control programs.[124] Collectively, these measures have contributed to substantial declines in tobacco use in the US.

Tobacco Excise Taxes

Increasing excise taxes on tobacco products regularly and significantly is one of the most effective tobacco control policies. It promotes smoking cessation among adults, discourages initiation in adolescents, and lowers the number of cigarettes smoked among those unable to quit. For each 10% increase in the price of cigarettes, cigarette consumption decreases by an estimated 3%-5%.[125] The decrease is nearly double among youths and individuals with lower SES.[125-128] The federal cigarette tax has been $1.01 since 2009, and the average state tax was $1.91 as of October 1, 2022,[129] ranging from $0.17 in Missouri to $4.50 in the District of Columbia.[29]

Smoke-free Public Places

Comprehensive smoke-free laws (prohibiting smoking in workplaces, restaurants, bars, and gaming facilities) reduce secondhand smoke exposure and youth initiation while increasing cessation, thereby reducing the risk of smoking-related diseases.[78, 125] As of October 2022, 62.5% of the US population lived in areas covered by 100% smoke-free laws in the workplace, restaurants, and bars.[130]

Smoking Cessation

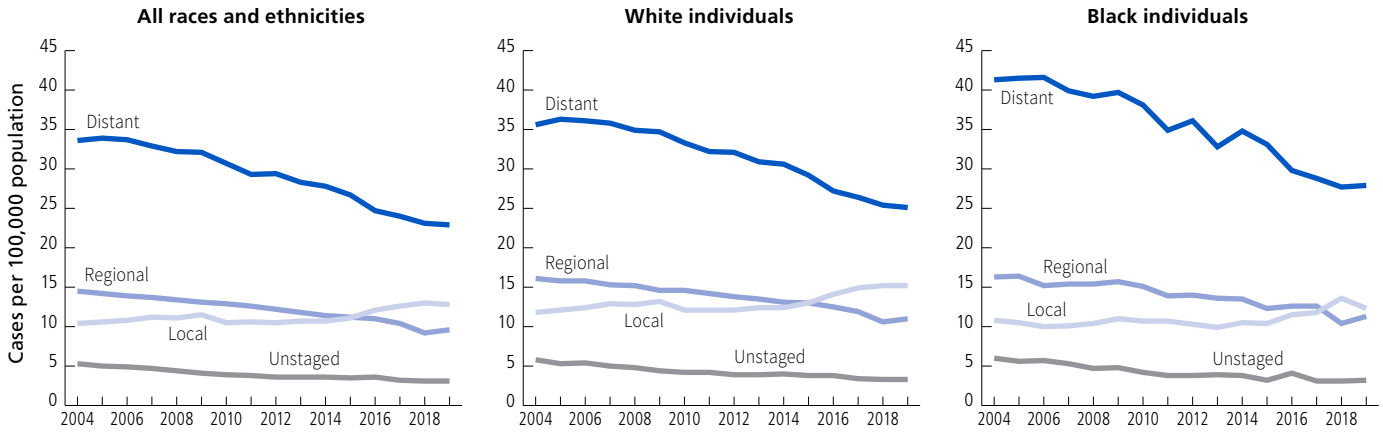
Smoking cessation is associated with a reduced risk of lung cancer and is beneficial at any age, with benefits increasing with earlier age at successful cessation.[125] Those people who smoke and quit before age 40 reduce their risk of lung cancer by 90% compared to those who continue to smoke throughout their lifetime. In general, people who smoke for their entire adult life lose a decade or more of life compared to people who never smoke because of premature death from lung cancer and other smoking-related diseases.[131, 132] Successful cessation usually takes an average of six attempts and increases with the use of FDA-approved cessation medications with counseling.[125, 133, 134] Although cessation attempts are highest among Black and AAPI individuals, successful cessation is highest among White individuals,[29] perhaps related to the use of cessation aids.[135] For more information about reducing tobacco use and exposure, see page 57.

Lung Cancer Screening

Lung cancer screening trials in the 1970s using chest radiography (x-rays) with or without sputum (mucus and other matter brought up from the lungs by coughing) examination showed no improvement in patient outcomes.[136] In 2011, however, screening high-risk individuals (ages 55 to 74 years with a 30+ pack-year smoking history) with annual low-dose computed tomography (LDCT)[137, 138] in the National Lung Screening Trial (NLST) was associated with a 20% reduction in lung cancer mortality compared to chest radiography. More recently, two European trials reported even larger mortality reductions among participants with more moderate disease risk.[139, 140] The American Cancer Society and the US Preventive Services Task Force (USPSTF) began recommending lung cancer screening using LDCT for high-risk individuals in 2013,[35] and have since expanded the eligibility criteria to people ages 50-80 years with a 20+ pack-year smoking history who currently smoke or have quit within the past 15 years.[141] Pack-years is a measurement of smoking history that takes into account duration and quantity of cigarette consumption, both of which determine lung cancer risk. An individual who smokes one pack a day for 20 years and one who smokes two packs a day for 10 years both have a 20 pack-year smoking history. Individuals who do not meet the 20 pack-year threshold, or who do but quit more than 15 years ago, are still at a 10-fold increased risk of lung cancer compared to people who have never smoked.[142] There were approximately 8.5 million adults eligible for lung cancer screening in 2020.

Despite evidence that screening in high-risk populations reduces lung cancer mortality, uptake has been low, especially in several Southern states with a high lung cancer burden.[143] The exception to this pattern is Kentucky, which although still low, has one of the highest screening rates in the country (13.7% in 2018) as a result of community-engaged programs,[144] governmental support,[145] expanded Medicaid eligibility, and no preauthorization requirement for lung cancer screening in Medicaid fee-for-service coverage.[143, 146] Despite generally low uptake, the proportion of cases diagnosed at a localized stage began to increase

Figure S12. Trends in Lung Cancer Incidence Rates* by Race and Stage, US, 2004-2019



*Age adjusted to the 2000 US Standard Population and adjusted for delays in case reporting. Rates for White and Black individuals are exclusive of individuals identifying as Hispanic.

Source: Surveillance, Epidemiology, and End Results 17 Registries, 2022.

©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

following the 2013 USPSTF guideline update, surpassing regional stage in 2016 (Figure S12).

In contrast to recent screening rates for some other cancers,[147] lung cancer screening rates did not decline in the first year of the COVID-19 pandemic and, in fact, increased in 19 states between 2019 and 2020.[148] While this increase is promising, national screening rates among eligible high-risk individuals (about 8.5 million people) remain low (6.5% in 2020). People who are screened are more likely to be older, female, and current smokers,[149] with the greatest barriers to screening among Black and socioeconomically disadvantaged individuals.[150] Patient and provider education is important for increasing uptake among eligible adults, with patients often placing trust in the decision of their provider.[151]

The Economic Impact of Lung Cancer

Lung cancer causes a substantial loss of earnings in the US, approximately $13 billion in 2019,[152] which does not include the costs associated with a cancer diagnosis such as treatment and caregiving. As cancer treatment advances, as it has for lung cancer, the cost of those treatments increases, causing cancer patients and their families to face increasing out-of-pocket costs to receive treatment.[153-155] The high cost associated with a lung cancer diagnosis likely exacerbates economic disparities among diagnosed individuals, a disproportionate number of whom are already impoverished due to higher smoking prevalence among those with low SES.[24]

What Is the American Cancer Society Doing About Lung Cancer?

Research

The American Cancer Society, through our Extramural Discovery Science program, funds individual investigators at medical schools, universities, research institutes, and hospitals throughout the US. Currently, this program is funding $28 million in lung cancer research through 70 research grants. Ongoing research includes:

- Determining how to deliver high-quality cancer care that maximizes patient quality of life and delivers care that is consistent with patients' values and preferences
- Targeting cancer stem cells to induce anti-tumor immunity in small cell lung cancer

- Predicting and tracking response to immunotherapy by harnessing information from cell-free DNA in the blood
- Developing diagnostic tools for the early detection of lung cancer and the discovery of precision medicine to provide personalized targeted treatment
- Utilizing an updated CRISPR approach to identify new tumor-specific vulnerabilities that can be targeted in combination with existing therapies in non-small cell lung cancers

National Lung Cancer Roundtable

Since its inception in 2017, the American Cancer Society National Lung Cancer Roundtable (NLCRT) has galvanized more than 190 organizations and over 200 leading experts, as well as patient and caregiver advocate representatives, at the national, state, and local levels to collectively partner to problem-solve and achieve enduring systematic change to reduce deaths from lung cancer. The NLCRT engages experts in multidisciplinary problem-solving collaborations, catalyzes action to create, build, and strengthen innovative solutions, and develops and disseminates evidence-based interventions and best practices. The work of the roundtable is guided by its Steering Committee and conducted through the efforts of its 10 strategic priority task groups.

The NLCRT engages in public and provider education, targeted research, and health policy initiatives. The roundtable advances lung cancer-related health equity by identifying and working to overcome barriers to equitable access to promote implementation, uptake, and adherence of lung cancer screening and nodule detection and management, promote guideline-concordant staging, and optimize the use of biomarker testing to guide appropriate and timely therapy and care, eliminate the pervasive stigma associated with lung cancer, and strengthen state-based initiatives.

The NLCRT was recommended by the 2022 President's Cancer Panel Report as a priority cancer control model that effectively harnesses the collective power and expertise of the entire lung cancer community to close gaps in cancer screening by connecting people, communities, and systems to improve equity and access. The NLCRT's mission is to create lung cancer survivors.

Visit NLCRT.org for more information.

Advocacy

Our advocacy affiliate, the American Cancer Society Cancer Action Network℠ (ACS CAN), is involved in advocacy efforts at both the federal and state levels that reduce the prevalence of tobacco product use and increase access to quality lung cancer screening, treatment, and care. Following are some of the ways ACS CAN is fighting to reduce the impact of tobacco and lung cancer in the US.

- ACS CAN advocates for insurance coverage for comprehensive biomarker testing in state-regulated insurance plans including Medicaid when supported by medical and scientific evidence.
- The organization sponsors research seeking to better understand private insurance coverage for comprehensive biomarker testing in lung cancer.
- ACS CAN works to improve clinical trial diversity and searchability, including for lung cancer, by improving clinicaltrials.gov, enabling electronic health records to automatically screen patients for trials, and modernizing outdated eligibility criteria for trial entry.
- The organization advocates for evidence-based tobacco control policies to prevent initiation and aid in cessation, including increases in tobacco excise taxes, comprehensive smoke-free laws, insurance coverage for tobacco cessation services, funding for tobacco control programs, and federal regulation of tobacco products, including the prohibition of all flavors in all tobacco products.
- ACS CAN advocates for insurance coverage with no cost sharing of lung cancer screening by all payers, including Medicare, Medicaid, and private insurers.

- The organization believes that the American public should be made aware of the known information concerning the potential problem of radon contamination in certain housing areas in the US and how to reduce such a risk. ACS CAN urges federal, state, and local governments to approve legislation that reduces the potential health threat posed by radon by implementing public awareness campaigns and requiring disclosure of radon levels by builders, homeowners, schools, and daycare facilities.
- ACS CAN supports a cap on total out-of-pocket spending for Medicare beneficiaries.
- The organization advocates that Medicare and Medicaid provide coverage of patient navigation services. Patient navigators have shown to help increase cancer screening rates among historically marginalized racial and ethnic populations by providing access to disease prevention education, conducting community outreach, and facilitating public education campaigns. Additionally, given that many cancer screening guidelines are based on family history and personal risk factors, patient navigators can offer individualized advice and help patients assess individual eligibility, improving compliance by increasing a patient's cancer knowledge and understanding their unique health risks. As such, health care systems should prioritize the use of patient navigators for helping to move cancer patients smoothly and effectively through separate phases of cancer care.

Resources for Lung Cancer Patients and Their Families

Lungevity
lungevity.org
Lung Cancer HELPLine: 1-844-360-5864

Lungevity is the nation's leading lung cancer-focused nonprofit organization. Their goal is to change outcomes for people with lung cancer through research, education, and support. They have numerous education and supportive resources available to lung cancer patients, including peer-to-peer support and survivorship programs.

Cancer*Care*
cancercare.org/diagnosis/lung_cancer

Cancer*Care* provides free professional support services for lung cancer patients and their families. These include financial assistance, support groups, and educational materials.

American Lung Association
lung.org
Lung HelpLine: 1-800-LUNG-USA (1-800-586-4872)

The American Lung Association is the nation's leading organization working to save lives by improving lung health and preventing lung disease through education, advocacy, and research. They provide education on and supportive resources for lung cancer patients and their families, as well as resources to help with smoking cessation.

References

1. Islami F, Goding Sauer A, Miller KD, et al. Proportion and number of cancer cases and deaths attributable to potentially modifiable risk factors in the United States. *CA Cancer J Clin*. Jan 2018;68(1):31-54. doi:10.3322/caac.21440.

2. Siegel RL, Miller KD, Sandeep-Wagle N, Jemal A. Cancer Statistics, 2023. *CA Cancer J Clin*. 2023.

3. Nicholson AG, Tsao MS, Beasley MB, et al. The 2021 WHO Classification of Lung Tumors: Impact of advances since 2015. *J Thorac Oncol*. Nov 19 2021;doi:10.1016/j.jtho.2021.11.003.

4. Wakelee HA, Chang ET, Gomez SL, et al. Lung cancer incidence in never smokers. *J Clin Oncol*. Feb 10 2007;25(5):472-8. doi:10.1200/JCO.2006.07.2983.

5. Song MA, Benowitz NL, Berman M, et al. Cigarette Filter Ventilation and its Relationship to Increasing Rates of Lung Adenocarcinoma. *J Natl Cancer Inst*. Dec 1 2017;109(12)doi:10.1093/jnci/djx075.

6. Araujo LH, Horn L, Merritt RE, Shilo K, Xu-Welliver M, Carbone DP. Cancer of the lung: non-small cell lung cancer and small cell lung cancer. *Abeloff's clinical oncology*. Elsevier; 2020:1108-1158. e16.

7. Chu ZG, Yang ZG, Shao H, et al. Small peripheral lung adenocarcinoma: CT and histopathologic characteristics and prognostic implications. *Cancer Imaging*. Dec 28 2011;11(1):237-46. doi:10.1102/1470-7330.2011.0033.

8. Thai AA, Solomon BJ, Sequist LV, Gainor JF, Heist RS. Lung cancer. *Lancet*. Aug 7 2021;398(10299):535-554. doi:10.1016/S0140-6736(21)00312-3.

9. Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov) SEER*Stat Database: Incidence – SEER Research Data, 17 Registries, Nov 2021 Sub (2000-2019) – Linked To County Attributes – Time Dependent (1990-2019) Income/Rurality, 1969-2020 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, released April 2022, based on the November 2021 submission.

10.Data from: SEER*Stat Database: NAACCR Incidence Data – CiNA Research Data, 1995-2019, with Race/Ethnicity, Standard File, ACS Facts & Figures projection Project (which includes data from CDC's National Program of Cancer Registries (NPCR), CCR's Provincial and Territorial Registries, and the NCI's Surveillance, Epidemiology and End Results (SEER) Registries), certified by the North American Association of Central Cancer Registries (NAACCR) as meeting high-quality incidence data standards for the specified time periods, submitted December 2021.

11. Byers LA, Rudin CM. Small cell lung cancer: where do we go from here? *Cancer*. Mar 1 2015;121(5):664-72. doi:10.1002/cncr.29098.

12. Miller KD, Nogueira L, Devasia T, et al. Cancer treatment and survivorship statistics, 2022. *CA Cancer J Clin*. Jun 23 2022;doi:10.3322/caac.21731.

13. Gallicchio L, Devasia TP, Tonorezos E, Mollica MA, Mariotto A. Estimation of the numbers of individuals living with metastatic cancer in the United States. *J Natl Cancer Inst*. Aug 22 2022;doi:10.1093/jnci/djac158.

14. Howlader N NA, Krapcho M, Miller D, Brest A, Yu M, Ruhl J, Tatalovich Z, Mariotto A, Lewis DR, Chen HS, Feuer EJ, Cronin KA (eds), ed. *SEER Cancer Statistics Review, 1975-2018*. 2021. https://seer.cancer.gov/archive/csr/1975_2018/, based on November 2020 SEER data submission, posted to the SEER web site, April 2021.

15. Thun MJ, Carter BD, Feskanich D, et al. 50-year trends in smoking-related mortality in the United States. *N Engl J Med*. Jan 24 2013;368(4):351-64. doi:10.1056/NEJMsa1211127.

16. Data from: SEER*Stat Database: NAACCR Incidence Data - CiNA Research Data, 2015-2019, Delay Adj Factors - ACS Facts & Figures (which includes data from CDC's National Program of Cancer Registries (NPCR), CCR's Provincial and Territorial Registries, and the NCI's Surveillance, Epidemiology and End Results (SEER) Registries), certified by the North American Association of Central Cancer Registries (NAACCR) as meeting high-quality incidence data standards for the specified time periods, submitted December 2021.

17. Jemal A, Miller KD, Ma J, et al. Higher Lung Cancer Incidence in Young Women Than Young Men in the United States. *N Engl J Med*. May 24 2018;378(21):1999-2009. doi:10.1056/NEJMoa1715907.

18. Data from: SEER 22 Incidence and Mortality, 2000-2019, with Kaposi Sarcoma and Mesothelioma.

19. Kratzer TB, Jemal A, Miller KD, et al. Cancer statistics for American Indian and Alaska Native individuals, 2022: Including increasing disparities in early onset colorectal cancer. *CA Cancer J Clin*. 2022.

20. Taparra K, Pellegrin K. Data aggregation hides Pacific Islander health disparities. *Lancet*. Jul 2 2022;400(10345):2-3. doi:10.1016/S0140-6736(22)01100-X.

21. Torre LA, Sauer AM, Chen MS, Jr., Kagawa-Singer M, Jemal A, Siegel RL. Cancer statistics for Asian Americans, Native Hawaiians, and Pacific Islanders, 2016: Converging incidence in males and females. *CA Cancer J Clin*. May 2016;66(3):182-202. doi:10.3322/caac.21335.

22. DeRouen MC, Canchola AJ, Thompson CA, et al. Incidence of Lung Cancer Among Never-Smoking Asian American, Native Hawaiian, and Pacific Islander Females. *J Natl Cancer Inst*. Jan 11 2022;114(1):78-86. doi:10.1093/jnci/djab143.

23. Pinheiro PS, Callahan KE, Siegel RL, et al. Cancer Mortality in Hispanic Ethnic Groups. *Cancer Epidemiol Biomarkers Prev*. Mar 2017;26(3):376-382. doi:10.1158/1055-9965.Epi-16-0684.

24. Hiscock R, Bauld L, Amos A, Fidler JA, Munafò M. Socioeconomic status and smoking: a review. *Ann. N. Y. Acad. Sci*. 2012;1248(1):107-123.

25. Ma J, Jemal A. Temporal Trends in Mortality From Major Cancers by Education in the United States, 2001–2016. *JNCI Cancer Spectrum*. 2019;3(4)doi:10.1093/jncics/pkz087.

26. Gupta A, Omeogu CH, Islam JY, Joshi AR, Akinyemiju TF. Association of area-level socioeconomic status and non-small cell lung cancer stage by race/ethnicity and health care-level factors: Analysis of the National Cancer Database. *Cancer*. Jun 20 2022;doi:10.1002/cncr.34327.

27. Moscelli G, Siciliani L, Gutacker N, Cookson R. Socioeconomic inequality of access to healthcare: Does choice explain the gradient? *J Health Econ*. Jan 2018;57:290-314. doi:10.1016/j.jhealeco.2017.06.005.

28. Fitzpatrick AL, Powe NR, Cooper LS, Ives DG, Robbins JA. Barriers to health care access among the elderly and who perceives them. *Am. J. Public Health*. 2004;94(10):1788-1794.

29. American Cancer Society. *Cancer Prevention & Early Detection Facts & Figures 2022* Tables and Figures. 2022.

30. Thun M, Peto R, Boreham J, Lopez AD. Stages of the cigarette epidemic on entering its second century. *Tob Control*. Mar 2012;21(2):96-101. doi:10.1136/tobaccocontrol-2011-050294.

31. Smoking USSGsACo. *Smoking and Health: Report of the Advisory Committee to the Surgeon General of the Public Health Service*. US Department of Health, Education, and Welfare, Public Health Service; 1964.

32. Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer statistics, 2022. *CA Cancer J Clin*. Jan 2022;72(1):7-33. doi:10.3322/caac.21708.

33. Humphrey LL, Deffebach M, Pappas M, et al. Screening for lung cancer with low-dose computed tomography: a systematic review to update the US Preventive Services Task Force recommendation. *Ann. Intern. Med*. 2013;159(6):411-420.

34. Jones GS, Baldwin DR. Recent advances in the management of lung cancer. *Clin Med (Lond)*. Apr 1 2018;18(Suppl 2):s41-s46. doi:10.7861/clinmedicine.18-2-s41.

35. Howlader N, Forjaz G, Mooradian MJ, et al. The Effect of Advances in Lung-Cancer Treatment on Population Mortality. *N Engl J Med*. Aug 13 2020;383(7):640-649. doi:10.1056/NEJMoa1916623.

36. Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer Statistics, 2021. *CA Cancer J Clin*. 2021;71(1):7-33. doi:https://doi.org/10.3322/caac.21654.

37. Health, United States, 2019. Hyattsville, Maryland. 2021. DOI: https://dx.doi.org/10.15620/cdc:100685.

38. Jemal A, Center MM, Ward E. The convergence of lung cancer rates between blacks and whites under the age of 40, United States. *Cancer Epidemiol. Biomarkers Prev*. 2009;18(12):3349-3352.

39. Fiore MC, Novotny TE, Pierce JP, Hatziandreu EJ, Patel KM, Davis RM. Trends in cigarette smoking in the United States: the changing influence of gender and race. *JAMA*. 1989;261(1):49-55.

40. Anderson C, Burns DM. Patterns of adolescent smoking initiation rates by ethnicity and sex. *Tob. Control*. 2000;9(suppl 2):ii4-ii8.

41. US Department of Health and Human Services. Tobacco use among US racial/ethnic minority groups—African Americans, American Indians and Alaska Natives, Asian Americans and Pacific Islanders, and Hispanics: A report of the surgeon general. National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. 1998;90.

42. Reyes-Guzman CM, Pfeiffer RM, Lubin J, et al. Determinants of Light and Intermittent Smoking in the United States: Results from Three Pooled National Health Surveys. *Cancer Epidemiol Biomarkers Prev.* Feb 2017;26(2):228-239. doi:10.1158/1055-9965.EPI-16-0028.

43. Felicitas-Perkins JQ, Sakuma KLK, Blanco L, et al. Smoking among Hispanic/Latino nationality groups and whites, comparisons between California and the United States. *Nicotine Tob Res*. 2018;20:1085-1094.

44. Minguet J, Smith KH, Bramlage P. Targeted therapies for treatment of non-small cell lung cancer—recent advances and future perspectives. *Int. J. Cancer*. 2016;138(11):2549-2561.

45. Rittmeyer A, Barlesi F, Waterkamp D, et al. Atezolizumab versus docetaxel in patients with previously treated non-small-cell lung cancer (OAK): a phase 3, open-label, multicentre randomised controlled trial. *Lancet*. 2017;389(10066):255-265.

46. Vokes EE, Ready N, Felip E, et al. Nivolumab versus docetaxel in previously treated advanced non-small-cell lung cancer (CheckMate 017 and CheckMate 057): 3-year update and outcomes in patients with liver metastases. *Ann. Oncol*. 2018;29(4):959-965.

47. Rami-Porta R, Call S, Dooms C, et al. Lung cancer staging: a concise update. *Eur Respir J*. 2018;51(5).

48. Chang JW, Asamura H, Kawachi R, Watanabe S. Gender difference in survival of resected non-small cell lung cancer: histology-related phenomenon? *J Thorac Cardiovasc Surg*. Apr 2009;137(4):807-12. doi:10.1016/j.jtcvs.2008.09.026.

49. Rodriguez-Lara V, Hernandez-Martinez JM, Arrieta O. Influence of estrogen in non-small cell lung cancer and its clinical implications. *J Thorac Dis*. Jan 2018;10(1):482-497. doi:10.21037/jtd.2017.12.61.

50. Midha A, Dearden S, McCormack R. EGFR mutation incidence in non-small-cell lung cancer of adenocarcinoma histology: a systematic review and global map by ethnicity (mutMapII). *Am. J. Cancer Res*. 2015;5(9):2892.

51. Javid SH, Varghese TK, Morris AM, et al. Guideline-concordant cancer care and survival among American Indian/Alaskan Native patients. *Cancer*. Jul 15 2014;120(14):2183-90. doi:10.1002/cncr.28683.

52. Lovly CM. Expanding Horizons for Treatment of Early-Stage Lung Cancer. *N Engl J Med*. May 26 2022;386(21):2050-2051. doi:10.1056/NEJMe2203330.

53. Lansdorp-Vogelaar I, Kuntz KM, Knudsen AB, van Ballegooijen M, Zauber AG, Jemal A. Contribution of screening and survival differences to racial disparities in colorectal cancer rates. *Cancer Epidemiol Biomarkers Prev*. May 2012;21(5):728-36. doi:10.1158/1055-9965.Epi-12-0023.

54. Pinheiro PS, Morris CR, Liu L, Bungum TJ, Altekruse SF. The impact of follow-up type and missed deaths on population-based cancer survival studies for Hispanics and Asians. *J Natl Cancer Inst Monogr*. Nov 2014;2014(49):210-7. doi:10.1093/jncimonographs/lgu016.

55. Vieira AR, Abar L, Vingeliene S, et al. Fruits, vegetables and lung cancer risk: a systematic review and meta-analysis. *Ann Oncol*. Jan 2016;27(1):81-96. doi:10.1093/annonc/mdv381.

56. Holford TR, Levy DT, McKay LA, et al. Patterns of birth cohort-specific smoking histories, 1965-2009. *Am J Prev Med*. Feb 2014;46(2):e31-7. doi:10.1016/j.amepre.2013.10.022.

57. Anderson CM, Burns DM, Dodd KW, Feuer EJ. Chapter 2: Birth-cohort-specific estimates of smoking behaviors for the U.S. population. *Risk Anal*. Jul 2012;32 Suppl 1:S14-24. doi:10.1111/j.1539-6924.2011.01703.x.

58. Burns D, Lee L, Shen L, et al. Cigarette smoking behavior in the United States: changes in cigarette-related disease risks and their implication for prevention and control. Smoking and tobacco control monograph no. 8. Bethesda, MD: National Cancer Institute, 1997:13-112. (NIH publication no. 97-4213.).

59. U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality. National Survey on Drug Use and Health, 2020. Accessed August 3, 2022. https://datafiles.samhsa.gov/.

60. Rostron B. Lung cancer mortality risk for U.S. menthol cigarette smokers. *Nicotine Tob Res*. Oct 2012;14(10):1140-4. doi:10.1093/ntr/nts014.

61. Brooks DR, Palmer JR, Strom BL, Rosenberg L. Menthol cigarettes and risk of lung cancer. *Am J Epidemiol*. Oct 1 2003;158(7):609-16; discussion 617-20. doi:10.1093/aje/kwg182.

62. Blot WJ, Cohen SS, Aldrich M, McLaughlin JK, Hargreaves MK, Signorello LB. Lung cancer risk among smokers of menthol cigarettes. *J Natl Cancer Inst*. May 18 2011;103(10):810-6. doi:10.1093/jnci/djr102.

63. Haiman CA, Stram DO, Wilkens LR, et al. Ethnic and racial differences in the smoking-related risk of lung cancer. *N Engl J Med*. 2006;354(4):333-342.

64. Cobb N, Espey D, King J. Health behaviors and risk factors among American Indians and Alaska Natives, 2000-2010. *Am J Public Health*. 2014;104(suppl 3): S481–S489. doi:10.21 05/A JPH. 2014 .301 879

65. Garrett BE, Dube SR, Trosclair A, et al. Cigarette smoking – United States, 1965-2008. *MMWR Suppl*. Jan 14 2011;60(1):109-13.

66. *Smoking Cessation: A Report of the Surgeon General*. 2020. Publications and Reports of the Surgeon General.

67. Cromer KJ, Wofford L, Wyant DK. Barriers to Healthcare Access Facing American Indian and Alaska Natives in Rural America. *J Community Health Nurs*. Oct-Dec 2019;36(4):165-187. doi:10.1080/07370016.2019.1665320.

68. Odani S, Armour BS, Graffunder CM, Garrett BE, Agaku IT. Prevalence and Disparities in Tobacco Product Use Among American Indians/Alaska Natives – United States, 2010-2015. *MMWR Morb Mortal Wkly Rep*. Dec 22 2017;66(50):1374-1378. doi:10.15585/mmwr.mm6650a2.

69. Services USDoHaH. *Tobacco use among U.S. racial/ethnic groups—African Americans, American Indians and Alaska Natives, Asian Americans and Pacific Islanders, and Hispanics: a report of the Surgeon General*. 1998.

70. Xu X, Pesko MF, Tynan MA, Gerzoff RB, Malarcher AM, Pechacek TF. Cigarette price-minimization strategies by U.S. smokers. *Am J Prev Med*. May 2013;44(5):472-6. doi:10.1016/j.amepre.2013.01.019.

71. Choi WS, Beebe LA, Nazir N, et al. All Nations Breath of Life: A Randomized Trial of Smoking Cessation for American Indians. *Am J Prev Med*. Nov 2016;51(5):743-751. doi:10.1016/j.amepre.2016.05.021.

72. Kunitz SJ. Historical Influences on Contemporary Tobacco Use by Northern Plains and Southwestern American Indians. *Am J Public Health*. Feb 2016;106(2):246-55. doi:10.2105/AJPH.2015.302909.

73. Miller KD, Ortiz AP, Pinheiro PS, et al. Cancer statistics for the US Hispanic/Latino population, 2021. *CA Cancer J Clin*. 2021;71(6):466-487.

74. Data from: Hawai'i Health Data Warehouse: Cigarettes – Current Smoking, Adult.

75. Christensen CH, Rostron B, Cosgrove C, et al. Association of cigarette, cigar, and pipe use with mortality risk in the US population. *JAMA Intern. Med*. 2018;178(4):469-476.

76. Chen-Sankey JC, Mead-Morse EL, Le D, et al. Cigar-Smoking Patterns by Race/Ethnicity and Cigar Type: A Nationally Representative Survey Among U.S. Adults. *Am J Prev Med*. Jan 2021;60(1):87-94. doi:10.1016/j.amepre.2020.07.005.

77. Park SH, Duncan DT, Shahawy OE, et al. Analysis of State-Specific Prevalence, Regional Differences, and Correlates of Hookah Use in U.S. Adults, 2012-2013. *Nicotine Tob Res*. 2016;19(11):1365-1374. doi:10.1093/ntr/ntw229.

78. US Department of Health and Human Services. *The health consequences of smoking – 50 years of progress: a report of the Surgeon General*. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention; 2014.

79. Brody DJ, Faust E, Tsai J. Secondhand smoke exposure among nonsmoking adults: United States, 2015-2018. 2021.

80. US Centers for Disese Control and Prevention, Office on Smoking and Health. How tobacco smoke causes disease: The biology and behavioral basis for smoking-attributable disease: A report of the surgeon general. 2010.

81. Kim CH, Lee YCA, Hung RJ, et al. Exposure to secondhand tobacco smoke and lung cancer by histological type: a pooled analysis of the International Lung Cancer Consortium (ILCCO). *Int. J. Cancer*. 2014;135(8):1918-1930.

82. Brenner DR, Boffetta P, Duell EJ, et al. Previous Lung Diseases and Lung Cancer Risk: A Pooled Analysis From the International Lung Cancer Consortium. *Am. J. Epidemiol*. 2012;176(7):573-585. doi:10.1093/aje/kws151.

83. Brenner DR, McLaughlin JR, Hung RJ. Previous lung diseases and lung cancer risk: a systematic review and meta-analysis. *PloS one*. 2011;6(3):e17479.

84. Rutgers SR, Postma DS, Ten Hacken NH, et al. Ongoing airway inflammation in patients with COPD who do not currently smoke. *Thorax*. 2000;55(1):12-18.

85. Moldoveanu B, Otmishi P, Jani P, et al. Inflammatory mechanisms in the lung. *J. Inflamm. Res*. 2009;2:1.

86. Engels EA. Inflammation in the development of lung cancer: epidemiological evidence. *Expert Rev. Anticancer Ther*. 2008;8(4):605-615.

87. Brody JS, Spira A. State of the art. Chronic obstructive pulmonary disease, inflammation, and lung cancer. *Proc. Am. Thorac. Soc*. 2006;3(6):535-537.

88. Ang L, Ghosh P, Seow WJ. Association between previous lung diseases and lung cancer risk: a systematic review and meta-analysis. *Carcinogenesis*. 2021;42(12):1461-1474. doi:10.1093/carcin/bgab082.

89. Benusiglio PR, Fallet V, Sanchis-Borja M, Coulet F, Cadranel J. Lung cancer is also a hereditary disease. *Eur Respir Rev*. Dec 31 2021;30(162)doi:10.1183/16000617.0045-2021.

90. Tokuhata GK, Lilienfeld AM. Familial aggregation of lung cancer among hospital patients. *Public Health Rep* (1896). Apr 1963;78:277-83.

91. Cote ML, Liu M, Bonassi S, et al. Increased risk of lung cancer in individuals with a family history of the disease: a pooled analysis from the International Lung Cancer Consortium. *Eur J Cancer*. Sep 2012;48(13):1957-68. doi:10.1016/j.ejca.2012.01.038.

92. Bougeard G, Renaux-Petel M, Flaman JM, et al. Revisiting Li-Fraumeni Syndrome From TP53 Mutation Carriers. *J Clin Oncol*. Jul 20 2015;33(21):2345-52. doi:10.1200/JCO.2014.59.5728.

93. Lou Y, Pecot CV, Tran HT, et al. Germline Mutation of T790M and Dual/Multiple EGFR Mutations in Patients With Lung Adenocarcinoma. *Clin Lung Cancer*. Mar 2016;17(2):e5-11. doi:10.1016/j.cllc.2015.11.003.

94. Gazdar A, Robinson L, Oliver D, et al. Hereditary lung cancer syndrome targets never smokers with germline EGFR gene T790M mutations. *J Thorac Oncol*. Apr 2014;9(4):456-63. doi:10.1097/JTO.0000000000000130.

95. Reckamp KL, Behrendt CE, Slavin TP, et al. Germline mutations and age at onset of lung adenocarcinoma. *Cancer*. Aug 1 2021;127(15):2801-2806. doi:10.1002/cncr.33573.

96. Li S, Silvestri V, Leslie G, et al. Cancer Risks Associated With BRCA1 and BRCA2 Pathogenic Variants. *J Clin Oncol*. May 10 2022;40(14):1529-1541. doi:10.1200/JCO.21.02112.

97. *IARC Monographs on the Evaluation of the Carcinogenic Risks to Humans: Man-made Mineral Fibres and Radon*. 1988.

98. National Research Council (U.S.). Committee on Health Risks of Exposure to Radon. *Health effects of exposure to radon*. Beir. National Academy Press; 1999:xiv, 500 p.

99. World Health Organization. *WHO handbook on indoor radon : a public health perspective*. World Health Organization; 2009:xiv, 94 p.

100. Darby S, Hill D, Auvinen A, et al. Radon in homes and risk of lung cancer: collaborative analysis of individual data from 13 European case-control studies. *BMJ*. Jan 29 2005;330(7485):223. doi:10.1136/bmj.38308.477650.63.

101. *A Citizen's Guide to Radon: The Guide to Protecting Yourself and Your Family from Radon*. 2012. Accessed August 12, 2022. https://www.epa.gov/sites/default/files/2016-02/documents/2012_a_citizens_guide_to_radon.pdf.

102. Agency UEP. Consumer's Guide to Radon Reduction. How to Fix Your Home. 2016.

103. Field RW, Withers BL. Occupational and environmental causes of lung cancer. *Clin. Chest Med*. 2012;33(4):681-703.

104. Järvholm B, Aström E. The risk of lung cancer after cessation of asbestos exposure in construction workers using pleural malignant mesothelioma as a marker of exposure. *J Occup Environ Med*. Dec 2014;56(12):1297-301. doi:10.1097/jom.0000000000000258.

105. Loomis D, Dement J, Richardson D, Wolf S. Asbestos fibre dimensions and lung cancer mortality among workers exposed to chrysotile. *Occup Environ Med*. Sep 2010;67(9):580-4. doi:10.1136/oem.2009.050120.

106. Alberg AJ, Samet JM. Epidemiology of lung cancer. *Chest*. 2003;123(1):21S-49S.

107. Unger N, Bond TC, Wang JS, et al. Attribution of climate forcing to economic sectors. *Proc. Natl. Acad. Sci. U.S.A*. 2010;107(8):3382-3387.

108. International Agency for Research on Cancer. *IARC monographs on the evaluation of carcinogenic risks to humans: vol. 109, outdoor air pollution*. Lyon, France: IARC. 2015.

109. Hamra GB, Guha N, Cohen A, et al. Outdoor Particulate Matter Exposure and Lung Cancer: A Systematic Review and Meta-Analysis. *Environ. Health Perspect*. 2014;122(9):906-911. doi:10.1289/ehp/1408092.

110. Brauer M, Amann M, Burnett RT, et al. Exposure assessment for estimation of the global burden of disease attributable to outdoor air pollution. *Envrion. Sci. Technol*. 2012;46(2):652-660.

111. Hosgood III HD, Wei H, Sapkota A, et al. Household coal use and lung cancer: systematic review and meta-analysis of case–control studies, with an emphasis on geographic variation. *Int. J. Epidemiol*. 2011;40(3):719-728.

112. Lan Q, Chapman RS, Schreinemachers DM, Tian L, He X. Household stove improvement and risk of lung cancer in Xuanwei, China. *J. Natl. Cancer Inst*. 2002;94(11):826-835.

113. Smith KR, Aggarwal A, Dave R. Air pollution and rural biomass fuels in developing countries: a pilot village study in India and implications for research and policy. *Atmos. Environ* (1967). 1983;17(11):2343-2362.

114. Chiang T-A, Wu P-F, Ko Y-C. Identification of carcinogens in cooking oil fumes. *Environ Res*. 1999;81(1):18-22.

115. Shields P, Xu G, Blot W, et al. Mutagens from heated Chinese and US cooking oils. *J. Natl. Cancer Inst*. 1995;87(11):836-841.

116. Ferreccio C, González C, Milosavjlevic V, Marshall G, Sancha AM, Smith AH. Lung cancer and arsenic concentrations in drinking water in Chile. *Epidemiology*. 2000:673-679.

117. National Research Council. Arsenic in Drinking Water. 1999. https://nap.nationalacademies.org/catalog/6444/arsenic-in-drinking-water.

118. Gallicchio L, Boyd K, Matanoski G, et al. Carotenoids and the risk of developing lung cancer: a systematic review. *Am. J. Clin. Nutr*. 2008;88(2):372-383.

119. Hinwood AL, Jolley DJ, Sim MR. Cancer incidence and high environmental arsenic concentrations in rural populations: results of an ecological study. *Int. J. Environ. Health Res*. 1999;9(2):131-141.

120. Lewis DR, Southwick JW, Ouellet-Hellstrom R, Rench J, Calderon RL. Drinking water arsenic in Utah: A cohort mortality study. *Environ. Health Perspect*. 1999;107(5):359-365.

121. Bates MN, Smith AH, Cantor KP. Case-control study of bladder cancer and arsenic in drinking water. *Am. J. Epidemiol*. 1995;141(6):523-530.

122. Mendez WM, Eftim S, Cohen J, et al. Relationships between arsenic concentrations in drinking water and lung and bladder cancer incidence in U.S. counties. *J. Expo. Sci. Environ. Epidemiol*. 2017/05/01 2017;27(3):235-243. doi:10.1038/jes.2016.58.

123. Desimone LA, McMahon PB, Rosen MR. *Water Quality in Principal Aquifers of the United States, 1991-2010*. US Department of the Interior, US Geological Survey; 2014.

124. Bandi P, Minihan AK, Siegel RL, et al. Updated Review of Major Cancer Risk Factors and Screening Test Use in the United States in 2018 and 2019, with a Focus on Smoking Cessation. *Cancer Epidemiol. Biomarkers Prev*. 2021;30(7):1287-1299. doi:10.1158/1055-9965.Epi-20-1754

125. Office USPHS. Smoking Cessation: A Report of the Surgeon General. https://www.hhs.gov/sites/default/files/2020-cessation-sgr-full-report.pdf. 2020;

126. US Department of Health and Human Services. *Reducing tobacco use: a report of the Surgeon General*. 2000. US Government Printing Office: Washington, DC. 2000.

127. Chaloupka FJ, Straif K, Leon ME. Effectiveness of tax and price policies in tobacco control. *Tob. Control*. 2011;20(3):235-238.

128. Wallace RB, Stratton K, Bonnie RJ. *Ending the tobacco problem: a blueprint for the nation*. National Academies Press; 2007.

129. State Cigarette Excise Tax Rates. Accessed October 21, 2022. https://www.tobaccofreekids.org/assets/factsheets/0097.pdf.

130. Foundation ANR. Overview List – Number of Smokefree and Other Tobacco-Related Laws. 2022. September 12, 2022. https://no-smoke.org/wp-content/uploads/pdf/mediaordlist.pdf.

131. Jha P, Ramasundarahettige C, Landsman V, et al. 21st-century hazards of smoking and benefits of cessation in the United States. *N Engl J Med*. 2013;368(4):341-350.

132. Inoue-Choi M, McNeel TS, Hartge P, Caporaso NE, Graubard BI, Freedman ND. Non-Daily Cigarette Smokers: Mortality Risks in the U.S. *Am J Prev Med*. Jan 2019;56(1):27-37. doi:10.1016/j.amepre.2018.06.025.

133. Use T, Panel D. *Clinical Practice Guideline: Treating Tobacco Use and Dependence-2008 Update*. Books Express Publishing; 2008.

134. Krist AH, Davidson KW, Mangione CM, et al. Interventions for tobacco smoking cessation in adults, including pregnant persons: US Preventive Services Task Force recommendation statement. *JAMA*. 2021;325(3):265-279.

135. Cokkinides VE, Halpern MT, Barbeau EM, Ward E, Thun MJ. Racial and ethnic disparities in smoking-cessation interventions: analysis of the 2005 National Health Interview Survey. *Am J Prev Med*. 2008;34(5):404-412.

136. Humphrey LL, Teutsch S, Johnson M, Force USPST. Lung cancer screening with sputum cytologic examination, chest radiography, and computed tomography: an update for the U.S. Preventive Services Task Force. *Ann Intern Med*. May 4 2004;140(9):740-53. doi:10.7326/0003-4819-140-9-200405040-00015.

137. National Lung Screening Trial Research T, Aberle DR, Adams AM, et al. Reduced lung-cancer mortality with low-dose computed tomographic screening. *N Engl J Med*. Aug 4 2011;365(5):395-409. doi:10.1056/NEJMoa1102873.

138. de Koning HJ, van der Aalst CM, de Jong PA, et al. Reduced Lung-Cancer Mortality with Volume CT Screening in a Randomized Trial. *N Engl J Med*. Feb 6 2020;382(6):503-513. doi:10.1056/NEJMoa1911793.

139. de Koning HJ, van der Aalst CM, de Jong PA, et al. Reduced lung-cancer mortality with volume CT screening in a randomized trial. *N Engl J Med*. 2020;382(6):503-513.

140. Becker N, Motsch E, Trotter A, et al. Lung cancer mortality reduction by LDCT screening—results from the randomized German LUSI trial. *International journal of cancer*. 2020;146(6):1503-1513.

141. Jonas DE, Reuland DS, Reddy SM, et al. Screening for lung cancer with low-dose computed tomography: updated evidence report and systematic review for the US Preventive Services Task Force. *JAMA*. 2021;325(10):971-987.

142. Faselis C, Nations JA, Morgan CJ, et al. Assessment of Lung Cancer Risk Among Smokers for Whom Annual Screening Is Not Recommended. *JAMA Oncol*. 2022;8(10):1428-1437. doi:10.1001/jamaoncol.2022.2952.

143. Fedewa SA, Kazerooni EA, Studts JL, et al. State Variation in Low-Dose Computed Tomography Scanning for Lung Cancer Screening in the United States. *J Natl Cancer Inst*. Aug 2 2021;113(8):1044-1052. doi:10.1093/jnci/djaa170.

144. Kentucky LEADS Collaborative. Accessed August 25, 2022. https://www.kentuckyleads.org/.

145. Gov. Beshear Signs Bill Establishing Lung Cancer Screening Program. University of Kentucky College of Medicine; July 22, 2022, 2022. https://medicine.uky.edu/news/gov-beshear-signs-bill-establishing-lung-cancer-2022-07-22t08-19-34.

146. Zeliadt SB, Hoffman RM, Birkby G, et al. Challenges implementing lung cancer screening in federally qualified health centers. *Am J Prev Med*. 2018;54(4):568-575.

147. Fedewa SA, Star J, Bandi P, et al. Changes in Cancer Screening in the US During the COVID-19 Pandemic. *JAMA Netw Open*. Jun 1 2022;5(6):e2215490. doi:10.1001/jamanetworkopen.2022.15490.

148. Fedewa SA, Bandi P, Smith RA, Silvestri GA, Jemal A. Lung Cancer Screening Rates During the COVID-19 Pandemic. *Chest*. Feb 2022;161(2):586-589. doi:10.1016/j.chest.2021.07.030.

149. Silvestri GA, Goldman L, Burleson J, et al. Characteristics of Persons Screened for Lung Cancer in the United States: A Cohort Study. *Ann Intern Med*. 2022.

150. Sosa E, D'Souza G, Akhtar A, et al. Racial and socioeconomic disparities in lung cancer screening in the United States: A systematic review. *CA Cancer J Clin*. Jul 2021;71(4):299-314. doi:10.3322/caac.21671.

151. Sedani AE, Davis OC, Clifton SC, Campbell JE, Chou AF. Facilitators and Barriers to Implementation of Lung Cancer Screening: A Framework Driven Systematic Review. *J Natl Cancer Inst*. Aug 22 2022;doi:10.1093/jnci/djac154.

152. Islami F, Marlow EC, Zhao J, et al. Person-years of life lost and lost earnings from cigarette smoking-attributable cancer deaths, United States, 2019. *Int J Cancer*. Aug 10 2022;doi:10.1002/ijc.34217.

153. Shih Y-CT, Xu Y, Liu L, Smieliauskas F. Rising prices of targeted oral anticancer medications and associated financial burden on Medicare beneficiaries. *J. Clin. Onc*. 2017;35(22):2482.

154. Dusetzina SB, Huskamp HA, Keating NL. Specialty drug pricing and out-of-pocket spending on orally administered anticancer drugs in Medicare Part D, 2010 to 2019. *JAMA*. 2019;321(20):2025-2028.

155. Shih Y-CT, Smieliauskas F, Geynisman DM, Kelly RJ, Smith TJ. Trends in the cost and use of targeted cancer therapies for the privately insured nonelderly: 2001 to 2011. *J. Clin. Onc*. 2015;33(19):2190.

Cancer Disparities

Eliminating disparities in cancer is a critical component of the American Cancer Society's mission. Cancer disparities occur when barriers to high-quality cancer prevention, early detection, and treatment create differences in cancer occurrence and outcomes based on factors such as race, ethnicity, age, income, sexual orientation, gender identity, or geographic location. Many non-medical factors have a powerful influence on health and are referred to collectively as the social determinants of health, which are the conditions in which people are born, live, grow, and age. Much of the inequality in these social determinants among people of color stems from historical and persistent structural racism that has limited opportunities for education and the accumulation of wealth.[1] Inherited genetic factors contribute minimally to overall cancer disparities but do help explain some differences 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 the breast cancer susceptibility genes *BRCA1* and *BRCA2*.[2]

Socioeconomic Status

Socioeconomic status (SES) is often measured in terms of income, education, and/or health insurance coverage for research purposes. Cancer death rates are higher among people with lower SES compared to people with higher SES, and this gap is widening.[3] For example, lung cancer mortality rates were 4.6 times higher among men with 12 or fewer years of education than among men with 4-year college degrees in 2016, up from 3 times higher in 2001.[4] This is because progress in reducing cigarette smoking has been slower and current smoking prevalence is considerably higher in people with lower SES. In 2020, smoking prevalence was 28% among men without a high school education versus 6% among college graduates,[5] partly because of targeted marketing in low-income neighborhoods by tobacco companies.

Several additional interrelated social and structural inequities contribute to increased cancer risk factor prevalence and a higher likelihood of cancer death among people with lower SES. In particular, people of lower SES have fewer choices of where to live and work and are thus often constrained to areas with limited resources, fewer opportunities for physical activity, less availability of fresh fruits and vegetables, and a higher risk of harmful exposures (e.g., air pollutants from vehicular traffic).[6, 7] People with fewer resources also have less access to high-quality health care because of inadequate health insurance; fewer health care providers in low-income neighborhoods; financial, structural, and personal obstacles (e.g., transportation and time off from work); low health literacy; and delays in the dissemination of advances in early detection and treatment to low-income areas.[1] As a result, people of lower SES have a higher likelihood of developing most cancers and are more often diagnosed at a late stage; they are also less likely to receive the standard of care and are more likely to have lower survival.[3, 8, 9] Approximately one-half of individuals with cancer also face personal economic burdens associated with the disease and its treatment (financial toxicity),[10] creating disparities in cancer survivorship and other health outcomes.[11]

Race and Ethnicity

Race and ethnicity are social constructs but continue to be helpful in elucidating the influence of injustice and discrimination on health disparities. For example, racial and ethnic disparities in the cancer burden largely reflect long-standing inequities in SES and access to high-quality health care, which can be attributed to historical and persistent structural racism in the US experienced by all people of color. According to official estimates from the US Census Bureau, in 2021, 24% of American Indian/Alaska Native (AIAN), 20% of Black, and 17% of Hispanic/Latino populations lived below the poverty line, compared to 8% of non-Hispanic White (White) and 9% of Asian American

Table 9. Incidence and Mortality Rates for Selected Cancers by Race and Ethnicity, US

Incidence, 2015-2019	All races & ethnicities	White	Black	American Indian/ Alaska Native†	Asian American/ Pacific Islander	Hispanic/ Latino
All sites	449.4	466.6	453.7	456.8	295.5	352.2
Male	488.2	502.1	527.5	481.2	294.9	372.1
Female	423.3	442.8	404.2	443.6	300.1	344.8
Breast (female)	128.1	133.7	127.8	111.3	101.3	99.2
Colon & rectum*	35.9	35.7	41.7	48.6	28.6	32.5
Male	41.5	41.0	49.6	56.2	33.9	38.8
Female	31.2	30.9	35.9	42.5	24.3	27.4
Kidney & renal pelvis	17.3	17.5	19.1	31.0	8.1	17.5
Male	23.5	23.8	26.2	41.2	11.4	22.8
Female	12.0	11.9	13.6	22.5	5.5	13.1
Liver & intrahepatic bile duct	8.6	7.3	10.7	18.4	12.2	13.8
Male	13.1	11.0	17.4	26.8	18.9	20.3
Female	4.8	4.0	5.5	11.5	6.8	8.2
Lung & bronchus	56.3	60.6	58.2	61.6	34.2	29.1
Male	64.1	67.3	74.8	66.9	42.1	35.6
Female	50.3	55.5	46.9	57.9	28.3	24.4
Prostate	109.9	103.5	176.2	82.6	57.2	87.2
Stomach	6.4	5.2	9.7	9.6	9.4	9.4
Male	8.5	7.2	13.0	12.5	12.2	11.6
Female	4.6	3.4	7.4	7.5	7.2	7.8
Uterine cervix	7.7	7.2	8.8	10.9	6.1	9.7
Mortality, 2016-2020						
All sites	149.4	154.4	174.7	179.3	94.5	108.2
Male	177.5	182.5	216.0	216.5	110.4	129.6
Female	128.7	133.0	149.2	153.7	82.9	93.2
Breast (female)	19.6	19.7	27.6	20.5	11.7	13.7
Colon & rectum	13.1	13.1	17.6	18.6	9.1	10.7
Male	15.7	15.5	22.3	22.6	10.9	13.5
Female	11.0	11.1	14.3	15.6	7.7	8.5
Kidney & renal pelvis	3.5	3.6	3.4	6.5	1.6	3.3
Male	5.1	5.3	5.2	9.7	2.4	4.8
Female	2.2	2.3	2.1	4.1	1.0	2.1
Liver & intrahepatic bile duct	6.6	5.9	8.3	13.3	8.4	9.2
Male	9.6	8.4	12.9	19.5	12.5	13.1
Female	4.1	3.6	4.8	8.5	5.1	6.0
Lung & bronchus	35.0	38.0	37.2	42.3	19.8	15.4
Male	42.2	44.7	51.0	51.1	25.6	20.9
Female	29.3	32.8	27.8	36.0	15.4	11.4
Prostate	18.8	17.8	37.5	21.9	8.6	15.3
Stomach	2.8	2.1	5.0	5.5	4.6	4.8
Male	3.8	2.9	7.2	7.5	5.9	5.9
Female	2.1	1.5	3.5	4.0	3.7	3.9
Uterine cervix	2.2	2.0	3.3	3.2	1.6	2.5

Rates are per 100,000 population, age adjusted to the 2000 US standard population, and exclude data from Puerto Rico. All race groups are exclusive of Hispanic origin. (See Sources of Statistics, page 78.) *Colorectal cancer incidence rates exclude appendix. †To reduce racial misclassification for American Indian and Alaska Native individuals, incidence rates are limited to Purchased/Referred Care Delivery Area counties and mortality rates, which are based on the entire US, are adjusted for racial misclassification on death certificates using factors from the National Center for Health Statistics. (See Sources of Statistics, page 78.)

Source: Incidence – North American Association of Central Cancer Registries (NAACCR), 2022. Mortality – National Center for Health Statistics, Centers for Disease Control and Prevention, 2022.

©2023 American Cancer Society, Inc., Surveillance and Health Equity Science

populations. Notably, poverty rates in all non-White populations, including Asian Americans, were about double those in Whites after adjusting for participation in government assistance programs.[12] According to estimates from the National Health Interview Survey, adults ages 18-64 years who were most likely to be uninsured in 2021 included Hispanic (34%), Native Hawaiian or Pacific Islander (31%), AIAN (29%), and Black (19%) individuals compared to 12% of White individuals and 10% of Asian Americans. Existing

cancer disparities will likely be further exacerbated by the COVID-19 pandemic, which has disproportionately affected Black, AIAN, and Hispanic individuals in terms of both illness and secondary consequences.[13]

Disparities by race and ethnicity persist even when SES is similar. People of color are less likely to receive high-quality health care than White people even when health insurance status, age, severity of disease, and health status are comparable.[14] When treatment is equivalent, such as in a clinical trial or equal access care setting, cancer outcomes are similar.[15-18] However, disparities may persist even in these settings due to other obstacles, such as reliable transportation, access to supportive care, language barriers, and provider implicit and explicit bias.[19] Further, diverse groups are extremely underrepresented in clinical trials, reducing the generalizability of treatment advances. Reasons for the lack of diversity include restrictive inclusion criteria, limited recruitment sites that favor White patients, and medical mistrust due to historical research misconduct and human rights violations.[20, 21]

Racial and ethnic variations in cancer occurrence also reflect differences in risk factor prevalence for cultural or other reasons. For example, persons who are Hispanic or Asian American have lower rates of lung cancer than other groups (Table 9) because these populations, as a whole, are historically less likely to smoke, although smoking behavior varies substantially within these broadly defined categories.[1] Conversely, because a relatively large proportion of persons who are Hispanic or Asian American are recent immigrants, these populations generally have higher rates of cancers related to infectious agents (e.g., stomach), typically reflecting higher infection prevalence (e.g., *Helicobacter pylori*) in their native countries (Table 9). Acculturation also has a complex influence on the health of immigrant populations, creating large differences in cancer rates by nativity.

Following is a brief overview of the cancer burden in four broad racial and ethnic groups that is masked in overall US data. Importantly, as mentioned earlier, there is substantial variation within these diverse populations by country of origin, duration of residence in the US, geographic location, tribal affiliation (for AIAN individuals), etc. However, health data for smaller subgroups are limited because official population estimates are not available from the US Census Bureau, nor are health data collected for specific groups on several federal and state surveys. In addition, cancer rates for Hispanic and AIAN individuals are known to be underestimated due to substantial racial misclassification on medical and death records. All statistics for racial groups presented in this and subsequent sections are exclusive of Hispanic/Latino ethnicity.

Black individuals: Black men, along with AIAN men, have the highest overall cancer mortality rate (216 per 100,000), 18% higher than White men (183) (Table 9). In particular, prostate cancer mortality among Black men is approximately double that of men in most other groups and more than fourfold that in Asian American and Pacific Islander men combined (Table 9). Black women have 40% higher breast cancer death rates than White women despite lower incidence rates, a disparity that peaked in 2011 and has since remained largely unchanged. Larger gaps in mortality compared to incidence reflect substantial disparities in survival for Black individuals (Table 7) due to systemic racism that has perpetuated disproportionate poverty and reduced access to equitable care.[1] For example, more than one-third of the Black-White breast cancer survival disparity in women <65 years of age can be explained by less access to high-quality health insurance coverage among Black women.[22] See *Cancer Facts & Figures for African Americans/Black People*, available online at cancer.org/statistics, for more information.

American Indian and Alaska Native (AIAN) individuals: Like other broad racial and ethnic groups, AIAN individuals are culturally and geographically diverse and have widely different cancer rates because of variations in risk factor prevalence, such as smoking, excess body weight, and hypertension. For example, lung cancer incidence in AIAN men is nearly double that in White men in the Northern Plains, but less than half that in White men in the Southwest.[23] Notably, in

contrast to White individuals, lung cancer is the most commonly diagnosed cancer among AIAN men and women combined in every region except the Southwest and Alaska, where it is second after colorectal cancer. The Alaska Native population has the highest colorectal cancer incidence in the US (89 per 100,000 during 2015-2019), at least double the rates in American Indian (46), Black (42), or White (36) individuals. Kidney cancer incidence and death rates in the overall AIAN population are also the highest among the broad racial and ethnic groups (Table 9) and are elevated in every region compared to White individuals except in the East. See the *Cancer Facts & Figures 2022* Special Section on Cancer in the American Indian and Alaska Native Population, available online at cancer.org/statistics, for more information.

Asian American and Pacific Islander (AAPI) individuals: Cancer is the leading cause of death among Asian Americans, but the second-leading cause (after heart disease) among Native Hawaiian and other Pacific Islander individuals. As with other broad racial and ethnic groups, cancer statistics for Asian American and Pacific Islander individuals are typically merged because of limited data, including accurate population estimates, for smaller more homogenous groups, e.g., by nativity. Low rates for AAPI individuals combined thus mask wide variation in occurrence by geographic origin, language, acculturation, and socioeconomic status.[24, 25] For example, lung cancer incidence in the AAPI population overall is about half that in White individuals (Table 9), but in Native Hawaiian people specifically, rates surpass those in Whites because of historically high smoking prevalence.[1] Despite the lowest rate for all cancers combined, AAPI people have liver and stomach cancer rates that are about double those in White individuals (Table 9), and even higher for some high-risk groups, such as Korean individuals; however, rates are lower than Whites among Asian Indian/Pakistani individuals.[13] See the *Cancer Facts & Figures 2016* Special Section on Cancer in Asian American, Native Hawaiians, and Pacific Islanders, available online at cancer.org/statistics, for more information.

Hispanic/Latino individuals: The Hispanic population is the second-largest racial and ethnic group in the US (19%) and the second fastest-growing after AAPI individuals. The Hispanic population within the US is comprised of more than 20 heritage groups, with the majority of individuals identifying as having Mexican heritage (62%), followed by Puerto Rican (10%), Cuban (4%), Salvadoran (4%), Dominican (4%), and Guatemalan (3%). Among Hispanic individuals in the US combined, cancer was the leading cause of death prior to 2020, but was displaced by COVID-19 because of its disproportionate burden on this population. Compared to (non-Hispanic) White people, Hispanic individuals have lower overall rates for the most common cancers (female breast, colorectum, lung, and prostate), but among the highest rates for cancers associated with infectious agents. For example, cervical cancer incidence is more than 30% higher in Hispanic women than in White women, and liver and stomach cancer rates in Hispanic persons are double those in Whites (Table 9). However, cancer incidence rates vary substantially by country of origin, generation, birthplace, and duration of residence in the US due to acculturation and other factors.[26] For example, prostate cancer incidence is about 16% lower in Hispanic men than in White men (Table 9), but 44% higher in men residing in Puerto Rico, which is 99% Hispanic (Table 4). Although emerging studies are untangling differences between Hispanic heritage groups, the diversity that constitutes this population remains poorly understood and more research and focused attention are needed.

See *Cancer Facts & Figures for Hispanic/Latino People*, available online at cancer.org/statistics, for more information.

For information about American Cancer Society efforts to reduce the cancer burden among historically excluded populations, see the Advocacy section on page 71.

References

1. Zavala VA, Bracci PM, Carethers JM, et al. Cancer health disparities in racial/ethnic minorities in the United States. *Br J Cancer*. 2021;124(2):315-332.

2. Warner E, Foulkes W, Goodwin P, et al. Prevalence and Penetrance of BRCA1 and BRCA2 Gene Mutations in Unselected Ashkenazi Jewish Women With Breast Cancer. *J Natl Cancer Inst*. 1999;91(14):1241-1247. doi:10.1093/jnci/91.14.1241

3. Singh GK, Jemal A. Socioeconomic and Racial/Ethnic Disparities in Cancer Mortality, Incidence, and Survival in the United States, 1950-2014: Over Six Decades of Changing Patterns and Widening Inequalities. *J Environ Public Health*. 2017;2017:2819372. doi:10.1155/2017/2819372

4. Ma J, Jemal A. Temporal Trends in Mortality From Major Cancers by Education in the United States, 2001-2016. *JNCI Cancer Spectrum*. 2019;3(4):pkz087.

5. American Cancer Society. *Cancer Prevention & Early Detection Facts & Figures* Tables and Figures 2022. American Cancer Society; 2022.

6. Pampel FC, Krueger PM, Denney JT. Socioeconomic disparities in health behaviors. *Annu Rev Onc*. 2010;36:349-370.

7. Bowe B, Xie Y, Yan Y, Al-Aly Z. Burden of Cause-Specific Mortality Associated With PM2.5 Air Pollution in the United States. *JAMA Network Open*. 2019;2(11):e1915834-e1915834. doi:10.1001/jamanetworkopen.2019.15834

8. Zhao J, Han X, Nogueira L, et al. Health insurance status and cancer stage at diagnosis and survival in the United States. *CA Cancer J Clin*. Jul 13 2022;doi:10.3322/caac.21732

9. Islami F, Guerra CE, Minihan A, et al. American Cancer Society's report on the status of cancer disparities in the United States, 2021. *CA Cancer J Clin*. Mar 2022;72(2):112-143. doi:10.3322/caac.21703

10. Smith GL, Banegas MP, Acquati C, et al. Navigating financial toxicity in patients with cancer: A multidisciplinary management approach. *CA Cancer J Clin*. May 18 2022;doi:10.3322/caac.21730

11. Zheng Z, Han X, Zhao J, et al. Financial Hardship, Healthcare Utilization, and Health Among U.S. Cancer Survivors. *Am J Prev Med*. Jul 2020;59(1):68-78. doi:10.1016/j.amepre.2020.02.016

12. Creamer J, Shrider EA, Burns K, Chen F. U.S. Census Bureau, Current Population Reports, P60-277, Poverty in the United States: 2021, U.S. Government Publishing Office, Washington, DC, September 2022.

13. CancerDisparitiesProgressReport.org [Internet]. Philadelphia: American Association for Cancer Research; 2022. Available from http://www.CancerDisparitiesProgressReport.org/ (Accessed August 19, 2022).

14. Kish JK, Yu M, Percy-Laurry A, Altekruse SF. Racial and ethnic disparities in cancer survival by neighborhood socioeconomic status in Surveillance, Epidemiology, and End Results (SEER) Registries. *J Natl Cancer Inst Monogr*. Nov 2014;2014(49):236-43. doi:10.1093/jncimonographs/lgu020

15. Dong J, Garacci Z, Buradagunta CS, et al. Black patients with multiple myeloma have better survival than white patients when treated equally: a matched cohort study. *Blood Cancer J*. Feb 24 2022;12(2):34. doi:10.1038/s41408-022-00633-5

16. Riviere P, Luterstein E, Kumar A, et al. Survival of African American and non-Hispanic white men with prostate cancer in an equal-access health care system. *Cancer*. 2020;126(8):1683-1690.

17. Dess RT, Hartman HE, Mahal BA, et al. Association of Black Race With Prostate Cancer-Specific and Other-Cause Mortality. *JAMA Oncol*. Jul 1 2019;5(7):975-983. doi:10.1001/jamaoncol.2019.0826

18. Snyder RA, He J, Le-Rademacher J, et al. Racial differences in survival and response to therapy in patients with metastatic colorectal cancer: A secondary analysis of CALGB/SWOG 80405 (Alliance A151931). *Cancer*. Oct 15 2021;127(20):3801-3808. doi:10.1002/cncr.33649

19. Unger JM, Moseley AB, Cheung CK, et al. Persistent Disparity: Socioeconomic Deprivation and Cancer Outcomes in Patients Treated in Clinical Trials. *J Clin Oncol*. Apr 20 2021;39(12):1339-1348. doi:10.1200/JCO.20.02602

20. Wang WJ, Ramsey SD, Bennette CS, Bansal A. Racial Disparities in Access to Prostate Cancer Clinical Trials: A County-Level Analysis. *JNCI Cancer Spectr*. Feb 2022;6(1)doi:10.1093/jncics/pkab093

21. Grant SR, Lin TA, Miller AB, et al. Racial and Ethnic Disparities Among Participants in US-Based Phase 3 Randomized Cancer Clinical Trials. *JNCI Cancer Spectr*. Oct 2020;4(5):pkaa060. doi:10.1093/jncics/pkaa060

22. Jemal A, Robbins AS, Lin CC, et al. Factors That Contributed to Black-White Disparities in Survival Among Nonelderly Women With Breast Cancer Between 2004 and 2013. *J Clin Oncol*. Jan 1 2018;36(1):14-24. doi:10.1200/JCO.2017.73.7932

23. Kratzer TB, Siegel RL, Miller KD, et al. Cancer statistics for American Indians and Alaska Native individuals, 2022: Increasing disparities in early-onset colorectal cancer. *CA Cancer J Clin*. 2022;published online November 8, 2022.

24. Torre LA, Sauer AM, Chen MS, Jr., Kagawa-Singer M, Jemal A, Siegel RL. Cancer statistics for Asian Americans, Native Hawaiians, and Pacific Islanders, 2016: Converging incidence in males and females. *CA Cancer J Clin*. May 2016;66(3):182-202. doi:10.3322/caac.21335

25. Lee RJ, Madan RA, Kim J, Posadas EM, Yu EY. Disparities in cancer care and the Asian American population. *The Oncologist*. 2021;26(6):453-460.

26. Miller KD, Ortiz AP, Pinheiro PS, et al. Cancer statistics for the US Hispanic/Latino population, 2021. *CA Cancer J Clin*. Nov 2021;71(6):466-487. doi:10.3322/caac.21695

Tobacco Use

Despite the well-established health hazards, tobacco use remains the most preventable cause of cancer occurrence and death in the US.[1] Cigarette smoking still causes about 30% of all cancer deaths,[2, 3] and as much as 40% in parts of the South and Appalachia, despite decades of declining smoking rates.[4] Current smoking prevalence is especially high among persons who live in rural areas or are American Indian or Alaska Native; lesbian, gay, or bisexual; who have low income or education; or who have a disability or history of mental illness.[5] In 2021, about 46 million US adults (19%) used a commercial tobacco product.

Cigarette Smoking

Cigarette smoking increases the risk of at least 12 cancers, including those of the oral cavity and pharynx, larynx, lung, esophagus, pancreas, uterine cervix, kidney, bladder, stomach, colorectum, and liver, as well as acute myeloid leukemia (Figure 4).[6] Smoking may also increase the risk of fatal prostate cancer and a rare type of ovarian cancer.[6-8]

- The prevalence of current cigarette smoking among US adults ages 18 and older has declined from 42% in 1965 to 12% in 2021, with the steepest drop among the youngest individuals (18-24 years of age; males: 54% to 6%, females: 38% to 4%).[9, 10]
- In 2021, there continued to be wide variation in smoking prevalence by racial/ethnic group, ranging from 5% among Asian adults to 19% among American Indian/Alaska Native adults.[10]
- Cigarette smoking prevalence remains high among those with low levels of education; for example, among adults 25 years of age and older, 21% of those with less than a high school diploma and 31% of those with a GED (General Educational Development) smoked in 2021, compared to 3% of those with graduate degrees.[10]
- At the state level, adult cigarette smoking prevalence in 2020 ranged from 8% in Utah and California to 23% in West Virginia.[11]
- Among US high school students, the prevalence of current cigarette smoking (past month) in 2021 was 2% (males: 2%, females: 2%),[12] down from 29% in 1999.[13]

Other Combustible Tobacco Products

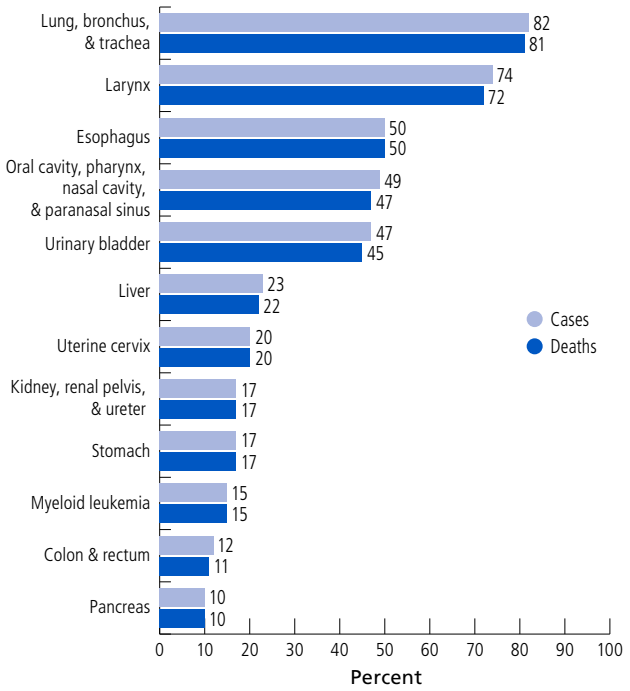
In addition to cigarettes, other forms of combustible tobacco include cigars, pipes, waterpipes (also known as hookahs or shishas), and roll-your-own products. Persons who smoke cigars regularly have an increased risk of cancers of the lung, oral cavity, larynx, and esophagus.[14-16] Waterpipe smoking is often perceived to be less harmful than cigarettes, but it delivers the same or higher levels of toxins[17] and probably has the same adverse health effects as cigarettes.[18-20]

- In 2021, 4% of adults (men: 6%, women: 1%) reported currently smoking cigars.[10]
- Cigar smoking was more common among Black (5%) and White persons (4%) than among Hispanic (2%) or Asian (1%) persons.[10]
- Among high school students, 2% (1% of girls and 2% of boys) had smoked cigars at least once in the past month in 2020.[12]
- Cigar smoking is highest among Black students (3%), compared to White (1%) or Hispanic (1%) students.[12]
- In 2020, waterpipe smoking in the past month was reported by 1% of high school students[12] and 2% of adults 18-24 years of age reported regular use.[5]

E-cigarettes

Electronic cigarettes, or e-cigarettes, are devices that aerosolize a liquid that typically contains nicotine, propylene glycol and/or vegetable glycerin, flavoring, and other ingredients that is then inhaled by users.

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



Source: Islami F, et al. *CA Cancer J Clin* 2018; 68(1):31.
©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

Potentially harmful substances include metals and other hazardous chemicals that can seep into the inhaled aerosol, as well as some flavoring components or additives. There is accumulating evidence that e-cigarette use causes short-term adverse effects on airways and blood vessels,[21] but long-term risks are not yet known.[22] E-cigarettes are additionally concerning because they are addictive and may be a gateway to combustible tobacco among some individuals who would otherwise not have smoked. Adolescents and young adults who use e-cigarettes are more likely than nonusers to begin using combustible tobacco products.[23, 24] E-cigarette use is particularly concerning among youth because nicotine can impair adolescent brain development.[25]

The American Cancer Society recommends that youth and young adults not use any tobacco product, including e-cigarettes. To date, no e-cigarette has been FDA-approved as a cessation aid. Visit cancer.org/healthy/stay-away-from-tobacco/e-cigarette-position-statement.html for more information about the American Cancer Society's position on e-cigarettes.

- About 5% of adults were current e-cigarette users in 2021 (5% of males and 4% of females), with prevalence higher in younger people (ages 18-24 years: 11%, 25-44 years: 6%) than older people (≥65 years of age: 0.9%).[10]
- In 2021, e-cigarettes were the most commonly used tobacco product among high school (past-month use: 11.3%; 1.72 million users) and middle school students (2.8%; 0.32 million).[12]
- In 2020, e-cigarette use was similar in high school girls (8%) and boys (7%) but was higher among White students (10%) compared to Hispanic (6%) and Black (4%) students.[12]

Smokeless Tobacco Products

The major smokeless tobacco products marketed in the US are chewing tobacco and snuff, including snus (a "spitless," moist powder tobacco, often in a pouch). These products can cause oral, esophageal, and pancreatic cancers and are not a safe alternative to cigarettes.[26] Switching from combustible to spit tobacco has been shown to result in a higher risk of tobacco-related death than complete tobacco cessation.[27]

- In 2021, 4% of men and 0.3% of women were current (every day or some days) users of smokeless tobacco,[10] a pattern that has remained stable since 2003.[28]
- Among US states and territories, adult smokeless tobacco use in 2020 ranged from 0.6% in Puerto Rico to 10% in Wyoming.[11]
- In 2020, 1.3% of high school boys and 0.5% of girls had used smokeless tobacco in the past month.[12]

Secondhand Smoke

Secondhand smoke (SHS) contains more than 7,000 chemicals, including hundreds that are toxic and at least 69 that can cause cancer.[6] There is no safe level of exposure to SHS. People who don't smoke who are exposed to SHS are at increased risk of lung cancer,

other respiratory diseases, and heart disease.[29-31] Approximately 3,600 lung cancer deaths in the US in 2023 will be the result of SHS exposure.[2] Comprehensive smoke-free laws are effective in reducing SHS exposure by modifying smoking behavior and reducing smoking-related disease.[31]

- Nationwide, SHS exposure (measured by testing a person's blood for cotinine, a by-product of nicotine) among people who don't smoke declined from 88% in 1988-1991 to 28% in 2009-2010 and 21% in 2017-2018, but remains substantially higher among Black (40%) persons than other racial/ethnic groups (Hispanic: 17%, White: 18%, Asian: 21%); exposure also decreases with increasing family income.[32]
- SHS exposure is highest among youth ages 3-17 years (35%), especially those who are Black (62%) versus White (34%), Hispanic (25%), or Asian (18%).[33]

Smoking Cessation

People who quit smoking increase their longevity regardless of age; however, those who quit by age 30 live an average of 10 years longer than if they had continued to smoke.[34, 35] Smoking cessation reduces the risk of at least 12 cancers, as well as heart disease and many other smoking-related diseases, and also improves outcomes for cancer survivors.[35] The 2020 US Surgeon General's report on smoking cessation noted historical improvements in several cessation indicators among US adults overall, but also found persistent disparities by sociodemographic, racial/ethnic, and geographic factors.[35]

- In 2021, 2 out of 3 persons (67%, 56 million) who had ever smoked at least 100 cigarettes had quit (also known as the "quit ratio"), up from 52% in 2009.[10, 36]
- However, the quit ratio in 2021 was <50% in persons who were at <100% of the federal poverty level (46%), uninsured (44%), or Medicaid insured (47%).[10]
- For the first time since 2011, the annual prevalence of past-year quit attempts among US adults who smoke declined from 65% in 2019 to 63% in 2020, coinciding with the onset of the COVID-19 pandemic.[37]
- Although use of effective cessation treatments (i.e., counseling; FDA-approved nicotine replacement therapy or medications, such as varenicline [Chantix] or bupropion [Zyban]) can double or triple the likelihood of successfully quitting long term, only about one-third of people who smoke used these aids in 2018-2019.[38]

Reducing Tobacco Use and Exposure

Numerous federal, state, and local tobacco control policies have been enacted since the release of the 1964 Surgeon General's Report on Smoking and Health, including increasing cigarette taxes, improving access to cessation treatment, implementing smoke-free workplace laws, improving health warnings, and regulating tobacco marketing.[6] These policies have helped reduce smoking prevalence and avert approximately 2 million smoking-related deaths.[39]

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 manufacture, sale, and marketing of tobacco products. In April 2022, after substantial public health advocacy, including from our advocacy affiliate, the American Cancer Society Cancer Action Network℠ (ACS CAN), the FDA proposed product standards to prohibit menthol and other flavoring in cigarettes and cigars.[40-42] When in effect, this regulation has the potential to reduce smoking initiation and encourage cessation, especially among Black persons, sexual and gender minority persons, and those with lower socioeconomic status who have disproportionately high use of menthol and flavored products because of targeted advertising by the tobacco industry.[41, 43, 44] Other federal efforts include the FDA's highly successful mass media educational campaigns (e.g., "The Real Cost" targeting youth and "Every Try Counts" targeting adults who smoke) and an increase in the federal minimum age to purchase tobacco from age 18 to 21. 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 (i.e., counseling, nicotine replacement therapy, medications), although for many people, minimum coverage falls short of what is needed for long-term cessation.[35]

State initiatives have been on the forefront of effective tobacco control. Since 2000, all but two states – Missouri and North Dakota – have raised their cigarette taxes, and about 63% of the population is covered by a comprehensive smoke-free law.[45] The Centers for Disease Control and Prevention recommends best practices and funding levels for state tobacco control programs.[46] Unfortunately, for fiscal year 2022, the funding level for state tobacco prevention programs was less than 1% of the recommended level for three states (Connecticut, Georgia, and Missouri) and less than 50% of the recommended level for all states except Alaska, California, Hawaii, Delaware, Maine, North Dakota, Oklahoma, Oregon, Utah, and Wyoming.

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, more than 31 million people still smoke cigarettes, a disproportionate number of whom are lower income. Numerous studies confirm that adequately funded comprehensive tobacco control efforts can improve health and save lives, including higher taxes, 100% smoke-free laws, barrier-free tobacco cessation treatment coverage, graphic cigarette package warnings, and regulations to reduce the appeal and addictiveness of tobacco products, including menthol and flavor bans.

See *Cancer Prevention & Early Detection Facts & Figures* at cancer.org/statistics for more information about tobacco control in the US, including the role of taxation. Visit the ACS CAN website at fightcancer.org/what-we-do/tobacco-control for information on US tobacco control advocacy. See *The Tobacco Atlas* at tobaccoatlas.org for a comprehensive presentation of tobacco-related problems and solutions on a global scale.

References

1. Patel AV, Deubler E, Teras LR, et al. Key risk factors for the relative and absolute 5-year risk of cancer to enhance cancer screening and prevention. *Cancer*. 2022.

2. Islami F, Goding Sauer A, Miller KD, et al. Proportion and number of cancer cases and deaths attributable to potentially modifiable risk factors in the United States. *CA Cancer J Clin*. 2018;68(1): 31-54.

3. Jacobs EJ, Newton CC, Carter BD, et al. What proportion of cancer deaths in the contemporary United States is attributable to cigarette smoking? *Ann Epidemiol*. 2015;25(3): 179-182.

4. Islami F, Bandi P, Sahar L, Ma J, Drope J, Jemal A. Cancer deaths attributable to cigarette smoking in 152 U.S. metropolitan or micropolitan statistical areas, 2013-2017. *Cancer Causes Control*. 2021;32(3): 311-316.

5. Cornelius ME, Loretan CG, Wang TW, Jamal A, Homa DM. Tobacco Product Use Among Adults – United States, 2020. *MMWR Morb Mortal Wkly Rep*. 2022;71(11): 397-405.

6. US Department of Health and Human Services. *The Health Consequences of Smoking-50 Years of Progress. A Report from the Surgeon General*. Atlanta, GA; USA: Department of Health and Human Services. Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 2014.

7. Secretan B, Straif K, Baan R, et al. A review of human carcinogens – Part E: tobacco, areca nut, alcohol, coal smoke, and salted fish. *Lancet Oncol*. 2009 10(1033-1034.

8. Foerster B, Pozo C, Abufaraj M, et al. Association of Smoking Status With Recurrence, Metastasis, and Mortality Among Patients With Localized Prostate Cancer Undergoing Prostatectomy or Radiotherapy: A Systematic Review and Meta-analysis. *JAMA Oncol*. 2018;4(7): 953-961.

9. National Center for Health Statistics. *Health, United States, 2017: With Chartbook on Long-term Trends in Health*. Hyattsville, MD, 2018.

10. National Center for Health Statistics. National Health Interview Survey, 2021. Public-use data file and documentation. Available from URL: https://www.cdc.gov/nchs/nhis/2020nhis.htm [accessed October 6, 2021].

11. Center for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Survey Data, 2020. Available from URL: https://www.cdc.gov/brfss/annual_data/annual_data.htm [accessed August 31, 2021].

12. Gentzke AS, Wang TW, Cornelius M, et al. Tobacco Product Use and Associated Factors Among Middle and High School Students – National Youth Tobacco Survey, United States, 2021. *MMWR Surveill Summ*. 2022;71(5): 1-29.

13. Centers for Disease Control and Prevention. Youth Tobacco Surveillance United States, 1998-1999. *MMWR Surveill Summ*. 2000;49(10).

14. Baker F, Ainsworth SR, Dye JT, et al. Health risks associated with cigar smoking. *JAMA*. 2000;284(6): 735-740.

15. Shanks TG, Burns DM. Disease consequences of cigar smoking. *National Cancer Institute, Smoking and Tobacco Control, Monograph 9: Cigars – Health Effects and Trends*. Washington, DC: National Institutes of Health, 1998.

16. Shapiro JA, Jacobs EJ, Thun MJ. Cigar smoking in men and risk of death from tobacco-related cancers. *J Natl Cancer Inst*. 2000;92(4): 333-337.

17. Knishkowy B, Amitai Y. Water-pipe (narghile) smoking: an emerging health risk behavior. *Pediatrics*. 2005;116(1): e113-119.

18. Waziry R, Jawad M, Ballout RA, Al Akel M, Akl EA. The effects of waterpipe tobacco smoking on health outcomes: an updated systematic review and meta-analysis. *Int J Epidemiol*. 2017;46(1): 32-43.

19. Montazeri Z, Nyiraneza C, El-Katerji H, Little J. Waterpipe smoking and cancer: systematic review and meta-analysis. *Tob Control*. 2017;26(1): 92-97.

20. Qasim H, Alarabi AB, Alzoubi KH, Karim ZA, Alshbool FZ, Khasawneh FT. The effects of hookah/waterpipe smoking on general health and the cardiovascular system. *Environ Health Prev Med*. 2019;24(1): 58.

21. Neczypor EW, Mears MJ, Ghosh A, et al. E-Cigarettes and Cardiopulmonary Health: Review for Clinicians. *Circulation*. 2022;145(3): 219-232.

22. National Academy of Sciences E, and Medicine. *Public Health Consequences of E-Cigarettes*. Washington, DC: The National Academies Press, 2018.

23. Khouja JN, Suddell SF, Peters SE, Taylor AE, Munafo MR. Is e-cigarette use in non-smoking young adults associated with later smoking? A systematic review and meta-analysis. *Tob Control*. 2020.

24. Leventhal AM, Strong DR, Kirkpatrick MG, et al. Association of Electronic Cigarette Use With Initiation of Combustible Tobacco Product Smoking in Early Adolescence. *JAMA*. 2015;314(7): 700-707.

25. US Department of Health and Human Services. *E-Cigarette Use Among Youth and Young Adults*. Rockville, MD: US Department of Health and Human Services, Office of the Surgeon General, 2016.

26. Boffetta P, Hecht S, Gray N, Gupta P, Straif K. Smokeless tobacco and cancer. *Lancet Oncol*. 2008;9(7): 667-675.

27. Henley SJ, Connell CJ, Richter P, et al. Tobacco-related disease mortality among men who switched from cigarettes to spit tobacco. *Tob Control*. 2007;16(1): 22-28.

28. Chang JT, Levy DT, Meza R. Trends and Factors Related to Smokeless Tobacco Use in the United States. *Nicotine Tob Res*. 2016;18(8): 1740-1748.

29. International Agency for Research on Cancer. *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Volume 83: Tobacco smoke and Involuntary Smoking*. Lyon, France: IARC, 2004.

30. US Department of Health and Human Services. *The Health Consequences of Involuntary Exposure to Tobacco Smoke. A Report from the Surgeon General*. Washington, DC: US Department of Health and Human Services, Centers for Disease Control and Prevention and Health Promotion, Office of Smoking and Health, 2006.

31. Institute of Medicine. *Secondhand Smoke Exposure and Cardiovascular Effects: Making Sense of the Evidence*. Washington, DC: Institute of Medicine, 2009.

32. Brody DJ, Faust E, Tsai J. Secondhand Smoke Exposure Among Nonsmoking Adults: United States, 2015-2018. *NCHS Data Brief*. 2021369): 1-8.

33. Brody DJ, Lu Z, Tsai J. Secondhand Smoke Exposure Among Nonsmoking Youth: United States, 2013-2016. *NCHS Data Brief*. 2019;348(

34. Doll R, Peto R, Boreham J, Sutherland I. Mortality in relation to smoking: 50 years' observation on male British doctors. *BMJ*. 2004;328(1519-1527.

35. US Department of Health and Human Services. *Smoking Cessation. A Report of the Surgeon General*. Atlanta, GA: Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office of Smoking and Health, 2020.

36. Creamer MR, Wang TW, Babb S, et al. Tobacco Product Use and Cessation Indicators Among Adults – United States, 2018. *MMWR Morb Mortal Wkly Rep*. 2019;68(45): 1013-1019.

37. Bandi P, Asare S, Majmundar A, et al. Changes in Smoking Cessation-Related Behaviors Among US Adults During the COVID-19 Pandemic. *JAMA Network Open*. 2022;5(8): e2225149-e2225149.

38. Bandi P, Minihan AK, Siegel RL, et al. Updated Review of Major Cancer Risk Factors and Screening Test Use in the United States in 2018 and 2019, with a Focus on Smoking Cessation. *Cancer Epidemiol Biomarkers Prev*. 2021;30(7): 1287-1299.

39. Levy DT, Meza R, Zhang Y, Holford TR. Gauging the Effect of U.S. Tobacco Control Policies From 1965 Through 2014 Using SimSmoke. *Am J Prev Med*. 2016;50(4): 535-542.

40. US Food and Drug Administration. FDA Proposes Rules Prohibiting Menthol Cigarettes and Flavored Cigars to Prevent Youth Initiation, Significantly Reduce Tobacco-Related Disease and Death, 2022.

41. Campaign for Tobacco Free Kids. Impact of Menthol Cigarettes on Youth Smoking Initiation and Health Disparities. Available from URL: https://www.tobaccofreekids.org/assets/factsheets/0390.pdf [accessed July 12, 2022].

42. Smith PH, Assefa B, Kainth S, Salas-Ramirez KY, McKee SA, Giovino GA. Use of Mentholated Cigarettes and Likelihood of Smoking Cessation in the United States: A Meta-Analysis. *Nicotine Tob Res*. 2020;22(3): 307-316.

43. Levy DT, Cadham CJ, Sanchez-Romero LM, et al. An Expert Elicitation on the Effects of a Ban on Menthol Cigarettes and Cigars in the United States. *Nicotine Tob Res*. 2021;23(11): 1911-1920.

44. Levy DT, Meza R, Yuan Z, et al. Public health impact of a US ban on menthol in cigarettes and cigars: a simulation study. *Tob Control*. 2021.

45. American Nonsmokers' Rights Foundation. Overview List – How many Smokefree Laws? Available from URL: http://no-smoke.org/wp-content/uploads/pdf/mediaordlist.pdf [accessed July 12, 2022].

46. Centers for Disease Control and Prevention. *Best Practices for Comprehensive Tobacco Control Programs-2014*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014.

Nutrition & Physical Activity

Aside from avoiding tobacco use, maintaining a healthy body weight, being physically active, consuming a healthy diet, and avoiding or limiting alcohol intake are the most effective strategies for reducing cancer risk. An estimated 18% of cancer cases and 16% of cancer deaths are attributable to the combined effects of excess body weight, alcohol consumption, physical inactivity, and an unhealthy diet.[1] In 2020, the American Cancer Society (ACS) released new diet and physical activity guidelines for reducing cancer risk.[2] These guidelines include community action recommendations because of the strong influence of environment on individual diet and physical activity choices. Research has shown that adults who most closely followed prior ACS recommendations are 10%-20% less likely to be diagnosed with cancer and 25% less likely to die from the disease.[3]

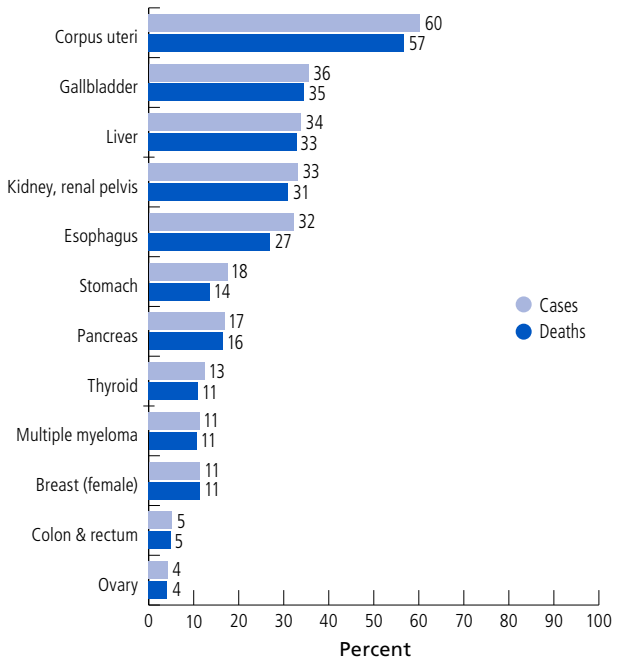
Excess Body Weight

Excess body weight (i.e., overweight or obesity) is associated with an increased risk of developing several types of cancer: uterine corpus (endometrium), esophagus (adenocarcinoma), liver, stomach (cardia), kidney (renal cell), meningioma, multiple myeloma, pancreas, colorectum, gallbladder, ovary, female breast (postmenopausal), and thyroid.[4] There is some evidence that excess body weight may also increase the risk for cancers of the mouth, pharynx, larynx, and male breast, as well as fatal prostate cancer and non-Hodgkin lymphoma (diffuse large B-cell lymphoma).[5]

Excess body weight accounts for a larger proportion of cancer in women (11%) than in men (5%) because it is associated with several female cancers.[1] The cancer burden is also influenced by the strength of the association with excess weight. For example, 60% of uterine corpus cancers are attributed to excess body weight compared to 4% of ovarian cancers (Figure 5).[1] 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 that begins during childhood.[6, 7] However, emerging research suggests that even modest sustained weight loss can help mitigate breast cancer risk among women ages 50 and older (who do not use hormone replacement therapy).[8]

- The prevalence of overweight (body mass index [BMI] – defined as weight in kilograms divided by the square of height in meters – 25.0 to 29.9 kg/m^2) has remained relatively stable among US adults (ages 20-74 years) since the early 1960s at about 40% in men and 25%-30% in women.[9]
- In contrast, obesity (BMI ≥30 kg/m^2) prevalence among adults has markedly increased from 11% of men and 16% of women during 1960-1962 to 42% of men and women during 2017-March 2020.[9, 10]
- Studies indicate that US adult obesity prevalence increased during the COVID-19 pandemic, although more years of data are needed to assess whether this may be a continuation of the established trend.[11, 12]
- During 2017-March 2020, obesity prevalence among men was highest in Hispanic persons (46%), followed by those who were White (44%), Black (41%), and Asian (19%); among women, obesity was highest among Black persons (59%), followed by those who were Hispanic (46%), white (40%), and Asian (15%).[10]
- Among youth (ages 2-19 years), overweight (BMI-for-age from 85th to <95th percentile) prevalence increased from 10% in the early 1970s to 17% during 2017-March 2020, whereas obesity (BMI-for-age ≥95th percentile) prevalence rose four-fold, from 5% in the early 1970s to 20% during 2017-March 2020.[10, 13]
- Based on cohort studies, obesity prevalence among youth appears to have risen more sharply during the COVID-19 pandemic compared to the pre-pandemic period, particularly among children ages 6-11 years, among whom the rate of increase in BMI was 2.5 times steeper.[14, 15]

Figure 5. Proportion of Cancer Cases and Deaths Attributable to Excess Body Weight in Adults 30 Years and Older, US, 2014



Source: Islami F, et al. *CA Cancer J Clin* 2018; 68(1):31.
©2023, American Cancer Society, Inc., Surveillance and Health Equity Science

- Between 1999-2000 and 2017-March 2020, there was a statistically significant increase in obesity prevalence among adolescents (ages 12-19 years) who were Mexican American (22% to 33%) and Black (21% to 29%) but not in those who were White adolescents (14% to 19%).[10, 16]
- During 2017-March 2020, the prevalence of overweight/obese was 29% among children ages 2-5 years, 37% among children ages 6-11 years, and 40% among adolescents ages 12-19 years.[10]

Physical Activity

Physical activity decreases the risk of cancers of the colon (but not rectum), female breast, endometrium, kidney, bladder, esophagus (adenocarcinoma), stomach (cardia), and possibly lung.[17-19] Approximately 3% of cancer cases are attributed to physical inactivity, ranging from 2% in Utah to 4% in Kentucky, although this is likely an underestimate because it excludes lung cancers and other cancer sites that might be associated with physical inactivity.[20] Cancer patients who are physically active are less likely to have adverse effects from treatment and to die from their cancer than those who are inactive.[21] Extended leisure-time sitting has also been associated with increased risk of cancer death,[22] whereas replacing sedentary time with even short durations of moderate- to vigorous-intensity aerobic physical activity appears to reduce cancer mortality.[23]

- The prevalence of adults who met recommended aerobic activity levels increased from 40% in 1998 to 54% in 2018; although the estimate appeared to drop in 2020 to 48%, this may reflect changes in survey design in 2019.[24, 25]
- In 2020, 26% of adults reported no leisure-time physical activity (men: 25%, women: 28%), with a higher proportion of Black (33%) and Hispanic (35%) persons reporting physical inactivity than those who were White (23%) and Asian (23%).[25]
- In 2019, only 23% of US high school students (males: 31%, females: 15%) had engaged in the recommended minimum of 60 minutes of daily physical activity on all 7 days in the previous week, ranging from 21% in students who were Black or Hispanic to 27% in those who were American Indian/Alaskan Native.[26]

Diet

Approximately 4%-5% of all cancer cases are attributed to poor diet.[1] 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),[27] whereas those with an emphasis on a variety of fruits and vegetables, whole grains, legumes, fish or poultry, and fewer red and processed meats are associated with lower risk.[28, 29] One study found that individuals who have the healthiest diet have a 11%-24% lower risk of cancer death than those with the least healthy diet.[30] Moreover, cancer survivors who follow a healthy diet pattern have a 17%-18% lower risk of dying from cancer or other causes.[28]

2020 American Cancer Society Guideline on Diet and Physical Activity for Cancer Prevention[1]

Recommendations for individuals

1. Achieve and maintain a healthy body weight throughout life.

Keep body weight within the healthy range and avoid weight gain in adult life.

2. Be physically active.

Adults should engage in 150-300 minutes of moderate-intensity physical activity per week, or 75-150 minutes of vigorous-intensity physical activity, or an equivalent combination; achieving or exceeding the upper limit of 300 minutes is optimal.

Children and adolescents should engage in at least 1 hour of moderate- or vigorous-intensity activity each day.

Limit sedentary behavior, such as sitting, lying down, and watching television, and other forms of screen-based entertainment.

3. Follow a healthy eating pattern at all ages.

A healthy eating pattern includes:

- Foods that are high in nutrients in amounts that help achieve and maintain a healthy body weight
- A variety of vegetables – dark green, red, and orange, fiber-rich legumes (beans and peas), and others
- Fruits, especially whole fruits with a variety of colors
- Whole grains

A healthy eating pattern limits or does not include:

- Red and processed meats
- Sugar-sweetened beverages
- Highly processed foods and refined-grain products

4. It is best not to drink alcohol.

People who do choose to drink alcohol should limit their consumption to no more than 1 drink per day for women and 2 drinks per day for men.

Recommendation for community action

Public, private, and community organizations should work collaboratively at national, state, and local levels to develop, advocate for, and implement policy and environmental changes that increase access to affordable, nutritious foods; provide safe, enjoyable, and accessible opportunities for physical activity; and limit alcohol for all individuals.

For more information:

Visit cancer.org/healthy/eat-healthy-get-active/acs-guidelines-nutrition-physical-activity-cancer-prevention/guidelines.html for the diet and physical activity guideline for cancer prevention.

Visit cancer.org/health-care-professionals/american-cancer-society-prevention-early-detection-guidelines/nupa-guidelines-for-cancer-survivors.html for the nutrition and physical activity guideline for cancer survivors.

- Among adults, a median of 27% reported eating two or more servings of fruit per day, and 13% reported eating vegetables three or more times per day in 2019.[31]
- Between 1999-2002 and 2015-2018, total energy intake (kcal) from carbohydrates (51% to 45%) declined while intake from fat (33% to 36%) and protein (15% to 16%) increased among adults ages 20 years and older.[32]
- Between 1999 and 2018, total energy consumed from ultraprocessed foods (e.g., packaged snacks, sugar-sweetened beverages, candy, industrial breads/cereals, ready-to-eat dishes, and reconstituted meat) among youth ages 2-19 years increased from 61% to 67%, with significantly larger increases in Black and Mexican American youth than among White youth.[33]

Alcohol

Alcohol consumption increases risk for cancers of the mouth, pharynx, larynx, esophagus (squamous cell carcinoma), liver, colorectum, female breast, and stomach.[34] An estimated 5% to 6% of cancer cases are attributed to alcohol consumption, ranging from 3% in Utah to 7% in Delaware.[1, 35] Cancer risk increases with alcohol volume, and even a few drinks per week appear to increase risk for some cancers.[36] Alcohol consumption combined with tobacco use synergistically increases the risk of cancers of the mouth, pharynx, larynx, and esophagus far more than the additive effect of these exposures individually.[37]

- In 2020, 70% of adults reported current alcohol consumption (≥12 drinks in lifetime and ≥1 drink in the past year).[25]
- About 6% reported heavy drinking ([male] >14 drinks/week in the past year or [female] >7 drinks/week in the past year) in 2020, ranging from 2% in Asian persons to 8% in White persons.[25]
- In 2019, 29% of US high school students reported current (past month) use of alcohol, with substantially higher levels among females (32%) compared to males (26%).[38]

Type 2 Diabetes

Type 2 diabetes, a chronic condition characterized by high blood sugar 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 physical inactivity. Evidence also suggests that type 2 diabetes independently increases risk for several cancers, including liver, endometrium, pancreas, colorectum, kidney, bladder, breast, and perhaps ovary.[39-41] More than 90% of adults with diabetes have type 2 disease.[42]

- From 2001-2004 to 2017-March 2020, diagnosed diabetes prevalence among adults ≥18 years of age increased from 7% to 10%.[43]
- In 2018-2019, the prevalence of diagnosed diabetes was higher among American Indian/Alaska Native (15%), Black (12%), and Hispanic (12%) persons than those who were Asian (10%) or White (7%), although rates varied by subpopulation (e.g., Asian Indian in 2017-2018: 13%).[43]

Conclusion

Almost 1 in 5 cancers is caused by excess body weight, alcohol consumption, poor diet, and/or physical inactivity. Many Americans encounter substantial barriers to consuming a healthy diet and engaging in regular physical activity. To facilitate healthier lifestyles and curtail the future cancer burden, policy and environmental interventions across national, state, and local levels are needed. Efforts should include creative new strategies that are culturally appropriate and equitable to increase access to affordable, nutritious foods (e.g., healthy checkout aisles) and safe, enjoyable opportunities for physical activity (e.g., quality school physical education programs).[2]

Visit 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.

References

1. Islami F, Goding Sauer A, Miller KD, et al. Proportion and number of cancer cases and deaths attributable to potentially modifiable risk factors in the United States. *CA Cancer J Clin*. 2018;68(1): 31-54.

2. Rock CL, Thomson C, Gansler T, et al. American Cancer Society guideline for diet and physical activity for cancer prevention. *CA Cancer J Clin*. 2020;70(4): 245-271.

3. Kabat GC, Matthews CE, Kamensky V, Hollenbeck AR, Rohan TE. Adherence to cancer prevention guidelines and cancer incidence, cancer mortality, and total mortality: a prospective cohort study. *Am J Clin Nutr*. 2015;101(3): 558-569.

4. Lauby-Secretan B, Scoccianti C, Loomis D, Grosse Y, Bianchini F, Straif K. Body Fatness and Cancer–Viewpoint of the IARC Working Group. *N Engl J Med*. 2016;375(8): 794-798.

5. World Cancer Research Fund and American Institute for Cancer Research. Continuous Update Project Available from URL: wcrf.org/diet-activity-and-cancer/global-cancer-update-programme/about-the-global-cancer-update-programme/ [accessed July 24, 2021].

6. Lee JM, Pilli S, Gebremariam A, et al. Getting heavier, younger: trajectories of obesity over the life course. *Int J Obes* (Lond). 2010;34(4): 614-623.

7. Song M, Willett WC, Hu FB, et al. Trajectory of body shape across the lifespan and cancer risk. *Int J Cancer.* 2016;138(10): 2383-2395.

8. Teras LR, Patel AV, Wang M, et al. Sustained Weight Loss and Risk of Breast Cancer in Women 50 Years and Older: A Pooled Analysis of Prospective Data. *J Natl Cancer Inst.* 2020;112(9): 929-937.

9. Fryar CD, Carroll MD, Ogden CL. Prevalence of Overweight, Obesity, and Severe Obesity Among Adults Aged 20 and Over: United States, 1960-1962 Through 2017-2018. Available at cdc.gov/nchs/data/hestat/obesity-adult-17-18/obesity-adult.htm.

10. National Center for Health Statistics. National Health and Nutrition Examination Survey Data, 2017-March 2020. Available from URL: https://wwwn.cdc.gov/nchs/nhanes/Default.aspx [accessed February 27, 2022].

11. Restrepo BJ. Obesity Prevalence Among U.S. Adults During the COVID-19 Pandemic. *Am J Prev Med*. 2022;63(1): 102-106.

12. Han X, Shi SK, Zhao J, et al. The first year of the COVID-19 pandemic and health among cancer survivors in the United States. *Cancer.* 2022.

13. Fryar CD, Carroll MD, Ogden CL. Prevalence of Overweight, Obesity, and Severe Obesity Among Children and Adolescents Aged 2-19 Years: United States, 1963-1965 Through 2017-2018. Available from cdc.gov/nchs/data/hestat/obesity-child-17-18/obesity-child.htm.

14. Woolford SJ, Sidell M, Li X, et al. Changes in Body Mass Index Among Children and Adolescents During the COVID-19 Pandemic. *JAMA*. 2021;326(14): 1434-1436.

15. Lange Sj Fau – Kompaniyets L, Kompaniyets L Fau – Freedman DS, Freedman Ds Fau – Kraus EM, et al. Longitudinal Trends in Body Mass Index Before and During the COVID-19 Pandemic Among Persons Aged 2-19 Years – United States, 2018-20201545-861X (Electronic).

16. Ogden CL, Fryar CD, Martin CB, et al. Trends in Obesity Prevalence by Race and Hispanic Origin-1999-2000 to 2017-2018. *JAMA*. 2020;324(12): 1208-1210.

17. World Cancer Research Fund/American Institute for Cancer Research. *Continuous Update Project Expert Report 2018. Physical activity and the risk of cancer.* London, UK: World Cancer Research Fund/American Institute for Cancer Research, 2018.

18. 2018 Physical Activity Guidelines Advisory Committee. *2018 Physical Activity Guidelines Advisory Committee Scientific Report*. Washington, DC: U.S. Department of Health and Human Services, 2018.

19. Patel AV, Friedenreich CM, Moore SC, et al. American College of Sports Medicine Roundtable Report on Physical Activity, Sedentary Behavior, and Cancer Prevention and Control. *Med Sci Sports Exerc*. 2019;51(11): 2391-2402.

20. Minihan AK, Patel AV, Flanders WD, Sauer AG, Jemal A, Islami F. Proportion of Cancer Cases Attributable to Physical Inactivity by US State, 2013-20161530-0315 (Electronic)).

21. Cormie P, Zopf EM, Zhang X, Schmitz KH. The Impact of Exercise on Cancer Mortality, Recurrence, and Treatment-Related Adverse Effects. *Epidemiol Rev.* 2017;39(1): 71-92.

22. Patel AV, Maliniak ML, Rees-Punia E, Matthews CE, Gapstur SM. Prolonged Leisure-Time Spent Sitting in Relation to Cause-specific Mortality in a Large U.S. Cohort. *Am J Epidemiol*. 2018.

23. Rees-Punia E, Evans EM, Schmidt MD, et al. Mortality Risk Reductions for Replacing Sedentary Time With Physical Activities. *Am J Prev Med*. 2019;56(5): 736-741.

24. National Center for Health Statistics. *Health, United States, 2016: With Chartbook on Long-term Trends in Health*. Hyattsville, MD, 2017.

25. National Center for Health Statistics. National Health Interview Survey, 2020. Public-use data file and documentation. Available from URL: http://www.cdc.gov/nchs/nhis/quest_data_related_1997_forward.htm [accessed June 25, 2022].

26. Merlo CL, Jones SE, Michael SL, et al. Dietary and Physical Activity Behaviors Among High School Students – Youth Risk Behavior Survey, United States, 2019. *MMWR Suppl*. 2020;69(1): 64-76.

27. Grosso G, Bella F, Godos J, et al. Possible role of diet in cancer: systematic review and multiple meta-analyses of dietary patterns, lifestyle factors, and cancer risk. *Nutr Rev.* 2017;75(6): 405-419.

28. Morze J, Danielewicz A, Hoffmann G, Schwingshackl L. Diet Quality as Assessed by the Healthy Eating Index, Alternate Healthy Eating Index, Dietary Approaches to Stop Hypertension Score, and Health Outcomes: A Second Update of a Systematic Review and Meta-Analysis of Cohort Studies. *J Acad Nutr Diet*. 2020;120(12): 1998-2031 e1915.

29. Morze J, Danielewicz A, Przybylowicz K, Zeng H, Hoffmann G, Schwingshackl L. An updated systematic review and meta-analysis on adherence to mediterranean diet and risk of cancer. *Eur J Nutr.* 2021;60(3): 1561-1586.

30. Liese AD, Krebs-Smith SM, Subar AF, et al. The Dietary Patterns Methods Project: synthesis of findings across cohorts and relevance to dietary guidance. *J Nutr.* 2015;145(3): 393-402.

31. Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Data, 2019. Available from URL: https://www.cdc.gov/brfss/data_documentation/index.htm [accessed September 6, 2020].

32. National Center for Health Statistics. *Health, United States, 2020-2021*. Hyattsville, Maryland, 2022.

33. Wang L, Martinez Steele E, Du M, et al. Trends in Consumption of Ultraprocessed Foods Among US Youths Aged 2-19 Years, 1999-2018. *JAMA*. 2021;326(6): 519-530.

34. World Cancer Research Fund and American Institute for Cancer Research. Continuous Update Project Available from URL: wcrf.org/diet-activity-and-cancer/global-cancer-update-programme/about-the-global-cancer-update-programme/ [accessed July 24, 2021].

35. Goding Sauer A, Fedewa SA, Bandi P, et al. Proportion of cancer cases and deaths attributable to alcohol consumption by US state, 2013-2016. *Cancer Epidemiol*. 2021;71(1877-783X (Electronic)).

36. Bagnardi V, Rota M, Botteri E, et al. Alcohol consumption and site-specific cancer risk: a comprehensive dose-response meta-analysis. *BR J Cancer.* 2015;112(1532-1827 (Electronic)): 580-593.

37. International Agency for Research on Cancer. *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Alcohol Consumption and Ethyl Carbamate*. Lyon, France: International Agency for Research on Cancer, 2010.

38. Jones CM, Clayton HB, Deputy NP, al e. Prescription Opioid Misuse and Use of Alcohol and Other Substances Among High School Students – Youth Risk Behavior Survey, United States, 2019. *MMWR Suppl*. 2020;69(Suppl-1): 38-46.

39. Giovannucci E, Harlan DM, Archer MC, et al. Diabetes and cancer: a consensus report. *CA Cancer J Clin*. 2010;60(4): 207-221.

40. Bao C, Yang X, Xu W, et al. Diabetes mellitus and incidence and mortality of kidney cancer: a meta-analysis. *J Diabetes Complications*. 2013;27(4): 357-364.

41. Wang L, Wang L, Zhang J, Wang B, Liu HD. Association between diabetes mellitus and subsequent ovarian cancer in women: A systematic review and meta-analysis of cohort studies. *Medicine*. 2017;96(16): e6396.

42. Centers for Disease Control and Prevention. Type 2 Diabetes. Available from URL: https://www.cdc.gov/diabetes/basics/type2.html [accessed July 15, 2022].

43. Centers for Disease Control and Prevention. National Diabetes Statistics Report Available from URL: https://www.cdc.gov/diabetes/data/statistics-report/index.html [accessed July 14, 2022].

The Global Cancer Burden

The American Cancer Society is working to end cancer as we know it, for everyone. In 2020, there were an estimated 18.1 million new cancer cases and 9.9 million cancer deaths globally.[1] The most commonly diagnosed cancers are female breast, lung, colorectal, prostate, and stomach, which account for about half of all cases. Lung cancer is by far the most common cause of cancer death, accounting for 1 in 5 deaths. Cancers that are common in the most developed countries (e.g., female breast, lung, colorectum, and prostate) are beginning to displace infection-related cancers (e.g., cervix, liver, and stomach) in many transitioning countries because of the adoption of lifestyles associated with globalization and urbanization (e.g., smoking, poor diet, and physical inactivity) and changes in reproductive patterns (e.g., declining fertility rate and later age at first childbirth). By 2040, the global burden is expected to reach 28.0 million new cancer cases and 16.2 million cancer deaths, solely due to the growth and aging of the population.[2] In low and medium Human Development Index Countries – many of which lack the medical resources and health systems to address the current disease burden – new cases are projected to increase by 95% and 64%, respectively.

Tobacco Use

Tobacco use is the largest avoidable cause of cancer mortality worldwide, responsible for 26% of total cancer deaths in 2019 (36% in men and 12% in women).[3] Currently, only 19% of tobacco-attributable cancer deaths occur in low- and middle-income countries (LMICs), reflecting low historical smoking prevalence compared to higher-income countries.[4] However, tobacco use has increased in many LMICs in recent years, foreshadowing a growing tobacco-related cancer burden. In 2019, residents of LMICs accounted for over 80% of the 1.1 billion current smokers worldwide ages 15 and over.[5] Further, more than 35% of individuals in upper middle-income countries smoked cigarettes in 2018, substantially higher than any other income group.[6]

In 2005, the World Health Organization's Framework Convention on Tobacco Control (FCTC), the world's first public health treaty, came into effect. Still, as of September 2022, several major tobacco-producing nations, including Argentina, Indonesia, and the United States, have not acceded to it. In 2020, about 69% of the world's population was covered by at least one significant comprehensive tobacco control measure at the highest level recommended by the FCTC, up from about 15% in 2008.[7] The WHO estimates that 23% of the world's population lives in complete smoke-free public and workplace environments and only 13% is covered by tobacco tax policy – the single-most effective intervention – that is at the prescribed level for optimal tobacco control. More encouragingly, 4.7 billion people (60% of the world's population) benefit from large graphic warnings on cigarette pack labels featuring all WHO-recommended characteristics.

Infection

Many cancers, including stomach, liver, cervical, oropharyngeal, anogenital, non-Hodgkin and Hodgkin lymphoma, and Kaposi sarcoma, are caused by infectious agents. In 2018, an estimated 13% of all cancers worldwide (2.2 million) were attributable to infectious agents, ranging from less than 5% in the US to 50% in some countries in sub-Saharan Africa.[8] The most prominent cancer-causing infectious agents are *Helicobacter pylori* (*H. pylori*), human papillomavirus (HPV), hepatitis B virus (HBV), and hepatitis C virus (HCV), which together are responsible for more than 90% of all infection-related cancers. Most of these cancers are preventable through vaccination (HPV and HBV), screening (HPV), treatment (*H. pylori* and HCV), and behavioral changes. East Asia has the highest burden of infection-attributable cancer worldwide because of the large population size and high prevalence of *H pylori* (stomach cancer) and HBV infection (liver cancer), whereas sub-Saharan Africa has the highest proportion of infection-attributable cancers, largely driven by HPV (cervical cancer) and HBV (liver cancer; https://canceratlas.cancer.org/risk-factors/infection/).

Excess Body Weight

Excess body weight increases the risk of at least 13 cancer types and accounted for more than 4% of all cancer cases among adults worldwide in 2019, ranging from an estimated 2.6% in low-income countries to 5.7% in high-income countries.[4, 9] The prevalence of excess body weight continues to increase rapidly across the globe. Approximately 40% of adults and 18% of children had excess body weight in 2016.[10] Many LMICs have experienced the steepest increases due to changes in the food environment, such as increased availability of energy-dense, nutrient-poor foods, alongside reduced opportunities for physical activity. Globally, 28% of adults and 81% of adolescents were insufficiently physically active (less than 150 minutes of moderate-intensity physical activity per week, or less than 75 minutes of vigorous-intensity physical activity per week, or equivalent) in 2016.[11]

Alcohol consumption

Alcohol consumption increases the risk of cancers of upper aerodigestive tract (oral cavity, larynx, and esophagus) and cancers of the colorectum, liver, and female breast. Globally, an estimated 741,300 cases or 4% of all new cancer cases in 2020 were attributable to alcohol consumption,[12] with the lowest proportion in northern Africa (0.3%) and western Asia (0.7%) and the highest in eastern Asia (5.7%) and central and eastern Europe (5.6%).

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 globally by assisting and empowering health professionals, health institutions, and cancer organizations in LMICs to implement evidence-based cancer control practices.

Increase HPV vaccination worldwide. The Global HPV Cancer Free initiative works to normalize HPV vaccination as cancer prevention in LMICs. The initiative envisions all clinicians recommending the vaccine routinely and confidently to age-appropriate adolescents; parents demanding and consenting for their adolescents to be vaccinated; community influencers advocating for its access and uptake; and policymakers mandating and funding the vaccine in national and sub-national programs. Currently engaged in Kenya, Colombia, and India, the initiative is seeding multicomponent action led by in-country cancer organizations to increase the uptake of HPV vaccination among clinicians and parents through behavioral interventions that are experimentally tested for effectiveness and engineered for scale-up through health systems and communities.

Improve global patient support. Through the American Cancer Society Building Expertise, Advocacy, and Capacity for Oncology Navigation (BEACON) Initiative, we support health institutions and

cancer organizations in LMICs to design, implement, and sustain cancer patient navigation programs to remove barriers to care. We have created a dynamic and self-service global patient navigation toolkit supported by a peer-learning collaborative to help stakeholders interested in providing more patient-centered care build and deliver programs suited to their local context utilizing available resources. The toolkit also provides resources to facilitate the delivery of high-quality cancer education for patients, caregivers, and their families, including two new global cancer education materials in easy-to-understand English designed for use by cancer patients and health workers in a variety of LMIC settings around the world. The BEACON Initiative is being piloted from February 2022 through April 2023 with 10 pilot organizations in Armenia, Brazil, Guatemala, Egypt, Indonesia, Malaysia, Nigeria, and South Africa.

Make effective treatment available to all in need. The American Cancer Society Global Cancer Treatment team works to reduce cancer mortality by addressing disparities in access to affordable, high-quality treatment. Along with collaborators in the Allied Against Cancer alliance, the National Comprehensive Cancer Network, the Clinton Health Access Initiative (CHAI), and the African Cancer Coalition, the American Cancer Society has developed more than 50 cancer treatment guidelines adapted for use in sub-Saharan Africa covering more than 90% of people with cancer in the region. The American Cancer Society and CHAI have brokered agreements with four pharmaceutical companies to reduce the cost of 26 lifesaving cancer treatments by an expected 60%. Additionally, the ChemoSafe project supports African Health Ministries and cancer treatment centers to improve the safe handling and administration of chemotherapy through the implementation of safety standards, training, and access to personal protective equipment.

More than 3.2 billion people worldwide lack access to adequate pain relief. Improved access to essential pain medicines is arguably the easiest and least expensive unmet need to improve cancer care in LMICs. The American Cancer Society leads projects to improve access to essential pain medicines and supports national morphine production programs that have dramatically reduced cost and increased access. The Pain-Free Hospital Initiative is a one-year hospital-wide quality improvement initiative designed to integrate pain treatment into service delivery by providing education, raising motivation and awareness, documenting pain levels, improving medicine supply, and communicating impact. The initiative has been implemented in more than 75 hospitals and has trained 25,000 health workers, resulting in a reduction of more than 50% in patient-reported pain scores.

References

1. Sung H, Ferlay J, Siegel RL, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA Cancer J Clin*. 2021;71(3): 209-249.

2. Ferlay J, Laversanne M, Ervik M, et al. Global Cancer Observatory: Cancer Tomorrow. gco.iarc.fr/tomorrow/en/dataviz/isotype [accessed August 24, 2021].

3. Collaborators GBDCRF. The global burden of cancer attributable to risk factors, 2010-19: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet*. 2022;400(10352): 563-591.

4. Network GBoDC. Global Burden of Disease Study 2019 (GBD 2019) Results. Available from URL: http://ghdx.healthdata.org/gbd-results-tool [accessed July 26, 2021].

5. Collaborators GBDT. Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and attributable disease burden in 204 countries and territories, 1990-2019: a systematic analysis from the Global Burden of Disease Study 2019. *Lancet*. 2021;397(10292): 2337-2360.

6. WHO global report on trends in prevalence of tobacco use 2000-2025, third edition. Geneva: World Health Organization, 2019.

7. WHO report on the global tobacco epidemic 2021: addressing new and emerging products. Geneva: World Health Organization, 2021.

8. de Martel C, Georges D, Bray F, Ferlay J, Clifford GM. Global burden of cancer attributable to infections in 2018: a worldwide incidence analysis. *Lancet Glob Health*. 2020;8(2): e180-e190.

9. Sung H, Siegel RL, Torre LA, et al. Global patterns in excess body weight and the associated cancer burden. *CA Cancer J Clin*. 2019;69(2): 88-112.

10. Collaboration NCDRF. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. *Lancet*. 2017;390(10113): 2627-2642.

11. Organization WH. Global Health Obervatory (GHO) Data. Prevalence of insufficient physical activity. Available from URL: https://apps.who.int/gho/data/node.main.A892?lang=en [accessed October 14, 2021].

12. Rumgay H, Shield K, Charvat H, et al. Global burden of cancer in 2020 attributable to alcohol consumption: a population-based study. *Lancet Oncol*. 2021;22(8): 1071-1080.

The American Cancer Society

The American Cancer Society is the preeminent cancer-fighting organization with a vision of ending cancer as we know it, for everyone. We are the only organization improving the lives of people with cancer and their families through advocacy, research, and patient support, and ensuring that everyone has an opportunity to prevent, detect, treat, and survive cancer.

This work could not be accomplished without the strength of our dedicated volunteers, who drive every part of our mission. With the support of our professional staff, volunteers raise funds to provide essential patient support, to advocate for important issues like health equity and more affordable care, and to fund breakthrough research that saves lives. Thanks in part to our contributions, 3.8 million cancer deaths have been averted in the US since 1991, when cancer death rates were at their peak.

Patient Support

At the American Cancer Society, we continue to refine our approach and deepen our commitment to ending cancer as we know it, for everyone. We work to touch as many lives as possible and ensure no one faces cancer alone, understanding that people have different circumstances and needs throughout their cancer journey. We also work to establish and enhance collaborative partnerships with shared goals to eliminate cancer disparities, improve the lives of people with cancer and their families, assist cancer professionals in providing the highest quality care, and provide anyone impacted by cancer with the support, information, and resources they need, from prevention to detection and diagnosis, through treatment and survivorship, and for some, the end of life.

Lives Touched

The American Cancer Society Patient Support Pillar programs and services touch more than 55 million lives each year. We provide trusted information and support where and when people need it most, helping them live their best and longest lives. Evidence-based health equity principles are the foundation of everything we do as we work to eliminate barriers and ensure everyone has the same opportunity to prevent, detect, treat, and survive cancer.

Cancer information and support. The American Cancer Society provides cancer information and support for people with cancer, caregivers, and survivors through our free cancer helpline and online resources.

Cancer Helpline. Our caring, trained cancer helpline staff are available 24/7 to answer questions about cancer and connect people with resources to help meet needs that emerge throughout the cancer continuum. Services are provided 365 days per year via our toll-free helpline (1-800-227-2345) in English, Spanish, and more than 200 other languages through a translation service. Additionally, online live chat sessions and video calls are available in English during weekdays. Visit cancer.org/about-us/online-help/contact-us for more information.

Cancer.org and patient education materials. Our website, cancer.org, and educational materials offer evidence-based, understandable, and actionable health information curated by oncology physicians and nurses. Our cancer information includes print materials, downloadable PDFs, videos, quizzes, image galleries, and 3-D animations to help people understand and manage issues related to cancer risk, prevention, screening, diagnosis, treatment and side effects, survivorship, and end of life. Visit cancer.org/materials to order patient education print materials. At cancer.org/cancer-information-in-other-languages, there are resources for people who speak languages other than English and Spanish.

Books and journals. The American Cancer Society also publishes books to help people navigate their cancer journey. Visit cancer.org/bookstore to learn more. In addition, we publish three peer-reviewed scientific journals for health care professionals and researchers:

Cancer, Cancer Cytopathology, and *CA: A Cancer Journal for Clinicians.* Visit cancer.org/health-care-professionals/acs-publications to learn more.

Cancer Survivors Network℠. We offer the Cancer Survivors Network (CSN, csn.cancer.org), a safe online community where survivors and caregivers can share their stories, ask questions, and support each other. With a chatroom and over 40 discussion boards, CSN allows survivors to connect with others who have a similar cancer experience.

Reach To Recovery®. The Reach To Recovery program connects people facing breast cancer with trained volunteers who are breast cancer survivors. These volunteers provide one-on-one support to help people cope with their breast cancer diagnosis, treatment, side effects, and more. Visit reach.cancer.org to learn more.

Transportation to treatment. Lack of transportation can be one of the greatest barriers to receiving timely treatment and quality cancer care. The American Cancer Society offers transportation solutions through our Road To Recovery® program, where volunteers provide people with cancer rides to and from treatment. Other community transportation programs are available in certain geographic areas.

Lodging during treatment. The American Cancer Society Hope Lodge® communities provide free, temporary lodging for people facing cancer and their caregivers when treatment is far from home. These facilities offer guests a nurturing, home-like environment where they can retreat to private rooms or safely connect with others facing a similar journey.

Transportation and lodging grants. Through the Patient Transportation Grant and the Patient Lodging Grant programs, the American Cancer Society awards funds to health systems or health system foundations. This funding provides direct assistance to people with cancer who need transportation assistance to and from cancer-related appointments or temporary lodging near treatment centers.

Patient navigation. The American Cancer Society recognizes the critical role navigation plays in achieving positive health outcomes for people with cancer. Our Navigation Capacity-Building Initiative Grant Program is a component of our commitment to enhancing oncology patient navigation and addressing barriers to individualized, timely, and equitable access to care for people facing cancer and their families in the United States, particularly for those with limited incomes, people of color, and people who reside in areas with increased barriers. The goal of this multi-year competitive grant opportunity is to ensure that communities can provide the right type of access, support, and navigation for everyone facing cancer through capacity building and support for innovative, sustainable models of oncology patient navigation, and a technology-enabled navigation platform/volunteer community navigation network. The American Cancer Society has awarded multi-year grants for patient navigation programs to 14 health systems that will be part of a multi-institutional learning community convened to provide a platform for grantees to share navigation best practices and lessons learned, and access training and expertise.

Hair loss and mastectomy products. The American Cancer Society *"tlc" Tender Loving Care®* program offers products for people coping with breast cancer or cancer treatment that causes hair loss. Products include wigs, hairpieces, hats, turbans, breast forms, mastectomy bras, post-surgical support, and mastectomy swimwear. The *tlc*™ mission is to help people facing cancer treatment cope with the appearance-related side effects of cancer by making hard-to-find products affordable and readily available for purchase from the privacy of their own homes. To order products or catalogs, visit tlcdirect.org or call 1-800-850-9445.

Support for caregivers. The American Cancer Society recognizes that cancer is not isolated to the individuals diagnosed, but also impacts the entire family unit and network of close friends. We are committed to meeting the information, education, and support needs of the millions of people who are caregivers for people with

cancer. One of the informational tools we offer is our *Caregiver Resource Guide*, which helps caregivers better understand what their loved one is going through, develop skills for coping and caring, and practice self-care to help protect their own health and well-being. Also, our *Caregiver Support Video Series* provides educational support to caregivers as they assist with the everyday needs of people with cancer.

Partners Engaged

Some barriers challenging our efforts to improve the lives of people with cancer and their families are too complex for any one organization to address on its own. To overcome these barriers, the American Cancer Society unites organizations in collaborative partnerships through our mission-critical national roundtables and other coalitions. More than 500 partner organizations join with us each year to develop solutions and take action to improve cancer outcomes for all people by bringing together key leaders and partners to share resources and expertise to drive progress on cancer priorities.

National roundtables. In 1997, in partnership with the Centers for Disease Control and Prevention, the American Cancer Society established our first roundtable, the National Colorectal Cancer Roundtable. This was followed by national roundtables focused on HPV vaccination (2014), patient navigation (2017), and lung cancer (2017). In 2022, we committed to further expanding our national roundtables to include a breast cancer roundtable and cervical cancer roundtable.

Due to their established history and replicated success, these collaborative roundtables are a recommended and proven model for creating sustained partnerships across diverse sectors to tackle the most complex problems in cancer. Roundtables succeed by bringing together leading advocacy organizations, professional societies, government agencies, cancer centers, community organizations, academic institutions, industry leaders, and other key partners to share resources and expertise to drive progress on cancer priorities. Visit cancer.org /about-us/our-partners/american-cancer-society-roundtables for more information on the American Cancer Society roundtables.

Cancer control coalitions. Since 1998, the American Cancer Society has partnered with the Centers for Disease Control and Prevention's National Comprehensive Cancer Control Program to provide support through training and technical assistance. These state Cancer Control Coalitions (CCC) include stakeholders across many sectors. Through interactive webinars, live workshops, virtual forums, and online resources, the program provides coalitions with subject matter expertise in science, research, and coalition health to directly inform the development and implementation of state cancer plans with over 200 state-level public health leaders in all 50 states and the District of Columbia, 7 US associated Pacific islands/territories, and 8 tribes and tribal organizations. In addition, the American Cancer Society is a founding member of the Comprehensive Cancer Control National Partnership (CCCNP), a 19-member national coalition that works together to build and strengthen CCC efforts across the nation.

Health equity. Cancer is a disease that affects everyone, but it doesn't affect everyone equally. We are working to ensure everyone has an opportunity to prevent, detect, treat, and survive cancer. Our commitment to advance health equity involves national, state, and local partnerships.

Community health equity projects. With funding from the Robert Wood Johnson Foundation, 12 Health Equity Pilot Community Projects are being supported to explore, identify, and implement community-driven solutions aimed at addressing medical mistrust related to colorectal cancer screening. Community health centers, in collaboration with their patient advisory councils and/or governing boards and community based organizations, are working together to address the unique needs of their communities, and the American Cancer Society is providing funding, technical expertise, and a virtual environment to facilitate learning and best practice sharing.

National Advisory Council on Health Equity. The National Advisory Council (NAC) on Health Equity is comprised of 16 thought leaders from racial, ethnic,

and geographically diverse backgrounds, organizations, and sectors, and provides advice and recommendations on how the American Cancer Society can advance health equity in organizational policies, practices, programs, and research. The NAC provides recommendations on how to embed health equity more deeply into our work.

Project ECHO. Project ECHO® (Extension for Community Healthcare Outcomes) is a hub-and-spoke telementoring and knowledge-sharing network conducted virtually. Since 2018, the American Cancer Society has engaged more than 3,700 unique health care professionals and caregivers in over 32 ECHO series focused on topics, including colorectal cancer treatment; increasing HPV vaccination, colorectal, and lung cancer screening rates; increasing access to smoking cessation resources; addressing the impact of COVID-19 on cancer care teams and caregivers; and increasing organizational capacity in cancer-fighting organizations in Kenya. The program is a proven educational intervention utilizing an all-teach, all-learn model to help build capacity of partners, aiming to efficiently disseminate evidence-based strategies to improve cancer outcomes across the continuum of care, increase prevention and early detection efforts in health systems, and improve the overall quality of care.

Hospital Systems Capacity Building initiative. The American Cancer Society Hospital System Capacity Building (HSCB) initiative, funded by the Centers for Disease Control and Prevention, aims to decrease cancer morbidity by increasing cancer screening and prevention efforts across the US. The initiative engages representatives from hospital systems, health departments, the American Cancer Society, and selected community organizations to form Communities of Practice (COP) teams. The HSCB Initiative uses the COP approach to offer tailored capacity-building assistance, foster peer-to-peer learning, and engage multisector partners in bidirectional learning.

Regional cancer support. The American Cancer Society regional cancer support teams establish state and local partnerships to amplify initiatives across the cancer continuum and extend our reach in communities. Regional staff provide technical assistance and networking in local communities to address challenges and opportunities across the cancer care continuum. Partnerships include cancer treatment centers, aiming to reduce barriers by ensuring patients and families have the information and resources they need after a cancer diagnosis, such as transportation and lodging. The cancer support teams also collaborate with partners to help people get the preventive care they need to help detect cancer at the earliest, most treatable stage. These partnerships include working with community clinics or federally qualified health centers (FQHCs) to reduce barriers to screening and help ensure patients have access to follow-up care.

Advocacy

Saving lives from cancer is as much a matter of public policy as scientific discovery. Lawmakers play a critical role in enacting policies that help save lives – from improving access to quality, affordable health care for all to increasing funding for cancer research and programs. The American Cancer Society Cancer Action Network℠ (ACS CAN), the advocacy affiliate of the American Cancer Society, improves the lives of people with cancer and their families through public policy advocacy. ACS CAN fights cancer in city halls, statehouses, and Congress by elevating the patient voice to advance policy change and making cancer a top priority for public officials. ACS CAN partners with lawmakers, civic leaders, and community organizations to push for policies that eliminate health disparities and advance equitable outcomes in cancer care. ACS CAN empowers advocates across the country to make their voices heard and influence evidence-based public policy change, as well as legislative and regulatory solutions, that will reduce the cancer burden.

ACS CAN is the nation's leading voice advocating for public policies that help to defeat cancer. Since its creation in 2001, the organization has successfully advocated for billions of dollars in cancer research funding, expanded access to quality, affordable health care, and made workplaces, including restaurants and bars, smoke-free.

ACS CAN's recent advocacy accomplishments 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 July 2022 and do not reflect any potential changes to health care being considered by Congress, the administration, or the courts.

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 and marketplace subsidies, allowing millions of limited-income individuals and families to gain access to comprehensive and affordable health care coverage. Additionally, ACS CAN urges policymakers to advance and support policies that protect and improve access to health care for limited-income Americans 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 costs
- Enacting market stabilization measures, including individual state mandates for insurance coverage and reinsurance programs that bring down premiums
- The removal of barriers to patient access to prescription drugs, including capping patient costs in the Medicare Part D program and ensuring that the use of utilization management tools by health care payers does not delay cancer treatments
- Full federal funding for community health centers that provide community-oriented primary care in areas that have been historically marginalized
- Access to preventive services without cost sharing
- Ensuring expansion of the Medicaid program, which provides much-needed health services to limited-income individuals

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 (NCI). Thanks in no small part to ACS CAN's work, Congress has steadily increased funding for the NCI over the past several years. Today, the NCI has a budget of more than $6.5 billion, most of which is awarded through grants to researchers in cancer centers, universities, and labs in every state of the country. Federal budget pressures threaten this funding every year. ACS CAN recognizes the critical importance of federal research funding in the search for cures and works to protect federal funding.

In addition to advocating for cancer research funding, the organization works to enhance access for people with cancer to innovative therapies by removing barriers to clinical trial enrollment. Clinical trials are the key step in advancing potential new cancer treatments from the research setting to the cancer clinic, and patient participation in trials is crucial to their success. Approximately 20% of cancer clinical trials fail because of insufficient patient enrollment, despite a strong patient willingness to participate. To address this problem, ACS CAN, in collaboration with other stakeholders, has identified several barriers and is working on implementing a set of consensus recommendations to make it easier for interested patients to enroll in an appropriate clinical trial. The organization also works to ensure that traditionally underrepresented patient populations have an equal opportunity to enroll in clinical trials through efforts to expand eligibility screening and advocate for legislation that would make it easier for trial sponsors to pay for non-medical patient costs related to participating in a clinical trial (e.g., parking, transportation, or lodging).

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 and prohibition of flavors in all tobacco products
- Leading efforts to pass comprehensive smoke-free laws requiring all workplaces, restaurants, bars, and gaming establishments to be smoke-free, such as an ordinance in New Iberia, Louisiana, and Gwinnett County, Georgia, that went into effect on March 15, 2022, and June 23, 2022, respectively, making all workplaces, restaurants, and bars smoke-free
- 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 $1.91 per pack (as of July 2022).
- Working to increase and protect state funding for tobacco control programs, such as the $12 million appropriated to Connecticut's tobacco prevention and cessation program for FY2023. This $12 million represents the first state funding dedicated to tobacco control in Connecticut since 2016 and will move the state up from ranking 50th in state funding for the past 6 years.
- 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 people to their deadly products
- Addressing systemic racism in the enforcement of commercial tobacco control laws by advocating for implementation to be entrusted with public health or other non-police officers and that no law enforcement entity has the authority to enforce this rule against consumers
- Advocating for coverage of cancer screenings and other recommended preventive services without financial barriers in private insurance, Medicare, and Medicaid, including federal legislation to create a pathway for Medicare to consider covering new cancer early-detection blood tests once they are approved by the FDA
- Advocating for full funding for the National Breast and Cervical Cancer Early Detection Program, which provides limited-income and uninsured and underinsured women access to cancer screenings, as well as diagnostic, patient navigation, and treatment services
- Urging policymakers to invest federal and state funds in colorectal cancer control programs and eliminate out-of-pocket costs for colonoscopy following a positive stool test
- Supporting efforts to help increase HPV vaccination uptake
- Advocating for evidence-based child nutrition programs

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 ensure that people with cancer 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. ACS CAN supports legislation that 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 its sophisticated and effective volunteer structure. Across the country, volunteers in every congressional district work closely with the organization 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 American Cancer Society Relay For Life® and Making Strides Against Breast Cancer® signature events, as well as the Coaches vs. Cancer® initiative, a collaboration between the American Cancer Society and the National Association of Basketball Coaches.

Research

Research is at the heart of the American Cancer Society's mission. We have invested more than $5 billion in research since 1946, all to find the causes of cancer, ways to detect the disease earlier, more effective treatments, and ways to help people thrive during and after treatment. The American Cancer Society is unique among nongovernmental, nonprofit organizations in having both intramural and extramural research programs, both of which will turn 77 years old in 2023. The top-tier research we fund and conduct covers the cancer continuum from cell biology to survivorship and is currently organized under three departments: Extramural Discovery Science, Population Science, and Surveillance and Health Equity Science, which are described below.

Extramural Discovery Science

The American Cancer Society's extramural research program supports a portfolio of highly innovative cancer research at top US academic research institutions. Since 1946, we have awarded more than 33,700 grants to academic research institutions across the US supporting over 25,000 investigators and made critical contributions to many of the most important discoveries in cancer. In 2019, William Kaelin, MD, from Dana Farber Cancer Institute and Gregg Semenza, MD, PhD, from Johns Hopkins School of Medicine were the latest additions to the list of 50 American Cancer Society grantees who have gone on to win the Nobel Prize. Current grantees publish over 1,200 scientific papers annually, detailing their discoveries across a wide range of cancers using a multitude of scientific approaches.

Extramural Discovery Science has three research programs – Biochemistry and Immunology of Cancer, Cell Biology and Preclinical Cancer Research, and Clinical and Cancer Control Research. The primary strategic goal for American Cancer Society-funded extramural research is to support innovation in cancer research, regardless of cancer type. Time and again, scientific history teaches us that novel discoveries occur in unexpected places, and we believe that a focus on innovation gives us the greatest chance to make advances to benefit cancer patients. Except for professorships, all grant applications must align with at least one of the six American Cancer Society research priority areas: causes of cancer; obesity/healthy eating and active living; diagnosis and screening; and treatment, survivorship, and health equity across the continuum.

All extramurally funded projects are subjected to a rigorous, independent, and highly competitive two-stage peer review, with the primary review conducted by one of 12 peer review committees:

- DNA Mechanisms in Cancer
- RNA Mechanisms in Cancer
- Tumor Biology and Endocrinology
- Immunology and Blood Cell Development
- Mission Boost Grants
- Cancer Cell Biology
- Metastasis and Microenvironment
- Cancer Detection and Progression
- Experimental Therapeutics
- Cancer Prevention, Screening, and Health Promotion
- Cancer Treatment, Palliative Care, and Survivorship
- Health Outcomes, Policy, and Systems Research

Using the application ranking provided by the Peer Review Committees, the Extramural Discovery Science Council recommends funding based on the relative merit of the applications, the amount of available funds, and American Cancer Society objectives. This independent and nationally competitive process ensures that the most innovative research is funded. Beginning in the late 1990s, Extramural Discovery Science began to focus on early-stage investigators, who continue to have a difficult time launching their cancer research programs. Today, about 70% of the budget is committed to these scientists, giving the best and brightest minds in cancer research an opportunity to explore highly innovative ideas as they begin their careers in hopes that this early investment will pay dividends for decades to come.

The following competitive grants are offered by the American Cancer Society for extramural support:

- **Research Scholar Grant (RSG)** – provides resources for investigator-initiated research projects in a variety of cancer-relevant areas. Applicants are independent, self-directed researchers within eight to 10 years (depending on clinical service) of their first academic appointment.
- **Postdoctoral Fellowship (PF)** – funds mentored training for a career in cancer research
- **Clinician Scientist Development Grant (CSDG)** – supports protected time to allow junior faculty who see patients to be mentored and participate in research training
- **Institutional Research Grant (IRG)** – awards seed money to institutions for new investigators to initiate cancer research projects
- **Mission Boost Grant (MBG)** – provides opportunities for American Cancer Society grantees to seek additional ("boost") resources for innovative high-risk/high-reward projects nearing patient testing
- **Pilot and Exploratory Project (PEP)** – supports research studies to explore novel areas of research in palliative care of cancer patients
- **TheoryLab™ Collaborative Grants (TLC)** – provides pilot grant funding for collaborative research through participation in the American Cancer Society TheoryLab online research community to explore high-risk ideas
- **American Cancer Society Professor (RP & CRP)** – provides flexible funding for individuals who have made seminal contributions that have changed, and will continue to change, the direction of cancer

In addition, to amplify its impact, the Extramural Discovery Science department has partnered with several other organizations, including the Emerson Collective, Flatiron Health, the National Palliative Care Research Center, the Melanoma Research Alliance, and the St. Baldrick's Foundation. The Extramural Discovery Science department houses three scientific research portfolios that support innovative cancer research to meet critical needs in cancer:

A. Biochemistry and Immunology of Cancer

- Molecules involved in cancer
- Genes involved in cancer
- Potential targets for new treatments of cancer and mechanisms of signal transduction
- Immunology of cancer including immunotherapy

B. Cell Biology and Preclinical Cancer Research

- Fundamental controls that dictate cancer cell development and regulation of cell growth
- Mechanisms driving cancer progression
- Cancer biomarker discovery and development
- Discovery, synthesis, and delivery of cancer drugs

C. Clinical and Cancer Control Research

- Clinical research to test novel interventions, methods to prevent, detect, treat, or survive cancer
- Innovative methods to sustain behavioral change
- Access to care and palliative care research

- Health equity research to uncover root causes of inequities based on the social determinants of health and testing strategies to achieve health equity

As of September 2022, the American Cancer Society was funding a portfolio of 618 research grants totaling more than $404.8 million, including $69.5 million for breast cancer (153 grants), $27.9 million for lung cancer (69 grants), and $27.3 million for colorectal cancer (67 grants). In addition, extramural funding supports studies of some of the most lethal cancers, including pancreas ($12.2 million), brain ($11.2 million), ovarian ($14.8 million), and liver ($14.1 million). Since many cancers share biological characteristics, a significant portion of the funding portfolio is focused on these pan-cancer studies ($69.8 million), which investigate topics such as common cellular differences across cancer type that can result in simultaneous advances against multiple cancers. To encourage greater collaboration among American Cancer Society grantees, the Extramural Discovery Science department launched the TheoryLab™ online platform in 2018 to enable and encourage greater collaboration among our grantees. There are currently more than 1,500 members representing a wide range of cancer research.

Population Science

The Population Science program has two primary focus areas; a long-standing epidemiology program that increases knowledge of factors associated with cancer occurrence and survivorship, and more recent initiatives in behavioral interventions research. Contributions from Population Science ultimately inform our evidence-based programs and recommendations, which are focused on enhancing cancer prevention, improving outcomes, and reducing disparities.

The epidemiology work began in 1952, when biologist and epidemiologist E. Cuyler 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 70 years, results from these studies have contributed extensively to the science on cancer risk associated with modifiable and non-modifiable factors, and they have informed the American Cancer Society's and international guidelines for cancer prevention.

Today, Population Science 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 genetics; modifiable risk factors such as smoking, physical and sedentary activity, diet, alcohol, and excess body weight; medical conditions and common medications; and environmental exposures (e.g., circadian rhythm disruption, radon, and pollutants).
- **Molecular epidemiology:** Improve understanding of the molecular epidemiology of cancer, with a focus on breast, gastrointestinal, hematologic, ovary, 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.
- **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 Equity Science

The Surveillance and Health Equity Science (SHES) department informs and promotes cancer prevention and control via five overlapping areas of research: cancer surveillance; risk factors and screening; health services; disparities; and tobacco control. Information is disseminated via peer-reviewed journal articles for scientific audiences and educational publications for a lay audience. For example, the program has produced this *Cancer Facts & Figures* report annually since 1951, and its accompanying Cancer Statistics article, published in *CA: A Cancer Journal for Clinicians*, since 1967. These publications, which are available on our website at cancer.org/statistics, are the most widely cited sources for cancer statistics in the scientific literature. Visit the Cancer Statistics Center mobile-friendly interactive website at cancerstatisticscenter.cancer.org to generate customized data.

Since 1998, SHES staff have collaborated with leading cancer organizations, such as the National Cancer Institute and the Centers for Disease Control and Prevention, to produce the Annual Report to the Nation on the Status of Cancer, a highly cited, peer-reviewed journal article that reports cancer rates and trends in the US. International products include *The Cancer Atlas* (canceratlas.cancer.org), a one-stop resource for global cancer data, and *Global Cancer Facts & Figures* (cancer.org/research/cancer-facts-statistics/global.html).

With an overarching goal of reducing health inequalities, staff in the SHES department also generate scientific evidence to inform and support American Cancer Society priority areas for cancer prevention and control. For example, a series of high-profile studies conducted by our Surveillance Research group that demonstrated increasing rates of colorectal cancer in individuals under 55 years of age helped inform the decision to lower the recommended age to begin colorectal cancer screening from 50 to 45 by the American Cancer Society in 2018 and the US Preventive Services Task Force in 2021. Researchers also study barriers to receipt of screening and provide data to guide roundtable activities, such as evaluating the impact of the COVID-19 pandemic on screening test use.

SHES staff also study public policies such as excise tax on tobacco products (including e-cigarettes) and tobacco industry activities on tobacco consumption to inform or support advocacy for tobacco control policies at the federal, state, and local levels. For example, findings from the Tobacco Control Research team informed the FDA's proposed rule to ban menthol as a characterizing flavor in cigarettes. Further, the department evaluates policies associated with access to and receipt of guideline-recommended care, economic burden, and health outcomes. For example, findings from the Health Services Research group have been instrumental in understanding the effects of health insurance coverage and provisions of the Affordable Care Act (ACA) on cancer care and outcomes. A recent study found that newly diagnosed cancer patients living in states that had expanded Medicaid eligibility were more likely to be diagnosed with early-stage disease than those living in non-expansion states.

Sources of Statistics

Estimated new cancer cases. The number of invasive cancer cases diagnosed in 2023 was calculated by estimating complete case counts during 2005 through 2019 in all 50 states and the District of Columbia (DC) using a spatiotemporal model that considers state variation in sociodemographic and lifestyle factors, medical settings, and cancer screening behaviors, and accounts for expected delays in case reporting. Input data for the model was cancer occurrence information from cancer registries that consented to participate and met the North American Association of Central Cancer Registries' (NAACCR) high-quality data standards. The 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. Modeled counts are then projected forward 4 years based on the most recent 4-year average annual percent change (AAPC) in cases. For more information on this method, see "A" and "B" under Additional information on page 79.

The number of new cases in 2023 of melanoma in situ and ductal carcinoma in situ of the female breast was estimated by first approximating the actual number of cases diagnosed each year during 2010 through 2019 by applying annual age-specific incidence rates to the corresponding population estimates and then projecting 4 years ahead based on the overall AAPC. These projections were adjusted for delays in case reporting based on established national delay factors for invasive cancer from the NAACCR and thus may be underestimates. SEER delays factors, which do not capture the full magnitude of national reporting delays, were used to adjust these estimates in previous reports.

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 (19 age groups) to allow comparisons across populations with different age distributions. Beginning with *Cancer Facts & Figures 2022*, rates for American Indian or Alaska Native (AIAN) people and Asian American or Pacific Islander (AAPI) people now exclude persons of Hispanic ethnicity to improve their accuracy. National and state rates presented herein differ slightly from those previously published by the NAACCR for several reasons. First, rates in NAACCR's publication, *Cancer Incidence in North America, 2015-2019*, are now age adjusted using 20 age groups and are also adjusted for reporting delays. (See "C" under Additional information on page 80 for full reference.) Second, national rates in this publication exclude Puerto Rico, which is presented separately. Finally, colorectal cancer incidence rates presented herein exclude cancers of the appendix.

Trends in cancer incidence provided in the Selected Cancers section are based on delay-adjusted rates from states that met high-quality data standards for every year during 1998-2019, representing 90% of the US population, as provided in a customized NAACCR database. 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 likely to be diagnosed in a hospital, such as leukemia.

Stage distribution. The proportion of cancer cases diagnosed at a local, regional, or distant stage (as well as in situ for urinary bladder) was based on the 2015-2019 NAACCR data described above for incidence rates.

Estimated cancer deaths. The number of cancer deaths in the US in 2023 was estimated by fitting the observed number of cancer deaths from 2006 to 2020 to the same log-linear regression model used to produce estimated cases and then similarly using the most recent 4-year AAPC to forecast the number of deaths expected in

2023. 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 "B" under Additional information on page 79.)

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, presented per 100,000 people and age adjusted to the 2000 US standard population. Mortality rates for AIAN individuals were adjusted for racial misclassification on death certificates using factors published by the NCHS (See "D" under Additional information on page 80 for a description of the complete methodology). Trends in cancer mortality rates provided in the text are based on mortality data from 1975 to 2020. Mortality rates for Puerto Rico (Table 5) were obtained from State Cancer Profiles (statecancerprofiles.cancer.gov/).

Important note about estimated cancer cases and deaths for the current year. The methodologies for predicting cancer cases and deaths in the current year were recently re-evaluated and updated. 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 and methodology. As such, they are not informative for tracking cancer trends. Because data for incidence and mortality are only available through 2019 and 2020, respectively, case estimates also do not reflect the impact of COVID-19 on cancer diagnoses while death estimates only reflect one year of the pandemic. 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 relative survival rates, which is a measure of life expectancy among cancer patients compared to that among the general population of the same age, race/ethnicity, and sex. Survival rates herein are based on data from the National Cancer Institute's SEER registries for individuals diagnosed from 2012 through 2018 for 5-year survival and 2004 through 2018 for 10-year survival, with all patients followed through 2019. Contemporary survival rates for White and Black individuals are exclusive of Hispanic ethnicity. All rates were either previously published on the SEER Explorer website or generated using SEER*Stat software version 8.4.0. (See "E" and "F" under Additional information on page 80 for full reference.)

Probability of developing cancer. Probabilities of developing cancer were calculated using DevCan (Probability of Developing Cancer) software version 6.8.0, developed by the NCI, and are based on all 22 SEER registries. (See "G" under Additional information on page 80 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 in 16 men 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. Lui B, Zhu L, Zou J, et al. Updated methodology for projecting US and state-level cancer counts for the current calendar year: Part I: Spatiotemporal small area modeling for cancer incidence. *Cancer Epidemiol Biomarkers Prev.* 2021; published online June 22.

B. Miller KD, Siegel RL, Lui B, et al. Updated methodology for projecting US and state-level cancer counts for the current calendar year: Part II: Evaluation of temporal projection methods for incidence and mortality. *Cancer Epidemiol Biomarkers Prev.* 2021; published online August 17.

C. Sherman R, Firth R, Kahl A M, et al. (eds). Cancer in North America: 2015-2019. Volume One: Combined Cancer Incidence for the United States, Canada, and North America. Springfield, IL: North American Association of Central Cancer Registries, Inc. May 2022. Available at https://www.naaccr.org/wp-content/uploads/2022/06/CiNA.2015-2019.v1.combined-incidence.pdf.

D. Arias E, Xu JQ, Curtis S, et al. Mortality profile of the non-Hispanic American Indian or Alaska Native population, 2019. National Vital Statistics Reports; vol 70 no 12. Hyattsville, MD: National Center for Health Statistics. 2021.

E. SEER*Explorer: An interactive website for SEER cancer statistics [Internet]. Surveillance Research Program, National Cancer Institute. [Cited 2022 April 15]. Available from https://seer.cancer.gov/explorer/.

F. Surveillance, Epidemiology, and End Results (SEER) Program (seer.cancer.gov) SEER*Stat Database: Incidence – SEER Research Data, 17 Registries, Nov 2021 Sub (2000-2019) – Linked To County Attributes – Time Dependent (1990-2019) Income/Rurality, 1969-2020 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, released April 2022, based on the November 2021 submission.

G. DevCan: Probability of Developing or Dying of Cancer Software, Version 6.8.0; Statistical Research and Applications Branch, National Cancer Institute, 2022. https://surveillance.cancer.gov/devcan/.

Acknowledgments

We gratefully acknowledge all cancer registries and their staff for their hard work and diligence in collecting cancer information, without which this report would not exist. We would also like to acknowledge the following subject matter experts and production staff for their valuable contributions: Devon Adams; Rick Alteri; Meenu Anand; Priti Bandi; Nina DaSilva Baptista; Ashley Brown; Ellen Chang; Marcie Fisher-Borne; Mark Fleury; Neal Freedman; Ted Gansler; Angela Giaquinto; Jennifer Hoque; Anna Howard; Farhad Islami; Steve Itzkowitz; Mamta Kalidas; Tyler Kratzer; Kristie McComb; Marji McCullough; Catherine McMahon; Kimberly Miller; Adair Minihan; Meg O'Brien; Alpa Patel; Debbie Saslow; Scott Simpson; Robert Smith; Kristen Sullivan; Hyuna Sung; Lauren Teras; Britton Trabert; Lynn Urquhart; Nikita Wagle; Dana Wagner; Lee Westmaas; Tracy Wiedt; Tracy Wyant; Robin Yabroff; Kathy Zamora; and Joe Zou.

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

For more information, contact:
Rebecca Siegel or Ahmedin Jemal
Surveillance and Health Equity Science Department

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 25-65	HPV DNA test, **OR** Pap test & HPV DNA test	**Preferred:** Primary HPV test alone every 5 years with an FDA-approved test for primary HPV screening. **Acceptable:** Co-testing (HPV test and Pap test) every 5 years or Pap test alone every 3 years.
	Women, ages >65		Discontinue screening if results from regular screening in the past 10 years were negative, with the most recent test within the past 5 years.
	Women who have been vaccinated against HPV		Follow age-specific screening recommendations (same as unvaccinated individuals).
	Women who have had a total hysterectomy		Individuals without a cervix and without a history of cervical cancer or a history of CIN2 or a more severe diagnosis in the past 25 years should not be screened.
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 50-80 in fairly good health with 20+ pack-year history	Low-dose helical CT (LDCT)	The American Cancer Society is currently reviewing the new scientific evidence for lung cancer screening. In the interim we recommend following the updated guidelines from the US Preventive Services Task Force (uspreventiveservicestaskforce.org/uspstf/recommendation/lung-cancer-screening), which recommends annual LDCT screening in adults ages 50-80 who have a 20-pack year smoking history and currently smoke or have quit within the past 15 years.
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.

©2023, American Cancer Society, Inc.
No. 500823

The American Cancer Society's mission is to improve the lives of people with cancer and their families through advocacy, research, and patient support, to ensure everyone has an opportunity to prevent, detect, treat, and survive cancer.

American Cancer Society®

Every cancer. Every life.

cancer.org | 1.800.227.2345

BBB ACCREDITED CHARITY

bbb.org/charity

PUTTING PATIENTS FIRST

National Health Council

Standards of Excellence Certification Program ®