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Cancer Statistics, 2019

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Abstract: Each year, the American Cancer Society estimates the numbers of new cancer cases and deaths that will occur in the United States and compiles the most recent data on cancer incidence, mortality, and survival. Incidence data, available through 2015, were collected by the Surveillance, Epidemiology, and End Results Program; the National Program of Cancer Registries; and the North American Association of Central Cancer Registries. Mortality data, available through 2016, were collected by the National Center for Health Statistics. In 2019, 1,762,450 new cancer cases and 606,880 cancer deaths are projected to occur in the United States. Over the past decade of data, the cancer incidence rate (2006-2015) was stable in women and declined by approximately 2% per year in men, whereas the cancer death rate (2007-2016) declined annually by 1.4% and 1.8%, respectively. The overall cancer death rate dropped continuously from 1991 to 2016 by a total of 27%, translating into approximately 2,629,200 fewer cancer deaths than would have been expected if death rates had remained at their peak. Although the racial gap in cancer mortality is slowly narrowing, socioeconomic inequalities are widening, with the most notable gaps for the most preventable cancers. For example, compared with the most affluent counties, mortality rates in the poorest counties were 2-fold higher for cervical cancer and 40% higher for male lung and liver cancers during 2012-2016. Some states are home to both the wealthiest and the poorest counties, suggesting the opportunity for more equitable dissemination of effective cancer prevention, early detection, and treatment strategies. A broader application of existing cancer control knowledge with an emphasis on disadvantaged groups would undoubtedly accelerate progress against cancer. **CA Cancer J Clin 2019;69:7-34.**
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Introduction

Cancer is a major public health problem worldwide and is the second leading cause of death in the United States. In this article, we provide the estimated numbers of new cancer cases and deaths in 2019 in the United States nationally and for each state, as well as a comprehensive overview of cancer occurrence based on the most current population-based data for cancer incidence through 2015 and for mortality through 2016. We also estimate the total number of deaths averted because of the continuous decline in cancer death rates since the early 1990s and analyze cancer mortality rates by county-level poverty.

Materials and Methods

Incidence and Mortality Data

Mortality data from 1930 to 2016 were provided by the National Center for Health Statistics (NCHS).[1–3] Forty-seven states and the District of Columbia met data quality requirements for reporting to the national vital statistics system in 1930, and Texas, Alaska, and Hawaii began reporting in 1933, 1959, and 1960, respectively. The methods for abstraction and age adjustment of historic mortality data are described elsewhere.[3,4] Five-year mortality rates (2011-2015) for Puerto Rico were previously published in volume 3 of the North American Association of Central Cancer Registries' (NAACCR's) *Cancer in North America: 2011-2015*.[5]

Population-based cancer incidence data in the United States have been collected by the National Cancer Institute's (NCI's) Surveillance, Epidemiology, and End Results (SEER) Program since 1973 and by the Centers for Disease Control and Prevention's (CDC's) National Program of Cancer Registries (NPCR) since 1995. The SEER program is the only source for historic population-based incidence data. Long-term (1975–2015) incidence and survival trends were based on data from the 9 oldest SEER areas (Connecticut, Hawaii, Iowa, New Mexico, Utah, and the metropolitan areas of Atlanta, Detroit, San Francisco–Oakland, and Seattle–Puget Sound), representing approximately 9% of the US population.[6,7] The lifetime probability of developing cancer and contemporary stage distribution and survival statistics were based on data from all 18 SEER registries (the SEER 9 registries plus Alaska Natives, California, Georgia, Kentucky, Louisiana, and New Jersey), covering 28% of the US population.[8] The probability of developing cancer was calculated using NCI's DevCan software (version 6.7.6).[9] Some of the statistical information presented herein was adapted from data previously published in the *SEER Cancer Statistics Review 1975-2015*.[10]

The NAACCR compiles and reports incidence data from 1995 onward for registries that participate in the SEER program and/or the NPCR. These data approach 100% coverage of the US population for the most recent years and were the source for the projected new cancer cases in 2019 and cross-sectional incidence rates by state and race/ethnicity.[11,12] Some of the incidence data presented herein were previously published in volumes 1 and 2 of *Cancer in North America: 2011-2015*.[13,14]

All cancer cases were classified according to the *International Classification of Diseases for Oncology* except childhood and adolescent cancers, which were classified according to the International Classification of Childhood Cancer (ICCC).[15,16] Causes of death were classified according to the *International Classification of Diseases*.[17] All incidence and death rates were age standardized to the 2000 US standard population and expressed per 100,000 population, as calculated by NCI's SEER*Stat software (version 8.3.5).[18] The annual percent change in rates was quantified using NCI's Joinpoint Regression Program (version 4.6.0).[19]

Whenever possible, cancer incidence rates were adjusted for delays in reporting, which occur because of a lag in case capture or data corrections. Delay-adjustment has the largest effect on the most recent data years for cancers that are frequently diagnosed in outpatient settings (eg, melanoma, leukemia, and prostate cancer) and provides the most accurate portrayal of cancer occurrence in the most recent time period.[20] For example, the leukemia incidence rate for 2015 in the 9 oldest SEER registries was 12% higher after adjusting for reporting delays (15.2 vs 13.6 per 100,000 population).[10]

Projected Cancer Cases and Deaths in 2019

The most recent year for which reported incidence and mortality data are available lags 2 to 4 years behind the current year due to the time required for data collection, compilation, quality control, and dissemination. Therefore, we projected the numbers of new cancer cases and deaths in the United States in 2019 to provide an estimate of the contemporary cancer burden.

To calculate the number of invasive cancer cases, a generalized linear mixed model was used to estimate complete counts for each county (or health service area for rare cancers) from 2001 through 2015 using delay-adjusted, high-quality incidence data from 48 states and the District of Columbia (96% population coverage) and geographic variations in sociodemographic and lifestyle factors, medical settings, and cancer screening behaviors.[21] (Data were unavailable for all years for Kansas and Minnesota, as well as for a few sporadic years for a handful of states.) Modeled counts were aggregated to the national and state level for each year, and a time series projection method (vector autoregression) was applied to all 15 years to estimate cases for 2019. Basal cell and squamous cell skin cancers cannot be estimated because incidence data are not collected by most cancer registries. For complete details of the case projection methodology, please refer to Zhu et al.[22]

New cases of in situ female breast carcinoma and melanoma of the skin diagnosed in 2019 were estimated by first approximating the number of cases occurring annually from 2006 through 2015 based on age-specific NAACCR incidence rates (data from 46 states with high-quality data for all 10 years) and US Census Bureau population estimates obtained via SEER*Stat. Counts were then adjusted for delays in reporting using SEER delay factors for invasive disease (delay factors are unavailable for in situ cases) and projected to 2019 based on the average annual percent change generated by the joinpoint regression model.

The number of cancer deaths expected to occur in 2019 was estimated based on the most recent joinpoint-generated annual percent change in reported cancer deaths from 2002 through 2016 at the state and national levels as reported to the NCHS. For the complete details of this methodology, please refer to Chen et al.[23]

Other Statistics

The number of cancer deaths averted in men and women due to the reduction in cancer death rates since the early 1990s was estimated by summing the difference between the annual number of recorded cancer deaths from the number that would have been expected if cancer death rates had remained at their peak. The expected number of deaths was estimated by applying the 5-year age- and sex-specific cancer death rates in the peak year for age-standardized cancer death rates (1990 in men and 1991 in women) to the corresponding age- and sex-specific populations in subsequent years through 2016.

Temporal trends in socioeconomic disparities in cancer mortality were examined using county-level poverty as a proxy for socioeconomic status. Cancer death rates by county-level poverty quintile were calculated using linked attributes from the US Census Bureau American Community Survey 2012–2016 available through SEER*Stat. The total resident population in each quintile was 73,559,180 persons (1.81%-10.84% poverty); 62,695,449 persons (10.85%-14.10% poverty); 74,157,401 persons (14.11%-17.16% poverty); 76,945,467 persons (17.17%-21.17% poverty); and 35,770,016 persons (21.18%-53.95% poverty), respectively. County-level poverty in the United States has shifted slightly from the South to the West since 1970, although the highest concentration remains in the South.[24]

Selected Findings

Expected Numbers of New Cancer Cases

Table 1 presents the estimated numbers of new cases of invasive cancer in the United States in 2019 by sex and cancer type. In total, there will be approximately 1,762,450 cancer cases diagnosed, which is the equivalent of more than 4,800 new cases each day. In addition, there will be approximately 62,930 new cases of female breast carcinoma in situ and 95,830 new cases of melanoma in situ of the skin. The estimated numbers of new cases by state are shown in Table 2.

Figure 1 depicts the most common cancers expected to be diagnosed in men and women in 2019. Prostate, lung and bronchus (referred to as lung hereafter), and colorectal cancers (CRCs) account for 42% of all cases in men, with prostate cancer alone accounting for nearly 1 in 5 new diagnoses. For women, the 3 most common cancers are breast, lung, and colorectum, which collectively represent one-half of all new diagnoses; breast cancer alone accounts for 30% of all new cancer diagnoses in women.

The lifetime probability of being diagnosed with invasive cancer is slightly higher for men (39.3%) than for women (37.7%) (Table 3). The reasons for the excess risk in men are not fully understood, but partly reflect differences in environmental exposures, endogenous hormones, and probably complex interactions between these influences. Recent research suggests that sex differences in immune function and response may also play a role.[25] Adult height, which is determined by genetics and childhood nutrition, is positively associated with cancer incidence and mortality in both men and women,[26] and has been estimated to account for one-third of the sex disparity.[27]

Expected Number of Cancer Deaths

An estimated 606,880 Americans will die from cancer in 2019, corresponding to almost 1,700 deaths per day (Table 1). The greatest number of deaths are from cancers of the lung, prostate, and colorectum in men and the lung, breast, and colorectum in women (Fig. 1). One-quarter of all cancer deaths are due to lung cancer. Table 4 provides the estimated numbers of cancer deaths in 2019 by state.

Trends in Cancer Incidence

Figure 2 illustrates long-term trends in cancer incidence rates for all cancers combined by sex. Cancer incidence patterns reflect trends in behaviors associated with cancer risk and changes in medical practice, such as the use of cancer screening tests. The volatility in incidence for males reflects rapid changes in prostate cancer incidence rates, which spiked in the late 1980s and early 1990s (Fig. 3) due to a surge in the detection of asymptomatic disease as a result of widespread prostate-specific antigen (PSA) testing among previously unscreened men.[28]

Over the past decade of data, the overall cancer incidence rate in men declined by approximately 2% per year (Table 5). This trend reflects accelerated declines during the past 5 data years (2011-2015) of approximately 3% per year for cancers of the lung and colorectum, and 7% per year for prostate cancer. The sharp drop in prostate cancer incidence has been attributed to decreased PSA testing from 2008 to 2013 in the wake of US Preventive Services Task Force recommendations against the routine use of the test to screen for prostate cancer (Grade D) in men aged 75 years and older in 2008 and in all men in 2011 because of growing concerns about overdiagnosis and overtreatment.[29,30] Although PSA testing prevalence stabilized from 2013 to 2015,[31] the effect of the reduction in screening on the occurrence of advanced disease is being watched closely. Based on analysis of cancer registry data covering 89% of the US population, Negoita et al recently reported that the overall decline in prostate cancer incidence masks an increase in distant stage diagnoses since around 2010 across age and race, although improved staging may have contributed to this trend.[32] The Task Force has revised their recommendation for men aged 55 to 69 years to informed decision making (Grade C) based on an updated evidence review, noting that "screening offers a small potential benefit" of reduced prostate cancer mortality "in some men."[33–35]

TABLE 1. Estimated New Cancer Cases and Deaths by Sex, United States, 2019*

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

*Rounded to the nearest 10; cases exclude basal cell and squamous cell skin cancers and in situ carcinoma except urinary bladder. Approximately 62,930 cases of carcinoma in situ of the female breast and 95,830 cases of melanoma in situ will be newly diagnosed in 2019.

†Deaths for colon and rectal cancers are combined because a large number of deaths from rectal cancer are misclassified as colon.

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

Note: These are model-based estimates that should be interpreted with caution and not compared with those for previous years.

TABLE 2. Estimated New Cases for Selected Cancers by State, 2019*

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

*Rounded to the nearest 10; excludes basal cell and squamous cell skin cancers and in situ carcinomas except urinary bladder. Estimates for Puerto Rico are not available.

†Estimate is fewer than 50 cases.

Note: These are model-based estimates that should be interpreted with caution and not compared with those for previous years. State estimates may not add to US total due to rounding and the exclusion of states with fewer than 50 cases.

Estimated New Cases

Males			Females		
Prostate	174,650	20%	Breast	268,600	30%
Lung & bronchus	116,440	13%	Lung & bronchus	111,710	13%
Colon & rectum	78,500	9%	Colon & rectum	67,100	8%
Urinary bladder	61,700	7%	Uterine corpus	61,880	7%
Melanoma of the skin	57,220	7%	Melanoma of the skin	39,260	4%
Kidney & renal pelvis	44,120	5%	Thyroid	37,810	4%
Non-Hodgkin lymphoma	41,090	5%	Non-Hodgkin lymphoma	33,110	4%
Oral cavity & pharynx	38,140	4%	Kidney & renal pelvis	29,700	3%
Leukemia	35,920	4%	Pancreas	26,830	3%
Pancreas	29,940	3%	Leukemia	25,860	3%
All Sites	**870,970**	**100%**	**All Sites**	**891,480**	**100%**

Estimated Deaths

Males			Females		
Lung & bronchus	76,650	24%	Lung & bronchus	66,020	23%
Prostate	31,620	10%	Breast	41,760	15%
Colon & rectum	27,640	9%	Colon & rectum	23,380	8%
Pancreas	23,800	7%	Pancreas	21,950	8%
Liver & intrahepatic bile duct	21,600	7%	Ovary	13,980	5%
Leukemia	13,150	4%	Uterine corpus	12,160	4%
Esophagus	13,020	4%	Liver & intrahepatic bile duct	10,180	4%
Urinary bladder	12,870	4%	Leukemia	9,690	3%
Non-Hodgkin lymphoma	11,510	4%	Non-Hodgkin lymphoma	8,460	3%
Brain & other nervous system	9,910	3%	Brain & other nervous system	7,850	3%
All Sites	**321,670**	**100%**	**All Sites**	**285,210**	**100%**

FIGURE 1. Ten Leading Cancer Types for the Estimated New Cancer Cases and Deaths by Sex, United States, 2019. Estimates are rounded to the nearest 10 and exclude basal cell and squamous cell skin cancers and in situ carcinoma except urinary bladder. Ranking is based on modeled projections and may differ from the most recent observed data.

The overall cancer incidence rate in women has remained generally stable over the past few decades. Declines have continued for lung cancer, but tapered in recent years for CRC, whereas rates for other common cancers are increasing or stable (Table 5). Breast cancer incidence rates increased from 2006 to 2015 by approximately 0.3% to 0.4% per year among non-Hispanic white (NHW) and Hispanic women, by 0.7% to 0.8% per year among black (non-Hispanic) and American Indian/Alaska Native women, and by 1.8% per year among Asian/Pacific Islander women.[36] This trend may in part be a consequence of the obesity epidemic, as well as declining parity.[37,38]

Lung cancer incidence continues to decline twice as fast in men as in women, reflecting historical differences in tobacco uptake and cessation, as well as upturns in female smoking prevalence in some birth cohorts.[39,40] However, smoking patterns do not appear to explain the higher lung cancer incidence rates recently reported in young women compared with men born around the 1960s.[41] In contrast, CRC incidence patterns are generally similar in men and women (Fig. 3), although in the past 5 data years rates have continued to decline by approximately 3% per year in men, but appear to have stabilized in women (Table 5). Reductions in CRC incidence prior to 2000 are attributed equally to changes in risk factors and the use of screening, which allows for the removal of premalignant lesions.[42] However, more recent rapid declines are thought to primarily reflect the increased uptake of colonoscopy, which now is the predominant screening test.[43,44] Colonoscopy use among US adults aged 50 years and older tripled from 21% in 2000 to 60% in 2015.[45] The rapid declines in overall CRC incidence rates mask an increase in adults aged younger than 55 years of almost 2% per year since the mid-1990s.[7]

Incidence rates continue to increase for melanoma and cancers of the liver, thyroid, uterine corpus, and pancreas. Liver cancer incidence is rising faster than that for any other cancer in both men and women.[38] Notably, however, the majority (71%) of cases in the United States are potentially preventable because most risk factors are modifiable (eg, obesity, excess alcohol consumption, cigarette smoking, and

TABLE 3. Probability (%) of Developing Invasive Cancer Within Selected Age Intervals by Sex, United States, 2013 to 2015*

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

*For people without a history of cancer at beginning of age interval.
†All sites excludes basal cell and squamous cell skin cancers and in situ cancers except urinary bladder.
‡Probabilities for non-Hispanic whites only.

hepatitis B and C viruses).[46] Approximately 24% of cases are caused by chronic hepatitis C virus (HCV) infection, which confers the largest relative risk and is also the most common chronic blood-borne infection in the United States.[47] Although there is exciting potential to avert much of the future burden of HCV-associated disease because of new, well-tolerated, antiviral therapies that achieve cure rates of greater than 90%,[48] most infected individuals are undiagnosed. One-time screening has been recommended for baby boomers (those born between 1945 and 1965), who account for three-fourths of affected individuals,[49,50] since 2012 and is now even mandated in several states.[51] However, only 14% of the more than 76 million boomers reported having received HCV testing in 2015.[52] Compounding the challenge is a 3-fold spike in acute HCV infections reported to the CDC from 2010 through 2016, after a decade of stable/declining rates, that is attributed to the opioid epidemic.[53,54] Fewer than 10% of new infections are reported and the CDC estimates the actual number of acute infections in 2016 to be 41,200 (95% confidence interval, 32,600-140,600), approximately 75% to 85% of which will progress to chronic infection.

Cancer Survival

The 5-year relative survival rate for all cancers combined diagnosed during 2008 through 2014 was 67% in whites and 62% in blacks.[10] Figure 4 shows 5-year relative survival rates by cancer type, stage at diagnosis, and race. For all stages combined, survival is highest for prostate cancer (98%), melanoma of the skin (92%), and female breast cancer (90%) and lowest for cancers of the pancreas (9%), liver (18%), esophagus (19%), and lung (19%). Black patients have lower survival rates than whites for every cancer type shown in Figure 4 except for cancers of the kidney and pancreas, with the absolute difference being 10% or higher for most. The largest disparities are for melanoma (26%) and cancers of the uterine corpus (21%) and oral cavity and pharynx (18%), in part reflecting a much later stage at diagnosis in black patients (Fig. 5). However, blacks also have lower stage-specific survival for most cancer types. After adjusting for sex, age, and stage at diagnosis, the relative risk of death after a cancer diagnosis is 33% higher in black patients than in white patients.[55] The disparity is even larger for American Indians/Alaska Natives, who are 51% more likely than whites to die from their cancer.

TABLE 4. Estimated Deaths for Selected Cancers by State, 2019*

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

*Rounded to the nearest 10. Estimates for Puerto Rico are not available.

†Estimate is fewer than 50 deaths.

Note: These are model-based estimates that should be interpreted with caution and not compared with those for previous years. State estimates may not add to US total due to rounding and the exclusion of states with fewer than 50 deaths.

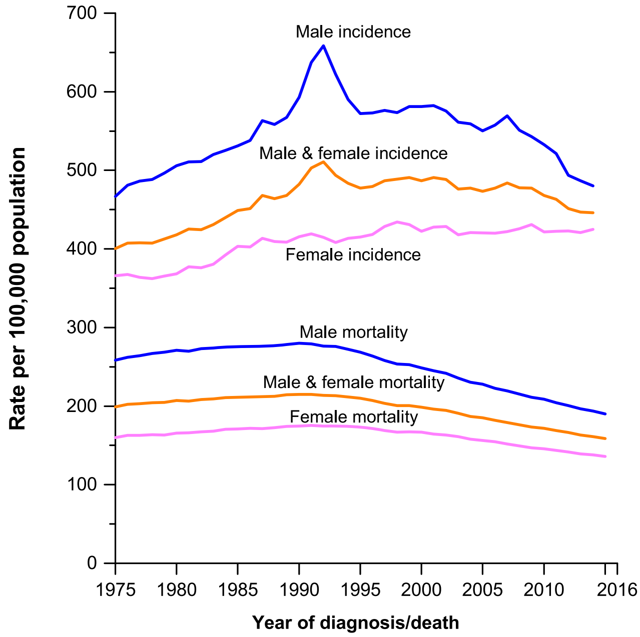

FIGURE 2. Trends in Cancer Incidence (1975 to 2015) and Mortality Rates (1975 to 2016) by Sex, United States. Rates are age adjusted to the 2000 US standard population. Incidence rates also are adjusted for delays in reporting.

Cancer survival has improved since the mid-1970s for all of the most common cancers except those of the uterine cervix and uterine corpus,[55] although for some cancer types (eg, breast and prostate) this partly reflects lead time bias because of changes in detection practice. Progress has been especially rapid for hematopoietic and lymphoid malignancies due to improvements in treatment protocols, including the discovery of targeted therapies. For example, the 5-year relative survival rate for chronic myeloid leukemia increased from 22% for patients diagnosed in the mid-1970s to 69% for those diagnosed during 2008 through 2014,[10] and most patients treated with tyrosine kinase inhibitors experience nearly normal life expectancy.[56]

In contrast to the steady increase in survival for most cancer types, advances have been slow for lung and pancreatic cancers, partly because greater than one-half of cases are diagnosed at a distant stage (Fig. 5). There is a potential for earlier lung cancer diagnosis through screening with low-dose computed tomography, which has demonstrated a 20% reduction in lung cancer mortality in current/former smokers with a history of 30 or more pack-years.[57] However, the translation of this benefit from clinical trial participants to the general population remains challenging. In 2015, only 4% of the 6.8 million eligible Americans reported being screened for lung cancer with low-dose computed tomography.[58] Another study found that more individuals who did not meet guideline-recommended criteria for lung cancer screening had received a recent test than those who did meet criteria.[59] Broad implementation of guideline-recommended lung cancer screening will require new systems to facilitate unique aspects of the process, such as identifying eligible patients and acquainting physicians with information that should be delivered during the shared

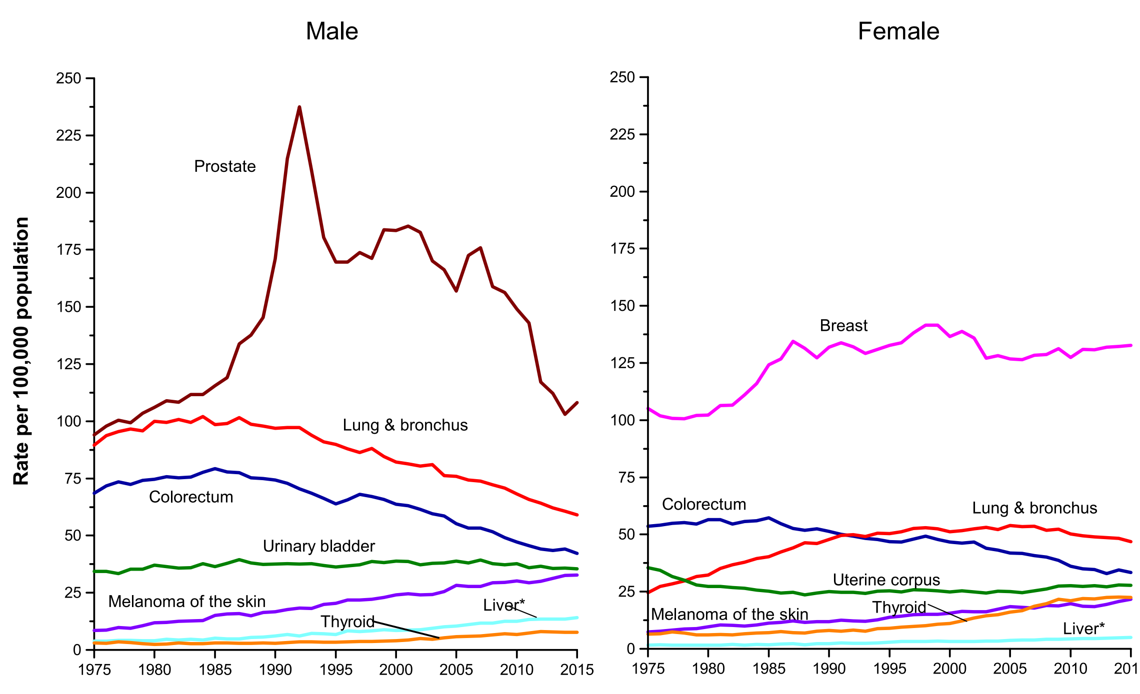

FIGURE 3. Trends in Incidence Rates for Selected Cancers by Sex, United States, 1975 to 2015. Rates are age adjusted to the 2000 US standard population and adjusted for delays in reporting. *Includes intrahepatic bile duct.

TABLE 5. Trends in Delay-Adjusted Incidence Rates for Selected Cancers by Sex, United States, 1975 to 2015

	TREND 1		TREND 2		TREND 3		TREND 4		TREND 5		TREND 6		2006-2015	2011-2015
	YEARS	APC	YEARS	APC	YEARS	APC	YEARS	APC	YEARS	APC	YEARS	APC	AAPC	AAPC
All sites														
Overall	1975-1989	1.2*	1989-1992	2.8	1992-1995	-2.4	1995-1998	1.1	1998-2009	-0.3*	2009-2015	-1.2*	-0.9*	-1.2*
Male	1975-1989	1.3*	1989-1992	5.2*	1992-1995	-4.9*	1995-1999	0.6	1999-2008	-0.6*	2008-2015	-2.3*	-1.9*	-2.3*
Female	1975-1979	-0.3	1979-1987	1.6*	1987-1995	0.1	1995-1998	1.5	1998-2003	-0.6	2003-2015	0.1	0.1	0.1
Female breast	1975-1980	-0.5	1980-1987	4.0*	1987-1994	-0.2	1994-1999	1.8*	1999-2004	-2.3*	2004-2015	0.4*	0.4*	0.4*
Colorectum														
Male	1975-1985	1.1*	1985-1991	-1.2*	1991-1995	-3.2*	1995-1998	2.1	1998-2015	-2.9*			-2.9*	-2.9*
Female	1975-1985	0.3	1985-1995	-1.9*	1995-1998	1.8	1998-2008	-2.0*	2008-2011	-4.6*	2011-2015	-0.9	-2.4*	-0.9
Liver & intrahepatic bile duct														
Male	1975-1984	2.2*	1984-2011	3.9*	2011-2015	1.0							2.6*	1.0
Female	1975-1983	0.4	1983-1998	4.4*	1998-2001	-0.4	2001-2015	3.4*					3.4*	3.4*
Lung & bronchus														
Male	1975-1982	1.5*	1982-1991	-0.5*	1991-2008	-1.7*	2008-2015	-2.9*					-2.6*	-2.9*
Female	1975-1982	5.6*	1982-1991	3.4*	1991-2006	0.5*	2006-2015	-1.5*					-1.5*	-1.5*
Melanoma of skin														
Male	1975-1986	5.4*	1986-2005	3.1*	2005-2015	1.8*							1.8*	1.8*
Female	1975-1980	5.5*	1980-2009	2.4*	2009-2012	-1.3	2012-2015	5.4*					2.1	3.7*
Pancreas														
Male	1975-1981	-1.8*	1981-1985	1.2	1985-1990	-2.2*	1990-2003	0.2	2003-2006	3.1	2006-2015	0.3	0.3	0.3
Female	1975-1984	1.4*	1984-1996	-0.5	1996-2015	1.0*							1.0*	1.0*
Prostate	1975-1988	2.6*	1988-1992	16.5*	1992-1995	-11.5*	1995-2000	2.2	2000-2009	-1.6*	2009-2015	-7.4*	-5.5*	-7.4*
Thyroid														
Male	1975-1980	-4.6	1980-1997	1.8*	1997-2012	5.5*	2012-2015	-1.1					3.2*	0.5
Female	1975-1977	6.5	1977-1980	-5.2	1980-1993	2.3*	1993-1999	4.4*	1999-2009	7.1*	2009-2015	1.2*	3.1*	1.2*
Uterine corpus	1975-1979	-6.0*	1979-1988	-1.7*	1988-1997	0.7*	1997-2006	-0.4*	2006-2009	3.5*	2009-2015	0.3	1.3*	0.3

AAPC indicates average annual percent change; APC, annual percent change based on delay-adjusted incidence rates age adjusted to the 2000 US standard population.

Note: Trends analyzed by the Joinpoint Regression Program, version 4.6, allowing up to 5 joinpoints. Trends are based on Surveillance, Epidemiology, and End Results (SEER) 9 areas.

*The APC or AAPC is significantly different from zero ($P < .05$).

decision-making conversation, which is recommended by the American Cancer Society and US Preventive Services Task Force and required by the Centers for Medicare and Medicaid Services. A recent small study suggests stark failure in the practice of shared decision making by primary care and pulmonary physicians.[60]

Trends in Cancer Mortality

Mortality rates are a better indicator of progress against cancer than incidence or survival rates because they are less affected by biases resulting from changes in detection practices.[61] The cancer death rate rose during most of the 20th century, largely driven by rapid increases in lung cancer deaths among men as a consequence of the tobacco epidemic. However, since its peak of 215.1 deaths (per 100,000 population) in 1991, the cancer death rate has dropped steadily by approximately 1.5% per year, resulting in an overall decline of 27% as of 2016 (156.0 per 100,000 population). This translates to an estimated 2,629,200 fewer cancer deaths (1,804,000 in men and 825,200 in women) than what would have occurred if mortality rates had remained at their peak (Fig. 6). The number of averted deaths is larger for men than for women because the total decline in cancer mortality has been steeper for men (34% vs 24%).

The decline in cancer mortality over the past 2 decades is primarily the result of steady reductions in smoking and advances in early detection and treatment, which are reflected in the rapid declines for the 4 major cancers (lung, breast, prostate, and colorectum) (Fig. 7). Specifically, the death rate for lung cancer dropped by 48% from 1990 to 2016 among males and by 23% from 2002 to 2016 among females, whereas the death rate for breast cancer dropped by 40% from 1989 to 2016, that for prostate cancer dropped by 51% from 1993 to 2016, and that for CRC dropped by 53% from 1970 to 2016. During the most recent data years, declines in mortality from lung cancer have accelerated whereas those for CRC have slowed (Table 6). Prostate cancer mortality stabilized during 2013 through 2016 after 2 decades of steep (4% per year) reductions that are attributed to an earlier stage at diagnosis due to PSA testing and advances in treatments.[62,63] The leveling of rates is temporally associated with both

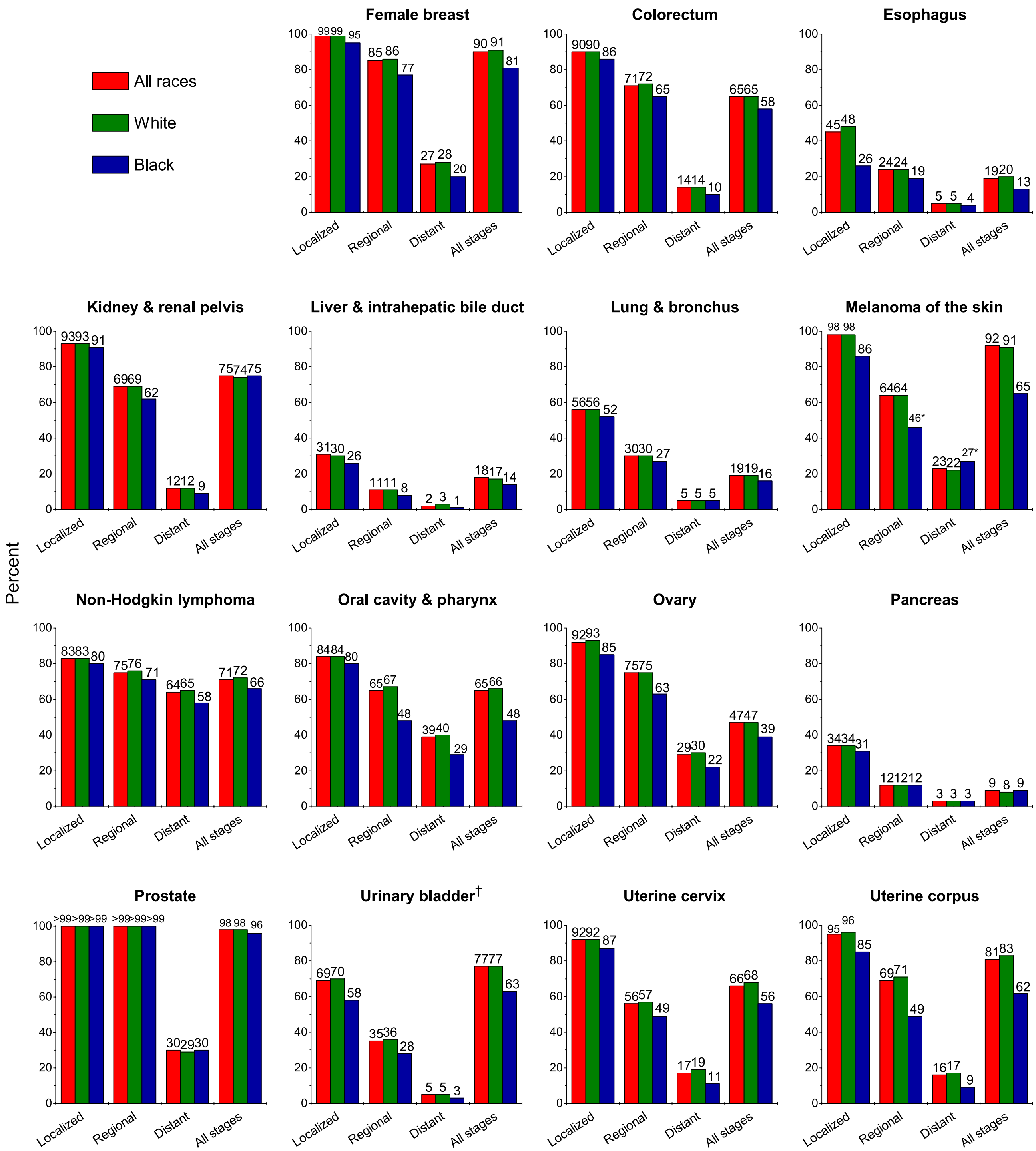

FIGURE 4. Five-Year Relative Survival Rates for Selected Cancers by Race and Stage at Diagnosis, United States, 2008 to 2014. *The standard error of the survival rate is between 5 and 10 percentage points. †The survival rate for carcinoma in situ of the urinary bladder is 95% in all races, 95% in whites, and 91% in blacks.

declines in PSA testing and an uptick in distant stage disease diagnoses.[32] Death rates rose from 2012 through 2016 for cancers of the liver, pancreas, and uterine corpus (Table 6), as well as for cancers of the brain and other nervous system, soft tissue (including heart), and sites within the oral cavity and pharynx associated with the human papillomavirus (HPV).[1]

Recorded Number of Deaths in 2016

A total of 2,744,248 deaths were recorded in the United States in 2016, 22% of which were from cancer (Table 7). Cancer is the second leading cause of death after heart disease in both men and women nationally, but is the leading cause of death in many states,[64] in Hispanic and Asian Americans,[65,66] and in people younger than 80 years.

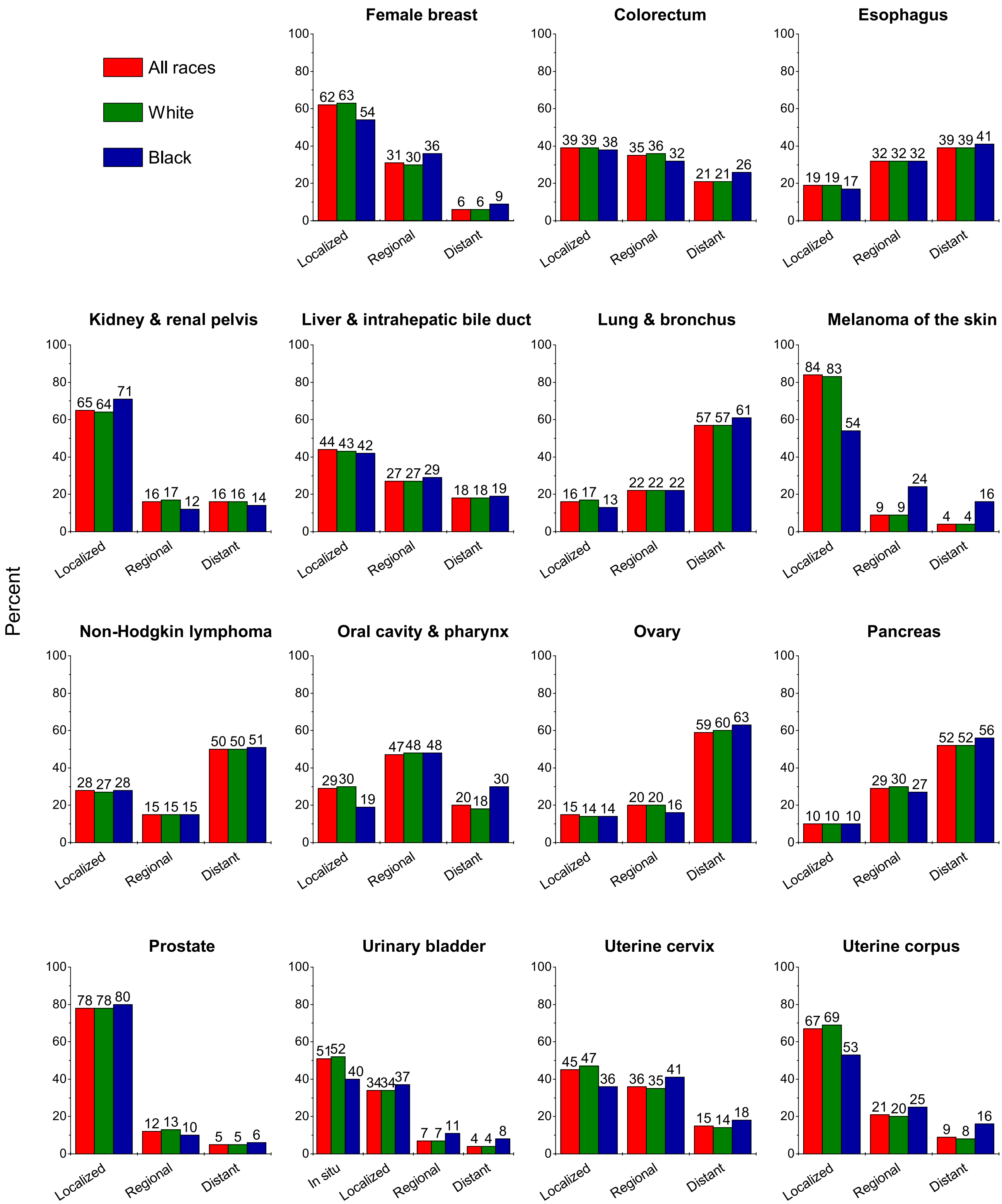

FIGURE 5. Stage Distribution for Selected Cancers by Race, United States, 2008 to 2014. Stage categories do not sum to 100% because sufficient information was not available to stage all cases.

However, those 80 years and older are nearly 2 times more likely to die from heart disease than from cancer. Among females, cancer is the first or second leading cause of death for every age group shown in Table 8, whereas among males, accidents, assault, and suicide predominate before age 40 years.

Table 9 presents the number of deaths in 2016 for the 5 leading cancer types by age and sex. Brain and other nervous

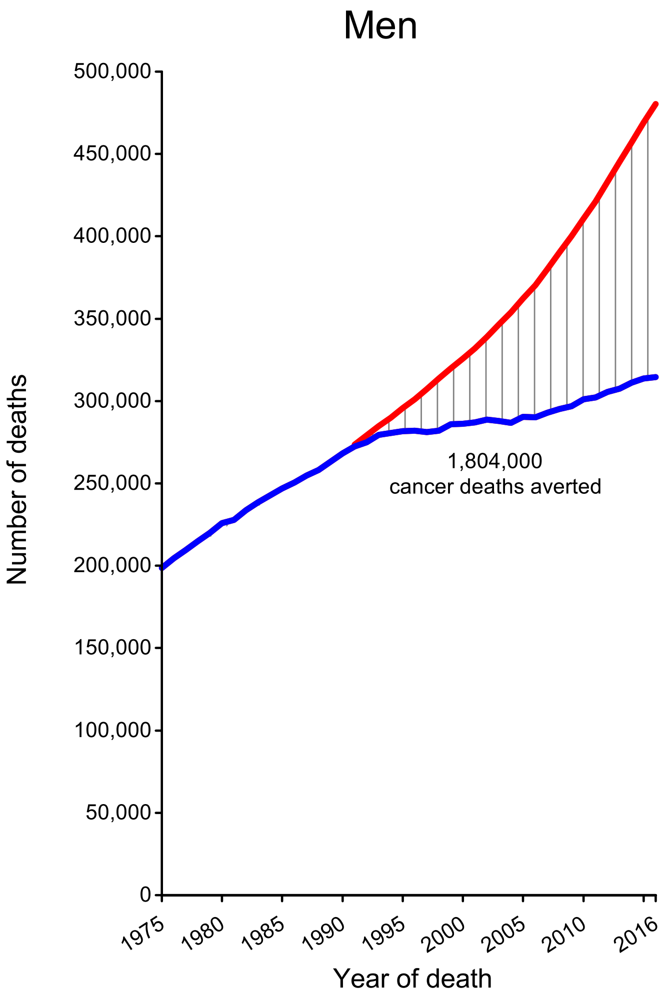

FIGURE 6. **Total Number of Cancer Deaths Averted From 1991 to 2016 in Men and From 1992 to 2016 in Women, United States.** The blue line represents the actual number of cancer deaths recorded in each year, and the red line represents the number of cancer deaths that would have been expected if cancer death rates had remained at their peak.

system tumors are the leading cause of cancer death among men aged younger than 40 years and women aged younger than 20 years, whereas breast cancer leads among women aged 20 to 59 years. Lung cancer leads in cancer deaths among men aged 40 years and older and women aged 60 years and older, causing more deaths in 2016 than breast cancer, prostate cancer, CRC, and leukemia combined. There were approximately 20% more lung cancer deaths in men (80,775) than in women (68,095) in 2016, but this pattern is projected to reverse by 2045 if current smoking trends continue.[67] Cervical cancer continues to be the second leading cause of cancer death in women aged 20 to 39 years, causing 9 deaths per week in this age group. This finding underscores the need for increased HPV vaccination uptake in adolescents and guideline-adherent screening in young women. Notably, the percentage of women aged 22 to 30 years who had never been screened for cervical cancer increased between 2000 and 2010.[68] In addition, an estimated 14 million screening-aged women (ages 21-65 years) had not been tested in the past 3 years in 2015.[69]

Cancer Disparities by Socioeconomic Status

Lower socioeconomic status (SES), whether measured at the individual or area level, is associated with numerous health disadvantages and higher mortality across race and ethnicity.[70–72] A recent study estimated that approximately one-third (34%) of cancer deaths in Americans aged 25 to 74 years could be averted with the elimination of socioeconomic disparities.[72] Notably, socioeconomic deprivation was associated with lower cancer mortality prior to the mid-1980s because of the later development of effective treatment and the historically elevated risk of lung and colorectal cancers among individuals with high SES.[73,74]

County-level SES indicators only indirectly reflect individual SES, but are valuable because the county is the smallest geographic unit for which policy is legislated. In addition, county-level indicators potentially capture some of the complex environmental influences on health. Figure 8 depicts the distribution of county-level poverty by quintile across the United States during 2012-2016, when

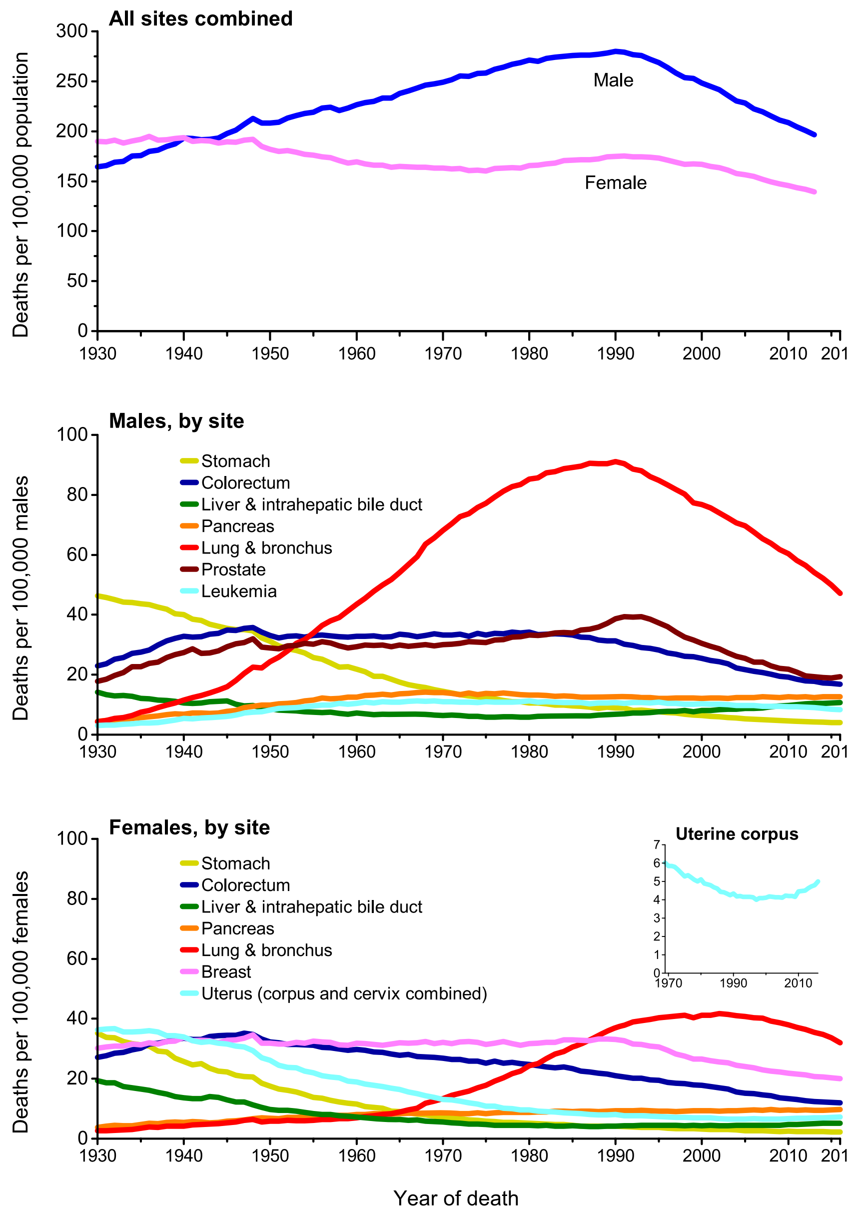

FIGURE 7. Trends in Cancer Mortality Rates by Sex Overall and for Selected Cancers, United States, 1930 to 2016. Rates are age adjusted to the 2000 US standard population. Due to improvements in International Classification of Diseases (ICD) coding over time, numerator data for cancers of the lung and bronchus, colon and rectum, liver, and uterus differ from the contemporary time period. For example, rates for lung and bronchus include pleura, trachea, mediastinum, and other respiratory organs.

the overall cancer death rate was approximately 20% higher among residents of the poorest compared with the most affluent counties. Socioeconomic inequalities in cancer mortality widened over the past 3 decades overall, but there is substantial variation by cancer type. Consistent with socioeconomic inequalities for cancer incidence,[75] the largest gaps are for the most preventable cancers. For example, cervical cancer mortality among women in poor counties is twice that of women in affluent counties, and lung and liver cancer mortality among men is >40% higher (Table 10).

The most striking socioeconomic shift occurred for CRC mortality; rates in men in the poorest counties were approximately 20% lower than those in affluent counties in the early 1970s, but are now 35% higher (Fig. 9). This reversal reflects changes in dietary and smoking patterns that influence CRC risk,[73] as well as the slower dissemination of screening and treatment advances among disadvantaged populations.[76] A similar crossover occurred earlier for male lung cancer mortality because historically, men of higher SES were much more likely to smoke.[73]

TABLE 6. Trends in Mortality Rates for Selected Cancers by Sex, United States, 1975 to 2016

	TREND 1		TREND 2		TREND 3		TREND 4		TREND 5		TREND 6		2007-2016	2012-2016
	YEARS	APC	YEARS	APC	YEARS	APC	YEARS	APC	YEARS	APC	YEARS	APC	AAPC	AAPC
All sites														
Overall	1975-1984	0.5*	1984-1991	0.3*	1991-1994	-0.5	1994-1998	-1.3*	1998-2001	-0.8*	2001-2016	-1.5*	-1.5*	-1.5*
Male	1975-1979	1.0*	1979-1990	0.3*	1990-1993	-0.5	1993-2001	-1.5*	2001-2016	-1.8*			-1.8*	-1.8*
Female	1975-1990	0.6*	1990-1994	-0.2	1994-2002	-0.8*	2002-2016	-1.4*					-1.4*	-1.4*
Female breast	1975-1990	0.4*	1990-1995	-1.7*	1995-1998	-3.4*	1998-2016	-1.8*					-1.8*	-1.8*
Colorectum														
Male	1975-1979	0.6	1979-1987	-0.0 *	1987-2002	-1.9*	2002-2005	-4.2*	2005-2016	-2.4*			-2.4*	-2.4*
Female	1975-1984	-1.0*	1984-2001	-1.8*	2001-2012	-2.9*	2012-2016	-1.5*					-2.3*	-1.5*
Liver & intrahepatic bile duct														
Male	1975-1985	1.5*	1985-1996	3.8*	1996-1999	0.3	1999-2013	2.7*	2013-2016	0.7			2.0*	1.2*
Female	1975-1978	-1.5	1978-1988	1.4*	1988-1995	3.9*	1995-2000	0.4	2000-2008	1.6*	2008-2016	2.6*	2.5*	2.6*
Lung & bronchus														
Male	1975-1978	2.4*	1978-1984	1.2*	1984-1991	0.3*	1991-2005	-1.9*	2005-2012	-2.9*	2012-2016	-4.3*	-3.5*	-4.3*
Female	1975-1983	5.9*	1983-1992	3.8*	1992-2002	0.5*	2002-2007	-0.7*	2007-2014	-2.0*	2014-2016	-4.2*	-2.5*	-3.1*
Melanoma of skin														
Male	1975-1989	2.3*	1989-2013	0.3*	2013-2016	-6.9*							-2.2*	-5.2*
Female	1975-1988	0.8*	1988-2014	-0.6*	2014-2016	-9.3*							-2.6*	-5.0*
Pancreas														
Male	1975-1986	-0.8*	1986-2000	-0.3*	2000-2016	0.3*							0.3*	0.3*
Female	1975-1984	0.8*	1984-2003	0.1	2003-2006	1.0	2006-2016	0.0					0.0	0.0
Prostate	1975-1987	0.9*	1987-1991	3.0*	1991-1994	-0.5	1994-1998	-4.2*	1998-2013	-3.5*	2013-2016	-0.0	-2.3*	-0.9
Uterine corpus	1975-1993	-1.5*	1993-2008	0.1	2008-2016	2.1*							1.9*	2.1*

AAPC indicates average annual percent change; APC, annual percent change based on mortality rates age adjusted to the 2000 US standard population.
Note: Trends analyzed by the Joinpoint Regression Program, version 4.6, allowing up to 5 joinpoints.
*The APC or AAPC is significantly different from zero (P <.05).

TABLE 7. Ten Leading Causes of Death in the United States, 2015 and 2016

		2015			2016			
		NO.	PERCENT	RATE	NO.	PERCENT	RATE	RELATIVE CHANGE IN RATE
RANK (2016)	**All causes**	**2,712,630**		**733.0**	**2,744,248**		**729.1**	**-0.5%**
1	Heart disease	633,842	23%	168.3	635,260	23%	165.5	-1.7%
2	Cancer	595,930	22%	158.7	598,038	22%	156.0	-1.7%
3	Accidents (unintentional injuries)	146,571	5%	43.1	161,374	6%	47.3	9.7%
4	Chronic lower respiratory diseases	155,041	6%	41.8	154,596	6%	40.8	-2.4%
5	Cerebrovascular disease	140,323	5%	37.6	142,142	5%	37.4	-0.5%
6	Alzheimer disease	110,561	4%	29.4	116,103	4%	30.3	3.1%
7	Diabetes mellitus	79,535	3%	21.3	80,058	3%	21.0	-1.4%
8	Influenza and pneumonia	57,062	2%	15.2	51,537	2%	13.6	-10.5%
9	Nephritis, nephrotic syndrome, & nephrosis	49,959	2%	13.4	50,046	2%	13.2	-1.5%
10	Intentional self-harm (suicide)	44,193	2%	13.3	44,965	2%	13.4	0.8%

Death counts include unknown age.
Rates are per 100,000 population and age adjusted to the 2000 US standard population. Rank is based on number of deaths.
Source: National Center for Health Statistics, Centers for Disease Control and Prevention.

TABLE 8. Ten Leading Causes of Death in the United States by Age and Sex, 2016

	ALL AGES		AGES 1 TO 19		AGES 20 TO 39		AGES 40 TO 59		AGES 60 TO 79		AGES ≥80	
	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
	All Causes 1,400,232	All Causes 1,344,016	All Causes 13,110	All Causes 7,250	All Causes 79,366	All Causes 35,290	All Causes 230,142	All Causes 148,035	All Causes 573,327	All Causes 437,947	All Causes 491,323	All Causes 705,160
1	Heart disease 339,265	Heart disease 295,995	Accidents (unintentional injuries) 4,674	Accidents (unintentional injuries) 2,373	Accidents (unintentional injuries) 33,073	Accidents (unintentional injuries) 11,808	Heart disease 52,128	Cancer 48,075	Cancer 172,243	Cancer 140,971	Heart disease 141,049	Heart disease 188,116
2	Cancer 314,571	Cancer 283,467	Assault (homicide) 1,886	Cancer 789	Intentional self-harm (suicide) 11,593	Cancer 4,653	Cancer 49,227	Heart disease 22,669	Heart disease 140,213	Heart disease 82,175	Cancer 87,954	Cancer 88,944
3	Accidents (unintentional injuries) 103,864	Cerebrovascular disease 82,787	Intentional self-harm (suicide) 1,873	Intentional self-harm (suicide) 687	Assault (homicide) 9,042	Intentional self-harm (suicide) 2,976	Accidents (unintentional injuries) 31,493	Accidents (unintentional injuries) 14,091	Chronic lower respiratory diseases 37,398	Chronic lower respiratory diseases 36,278	Chronic lower respiratory diseases 29,525	Alzheimer disease 69,826
4	Chronic lower respiratory diseases 73,045	Chronic lower respiratory diseases 81,551	Cancer 1,064	Assault (homicide) 555	Heart disease 5,362	Heart disease 2,621	Intentional self-harm (suicide) 12,002	Chronic lower respiratory diseases 6,166	Cerebrovascular disease 23,494	Cerebrovascular disease 21,359	Cerebrovascular disease 28,254	Cerebrovascular disease 55,642
5	Cerebrovascular disease 59,355	Alzheimer disease 80,731	Congenital anomalies 519	Congenital anomalies 460	Cancer 4,044	Assault (homicide) 1,610	Chronic liver disease & cirrhosis 11,157	Chronic liver disease & cirrhosis 5,823	Diabetes mellitus 22,078	Diabetes mellitus 15,952	Alzheimer disease 27,841	Chronic lower respiratory diseases 38,684
6	Diabetes mellitus 43,763	Accidents (unintentional injuries) 57,510	Heart disease 341	Heart disease 258	Chronic liver disease & cirrhosis 1,255	Pregnancy, childbirth & puerperium 864	Diabetes mellitus 8,545	Cerebrovascular disease 5,075	Accidents (unintentional injuries) 19,864	Accidents (unintentional injuries) 10,771	Accidents (unintentional injuries) 14,032	Accidents (unintentional injuries) 17,948
7	Alzheimer disease 35,372	Diabetes mellitus 36,295	Chronic lower respiratory diseases 169	Influenza & pneumonia 111	Diabetes mellitus 1,029	Chronic liver disease & cirrhosis 818	Cerebrovascular disease 6,621	Diabetes mellitus 5,039	Chronic liver disease & cirrhosis 11,656	Alzheimer disease 10,667	Influenza & pneumonia 12,434	Influenza & pneumonia 16,333
8	Intentional self-harm (suicide) 34,727	Influenza & pneumonia 26,526	Influenza & pneumonia 133	Chronic lower respiratory diseases 105	Cerebrovascular disease 784	Diabetes mellitus 722	Chronic lower respiratory diseases 5,517	Intentional self-harm (suicide) 4,243	Nephritis, nephrotic syndrome & nephrosis 10,604	Nephritis, nephrotic syndrome & nephrosis 9,076	Diabetes mellitus 12,062	Diabetes mellitus 14,541
9	Chronic liver disease & cirrhosis 25,818	Nephritis, nephrotic syndrome & nephrosis 24,647	Cerebrovascular disease 120	Septicemia 87	HIV disease 727	Cerebrovascular disease 576	Assault (homicide) 3,373	Septicemia 2,586	Influenza & pneumonia 9,197	Septicemia 8,294	Nephritis, nephrotic syndrome & nephrosis 11,596	Nephritis, nephrotic syndrome & nephrosis 13,191
10	Nephritis, nephrotic syndrome & nephrosis 25,399	Septicemia 20,935	Septicemia 96	Cerebrovascular disease 85	Influenza & pneumonia 519	Influenza & pneumonia 422	Septicemia 3,012	Influenza & pneumonia 2,140	Septicemia 8,875	Influenza & pneumonia 7,460	Parkinson disease 11,342	Hypertension & hypertensive renal disease* 12,241

HIV indicates human immunodeficiency virus.

Note: Deaths within each age group do not sum to all ages combined due to the inclusion of unknown ages. In accordance with the National Center for Health Statistics' cause-of-death ranking, "Symptoms, signs, and abnormal clinical or laboratory findings" and categories that begin with "Other" and "All other" were not ranked.

Source: US Final Mortality Data, 2016, National Center for Health Statistics, Centers for Disease Control and Prevention, 2018.

*Includes primary and secondary hypertension.

TABLE 9. Five Leading Causes of Cancer Death by Age and Sex, United States, 2016

ALL AGES	<20	20 TO 39	40 TO 59	60 TO 79	≥ 80
			MALE		
ALL SITES	**ALL SITES**	**ALL SITES**	**ALL SITES**	**ALL SITES**	**ALL SITES**
314,571	**1,100**	**4,044**	**49,227**	**172,243**	**87,954**
Lung & bronchus	Brain & ONS	Brain & ONS	Lung & bronchus	Lung & bronchus	Lung & bronchus
80,775	314	538	11,588	49,877	19,095
Prostate	Leukemia	Leukemia	Colorectum	Colorectum	Prostate
30,370	280	526	5,888	14,010	15,535
Colorectum	Bones & joints	Colorectum	Liver*	Prostate	Colorectum
27,642	120	487	4,001	13,447	7,250
Pancreas	Soft tissue (including heart)	Non-Hodgkin lymphoma	Pancreas	Pancreas	Urinary bladder
21,899	87	237	3,747	12,926	5,621
Liver*	Non-Hodgkin lymphoma	Soft tissue (including heart)	Brain & ONS	Liver*	Pancreas
17,843	42	232	2,562	10,961	5,099
			FEMALE		
ALL SITES	**ALL SITES**	**ALL SITES**	**ALL SITES**	**ALL SITES**	**ALL SITES**
283,467	**820**	**4,653**	**48,075**	**140,971**	**88,944**
Lung & bronchus	Brain & ONS	Breast	Breast	Lung & bronchus	Lung & bronchus
68,095	238	1,158	10,405	39,029	19,199
Breast	Leukemia	Uterine cervix	Lung & bronchus	Breast	Breast
41,488	219	469	9,676	18,922	11,002
Colorectum	Bone & joints	Colorectum	Colorectum	Pancreas	Colorectum
24,644	80	417	4,328	10,971	9,637
Pancreas	Soft tissue (including heart)	Brain & ONS	Ovary	Colorectum	Pancreas
20,858	80	371	2,777	10,259	7,074
Ovary	Liver*	Leukemia	Pancreas	Ovary	Leukemia
14,223	28	342	2,725	7,669	4,135

ONS indicates other nervous system.
Note: Ranking order excludes category titles that begin with the word "Other."
*Includes intrahepatic bile duct.

In contemporary times, the prevalence of behaviors that increase cancer incidence and mortality are vastly higher among residents of the poorest counties, including double the prevalence of smoking and obesity compared to residents of the wealthiest counties.[70] Poverty is also associated with lower cancer screening prevalence,[77] later stage diagnosis,[78] and a lower likelihood of optimal treatment. Although lack of health care capacity in economically challenged areas likely contributes to these disparities, some states are home to both the poorest and most affluent counties, suggesting an opportunity for improvement in the distribution of services. Increasing access to care weakens the link between SES and health.[79] Numerous states have reduced inequalities through various strategies that removed barriers to prevention, early detection, and treatment.[80–82]

Socioeconomic inequalities in cancer mortality are small or absent for malignancies that are less amenable to prevention or treatment. For example, mortality for leukemia and non-Hodgkin lymphoma was equivalent across poverty levels, despite a higher incidence in more affluent counties,[75] likely reflecting survival disparities.[83–85] Inferior survival among those with low SES is predominantly driven by a later stage of disease at diagnosis and less aggressive treatment.[86] Disparities are also minimal or nonexistent for pancreatic and ovarian cancers, for which early detection is lacking and even optimal treatment has a nominal influence on survival. The inequality for prostate cancer mortality was largely confined to black men, even after accounting for Hispanic ethnicity among whites (data not shown). This finding is consistent with previous studies showing a stronger association between SES and prostate cancer mortality among blacks.[87,88] The slight excess mortality for brain/other nervous system tumors and urinary bladder cancer in affluent counties is in agreement with incidence studies and may partly reflect detection bias.[75,89]

Cancer Disparities by Race/Ethnicity

Cancer occurrence and outcomes vary considerably between racial and ethnic groups, largely because of inequalities in wealth that lead to differences in risk factor exposures and barriers to high-quality cancer prevention, early detection, and treatment,[90,91] as discussed in the previous section.

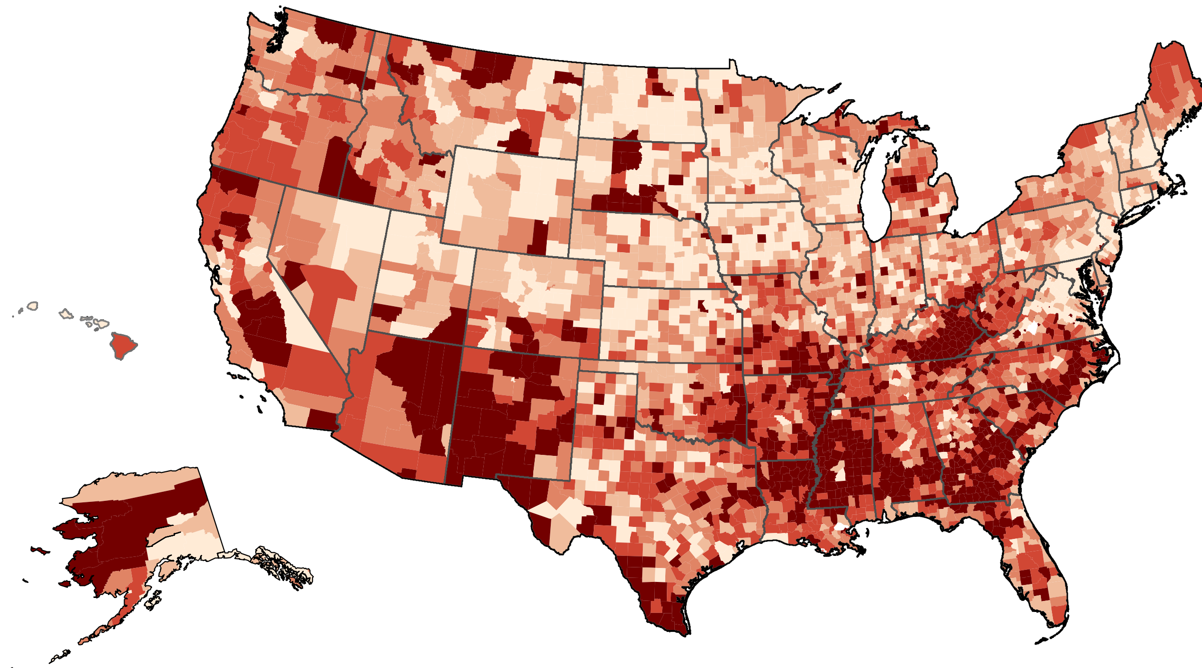

FIGURE 8. County-Level Poverty (in Percentage) in the United States, 2012 to 2016.

Cancer incidence and mortality are generally highest among non-Hispanic blacks (NHBs) and lowest among Asian/Pacific Islanders (Table 11). The overall cancer incidence rate in NHB men during 2011 through 2015 was 84% higher than that in Asian/Pacific Islander men and 9% higher than that in NHW men. Notably, NHB women had 7% lower cancer incidence than NHW women (because of lower rates of breast and lung cancer), but 13% higher cancer mortality. In men and women combined, the black-white disparity in overall cancer mortality has declined from a peak of 33% in 1993 (279.0 vs 210.5 per 100,000 population) to 14% in 2016 (183.6 vs 160.7 per 100,000 population). This progress is largely due to the steep drop in smoking prevalence unique among black teens from the late 1970s through the early 1990s.[92]

Geographic Variation in Cancer Occurrence

Tables 12 and 13 show cancer incidence and mortality rates for selected cancers by state. State variation in cancer incidence results from differences in medical detection practices and the prevalence of risk factors, such as smoking, obesity, and other health behaviors. For example, up-to-date HPV vaccination coverage among adolescent (ages 13-17 years) boys and girls ranged widely in 2017, from just 29% in Mississippi to 78% in Rhode Island and the District of Columbia.[93] This variation may contribute to future differential patterns in HPV-associated cancers across states.[94,95] Geographic health disparities, which have increased over time,[96,97] often reflect the national distribution of poverty.[98] This trend may be exacerbated by widening inequalities in access to health care because of state/territory differences in Medicaid expansion and other initiatives to improve insurance coverage.[99,100]

The largest geographic variation in cancer occurrence by far is for lung cancer, reflecting the large historical and continuing differences in smoking prevalence between states.[101] For example, lung cancer incidence rates during 2011 through 2015 in Kentucky (113 per 100,000 population in men and 79 per 100,000 population in women), where smoking prevalence continues to be highest, were approximately 3.5 times higher than those in Utah (32 per 100,000 population in men and 24 per 100,000 population in women), where smoking prevalence is lowest. In 2016, 1 in 4 residents of Kentucky and West Virginia were current smokers compared with 1 in 10 in Utah, Puerto Rico, and California.[102]

Cancer in Children and Adolescents

Cancer is the second most common cause of death among children aged 1 to 14 years in the United States, surpassed

TABLE 10. Change in Cancer Mortality Rates by County-Level Poverty, 1970 to 1974 Versus 2012 to 2016

	1970 TO 1974			2012 TO 2016		
	POOR	AFFLUENT	RATE RATIO (95% CI) POOR VS AFFLUENT	POOR	AFFLUENT	RATE RATIO (95% CI) POOR VS AFFLUENT
All cancers						
Both sexes	199.7	198.8	1.00 (1.00-1.01)	176.7	149.7	1.18 (1.18-1.19)
Male	259.0	250.4	1.03 (1.03-1.04)	217.5	177.3	1.23 (1.22-1.23)
Female	157.5	164.4	0.96 (0.95-0.97)	147.6	130.2	1.13 (1.13-1.14)
Brain & ONS						
Both sexes	3.7	4.1	0.90 (0.86-0.93)	4.0	4.6	0.89 (0.86-0.91)
Male	4.6	4.9	0.93 (0.88-0.97)	4.9	5.6	0.87 (0.84-0.91)
Female	3.0	3.4	0.87 (0.82-0.92)	3.4	3.7	0.91 (0.87-0.95)
Breast (female)						
All races	29.0	34.0	0.85 (0.84-0.87)	22.5	19.5	1.16 (1.14-1.17)
White	28.8	34.4	0.84 (0.82-0.85)	20.9	19.7	1.06 (1.04-1.09)
Black	30.1	30.8	0.97 (0.90-1.05)	28.8	25.7	1.12 (1.08-1.16)
Colorectum						
Both sexes	25.5	30.9	0.83 (0.81-0.84)	16.5	12.7	1.30 (1.28-1.32)
Male	28.6	35.6	0.81 (0.79-0.82)	20.2	14.9	1.35 (1.33-1.38)
Female	23.3	27.8	0.84 (0.82-0.86)	13.6	10.9	1.25 (1.23-1.28)
Esophagus						
Both sexes	3.9	3.3	1.19 (1.14-1.24)	4.0	3.9	1.02 (0.99-1.04)
Male	6.7	5.5	1.20 (1.14-1.26)	7.1	6.9	1.03 (1.00-1.06)
Female	1.8	1.6	1.15 (1.06-1.25)	1.5	1.5	0.99 (0.93-1.05)
Leukemia						
Both sexes	8.1	8.3	0.97 (0.94-1.00)	6.4	6.4	1.00 (0.97-1.02)
Male	10.5	11.1	0.94 (0.91-0.98)	8.6	8.7	0.99 (0.97-1.02)
Female	6.3	6.4	0.99 (0.95-1.04)	4.8	4.8	1.00 (0.97-1.04)
Liver & intrahepatic bile duct						
Both sexes	3.5	2.8	1.27 (1.21-1.33)	7.7	5.6	1.37 (1.35-1.40)
Male	4.8	3.8	1.29 (1.21-1.37)	11.5	8.2	1.41 (1.37-1.44)
Female	2.5	2.0	1.22 (1.13-1.31)	4.5	3.5	1.31 (1.27-1.36)
Lung & bronchus						
Both sexes	41.2	37.3	1.11 (1.09-1.12)	47.7	37.2	1.28 (1.27-1.29)
Male	76.3	66.8	1.14 (1.13-1.16)	63.0	44.2	1.42 (1.41-1.44)
Female	14.2	14.7	0.96 (0.94-0.99)	36.1	32.0	1.13 (1.12-1.14)
Myeloma						
Both sexes	2.8	2.8	1.00 (0.96-1.05)	3.7	3.1	1.17 (1.14-1.21)
Male	3.4	3.4	1.00 (0.93-1.07)	4.6	4.0	1.14 (1.09-1.19)
Female	2.3	2.3	1.01 (0.94-1.08)	3.0	2.5	1.22 (1.17-1.28)
Non-Hodgkin lymphoma						
Both sexes	4.9	6.0	0.83 (0.80-0.85)	5.6	5.5	1.02 (1.00-1.05)
Male	6.2	7.3	0.85 (0.81-0.89)	7.2	7.1	1.02 (0.98-1.05)
Female	4.0	5.0	0.80 (0.76-0.84)	4.4	4.2	1.03 (0.99-1.06)
Ovary						
All races	9.0	10.6	0.84 (0.81-0.87)	7.0	7.0	1.00 (0.97-1.03)
White	9.3	10.8	0.86 (0.83-0.90)	7.3	7.3	1.00 (0.97-1.04)
Black	7.6	8.5	0.89 (0.77-1.04)	6.4	6.1	1.05 (0.97-1.14)
Pancreas						
Both sexes	10.8	10.5	1.03 (1.01-1.06)	11.4	10.8	1.06 (1.04-1.07)
Male	14.3	13.3	1.07 (1.04-1.11)	13.0	12.5	1.04 (1.02-1.07)
Female	8.3	8.4	0.98 (0.95-1.02)	10.1	9.4	1.07 (1.05-1.10)
Prostate						
All races	32.6	30.2	1.08 (1.05-1.11)	22.5	17.9	1.26 (1.23-1.28)
White	28.1	29.9	0.94 (0.91-0.97)	18.2	17.7	1.03 (1.00-1.05)
Black	51.4	52.8	0.97 (0.90-1.06)	42.9	33.7	1.27 (1.21-1.34)
Urinary bladder						
Both sexes	5.2	5.9	0.87 (0.84-0.91)	4.2	4.3	0.96 (0.94-0.99)
Male	8.5	10.4	0.82 (0.78-0.86)	7.2	7.6	0.95 (0.92-0.98)
Female	2.9	3.0	0.97 (0.91-1.04)	2.2	2.1	1.03 (0.98-1.08)
Uterine corpus						
All races	5.9	5.5	1.08 (1.04-1.13)	5.3	4.6	1.15 (1.11-1.19)
White	5.2	5.4	0.96 (0.92-1.01)	4.3	4.5	0.96 (0.92-1.00)
Black	9.0	8.6	1.04 (0.90-1.22)	8.9	8.2	1.08 (1.01-1.16)
Uterine cervix						
All races	8.9	5.1	1.73 (1.66-1.80)	3.2	1.6	2.00 (1.90-2.10)
White	6.7	4.9	1.36 (1.30-1.43)	2.9	1.6	1.86 (1.75-1.98)
Black	16.9	12.4	1.37 (1.22-1.54)	4.3	2.4	1.76 (1.57-1.99)

95% CI indicates 95% confidence interval; ONS, other nervous system.

"Poor" and "affluent" refer to extreme county-level poverty categories: 21.18% to 53.95% and 1.81% to 10.84%, respectively.

Rates are per 100,000 population and age adjusted to the 2000 US standard population. Rate ratio is the unrounded rate in poor counties divided by the corresponding unrounded rate in affluent counties.

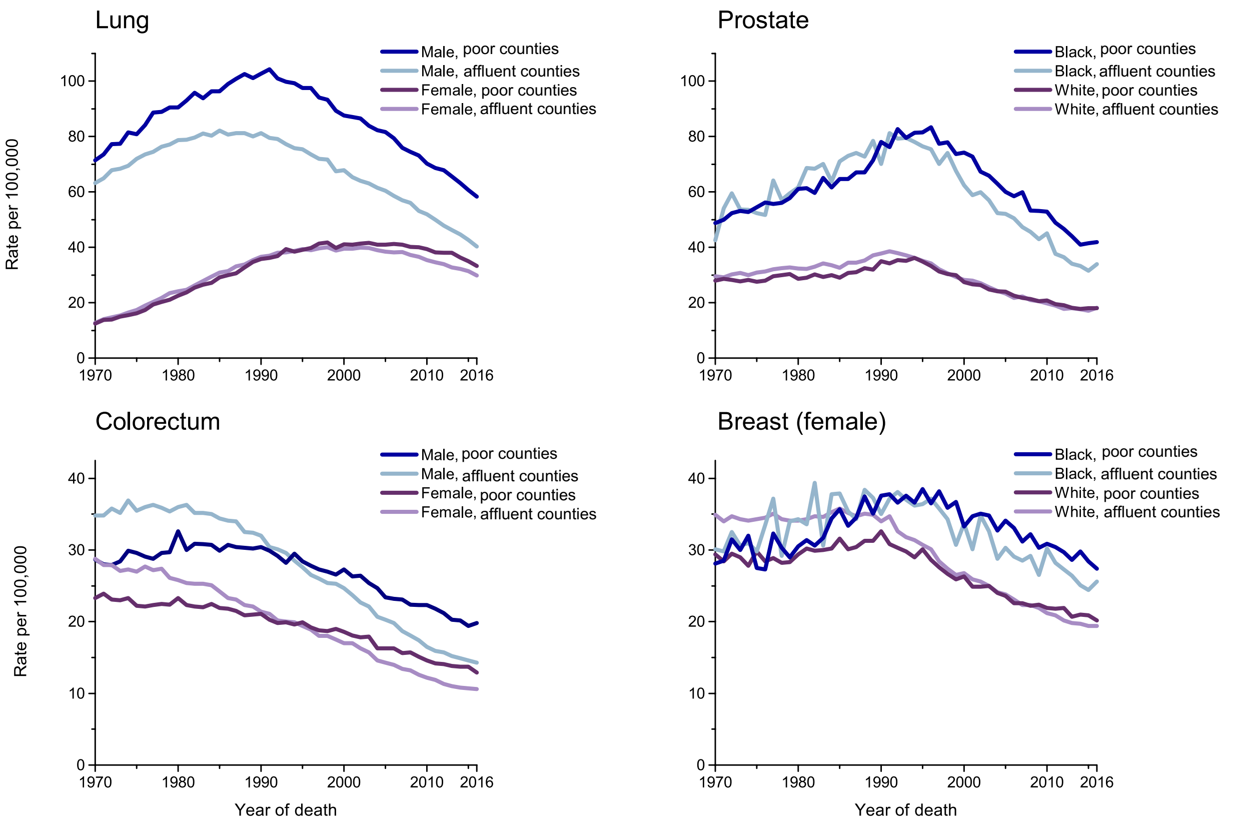

FIGURE 9. Cancer Mortality Rates by County-Level Poverty, United States, 1970 to 2016. Rates are per 100,000 population and are age adjusted to the 2000 US standard population. County-level poverty was derived from the 2012 to 2016 American Community Survey. "Poor" and "affluent" refer to extreme county-level poverty categories: 21.18% to 53.95% and 1.81% to 10.84%, respectively.

only by accidents. In 2019, an estimated 11,060 children (birth to 14 years) will be diagnosed with cancer and 1,190 will die from the disease. Benign and borderline malignant brain tumors are not included in the 2019 case estimates because the calculation method requires historical data and these tumors were not required to be reported to cancer registries until 2004.

Leukemia is the most common childhood cancer, accounting for 28% of cases (including benign and borderline malignant brain tumors). Brain and other nervous system tumors, approximately one-quarter of which are benign/borderline malignant, are second most common (26%) (Table 14). The distribution of cancers that occur in adolescents (aged 15 to 19 years) differs somewhat from that in children. For example, brain and other nervous system tumors (21%), greater than one-half of which (58%) are benign/borderline malignant, and lymphoma (20%) are the most common cancers, whereas leukemia accounts for just 13% of cases. Thyroid carcinoma and melanoma of the skin account for 11% and 4%, respectively, of cancers in adolescents, but only 2% and 1%, respectively, in children.

The overall cancer incidence rate in children and adolescents has been increasing slightly (by 0.7% per year) since 1975. In contrast, death rates have declined continuously for many decades, from 6.5 per 100,000 population in 1970 to 2.3 per 100,000 population in 2016, an overall reduction of 65% (65% in children and 61% in adolescents). Much of this progress reflects the dramatic 78% decline in leukemia mortality, from 2.7 per 100,000 children and adolescents in 1970 to 0.6 in 2016. Improved remission rates of 90% to 100% for childhood acute lymphocytic leukemia over the past 4 decades have been achieved primarily through the optimization of established chemotherapeutic agents as opposed to the development of new therapies.[103] The 5-year relative survival rate for all cancers combined improved from 58% during the mid-1970s to 83% during 2008 through 2014 for children and from 68% to 85% for adolescents.[10] However, survival varies substantially by cancer type and age at diagnosis (Table 14).

Limitations

Although the estimated numbers of new cancer cases and deaths expected to occur in 2019 provide a reasonably

TABLE 11. Incidence and Mortality Rates for Selected Cancers by Race and Ethnicity, United States, 2011 to 2016

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

Rates are per 100,000 population and age adjusted to the 2000 US standard population. Nonwhite and nonblack race categories are not mutually exclusive of Hispanic origin.

*Data based on Indian Health Service Contract Health Service Delivery Areas (CHSDA) counties.

accurate portrayal of the contemporary cancer burden, they are model-based, 3-year- and 4-year-ahead projections that should be interpreted with caution and not be used to track trends over time. First, the estimates may be affected by changes in methodology as we take advantage of improvements in modeling techniques and cancer surveillance coverage. Second, although the models are robust, they can only account for trends through the most recent data year (currently 2015 for incidence and 2016 for mortality) and cannot anticipate abrupt fluctuations for cancers affected by changes in detection practice (eg, PSA testing and prostate cancer). Third, the model can be oversensitive to sudden or large changes in observed data. The most informative metrics for tracking cancer trends

TABLE 12. Incidence Rates for Selected Cancers by State, United States, 2011 to 2015

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

Rates are per 100,000 population and age adjusted to the 2000 US standard population.

— Data unavailable.

*Data for these states are not included in the US combined rates because either the registry did not consent or high-quality incidence data were not available for all years during 2011 through 2015 according to the North American Association of Central Cancer Registries (NAACCR).

†Rates are based on cases diagnosed during 2011 through 2014.

‡Data for Puerto Rico are not included in the US combined rates for comparability to previously published US rates.

TABLE 13. Mortality Rates for Selected Cancers by State, United States, 2012 to 2016

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

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

TABLE 14. Case Distribution (2011 Through 2015) and 5-Year Relative Survival (2008 Through 2014)* by Age and ICCC Type, Ages Birth to 19 Years, United States

	BIRTH TO 14		15 TO 19	
	PERCENTAGE OF CASES	5-YEAR SURVIVAL, %	PERCENTAGE OF CASES	5-YEAR SURVIVAL, %
All ICCC groups combined		**83.4**		**84.6**
Lymphoid leukemia	22%	90.8	7%	73.8
Acute myeloid leukemia	4%	66.4	4%	64.2
Hodgkin lymphoma	3%	97.8	12%	96.1
Non-Hodgkin lymphoma (including Burkitt lymphoma)	5%	90.2	7%	89.1
Central nervous system neoplasms	26%	72.9	21%	77.9
Neuroblastoma & other peripheral nervous cell tumors	6%	80.2	<1%	54.1†
Retinoblasoma	2%	95.2	<1%	—
Nephroblastoma & other nonepithelial renal tumors	5%	92.7	<1%	—
Hepatic tumors	2%	80.4	<1%	52.4†
Hepatoblastoma	1%	84.6	<1%	—
Osteosarcoma	2%	69.6	3%	65.7
Ewing tumor & related bone sarcomas	1%	77.7	2%	64.3
Rhabdomyosarcoma	3%	70.3	1%	46.2
Germ cell & gonadal tumors	3%	91.6	11%	92.6
Thyroid carcinoma	2%	99.7	11%	99.2
Malignant melanoma	1%	94.9	4%	94.0

ICCC indicates International Classification of Childhood Cancer.
Survival rates are adjusted for normal life expectancy and are based on follow-up of patients through 2015.
— Statistic could not be calculated due to fewer than 25 cases diagnosed during 2008 to 2014.
*Benign and borderline brain tumors were excluded from survival calculations, but were included in the denominator for case distribution.
†The standard error of the survival rate is between 5 and 10 percentage points.

are age-standardized or age-specific cancer death rates from the NCHS and cancer incidence rates from SEER, NPCR, and/or NAACCR.

Errors in reporting race/ethnicity in medical records and on death certificates may result in underestimates of cancer incidence and mortality in nonwhite and nonblack populations, particularly American Indian/Alaska Native populations. It is also important to note that cancer data in the United States are primarily reported for broad, heterogeneous racial and ethnic groups, masking important differences in the cancer burden within these populations. For example, lung cancer incidence is equivalent in Native Hawaiian and NHW men, but approximately 50% lower in Asians/Pacific Islanders overall.[66]

Conclusions

The continuous decline in cancer death rates since 1991 has resulted in an overall drop of 27%, translating to approximately 2.6 million fewer cancer deaths. Although the racial gap in cancer mortality is slowly narrowing, socioeconomic inequalities are widening, with residents of the poorest counties experiencing an increasingly disproportionate burden of the most preventable cancers. These counties are low-hanging fruit for locally focused cancer control efforts, including increased access to basic health care and interventions for smoking cessation, healthy living, and cancer screening programs. A broader application of existing cancer control knowledge with an emphasis on disadvantaged groups would undoubtedly accelerate progress against cancer. ■

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