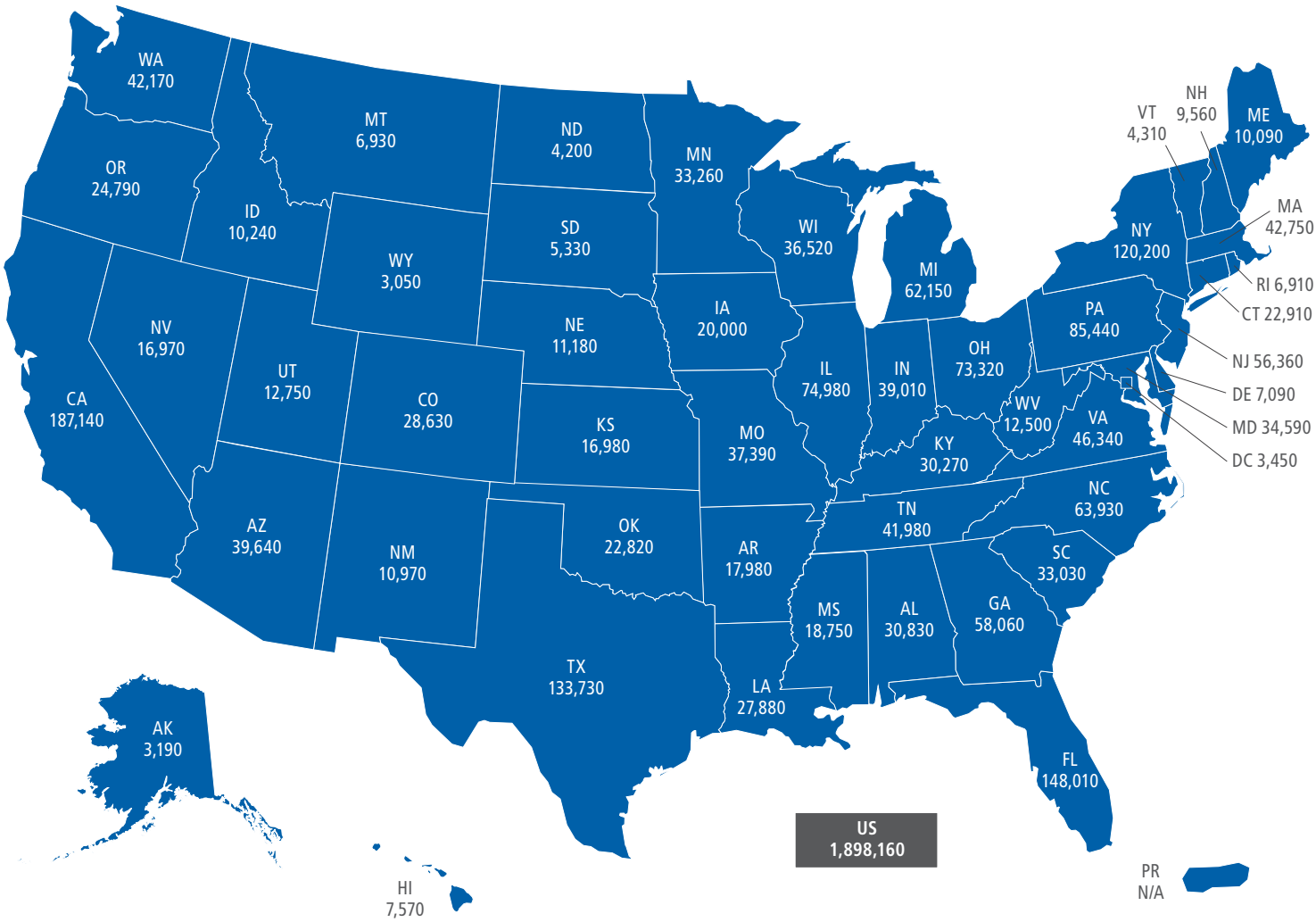
American Cancer Society®

# Cancer Facts & Figures 2021




Estimated number of new cancer cases for 2021, excluding basal cell and squamous cell skin cancers and in situ carcinomas except urinary bladder. Estimates are not available for Puerto Rico.
**Note:** Incidence counts for 2021 are model-based and thus should be interpreted with caution. State estimates may not equal US total due to rounding.

## Special Section: COVID-19 and Cancer

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


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# Basic Cancer Facts

## What Is Cancer?

Cancer is a group of diseases characterized by the uncontrolled growth and spread of abnormal cells that can result in death if not treated. Although the causes of cancer 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 797,000 cases in 2021 – 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 avoid the 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.

In addition, screening can help prevent colorectal and cervical cancers by detecting and removing precancers in the colon, rectum, and uterine cervix. Screening can also detect these and some other cancers early, when treatment is often less intensive and more successful. Screening is known to reduce mortality for cancers of the breast, colon, rectum, cervix, lung (among people who smoke, or used to smoke), and probably prostate. In addition, being aware of changes in the body, such as the breasts, skin, mouth, eyes, or genitalia, and bringing these to the attention of a health care professional may also result in the early detection of cancer. For complete cancer screening guidelines, see page 67.

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

More than 16.9 million Americans with a history of invasive cancer were alive on January 1, 2019, 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 2021?

Almost 1.9 million new cancer cases are expected to be diagnosed in 2021 (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 2021 by state.

Approximately 608,570 Americans are expected to die of cancer in 2021 (Table 1), which translates to 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 2021.

Importantly, these estimates are based on reported cancer incidence and mortality through 2017 and 2018, respectively, and do not account for the unknown impact of COVID-19 on cancer diagnoses and deaths. For information on COVID-19 and cancer, see the Special Section on page 30.

## How Much Progress Has Been Made Against Cancer?

Death rates are the best measure of progress against cancer because they are less affected by 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 cancer deaths per 100,000 people, mainly because of the smoking epidemic. As of 2018, the rate had dropped to 149 per 100,000 (a decline of 31%) because of reductions in

smoking, as well as improvements in early detection and treatment for some cancers. This decline translates into about 3.2 million fewer cancer deaths from 1991 to 2018, and is largely driven by progress against the four most common cancer types – lung, colorectal, breast, and prostate (Figure 1 and Figure 2).

## Do Cancer Incidence and Death Rates Vary by State?

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

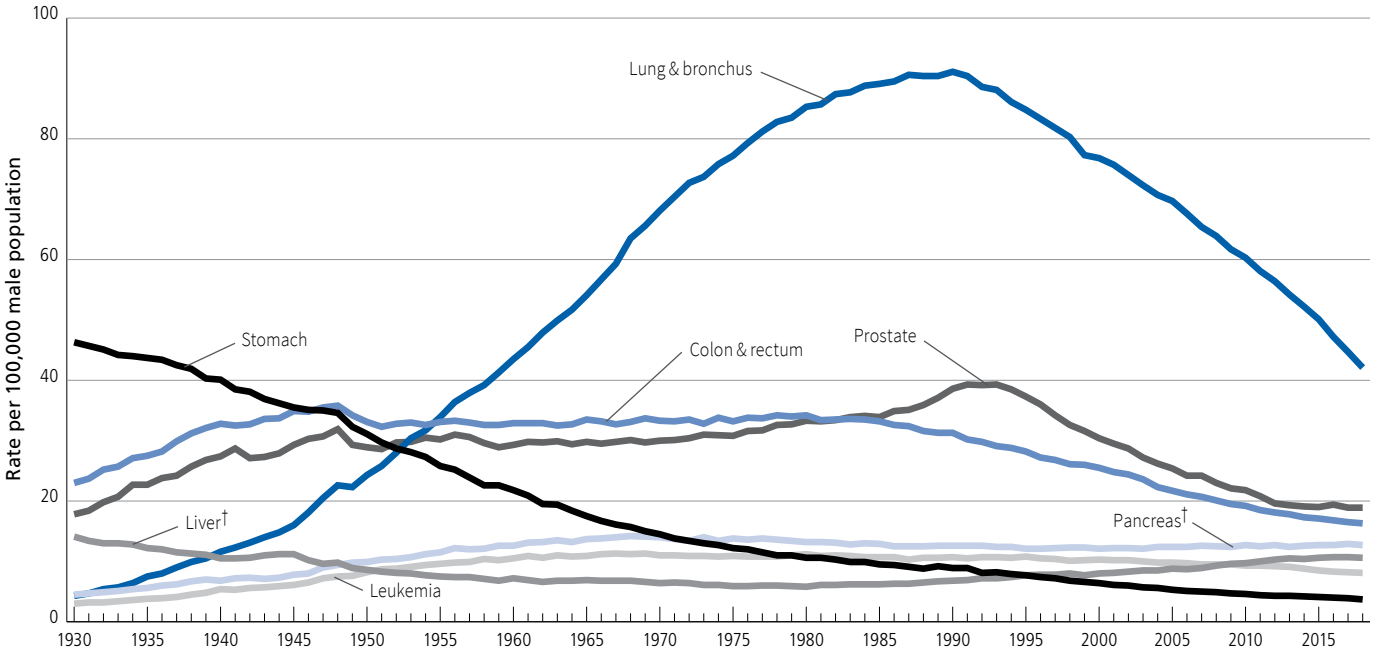
## Who Is at Risk of Developing Cancer?

The risk of developing cancer increases with advancing age; 80% of all cancers in the United States are diagnosed in people 55 years of age or older. Certain behaviors and other modifiable factors also increase risk, such as smoking, having excess body weight, drinking alcohol, and having 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 general population and may differ because of variations in individual exposures (e.g., smoking), family history, and/or genetic susceptibility.

A family history of cancer is thought to primarily reflect inheritance of genetic variations that confer slight-to-moderate increased risk in concert with similar exposures to lifestyle/environmental factors among family members. 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, men and women who smoke cigarettes are about 25 times more likely to develop lung cancer than people who never

**Figure 1. Trends in Age-adjusted Cancer Death Rates* by Site, Males, US, 1930-2018**




*Per 100,000, age adjusted to the 2000 US standard population. †Mortality rates for pancreatic and liver cancers are increasing.
Note: Due to changes in ICD coding, numerator information has changed over time for cancers of the liver, lung and bronchus, and colon and rectum.
**Source:** US Mortality Volumes 1930 to 1959, US Mortality Data 1960 to 2018, National Center for Health Statistics, Centers for Disease Control and Prevention.

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.

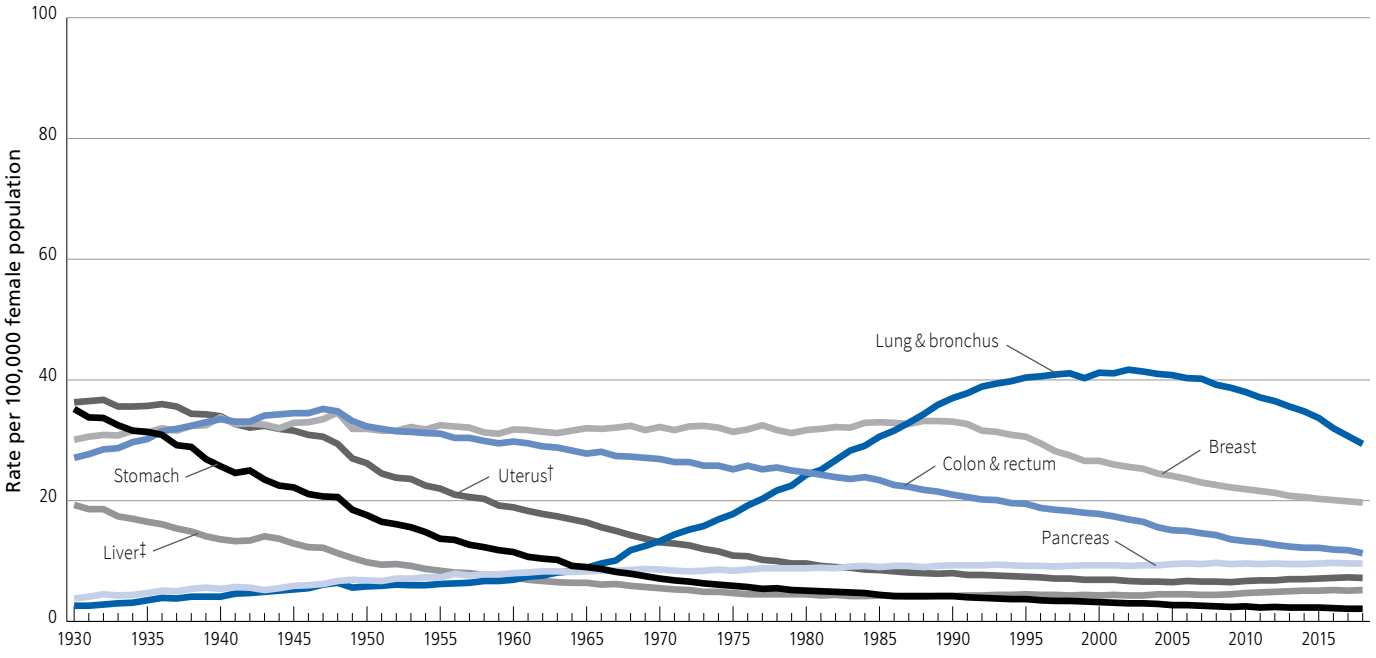
## What Percentage of People Survive Cancer?

The 5-year relative survival rate for all cancers combined has increased substantially since the early 1960s, from 39% to 68% among White people and from 27% to 63% 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.

Relative survival is the proportion of people who are alive for a designated time (usually 5 years) after a cancer diagnosis, divided by the proportion of people of similar age, race, and gender that would be expected to be alive in the absence of cancer based on normal life expectancy. Relative survival does not distinguish between patients who have no evidence of cancer and those who have relapsed or are still in treatment, nor does it represent the proportion of people who are cured, because cancer death can occur beyond 5 years after diagnosis. For information about how survival rates were calculated for this report, see Sources of Statistics on page 64.

Although relative survival rates provide some indication about the average experience of cancer patients, they should be interpreted with caution for several reasons. First, they do not reflect the most recent advances in detection and treatment because they are based on people who were diagnosed several years in the past. Second, they do not account for many factors that can influence an individual's survival, such as access to

**Figure 2. Trends in Age-adjusted Cancer Death Rates* by Site, Females, US, 1930-2018**




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

Note: Due to changes in ICD coding, numerator information has changed 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 2018, National Center for Health Statistics, Centers for Disease Control and Prevention.

## Table 1. Estimated Number* of New Cancer Cases and Deaths by Sex, US, 2021

| | Estimated New Cases | | | Estimated Deaths | | |
|---|---|---|---|---|---|---|
| | **Both sexes** | **Male** | **Female** | **Both sexes** | **Male** | **Female** |
| All sites | 1,898,160 | 970,250 | 927,910 | 608,570 | 319,420 | 289,150 |
| Oral cavity & pharynx | 54,010 | 38,800 | 15,210 | 10,850 | 7,620 | 3,230 |
| Tongue | 17,960 | 13,040 | 4,920 | 2,870 | 1,930 | 940 |
| Mouth | 14,290 | 8,400 | 5,890 | 2,650 | 1,520 | 1,130 |
| Pharynx | 18,470 | 14,990 | 3,480 | 3,870 | 3,060 | 810 |
| Other oral cavity | 3,290 | 2,370 | 920 | 1,460 | 1,110 | 350 |
| Digestive system | 338,090 | 191,090 | 147,000 | 169,280 | 98,140 | 71,140 |
| Esophagus | 19,260 | 15,310 | 3,950 | 15,530 | 12,410 | 3,120 |
| Stomach | 26,560 | 16,160 | 10,400 | 11,180 | 6,740 | 4,440 |
| Small intestine | 11,390 | 6,130 | 5,260 | 2,100 | 1,110 | 990 |
| Colon† | 104,270 | 52,590 | 51,680 | 52,980 | 28,520 | 24,460 |
| Rectum | 45,230 | 26,930 | 18,300 | | | |
| Anus, anal canal, & anorectum | 9,090 | 3,020 | 6,070 | 1,430 | 560 | 870 |
| Liver & intrahepatic bile duct | 42,230 | 29,890 | 12,340 | 30,230 | 20,300 | 9,930 |
| Gallbladder & other biliary | 11,980 | 5,730 | 6,250 | 4,310 | 1,770 | 2,540 |
| Pancreas | 60,430 | 31,950 | 28,480 | 48,220 | 25,270 | 22,950 |
| Other digestive organs | 7,650 | 3,380 | 4,270 | 3,300 | 1,460 | 1,840 |
| Respiratory system | 254,170 | 132,910 | 121,260 | 137,040 | 73,340 | 63,700 |
| Larynx | 12,620 | 9,940 | 2,680 | 3,770 | 3,020 | 750 |
| Lung & bronchus | 235,760 | 119,100 | 116,660 | 131,880 | 69,410 | 62,470 |
| Other respiratory organs | 5,790 | 3,870 | 1,920 | 1,390 | 910 | 480 |
| Bones & joints | 3,610 | 2,100 | 1,510 | 2,060 | 1,190 | 870 |
| Soft tissue (including heart) | 13,460 | 7,720 | 5,740 | 5,350 | 2,840 | 2,510 |
| Skin (excluding basal & squamous) | 115,320 | 68,120 | 47,200 | 11,540 | 7,660 | 3,880 |
| Melanoma of the skin | 106,110 | 62,260 | 43,850 | 7,180 | 4,600 | 2,580 |
| Other nonepithelial skin | 9,210 | 5,860 | 3,350 | 4,360 | 3,060 | 1,300 |
| Breast | 284,200 | 2,650 | 281,550 | 44,130 | 530 | 43,600 |
| Genital system | 376,970 | 260,210 | 116,760 | 69,110 | 35,030 | 34,080 |
| Uterine cervix | 14,480 | | 14,480 | 4,290 | | 4,290 |
| Uterine corpus | 66,570 | | 66,570 | 12,940 | | 12,940 |
| Ovary | 21,410 | | 21,410 | 13,770 | | 13,770 |
| Vulva | 6,120 | | 6,120 | 1,550 | | 1,550 |
| Vagina & other genital, female | 8,180 | | 8,180 | 1,530 | | 1,530 |
| Prostate | 248,530 | 248,530 | | 34,130 | 34,130 | |
| Testis | 9,470 | 9,470 | | 440 | 440 | |
| Penis & other genital, male | 2,210 | 2,210 | | 460 | 460 | |
| Urinary system | 164,000 | 115,750 | 48,250 | 31,940 | 21,640 | 10,300 |
| Urinary bladder | 83,730 | 64,280 | 19,450 | 17,200 | 12,260 | 4,940 |
| Kidney & renal pelvis | 76,080 | 48,780 | 27,300 | 13,780 | 8,790 | 4,990 |
| Ureter & other urinary organs | 4,190 | 2,690 | 1,500 | 960 | 590 | 370 |
| Eye & orbit | 3,320 | 1,750 | 1,570 | 400 | 220 | 180 |
| Brain & other nervous system | 24,530 | 13,840 | 10,690 | 18,600 | 10,500 | 8,100 |
| Endocrine system | 47,200 | 13,730 | 33,470 | 3,290 | 1,620 | 1,670 |
| Thyroid | 44,280 | 12,150 | 32,130 | 2,200 | 1,050 | 1,150 |
| Other endocrine | 2,920 | 1,580 | 1,340 | 1,090 | 570 | 520 |
| Lymphoma | 90,390 | 50,460 | 39,930 | 21,680 | 12,740 | 8,940 |
| Hodgkin lymphoma | 8,830 | 4,830 | 4,000 | 960 | 570 | 390 |
| Non-Hodgkin lymphoma | 81,560 | 45,630 | 35,930 | 20,720 | 12,170 | 8,550 |
| Myeloma | 34,920 | 19,320 | 15,600 | 12,410 | 6,840 | 5,570 |
| Leukemia | 61,090 | 35,530 | 25,560 | 23,660 | 13,900 | 9,760 |
| Acute lymphocytic leukemia | 5,690 | 3,000 | 2,690 | 1,580 | 900 | 680 |
| Chronic lymphocytic leukemia | 21,250 | 13,040 | 8,210 | 4,320 | 2,620 | 1,700 |
| Acute myeloid leukemia | 20,240 | 11,230 | 9,010 | 11,400 | 6,620 | 4,780 |
| Chronic myeloid leukemia | 9,110 | 5,150 | 3,960 | 1,220 | 680 | 540 |
| Other leukemia‡ | 4,800 | 3,110 | 1,690 | 5,140 | 3,080 | 2,060 |
| Other & unspecified primary sites‡ | 32,880 | 16,270 | 16,610 | 47,230 | 25,610 | 21,620 |

*Rounded to the nearest 10; cases exclude basal cell and squamous cell skin cancer and in situ carcinoma except urinary bladder. About 49,290 cases of female breast ductal carcinoma in situ and 101,280 cases of melanoma in situ will be diagnosed in 2021. †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 2003-2017 incidence data reported by the North American Association of Central Cancer Registries (NAACCR). Estimated deaths are based on 2004-2018 US mortality data, National Center for Health Statistics, Centers for Disease Control and Prevention.

## Table 2. Estimated Number* of New Cases for Selected Cancers by State, US, 2021

| State | All sites | Female breast | Uterine cervix | Colon & rectum | Uterine corpus | Leukemia | Lung & bronchus | Melanoma of the skin | Non-Hodgkin lymphoma | Prostate | Urinary bladder |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Alabama | 30,830 | 4,460 | 250 | 2,470 | 820 | 870 | 4,520 | 1,590 | 1,080 | 4,020 | 1,300 |
| Alaska | 3,190 | 520 | † | 330 | 100 | 100 | 370 | 110 | 110 | 440 | 160 |
| Arizona | 39,640 | 5,850 | 300 | 3,060 | 1,290 | 1,110 | 4,550 | 2,900 | 1,690 | 4,680 | 1,910 |
| Arkansas | 17,980 | 2,370 | 160 | 1,500 | 540 | 520 | 2,970 | 930 | 680 | 2,470 | 780 |
| California | 187,140 | 30,730 | 1,720 | 15,880 | 7,470 | 5,830 | 17,760 | 11,450 | 8,510 | 25,880 | 7,730 |
| Colorado | 28,630 | 4,580 | 200 | 2,140 | 930 | 870 | 2,570 | 2,240 | 1,090 | 3,920 | 1,230 |
| Connecticut | 22,910 | 3,540 | 120 | 1,560 | 860 | 650 | 2,750 | 1,300 | 1,010 | 3,160 | 1,180 |
| Delaware | 7,090 | 990 | † | 490 | 250 | 200 | 910 | 430 | 290 | 900 | 320 |
| Dist. of Columbia | 3,450 | 630 | † | 270 | 140 | 80 | 360 | 120 | 110 | 550 | 110 |
| Florida | 148,010 | 20,160 | 1,260 | 11,220 | 4,870 | 6,660 | 18,470 | 9,680 | 8,440 | 19,950 | 6,870 |
| Georgia | 58,060 | 8,770 | 490 | 4,840 | 1,820 | 1,840 | 7,250 | 3,800 | 2,100 | 8,550 | 2,150 |
| Hawaii | 7,570 | 1,390 | 60 | 710 | 360 | 200 | 930 | 460 | 330 | 880 | 300 |
| Idaho | 10,240 | 1,410 | 70 | 740 | 330 | 350 | 1,060 | 860 | 450 | 1,260 | 500 |
| Illinois | 74,980 | 11,190 | 560 | 6,200 | 2,710 | 2,120 | 9,600 | 4,030 | 3,010 | 10,250 | 3,320 |
| Indiana | 39,010 | 5,460 | 290 | 3,310 | 1,300 | 1,150 | 5,960 | 2,310 | 1,570 | 4,260 | 1,830 |
| Iowa | 20,000 | 2,710 | 120 | 1,570 | 700 | 740 | 2,610 | 1,290 | 890 | 2,530 | 880 |
| Kansas | 16,980 | 2,380 | 100 | 1,440 | 530 | 570 | 2,160 | 940 | 690 | 2,420 | 710 |
| Kentucky | 30,270 | 3,820 | 200 | 2,540 | 910 | 870 | 4,970 | 1,740 | 1,130 | 3,710 | 1,270 |
| Louisiana | 27,880 | 4,020 | 240 | 2,440 | 720 | 850 | 3,910 | 1,130 | 1,110 | 3,990 | 1,120 |
| Maine | 10,090 | 1,430 | 50 | 700 | 380 | 330 | 1,530 | 650 | 430 | 1,110 | 600 |
| Maryland | 34,590 | 5,470 | 220 | 2,550 | 1,260 | 980 | 4,230 | 1,870 | 1,360 | 5,020 | 1,320 |
| Massachusetts | 42,750 | 6,650 | 210 | 2,940 | 1,500 | 1,000 | 5,550 | 2,530 | 1,730 | 5,290 | 2,080 |
| Michigan | 62,150 | 8,700 | 380 | 4,690 | 2,240 | 1,800 | 8,590 | 3,440 | 2,620 | 8,940 | 3,010 |
| Minnesota | 33,260 | 4,850 | 160 | 2,490 | 1,210 | 1,380 | 3,970 | 1,850 | 1,520 | 4,020 | 1,520 |
| Mississippi | 18,750 | 2,550 | 160 | 1,670 | 500 | 510 | 2,870 | 750 | 630 | 2,380 | 700 |
| Missouri | 37,390 | 5,490 | 250 | 2,930 | 1,280 | 1,180 | 5,570 | 1,840 | 1,500 | 4,280 | 1,640 |
| Montana | 6,930 | 950 | † | 500 | 210 | 240 | 810 | 510 | 310 | 750 | 340 |
| Nebraska | 11,180 | 1,560 | 80 | 950 | 360 | 390 | 1,350 | 670 | 460 | 1,420 | 510 |
| Nevada | 16,970 | 2,490 | 160 | 1,400 | 480 | 530 | 2,080 | 1,000 | 740 | 2,090 | 790 |
| New Hampshire | 9,560 | 1,340 | 50 | 670 | 380 | 270 | 1,240 | 770 | 410 | 1,180 | 560 |
| New Jersey | 56,360 | 8,330 | 420 | 4,250 | 2,260 | 1,840 | 5,900 | 2,570 | 2,460 | 8,120 | 2,620 |
| New Mexico | 10,970 | 1,640 | 90 | 860 | 410 | 350 | 960 | 680 | 460 | 1,350 | 430 |
| New York | 120,200 | 17,540 | 920 | 8,920 | 4,810 | 4,110 | 13,950 | 4,290 | 5,480 | 15,840 | 5,610 |
| North Carolina | 63,930 | 9,850 | 430 | 4,650 | 2,110 | 2,050 | 8,830 | 4,250 | 2,480 | 8,970 | 2,650 |
| North Dakota | 4,200 | 570 | † | 350 | 140 | 170 | 490 | 250 | 190 | 560 | 200 |
| Ohio | 73,320 | 10,450 | 500 | 5,860 | 2,750 | 1,930 | 10,350 | 4,610 | 2,890 | 9,010 | 3,330 |
| Oklahoma | 22,820 | 3,230 | 200 | 1,900 | 660 | 760 | 3,300 | 1,110 | 900 | 2,710 | 920 |
| Oregon | 24,790 | 3,870 | 160 | 1,810 | 930 | 720 | 2,990 | 1,710 | 1,070 | 3,130 | 1,270 |
| Pennsylvania | 85,440 | 12,140 | 560 | 6,670 | 3,290 | 2,690 | 11,170 | 3,690 | 3,840 | 11,160 | 4,260 |
| Rhode Island | 6,910 | 1,000 | 50 | 490 | 250 | 210 | 950 | 410 | 310 | 920 | 370 |
| South Carolina | 33,030 | 4,990 | 240 | 2,570 | 1,060 | 1,010 | 4,510 | 1,970 | 1,260 | 4,860 | 1,340 |
| South Dakota | 5,330 | 740 | † | 450 | 170 | 190 | 650 | 310 | 230 | 750 | 240 |
| Tennessee | 41,980 | 5,850 | 350 | 3,370 | 1,250 | 1,180 | 6,410 | 1,830 | 1,560 | 5,430 | 1,720 |
| Texas | 133,730 | 20,900 | 1,470 | 11,280 | 4,590 | 4,820 | 15,010 | 4,600 | 5,780 | 14,200 | 4,780 |
| Utah | 12,750 | 1,850 | 80 | 900 | 480 | 400 | 770 | 1,610 | 510 | 1,980 | 480 |
| Vermont | 4,310 | 610 | † | 310 | 170 | 110 | 570 | 380 | 190 | 430 | 230 |
| Virginia | 46,340 | 7,450 | 310 | 3,600 | 1,500 | 1,310 | 5,820 | 2,530 | 1,840 | 6,540 | 1,940 |
| Washington | 42,170 | 6,810 | 310 | 3,140 | 1,320 | 1,290 | 4,780 | 2,730 | 1,870 | 5,370 | 2,000 |
| West Virginia | 12,500 | 1,610 | 80 | 1,090 | 440 | 410 | 2,020 | 720 | 530 | 1,430 | 660 |
| Wisconsin | 36,520 | 5,210 | 210 | 2,620 | 1,390 | 1,240 | 4,540 | 2,410 | 1,560 | 4,930 | 1,810 |
| Wyoming | 3,050 | 440 | † | 230 | 100 | 90 | 320 | 250 | 130 | 490 | 150 |
| **United States** | **1,898,160** | **281,550** | **14,480** | **149,500** | **66,570** | **61,090** | **235,760** | **106,110** | **81,560** | **248,530** | **83,730** |

*Rounded to the nearest 10. Excludes basal and squamous cell skin cancers and in situ carcinomas except urinary bladder. Estimates for Puerto Rico are unavailable.
†Estimate is fewer than 50 cases. These estimates are offered as a rough guide and should be interpreted with caution. State estimates may not sum to US total due to rounding and exclusion of state estimates fewer than 50 cases.

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

## Table 3. Estimated Number* of Deaths for Selected Cancers by State, US, 2021

| State | All sites | Brain/ nervous system | Female breast | Colon & rectum | Leukemia | Liver‡ | Lung & bronchus | Non-Hodgkin lymphoma | Ovary | Pancreas | Prostate |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Alabama | 10,590 | 310 | 720 | 920 | 350 | 470 | 2,860 | 270 | 220 | 820 | 480 |
| Alaska | 940 | † | 60 | 110 | † | † | 180 | † | † | 60 | 50 |
| Arizona | 12,510 | 410 | 900 | 1,240 | 490 | 590 | 2,580 | 420 | 310 | 1,060 | 780 |
| Arkansas | 6,250 | 140 | 400 | 500 | 210 | 280 | 1,810 | 200 | 130 | 450 | 270 |
| California | 61,860 | 1,990 | 4,730 | 5,390 | 2,300 | 3,780 | 9,900 | 2,190 | 1,640 | 4,940 | 4,140 |
| Colorado | 8,420 | 300 | 690 | 700 | 300 | 420 | 1,290 | 270 | 180 | 660 | 560 |
| Connecticut | 6,400 | 210 | 420 | 440 | 250 | 320 | 1,350 | 230 | 160 | 550 | 390 |
| Delaware | 2,170 | 60 | 160 | 160 | 90 | 120 | 540 | 80 | 50 | 190 | 90 |
| Dist. of Columbia | 1,020 | 70 | 100 | 90 | † | 50 | 140 | † | † | 100 | 70 |
| Florida | 47,170 | 1,370 | 3,120 | 4,360 | 1,930 | 2,080 | 10,940 | 1,590 | 1,020 | 3,700 | 2,850 |
| Georgia | 17,760 | 570 | 1,410 | 1,700 | 640 | 890 | 4,200 | 550 | 410 | 1,380 | 1,030 |
| Hawaii | 2,430 | 60 | 170 | 230 | 90 | 180 | 540 | 90 | † | 230 | 180 |
| Idaho | 3,230 | 110 | 250 | 330 | 140 | 140 | 620 | 120 | 80 | 250 | 200 |
| Illinois | 23,070 | 680 | 1,750 | 2,100 | 890 | 1,090 | 4,990 | 770 | 550 | 2,110 | 1,210 |
| Indiana | 13,460 | 380 | 910 | 1,160 | 510 | 610 | 3,520 | 450 | 290 | 1,030 | 760 |
| Iowa | 6,510 | 190 | 390 | 550 | 260 | 240 | 1,460 | 240 | 140 | 450 | 440 |
| Kansas | 5,620 | 180 | 370 | 500 | 250 | 270 | 1,360 | 190 | 140 | 420 | 270 |
| Kentucky | 10,090 | 300 | 630 | 930 | 390 | 400 | 2,660 | 330 | 180 | 730 | 440 |
| Louisiana | 9,380 | 240 | 670 | 860 | 330 | 610 | 2,360 | 290 | 240 | 660 | 490 |
| Maine | 3,390 | 110 | 190 | 230 | 120 | 130 | 840 | 120 | 70 | 250 | 160 |
| Maryland | 11,010 | 310 | 860 | 1,050 | 430 | 540 | 2,440 | 350 | 250 | 840 | 640 |
| Massachusetts | 12,540 | 430 | 780 | 1,000 | 500 | 640 | 2,770 | 490 | 310 | 1,070 | 690 |
| Michigan | 21,260 | 600 | 1,420 | 1,640 | 800 | 940 | 5,040 | 750 | 380 | 1,750 | 980 |
| Minnesota | 10,220 | 350 | 640 | 850 | 470 | 480 | 1,950 | 400 | 210 | 820 | 560 |
| Mississippi | 6,580 | 190 | 450 | 650 | 270 | 370 | 1,740 | 170 | 120 | 530 | 340 |
| Missouri | 12,960 | 340 | 850 | 1,070 | 510 | 680 | 3,250 | 410 | 250 | 960 | 630 |
| Montana | 2,150 | 70 | 140 | 180 | 80 | 110 | 480 | 70 | 50 | 160 | 170 |
| Nebraska | 3,560 | 120 | 240 | 320 | 160 | 100 | 680 | 120 | 80 | 290 | 270 |
| Nevada | 5,410 | 170 | 400 | 560 | 210 | 270 | 1,080 | 180 | 130 | 420 | 300 |
| New Hampshire | 2,840 | 90 | 170 | 290 | 80 | 120 | 730 | 90 | 100 | 200 | 150 |
| New Jersey | 15,870 | 520 | 1,250 | 1,410 | 640 | 760 | 3,050 | 570 | 360 | 1,360 | 760 |
| New Mexico | 3,820 | 110 | 290 | 350 | 130 | 280 | 560 | 130 | 110 | 280 | 220 |
| New York | 33,920 | 990 | 2,510 | 2,820 | 1,410 | 1,330 | 6,860 | 1,220 | 870 | 2,920 | 1,880 |
| North Carolina | 20,150 | 590 | 1,470 | 1,590 | 760 | 950 | 4,790 | 630 | 410 | 1,560 | 970 |
| North Dakota | 1,310 | † | 80 | 110 | 60 | 60 | 300 | 50 | † | 100 | 70 |
| Ohio | 25,140 | 720 | 1,720 | 2,110 | 960 | 1,130 | 6,180 | 870 | 390 | 2,000 | 1,450 |
| Oklahoma | 8,610 | 240 | 600 | 770 | 310 | 440 | 2,030 | 270 | 190 | 590 | 400 |
| Oregon | 8,430 | 270 | 570 | 650 | 320 | 460 | 1,690 | 310 | 240 | 690 | 520 |
| Pennsylvania | 27,960 | 830 | 1,970 | 2,340 | 1,100 | 1,140 | 6,140 | 980 | 620 | 2,300 | 1,510 |
| Rhode Island | 2,140 | 70 | 120 | 160 | 120 | 120 | 430 | 70 | † | 180 | 100 |
| South Carolina | 10,940 | 360 | 780 | 880 | 410 | 580 | 2,550 | 320 | 180 | 860 | 620 |
| South Dakota | 1,710 | 60 | 110 | 170 | 60 | 70 | 410 | 60 | 80 | 130 | 80 |
| Tennessee | 14,050 | 390 | 1,070 | 1,220 | 540 | 690 | 3,390 | 480 | 340 | 1,040 | 710 |
| Texas | 42,840 | 1,330 | 3,420 | 4,030 | 1,710 | 2,800 | 8,300 | 1,420 | 940 | 3,220 | 2,180 |
| Utah | 3,470 | 150 | 300 | 290 | 170 | 160 | 460 | 150 | 100 | 280 | 240 |
| Vermont | 1,470 | 60 | 80 | 130 | 50 | 50 | 340 | 50 | † | 110 | 70 |
| Virginia | 15,550 | 480 | 1,240 | 1,400 | 580 | 710 | 3,520 | 580 | 360 | 1,220 | 940 |
| Washington | 13,130 | 470 | 940 | 1,020 | 510 | 780 | 2,690 | 470 | 330 | 1,030 | 850 |
| West Virginia | 4,580 | 120 | 290 | 430 | 190 | 210 | 1,190 | 160 | 90 | 310 | 180 |
| Wisconsin | 11,700 | 360 | 750 | 900 | 490 | 490 | 2,490 | 400 | 260 | 870 | 730 |
| Wyoming | 990 | 50 | 70 | 80 | † | 60 | 210 | † | † | 80 | 50 |
| **United States** | **608,570** | **18,600** | **43,600** | **52,980** | **23,660** | **30,230** | **131,880** | **20,720** | **13,770** | **48,220** | **34,130** |

*Rounded to the nearest 10. †Estimate is fewer than 50 deaths. ‡Liver includes intrahepatic bile duct. These estimates are offered as a rough guide and should be interpreted with caution. State estimates may not sum to US total due to rounding and exclusion of state estimates fewer than 50 deaths. Estimates are not available for Puerto Rico.

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

## Table 4. Incidence Rates for Selected Cancers by State, US, 2013-2017

| | All sites | | Breast | Uterine cervix | Colon & rectum* | | Lung & bronchus | | Non-Hodgkin lymphoma | | Prostate |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **State** | **Male** | **Female** | **Female** | **Female** | **Male** | **Female** | **Male** | **Female** | **Male** | **Female** | **Male** |
| Alabama | 517.6 | 403.3 | 121.6 | 9.4 | 48.9 | 36.2 | 84.1 | 50.0 | 19.8 | 13.4 | 121.0 |
| Alaska | 437.2 | 403.2 | 120.1 | 7.2 | 43.9 | 39.0 | 64.8 | 47.6 | 21.0 | 13.5 | 83.4 |
| Arizona | 409.8 | 370.1 | 114.3 | 6.5 | 36.3 | 27.1 | 51.2 | 43.0 | 18.5 | 12.9 | 79.1 |
| Arkansas | 537.2 | 424.8 | 118.2 | 9.5 | 49.7 | 36.2 | 95.8 | 62.7 | 22.0 | 15.2 | 112.4 |
| California | 432.9 | 387.6 | 121.5 | 7.2 | 38.9 | 29.7 | 46.4 | 37.8 | 22.4 | 15.1 | 93.0 |
| Colorado | 419.4 | 388.5 | 127.6 | 6.2 | 35.5 | 28.1 | 44.1 | 39.6 | 20.8 | 14.1 | 92.7 |
| Connecticut | 504.9 | 449.9 | 140.5 | 6.1 | 38.7 | 29.1 | 65.0 | 55.8 | 26.2 | 17.1 | 111.3 |
| Delaware | 537.5 | 453.1 | 134.7 | 7.8 | 42.1 | 30.8 | 75.3 | 60.8 | 24.5 | 16.8 | 124.5 |
| Dist. of Columbia | 452.8 | 417.8 | 139.4 | 8.8 | 38.9 | 34.7 | 49.8 | 44.5 | 19.2 | 12.1 | 127.4 |
| Florida | 499.1 | 425.9 | 118.3 | 8.9 | 40.5 | 30.4 | 66.5 | 50.5 | 28.2 | 20.1 | 93.9 |
| Georgia | 532.1 | 421.4 | 126.8 | 7.8 | 47.0 | 34.0 | 79.0 | 50.6 | 22.3 | 14.9 | 124.2 |
| Hawaii | 437.7 | 406.4 | 138.9 | 6.8 | 45.7 | 34.5 | 57.3 | 36.3 | 19.8 | 13.5 | 88.2 |
| Idaho | 473.1 | 419.5 | 126.7 | 6.5 | 38.0 | 29.7 | 54.3 | 45.7 | 23.0 | 16.0 | 105.3 |
| Illinois | 504.2 | 442.0 | 133.1 | 7.7 | 48.0 | 35.1 | 73.8 | 56.3 | 23.7 | 16.2 | 109.1 |
| Indiana | 503.6 | 430.7 | 122.9 | 8.2 | 47.4 | 35.8 | 86.4 | 61.4 | 22.3 | 15.6 | 94.2 |
| Iowa | 523.9 | 449.2 | 128.9 | 7.5 | 47.7 | 36.9 | 74.7 | 54.5 | 25.8 | 17.3 | 107.7 |
| Kansas | 493.3 | 425.2 | 126.0 | 7.6 | 43.3 | 32.5 | 64.9 | 49.7 | 23.6 | 16.0 | 108.3 |
| Kentucky | 574.4 | 483.3 | 126.7 | 9.6 | 54.3 | 39.1 | 109.0 | 77.5 | 24.5 | 16.6 | 104.1 |
| Louisiana | 556.1 | 425.6 | 125.9 | 9.1 | 51.8 | 37.0 | 82.6 | 53.6 | 23.3 | 15.9 | 131.2 |
| Maine | 500.5 | 458.9 | 127.4 | 5.9 | 38.7 | 30.8 | 80.3 | 65.8 | 25.4 | 16.7 | 88.1 |
| Maryland | 493.8 | 428.0 | 132.9 | 6.6 | 39.3 | 31.3 | 62.9 | 51.7 | 21.5 | 15.3 | 124.7 |
| Massachusetts | 483.3 | 443.1 | 137.9 | 5.2 | 38.6 | 29.8 | 65.5 | 59.2 | 23.4 | 15.6 | 102.6 |
| Michigan | 487.9 | 421.7 | 122.6 | 6.7 | 40.8 | 31.9 | 71.8 | 56.9 | 23.7 | 16.4 | 106.3 |
| Minnesota | 503.6 | 443 | 132.5 | 5.5 | 40.8 | 31.9 | 61.5 | 52.2 | 26.1 | 17.3 | 108.8 |
| Mississippi | 547.4 | 414.2 | 118.0 | 9.4 | 55.0 | 39.4 | 97.6 | 57.7 | 20.5 | 14.0 | 127.7 |
| Missouri | 490.3 | 431.9 | 130.5 | 8.0 | 45.5 | 33.4 | 83.6 | 63.2 | 22.7 | 15.5 | 91.4 |
| Montana | 490.5 | 435.4 | 128.5 | 6.8 | 43.3 | 30.3 | 53.3 | 54.7 | 22.6 | 15.4 | 118.3 |
| Nebraska | 501.9 | 433.6 | 127.2 | 7.8 | 46.4 | 36.1 | 65.4 | 50.8 | 24.7 | 17.0 | 116.7 |
| Nevada† | 405.6 | 379.6 | 110.3 | 8.9 | 40.3 | 31.1 | 53.9 | 51.6 | 17.4 | 12.3 | 85.1 |
| New Hampshire | 511.6 | 463.9 | 144.7 | 4.7 | 40.3 | 29.8 | 67.2 | 61.8 | 25.2 | 17.3 | 109.2 |
| New Jersey | 530.5 | 458.8 | 136.6 | 7.7 | 45.4 | 34.1 | 60.8 | 51.7 | 26.1 | 18.3 | 131.3 |
| New Mexico | 391.5 | 365.7 | 111.8 | 8.2 | 36.5 | 28.4 | 43.9 | 34.3 | 17.1 | 13.4 | 82.8 |
| New York | 531.6 | 456.3 | 132.8 | 7.8 | 43.3 | 32.2 | 66.2 | 53.4 | 26.3 | 18.0 | 125.0 |
| North Carolina | 522.2 | 431.7 | 134.0 | 7.1 | 41.1 | 31.0 | 82.8 | 56.4 | 21.4 | 14.6 | 117.4 |
| North Dakota | 489.6 | 430.1 | 128.6 | 5.5 | 46.8 | 37.2 | 65.4 | 52.3 | 21.9 | 16.4 | 113.5 |
| Ohio | 502.9 | 441.3 | 128.9 | 7.9 | 45.7 | 34.9 | 80.0 | 58.7 | 23.5 | 15.7 | 104.1 |
| Oklahoma | 490.8 | 421.2 | 122.7 | 9.2 | 46.9 | 34.7 | 80.5 | 57.1 | 21.0 | 15.6 | 93.8 |
| Oregon | 460.2 | 417.7 | 125.5 | 7.0 | 37.6 | 29.3 | 58.7 | 50.6 | 22.8 | 15.7 | 93.3 |
| Pennsylvania | 522.3 | 462.2 | 132.3 | 7.3 | 45.9 | 34.2 | 73.4 | 56.4 | 25.0 | 17.9 | 103.7 |
| Rhode Island | 489.8 | 460.4 | 137.8 | 7.0 | 36.3 | 28.2 | 75.4 | 65.6 | 24.7 | 16.5 | 96.5 |
| South Carolina | 511.0 | 413.1 | 129.9 | 7.9 | 42.5 | 31.4 | 80.1 | 52.3 | 20.5 | 13.8 | 114.5 |
| South Dakota | 496.7 | 434.1 | 128.3 | 7.3 | 46.2 | 35.4 | 66.7 | 54.1 | 22.6 | 16.1 | 114.8 |
| Tennessee | 520.7 | 422.1 | 122.6 | 8.4 | 44.4 | 33.7 | 91.6 | 61.4 | 21.9 | 14.1 | 111.5 |
| Texas | 450.3 | 378.4 | 112.8 | 9.2 | 43.7 | 30.2 | 61.3 | 42.2 | 20.9 | 14.3 | 94.0 |
| Utah | 439.1 | 375.2 | 114.4 | 5.4 | 31.6 | 25.2 | 30.2 | 22.5 | 23.0 | 14.8 | 112.8 |
| Vermont | 478.1 | 440.7 | 131.3 | 4.3 | 35.5 | 30.7 | 67.9 | 55.6 | 25.2 | 16.1 | 87.1 |
| Virginia | 445.6 | 397.4 | 127.3 | 6.0 | 38.5 | 30.2 | 65.9 | 49.2 | 20.7 | 14.2 | 99.4 |
| Washington | 473.6 | 429.8 | 134.3 | 6.7 | 37.7 | 30.1 | 58.8 | 50.3 | 24.1 | 16.0 | 98.7 |
| West Virginia | 512.7 | 457.1 | 117.5 | 9.2 | 51.3 | 39.7 | 94.0 | 68.9 | 22.5 | 16.4 | 92.1 |
| Wisconsin | 503.7 | 438.3 | 131.5 | 6.4 | 39.5 | 30.7 | 66.6 | 53.5 | 25.1 | 17.1 | 109.3 |
| Wyoming | 431.5 | 376.6 | 112.5 | 6.4 | 34.2 | 27.9 | 45.2 | 40.0 | 20.7 | 13.5 | 108.1 |
| Puerto Rico‡ | 409.4 | 333.7 | 93.9 | 13.0 | 50.1 | 34.0 | 23.6 | 12.0 | 17.2 | 12.4 | 142.5 |
| **United States** | **489.1** | **422.4** | **126.0** | **7.6** | **42.6** | **32.1** | **67.6** | **51.3** | **23.3** | **16.0** | **104.6** |

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 either the registry did not consent or incidence data did not meet inclusion standards for all years during 2013-2017 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, 2020. Data are collected by cancer registries participating in the National Cancer Institute's SEER program and the Centers for Disease Control and Prevention's National Program of Cancer Registries.

## Table 5. Death Rates for Selected Cancers by State, US, 2014-2018

| | 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 | 216.6 | 142.3 | 21.5 | 19.0 | 12.6 | 65.5 | 35.7 | 6.7 | 3.8 | 13.6 | 10.2 | 21.0 |
| Alaska | 175.8 | 133.6 | 18.8 | 16.4 | 14.0 | 41.5 | 32.0 | 6.6 | 4.4 | 11.7 | 9.1 | 18.6 |
| Arizona | 162.1 | 118.1 | 18.5 | 15.3 | 10.2 | 36.4 | 27.1 | 5.8 | 3.7 | 11.7 | 8.8 | 17.3 |
| Arkansas | 216.8 | 148.0 | 20.3 | 19.0 | 12.8 | 67.6 | 41.0 | 6.9 | 4.1 | 12.9 | 9.4 | 18.4 |
| California | 164.9 | 122.5 | 19.3 | 14.6 | 10.7 | 33.2 | 24.1 | 6.6 | 4.1 | 11.7 | 9.1 | 19.9 |
| Colorado | 157.9 | 116.3 | 18.9 | 13.6 | 10.2 | 29.2 | 24.5 | 6.1 | 3.4 | 11.0 | 8.1 | 21.4 |
| Connecticut | 167.5 | 122.9 | 17.4 | 12.6 | 9.1 | 38.0 | 29.6 | 7.0 | 3.9 | 12.4 | 9.8 | 17.8 |
| Delaware | 195.8 | 141.6 | 21.4 | 15.7 | 11.3 | 51.2 | 37.0 | 7.4 | 4.3 | 14.3 | 10.5 | 17.2 |
| Dist. of Columbia | 183.5 | 146.3 | 26.2 | 17.9 | 13.1 | 36.4 | 25.8 | 6.0 | 3.4 | 15.6 | 12.2 | 28.2 |
| Florida | 174.9 | 125.3 | 18.8 | 15.3 | 10.8 | 45.3 | 31.0 | 6.4 | 3.9 | 12.2 | 9.0 | 16.6 |
| Georgia | 196.4 | 133.7 | 21.6 | 18.4 | 12.2 | 53.9 | 31.1 | 6.6 | 3.9 | 12.6 | 9.5 | 21.7 |
| Hawaii | 156.7 | 109.6 | 16.1 | 14.2 | 9.7 | 37.4 | 22.6 | 5.7 | 3.5 | 12.1 | 10.0 | 15.0 |
| Idaho | 179.2 | 132.5 | 21.5 | 15.0 | 11.2 | 36.9 | 28.6 | 7.4 | 4.9 | 12.8 | 9.5 | 23.1 |
| Illinois | 192.1 | 140.6 | 21.0 | 17.7 | 12.4 | 50.0 | 34.5 | 7.2 | 4.1 | 13.3 | 9.7 | 20.0 |
| Indiana | 209.7 | 146.4 | 20.8 | 17.7 | 12.9 | 60.5 | 39.9 | 8.0 | 4.6 | 13.7 | 9.9 | 19.5 |
| Iowa | 193.7 | 136.6 | 18.6 | 16.7 | 12.4 | 50.9 | 34.1 | 8.1 | 4.4 | 12.7 | 10.0 | 20.0 |
| Kansas | 190.7 | 138.7 | 19.8 | 17.6 | 12.2 | 49.9 | 35.3 | 7.0 | 4.6 | 12.8 | 9.8 | 18.7 |
| Kentucky | 233.4 | 160.5 | 21.0 | 19.9 | 13.9 | 75.3 | 49.0 | 8.2 | 4.5 | 13.3 | 10.2 | 19.3 |
| Louisiana | 215.6 | 147.0 | 22.8 | 19.8 | 13.6 | 61.6 | 36.6 | 7.6 | 4.3 | 14.4 | 11.0 | 20.5 |
| Maine | 201.1 | 145.4 | 18.0 | 14.6 | 11.4 | 55.3 | 40.0 | 7.6 | 4.6 | 12.4 | 10.3 | 19.2 |
| Maryland | 183.5 | 135.5 | 21.7 | 16.4 | 11.6 | 44.1 | 32.1 | 6.9 | 3.9 | 13.4 | 9.8 | 20.0 |
| Massachusetts | 180.1 | 129.2 | 17.3 | 13.8 | 9.9 | 42.7 | 33.2 | 6.8 | 4.2 | 13.0 | 10.0 | 18.3 |
| Michigan | 196.1 | 144.1 | 20.8 | 16.1 | 11.8 | 52.4 | 37.8 | 7.8 | 4.8 | 14.0 | 10.6 | 18.7 |
| Minnesota | 176.2 | 129.4 | 17.7 | 14.2 | 10.6 | 40.2 | 31.3 | 7.8 | 4.2 | 12.5 | 9.6 | 19.9 |
| Mississippi | 235.4 | 151.5 | 23.2 | 22.3 | 14.6 | 72.3 | 38.1 | 6.8 | 3.8 | 15.5 | 10.8 | 24.4 |
| Missouri | 204.6 | 144.4 | 20.9 | 17.7 | 11.9 | 59.4 | 40.4 | 7.2 | 4.1 | 13.6 | 9.6 | 17.6 |
| Montana | 174.7 | 132.2 | 18.9 | 15.9 | 10.6 | 37.9 | 34.6 | 7.0 | 4.1 | 11.2 | 9.4 | 22.3 |
| Nebraska | 183.9 | 133.6 | 19.6 | 17.3 | 12.5 | 45.3 | 32.3 | 7.3 | 4.1 | 13.2 | 9.4 | 18.1 |
| Nevada | 178.6 | 139.0 | 21.6 | 18.7 | 13.3 | 42.6 | 36.4 | 6.5 | 3.5 | 11.8 | 9.2 | 19.0 |
| New Hampshire | 182.1 | 137.0 | 18.3 | 14.3 | 11.0 | 45.9 | 37.5 | 6.4 | 4.3 | 11.8 | 9.0 | 18.6 |
| New Jersey | 172.3 | 132.6 | 20.9 | 16.4 | 11.6 | 39.0 | 29.9 | 7.1 | 4.0 | 12.6 | 10.2 | 17.6 |
| New Mexico | 165.1 | 120.5 | 19.7 | 16.2 | 10.8 | 31.7 | 22.9 | 5.9 | 3.9 | 11.1 | 8.0 | 19.3 |
| New York | 170.0 | 127.7 | 19.1 | 14.9 | 10.9 | 40.3 | 28.7 | 6.9 | 3.9 | 12.7 | 9.7 | 17.8 |
| North Carolina | 197.7 | 135.7 | 20.9 | 16.0 | 11.2 | 56.8 | 34.6 | 6.9 | 3.9 | 12.9 | 9.4 | 19.9 |
| North Dakota | 174.6 | 126.6 | 18.0 | 16.4 | 10.1 | 42.3 | 29.4 | 7.1 | 4.4 | 12.7 | 8.8 | 19.3 |
| Ohio | 207.2 | 147.3 | 21.9 | 17.9 | 12.9 | 58.3 | 37.9 | 7.9 | 4.6 | 13.7 | 10.6 | 19.3 |
| Oklahoma | 216.6 | 151.4 | 22.7 | 20.5 | 13.7 | 62.2 | 40.4 | 7.9 | 4.7 | 12.7 | 9.5 | 20.1 |
| Oregon | 182.3 | 137.9 | 19.7 | 14.8 | 11.0 | 40.9 | 33.3 | 7.5 | 4.7 | 13.7 | 10.3 | 20.9 |
| Pennsylvania | 196.3 | 140.5 | 21.0 | 17.4 | 12.3 | 50.2 | 33.8 | 7.7 | 4.5 | 14.3 | 10.4 | 18.6 |
| Rhode Island | 192.2 | 136.4 | 17.6 | 14.8 | 10.5 | 49.8 | 37.1 | 6.9 | 3.9 | 13.9 | 9.8 | 18.2 |
| South Carolina | 203.6 | 136.9 | 21.6 | 17.0 | 11.5 | 55.8 | 32.7 | 6.3 | 4.2 | 13.3 | 9.9 | 21.5 |
| South Dakota | 190.0 | 132.7 | 18.9 | 19.2 | 12.8 | 47.5 | 33.5 | 7.2 | 4.0 | 12.4 | 9.7 | 19.2 |
| Tennessee | 217.4 | 148.1 | 22.0 | 18.0 | 12.6 | 66.1 | 40.0 | 7.8 | 4.6 | 12.9 | 9.8 | 19.7 |
| Texas | 179.5 | 125.9 | 19.8 | 17.3 | 11.1 | 43.0 | 27.3 | 6.7 | 4.0 | 11.7 | 9.0 | 17.6 |
| Utah | 144.3 | 107.6 | 20.1 | 12.4 | 9.6 | 21.8 | 14.9 | 6.9 | 3.9 | 10.8 | 8.0 | 20.4 |
| Vermont | 193.2 | 140.1 | 18.0 | 15.7 | 13.7 | 47.7 | 36.5 | 8.1 | 4.2 | 12.2 | 9.6 | 19.7 |
| Virginia | 187.2 | 133.0 | 21.5 | 16.4 | 11.3 | 48.5 | 31.4 | 6.9 | 3.9 | 13.1 | 9.5 | 19.7 |
| Washington | 177.6 | 132.6 | 19.7 | 14.3 | 10.2 | 40.4 | 31.6 | 7.3 | 4.2 | 12.3 | 9.6 | 20.3 |
| West Virginia | 218.7 | 158.2 | 21.9 | 20.0 | 15.2 | 67.1 | 43.0 | 7.7 | 4.5 | 11.9 | 9.6 | 17.0 |
| Wisconsin | 187.9 | 135.0 | 18.8 | 15.1 | 10.9 | 45.7 | 33.0 | 7.5 | 4.4 | 13.5 | 9.9 | 20.6 |
| Wyoming | 160.6 | 122.3 | 18.2 | 13.9 | 10.1 | 33.1 | 29.3 | 6.5 | 4.0 | 12.3 | 8.3 | 16.9 |
| Puerto Rico† | 143.9 | 90.9 | 17.9 | 19.0 | 11.7 | 17.9 | 8.1 | 4.7 | 2.6 | 8.1 | 5.3 | 24.7 |
| **United States** | **185.5** | **133.5** | **20.1** | **16.3** | **11.5** | **46.9** | **32.0** | **7.0** | **4.1** | **12.7** | **9.6** | **19.0** |

Rates are per 100,000, age adjusted to the 2000 US standard population. *Rates for Puerto Rico are for 2013-2017 and are not included in overall US combined rates.

**Source:** US Mortality Data, National Center for Health Statistics, Centers for Disease Control and Prevention, 2020.

treatment, other health issues, and 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 an individual living longer than they would have in the absence of screening. In other words, a person may live longer with a cancer diagnosis because screening detected the disease before symptoms arose, but 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).

## How Is Cancer Staged?

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

Clinicians typically use a different staging system called TNM that assesses cancer growth and spread in 3 ways: size/extent of the primary tumor (T), absence or presence of regional lymph node involvement (N), and absence or presence of distant metastases (M). Once the T, N, and M categories are determined, a stage of 0, I, II, III, or IV is assigned, with stage 0 being in situ, stage I being early, and stage IV being the most advanced disease. However, some cancers do not have a stage IV (e.g., testis) and others (e.g., lymphoma) have alternative staging systems. As the biology of cancer has become better understood, additional tumor-specific features have been incorporated into staging for some cancers.

## What Are the Costs of Cancer?

The costs of cancer can be measured 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 estimates that cancer-related direct medical costs in the US were $183 billion in 2015 and are projected to increase to $246 billion by 2030, a 34% increase based only on population growth and aging. However, the projection is likely an underestimate because of the growing cost of prescription medicines, with the list price for many now more than $100,000 annually.

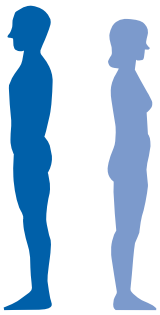
Cancer care costs and lost income due to time away from work during treatment and recovery can lead to medical financial hardship for cancer patients and their families. Many cancer survivors report financial hardship associated with cancer, including problems paying medical bills, distress and worry about medical bills, or delaying or forgoing medical care due to cost.

Lack of health insurance is strongly associated with medical financial hardship and also prevents many Americans from receiving optimal cancer prevention, early detection, and treatment. Despite gains in health insurance coverage following the implementation of the Affordable Care Act (ACA), nearly 26 million Americans were uninsured at some point during the 2019 calendar year, with the percentage ranging from 3% in Massachusetts to 18% in Texas. Uninsured individuals and those from other marginalized populations are substantially more likely to be diagnosed with cancer at a later stage, when treatment is often more intensive, costlier, and less successful. To learn more about how the ACA helps save lives from cancer, see Advocacy on page 62.

**Figure 3. Leading Sites of New Cancer Cases and Deaths – 2021 Estimates**

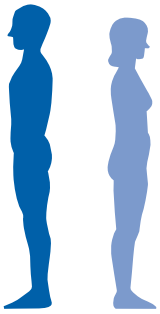
Estimated New Cases

| Male | | | Female | | |
|---|---|---|---|---|---|
| Prostate | 248,530 | 26% | Breast | 281,550 | 30% |
| Lung & bronchus | 119,100 | 12% | Lung & bronchus | 116,660 | 13% |
| Colon & rectum | 79,520 | 8% | Colon & rectum | 69,980 | 8% |
| Urinary bladder | 64,280 | 7% | Uterine corpus | 66,570 | 7% |
| Melanoma of the skin | 62,260 | 6% | Melanoma of the skin | 43,850 | 5% |
| Kidney & renal pelvis | 48,780 | 5% | Non-Hodgkin lymphoma | 35,930 | 4% |
| Non-Hodgkin lymphoma | 45,630 | 5% | Thyroid | 32,130 | 3% |
| Oral cavity & pharynx | 38,800 | 4% | Pancreas | 28,480 | 3% |
| Leukemia | 35,530 | 4% | Kidney & renal pelvis | 27,300 | 3% |
| Pancreas | 31,950 | 3% | Leukemia | 25,560 | 3% |
| **All sites** | **970,250** | | **All sites** | **927,910** | |



Estimated Deaths

| Male | | | Female | | |
|---|---|---|---|---|---|
| Lung & bronchus | 69,410 | 22% | Lung & bronchus | 62,470 | 22% |
| Prostate | 34,130 | 11% | Breast | 43,600 | 15% |
| Colon & rectum | 28,520 | 9% | Colon & rectum | 24,460 | 8% |
| Pancreas | 25,270 | 8% | Pancreas | 22,950 | 8% |
| Liver & intrahepatic bile duct | 20,300 | 6% | Ovary | 13,770 | 5% |
| Leukemia | 13,900 | 4% | Uterine corpus | 12,940 | 4% |
| Esophagus | 12,410 | 4% | Liver & intrahepatic bile duct | 9,930 | 3% |
| Urinary bladder | 12,260 | 4% | Leukemia | 9,760 | 3% |
| Non-Hodgkin lymphoma | 12,170 | 4% | Non-Hodgkin lymphoma | 8,550 | 3% |
| Brain & other nervous system | 10,500 | 3% | Brain & other nervous system | 8,100 | 3% |
| **All sites** | **319,420** | | **All sites** | **289,150** | |



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.



# Selected Cancers

This section provides information on the occurrence, risk factors, symptoms, early detection, and treatment for the most commonly diagnosed cancers, and may have limited relevance for cancer subtypes. (For information on rare cancers, see the Special Section in *Cancer Facts & Figures 2017* at cancer.org/statistics.) Cancer trends are generally based on incidence data during 2000 through 2017 from the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program, and mortality data during 1975 through 2018 from the National Center for Health Statistics. See Sources of Statistics on page 64 for more information.

## Breast

**New cases and deaths:** In the US in 2021, there will be an estimated 281,550 new cases of invasive breast cancer diagnosed in women (Figure 3); 2,650 cases diagnosed in men; and an additional 49,290 cases of ductal carcinoma in situ (DCIS) diagnosed in women (Table 1). An estimated 44,130 breast cancer deaths (43,600 women, 530 men) will occur in 2021.

**Incidence trends:** From 2008 to 2017, invasive female breast cancer incidence rates increased by about 0.5% per year.

**Mortality trends:** Since its peak in 1989, the female breast cancer death rate had declined by 41% in 2018 because of earlier detection (through screening, as well as increased awareness of symptoms) and improved treatment. This decrease translates to approximately 403,200 fewer breast cancer deaths during this time period than would have been expected in the absence of this progress. However, the pace of the decline has slowed from almost 2% annually during the 2000s to 1% per year from 2013 to 2018.

**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 being overweight or obese (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 inherited genetic variations in breast cancer susceptibility genes (e.g., *BRCA1* or *BRCA2*). These mutations are most common among people with a family history of breast, ovarian, and/or some other cancers. Other non-modifiable factors include a personal or family history of breast cancer; 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 at a young age (e.g., for treatment of lymphoma). Reproductive factors that increase risk include a long menstrual history (menstrual periods that start early and/or end late in life); not having children or having children after age 30; high natural levels of estrogen or testosterone; and recent use of hormonal contraceptives.

**Early detection:** Mammography is a low-dose x-ray procedure used to detect breast cancer at an early stage. Early diagnosis reduces the risk of dying from breast cancer and increases treatment options. However, like any screening tool, mammography is not perfect. It can miss cancer (false negative) or appear abnormal in the absence of cancer (false positive); about 12% of women who are screened have an abnormal mammogram, but only 5% of these women have cancer. Other potential harms of screening include detection of cancers and in situ lesions (e.g., DCIS) that would never have progressed or caused harm (i.e., overdiagnoses) and anxiety and medical costs associated with additional diagnostic testing in women without cancer. Although radiation exposure from mammograms is cumulative over time, it does not meaningfully increase breast cancer risk. For women at average risk of developing breast cancer, the American Cancer Society recommends that those 40 to 44 years of age have the option to begin annual mammography; those 45 to 54 undergo annual mammography; and those 55 years of age and older either transition to biennial mammography or continue annual mammography. Women should continue mammography as long as overall health is good and life expectancy is 10 or more years. For some women at high risk for breast cancer, annual breast magnetic resonance imaging (MRI) is recommended along with mammography, typically starting at age 30. For more information on breast cancer screening, see the American Cancer Society's screening guidelines on page 67. Women are encouraged to discuss an individualized screening plan with their health care team.

**Signs and symptoms:** Early breast cancer often causes no signs or symptoms and is usually diagnosed through mammography screening. 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).

**Treatment:** Treatment usually involves either breast-conserving surgery (surgical removal of the tumor and a rim of surrounding tissue, sometimes called a lumpectomy) with radiation or mastectomy (surgical removal of the entire breast), depending on tumor characteristics (e.g., size and extent of spread) and patient preference. One or more underarm lymph nodes are usually evaluated to determine whether the tumor has spread beyond the breast. For women with early-stage breast cancer (without 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. Although most patients undergoing mastectomy do not need radiation, it is sometimes recommended when the tumor is large or lymph nodes are involved. 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 (immediate reconstruction) or later as a second procedure (delayed reconstruction), but it often requires more than one surgery. Depending on cancer stage, subtype, and sometimes other test results, such as tumor genetic profiling (e.g., Oncotype DX), treatment may also involve

chemotherapy (before 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 for women with invasive breast cancer are 90% and 84%, respectively. Although survival has improved over time, large inequalities remain, especially for Black women. For example, the survival rate is 9%-10% lower (in absolute terms) for Black women than for White women overall (Table 7) and for regional- and distant-stage disease. 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.

## Childhood and Adolescent Cancer

**New cases and deaths:** In 2021, new cancer cases will be diagnosed in an estimated 10,500 children (ages 0 to 14 years) and 5,090 adolescents (ages 15-19 years). Cancer is the second-leading cause of death among children ages 1-14 years, after accidents; approximately 1,190 children and 590 adolescents will die from cancer in 2021.

Including benign and borderline brain tumors, the most commonly diagnosed cancers in children and adolescents are leukemia (28% and 13%, respectively), brain (27% and 21%), and lymphoma (9% and 19%). Certain common cancers in adulthood, such as thyroid and melanoma, are also common in adolescents, accounting for 11% and 3% of cases, respectively, compared to 2% and 1% in children.

**Incidence trends:** Overall, incidence rates have increased since 1975 by 0.6% per year on average among children and by 0.7% per year among adolescents, although trends vary by cancer type.

**Mortality trends:** The death rate for cancer has declined by more than half in both children and adolescents, from 4.9 (per 100,000) in 1975 to 2.0 in 2018 and from 5.9 to 2.9, respectively, largely due to improvements in treatment and high participation, especially among children, in clinical trials.

**Risk factors:** There are few known risk factors for cancer that occurs during childhood or adolescence, and most cases are thought to be due to random cell mutations without an external cause. Exposure to ionizing radiation, such as that from prior radiotherapy, increases the risk of leukemia and possibly other cancers. 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. Cancer risk is also increased in children and adolescents with certain genetic syndromes (e.g., Down syndrome, Li-Fraumeni syndrome, and Beckwith-Wiedemann syndrome).

**Signs and symptoms:** Early diagnosis of childhood and adolescent cancer is often hampered by nonspecific symptoms shared by common childhood conditions. 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; a persistent, localized pain or limping; a prolonged, unexplained fever or illness; frequent headaches, often with vomiting; sudden eye or vision changes; and excessive, rapid weight loss.

Following are more specific symptoms for the major categories of pediatric cancer according to the International Classification of Childhood Cancer (ICCC):

- 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.
- Non-Hodgkin lymphoma and Hodgkin lymphoma often cause lymph nodes to swell, which can appear as a lump in the neck, armpit, or groin; other symptoms can include fatigue, weight loss, and fever.

- Neuroblastoma, a cancer of the peripheral nervous system that is most common in children younger than 5 years of age, usually appears as a swelling in the abdomen, sometimes accompanied by loss of appetite.
- 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, a soft tissue sarcoma that can occur in the head and neck, genitourinary area, trunk, and extremities, may cause pain and/or a mass or swelling at the tumor site.
- Retinoblastoma, an eye cancer that usually occurs in children younger than 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 in girls (ovarian) may be difficult to detect because symptoms, such as abdominal pain, often do not present until the tumor is advanced. Conversely, testicular germ cell tumors are often visible and 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 for some cancers, such as acute lymphocytic leukemia, have been reported in the pediatric setting. If the child or adolescent is eligible, placement in a clinical trial, which compares a new treatment with the best currently available standard treatment, should be considered.

**Survival:** The 5-year relative survival for all types of cancer classified by the ICCC during the most recent time period (2010-2016) is 84% among children and 85% among adolescents, although rates vary considerably depending on cancer type, patient age, and other factors. For example, 5-year survival among the more common cancers ranges from 99% for Hodgkin lymphoma to 68% for osteosarcoma among children and from >99% for thyroid cancer to 46% for rhabdomyosarcoma among adolescents. Overall survival among adolescents is influenced by relatively high thyroid cancer survival, masking lower survival compared to children for several common cancers. For example, 5-year survival for acute lymphocytic leukemia is 91% in children vs 75% in adolescents. (For more childhood and adolescent cancer survival rates, see Table 13 in Cancer Statistics, 2021 at acsjournals.onlinelibrary.wiley.com/journal/15424863.) Pediatric and adolescent cancer survivors may experience treatment-related side effects long after active treatment, including impairment in organ function (e.g., cognitive defects) and new cancers. The Children's Oncology Group (COG) has developed guidelines for screening for and managing late effects in survivors of childhood cancer. See the COG website at survivorshipguidelines.org for more information.

For more information on cancer in children and adolescents, see the *Cancer Facts & Figures 2014* Special Section: Childhood & Adolescent Cancers and *Cancer Facts & Figures 2020* Special Section: Adolescent & Young Adult Cancer at cancer.org/statistics, as well as the Childhood Cancer Research Landscape Report at cancer.org.

## Colon and Rectum

**New cases and deaths:** In 2021, an estimated 104,270 cases of colon cancer and 45,230 cases of rectal cancer will be diagnosed in the US, and a total of 52,980 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.

**Table 6. Probability (%) of Developing Invasive Cancer During Selected Age Intervals by Sex, US, 2015-2017***

| | | Birth 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) | 13.6 (1 in 7) | 33.2 (1 in 3) | 40.5 (1 in 2) |
| | Female | 5.8 (1 in 17) | 6.4 (1 in 16) | 10.3 (1 in 10) | 26.8 (1 in 4) | 38.9 (1 in 3) |
| Breast | Female | 2.1 (1 in 49) | 2.4 (1 in 42) | 3.5 (1 in 28) | 7.0 (1 in 14) | 12.9 (1 in 8) |
| Colon & rectum | Male | 0.4 (1 in 254) | 0.7 (1 in 143) | 1.1 (1 in 92) | 3.2 (1 in 32) | 4.3 (1 in 23) |
| | Female | 0.4 (1 in 266) | 0.5 (1 in 191) | 0.8 (1 in 128) | 2.9 (1 in 34) | 4.0 (1 in 25) |
| Kidney & renal pelvis | Male | 0.2 (1 in 410) | 0.4 (1 in 263) | 0.7 (1 in 151) | 1.4 (1 in 73) | 2.2 (1 in 46) |
| | Female | 0.2 (1 in 647) | 0.2 (1 in 541) | 0.3 (1 in 310) | 0.8 (1 in 133) | 1.3 (1 in 80) |
| Leukemia | Male | 0.3 (1 in 391) | 0.2 (1 in 549) | 0.4 (1 in 255) | 1.4 (1 in 69) | 1.8 (1 in 55) |
| | Female | 0.2 (1 in 500) | 0.1 (1 in 834) | 0.2 (1 in 427) | 0.9 (1 in 110) | 1.3 (1 in 78) |
| Lung & bronchus | Male | 0.1 (1 in 776) | 0.6 (1 in 163) | 1.7 (1 in 58) | 5.9 (1 in 17) | 6.6 (1 in 15) |
| | Female | 0.1 (1 in 679) | 0.6 (1 in 172) | 1.4 (1 in 70) | 4.9 (1 in 21) | 6.0 (1 in 17) |
| Melanoma of the skin‡ | Male | 0.4 (1 in 230) | 0.5 (1 in 198) | 0.9 (1 in 109) | 2.7 (1 in 37) | 3.7 (1 in 27) |
| | Female | 0.6 (1 in 156) | 0.4 (1 in 241) | 0.5 (1 in 187) | 1.2 (1 in 86) | 2.5 (1 in 40) |
| Non-Hodgkin lymphoma | Male | 0.3 (1 in 375) | 0.3 (1 in 345) | 0.6 (1 in 177) | 1.9 (1 in 54) | 2.4 (1 in 42) |
| | Female | 0.2 (1 in 523) | 0.2 (1 in 463) | 0.4 (1 in 242) | 1.4 (1 in 73) | 1.9 (1 in 52) |
| Prostate | Male | 0.2 (1 in 451) | 1.8 (1 in 55) | 5.0 (1 in 20) | 8.7 (1 in 12) | 12.1 (1 in 8) |
| Thyroid | Male | 0.2 (1 in 447) | 0.1 (1 in 703) | 0.2 (1 in 571) | 0.2 (1 in 412) | 0.7 (1 in 146) |
| | Female | 0.9 (1 in 114) | 0.4 (1 in 258) | 0.4 (1 in 283) | 0.4 (1 in 263) | 1.9 (1 in 53) |
| Uterine cervix | Female | 0.3 (1 in 362) | 0.1 (1 in 837) | 0.1 (1 in 916) | 0.2 (1 in 590) | 0.6 (1 in 158) |
| Uterine corpus | Female | 0.3 (1 in 322) | 0.6 (1 in 157) | 1.1 (1 in 94) | 1.5 (1 in 67) | 3.1 (1 in 32) |

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

**Source:** DevCan: Probability of Developing or Dying of Cancer Software, Version 6.7.8. Statistical Research and Applications Branch, National Cancer Institute, 2020. 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.



**Incidence trends:** Colorectal cancer incidence has generally declined since the mid-1980s, with accelerated progress since 2000 largely due to the uptake of screening. From 2013 to 2017, the incidence rate decreased by about 1% per year. However, this trend is driven by older adults, who have the highest rates, and masks increasing incidence among younger adults since at least the mid-1990s. For example, a recent study based on national data showed an annual increase from 2012 through 2016 of 2% in individuals younger than 50 years and 1% in those 50-64 years. These trends and the incidence rates herein exclude tumors in the appendix, which differ in biology and other characteristics from those that arise in the colon or rectum.

**Mortality trends:** The colorectal cancer death rate has dropped by 55%, from 29.2 (per 100,000) in 1970 to 13.1 in 2018, mostly due to earlier detection through screening and improvements in treatment. From 2014 to 2018, the death rate declined by almost 2% per year; similar to incidence, however, this progress obscures rising mortality in adults younger than 55 years.

**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 these drugs can have serious adverse health effects, such as stomach bleeding. Decision making about aspirin use should involve a conversation with your health care provider.

**Early detection:** Screening can prevent colorectal cancer through the detection and removal of precancerous growths (polyps), as well as detect cancer at an early stage, when treatment is usually less intensive and more successful. Regular adherence to screening with either stool testing (fecal immunochemical tests, highly sensitive guaiac-based tests, or a multi-target stool DNA test) or structural exams (e.g., colonoscopy or computed tomography colonography) results in a similar reduction in premature colorectal cancer death over a lifetime. 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 years and continue through age 75 years, with more individualized decision making from ages 76 to 85 years based on health status/life expectancy, patient preferences, and prior screening history. For more information on the American Cancer Society's recommendations, see page 67.

**Signs and symptoms:** The most common signs and symptoms are rectal bleeding, blood in the stool, a change in bowel habits or stool shape (e.g., narrower than usual), the feeling that the bowel is not completely empty, abdominal cramping or pain, decreased appetite, and weight loss. In some cases, the cancer causes blood loss that leads to anemia (low red blood cell count) that may be detected on a blood test and/or result in symptoms such as weakness and fatigue. Increasing incidence of colorectal cancer in young individuals, who are often diagnosed with advanced disease, reinforces the need for timely evaluation of persistent symptoms in 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. For most patients whose cancer has penetrated the bowel wall deeply or spread to lymph nodes, chemotherapy is given after surgery for colon cancer, and before and/or after surgery, alone or in combination with radiation, for rectal cancer. For colorectal cancer that has spread to other parts of the body (metastatic colorectal cancer), treatments typically include chemotherapy and/or targeted therapy. Immunotherapy is a newer option for some advanced cancers.

**Survival:** The 5-year relative survival rate for colorectal cancer is 65%. Only 38% of patients are diagnosed with localized disease, for which 5-year survival is 90% (Table 8).

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

## Kidney and Renal Pelvis

**New cases and deaths:** In 2021, an estimated 76,080 new cases of kidney (renal) cancer will be diagnosed in the US and 13,780 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 Childhood and Adolescent Cancer 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. From 2008 to 2017, the incidence rate increased by about 1% per year.

**Mortality trends:** In contrast to incidence trends, kidney cancer mortality has been declining since the mid-1990s; from 2009 to 2018, the death rate decreased by about 1% per year.

**Risk factors:** About half of kidney cancers could potentially be prevented by eliminating excess body weight and tobacco smoking, which are strong risk factors. 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 renal cell 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 increased risk associated with other diseases far outweighs this benefit.

**Signs and symptoms:** Signs and symptoms of kidney cancer can include blood in the urine, a pain or 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 temperature to destroy the tumor. Adjuvant treatment (after surgery) with a targeted therapy drug may be an option for certain patients at high risk for cancer recurrence. For metastatic disease, immunotherapy and targeted 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 75%, largely because about two-thirds of cases are diagnosed at a local stage (Table 8).

## Leukemia

**New cases and deaths:** In 2021, an estimated 61,090 new cases of leukemia will be diagnosed in the US and 23,660 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 is included with leukemia in this report to enable description of trends over time, it is now recognized to be the same disease as small lymphocytic lymphoma [SLL], and these cancers are collectively referred to as CLL/SLL and classified as a type of non-Hodgkin lymphoma.) Among adults (20 years of age and older), the most common types of leukemia are CLL (38%) and AML (31%), whereas ALL is most common in children and adolescents (ages 0 to 19 years), accounting for 74% of cases. (See page 12 for information about childhood and adolescent cancer.)

**Incidence trends:** From 2008 to 2017, the leukemia incidence rate increased in children and adolescents by about 1% per year and was stable in adults aged 20 and older, although trends varied by subtype.

**Mortality trends:** In contrast to incidence, the leukemia death rate declined by about 3% per year in children and adolescents and 2% per year in adults from 2009 to 2018.

**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. Certain types of chemotherapy also increase risk of some subtypes. 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, can include fatigue, paleness, weight loss, repeated infections, fever, bleeding or bruising easily, bone or joint pain, and swelling in the lymph nodes or abdomen. Chronic leukemia typically progresses slowly with few symptoms during early stages.

**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 acquired genetic abnormality (Philadelphia chromosome) 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. CLL that is not progressing or causing symptoms may not require treatment right away, but these patients need to be closely monitored. More aggressive CLL is treated with targeted drugs and/or chemotherapy. Certain types of leukemia may be treated with high-dose chemotherapy, followed by stem cell transplantation under appropriate conditions. Newer experimental treatments that boost the body's immune system, such as CAR T-cell therapy, have shown much promise, even against some hard-to-treat leukemias.

**Survival:** The 5-year relative survival rate varies substantially by age and leukemia subtype: for adults ages 20 and older, the rate is 26% for AML, 38% for ALL, 70% for CML, and 86% for CLL. For youth ages 0-19 years, it is 68% for AML and 89% for ALL. Treatment advances such as the development of targeted drugs have resulted in large improvements for most types of leukemia; for example, the 5-year relative survival has more than tripled for CML, up from 22% in the mid-1970s.

## Liver

**New cases and deaths:** In 2021, an estimated 42,230 new cases of liver cancer (including intrahepatic bile duct cancers) will be diagnosed in the US and 30,230 people will die from the disease (Table 1). Approximately three-fourths of liver cancers are hepatocellular carcinoma (HCC). Liver cancer incidence is 3 times higher in men than in women.

**Incidence trends:** Liver cancer incidence has more than tripled since 1980; the rate continued to increase by more than 2% per year in women from 2013 to 2017 but has stabilized in men.

**Mortality trends:** Similar to incidence trends, liver cancer mortality rates have doubled since 1980 and continued to increase by 1% per year in women from 2014 to 2018, but have stabilized in men.

**Risk factors:** Approximately 70% of liver cancer cases in the US could potentially be prevented through the elimination of risk factors, the most important being excess body weight, type 2 diabetes, chronic infection with hepatitis B virus (HBV) and/or hepatitis C virus (HCV), heavy alcohol consumption (3 or more drinks per day), and tobacco smoking. 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). Accumulating evidence suggests that drinking coffee may reduce risk.

**Prevention:** A vaccine that protects against HBV infection has been available since 1982. There is no vaccine available to prevent HCV infection, although new combination antiviral therapies can often clear established infections and likely reduce cancer risk. The Centers for Disease Control and Prevention (CDC) and the US Preventive Services Task Force now recommend one-time HCV testing of adults 18 years 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 screening for liver cancer has not been shown to reduce mortality, many health care providers in the US test individuals at high risk (e.g., those with cirrhosis) with ultrasound 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, weakness, loss of appetite, jaundice (a yellowish discoloration of the skin and eyes), and fever. Enlargement of the liver is the most common physical sign.

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

**Survival:** The 5-year relative survival rate is 20%, up from 3% four decades ago. Even for the 44% of patients diagnosed with localized-stage disease, 5-year survival is only 34% (Table 8).

## Lung and Bronchus

**New cases and deaths:** In 2021, an estimated 235,760 new cases of lung cancer will be diagnosed in the US and 131,880 people will die from the disease (Table 1).

### Table 7. Trends in 5-year Relative Survival Rates* (%) by Race, US, 1975-2016

| | All races | | | White | | | Black | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1975-77 | 1987-89 | 2010-16 | 1975-77 | 1987-89 | 2010-16 | 1975-77 | 1987-89 | 2010-16 |
| All sites | 49 | 55 | 67 | 50 | 57 | 68 | 39 | 43 | 63 |
| Brain & other nervous system | 23 | 29 | 33 | 22 | 28 | 31 | 25 | 32 | 39 |
| Breast (female) | 75 | 84 | 90 | 76 | 85 | 91 | 62 | 71 | 82 |
| Colon & rectum | 50 | 60 | 65 | 50 | 60 | 65 | 45 | 52 | 59 |
| Colon | 51 | 60 | 63 | 51 | 61 | 64 | 45 | 52 | 57 |
| Rectum | 48 | 58 | 67 | 48 | 59 | 67 | 44 | 52 | 63 |
| Esophagus | 5 | 9 | 20 | 6 | 10 | 21 | 4 | 7 | 14 |
| Hodgkin lymphoma | 72 | 79 | 87 | 72 | 80 | 88 | 70 | 72 | 85 |
| Kidney & renal pelvis | 50 | 57 | 75 | 50 | 57 | 75 | 49 | 55 | 76 |
| Larynx | 66 | 66 | 61 | 67 | 67 | 62 | 58 | 56 | 52 |
| Leukemia | 34 | 43 | 64 | 35 | 44 | 64 | 33 | 35 | 59 |
| Liver & intrahepatic bile duct | 3 | 5 | 20 | 3 | 6 | 19 | 2 | 3 | 17 |
| Lung & bronchus | 12 | 13 | 21 | 12 | 13 | 21 | 11 | 11 | 18 |
| Melanoma of the skin | 82 | 88 | 93 | 82 | 88 | 92 | 57† | 79† | 67 |
| Myeloma | 25 | 27 | 54 | 24 | 27 | 53 | 29 | 30 | 57 |
| Non-Hodgkin lymphoma | 47 | 51 | 73 | 47 | 51 | 73 | 49 | 46 | 68 |
| Oral cavity & pharynx | 53 | 54 | 66 | 54 | 56 | 68 | 36 | 34 | 50 |
| Ovary | 36 | 38 | 49 | 35 | 38 | 48 | 42 | 34 | 41 |
| Pancreas | 3 | 4 | 10 | 3 | 3 | 10 | 2 | 6 | 10 |
| Prostate | 68 | 83 | 98 | 69 | 84 | 98 | 61 | 71 | 96 |
| Stomach | 15 | 20 | 32 | 14 | 18 | 31 | 16 | 19 | 32 |
| Testis | 83 | 95 | 95 | 83 | 96 | 95 | 73†‡ | 88† | 92 |
| Thyroid | 92 | 94 | 98 | 92 | 94 | 99 | 90 | 92 | 97 |
| Urinary bladder | 72 | 79 | 77 | 73 | 80 | 77 | 50 | 63 | 64 |
| Uterine cervix | 69 | 70 | 66 | 70 | 73 | 68 | 65 | 57 | 56 |
| Uterine corpus | 87 | 82 | 81 | 88 | 84 | 84 | 60 | 57 | 63 |

*Rates are adjusted for normal life expectancy and are based on cases diagnosed in the SEER 9 areas for 1975 to 77 and 1987 to 89, and on cases diagnosed in the SEER 18 areas for 2010 to 2016, with all cases followed through 2017. †The standard error is between 5 and 10 percentage points. ‡Survival rate is for cases diagnosed from 1978 to 1980.

**Source:** Source: Howlader N, Noone AM, Krapcho M, et al (eds). SEER Cancer Statistics Review, 1975-2017, National Cancer Institute. Bethesda, MD, https://seer.cancer.gov/csr/1975_2017/, based on November 2019 SEER data submission, posted to the SEER web site, April 2020.



**Incidence trends:** Lung cancer incidence has been declining since the mid-1980s in men, but only since the mid-2000s in women because of gender differences in historical patterns of smoking uptake and cessation. Since the mid-2000s, incidence has decreased steadily by about 2% per year overall, but at a faster pace in men than in women.

**Mortality trends:** Lung cancer mortality has declined by 54% since 1990 in men and by 30% since 2002 in women due to reductions in smoking, with the pace accelerating in recent years; from 2014 to 2018, the rate decreased by more than 5% per year in men and 4% per year in women.

**Risk factors:** Cigarette smoking is by far the most important risk factor for lung cancer, with approximately 80% of lung cancer deaths in the US still caused by smoking. Risk increases with both quantity and duration of smoking. Cigar and pipe smoking also increase risk. (See the chapter on Tobacco, page 39, for more information.) Exposure to radon gas, which is released from soil and can accumulate in indoor air, is the second-leading cause of lung cancer in the US. Other factors associated with increased risk include exposure to secondhand smoke (2.7% of new cases, the equivalent of 6,400 in 2021), asbestos (particularly among smokers), certain metals (chromium, cadmium, arsenic), some organic chemicals, radiation, air pollution, and diesel exhaust. Specific occupational exposures that increase risk include rubber manufacturing, paving, roofing, painting, and chimney sweeping.

**Early detection:** In a large US clinical trial, screening with low-dose spiral computed tomography (LDCT) reduced lung cancer mortality by about 20% compared to standard chest x-ray among current or former (quit within 15 years) heavy smokers (at least 30-pack years). Based largely on this information, the American Cancer Society issued guidelines in 2013 recommending annual lung cancer screening for current or former heavy smokers ages 55 to 74 years who are in relatively good health and have undergone evidence-based smoking-cessation counseling (current smokers) and a process of shared decision making with a clinician that included a description of the potential benefits and harms of screening. Recently, two European trials reported even larger mortality reductions for screening among a more moderate risk pool. In July 2020, the US Preventive Services Task Force issued a draft statement expanding their recommendation to adults ages 50 to 80 years with a 20 pack-year smoking history. For more information on lung cancer screening, see the American Cancer Society's screening guidelines on page 67.

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

**Treatment:** Appropriate treatment is based on whether the tumor is small cell lung cancer (SCLC; 13%) or non-small cell lung cancer (NSCLC; 84%), as well as its stage and molecular characteristics. For early-stage NSCLC, surgery is the usual treatment, sometimes with chemotherapy, alone or in combination with radiation therapy. Advanced-stage NSCLC is usually treated with chemotherapy, targeted drugs, and/or immunotherapy. Early-stage SCLC is usually treated with chemotherapy, alone or combined with radiation. Radiation to the brain (prophylactic cranial radiation) is also often given in early-stage SCLC to reduce the risk of brain metastases. People with advanced SCLC might be treated with chemotherapy with or without immunotherapy; a large percentage of patients on this regimen experience temporary remission.

**Survival:** The 5-year relative survival rate for lung cancer is 21% overall (17% for men and 24% for women), 25% for NSCLC, and 7% for SCLC. Only 17% of lung cancers are diagnosed at a localized stage, for which the 5-year survival rate is 59% (Table 8).

## Lymphoma

**New cases and deaths:** In 2021, an estimated 90,390 new cases of lymphoma will be diagnosed in the US and 21,680 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 grouped broadly as either Hodgkin lymphoma (8,830 cases and 960 deaths) or non-Hodgkin lymphoma (NHL, 81,560 cases and 20,720 deaths), and are further classified based on the type of cells that comprise the cancer and many other characteristics, such as cell-surface markers and anatomic site. (Although chronic lymphocytic leukemia is now classified as a type of NHL, statistics for NHL herein exclude these cancers for the purpose of describing historical trends.)

**Incidence trends:** Incidence rates continued to decline steadily by about 2% per year for Hodgkin lymphoma over the past decade (2008-2017) but have stabilized for NHL in recent years. For trends by lymphoma subtype, see 2016 US lymphoid malignancy statistics by World Health Organization subtypes.

**Mortality trends:** The death rate has been declining since at least 1975 for Hodgkin lymphoma and since 1997 for NHL due to improvements in treatment and, in recent years, reductions in incidence and improved survival for human immunodeficiency virus (HIV)-associated NHL. From 2009 to 2018, the death rate decreased by about 4% per year for Hodgkin lymphoma and 2% per year for NHL.

**Risk factors:** Typical of most cancers, the risk of NHL increases with age. In contrast, Hodgkin lymphoma incidence peaks first during adolescence/early adulthood and 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, lupus, and rheumatoid arthritis). Certain infectious agents (e.g., Epstein-Barr virus) increase the risk of some lymphoma subtypes directly, whereas others increase risk indirectly by weakening (e.g., HIV) or continuously activating (e.g., *Helicobacter pylori* and hepatitis C virus) the immune system. Studies also suggest that excess body weight and certain environmental exposures 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 radiation, alone or in combination with chemotherapy, is sometimes used. Targeted or immunotherapy drugs are used for some NHL 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 lymphomas.

Hodgkin lymphoma is usually treated with chemotherapy and/or radiation therapy, depending on disease stage and cell type. If these treatments are ineffective, options may include stem cell transplantation and/or treatment with a monoclonal antibody linked to a chemotherapy drug, as well as immunotherapy.

**Survival:** Survival varies widely by lymphoma subtype and stage of disease; overall 5-year relative survival is 87% for Hodgkin lymphoma and 73% for NHL.

## Oral Cavity and Pharynx

**New cases and deaths:** In 2021, an estimated 54,010 new cases of cancer of the oral cavity and pharynx (throat) will be diagnosed in the US and 10,850 people will die from the disease (Table 1). Incidence rates are more than twice as high in men as in women.

**Incidence trends:** Incidence rates increased by about 1% per year from 2008 to 2017, mostly confined to non-Hispanic White persons and a subset of cancers in the oropharynx (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.

**Mortality trends:** Mirroring incidence, the mortality rate for cancers of the oral cavity and pharynx increased in recent years (by 0.5% per year from 2009 to 2018) after decades of decline because of an uptick in deaths from subsites associated with HPV.

**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. Additionally, HPV infection of the mouth and throat, believed to be transmitted through sexual contact, also increases risk.

**Prevention:** The FDA recently added oral cancer prevention as an indication for HPV vaccines. Unfortunately, immunization rates are much lower than for other vaccines, with only 54% of adolescents ages 13 to 17 years (52% of boys and 57% of girls) up to date with HPV vaccination in 2019.

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

**Survival:** The 5-year relative survival rate for cancers of the oral cavity and pharynx overall is 66% (Table 8) but is much lower in Black people (50%) than in White people

**Table 8. Five-year Relative Survival Rates* (%) by Stage at Diagnosis, US, 2010-2016**

| | All stages | Local | Regional | Distant | | All stages | Local | Regional | Distant |
|---|---|---|---|---|---|---|---|---|---|
| Breast (female) | 90 | 99 | 86 | 28 | Oral cavity & pharynx | 66 | 85 | 67 | 40 |
| Colon & rectum | 65 | 90 | 72 | 14 | Ovary | 49 | 93 | 75 | 30 |
| Colon | 63 | 91 | 72 | 14 | Pancreas | 10 | 39 | 13 | 3 |
| Rectum | 67 | 89 | 72 | 16 | Prostate | 98 | >99 | >99 | 30 |
| Esophagus | 20 | 47 | 25 | 5 | Stomach | 32 | 70 | 32 | 6 |
| Kidney† | 75 | 93 | 70 | 13 | Testis | 95 | 99 | 96 | 73 |
| Larynx | 61 | 78 | 45 | 34 | Thyroid | 98 | >99 | 98 | 55 |
| Liver‡ | 20 | 34 | 12 | 3 | Urinary bladder§ | 77 | 69 | 37 | 6 |
| Lung & bronchus | 21 | 59 | 32 | 6 | Uterine cervix | 66 | 92 | 58 | 17 |
| Melanoma of the skin | 93 | 99 | 66 | 27 | Uterine corpus | 81 | 95 | 69 | 17 |

*Rates are adjusted for normal life expectancy and are based on cases diagnosed in the SEER 18 areas from 2010-2016, all followed through 2017. †Includes renal pelvis. ‡Includes intrahepatic bile duct. §Rate for in situ cases is 96%.

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

**Source:** Source: Howlader N, Noone AM, Krapcho M, et al (eds). *SEER Cancer Statistics Review, 1975-2017*, National Cancer Institute, Bethesda, MD, https://seer.cancer.gov/csr/1975_2017/, based on November 2018 SEER data submission, posted to the SEER website, April 2019.



(68%) (Table 7), partly reflecting subsite distribution. Studies indicate better survival for patients with HPV-associated cancer.

## Ovary

**New cases and deaths:** In 2021, an estimated 21,410 new cases of ovarian cancer will be diagnosed in the US and 13,770 women will die from the disease (Table 1). Most cases (90%) 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 the mid-1980s through 2017.

**Mortality trends:** The ovarian cancer death rate declined by about 2% per year from 2009 to 2018, a steady trend since the early 2000s.

**Risk factors:** The most important risk factor other than age is a strong family history of breast or ovarian cancer. Women who have certain inherited mutations (e.g., *BRCA1* or *BRCA2* or those related to Lynch syndrome) are at increased risk. 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 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, fallopian tube ligation or removal (salpingectomy), and use of oral contraceptives. Although results from case-control and cohort studies are inconsistent, the weight of the evidence does not support an association between genital exposure to talc-based powder and risk of ovarian cancer.

**Early detection:** Currently, there are no recommended screening tests for ovarian cancer, although clinical trials to identify effective strategies are underway. Women who are at high risk (e.g., *BRCA* or Lynch syndrome mutations) or have symptoms may be offered a thorough pelvic exam in combination with transvaginal ultrasound and a blood test for the CA125 tumor marker, although this strategy has not been proven to reduce ovarian cancer mortality and is associated with serious harms due to a high prevalence of false-positive results.

**Prevention:** Some women at high risk because of a strong family history or inherited genetic mutations may consider preventive surgery (prophylactic bilateral salpingo-oopherectomy) to remove both ovaries and fallopian tubes, which greatly reduces the risk of 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), which usually occurs when cancer is advanced.

**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. 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 only 49%, largely because most patients (58%) are diagnosed with distant-stage disease. For the 16% of women diagnosed with localized disease, the 5-year survival rate is 93%. Five-year survival is nearly twice as high in women younger than age 65 (61%) as in those 65 and older (32%).

## Pancreas

**New cases and deaths:** In 2021, an estimated 60,430 new cases of pancreatic cancer will be diagnosed in the US and 48,220 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 2000.

**Mortality trends:** The death rate for pancreatic cancer has increased slightly (by 0.3% per year) since around 2000.

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

**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, and occasionally the development of type 2 diabetes. Tumors sometimes cause jaundice (yellowing of the skin and eyes), which can facilitate earlier diagnosis. Signs of advanced-stage disease may include severe abdominal pain, nausea, and vomiting.

**Early detection:** There is no screening test for pancreatic cancer that has been shown to reduce mortality from the disease.

**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 when it is diagnosed. For those who do undergo surgery, adjuvant treatment with chemotherapy (and sometimes radiation) may lower the risk of recurrence. For advanced disease, chemotherapy (sometimes along with or followed by a targeted therapy drug) may lengthen survival. Clinical trials are testing several new targeted agents and immunotherapies.

**Survival:** For all stages combined, the 5-year relative survival rate is 10%. Even for the small percentage (11%) of people diagnosed with local disease, the 5-year survival rate is only 39%.

## Prostate

**New cases and deaths:** In 2021, an estimated 248,530 new cases of prostate cancer will be diagnosed in the US and 34,130 men will die from the disease (Table 1). The incidence of prostate cancer is almost 80% higher in non-Hispanic Black men than in non-Hispanic White men for reasons that remain unclear.

**Incidence trends:** Incidence rates for prostate cancer spiked dramatically in the late 1980s and early 1990s, in large part because of a surge in screening with the prostate-specific antigen (PSA) blood test. Likewise, reduced PSA screening, partly because of changes in guidelines, led to an incidence decline beginning around 2000, although the rate has stabilized in recent years (2013-2017).

**Mortality trends:** Prostate cancer death rates declined by about half from the mid-1990s to the mid-2010s due to earlier detection through PSA testing and advances in treatment, but remained stable from 2014 to 2018.

**Risk factors:** Well-established risk factors for prostate cancer are increasing age, African ancestry, a family history of the disease, and certain inherited genetic conditions (e.g., Lynch syndrome and *BRCA1* and *BRCA2* mutations). Black men in the US and the Caribbean have the highest documented prostate cancer incidence rates in the world. Studies suggest that a strong genetic predisposition may be responsible for 5%-10% of prostate cancers, with another 30%-40% caused by more common gene mutations (higher prevalence) conferring less excess risk (lower penetrance). The only modifiable risk factors are smoking and excess body weight, which may increase risk of aggressive and/or fatal disease.

**Early detection:** Although studies have shown that PSA testing reduces prostate cancer mortality, 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 an "informed decision-making" approach whereby men are educated about screening and encouraged to make a personal choice. The American Cancer Society recommends that beginning at age 50, men who are at average risk of prostate cancer and have a life expectancy of at least 10 years have a conversation with their health care provider about the benefits and limitations of PSA testing and make an informed decision about whether to be tested based on their personal values and preferences. 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.

**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 progression (called active surveillance) instead of

immediate treatment is appropriate for many patients, particularly men who are diagnosed at an early stage, have less aggressive tumors, and are older. The main treatment options for early-stage disease include surgery, external beam radiation, or radioactive seed implants (brachytherapy). Hormone therapy may be used along with surgery or radiation in more 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. Other types of drugs can be used to treat prostate cancer that has spread to the bones.

**Survival:** The 5-year relative survival rate for the vast majority (89%) of men diagnosed with local- or regional-stage prostate cancer approaches 100%, but drops to 30% 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), also referred to as nonmelanoma skin cancer – 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 2021, an estimated 106,110 new cases of invasive melanoma and 101,280 cases of in situ melanoma will be diagnosed in the US, while 7,180 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 and sex differences in historical occupational and recreational exposure to ultraviolet 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 has been increasing rapidly since the mid-1970s; from 2008 to 2017, the rate increased by about 2% per year, although this trend masks stable or declining rates among young age groups.

**Mortality trends:** Mortality trends also vary by age, with a declining trend in individuals younger than 50 years since the mid-1980s, but only in the past decade in older adults. Advances in treatment have accelerated declines in the past five years among all ages; from 2014 to 2018, the melanoma death rate fell by almost 7% per year in adults younger than 50 years of age and close to 5% per year in older adults.

**Risk factors:** Light skin color is the strongest risk factor, with incidence among non-Hispanic White individuals almost 30 times higher than that among non-Hispanic Black or Asian/Pacific Islander individuals. Additional risk factors include a personal or family history of melanoma and the presence of atypical, large, or numerous (more than 50) moles. Excess exposure to ultraviolet (UV) radiation from sunlight or the use of indoor tanning increases risk of all common types of skin cancer. Risk is also increased for people who are sun-sensitive (e.g., sunburn easily or have natural blond or red hair); those who have a history of excessive sun exposure (including sunburns); and people with a weakened immune system or certain genetic syndromes.

**Prevention:** Most skin cancer cases and deaths are caused by exposure to UV radiation, and thus 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 indoor tanning. Children and adolescents should be especially protected from the sun (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.

**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 for you to see, may be helpful in identifying 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 doesn't 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 certain topical medications may be used. For melanoma, the primary growth and surrounding normal tissue are surgically removed, and sometimes a sentinel lymph node is biopsied to determine stage. More extensive lymph node surgery may be needed if the sentinel nodes contain cancer. Melanomas with deep invasion or that have spread to lymph nodes may be treated with surgery, immunotherapy, chemotherapy, and/or radiation therapy. The treatment of advanced melanoma has changed greatly in recent years, with FDA approval of several new immunotherapy and targeted drugs that can be very effective. Traditional chemotherapy may be used but is usually much less effective than newer treatments.

**Survival:** Almost all cases of nonmelanoma skin cancer can be cured, especially if the cancer is detected and treated early. Although melanoma is also highly curable when detected in its earliest stages, it is more likely than nonmelanoma skin cancer to spread to other parts of the body. The 5-year relative survival rate for melanoma is 93%, ranging from 99% for cases diagnosed at a localized stage (83% of cases) to 27% for distant-stage (4%) (Table 8).

## Thyroid

**New cases and deaths:** In 2021, there will be an estimated 44,280 new cases of thyroid cancer diagnosed in the US and 2,200 people will die from the disease (Table 1). The incidence rate is almost 3 times higher in women than in men.

**Incidence trends:** Until recently, thyroid cancer was the most rapidly increasing cancer in the US. This was largely due to increased detection (probably including some overdiagnosis) of small papillary tumors, the most common subtype, as a result of increased imaging and more sensitive diagnostic procedures. Due in part to clinicians' adoption of more conservative diagnostic criteria, the incidence rate from 2013 to 2017 was stable in men and declined by about 2% annually in women.

**Mortality trends:** The death rate for thyroid cancer increased slightly during the period from 2009 to 2018 (0.6% per year) but appears to have stabilized in recent years.

**Risk factors:** Risk factors for thyroid cancer include being female, having a history of goiter (enlarged thyroid) or thyroid nodules, a family history of thyroid cancer, radiation exposure early in life (e.g., during cancer treatment), 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 before cancer develops.

**Signs and symptoms:** The most common symptom of thyroid cancer is a lump in the neck that is noticed by a patient or felt by a clinician during an exam. Other symptoms 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 being 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. The first choice of treatment is usually surgery to partially or totally remove the thyroid gland (thyroidectomy) and sometimes nearby lymph nodes. Treatment with radioactive iodine (I-131) after complete thyroidectomy (to destroy any remaining thyroid tissue) may be recommended for large tumors or when cancer has spread outside the thyroid. Thyroid hormone replacement therapy is given after thyroidectomy to replace hormones normally made by the thyroid gland and to prevent the pituitary gland from producing thyroid-stimulating hormone, decreasing the likelihood of recurrence. For some types of advanced thyroid cancer, targeted drugs can be used to help shrink or slow tumor growth.

**Survival:** The 5-year relative survival rate is 98%, largely because two-thirds of cases are diagnosed at a local stage, but also because treatment is usually successful for most tumor types; among people diagnosed with distant-stage disease, more than half (55%) survive at least five years (Table 8).

## Urinary Bladder

**New cases and deaths:** In 2021, an estimated 83,730 new cases of bladder cancer will be diagnosed in the US and 17,200 people will die from the disease (Table 1). The incidence rate is about 4 times higher in men than in women and 2 times higher in White men than in Black men.

**Incidence trends:** After increasing slowly since the mid-1970s, bladder cancer incidence rates declined from 2008 to 2017 by about 1% per year.

**Mortality trends:** The death rate for bladder cancer declined by 0.6% per year from 2009 to 2018 on average, with an acceleration in progress in the most recent years.

**Risk factors:** Smoking is the most well-established risk factor for bladder cancer, accounting for almost half (47%) of all cases in the US. Risk is also increased among workers in the dye, rubber, leather, and aluminum industries; painters; people who live in communities with high levels of arsenic in the drinking water; and people with certain bladder birth defects or long-term urinary catheters.

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

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

**Treatment:** Surgery, alone or in combination with other treatments, is used in more than 90% of cases. Early-stage cancers may be treated by removing the tumor and then administering immunotherapy (BCG-bacillus Calmette-Guérin) or chemotherapy drugs directly into the bladder (intravesical therapy). More advanced cancers may require removal of the entire bladder (cystectomy). Patient outcomes are improved with the use of chemotherapy before cystectomy. Distant-stage cancers are typically treated with chemotherapy, sometimes along with radiation. 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.

**Survival:** The 5-year relative survival rate for bladder cancer is 77%. Half (51%) of all cases are diagnosed before the tumor has spread beyond the layer of cells in which it developed (in situ), for which the 5-year survival is 96%.

## Uterine Cervix

**New cases and deaths:** In 2021, an estimated 14,480 cases of invasive cervical cancer will be diagnosed and about 4,290 deaths will occur in the US (Table 1).

**Incidence trends:** Cervical cancer incidence dropped by more than half from the mid-1970s to mid-2000s, largely due to the widespread uptake of screening with the Pap test, but has stabilized during the most recent decade of data.

**Mortality trends:** The cervical cancer death rate has also dropped by more than half since the mid-1970s due to reductions in incidence and the early detection of cancer through screening. However, the pace of decline has slowed from almost 4% per year during 1996 to 2003 to <1% during 2009 to 2018.

**Risk factors:** Almost all cervical cancers are caused by persistent infection with certain types of human papillomavirus (HPV), although these infections are common in healthy people with a cervix 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:** The HPV vaccine 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 years. The American Cancer Society recommends routine vaccination between ages 9 and 12 years with catch-up vaccination for all persons through age 26 years who are not adequately vaccinated. Unfortunately, the immunization rate remains low in the US; in 2019, 57% of girls and 52% of boys 13 to 17 years of age were up to date with the HPV vaccination series. HPV vaccines 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. Most cervical precancers develop slowly, so cancer can usually be prevented if an individual is screened regularly. The Pap test is a simple procedure in which a small sample of cells is collected from the cervix and examined under a microscope, and has historically been the only screening option. The HPV test, which can be done on the same sample, detects HPV infections associated with cervical cancer and can forecast cervical cancer risk. The HPV test can also identify individuals at risk for a type of cervical cancer (adenocarcinoma) that is often missed by Pap tests and accounts for 29% of cases.

**Early detection:** In addition to preventing cervical cancer, screening can detect invasive cancer early, when treatment is more successful. Most people diagnosed with cervical cancer have not been screened recently. The updated guideline from the American Cancer Society recommends that individuals with a cervix at average risk for cervical cancer initiate screening at age 25 years with primary HPV testing every 5 years through age 65 years; if a primary HPV test is not available, these individuals should undergo co-testing (HPV testing in combination with Pap test) every 5 years or screening with a Pap test alone every 3 years. For more detailed information on the American Cancer Society's screening guideline for the early detection of cervical cancer, see page 67.

**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 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 overall is 66%, but it ranges from 46% for Black women 50 and older to 78% for White women younger than 50.

## Uterine Corpus (Endometrium)

**New cases and deaths:** In 2021, an estimated 66,570 cases of cancer of the uterine corpus (body of the uterus) will be diagnosed in the US and 12,940 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 (lining of the uterus).

**Incidence trends:** Incidence trends have fluctuated over time; since the mid-2000s, rates have increased by about 1% per year.

**Mortality trends:** After declining for two decades, mortality for uterine corpus cancer began increasing in the mid-1990s and has accelerated in recent years; from 2009 to 2018, the rate rose by about 2% per year.

**Risk factors:** According to American Cancer Society research, an estimated 70% of uterine corpus cancers are attributable to excess body weight and insufficient physical activity, and thus potentially preventable. Obesity and abdominal fatness 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 include the use of postmenopausal estrogen alone (continuous estrogen plus progestin does not appear to increase risk), late menopause, and a history of polycystic ovary syndrome. Tamoxifen, a drug used to prevent breast cancer, increases risk slightly because it has estrogen-like effects on the uterus. Medical conditions that increase risk include Lynch syndrome and type 2 diabetes. Pregnancy and use of oral contraceptives or intrauterine devices are associated with reduced risk.

**Early detection:** There are no recommended screening tests for women at average risk; however, most cases (67%) are diagnosed at an early stage because of postmenopausal bleeding. Women are encouraged to report any unexpected bleeding or spotting to 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 as well.

**Survival:** The 5-year relative survival rate for uterine cancer is 84% for White women and 63% for Black women, partly because White women are much more likely to be diagnosed with early-stage disease (69% versus 54%), although survival is lower for Black women for every stage at diagnosis.

# Special Section: COVID-19 and Cancer

## What Is COVID-19?

Coronavirus disease 2019 (COVID-19) is the illness caused by a virus named severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). SARS-CoV-2 is a novel coronavirus (newly identified type) responsible for the global pandemic that began in early 2020. Coronavirus is the name of a family of viruses that cause illness ranging from mild upper respiratory tract infections, like the common cold, to more serious lower respiratory infections, such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). The first known case of COVID-19 was reported in China in December 2019.

Although the true number of infected individuals is unknown because some people are asymptomatic and testing prevalence remains low, as of mid-November 2020, there were 53 million people diagnosed with COVID-19 and 1.3 million deaths worldwide, including more than 10 million cases and 240,000 deaths in the US.[1] The US has one of the highest COVID-19 death rates in the world, 60.3 per 100,000 compared to 3.3 in Australia and 0.7 in South Korea from February through September 2020.[2] As a result, the US accounts for about 20% of COVID-19 deaths worldwide, despite reflecting less than 5% of the total population.

However, the death toll of the pandemic extends well beyond COVID-19 deaths, which account for just two-thirds of the excess deaths in the US from March through July 2020 (Figure S1). Increased deaths from other causes are partly due to misclassification of deaths from COVID-19, but also because of disruptions in care.[3] Additional excess mortality from other illnesses will likely be protracted. For example, cancer deaths dipped during the early months of the pandemic (Figure S1), but will likely rebound in higher numbers than expected in the months and years to come because of delays in diagnosis and treatment.

## What Are the Symptoms of COVID-19?

People with COVID-19 report a wide range of symptoms from none to severe illness. The most common symptoms are cough, fever, shortness of breath, loss or change in sense of taste and smell, muscle aches, chills, fatigue, congestion or runny nose, sore throat, headache, nausea or vomiting, and diarrhea. Many individuals also experience gastrointestinal symptoms. The average time from exposure to symptom onset is 3-7 days but can be as long as 14 days. The Centers for Disease Control and Prevention currently estimates that as many as 40% of persons infected with SARS-CoV-2 are asymptomatic, although the exact percentage remains uncertain and likely varies by age.[4]

## How Does COVID-19 Spread?

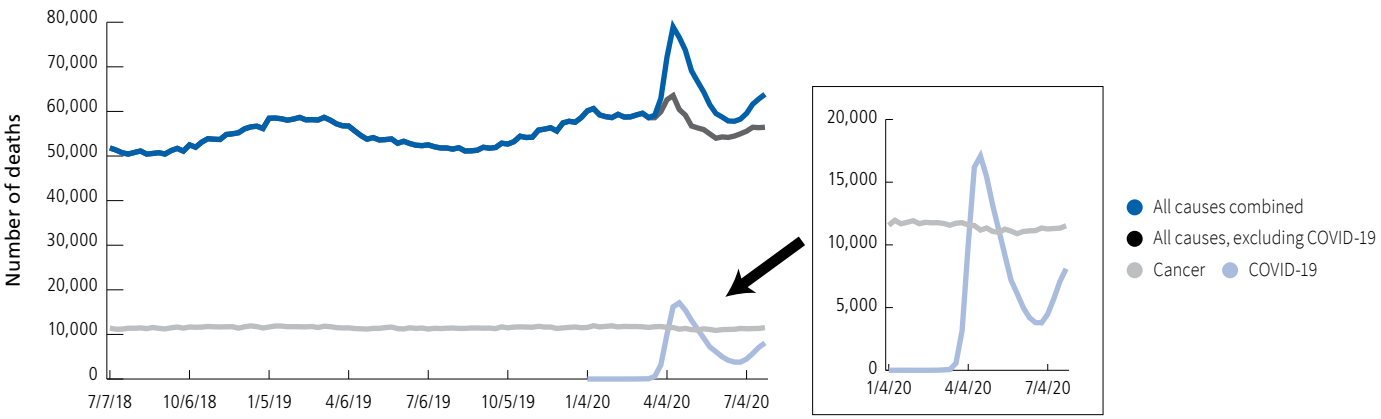
Current knowledge indicates that risk of infection is highest with prolonged close exposure to an infected person (i.e., being within 6 feet for at least 15 minutes) in indoor areas, and even brief exposure to people who are

### Recommendations for protecting yourself and others from COVID-19:

1. Wash your hands often.
2. Stay at least 6 feet apart from people who do not live in your household and from sick household members.
3. Cover your mouth and nose with a mask when around others.
4. Cover coughs and sneezes with a tissue or the inside of your elbow, then immediately wash your hands with soap and water or, if unavailable, use hand sanitizer that contains at least 60% alcohol.
5. Clean and disinfect frequently touched surfaces daily.
6. Monitor your health daily.

**Source:** Centers for Disease Control and Prevention (cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html)

**Figure S1. Weekly Number of Deaths in the US, January 2018 - July 2020***




*Counts during 2019 and 2020 are provisional (i.e., ≥75% complete within 8 weeks of death) and exclude Connecticut and North Carolina. COVID-19 deaths include deaths for which COVID-19 was identified on the death certificate as the underlying cause of death or a contributing cause (among multiple causes).

**Source:** NCHS, 2020. Available from: https://data.cdc.gov/NCHS/Weekly-Counts-of-Deaths-by-State-and-Select-Causes/muzy-jte6. Accessed November 2, 2020.



symptomatic (e.g., coughing).[5] Infected individuals appear to be most contagious during the 2-3 days before the onset of symptoms and remain infectious for up to 10 days following symptom onset for those with mild to moderate illness.[5] Up to 50% of transmission from one person to another may occur prior to the onset of symptoms.[4] Those with more severe illness or who are severely immunocompromised may be contagious for up to 20 days after symptom onset. Current evidence suggests that contact with contaminated surfaces or small droplets that remain suspended in air (aerosols) are not primary modes of transmission, although there is increased attention focused on the role of aerosol transmission, especially in closed spaces.[5,6] There has been widespread documentation of instances around the world where a single infected person who was in close contact with others at a large gathering (church, funeral, bar, family event, assembly line, etc.) has infected large numbers of people who then spread the virus to others. These occasions are referred to as "superspreader events" and underscore the importance of contact tracing, social distancing, and wearing a mask in combating the spread of COVID-19.

## Who Is at Risk for COVID-19?

Anyone can become infected with SARS-CoV-2 and develop COVID-19, but the likelihood of severe illness increases with age and the presence of certain other health conditions, such as cancer; chronic kidney disease; chronic obstructive pulmonary disease (COPD); obesity (body mass index of 30 kg/m$^2$ or higher); hypertension; type II diabetes; and serious heart conditions. Other factors associated with severe illness include male sex and race or ethnicity other than non-Hispanic White, partly due to occupational exposures that do not allow for social distancing. Higher amounts of viral particle exposure may also result in more serious illness.[7] Children may be at increased risk for poor outcomes if they have complex medical conditions; neurologic, genetic, or metabolic conditions; or congenital heart disease.

## COVID-19 in People With Cancer

People with active cancer are generally more susceptible to infectious agents because of an impaired immune system due to the cancer itself and/or its treatment (e.g., surgery and chemotherapy). This has led to concerns that cancer patients may be at greater risk of COVID-19 complications and death. However, factors that have been most consistently linked with increased risk of severe disease and/or death in patients with cancer mirror those in the general population, and include male sex, older age (≥60 years), a history of smoking, obesity, hypertension, cardiovascular disease, and diabetes.[8-13] For cancer-associated factors specifically, findings related to prognosis have been inconsistent. Early studies

suggested that COVID-19 patients with cancer were at higher risk for severe complications or death than those without cancer, especially individuals with lung and hematological cancers (e.g., leukemia, lymphoma) or who had undergone treatment in the past month.[14-16]

However, larger, more recent studies dispute these findings. A study of 928 patients from the US, Canada, and Spain enrolled in the COVID-19 and Cancer Consortium found no increased risk of death associated with cancer type or timing of cancer treatment.[10] Another analysis of 423 patients with symptomatic COVID-19 at a New York cancer center found that neither recent receipt of chemotherapy or surgery nor having metastatic cancer were associated with a higher risk of complications.[12] A study of COVID-19 patients with cancer who were matched 1:4 to individuals without cancer in terms of age, sex, and other health conditions again found similar outcomes for both groups, including those with recent anticancer therapy.[17] An evaluation of 22,900 Veterans Affairs patients with a history of cancer found that individuals who had received recent cancer therapy had a lower prevalence of COVID-19 and similar mortality compared to those who had not, but did find a higher prevalence of SARS-CoV-2 infection among those with hematologic versus solid cancers.[18] Finally, preliminary results from an international study of thoracic cancer patients with COVID-19 found that smoking history was the only predictor of death.[11]

The influence of cancer on COVID-19 outcomes is difficult to identify because these diseases share many risk factors, such as older age, a history of smoking, and obesity. In addition, patients with more severe COVID-19 disease may be overrepresented in studies to date due to the lack of comprehensive testing early in the pandemic. Thus, prospective studies with long-term follow up are needed to better understand the effects of COVID-19 in patients with cancer. The National Cancer Institute (NCI) is currently conducting a study of 2,000 people who are undergoing cancer treatment and have also been infected with COVID-19 (NCI COVID-19 in Cancer Patients Study) and will be followed for up to 2 years. Several longer-term prospective cohort studies, including the American Cancer Society's Cancer Prevention-3 (CPS-3), have also collected information about COVID-19 to examine the effects on cancer outcomes.

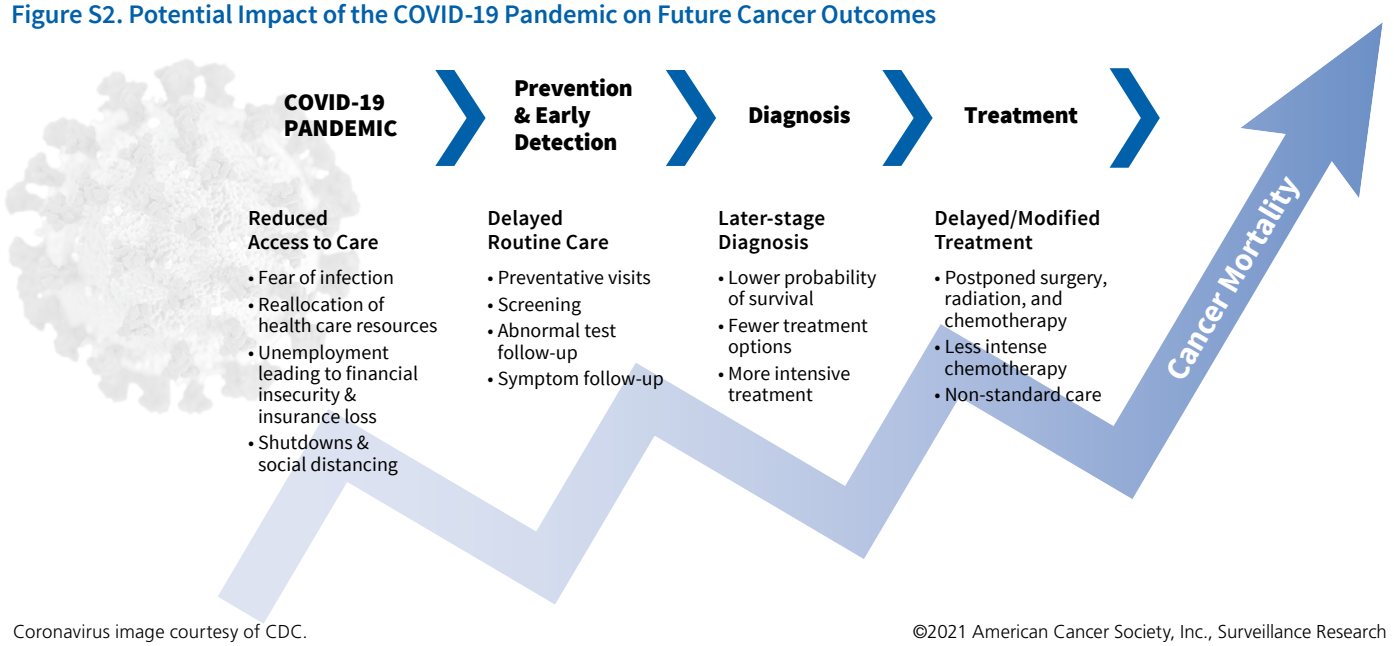
## Public Health Impact of COVID-19 Across the Cancer Continuum

The COVID-19 pandemic has had numerous consequences secondary to the disease itself, including reduced access to care for other illnesses. Early in the pandemic there was a need to divert health care resources to address a rapidly growing number of individuals ill with COVID-19 and also protect healthy people from exposure to SARS-CoV-2 by suspending non-urgent health care. While these measures were necessary, delays in cancer screening, diagnosis, and treatment due to reduced health care access will likely result in a short-term drop in cancer diagnoses followed by increases in late-stage diagnoses and preventable cancer deaths (Figure S2). Some individuals may continue to delay preventive care and symptom follow-up due to fear of exposure or loss of employment and/or employer-based health care. These ramifications will particularly affect historically disadvantaged communities that already have challenges accessing quality medical care and face a disproportionate burden of COVID-19 illness, hospitalization, and death. Additionally, behavioral changes adopted during the pandemic, such as weight gain, physical inactivity, and alcohol consumption, may carry over into long-term health consequences.

### Cancer prevention and early detection

At the onset of the COVID-19 pandemic, the American Cancer Society and other organizations recommended that routine cancer screenings and other elective medical procedures be postponed in order to prioritize urgent medical needs and reduce the spread of COVID-19. This guidance, along with fear of contracting the virus in health care settings, resulted in a steep drop in screening. One electronic medical record company reported an estimated 80% to 90% decline in screening for breast, colorectal, and cervical cancers among their patient population during March and April of 2020 compared to the same time period in 2019.[19-21] Screening for these cancers had risen by June of 2020, but was still down 29% to 36% from pre-pandemic levels.[22] In addition, according to data from the Centers for Disease Control and Prevention, HPV vaccinations dropped 73% between February and April 2020.[23] The full impact of the COVID-

**Figure S2. Potential Impact of the COVID-19 Pandemic on Future Cancer Outcomes**




Coronavirus image courtesy of CDC.



19 pandemic on cancer prevention and early detection will not be known until population-based nationwide data become available in the years to come.

Preventive visits have continued to increase as medical facilities have taken extensive infection-control precautions. As non-COVID-related health care has resumed, individuals who are at high risk of cancer due to genetic factors, personal or family medical history, or other reasons should be prioritized in capacity-limited situations. In addition, targeted efforts to promote screening are especially needed among historically underserved populations to counteract the disproportionate impact of COVID-19 and the pandemic's secondary consequences. For colorectal cancer (CRC) screening, in-home stool-based tests are a safe and effective alternative to colonoscopy for individuals at average risk and are being increasingly deployed.[24] However, a positive result must be followed up with a colonoscopy within 10 months for maximum benefit.[25] Colonoscopy is also required for individuals with CRC symptoms and others at elevated risk of developing CRC. Efforts to ensure safe delivery of colonoscopy for screening purposes through the COVID-19 era and beyond are ongoing.[26] For more information, see Cancer Screening During the COVID-19 Pandemic on the American Cancer Society's website at cancer.org.

Individuals with new or concerning symptoms associated with cancer, including lumps in the breast or elsewhere, abnormal vaginal bleeding, blood from the rectum or in stool, unexplained weight loss, fever, fatigue, or skin changes, should promptly seek medical attention and undergo diagnostic evaluation. In health care facilities throughout the country, aggressive infection control measures are being taken to ensure that diagnostic procedures are conducted safely.

## Cancer Incidence

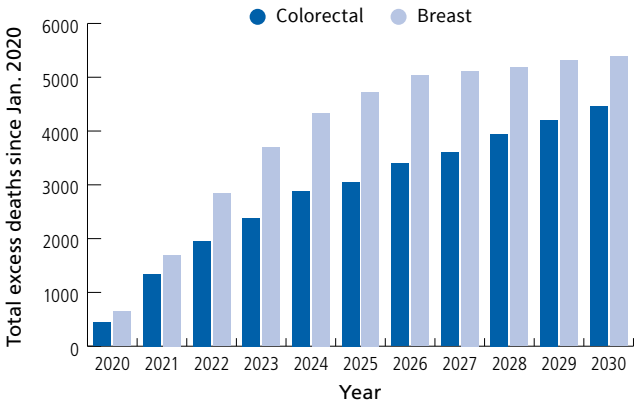
New cancer diagnoses in 2020 will likely be lower than expected due to aforementioned declines in cancer screening and other preventive care visits during the COVID-19 pandemic. One study of diagnostics data reported that among people who received medical testing for any reason, there was a 46% decline in diagnoses of six common cancers (breast, colorectal, lung, pancreas, stomach, and esophagus) during March 1 to April 18, 2020, compared with January 6, 2019, to February 29, 2020, ranging from a 25% drop for pancreatic cancer to 52% for breast cancer.[27] Another analysis reported that new CRC diagnoses were down by 30% from January to mid-April 2020 compared to that time period in 2019.[28] Likewise, an analysis of 20 US health care institutions that included more than 28 million people reported that patient

encounters related to new cancer diagnoses were 40% to 50% lower in April 2020 compared to April 2019.[21] Similar declines have been observed around the world, including in the Netherlands[29] and the United Kingdom.[21] Although these preliminary snapshots may provide a glimpse into the impact of the pandemic on cancer diagnoses, population-based cancer registry data and the extent to which these delays will translate to more advanced stage disease will not be known for some time.

## Cancer treatment and survivorship

The COVID-19 pandemic has resulted in unprecedented challenges to the care and treatment of patients with cancer. Many patient visits and procedures were abruptly cancelled at the onset of the pandemic to preserve health care resources and reduce the risk of exposure to SARS-CoV-2. The American Cancer Society Cancer Action Network℠ (ACS CAN) began surveying cancer patients and survivors in late March to examine the influence of the pandemic on health care delivery. In May 2020, 79% of respondents in active treatment reported delays in their care, up from 27% in April.[30] The most commonly reported delays were for in-person provider visits (57%), imaging services (25%), surgical procedures (15%), and access to supportive services (20%), including physical therapy or mental health care. The surveys also found that nearly half (46%) of respondents were facing significant financial stress, including 23% who were concerned about losing health insurance. Importantly, these results likely underestimate the impact on people of color, especially those who are Black, who have experienced a disproportionate burden of both COVID-19 and the pandemic's economic impact.

**Figure S3. Estimated Cumulative Excess Deaths From Colorectal and Breast Cancers in the US Due to the COVID-19 Pandemic, 2020 to 2030**




**Source:** Sharpless NE. COVID-19 and cancer. *Science.* 2020;368(6497): 1290. Reprinted with permission from AAAAS.



Cancer clinical trials have also been affected by the COVID-19 pandemic, with 60% of research programs halting screening and/or enrollment for clinical trials.[31] In addition, a large portion of research resources have been reallocated to COVID-19, for which there were more than 3,370 registered clinical trials at clinicaltrials.gov as of September 2020. It is hoped that recently enacted regulatory changes by US Federal agencies to support decentralized clinical trials will increase patient access and enrollment. Currently, these new regulations and rules are applicable only during the COVID-19 Public Health Emergency (PHE) and will expire after the PHE declaration is rescinded.

Guidelines for cancer care during the pandemic carefully balance concerns about limiting potential exposure to SARS-CoV-2 while preserving delivery of necessary care. The American Society of Clinical Oncology issued a special report on cancer care during the pandemic based on COVID-19 status that contains numerous links to additional resources.[32] Many organizations collaborated early in the pandemic to offer guidance around adjusting cancer treatment. Among them, the European Society of Medical Oncology issued recommendations that patients with potentially curable cancers be treated according to existing guidelines, including use of systemic therapies.[33] They also urged considerations for particularly vulnerable patients, including the use of supportive measures (e.g., growth factors) in individuals receiving treatments associated with a high risk of immunosuppression and adjusting chemotherapy regimens when appropriate to reduce the number of clinic visits. The Cancer and Aging Research Group published recommendations to guide delivery of care for older patients with cancer, which include a careful weighing of risks and benefits for those who are frail, especially elderly, and/or have significant underlying medical conditions.[34] More recently, the University of California Cancer Consortium published a summary of broad interventions implemented as a result

of the pandemic, but with the additional intent to permanently enhance cancer care delivery.[35]

### Cancer mortality

The COVID-19 pandemic is expected to result in increased cancer mortality over the long term due to delayed diagnoses; interruptions or alterations in potentially curative treatment; the possibility that some adults will abandon prior patterns of preventive care; and the expectation that millions of adults will remain unemployed and without health insurance. The National Cancer Institute estimated a 1% increase in deaths from breast and colorectal cancer over the next 10 years, the equivalent of approximately 10,000 excess deaths due to the pandemic's impact on screening and treatment (Figure S3).[36] However, this may be an underestimate because models assumed a 6-month disruption in care followed by the return to routine care, which has since proven too optimistic. A similar study estimated that cancer diagnosis delays in England would result in additional deaths ranging from 5% for lung cancer to about 15% for colorectal cancer.[37]

## Consequences of the COVID-19 Pandemic

### Telehealth (Telemedicine)

In response to the pandemic, health care providers transitioned many patient visits to virtual care, consisting of telephone or video consultations. Telehealth allows receipt of many aspects of necessary care remotely while minimizing transmission of coronavirus or other infectious agents to clinicians and patients. Telehealth was not widely used prior to the pandemic, despite evidence of substantial patient interest, in large part due to restricted reimbursement. However, the landscape had begun to change in recent years because of increased passage by many states of parity laws that require private insurers to reimburse for telemedicine services.[38] Although Medicare reimbursement had remained limited to patients in rural areas prior to COVID-19, major changes in federal and state policy in March 2020 facilitated the rapid expansion of telehealth by granting equal reimbursement; relaxing Health Insurance Portability and Accountability Act (HIPAA) requirements to allow for the use of video,

**Figure S4. Disproportionate Burden of COVID-19 Cases, Hospitalizations, and Deaths Among People of Color Compared to Non-Hispanic White Persons**

| | American Indian or Alaska Native | Asian | Black or African American | Hispanic/ Latinx |
|---|---|---|---|---|
| Cases | 2.8x higher | 1.1x higher | 2.6x higher | 2.8x higher |
| Hospitalizations | 5.3x higher | 1.3x higher | 4.7x higher | 4.6x higher |
| Deaths | 1.4x higher | No increase | 2.1x higher | 1.1x higher |

Comparisons are rate ratios, with non-Hispanic White persons as the reference group. Categories for persons of American Indian, Alaska Native, Asian, Black or African American race exclude individuals of Hispanic ethnicity.

**Source:** Centers for Disease Control and Prevention, 2020. Available from: cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-race-ethnicity.html. Accessed October 30, 2020.

telephone, and text-based applications; and reducing the burden of multi-state licensing requirements for out-of-state providers.[39] Although some of these changes may be temporary, the facilitation of necessary health care delivery that ensured the protection of both staff and patients was a critical need during the pandemic.[40] Additional information on current state laws and policies regarding telehealth can be found at the Center for Connected Health Policy website (cchpca.org/).

A report using data from 22 health systems across the US that included information on 7 million patients found that telehealth visits increased 300-fold from March/April 2019 to March/April 2020.[41] Usage peaked in mid-April 2020, with telehealth visits comprising 69% of total health care visits, but declined to 21% as the country began to reopen in late April and May.[42]

Telehealth offers many benefits to patients and providers.[38] For example, it eliminates some of the ancillary costs associated with traditional health care visits including transportation, childcare, and some of the time lost from work. In addition, telemedicine can allow more frequent check-ins with providers, which is particularly helpful for patients with chronic conditions. It can also allow patients to consult with specialists who would otherwise be inaccessible to them. For clinicians, telemedicine allows increased flexibility and may help alleviate burnout. However, some patients may not be comfortable with telehealth or have access to the

technology or bandwidth necessary to use it, especially those in rural areas.[43] It remains unclear whether the increased levels of telemedicine use will persist post-pandemic and how it may affect future health care prioritization and utilization.

## Health equity

The COVID-19 pandemic has highlighted and exacerbated existing health inequities in the United States. Black and Hispanic/Latinx individuals and people with lower incomes have a disproportionate burden of COVID-19, as they do for cancer and other chronic diseases, as well as the adverse economic consequences of the pandemic. A nationwide study of cancer patients within the Veterans Affairs health care system found that the prevalence of COVID-19 was 3 times higher among individuals who were African American and 2 times higher among those who were Hispanic, compared to those who were White.[18] A comparison of COVID-19 outcomes across New York City boroughs found the highest rates of hospitalization and death in the Bronx, which has the highest proportion of people of color, the most persons living in poverty, and the lowest levels of educational attainment.[44] According to the Centers for Disease Control and Prevention, as of September 1, 2020, 19% of cases and 22% of deaths had occurred among Black individuals, who make up only 12% of the US population, compared to 41% of cases and 51% of deaths among non-Hispanic White individuals, who comprise 60% of the population.[45] People with COVID-19 who are Black, Hispanic, or American Indian/Alaska Native are about five times more likely to be hospitalized than those who are non-Hispanic White (Figure S4).

This disproportionate burden likely reflects long-standing inequities in social and structural determinants of health, including housing, transportation, and employment.[46, 47] Black and Hispanic individuals are more likely than others to live in densely populated housing; depend on public transportation; and be employed in public-facing essential services, such as food service or health care, in which risk of infection with SARS-CoV-2 is greatest.[48] In addition, compared to White persons, Black persons have a higher prevalence of chronic health conditions, including severe obesity and diabetes, which are associated with increased risk for hospitalization and death due to COVID-19; however, one study suggested the contribution of these factors to poorer outcomes in Black persons may be minimal.[48] The American Indian and Alaska Native communities have also been disproportionately affected by the pandemic,[49] with the Navajo Nation surpassing New York City for the highest rates of COVID-19 infection in May 2020.[50] Although the rate of COVID-19 among Asian Americans is similar to that in the White population, Asian Americans have faced another crisis. Anti-Asian racism in the form of assaults, harassment, and hate crimes has become prevalent because of inflammatory racist rhetoric at the national level and in the popular press that refers to SARS-CoV-2 as the "China virus" in reference to the origin of the outbreak.[51]

Moreover, the COVID-19 pandemic threatens to worsen existing disparities that occur across the cancer continuum. (See Cancer Disparities on page 49 for details.) For example, the rapid dissemination of telehealth services could increase disparities in access to care without proactive efforts by health systems and providers to ensure equity.[52] Alternatively, telehealth could potentially reduce disparities by providing easier access to medical services for patients who live in rural areas; reducing missed time from work; and eliminating costs associated with in-person visits (e.g., childcare and transportation).[38] The backlog of screening and other preventive health care visits will likely further exacerbate delayed diagnosis and substandard treatment among Black and low-income individuals. The economic ramifications of the pandemic will only further widen this gap among individuals who were already financially insecure.[53]

## Unemployment and insurance loss

The COVID-19 pandemic has resulted in unprecedented job loss, eliminating employer-based health insurance as an option for millions of Americans. According to the US Bureau of Labor and Statistics, the unemployment rate rose from a 50-year low of 3.5% in February 2020 to 14.7% in April overall, 16.7% among Black individuals, and 18.9% among Hispanic individuals. Between March and May 2020, more than 40 million people lost their jobs and filed for unemployment insurance. Actual job and income loss were likely even higher because some people were only

marginally employed or did not file for unemployment benefits. As of June 2020, an estimated 14.6 million people had become uninsured due to the loss of employer-sponsored insurance as a result of COVID-19.[54] Others may be eligible for Medicaid coverage. Research has shown that disruptions in insurance coverage are associated with less frequent cancer screening, advanced stage at diagnosis, treatment delays, and poorer survival.[55-57] Although people are returning to work, the economy is not expected to fully rebound in the near future, leaving many individuals uninsured, especially people of color. The Affordable Care Act played a large role in reducing inequalities in health insurance coverage pre-COVID-19 and is even more important now for mitigating the effects of the pandemic on America's health.[58]

## Resources

Knowledge about COVID-19 and its long-term effects is constantly evolving as new information and data accumulate. The information contained in this section was current as of September 1, 2020. Sources for up-to-date information about COVID-19 and cancer include:

- American Cancer Society (cancer.org/coronavirus)
- National Cancer Institute (cancer.gov/about-cancer/coronavirus)
- Centers for Disease Control and Prevention (cdc.gov/coronavirus).
- Johns Hopkins University Coronavirus Resource Center (coronavirus.jhu.edu/map.html)

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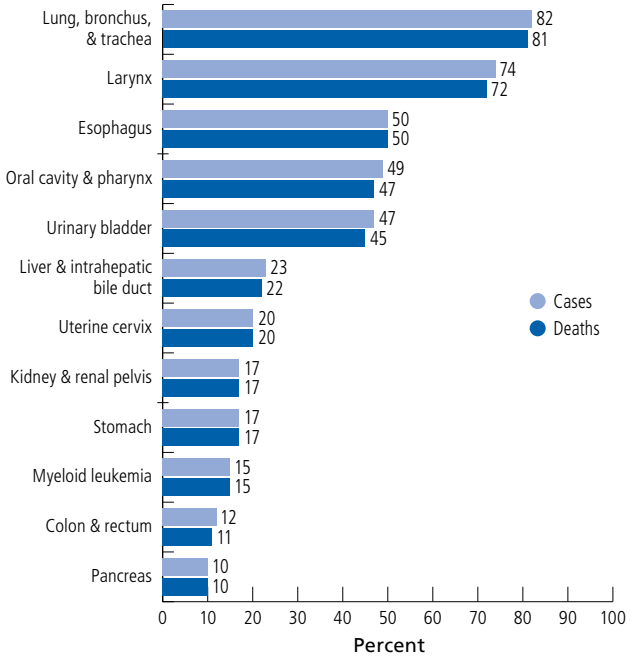
# Tobacco Use

Tobacco use remains the leading preventable cause of death in the US. Despite decades of decline, cigarette smoking causes about 30% of all cancer deaths,[1, 2] and as much as 40% of those among men in some Southern states.[3] More than 34 million persons ages 18 and older in the US still smoke cigarettes; rates are especially high in the South and among individuals who are poor, American Indian or Alaska Native, or have a history of mental illness.[4]

## Cigarette Smoking

Cigarette smoking increases the risk of several cancers, including those of the oral cavity and pharynx, larynx, lung, esophagus, pancreas, uterine cervix, kidney, bladder, stomach, colorectum and liver and acute myeloid leukemia (Figure 4).[5] Smoking may also increase risk of fatal prostate cancer and a rare type of ovarian cancer.[5-7] Health consequences increase with both duration and intensity of smoking.

**Figure 4. Proportion of Cancer 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.

- The prevalence of current cigarette smoking among US adults ages 18 and older declined from 42% in 1965 to 14% in 2018, with the steepest declines among young adults 18-24 years (males: 54% to 8%, females: 38% to 7%).[8, 9]
- Smoking prevalence is highest, and has declined most slowly, among those with low levels of education; among adults ages 25 and older in 2018, 24% of those with less than a high school diploma and 36% of those with a GED (General Educational Development) smoked, compared to 4% of those with graduate degrees.[9]
- At the state level, adult smoking prevalence in 2018 ranged from 9% in Utah to 27% in West Virginia.[10]
- Among US high school students, current cigarette smoking (past month) in 2019 was 6% (boys: 7%, girls: 4%), down from 29% in 1999.[11, 12]

## Other Combustible Tobacco Products

In addition to cigarettes, other forms of combustible tobacco use 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, and have 4 to 10 times the risk of dying from these cancers compared to never smokers.[13-15] Lower tax rates on cigars compared to cigarettes can lead smokers to switch to small cigars that resemble cigarettes.[16, 17] Cigars are often sold as singles and some include flavorings,[18] both of which are particularly appealing to youth. Waterpipe smoking, which often occurs in social settings (e.g., hookah bars), is considered more socially acceptable than cigarettes, particularly by younger populations.[19] Although many users perceive waterpipe smoking to be less harmful than cigarettes, it delivers the same or higher levels of toxins,[20] and accumulating evidence suggests that it probably has the same adverse health effects as cigarettes.[21-23]

- Overall, 4% of adults in 2018 (men: 7%, women: 1%) reported currently smoking cigars.[9]
- In 2018, cigar smoking was more common among non-Hispanic American Indian/Alaska Native persons (8%) compared to those who are non-Hispanic Black (5%), non-Hispanic White (4%), or Hispanic (3%).[24]
- Among high school students, 8% (boys: 9%, girls: 6%) had smoked cigars at least once in the past month in 2019, down from 15% in 1999.[11, 12] Cigar smoking is highest among non-Hispanic Black students (12%) compared to non-Hispanic White (8%) or Hispanic (6%) students.[12]
- In 2019, 3% of high school students reported waterpipe smoking in the past month.[12]

## E-cigarettes (Vaping Devices)

Electronic cigarettes, or e-cigarettes, first emerged in the US in the mid-to-late 2000s and are also referred to as "e-cigs," "vapes," "e-hookahs," "vape pens," and "electronic nicotine delivery systems (ENDS)." E-cigarettes have cartridges, tanks, or pods filled with a liquid that typically contains nicotine, propylene glycol and/or vegetable glycerin, flavoring, and other ingredients. The liquid is heated to produce an aerosol that is inhaled by users. The latest generation of e-cigarettes are shaped like USB flash drives, pens, and other everyday items; contain nicotine at levels comparable to a pack of 20 regular cigarettes; and come in a variety of flavors that appeal to youth.[25]

There is accumulating evidence that e-cigarette use causes short-term adverse effects on airways and blood vessels, but long-term risks are not yet known.[26-28] Potentially harmful substances include metals and other hazardous chemicals that can seep into the inhaled aerosol, and some commonly used flavoring components are hazardous to the lungs. E-cigarettes are additionally concerning because they are addictive and may be a gateway to combustible tobacco products among individuals who would otherwise have been nonsmokers; adolescents and young adults who use e-cigarettes are more likely than nonusers to begin using combustible tobacco products.[29-31] E-cigarette use is particularly concerning among youth because nicotine can impair adolescent brain development.[32]

A recent outbreak of e-cigarette, or vaping, product use-associated lung injury (EVALI) – causing more than 2,807 hospitalized cases or deaths of as of February 2020[33] – has been strongly linked to exposure to Vitamin E acetate, an additive in tetrahydrocannabinol (THC)-containing e-cigarettes.[34] Although the EVALI epidemic was primarily linked to contamination in illicit THC-containing e-cigarette products, this episode contains a broader lesson about the dangers of poor regulation with respect to products that are designed to be inhaled and come into close contact with highly sensitive lung tissues.

According to a 2019 American Cancer Society position statement on e-cigarettes, no youth or young adult should begin using e-cigarettes. To date, no e-cigarette has been FDA-approved as a cessation aid, and e-cigarettes should not be used to quit smoking. Current e-cigarette users should not also smoke cigarettes or switch to smoking cigarettes, and former smokers now using e-cigarettes should not revert to smoking. Visit cancer.org/healthy/stay-away-from-tobacco/e-cigarette-position-statement.html for the American Cancer Society's position statement on e-cigarettes.

- Current e-cigarette use increased from 5% in 2014 to 7% in 2018 among US adults ages 18-29 years, remained stable among adults ages 30-49 years (3%-4%), and declined among older adults ages ≥50 years (from 3% to 2%).[35]
- The largest population increase in e-cigarette users from 2014 to 2018 was among adults ages 18-29 years who had never smoked cigarettes (from 0.5 to 1.4 million), suggesting a rise in primary nicotine initiation with e-cigarettes. E-cigarette use also increased significantly across all age-groups among those who quit cigarette smoking recently (i.e., 1-8 years ago).
- Current (past month) e-cigarette use among high school students has skyrocketed from 1.5% in 2011 to 12% in 2017; 21% in 2018; and 28% (4.1 million users) in 2019.[36, 12]

- In 2019, 32% of non-Hispanic White high school students reported current e-cigarette use compared to 23% of Hispanic and 18% of non-Hispanic Black 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.[37] For example, switching from combustible to spit tobacco has been shown to result in a higher risk of tobacco-related death than complete tobacco cessation.[38] The tobacco industry markets smokeless tobacco as a cigarette alternative in smoke-free settings, and many new products have specific appeal to youth because they are relatively low in price, easy to conceal, and flavored.

- In 2018, 5% of men and <1% of women were current (every day or some days) users of smokeless tobacco products;[9] use has remained stable since 2003.[39]
- State-level adult smokeless tobacco use in 2018 ranged from 1% in New Jersey to 9% in West Virginia and Wyoming.[10]
- In 2019, 8% of high school boys and 2% 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.[5] There is no safe level of exposure to SHS. Nonsmokers who are exposed to SHS are at increased risk of lung cancer, other respiratory diseases, and heart disease.[40-43] In 2014, an estimated 5,840 nonsmoking adults in the US were diagnosed with lung cancer as a result of SHS exposure.[2] Comprehensive smoke-free laws are effective in reducing SHS exposure, modifying smoking behavior, and reducing smoking-related disease.[42]

Nationwide, SHS exposure (measured by testing a person's blood for cotinine, a byproduct of nicotine) among nonsmokers declined from 88% in 1988-1991 to 25% in 2013-2014, but it remains substantially higher among low-income and non-Hispanic Black populations.[4, 44]

- SHS exposure is highest among youth aged 3-17 years (35%), especially those who are non-Hispanic Black (62% versus 34% among non-Hispanic White, 25% among Hispanic, and 18% among non-Hispanic Asian).[45]
- Nearly 1 in 5 (19%) nonsmoking workers in the US in 2015 reported exposure to workplace SHS in the past year, and 10% reported frequent exposure, with the highest rates among younger individuals, men, and manual labor (blue-collar) workers.[46 47]
- Workers in states with comprehensive smoke-free laws reported lower exposure to workplace SHS exposure than workers in states with no laws (9% versus 11%).[47]
- As of April 2020, more than 1,100 cities and counties and 27 states, the District of Columbia, Puerto Rico, and the US Virgin Islands had comprehensive laws requiring all non-hospitality workplaces, restaurants, and bars to be 100% smoke-free, covering more than 61% of the US population.[48]

## Smoking Cessation

Smokers who quit, regardless of age, increase their longevity; those who quit by age 30 live an average of 10 years longer than if they had continued to smoke.[49, 50] Smoking cessation reduces the risk of the 12 established smoking-related cancers, as well as other smoking-related diseases, and also improves outcomes for cancer survivors.[50] 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.[50]

- In 2018, 62% of the 89.1 million Americans who had ever smoked at least 100 cigarettes were former smokers (quit ratio), up from 52% in 2009.[9, 51]
- However, non-Hispanic Black persons had a quit ratio (48%) that was substantially lower than that in non-Hispanic White (64%) or Hispanic (59%) persons,[9, 50] and stagnant from 2002 to 2016 compared to increasing trends in the other two groups.[52]
- Although effective cessation treatments (i.e., counseling, FDA-approved nicotine replacement therapy [NRT] or medication) can double or triple the likelihood of long-term abstinence, only about one-third of smokers use these aids.[50, 53]
- Although there have been improvements in Medicaid tobacco cessation coverage, as of December 31, 2018, only 15 states have mandated that health insurance covers individual counseling, group counseling, and the seven FDA-approved cessation medications (the nicotine patch, gum, lozenge, nasal spray, inhaler, and bupropion and varenicline), up from six states in 2008.[54]
- Large proportions of smokers switch to other nicotine-containing products, including e-cigarettes (35%) and smokeless tobacco (5%).[50]

## Reducing Tobacco Use and Exposure

Numerous federal, state, and local tobacco control policies have been enacted since the 1964 Surgeon General's Report on Smoking and Health, including increasing cigarette taxes, improving access to cessation treatment, implementation of smoke-free workplace laws, improving health warnings, and restricting tobacco marketing.[5] These policies helped reduce smoking prevalence and averted almost 2 million smoking-related deaths through 2014.[55]

Expanding federal initiatives in tobacco control holds promise for further reducing tobacco use. The Family Smoking Prevention and Tobacco Control Act of 2009 granted the US Food and Drug Administration (FDA) authority to regulate the manufacturing, selling, and marketing of tobacco products. As a result of legal efforts by the American Cancer Society, American Cancer Society Cancer Action Network, and other partners, the FDA is court-mandated to implement the requirements of the law, including finalizing graphic warnings that cover the top half of cigarette packs and one-fifth of cigarette advertisements, and requiring all new tobacco products to undergo scientific review.[56] The FDA has run highly successful mass media educational campaigns, including "The Real Costs" targeting youth and "Every Try Counts" targeting adult smokers. In December 2019, Congress raised the federal minimum age to purchase or use tobacco from 18 to 21 years, effective immediately. 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, NRT, medications), although for many smokers, minimum coverage falls short of what is needed for long-term cessation.

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 more than 60% of the population is covered by a comprehensive smoke-free law. The Centers for Disease Control and Prevention recommends best practices and funding levels for state tobacco control programs.[57] In fiscal year 2019, funding for tobacco control programs was >50% of recommended levels in only six states (Alaska, California, Delaware, Maine, North Dakota, and Oklahoma) and <1% of recommended levels in three states (Connecticut, Georgia, and Missouri). [58]

## 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 34 million people still smoke, a disproportionate number of whom are low-income. Numerous studies confirm that comprehensive tobacco control, including higher taxes, 100% smoke-free environments, and sustained tobacco control program funding; comprehensive, barrier-free, and widely promoted coverage for tobacco cessation treatments; graphic warnings on cigarette packaging; and regulations to reduce the appeal and addictiveness of tobacco products can successfully reduce deaths, disabilities, and economic disruption from tobacco use.

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

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# Nutrition & Physical Activity

Aside from avoiding tobacco use, maintaining a healthy body weight, being physically active, consuming a healthful diet, and avoiding or limiting alcohol intake are the most effective strategies for reducing the risk of cancer. 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 (summarized below) for reducing cancer risk.[2] These guidelines include community action recommendations because of the strong influence of environment on individual diet and 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] and a comparable reduction in risk has been demonstrated specifically among low-income and African American populations.[4]

## Excess Body Weight

An estimated 5% of cancers in men and 11% in women are attributed to excess body weight.[1] Excess body weight

### The American Cancer Society's nutrition and physical activity guidelines[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 min of moderate-intensity physical activity per week, or 75-150 min of vigorous-intensity physical activity, or an equivalent combination; achieving or exceeding the upper limit of 300 min is optimal.
- Children and adolescents should engage in at least 1 hr 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; and
- Whole grains.
- A healthy eating pattern limits or does not include:
- Red and processed meats;
- Sugar-sweetened beverages; or
- Highly processed foods and refined grain products.

*4. It is best not to drink alcohol.*

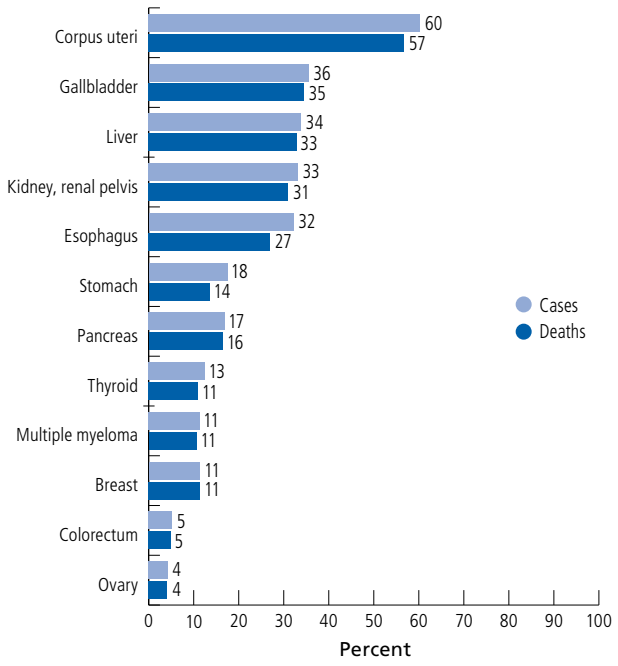
- People who do choose to drink alcohol should limit their consumption to no more than 1 drink per day for women and 2 drinks per day for men.

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.

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

**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.

(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.[5] There is some evidence that excess body weight may also increase 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).[6] Excess body weight influences risk more strongly for some cancers than for others. For example, 4% of ovarian cancer cases are attributed to excess body weight compared to 60% of uterine corpus (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.[7, 8] However, emerging research suggests that even modest sustained weight loss can help mitigate breast cancer risk among women 50 and older who do not use hormone replacement therapy.[9]

- The prevalence of being overweight (body mass index [BMI] – is 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 adults (ages 20-74 years) since the early 1960s at about 40% in men and 25%-30% in women.
- In contrast, obesity (BMI ≥30 kg/m$^2$) prevalence has markedly increased from 11% of men and 16% of women during 1960-1962 to 43% of men and 42% of women in 2017-2018.[10, 11]
- In 2017-2018, obesity prevalence among men was highest in Hispanic persons (46%), followed by those who were non-Hispanic White (45%), non-Hispanic Black (41%), and non-Hispanic Asian (18%); among women, obesity was highest among non-Hispanic Black persons (57%), followed by those who were Hispanic (44%), non-Hispanic White (40%), and non-Hispanic Asian (17%).[12]
- Among youth (ages 2-19 years), overweight prevalence increased from 10% in the early 1970s to 16% in 2017-2018, whereas obesity prevalence rose four-fold, from 5% in the early 1970s to about 19% in 2017-2018.[13]
- Specifically, 29% of children ages 2-5 years were overweight or obese in 2015-2016 compared to 38% of children ages 6-11 years and 37% of adolescents ages 12-19 years.[11]

## Physical Activity

Physical activity decreases the risk of cancers of the colon (but not rectum), female breast, endometrium, kidney, bladder, esophagus (adenocarcinoma), and stomach (cardia).[14, 15] Approximately 3% of cancer cases are attributed to physical inactivity, although this is likely an underestimate because it is only based on colon, female breast, and endometrial cancers.[1] Conversely, cancer patients who are physically active are less likely to have adverse effects and to die from their cancer than those who are inactive.[16] Extended leisure-time sitting has also been associated with increased risk of cancer death,[17] whereas replacing sedentary time with even short durations of moderate to vigorous physical activity appears to reduce cancer mortality.[18]

- In 2018, 26% of adults reported no leisure-time activity (men: 23%, women: 28%), with a higher proportion of Black (34%) and Hispanic (34%) persons reporting inactivity than those who were White (22%) and non-Hispanic Asian (21%).[19]
- From 1998 to 2018, the proportion of adults who met recommended levels of aerobic activity increased from 40% to 54%.[19, 20]
- In 2019, only 23% of US high school students (boys: 31%, girls: 15%) had engaged in at least 60 minutes of physical activity on all 7 days in the previous week, with lower levels among students who were non-Hispanic Black (21%) and Hispanic (21%).[21]

## Diet

Approximately 4% of all cancer cases are attributed to dietary factors.[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),[22] 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.[23, 24] One study found that individuals who have the healthiest diet have an 11%-24% lower risk of cancer death than those with the least healthy diet.[25] Moreover, cancer survivors who follow a healthy diet pattern have a 10%-12% lower risk of dying from cancer or other causes.[24]

- Among adults, 33% reported eating two or more servings of fruit per day, and 16% reported consuming vegetables three or more times per day in 2017.[26]
- Among adults, whole grains accounted for 16% of total grain consumption on a given day in 2013-2016, ranging from 11% among Hispanics to 18% among non-Hispanic Asians.[27]
- In 2019, 41% of US high school students reported eating fruit or drinking 100% fruit juices less than 1 time/day, and 40% reported eating vegetables <1 time/day, with higher levels among those who were non-Hispanic Black compared to White or Hispanic students.[21]

## Alcohol

An estimated 6% of cancer cases are attributed to alcohol consumption.[1] Alcohol consumption increases risk for cancers of the mouth, pharynx, larynx, esophagus (squamous cell carcinoma), liver, colorectum, female breast, and stomach.[28] Cancer risk increases with alcohol volume, and even a few drinks per week may increase risk for some cancers. 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.[29]

- In 2018, 67% of adults reported current alcohol consumption (12+ drinks in lifetime and ≥1 drink in past year). About 5% reported heavier drinking [male] >14 drinks/week in past year or [female] >7 drinks/week in past year), ranging from 2% in non-Hispanic Asian persons to 7% in non-Hispanic White persons.[19]
- In 2019, 29% of US high school students reported current (past month) use of alcohol, with significantly higher levels among females (32%) compared to males (26%).[30]

## Type 2 Diabetes

Type 2 diabetes, a chronic condition in which the body loses its ability to respond to insulin, shares several modifiable risk factors with cancer, including excess body weight, poor diet, and physical inactivity. Evidence suggests that type 2 diabetes independently increases risk for several cancers, including liver, endometrium, pancreas, colorectum, kidney, bladder, breast, and perhaps ovary.[31-33] The biology underlying the association between type 2 diabetes and cancer is not completely understood, but may involve abnormal glucose control and related factors, including inflammation.

- In 2013-2016, 13% of US adults ≥18 years had diabetes, more than 90% of which were type 2.[34]
- In 2017-2018, the prevalence of diagnosed diabetes was higher among American Indian/Alaska Native (15%), non-Hispanic Black (12%), and Hispanic (13%) persons than those who were Asian (9%) and non-Hispanic White (8%), although rates vary within subpopulation (e.g., Asian Indian: 13%).[34]

## Conclusion

Almost 1 in 5 cancers is caused by excess body weight, alcohol consumption, poor diet, and a sedentary lifestyle. Many Americans encounter substantial barriers to consuming a healthy diet and engaging in regular physical activity. The tobacco control experience has shown that policy and environmental interventions across national, state, and local levels are critical for changing individual behavior. To facilitate healthier lifestyles and curtail the future cancer burden, creative new strategies are needed 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.

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# Cancer Disparities

Eliminating disparities in cancer is an overarching goal of the American Cancer Society. Cancer disparities are differences in cancer occurrence and outcomes according to sociodemographic factors, such as race, ethnicity, age, and sexual orientation, or where you live. These differences occur mostly because of barriers to high-quality cancer prevention, early detection, and treatment due to interrelated inequities in work, wealth, education, housing, and overall standard of living. Much of this socioeconomic gap stems from longstanding structural racism. 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*.

## Socioeconomic Status

In research, socioeconomic status (SES) is often measured in terms of income, education, and/or insurance status. People with lower SES have higher cancer death rates than those with higher SES. For example, cancer mortality rates among both Black and non-Hispanic White (NHW) men with 12 or fewer years of education are almost 3 times higher than those of men with 4-year college degrees. This partly reflects higher incidence for some cancers in people with lower SES due to a higher prevalence of many factors that increase cancer risk. For example, people with lower SES are more likely to smoke and to be obese, partly because of targeted marketing to this population by tobacco companies and fast food chains. Moreover, community factors often limit opportunities for physical activity and access to fresh fruits and vegetables. Additional factors include a higher prevalence of cancer-causing infections and harmful exposures in the workplace and other environments.

Additionally, populations that have been marginalized face numerous barriers to preventive care, early detection, and optimal treatment, including inadequate health insurance; financial, structural, and personal obstacles to health care; low health literacy rates; and delays in the dissemination of advances in early detection and treatment. Thus, people living in poverty have lower survival rates after cancer diagnosis because of a higher likelihood of advanced-stage disease and lower likelihood of high-quality treatment.

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

| Incidence, 2013-2017 | All races | Non-Hispanic White | Non-Hispanic Black | Asian/ Pacific Islander | American Indian/ Alaska Native† | Hispanic/ Latinx |
|---|---|---|---|---|---|---|
| All sites | 449.0 | 465.6 | 457.6 | 291.0 | 379.8 | 346.9 |
| Male | 489.1 | 501.4 | 534.0 | 294.3 | 399.8 | 371.3 |
| Female | 422.4 | 442.2 | 406.6 | 292.6 | 368.8 | 335.5 |
| Breast (female) | 126.0 | 131.6 | 127.3 | 95.6 | 94.9 | 94.8 |
| Colon & rectum* | 36.9 | 36.6 | 43.6 | 29.2 | 42.3 | 32.9 |
| Male | 42.6 | 42.0 | 51.6 | 34.6 | 47.2 | 39.6 |
| Female | 32.1 | 31.8 | 37.9 | 24.8 | 38.3 | 27.6 |
| Kidney & renal pelvis | 16.9 | 17.1 | 18.9 | 8.0 | 23.9 | 16.7 |
| Male | 22.9 | 23.1 | 26.1 | 11.3 | 31.3 | 21.9 |
| Female | 11.7 | 11.7 | 13.3 | 5.3 | 17.7 | 12.4 |
| Liver & intrahepatic bile duct | 8.5 | 7.1 | 11.0 | 12.6 | 15.7 | 13.5 |
| Male | 12.9 | 10.7 | 18.0 | 19.3 | 22.9 | 20.1 |
| Female | 4.6 | 3.8 | 5.5 | 7.1 | 9.4 | 7.9 |
| Lung & bronchus | 58.4 | 62.6 | 60.9 | 34.4 | 52.7 | 29.7 |
| Male | 67.6 | 70.8 | 79.8 | 43.2 | 59.2 | 37.1 |
| Female | 51.3 | 56.4 | 47.9 | 27.9 | 47.9 | 24.3 |
| Prostate | 104.6 | 97.7 | 171.6 | 53.8 | 67.7 | 85.6 |
| Stomach | 6.5 | 5.3 | 10.0 | 10.0 | 8.8 | 9.6 |
| Male | 8.9 | 7.5 | 13.7 | 13.1 | 11.4 | 12.0 |
| Female | 4.6 | 3.5 | 7.4 | 7.7 | 6.8 | 7.7 |
| Uterine cervix | 7.6 | 7.2 | 9.0 | 6.1 | 8.8 | 9.5 |
| **Mortality, 2014-2018** | | | | | | |
| All sites | 155.5 | 160.2 | 182.5 | 97.2 | 141.1 | 110.8 |
| Male | 185.5 | 190.2 | 227.2 | 114.6 | 169.3 | 134.0 |
| Female | 133.5 | 137.8 | 154.9 | 84.6 | 120.1 | 94.6 |
| Breast (female) | 20.1 | 20.1 | 28.2 | 11.7 | 14.8 | 13.8 |
| Colon & rectum | 13.7 | 13.6 | 18.5 | 9.4 | 15.1 | 10.9 |
| Male | 16.3 | 16.1 | 23.2 | 11.2 | 18.5 | 14.0 |
| Female | 11.5 | 11.5 | 15.3 | 7.9 | 12.4 | 8.6 |
| Kidney & renal pelvis | 3.6 | 3.8 | 3.6 | 1.7 | 5.5 | 3.4 |
| Male | 5.3 | 5.5 | 5.5 | 2.5 | 8.3 | 4.9 |
| Female | 2.3 | 2.3 | 2.3 | 1.1 | 3.2 | 2.2 |
| Liver & intrahepatic bile duct | 6.6 | 5.8 | 8.6 | 8.8 | 10.6 | 9.3 |
| Male | 9.7 | 8.4 | 13.4 | 13.1 | 14.8 | 13.3 |
| Female | 4.0 | 3.6 | 4.9 | 5.4 | 7.0 | 6.0 |
| Lung & bronchus | 38.5 | 41.7 | 41.3 | 21.2 | 32.1 | 16.8 |
| Male | 46.9 | 49.4 | 57.0 | 28.0 | 38.4 | 23.0 |
| Female | 32.0 | 35.6 | 30.6 | 16.3 | 27.4 | 12.3 |
| Prostate | 19.0 | 17.9 | 38.3 | 8.8 | 18.5 | 15.6 |
| Stomach | 3.0 | 2.2 | 5.3 | 5.0 | 4.7 | 4.9 |
| Male | 4.0 | 3.1 | 7.8 | 6.3 | 6.3 | 6.3 |
| Female | 2.2 | 1.6 | 3.6 | 4.0 | 3.5 | 3.9 |
| Uterine cervix | 2.2 | 2.0 | 3.4 | 1.7 | 2.4 | 2.6 |

Hispanic origin is not mutually exclusive from Asian/Pacific Islander or American Indian/Alaska Native. Rates are per 100,000 population and age adjusted to the 2000 US standard population and exclude data from Puerto Rico. *Colorectal cancer incidence rates exclude appendix. †Data based on Purchased/Referred Care Delivery Area (PRCDA) counties.

**Source:** Incidence – North American Association of Central Cancer Registries, 2020. Mortality – National Center for Health Statistics, Centers for Disease Control and Prevention, 2020.



Importantly, socioeconomic disparities in cancer mortality are widening, with the most notable gaps for the most preventable cancers. For example, compared to mortality rates in the wealthiest counties in the US, rates in the poorest counties are two-fold higher for cervical cancer and 40% higher for male lung and liver cancers.

## Race/Ethnicity

Racial and ethnic disparities in the cancer burden largely reflect longstanding inequities in SES and access to high-quality health care, which can be attributed in part to historical and persistent racism in the United States.

According to the US Census Bureau, in 2019, 19% of Black and 16% of Hispanic/Latinx populations lived below the poverty line, compared to 7% of NHW and Asian populations. In addition, 10% of Black and 19% of Hispanic/Latinx populations were uninsured, compared to 6% of NHWs and 7% of Asians.

Disparities in cancer rates by race and ethnicity persist even when SES is similar. This partly reflects ongoing systemic racism, as marginalized racial/ethnic groups tend to receive lower-quality health care than NHWs even when insurance status, age, severity of disease, and health status are comparable. Social inequalities, such as communication barriers, can likewise affect interactions between patients and physicians and contribute to miscommunication and receipt of substandard care.

Racial/ethnic variations also reflect cultural influences on risk factor behaviors. For example, persons who are Hispanic or Asian have lower rates of lung cancer than other populations (Table 9) because these populations as a whole were historically less likely to smoke, although prevalence varies substantially by subpopulation. Conversely, because a relatively large proportion of persons who are Hispanic or Asian are recent immigrants, these populations generally have higher rates of cancer related to infectious agents (e.g., stomach), reflecting higher infection prevalence (e.g., *Helicobacter pylori*) in their native countries.

Following is a brief overview of the cancer burden for four major racial and ethnic minority groups in the US. However, it is important to note that there is substantial variation within these diverse populations by country of origin, duration of residence, geographic location, etc. A few examples of subgroup differences are also provided. In addition, cancer rates for several racial and ethnic groups, especially those who are American Indian or Alaska Native (AIAN), are known to be underestimated due to misclassification on medical and death records.

**Non-Hispanic Black:** Black males have the highest overall cancer mortality rate (227 per 100,000), 16% higher than NHW males (190) and twice that of Asian or Pacific Islander males (116), who have the lowest rate (Table 9). Prostate cancer mortality among Black men is more than double that of men in every other group (Table 9). Black females have 40% higher breast cancer death rates than NHW females despite similar incidence rates. Larger gaps in mortality compared to incidence reflect substantial disparities in survival for Black individuals (Table 7) due to disproportionate poverty and underlying systemic discrimination that reduce access to screening, early detection, and appropriate, high-quality treatment. See *Cancer Facts & Figures for African Americans*, available online at cancer.org/statistics, for more information.

**Asian and Pacific Islander (API):** The API population in the US has the lowest overall cancer incidence and mortality, but among the highest liver and stomach cancer rates, about double those in persons who are NHW (Table 9). Although lung cancer rates in the API population are about half those in NHWs, individuals belonging to some API subgroups with higher historical smoking prevalence, such as persons who are Native Hawaiian, have rates that approach those of NHWs. The variation in cancer occurrence within the API population reflects its diversity in terms of geographic origin, language, acculturation, and socioeconomic status. Unfortunately, contemporary cancer data are largely unavailable for Asian and Pacific Islander subpopulations. See the *Cancer Facts & Figures 2016* Special Section on Cancer in Asian Americans, Native Hawaiians, and Pacific Islanders, available online at cancer.org/statistics, for more information.

**American Indian and Alaska Native (AIAN):** Kidney cancer incidence and death rates in the AIAN population are the highest of any major racial or ethnic population in the US – nearly 3 times those among the API population, who have the lowest rates (Table 9). However, like other broad racial and ethnic groups, cancer rates vary greatly within the AIAN population because of differences in behaviors that influence disease risk. For example, kidney cancer death rates are about two-fold higher among AIAN men living in the Southern Plains than in those living in the East and Pacific Coast regions, likely because of differences in the prevalence of smoking, excess body weight, and hypertension. Likewise, variations in smoking patterns among AIAN men contribute to large differences in lung cancer rates, which are about double those in NHWs for persons living in Alaska, but less than half

those in NHWs for AIAN men living in the Southwest. Notably, the Alaska Native population has the highest colorectal cancer incidence in the US (91 per 100,000 during 2013-2017), more than double the rates in NHW (37), American Indian (40), or Black (44) individuals.

**Hispanic/Latinx:** US Hispanics 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, reflecting the risk profile in immigrant countries of origin. For example, compared to NHW individuals, those who are Hispanic have cervical cancer incidence rates that are more than 30% higher, and liver and stomach cancer incidence rates in both males and females are about double (Table 9). However, rates vary substantially by country of origin, generation, and duration of residence due to acculturation and other factors. For example, colorectal cancer incidence rates are about 6% lower in Hispanic men than in NHW men overall (Table 9), but are 19% higher in men residing in the US territory of Puerto Rico, which is 99% Hispanic (Table 4). See *Cancer Facts & Figures for Hispanics/Latinos*, available online at cancer.org/statistics, for more information.

For information about American Cancer Society advocacy efforts dedicated to reducing the cancer burden among historically disadvantaged populations, see Advocacy on page 62.

# The Global Cancer Burden

The ultimate mission of the American Cancer Society is to lead the fight for a world without cancer. Cancer accounts for about 1 in every 6 deaths worldwide – more than HIV/AIDS, tuberculosis, and malaria combined.[1] In 2018, there were an estimated 17.0 million new cancer cases and 9.5 million cancer deaths globally.[2] One-quarter of all cancer deaths occur in low- and medium-Human Development Index countries, many of which lack the medical resources and health systems to address the disease burden. By 2040, the global burden is expected to reach 27.5 million new cancer cases and 16.2 million cancer deaths, solely due to the growth and aging of the population.[2] However, these projections may be underestimates given the adoption of unhealthy behaviors and lifestyles associated with globalization and urbanization (e.g., smoking, poor diet, and physical inactivity) and changes in reproductive patterns (e.g., declining fertility rate, later age at first childbirth) in economically transitioning countries.

## Tobacco Use

Tobacco use is the largest avoidable cause of cancer mortality, responsible for about 1 in 4 cancer deaths worldwide. In 2017, tobacco was responsible for an estimated 2.3 million cancer deaths, with an additional 190,000 cancer deaths due to smokeless tobacco and secondhand smoke exposure among nonsmokers.[1] About 19% of tobacco-attributable cancer deaths are in low- and middle-income countries (LMICs).[3] However, people who live in LMICs accounted for 80% of the approximately 1.1 billion people aged 15 and over who smoked in 2016, foreshadowing a much larger future tobacco-related disease burden.[4] In 2005, the world's first public health treaty under the auspices of the World Health Organization, the Framework Convention on Tobacco Control (FCTC), came into effect. Still, as of August 2020, several major tobacco-producing nations, including Argentina, Indonesia, and the United States have not acceded to it.

In 2018, about 65% 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. The WHO estimates that 22% of the world's population lives in complete smoke-free public and workplace environments and only 14% is covered by tobacco tax policy – the single-most effective intervention – that is at the prescribed level for optimal tobacco control.[5] More encouragingly, nearly 4 billion people, the equivalent of more than half of the world population, benefit from large graphic pack warnings featuring all WHO-recommended characteristics.[5]

## Infection

In 2012, an estimated 15% of all cancers worldwide were attributable to infectious agents, ranging from less than 5% in the US to 50% in some countries in sub-Saharan Africa.[6] LMICs have a disproportionately high burden of infection-related cancers (e.g., cervical, stomach, and liver) because of a high prevalence of human papillomavirus (HPV), *Helicobacter pylori*, hepatitis B virus (HBV), and hepatitis C virus (HCV), which combined account 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.

## Excess Body Weight

Excess body weight increases the risk of at least 13 cancer types and accounted for almost 4% of all new cancer cases among adults worldwide in 2012, ranging from less than 1% in low-income countries to 7%-8% in some high-income Western countries and in Middle Eastern and Northern African countries.[7] The prevalence of excess body weight continues to increase rapidly across the globe, with approximately 40% of adults and 18% of children overweight or obese in 2016.[8] 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 80% of adolescents are insufficiently physically active.[9]

## The Role of the American Cancer Society

With more than a century of experience in cancer control, the American Cancer Society (ACS) is uniquely positioned to help save lives from cancer globally by assisting and empowering the world's cancer societies and antitobacco advocates in promoting evidence-based cancer and tobacco control programs with a focus on LMICs.

**Develop civil society capacity in cancer control globally.** Many LMICs lack a coordinated cancer control effort. The ACS Strengthening Organizations for a United Response to the Cancer Epidemic (SOURCE) Program aims to strengthen the civil society response to cancer across the continuum from prevention through end-of-life care in focus countries around the world. The program also facilitates the establishment of national cancer umbrella organizations to coordinate the civil society response and elevate the voice of all organizations, big and small, in the cancer fight.

**Improve tobacco control worldwide.** In 2016, ACS launched a global initiative that promotes the Sustainable Development target of a 30% reduction in smoking prevalence by 2025 through tobacco taxation with the active engagement of cancer organizations. ACS also provides scientific evidence on issues such as illicit trade in tobacco products and the economic livelihoods of tobacco farmers that are obstacles to the implementation of lifesaving tobacco control policies like increasing tobacco excise taxes. ACS is currently leading an effort to examine these issues in more than 20 countries in Africa, Asia, and Latin America that is partly supported by the US National Institutes of Health, the Secretariat of the FCTC, and the Bloomberg Philanthropies.

**Increase HPV vaccination worldwide.** The Global HPV Cancer Free program aims to normalize HPV vaccine as cancer prevention in LMICs so that physicians recommend the vaccine routinely and confidently; parents ensure their children get vaccinated; community influencers advocate for its access and uptake; and policymakers mandate the vaccine in national and sub-national programs. Currently engaged in Kenya, Colombia, and India, the program strengthens in-country cancer organizations to take the lead in increasing the uptake of HPV vaccination. Collaborating with local social and behavior change researchers and influential stakeholders across public and private sectors, the program is developing and implementing community and provider interventions using behavioral experiments.

**Improve global patient support.** The ACS Global Patient Support team works with organizations in LMICs to help cancer patients and their caregivers in four main areas: accommodation, education, navigation, and transportation.

**Make effective treatment available to all in need.** The ACS Global Cancer Treatment team works to reduce cancer mortality by addressing disparities in access to affordable, high-quality treatment. Along with collaborators such as IBM, the National Comprehensive Cancer Network, the Clinton Health Access Initiative (CHAI), and the African Cancer Coalition, ACS is working to develop standard cancer treatment guidelines to achieve the highest standard of care with available resources in sub-Saharan Africa. In 2020, ACS and CHAI announced agreements with pharmaceutical companies Pfizer, Novartis, and Mylan to reduce the cost of 20 lifesaving cancer treatments by an expected 59%. 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 in LMICs. ACS leads projects to improve access to essential pain medicines and also 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.

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# The American Cancer Society

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

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

Thanks in part to our contributions, 3.2 million cancer deaths have been averted in the US since 1991, when cancer death rates were at their peak. The American Cancer Society relies on the strength of our dedicated volunteers to drive every part of our mission. With the support of our professional staff, volunteers raise funds to support innovative research, provide cancer patients rides to treatment, and offer peer-to-peer support to those facing a cancer diagnosis – and that's just the beginning.

## Cancer Prevention and Early Detection

Cancer prevention and early detection are core components of the American Cancer Society's mission to save lives, celebrate lives, and lead the fight for a world without cancer. An estimated 42% of cancer cases are attributed to potentially modifiable risk factors, and cancer prevention and early detection through screening can reduce the cancer burden even further.

### Prevention

Tobacco use remains the most preventable cause of cancer death. Cigarette smoking increases the risk of at least 12 different cancers, with 30% of all cancer deaths in the US, including 80% of lung cancer deaths, attributed to smoking. The American Cancer Society continues our long history of work to reduce tobacco use through research (see page 58), education, and advocacy (see page 62). Our tobacco control efforts focus on the adoption and implementation of smoke- and tobacco-free policies in all workplaces, public places, and other important venues such as multiunit residential settings. In addition, we're taking steps to reduce tobacco-related health disparities, including among the disproportionately high percentage of smokers who also have mental health or substance use disorders. We are also addressing the evolving tobacco product marketplace and rapid increase in the use of electronic tobacco products, or e-cigarettes, by youth.

Aside from avoiding tobacco use, maintaining a healthy, active lifestyle is one of the most effective ways to reduce cancer risk. The American Cancer Society regularly performs a formal review of the current scientific evidence on diet and cancer and synthesizes it into clear, informative recommendations for the general public to promote healthy individual behaviors and environments that support healthy eating and active living to reduce cancer risk. These diet and physical activity guidelines were updated in 2020 and form the foundation for our communication, worksite, school, and community strategies designed to encourage and support people in making healthy choices.

Skin cancer is the most commonly diagnosed cancer in the US, with more than 5 million new cases annually. For this reason, the American Cancer Society promotes skin cancer prevention in educational messages throughout the year and joined with other members of the National Council on Skin Cancer Prevention to designate the Friday before Memorial Day as Don't Fry Day.

We also provide guidelines for human papillomavirus (HPV) vaccination and established the National HPV Vaccination Roundtable, which is working with health care professionals nationwide to increase vaccination in adolescents to eliminate cervical cancer and reduce incidence of other HPV-associated cancers. Through our Vaccinate Adolescents against Cancers (VACs) programs, we have implemented interventions in structured HPV vaccination in 138 federally qualified health care centers and 13 integrated delivery systems and trained over 15,000 providers on HPV vaccination as cancer prevention. Clinics have seen an average HPV series initiation rate increase of 12.8% over the course of our year-long intervention projects.

The challenges of engaging in health behaviors that reduce cancer risk are compounded for people with lower incomes, people of color, persons with disabilities, and those living in rural communities. Structural and social inequities (e.g., racism, classism, ableism) shape the factors that influence a person's health, including health-related behaviors and non-medical social and physical environmental factors, such as access to healthy affordable food, transportation, and the financial means to pay for medications, housing, utilities, and other services.

To address these obstacles, we work with community health centers and other health systems, corporate partners, policymakers, volunteers, and other stakeholders across the nation to advance health equity by increasing access to preventive care. Programmatic efforts include health equity pilots in 10 communities to address food insecurity through community-driven solutions; collaborating with Pfizer to reduce the breast cancer mortality disparity between Black and White women in nine communities; and partnering with the National Football League (NFL) to support Community Health Advocates implementing Nationwide Grants for Empowerment and Equity (CHANGE) in safety-net health systems across the country to increase cancer screening and improve timely follow-up care. Overall, the CHANGE program has contributed to more than one million breast, cervical, and colorectal cancer screenings in underserved communities since 2011.

Additionally, our advocacy affiliate, the American Cancer Society Cancer Action Network℠ (ACS CAN), actively pursues evidence-based public policies at the local, state, and federal levels that seek to reduce disparities and improve health outcomes for all individuals, regardless of race, ethnicity, gender, age, sexual orientation, SES, or zip code. For more information on these initiatives, see the Advocacy section on page 62. While ACS and ACS CAN have been working to address health disparities for some time, our health equity work is evolving. We can and must do more to tackle the underlying systemic issues impacting the ability to prevent, find, and treat cancer.

## Early Detection

Finding cancer at its earliest stage, when it might be easier to treat, gives patients the greatest chance of survival. Moreover, screening tests for cervical and colorectal cancer can detect precancers, allowing for cancer prevention. To help health care providers and the public make informed decisions about cancer screening, the American Cancer Society publishes early detection guidelines based on the most current scientific evidence for cancers of the breast, cervix, colorectum, endometrium, lung, and prostate. In addition, we have a history of implementing campaigns among the public and with health care professionals to increase awareness of the value of screening. For example, campaigns to increase the use of Pap testing and mammography have contributed to a 71% decrease in cervical cancer mortality since 1969 and a 40% decline in breast cancer mortality since 1989. In 2019, the American Cancer Society and the National Colorectal Cancer Roundtable (NCCRT) built on the success of an earlier initiative and launched an effort to increase colorectal cancer screening prevalence among adults aged 50 and older to 80% in every community. In the past five years, more than 1,750 organizations have committed to working toward this shared goal.

## Workplace Initiatives

Cancer is the leading cause of premature death in the US working-age population (ages 20-65 years). Therefore, the American Cancer Society is working with business leaders across the country to establish a workplace culture of health. Through the American Cancer Society Health Index for Employers™, we work with companies to implement evidence-based solutions to improve health outcomes across the cancer continuum. This initiative focuses on 5 domains across the cancer continuum:

1. Tobacco prevention and cessation
2. Healthy eating
3. Physical activity
4. Cancer screening and prevention
5. Cancer support

Features of the initiative include:

- Annual organization-level assessment that measures the health and well-being of the workplace across the five domains
- A score report with tailored recommendations to improve workplace health and well-being policies, programs, benefit structures, and communication practices
- A suite of evidence-based solutions to help employers make improvements to their current health and well-being initiatives
- National benchmark report and recognition program based on achievement

## Patient and Caregiver Services

The American Cancer Society provides patients and caregivers with resources that can help improve – and even save – lives. Our 24/7 cancer helpline offers one-on-one support through phone calls, live chats, and video chat with trained Cancer Information Specialists. Through our Reach To Recovery® program, the American Cancer Society offers support for newly diagnosed breast cancer patients. We also work to support patients who cannot drive themselves to treatment, as well as those who must travel far from home for treatment, through our transportation and lodging programs.

### Cancer Information

Caring, trained American Cancer Society staff are available 24/7 through our cancer helpline at 1-800-237-2345 to connect people with answers about a cancer diagnosis, health insurance assistance, American Cancer Society programs and services, print materials, and referrals to other services. Our website, cancer.org, offers easy-to understand, evidence-based, and accurate cancer information. Patients and their caregivers can find detailed and reliable information about 70+ types of cancer, available treatments, managing side effects, and living as a cancer survivor. Visitors to cancer.org will also find news and survivor stories, as well as what's happening in cancer research. We also help people living in the US who speak languages other than English find the assistance they need at cancer.org/easyreading or cancer.org/cancer-information-in-other-languages.

The American Cancer Society also publishes books to help people navigate the cancer experience. Visit cancer.org/bookstore to learn more. In addition, the American Cancer Society publishes three peer-reviewed scientific journals for health care professionals and researchers: *Cancer*, *Cancer Cytopathology*, and *CA: A Cancer Journal for Clinicians*. Visit https://www.cancer.org/health-care-professionals/resources-for-professionals.html to learn more about these journals.

### Programs and Services

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

**Support for caregivers:** Cancer not only affects the individual diagnosed, but also impacts an entire family unit and network of close friends who often must provide care for their loved one throughout diagnosis and treatment. One of the informational tools we offer is our Caregiver Resource Guide (cancer.org/treatment/caregivers/caregiverresource-guide.html), which helps caregivers learn to care for themselves as they provide care for a loved one; better understand what their loved one is going through; develop skills for coping and caring; and take steps to help protect their own health and well-being. Another helpful resource is our Caregiver Support Video Series (cancer.org/caregivervideos), which provides educational support to caregivers as they assist with everyday needs of loved ones, as well as self-care techniques to improve their quality of life.

**Transportation to treatment:** When transportation to treatment is a concern, the American Cancer Society may be able to help provide the rides. Our Road To Recovery® program offers free rides to cancer patients who would otherwise have difficulty getting to their cancer-related appointments, thanks to volunteer drivers.

**Lodging during treatment:** The American Cancer Society Hope Lodge® program provides a free home away from home for cancer patients and their caregivers. More than just a roof over their heads, it's a nurturing community that helps patients access the care they need. In 2019, more than 30 Hope Lodge locations provided over 500,000 nights of free lodging for more than 29,000 patients and caregivers – saving them more than $50 million in hotel expenses. Because of the temporary pause in services due to the COVID-19 pandemic, these figures represent the latest year from which a full year of data is available.

**Breast cancer support:** Through the American Cancer Society Reach To Recovery® program, those with breast cancer receive peer-to-peer support on everything from practical and emotional issues to helping them cope with their disease, treatment, and long-term survivorship issues.

**Hair-loss and mastectomy products:** Cancer and cancer treatment can have profound effects, including some that can alter a patient's appearance, such as hair loss. The American Cancer Society *"tlc" Tender Loving Care*® program helps women with appearance-related side effects by offering them a variety of affordable wigs, hats, and scarves, as well as a full range of mastectomy products. These items can be purchased from the privacy of home by calling 1-800-850-9445 or visiting the *"tlc"*™ website at tlcdirect.org

**Finding hope and inspiration:** The American Cancer Society Cancer Survivors Network® provides a safe online connection where cancer patients and caregivers can find others with similar experiences and interests. At csn.cancer.org, members can participate on discussion boards or join chat rooms and build their own support network from among the members.

## Research

Research is at the heart of the American Cancer Society's mission. We have invested more than $4.9 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. ACS is unique among non-governmental, nonprofit organizations in having both intramural and extramural research programs, both of which will turn 75 years old in 2021. The top-tier research we fund and conduct covers everything from nutrition to genetics to environmental and behavioral factors to inequalities in cancer occurrence and outcomes. Research at the American Cancer Society is currently organized under three departments: Extramural Discovery Sciences, Population Sciences, and Data Sciences, which are described below.

### Extramural Discovery Sciences

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 33,000 grants to 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 49 ACS grantees who have gone on to win the Nobel Prize. Current ACS grantees publish over 1,500 scientific papers annually, detailing their discoveries across a wide range of cancers using a multitude of scientific approaches.

The primary strategic goal for ACS-funded extramural research is to support innovation in cancer research, regardless of cancer type. Time and again, scientific history teaches us that the application of novel discoveries occurs in unexpected places, and thus we believe that a focus on innovation gives us the greatest chance to make advances to benefit cancer patients. 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

The Council for Extramural Research is responsible for setting the paylines across the entire program. This independent and nationally competitive process ensures that the most innovative research is funded.

Beginning in the late 1990s, Extramural Research began to focus on beginning 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 six years 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)** – awarded to institutions to provide seed money for new investigators to initiate cancer research projects
- **Mission Boost Grant (MBG)** – provides opportunities for ACS 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)** – pilot grant for collaborative research through participation in ACS TheoryLab 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 Research Department has partnered with several other organizations, including the National Palliative Care Research Center, the Melanoma Research Alliance (MRA), St. Baldrick's Foundation, and the Ovarian Cancer Research Alliance (OCRA).

The Extramural Discovery department houses three scientific research portfolios that support innovative cancer research to meet critical needs in cancer:

### A. Biochemistry and Immunology of Cancer

- Molecules and genes involved in cancer
- Potential targets for new treatments of cancer
- Immunology of cancer
- Investigations of oncogenic viruses or the microbiome

### 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 August 1, 2020, the American Cancer Society was funding a portfolio of 678 research grants totaling more than $389 million, including $91.1M for breast cancer (156 grants), $47.3M for lung cancer (83 grants), and $42.7M for colorectal cancer (69 grants). In addition, extramural funding supports studies of some of the most lethal cancers, including pancreas ($23.1M), brain ($21.9M), ovarian ($18.2M), and liver ($14.5M) cancers. Since many cancers share biological characteristics, a significant portion of the funding portfolio is focused on these pan-cancer studies ($92.8M), 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 ACS grantees, the Extramural Discovery Sciences department launched the TheoryLab™ online platform in 2018 to enable and encourage greater collaboration among ACS grantees. There are currently more than 1,200 members representing a wide range of cancer research.

## Population Science

The Population Science program has three focus areas; a longstanding epidemiology program that increases knowledge of factors associated with cancer occurrence and survivorship, and more recent initiatives in behavioral interventions research and cancer control program evaluation. 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 68 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 genetic and other predictors of smoking prevalence and health consequences; physical and sedentary activity, diet, alcohol, and excess body weight; medical conditions and common medications; and environmental exposures (e.g., circadian rhythm disruption, radon, pollutants).
- **Molecular epidemiology:** Improve understanding of the molecular epidemiology of cancer, with a focus on breast, gastrointestinal, hematologic, and prostate cancers, through studies of circulating biomarkers; genetic factors and gene-environmental interactions; and tumor heterogeneity.

- **Survivorship and quality of life:** Identify factors associated with optimal physical, emotional, and social well-being among cancer patients, survivors, and caregivers to improve their quality of life; assist American Cancer Society program staff in the design and enhancement of interventions and services for cancer survivors and their loved ones; and support the addition of patient-reported outcomes to population health reporting systems
- **Health behaviors:** Identify behaviors and related predictors associated with cancer prevention, with a primary focus on tobacco control, healthy eating, and active living, as well as their effects on cancer survivors' psychological adjustment and quality of life, in order enhance the efficacy of behavioral interventions and inform American Cancer Society programs, practices, and policies
- **Cancer disparities and health equity:** Develop approaches and methods for cancer disparities/health equity research, examine exposures and outcomes in medically vulnerable populations, and identify effective strategies to help eliminate cancer disparities from prevention to survivorship

## Data Science

The Data Science program informs and promotes cancer prevention and control via six overlapping research areas: Surveillance Research, Risk Factors & Screening Research, Health Services Research, Economics & Health Policy Research, Disparities Research, and Geospatial Research. Information is disseminated via peer-reviewed journal articles for a scientific audience and educational publications for a lay audience. For example, the program has produced *Cancer Facts & Figures* annually since 1951, and the accompanying Cancer Statistics article, published in *CA: A Cancer Journal for Clinicians*, since 1967. These publications are the most widely cited sources for cancer statistics in the world and are available on our website at cancer.org/statistics. An accompanying mobile-friendly interactive website, the Cancer Statistics Center, is available for generating customized data at cancerstatisticscenter.cancer.org.

Since 1998, Data Science staff have collaborated with leading cancer organizations, such as the National Cancer Institute and 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 available in multiple languages include *The Cancer Atlas* (canceratlas.cancer.org), a one-stop resource for global cancer data, and *The Tobacco Atlas* (tobaccoatlas.org), a comprehensive guide to tobacco control that receives tens of thousands of visitors each month from nearly every country in the world.

With an overarching goal of reducing inequalities, staff in the Data Science department also generate scientific evidence to inform and support ACS priority areas for cancer prevention and control. For example, a series of high-profile studies conducted by our Surveillance Research group demonstrating increasing rates of colorectal cancer in individuals under age 55 years of age informed the colorectal cancer screening guideline update in 2018, which lowered the recommended age to begin screening from 50 to 45 years. Researchers also study barriers to receipt of screening and provide data to guide roundtable activities, such as the interactive mapping tools developed by the geospatial team to support the National Lung Cancer Roundtable's lung cancer control efforts.

Data Science staff also study the economic and policy aspects of major preventable cancer risk factors, such as tobacco use, and evaluate 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. 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.

## 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 quality, affordable health care for all to increasing funding for cancer research and programs. The American Cancer Society Cancer Action Network℠ (ACS CAN), the nonprofit, nonpartisan advocacy affiliate of the American Cancer Society, works with federal, state, and local policymakers to achieve these goals and make cancer a top priority for public officials through a lens of health equity. ACS CAN also 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.

Created in 2001, ACS CAN is the nation's leading voice advocating for public policies that help to defeat cancer. ACS CAN has successfully worked to pass and implement laws at all levels of government that assure cancer patients' access to adequate and affordable health insurance coverage; increase funding for groundbreaking cancer research; improve access to prevention and early detection measures, treatment, and follow-up care; and improve quality of life for cancer patients and survivors.

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 2020 and do not take into account 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, allowing millions of low-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 low-income Americans' access to health care to in turn 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, which provide community-oriented primary care in underserved areas
- Access to preventive services without cost sharing
- Ensuring expansion of the Medicaid program, which provides much-needed health services to low-income individuals
- The continuation of the Prevention and Public Health Fund

### Research Funding and Drug Development

ACS CAN is a leader in the effort to ensure full funding for the nation's public cancer research institutions, including the National Institutes of Health and its National Cancer Institute (NCI). Thanks in no small part to ACS CAN's work, Congress has steadily increased funding for NCI over the past several years. Today, the NCI has a budget of more than $6.4 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, and ACS CAN recognizes this driver of the research pipeline to be of prime importance in the search for cures and in efforts not only to protect this funding, but also to expand it.

In addition to advocating for cancer research funding, the organization works to enhance cancer patients' access to innovative therapies by improving clinical trial enrollment. Clinical trials are the key step in advancing potential new cancer treatments from the research setting to the cancer clinic, and patient participation in trials is crucial to their success. Approximately 20% of cancer clinical trials fail because of insufficient patient enrollment. To address this problem, ACS CAN, in collaboration with other stakeholders, identified a number of barriers and is working on implementing a set of consensus recommendations to make it easier for patients to enroll in an appropriate clinical trial. ACS CAN also works to ensure that clinical trials enroll diverse patient populations (e.g., Henrietta Lacks Enhancing Cancer Research Act). Successes in the past year include passage of laws in three states that ensure Medicaid patients are able to enroll in cancer clinical trials.

## Prevention and Early Detection

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

- Working to expedite and defend the full implementation of the Family Smoking Prevention and Tobacco Control Act, including the regulation of new products
- Leading efforts to pass comprehensive smoke-free laws requiring all workplaces, restaurants, and bars to be smoke-free. In 2019, Atlanta, Georgia, home to the world's busiest airport, passed a comprehensive smoke-free bill that went into effect on January 2, 2020.
- 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 $1.82 per pack (as of June 29, 2020).
- Working to increase and protect state funding for tobacco control programs
- Continuing as an intervener in the long-pending tobacco industry appeal of the federal government's lawsuit against the industry, in which specific manufacturers were found to be in violation of the Racketeer Influenced and Corrupt Organizations statute for engaging in decades of fraudulent practices aimed at addicting generations of smokers to their deadly products
- 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
- Advocating for coverage of cancer screenings and other recommended preventive services without financial barriers in private insurance, Medicare, and Medicaid
- Advocating for full funding for the National Breast and Cervical Cancer Early Detection Program, which provides low-income, uninsured, and medically underserved women access to cancer screenings, as well as diagnostic, patient navigation, and treatment services
- Urging policymakers to invest federal and state funds in colorectal cancer control programs
- Supporting federal legislation to eliminate flawed language in the law that imposes substantial patient out-of-pocket costs on Medicare beneficiaries who have a polyp removed during colonoscopy
- Supporting efforts to help increase HPV vaccination uptake
- Advocating for evidence-based child nutrition programs and for state and local requirements to increase the quality and quantity of physical education and physical activity in K-12 schools
- Supporting the implementation of menu labeling in restaurants and other food retail establishments and of the updated Nutrition Facts label that appears on most packaged foods and beverages

- Pushing for increased access to affordable, nutritious foods and safe, enjoyable opportunities for physical activity among people living in poverty, Black and brown communities, people who identify as LGBTQ+, people who have a disability or who live in a rural community, and others who have historically been excluded
- Urging federal regulation of indoor tanning devices and working with states to pass legislation prohibiting minors from accessing those devices

### Quality of Life

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

Central to ACS CAN's success is 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 the 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.

## Sources of Statistics

**Estimated new cancer cases.** The number of cancer cases diagnosed in 2021 was estimated using a spatiotemporal model and the most recent 4-year average trend in modeled counts (identified via log-linear regression) to project forward. Input data for the model were based on incidence during 2003-2017 from 50 states and the District of Columbia (DC) that provided consent 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. The method for estimating incidence prior to projection considers geographic variations at the state level in sociodemographic and lifestyle factors, medical settings, and cancer screening behaviors, and also accounts for expected delays in case reporting. (For more information on this method, see "A" under Additional information on page 66.)

The number of in situ cases of female breast ductal carcinoma and melanoma diagnosed in 2021 was estimated by: 1) approximating the actual number of cases in the 10 most recent data years (2008-2017) by applying annual age-specific incidence rates (based on 48 states) to corresponding population estimates for the overall US; 2) calculating the average annual percent change (AAPC) in cases over this time period; and 3) using the AAPC to project the number of cases four years ahead. These estimates were also partially adjusted for expected reporting delays using invasive factors.

**Incidence rates.** Incidence rates are defined as the number of people who are diagnosed with cancer divided by the number of people who are at risk for the disease in the population during a given time period. Incidence rates in this publication are presented per 100,000 people

and are age-adjusted to the 2000 US standard population to allow comparisons across populations with different age distributions. State-specific incidence rates were previously published in the NAACCR's publication *Cancer Incidence in North America, 2013-2017*. National rates presented herein may differ slightly from those previously published by the NAACCR due to the exclusion of Puerto Rico, which is presented separately herein. Colorectal cancer incidence rates presented herein also exclude appendix. (See "B" under Additional information on page 66 for full reference.)

Trends in cancer incidence rates provided in Selected Cancers sections of this publication are based on delay-adjusted incidence rates from the 21 SEER registries. Delay adjustment accounts for delays and error corrections that occur in the reporting of cancer cases, which is substantial for some sites, particularly those less often diagnosed in a hospital, such as leukemia. Delay adjustment is not available for some cancer types. These trends were originally published in the SEER Cancer Statistics Review (CSR) 1975-2017. (See "C" under Additional information on page 66 for full reference.)

**Estimated cancer deaths.** The number of cancer deaths in the US in 2021 was estimated by fitting the observed number of cancer deaths from 2004 to 2018 to a statistical model and then, similar to the methodology for cases, using the most recent average trend derived from log-linear regression to forecast the number in 2021. Data on the number of deaths were obtained from the National Center for Health Statistics (NCHS) at the Centers for Disease Control and Prevention. (For more information on this method, see "D" under Additional information on page 66.)

**Mortality rates.** Mortality rates, or death rates, are defined as the number of people who die from cancer divided by the number of people at risk in the population during a given time period. Mortality rates in this publication are based on cancer death counts compiled by the NCHS and presented per 100,000 people and are age adjusted to the 2000 US standard population. Trends in cancer mortality rates provided in the text are based on mortality data from 1975 to 2018.

**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 re-evaluated and updated for 2021. 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. Due to the nature of these projections, they also do not reflect the impact of COVID-19 on cancer diagnoses and deaths. Trends in cancer occurrence are analyzed using age-adjusted incidence rates reported by population-based cancer registries and mortality rates reported by the NCHS.

**Survival.** This report describes survival in terms of 5-year relative survival rates, which are adjusted for normal life expectancy by comparing survival among cancer patients to survival in people of the same age, race, and sex who were not diagnosed with cancer. Many of the survival rates presented in this publication were previously published in the *CSR 1975-2017*. Historical trends in 5-year survival are based on data from the 9 oldest SEER registries, which go back to 1975, whereas all contemporary 5-year survival rates for 2010-2016 are based on data from the oldest 18 SEER registries, which provide greater population coverage while also allowing for stratification by stage at diagnosis. In addition to 5-year relative survival rates, 10-year breast and prostate cancer survival is also presented, based on patients diagnosed during 2002-2016, all followed through 2017, and generated using the NCI's SEER 18 database and SEER*Stat software version 8.3.7. (See "E" under Additional information on page 66 for full reference.)

**Probability of developing cancer.** Probabilities of developing cancer were calculated using DevCan (Probability of Developing Cancer) software version 6.7.8, developed by the NCI, and are based on all 21 SEER registries. (See "F" under Additional information on page 66 for full reference.) These probabilities reflect the average experience of people in the US and do not take into account individual behaviors and risk factors. For

example, the estimate of 1 man in 15 developing lung cancer in a lifetime underestimates the risk for smokers and overestimates the risk for nonsmokers.

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


A. 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: Spatio-temporal small area modeling for cancer incidence. Unpublished data.

B. Sherman R, Firth R, Charlton M, et al. (eds). Cancer in North America: 2013-2017. Volume Two: Registry-specific Cancer Incidence in the United States and Canada. Springfield, IL: North American Association of Central Cancer Registries, Inc. June 2020. Available at https://www.naaccr.org/wp-content/uploads/2020/06/CINA.2013-2017.v2.incidence-1.pdf.

C. Howlader N, Noone AM, Krapcho M, et al. (eds). *SEER Cancer Statistics Review, 1975-2017*. National Cancer Institute. Bethesda, MD, 2020. Available at seer.cancer.gov.

D. 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. Unpublished data.

E. Surveillance, Epidemiology, and End Results (SEER) Program (seer.cancer.gov) SEER*Stat Database: Incidence – SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2019 Sub (1973-2017 varying) – Linked To County Attributes – Total U.S., 1969-2018 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released April 2020, based on the November 2019 submission.

F. DevCan: Probability of Developing or Dying of Cancer Software, Version 6.7.8; Statistical Research and Applications Branch, National Cancer Institute, 2020. https://surveillance.cancer.gov/devcan/.

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

| Cancer Site | Population | Test or Procedure | Recommendation |
|---|---|---|---|
| **Breast** | Women, ages 40-54 | Mammography | Women should have the opportunity to begin annual screening between the ages of 40 and 44. Women should undergo regular screening mammography starting at age 45. Women ages 45 to 54 should be screened annually. |
| | Women, ages 55+ | | Transition to biennial screening, or have the opportunity to continue annual screening. Continue screening as long as overall health is good and life expectancy is 10+ years. |
| **Cervix** | Women, ages 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.<br>**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 55-74 in good health with 30+ pack-year history | Low-dose helical CT (LDCT) | Clinicians with access to high-volume, high-quality lung cancer screening and treatment centers should initiate a discussion about annual lung cancer screening with apparently healthy patients ages 55-74 who have at least a 30 pack-year smoking history, and who currently smoke or have quit within the past 15 years. A process of informed and shared decision making with a clinician related to the potential benefits, limitations, and harms associated with screening for lung cancer with LDCT should occur before any decision is made to initiate lung cancer screening. Smoking cessation counseling remains a high priority for clinical attention in discussions with current smokers, who should be informed of their continuing risk of lung cancer. Screening should not be viewed as an alternative to smoking cessation. |
| **Prostate** | Men, ages 50+ | Prostate-specific antigen test with or without digital rectal examination | Men who have at least a 10-year life expectancy should have an opportunity to make an informed decision with their health care provider about whether to be screened for prostate cancer, after receiving information about the potential benefits, risks, and uncertainties associated with prostate cancer screening. Prostate cancer screening should not occur without an informed decision-making process. African American men should have this conversation with their provider beginning at age 45. |

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

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Surveillance and Health Services Research Program

The American Cancer Society's mission
is to **save lives, celebrate lives,**
and **lead the fight** for a world without cancer.

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