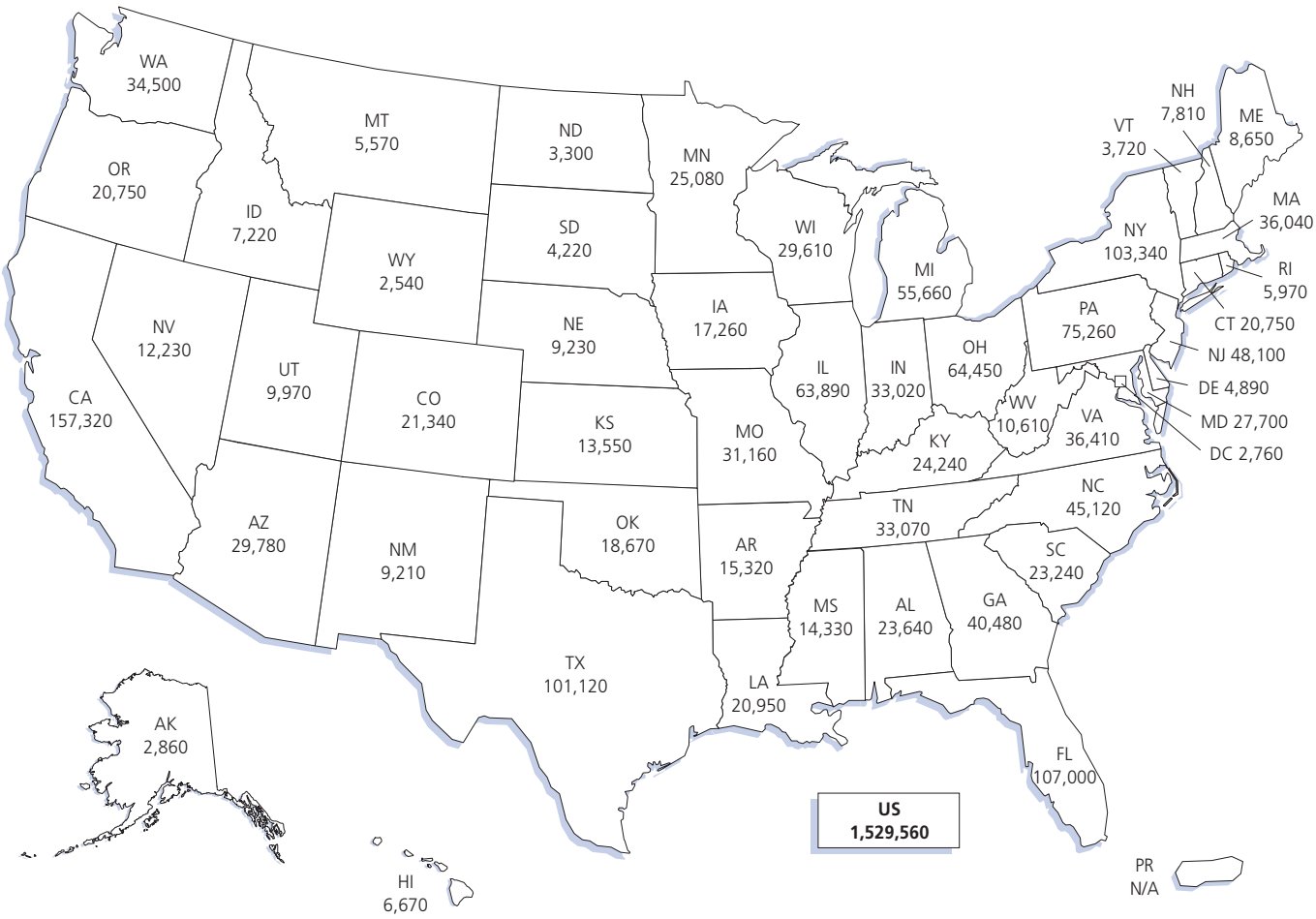
Cancer Facts & Figures 2010



Estimated number of new cancer cases for 2010, excluding basal and squamous cell skin cancers and in situ carcinomas except urinary bladder.
Note: State estimates are offered as a rough guide and should be interpreted with caution. State estimates may not add to US total due to rounding.

Special Section:
Prostate Cancer
see page 23

American Cancer Society®

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**Indicates a figure or table*

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Cancer: Basic Facts

What Is Cancer?

Cancer is a group of diseases characterized by uncontrolled growth and spread of abnormal cells. If the spread is not controlled, it can result in death. Cancer is caused by both external factors (tobacco, infectious organisms, chemicals, and radiation) and internal factors (inherited mutations, hormones, immune conditions, and mutations that occur from metabolism). These causal factors may act together or in sequence to initiate or promote carcinogenesis. Ten or more years often pass between exposure to external factors and detectable cancer. Cancer is treated with surgery, radiation, chemotherapy, hormone therapy, biological therapy, and targeted therapy.

Can Cancer Be Prevented?

All cancers caused by cigarette smoking and heavy use of alcohol could be prevented completely. The American Cancer Society estimates that in 2010 about 171,000 cancer deaths are expected to be caused by tobacco use. Scientific evidence suggests that about one-third of the 569,490 cancer deaths expected to occur in 2010 will be related to overweight or obesity, physical inactivity, and poor nutrition and thus could also be prevented. Certain cancers are related to infectious agents, such as hepatitis B virus (HBV), human papillomavirus (HPV), human immunodeficiency virus (HIV), *Helicobacter pylori (H. pylori),* and others, and could be prevented through behavioral changes, vaccines, or antibiotics. In addition, many of the more than 1 million skin cancers that are expected to be diagnosed in 2010 could be prevented by protection from the sun's rays and avoiding indoor tanning.

Regular screening examinations by a health care professional can result in the detection and removal of precancerous growths, as well as the diagnosis of cancers at an early stage, when they are most treatable. Cancers that can be prevented by removal of precancerous tissue include cancers of the cervix, colon, and rectum. Cancers that can be diagnosed early through screening include cancers of the breast, colon, rectum, cervix, prostate, oral cavity, and skin. For cancers of the breast, colon, rectum, and cervix, early detection has been proven to reduce mortality. A heightened awareness of breast changes or skin changes may also result in detection of these tumors at earlier stages. Cancers that can be prevented or detected earlier by screening account for at least half of all new cancer cases.

Who Is at Risk of Developing Cancer?

Anyone can develop cancer. Since the risk of being diagnosed with cancer increases as individuals age, most cases occur in adults who are middle-aged or older. About 78% of all cancers are diagnosed in persons 55 years and older. Cancer researchers use the word "risk" in different ways, most commonly expressing risk as lifetime risk or relative risk.

Lifetime risk refers to the probability that an individual, over the course of a lifetime, will develop or die from cancer. In the US, men have slightly less than a 1 in 2 lifetime risk of developing cancer; for women, the risk is a little more than 1 in 3.

Relative risk is a measure of the strength of the relationship between risk factors and a particular cancer. It compares the risk of developing cancer in persons with a certain exposure or trait to the risk in persons who do not have this characteristic. For example, male smokers are about 23 times more likely to develop lung cancer than nonsmokers, so their relative risk is 23. Most relative risks are not this large. For example, women who have a first-degree relative (mother, sister, or daughter) with a history of breast cancer have about twice the risk of developing breast cancer, compared to women who do not have this family history.

All cancers involve the malfunction of genes that control cell growth and division. About 5% of all cancers are strongly hereditary, in that an inherited genetic alteration confers a very high risk of developing one or more specific types of cancer. However, most cancers do not result from inherited genes but from damage to genes occurring during one's lifetime. Genetic damage may result from internal factors, such as hormones or the metabolism of nutrients within cells, or external factors, such as tobacco, chemicals, and sunlight.

How Many People Alive Today Have Ever Had Cancer?

The National Cancer Institute estimates that approximately 11.4 million Americans with a history of cancer were alive in January 2006. Some of these individuals were cancer-free, while others still had evidence of cancer and may have been undergoing treatment.

How Many New Cases Are Expected to Occur This Year?

About 1,529,560 new cancer cases are expected to be diagnosed in 2010. This estimate does not include carcinoma in situ (noninvasive cancer) of any site except urinary bladder, and does not include basal and squamous cell skin cancers, which are not required to be reported to cancer registries. More than 2 million people were treated for basal and squamous cell skin cancers in 2006.

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

This year, about 569,490 Americans are expected to die of cancer, more than 1,500 people a day. Cancer is the second most common cause of death in the US, exceeded only by heart disease. In the US, cancer accounts for nearly 1 of every 4 deaths.

What Percentage of People Survive Cancer?

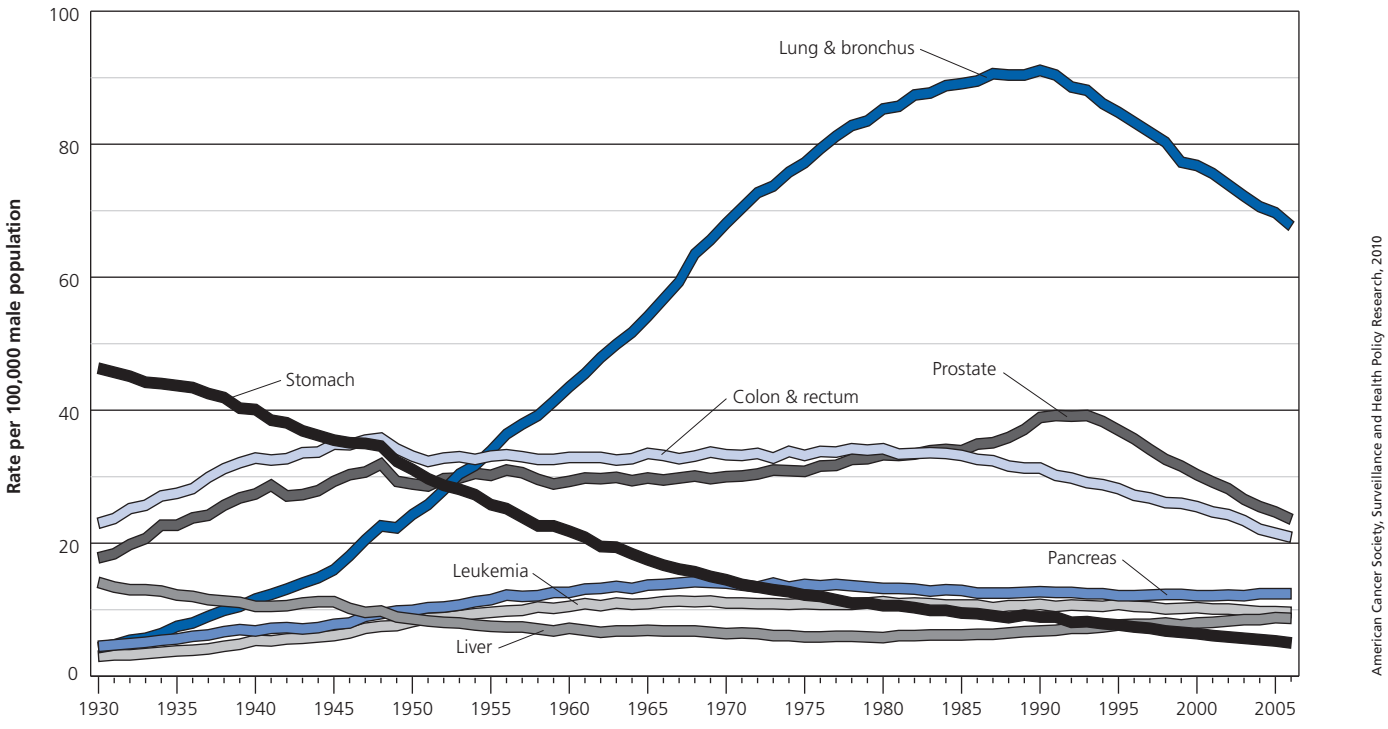
The 5-year relative survival rate for all cancers diagnosed between 1999-2005 is 68%, up from 50% in 1975-1977. (See page 18.) The improvement in survival reflects progress in diagnosing certain cancers at an earlier stage and improvements in treatment. Survival statistics vary greatly by cancer type and stage at diagnosis. Relative survival compares survival among cancer patients to that of people not diagnosed with cancer who are of the same age, race, and sex. It represents the percentage of cancer patients who are alive after some designated time period (usually 5 years) relative to persons without cancer. It does not distinguish between patients who have been cured and those who have relapsed or are still in treatment. While 5-year relative survival is useful in monitoring progress in the early detection and treatment of cancer, it does not represent the proportion of people who are cured permanently, since cancer deaths can occur beyond 5 years after diagnosis.

Although relative survival for specific cancer types provides some indication about the average survival experience of cancer patients in a given population, it may or may not predict individual prognosis and should be interpreted with caution. First, 5-year relative survival rates for the most recent time period are based on patients who were diagnosed from 1999 to 2005 and do not reflect recent advances in detection and treatment. Second, factors that influence survival, such as treatment protocols, additional illnesses, and biological or behavioral differences of each individual, cannot be taken into account in the estimation of relative survival rates. For more information about survival rates, see Sources of Statistics on page 59.

How Is Cancer Staged?

Staging describes the extent or spread of the disease at the time of diagnosis. Proper staging is essential in determining the

Age-adjusted Cancer Death Rates,* Males by Site, US, 1930-2006



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

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

Source: US Mortality Data, 1960 to 2006, US Mortality Volumes, 1930 to 1959, National Center for Health Statistics, Centers for Disease Control and Prevention, 2009.

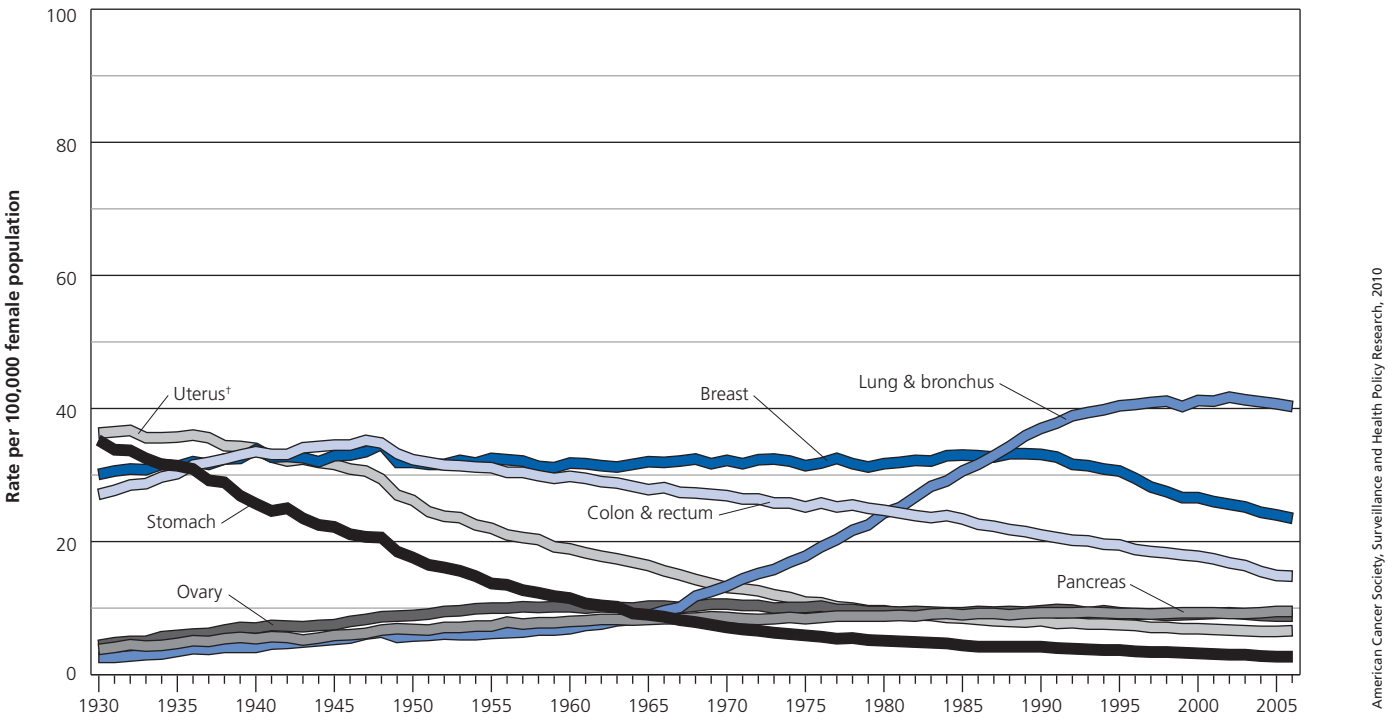
choice of therapy and in assessing prognosis. A cancer's stage is based on the primary tumor's size and whether it has spread to other areas of the body. A number of different staging systems are used to classify tumors. The TNM staging system assesses tumors in three ways: extent of the primary tumor (T), absence or presence of regional lymph node involvement (N), and absence or presence of distant metastases (M). Once the T, N, and M are determined, a stage of I, II, III, or IV is assigned, with stage I being early and stage IV being advanced disease. A different system of summary staging (in situ, local, regional, and distant) is used for descriptive and statistical analysis of tumor registry data. If cancer cells are present only in the layer of cells where they developed and have not spread, the stage is in situ. If cancer cells have penetrated the original layer of tissue, the cancer is invasive. (For a description of the other summary stage categories, see Five-year Relative Survival Rates by Stage at Diagnosis, 1999-2005, page 17.) As the molecular properties of cancer have become better understood, prognostic models have been developed for some cancer sites that incorporate biological markers and genetic features in addition to anatomical characteristics.

What Are the Costs of Cancer?

The National Institutes of Health estimates overall costs of cancer in 2010 at $263.8 billion: $102.8 billion for direct medical costs (total of all health expenditures); $20.9 billion for indirect morbidity costs (cost of lost productivity due to illness); and $140.1 billion for indirect mortality costs (cost of lost productivity due to premature death).

Lack of health insurance and other barriers prevents many Americans from receiving optimal health care. According to the US Census Bureau, 46 million Americans were uninsured in 2008; approximately 28% of Americans aged 18 to 34 years and 10% of children had no health insurance coverage. Uninsured patients and those from ethnic minorities are substantially more likely to be diagnosed with cancer at a later stage, when treatment can be more extensive and more costly. For more information on the relationship between health insurance and cancer, see *Cancer Facts & Figures 2008*, Special Section, available online at cancer.org.

Age-adjusted Cancer Death Rates,* Females by Site, US, 1930-2006



*Per 100,000, age adjusted to the 2000 US standard population. †Rates are uterine cervix and uterine corpus combined.

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

Source: US Mortality Data, 1960 to 2006, US Mortality Volumes, 1930 to 1959, National Center for Health Statistics, Centers for Disease Control and Prevention, 2009.

Estimated New Cancer Cases and Deaths by Sex for All Sites, US, 2010*

	Estimated New Cases			Estimated Deaths		
	Both Sexes	**Male**	**Female**	**Both Sexes**	**Male**	**Female**
All Sites	1,529,560	789,620	739,940	569,490	299,200	270,290
Oral cavity & pharynx	36,540	25,420	11,120	7,880	5,430	2,450
Tongue	10,990	7,690	3,300	1,990	1,300	690
Mouth	10,840	6,430	4,410	1,830	1,140	690
Pharynx	12,660	9,880	2,780	2,410	1,730	680
Other oral cavity	2,050	1,420	630	1,650	1,260	390
Digestive system	274,330	148,540	125,790	139,580	79,010	60,570
Esophagus	16,640	13,130	3,510	14,500	11,650	2,850
Stomach	21,000	12,730	8,270	10,570	6,350	4,220
Small intestine	6,960	3,680	3,280	1,100	610	490
Colon†	102,900	49,470	53,430	51,370	26,580	24,790
Rectum	39,670	22,620	17,050			
Anus, anal canal, & anorectum	5,260	2,000	3,260	720	280	440
Liver & intrahepatic bile duct	24,120	17,430	6,690	18,910	12,720	6,190
Gallbladder & other biliary	9,760	4,450	5,310	3,320	1,240	2,080
Pancreas	43,140	21,370	21,770	36,800	18,770	18,030
Other digestive organs	4,880	1,660	3,220	2,290	810	1,480
Respiratory system	240,610	130,600	110,010	161,670	89,550	72,120
Larynx	12,720	10,110	2,610	3,600	2,870	730
Lung & bronchus	222,520	116,750	105,770	157,300	86,220	71,080
Other respiratory organs	5,370	3,740	1,630	770	460	310
Bones & joints	2,650	1,530	1,120	1,460	830	630
Soft tissue (including heart)	10,520	5,680	4,840	3,920	2,020	1,900
Skin (excluding basal & squamous)	74,010	42,610	31,400	11,790	7,910	3,880
Melanoma-skin	68,130	38,870	29,260	8,700	5,670	3,030
Other nonepithelial skin	5,880	3,740	2,140	3,090	2,240	850
Breast	209,060	1,970	207,090	40,230	390	39,840
Genital system	311,210	227,460	83,750	60,420	32,710	27,710
Uterine cervix	12,200		12,200	4,210		4,210
Uterine corpus	43,470		43,470	7,950		7,950
Ovary	21,880		21,880	13,850		13,850
Vulva	3,900		3,900	920		920
Vagina & other genital, female	2,300		2,300	780		780
Prostate	217,730	217,730		32,050	32,050	
Testis	8,480	8,480		350	350	
Penis & other genital, male	1,250	1,250		310	310	
Urinary system	131,260	89,620	41,640	28,550	19,110	9,440
Urinary bladder	70,530	52,760	17,770	14,680	10,410	4,270
Kidney & renal pelvis	58,240	35,370	22,870	13,040	8,210	4,830
Ureter & other urinary organs	2,490	1,490	1,000	830	490	340
Eye & orbit	2,480	1,240	1,240	230	120	110
Brain & other nervous system	22,020	11,980	10,040	13,140	7,420	5,720
Endocrine system	46,930	11,890	35,040	2,570	1,140	1,430
Thyroid	44,670	10,740	33,930	1,690	730	960
Other endocrine	2,260	1,150	1,110	880	410	470
Lymphoma	74,030	40,050	33,980	21,530	11,450	10,080
Hodgkin lymphoma	8,490	4,670	3,820	1,320	740	580
Non-Hodgkin lymphoma	65,540	35,380	30,160	20,210	10,710	9,500
Myeloma	20,180	11,170	9,010	10,650	5,760	4,890
Leukemia	43,050	24,690	18,360	21,840	12,660	9,180
Acute lymphocytic leukemia	5,330	3,150	2,180	1,420	790	630
Chronic lymphocytic leukemia	14,990	8,870	6,120	4,390	2,650	1,740
Acute myeloid leukemia	12,330	6,590	5,740	8,950	5,280	3,670
Chronic myeloid leukemia	4,870	2,800	2,070	440	190	250
Other leukemia‡	5,530	3,280	2,250	6,640	3,750	2,890
Other & unspecified primary sites‡	30,680	15,170	15,510	44,030	23,690	20,340

*Rounded to the nearest 10; estimated new cases exclude basal and squamous cell skin cancers and in situ carcinomas except urinary bladder. About 54,010 female carcinoma in situ of the breast and 46,770 melanoma in situ will be newly diagnosed in 2010. †Estimated deaths for colon and rectum cancers are combined. ‡More deaths than cases may reflect lack of specificity in recording underlying cause of death on death certificates or an undercount in the case estimate.

Source: Estimated new cases are based on 1995-2006 incidence rates from 44 states and the District of Columbia as reported by the North American Association of Central Cancer Registries (NAACCR), represesnting about 89% of the US population. Estimated deaths are based on data from US Mortality Data, 1969 to 2007, National Center for Health Statistics, Centers for Disease Control and Prevention, 2010.

Estimated New Cancer Cases for Selected Cancer Sites by State, US, 2010*

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	23,640	3,450	200	2,300	520	560	4,160	1,210	940	3,300	920
Alaska	2,860	410	†	260	70	70	360	80	130	440	140
Arizona	29,780	3,950	210	2,620	710	760	4,030	1,430	1,210	3,850	1,530
Arkansas	15,320	1,770	140	1,500	330	420	2,620	460	640	2,330	610
California	157,320	21,130	1,540	13,950	4,470	4,460	18,490	8,030	7,010	22,640	6,620
Colorado	21,340	3,100	150	1,770	570	650	2,270	1,180	920	3,430	960
Connecticut	20,750	2,960	120	1,770	650	510	2,640	1,090	860	2,940	1,110
Delaware	4,890	690	†	440	140	120	800	210	200	710	250
Dist. of Columbia	2,760	390	†	260	80	60	360	70	100	450	90
Florida	107,000	14,080	940	10,500	2,710	3,330	18,390	4,980	4,660	14,610	5,600
Georgia	40,480	6,130	390	3,840	950	1,040	6,280	2,020	1,600	6,380	1,470
Hawaii	6,670	910	50	680	220	160	770	310	230	1,060	200
Idaho	7,220	910	60	600	200	230	860	360	310	1,300	380
Illinois	63,890	8,770	490	6,340	1,960	1,860	9,190	2,060	2,690	8,730	3,050
Indiana	33,020	4,350	230	3,330	960	890	5,430	1,200	1,370	4,160	1,510
Iowa	17,260	2,020	100	1,760	550	560	2,450	900	750	2,420	840
Kansas	13,550	1,780	90	1,270	410	400	1,990	650	590	1,630	550
Kentucky	24,240	3,290	210	2,370	610	630	4,780	1,440	1,030	3,180	1,030
Louisiana	20,950	2,530	180	2,060	440	590	3,320	600	920	3,410	850
Maine	8,650	1,160	50	800	280	260	1,370	410	360	1,410	530
Maryland	27,700	4,150	200	2,630	810	620	4,170	1,290	1,110	4,010	1,180
Massachusetts	36,040	5,320	200	3,120	1,150	910	5,020	1,770	1,460	4,820	2,000
Michigan	55,660	7,340	330	5,170	1,700	1,600	8,150	2,240	2,400	8,490	2,790
Minnesota	25,080	3,330	140	2,410	850	830	3,150	970	1,100	3,870	1,160
Mississippi	14,330	1,970	130	1,480	300	340	2,360	470	540	2,260	510
Missouri	31,160	3,880	210	3,080	910	870	5,360	1,320	1,260	3,600	1,360
Montana	5,570	680	†	490	150	160	740	200	240	960	280
Nebraska	9,230	1,160	60	910	290	290	1,200	450	410	1,470	420
Nevada	12,230	1,350	130	1,090	290	320	1,920	410	480	1,750	620
New Hampshire	7,810	990	†	720	240	200	1,070	390	310	1,100	430
New Jersey	48,100	6,820	420	4,430	1,580	1,330	6,260	2,650	2,130	6,790	2,510
New Mexico	9,210	1,180	90	790	230	280	920	420	370	1,610	350
New York	103,340	14,610	930	9,780	3,430	2,980	13,720	4,050	4,680	14,840	5,230
North Carolina	45,120	6,500	360	4,220	1,190	1,150	7,520	2,130	1,800	6,910	1,890
North Dakota	3,300	400	†	340	100	100	410	120	150	580	180
Ohio	64,450	8,280	410	5,960	2,010	1,810	10,710	2,200	2,720	8,010	2,970
Oklahoma	18,670	2,300	150	1,730	460	560	3,250	640	810	2,440	770
Oregon	20,750	2,910	130	1,710	600	530	2,810	1,200	930	3,010	1,040
Pennsylvania	75,260	10,000	540	7,440	2,450	2,070	10,520	3,550	3,430	9,800	4,050
Rhode Island	5,970	790	†	540	190	160	840	290	240	740	350
South Carolina	23,240	3,260	170	2,140	560	590	3,970	1,060	950	3,600	950
South Dakota	4,220	530	†	450	130	130	540	170	180	760	230
Tennessee	33,070	4,700	270	3,130	750	850	5,980	1,720	1,360	4,600	1,350
Texas	101,120	12,920	1,070	9,190	2,420	3,240	14,030	3,570	4,410	13,740	3,650
Utah	9,970	1,260	80	740	280	310	620	610	430	1,730	390
Vermont	3,720	520	†	320	110	90	490	190	150	600	210
Virginia	36,410	5,470	280	3,370	1,040	880	5,510	1,810	1,470	5,550	1,520
Washington	34,500	4,900	220	2,740	1,010	1,000	4,320	1,930	1,600	5,220	1,720
West Virginia	10,610	1,310	80	1,060	330	280	2,070	440	450	1,440	530
Wisconsin	29,610	4,120	200	2,760	1,040	940	3,990	1,050	1,340	4,670	1,510
Wyoming	2,540	330	†	220	70	70	320	110	110	420	130
United States	1,529,560	207,090	12,200	142,570	43,470	43,050	222,520	68,130	65,540	217,730	70,530

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

Note: 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.

Estimated Deaths for Selected Cancer Sites by State, US, 2010*

State	All Sites	Brain/ Nervous System	Female Breast	Colon & Rectum	Leukemia	Liver	Lung & Bronchus	Non-Hodgkin Lymphoma	Ovary	Pancreas	Prostate
Alabama	10,150	210	690	950	350	310	3,190	320	260	590	600
Alaska	880	†	70	80	†	†	250	†	†	60	†
Arizona	10,630	280	740	1,020	420	380	2,670	360	290	740	650
Arkansas	6,460	150	430	600	240	200	1,900	200	140	430	460
California	55,710	1,490	4,230	4,970	2,220	2,600	12,630	2,110	1,500	3,900	3,710
Colorado	6,880	210	500	660	270	230	1,670	280	210	460	390
Connecticut	6,850	150	490	540	230	200	1,760	230	180	540	410
Delaware	1,900	†	120	160	70	50	580	60	†	120	100
Dist. of Columbia	960	†	80	100	†	†	230	†	†	70	70
Florida	40,880	800	2,650	3,540	1,560	1,360	11,620	1,480	930	2,560	2,590
Georgia	15,570	340	1,100	1,430	560	430	4,620	500	390	940	930
Hawaii	2,330	†	140	220	80	120	570	90	50	180	120
Idaho	2,530	80	160	220	120	70	640	90	60	190	180
Illinois	23,360	470	1,790	2,310	900	700	6,490	740	570	1,580	1,420
Indiana	12,900	340	860	1,130	520	340	4,000	440	300	790	620
Iowa	6,370	170	380	620	300	160	1,770	290	170	380	370
Kansas	5,370	140	370	530	260	140	1,590	200	140	330	300
Kentucky	9,670	180	580	880	320	250	3,410	310	200	540	470
Louisiana	8,480	210	620	920	310	340	2,550	280	200	540	440
Maine	3,170	80	170	270	110	80	960	90	70	200	150
Maryland	10,250	210	800	950	390	360	2,760	310	250	710	650
Massachusetts	12,990	280	780	1,050	470	440	3,530	400	330	920	600
Michigan	20,740	500	1,320	1,740	810	600	5,830	700	500	1,330	1,010
Minnesota	9,200	240	610	780	390	280	2,450	330	220	600	440
Mississippi	6,060	130	400	630	230	190	2,010	190	130	360	330
Missouri	12,620	280	860	1,120	540	380	3,950	450	250	790	710
Montana	1,980	60	110	170	90	50	580	80	50	120	130
Nebraska	3,500	90	210	360	140	80	900	150	80	200	240
Nevada	4,640	120	330	530	110	180	1,300	150	110	300	270
New Hampshire	2,660	70	190	210	90	80	750	70	60	190	140
New Jersey	16,520	340	1,430	1,600	600	470	4,220	640	430	1,130	940
New Mexico	3,400	80	230	340	120	150	780	120	80	230	240
New York	34,540	800	2,490	3,120	1,380	1,270	8,720	1,480	910	2,440	1,690
North Carolina	19,100	350	1,340	1,520	650	500	5,650	570	390	1,160	980
North Dakota	1,280	†	80	120	60	†	320	†	†	90	70
Ohio	24,980	540	1,730	2,280	930	680	7,260	840	540	1,530	1,440
Oklahoma	7,660	170	520	700	290	220	2,390	280	160	400	320
Oregon	7,510	210	490	690	280	230	2,100	310	210	490	430
Pennsylvania	28,690	550	1,980	2,610	1,100	840	7,960	1,100	730	2,010	1,660
Rhode Island	2,170	50	130	150	90	70	600	60	60	120	80
South Carolina	9,180	200	640	770	330	270	2,870	300	220	560	490
South Dakota	1,670	†	100	160	70	†	450	60	50	100	100
Tennessee	13,600	340	890	1,190	490	380	4,520	470	250	750	690
Texas	36,540	840	2,780	3,340	1,410	1,660	9,600	1,280	840	2,200	1,820
Utah	2,820	100	250	250	140	80	480	100	80	200	200
Vermont	1,280	†	90	120	50	†	370	†	†	80	50
Virginia	14,230	300	1,120	1,300	510	410	4,050	450	370	930	710
Washington	11,640	370	790	980	480	440	3,110	440	330	760	770
West Virginia	4,670	100	270	440	150	120	1,480	190	110	220	130
Wisconsin	11,310	270	690	900	490	330	2,940	410	290	720	600
Wyoming	1,000	†	60	110	†	†	260	50	†	70	†
United States	569,490	13,140	39,840	51,370	21,840	18,910	157,300	20,210	13,850	36,800	32,050

*Rounded to nearest 10. †Estimate is fewer than 50 deaths.

Note: State estimates may not add to US total due to rounding and exclusion of state estimates fewer than 50 deaths.

Source: US Mortality Data, 1969 to 2007, National Center for Health Statistics, Centers for Disease Control and Prevention, 2010.

Cancer Incidence Rates* by Site and State, US, 2002-2006

	All Sites		Breast	Colon & Rectum		Lung & Bronchus		Non-Hodgkin Lymphoma		Prostate	Urinary Bladder	
State	**Male**	**Female**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Male**	**Female**
Alabama†	561.2	379.6	114.6	61.7	42.0	107.8	52.9	20.5	13.8	154.2	31.8	7.6
Alaska	529.4	417.7	126.4	60.0	45.6	84.6	64.3	22.6	17.6	141.4	41.6	7.3
Arizona‡	465.9	364.0	108.8	48.9	36.0	69.6	49.1	18.9	13.5	118.9	35.3	8.9
Arkansas	562.8	383.5	113.1	58.8	42.7	111.3	59.5	21.8	15.6	161.3	33.0	8.6
California	510.1	393.3	122.3	52.2	39.2	65.1	47.0	22.4	15.5	149.0	34.0	8.2
Colorado	501.5	394.1	123.1	50.0	39.5	60.5	45.2	21.0	16.2	156.4	33.6	8.8
Connecticut	591.0	455.5	135.0	62.8	46.5	81.8	60.1	25.8	18.1	164.6	45.4	12.6
Delaware	607.7	440.8	123.9	62.0	44.8	97.6	70.0	23.5	16.1	179.9	42.8	11.1
Dist. of Columbia‡	556.0	412.1	132.7	57.4	46.3	81.4	46.6	22.8	13.7	175.2	24.0	8.3
Florida	537.3	404.2	114.1	55.2	41.7	89.2	60.3	21.6	15.4	138.4	37.4	9.7
Georgia	566.4	392.4	118.5	58.7	42.3	101.7	53.3	20.8	14.1	162.4	32.7	8.0
Hawaii	486.7	383.0	121.4	61.3	41.5	68.8	40.1	19.0	12.6	128.6	26.2	6.2
Idaho	538.4	401.7	117.5	49.9	38.0	68.7	48.3	21.4	17.2	165.8	37.0	8.8
Illinois	579.8	429.1	123.1	67.2	48.3	92.3	58.8	24.1	16.2	157.9	40.7	10.5
Indiana	551.3	415.1	115.3	62.8	46.4	103.6	63.3	22.8	16.4	135.9	37.4	9.4
Iowa	558.9	429.2	124.0	64.4	49.6	89.9	53.1	24.4	17.6	144.9	40.7	9.6
Kansas	557.2	417.2	126.1	61.3	43.6	87.6	53.2	24.1	18.0	159.6	36.2	8.5
Kentucky	608.4	446.4	119.8	68.0	49.8	133.1	76.9	23.1	16.9	142.5	39.0	9.9
Louisiana†	619.2	409.6	119.6	68.5	47.3	109.5	57.9	23.2	16.7	176.8	35.2	8.6
Maine	620.9	465.8	128.6	65.9	48.8	99.2	66.0	24.5	19.2	164.8	49.4	13.4
Maryland§	—	—	—	—	—	—	—	—	—	—	—	—
Massachusetts	591.8	452.9	132.2	63.9	45.7	83.7	62.4	23.4	16.5	164.6	46.7	12.9
Michigan	597.5	437.9	124.2	58.8	44.6	93.0	61.5	25.2	18.7	179.4	41.9	10.5
Minnesota	567.2	416.4	126.4	56.4	42.3	69.8	49.5	26.4	17.7	184.6	40.1	10.3
Mississippi†‡	574.7	382.1	108.2	64.5	46.3	111.7	54.5	20.9	13.5	166.7	29.6	7.5
Missouri	544.3	417.2	121.9	62.3	44.9	105.2	63.4	21.8	15.5	129.3	35.8	8.9
Montana	541.9	406.3	119.6	52.5	40.3	75.3	57.4	22.8	14.9	174.5	40.8	9.1
Nebraska	561.8	418.2	126.4	67.6	47.5	84.6	49.3	24.7	17.4	157.6	37.2	9.5
Nevada	531.2	412.0	112.1	55.2	43.4	83.3	69.0	22.2	15.3	144.2	40.7	11.0
New Hampshire	584.3	455.3	131.2	59.0	44.5	82.1	62.7	23.5	18.2	159.5	48.0	13.4
New Jersey	603.9	449.5	128.0	65.4	48.0	79.6	56.0	25.6	17.7	177.9	46.2	12.2
New Mexico	480.5	366.1	109.6	49.4	35.8	57.5	39.0	17.9	14.3	146.1	26.7	7.0
New York	577.5	434.4	124.5	60.8	45.8	79.4	54.1	24.7	17.3	166.3	42.3	11.1
North Carolina	553.4	398.1	120.3	57.2	41.6	101.3	56.0	21.2	15.1	153.2	34.9	8.8
North Dakota	549.3	402.7	122.8	66.6	43.1	74.6	48.0	22.7	15.8	169.5	39.6	10.0
Ohio§	—	—	—	—	—	—	—	—	—	—	—	—
Oklahoma	561.4	422.2	127.2	60.1	43.7	105.6	65.1	22.9	17.5	150.0	34.9	8.6
Oregon	529.3	429.7	131.9	52.8	41.1	79.4	60.4	24.4	17.0	148.0	39.2	10.0
Pennsylvania	592.7	444.6	124.5	66.1	48.3	91.0	56.4	25.1	17.5	159.7	44.8	11.2
Rhode Island	608.9	455.3	128.3	65.7	46.2	92.2	62.2	24.8	17.5	152.2	53.1	13.0
South Carolina	587.4	397.5	119.2	61.2	44.1	102.2	53.0	20.7	14.6	171.5	32.4	7.8
South Dakota	547.8	395.3	119.6	60.2	44.5	78.7	46.3	22.1	17.0	171.0	39.1	8.1
Tennessee‡¶	548.3	400.6	116.4	58.4	43.2	113.6	60.6	21.6	15.8	132.7	34.0	8.3
Texas†	539.6	389.9	114.9	57.5	39.7	88.3	51.2	22.3	16.1	144.0	30.2	7.3
Utah	486.8	346.6	110.0	45.3	33.7	37.8	23.0	22.4	16.3	182.2	28.3	6.1
Vermont§	—	—	—	—	—	—	—	—	—	—	—	—
Virginia	529.5	385.8	120.7	55.5	41.8	88.5	53.6	20.6	13.4	155.0	33.3	8.4
Washington	566.9	443.3	134.8	52.6	40.1	78.7	59.5	27.2	18.3	165.3	41.3	10.2
West Virginia	578.6	437.1	114.7	69.5	50.7	117.7	70.1	22.9	16.8	138.6	39.8	11.4
Wisconsin§	—	—	—	—	—	—	—	—	—	—	—	—
Wyoming	516.5	392.9	117.8	52.0	43.0	62.1	47.7	21.4	15.8	168.0	42.1	10.0
United States	556.5	414.8	121.8	59.0	43.6	86.4	55.5	23.1	16.3	155.5	37.9	9.6

*Per 100,000, age adjusted to the 2000 US standard population. †Due to the effect of large migrations of populations on this state as a result of Hurricane Katrina in September 2005, rates exclude cases diagnosed from July-December, 2005. ‡This state's registry did not achieve high-quality data standards for one or more years during 2002-2006 according to the North American Association of Central Cancer Registry (NAACCR) data quality indicators. §This state's registry did not submit incidence data to NAACCR for 2002-2006. ¶Case ascertainment for this state's registry is incomplete for the years 2002-2006.

Source: NAACCR, 2009. Data are collected by cancer registries participating in the National Cancer Institute's SEER program and the Centers for Disease Control and Prevention's National Program of Cancer Registries.

American Cancer Society, Surveillance and Health Policy Research, 2010

Cancer Death Rates* by Site and State, US, 2002-2006

	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	267.7	161.5	25.1	24.2	15.2	93.4	41.7	8.8	5.8	12.7	8.9	31.2
Alaska	217.0	155.2	21.7	19.7	14.1	63.6	43.4	8.0	5.3	12.2	9.1	24.2
Arizona	196.9	138.4	21.8	19.0	12.9	56.4	36.3	8.1	5.4	10.6	7.8	22.1
Arkansas	261.6	165.2	24.3	24.0	16.1	96.9	47.6	9.3	5.3	12.6	9.1	27.5
California	202.2	147.6	23.2	19.2	13.9	53.0	35.3	8.5	5.3	11.5	9.2	24.2
Colorado	196.0	142.3	22.2	19.8	14.5	49.7	33.2	8.5	5.2	11.1	8.8	25.5
Connecticut	223.4	156.8	24.4	20.1	14.9	61.2	40.1	9.1	5.5	13.9	10.1	26.6
Delaware	246.0	165.8	24.0	23.2	15.5	78.6	48.5	9.1	5.3	11.5	8.8	26.8
Dist. of Columbia	270.2	164.3	28.9	26.2	17.5	74.3	35.0	9.6	4.0	14.9	10.2	43.3
Florida	215.2	147.9	22.6	19.5	13.9	68.3	41.2	8.6	5.4	11.6	8.5	21.3
Georgia	245.9	155.1	24.5	22.2	15.1	84.1	39.5	8.3	5.2	12.3	9.1	29.7
Hawaii	186.2	122.4	17.7	20.1	11.7	50.5	26.4	7.1	4.5	11.8	9.6	17.4
Idaho	205.5	146.2	22.3	17.6	13.4	54.6	35.1	8.6	5.8	11.3	10.3	28.2
Illinois	240.5	165.3	25.7	24.9	16.8	72.6	42.0	9.4	6.0	13.2	9.9	27.0
Indiana	253.0	170.1	24.8	24.9	16.3	85.3	48.0	10.1	6.2	13.1	9.6	26.2
Iowa	229.1	154.6	22.9	23.0	16.1	72.1	38.1	10.0	6.3	11.7	9.3	26.7
Kansas	227.1	156.5	24.6	22.0	15.7	72.7	41.8	9.7	6.1	12.5	9.2	23.5
Kentucky	280.7	178.7	24.8	26.2	18.2	107.6	56.4	9.8	6.0	12.4	9.3	26.6
Louisiana	278.6	175.8	28.9	27.6	17.5	92.9	46.1	9.7	6.4	13.8	10.8	30.4
Maine	251.3	172.4	23.4	21.9	16.3	79.2	49.4	9.3	6.1	12.9	10.1	26.2
Maryland	236.8	165.3	26.8	23.3	16.3	71.5	43.8	8.7	5.2	12.9	10.3	28.4
Massachusetts	235.4	163.5	24.2	22.3	15.9	67.0	44.2	9.3	6.1	13.5	9.9	25.5
Michigan	236.2	164.9	25.1	21.9	15.7	73.5	43.9	10.0	6.6	12.9	9.5	24.8
Minnesota	215.4	151.7	22.2	19.3	14.4	58.7	37.3	9.9	5.8	11.7	9.2	26.8
Mississippi	280.1	166.0	26.4	25.0	17.5	100.2	43.7	8.7	5.1	13.2	10.2	34.2
Missouri	249.4	167.1	26.3	23.3	16.2	86.0	46.6	9.2	5.9	12.7	9.2	24.0
Montana	214.9	160.0	23.1	19.8	14.5	61.7	43.0	8.8	5.8	11.9	8.7	28.4
Nebraska	220.5	149.7	22.9	24.0	16.3	65.8	35.5	9.1	6.2	11.9	8.1	24.5
Nevada	223.3	168.2	24.4	23.1	16.5	66.1	51.2	7.1	5.4	12.3	9.4	25.4
New Hampshire	233.2	163.1	23.3	22.0	15.1	66.9	44.7	9.2	6.2	11.6	10.8	27.2
New Jersey	226.7	166.2	27.4	24.1	17.2	62.7	40.1	9.5	5.8	12.7	10.0	24.5
New Mexico	199.2	140.2	22.5	19.9	13.6	47.3	29.7	7.5	5.0	11.3	9.2	26.3
New York	211.7	153.9	24.7	22.1	15.8	59.5	37.2	8.3	5.4	12.4	9.7	24.6
North Carolina	248.3	158.9	25.1	21.6	14.9	83.7	41.8	8.6	5.7	13.0	9.3	28.9
North Dakota	214.1	149.3	23.0	21.7	16.1	60.5	34.2	8.5	5.7	11.7	9.1	27.9
Ohio	251.9	170.2	27.1	24.2	17.1	81.5	45.5	9.7	6.0	12.5	9.4	27.0
Oklahoma	247.6	163.7	25.1	23.5	15.4	85.9	46.9	9.6	5.6	11.8	8.5	24.1
Oregon	223.2	165.5	23.9	19.5	14.8	65.7	46.8	9.7	6.5	12.4	9.8	26.9
Pennsylvania	243.2	166.3	26.4	24.6	16.5	72.4	40.7	9.9	6.2	13.2	9.7	26.0
Rhode Island	240.4	161.2	23.1	22.3	15.5	70.5	42.6	9.3	5.6	11.8	9.3	25.5
South Carolina	256.2	158.3	25.0	22.6	15.6	86.2	40.5	8.3	5.5	12.3	9.5	30.6
South Dakota	221.8	148.1	22.9	21.7	15.1	65.4	36.9	8.6	5.3	11.3	9.6	27.4
Tennessee	268.0	169.5	25.9	23.7	15.9	97.8	47.4	9.7	6.2	12.7	9.4	28.3
Texas	227.3	150.3	23.4	21.5	14.3	70.8	38.3	8.5	5.6	11.7	8.7	24.3
Utah	167.0	118.7	23.8	15.5	11.7	32.8	17.6	8.4	5.1	10.8	7.9	26.0
Vermont	216.2	155.1	22.9	22.1	15.7	60.7	40.7	9.2	5.5	10.7	8.2	26.2
Virginia	241.4	159.9	26.0	22.6	15.2	76.4	42.2	8.3	5.5	12.7	9.6	28.9
Washington	217.3	160.2	23.3	18.7	13.9	63.6	44.4	9.7	6.0	12.0	9.6	26.1
West Virginia	263.1	175.9	24.4	26.0	18.1	92.8	50.4	10.1	6.3	10.9	8.0	23.9
Wisconsin	226.3	156.6	23.4	20.7	14.5	62.9	38.7	9.4	6.1	12.7	9.7	27.8
Wyoming	206.7	154.4	22.6	18.7	17.1	57.3	38.1	8.0	7.3	12.1	9.9	24.1
United States	229.9	157.8	24.5	21.9	15.4	70.5	40.9	9.0	5.7	12.3	9.3	25.6

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

Source: US Mortality Data 2002-2006, National Center for Health Statistics, Centers for Disease Control and Prevention, 2009.

American Cancer Society, Surveillance and Health Policy Research, 2010

Selected Cancers

Breast

New Cases: An estimated 207,090 new cases of invasive breast cancer are expected to occur among women in the US during 2010; about 1,970 new cases are expected in men. Excluding cancers of the skin, breast cancer is the most frequently diagnosed cancer in women. After increasing from 1994 to 1999, female breast cancer incidence rates decreased from 1999 to 2006 by 2.0% per year. This decrease may reflect reductions in the use of menopausal hormone therapy (MHT), previously known as hormone replacement therapy, following the publication of results from the Women's Health Initiative in 2002, which linked combined estrogen plus progestin MHT use to increased risk of coronary heart disease and breast cancer. It might also reflect a slight drop in mammography utilization during that time period, which could delay the diagnosis of some tumors. According to the National Health Interview Survey, mammography rates in women 40 and older decreased from 70.1% in 2000 to 66.4% in 2005.

In addition to invasive breast cancer, 54,010 new cases of in situ breast cancer are expected to occur among women in 2010. Of these, approximately 85% will be ductal carcinoma in situ (DCIS). Since 1998, in situ breast cancer incidence rates have been stable in white women and increasing in African American women.

Deaths: An estimated 40,230 breast cancer deaths (39,840 women, 390 men) are expected in 2010. Breast cancer ranks second as a cause of cancer death in women (after lung cancer). Death rates for breast cancer have steadily decreased in women since 1990, with larger decreases in women younger than 50 (a decrease of 3.2% per year) than in those 50 and older (2.0% per year). The decrease in breast cancer death rates represents progress due to earlier detection, improved treatment, and in the more recent time period, decreased incidence.

Signs and symptoms: The earliest sign of breast cancer is often an abnormality detected on a mammogram, before it can be felt by the woman or a health care professional. Larger tumors may become evident as a painless mass. Less common symptoms include persistent changes to the breast, such as thickening, swelling, distortion, tenderness, skin irritation, redness, scaliness, or nipple abnormalities, such as ulceration, retraction, or spontaneous discharge. Typically, breast pain results from benign conditions and is not an early symptom of breast cancer.

Risk factors: Aside from being female, age is the most important risk factor for breast cancer. Potentially modifiable risk factors include weight gain after age 18, being overweight or obese (for postmenopausal breast cancer), use of combined estrogen and progestin MHT, physical inactivity, and consumption of one or more alcoholic beverages per day. Medical findings that predict higher risk include high breast tissue density (a mammographic measure of the amount of glandular tissue relative to fatty tissue in the breast), high bone mineral density (routinely measured to identify women at increased risk for osteoporosis), and biopsy-confirmed hyperplasia (especially atypical hyperplasia). High-dose radiation to the chest, typically related to cancer treatment, also increases risk. Reproductive factors that increase risk include a long menstrual history (menstrual periods that start early and/or end late in life), recent use of oral contraceptives, never having children, and having one's first child after age 30.

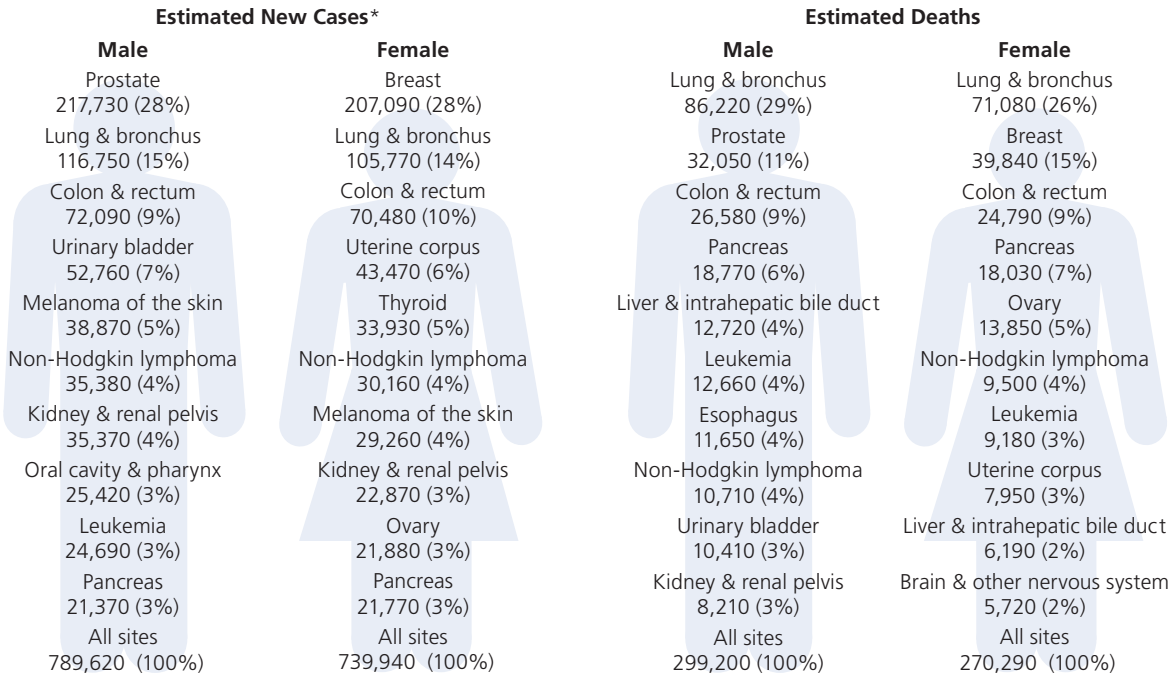
Risk is also increased by a personal or family history of breast cancer and inherited genetic mutations in the breast cancer susceptibility genes BRCA1 and BRCA2. Although these mutations account for approximately 5%-10% of all breast cancer cases, they are very rare in the general population (less than 1%), so widespread genetic testing is not recommended. Some population groups, such as individuals of Ashkenazi Jewish descent, have an increased prevalence of BRCA1 and BRCA2 mutation carriers. Women with a strong family history of breast and/or ovarian cancer should be offered counseling to determine if genetic testing is appropriate. Studies suggest that prophylactic removal of the ovaries and/or breasts in BRCA1 and BRCA2 mutation carriers decreases the risk of breast cancer considerably, although not all women who choose this surgery would have developed breast cancer. Women who consider these options should undergo counseling before reaching a decision. Men with family members who are BRCA gene mutation carriers are also at risk for these mutations, and male BRCA 2 mutation carriers are at particularly increased risk for breast cancer.

Modifiable factors that are associated with a lower risk of breast cancer include breastfeeding, moderate or vigorous physical activity, and maintaining a healthy body weight. Two medications, tamoxifen and raloxifene, have been approved to reduce breast cancer risk in women at high risk. Raloxifene appears to have a lower risk of side effects, such as uterine cancer and blood clots. In women with estrogen-receptor positive breast cancer, additional treatment with tamoxifen reduces the risk of second breast cancers by about half.

Research is ongoing to identify additional modifiable risk factors for breast cancer. The International Agency for Research on Cancer recently concluded that there is limited evidence that tobacco smoking causes breast cancer. There is also some evidence that shift work, particularly at night, is associated with an increased risk of breast cancer.

Early detection: Mammography can detect breast cancer at an early stage, when treatment is more effective and a cure is more likely. Numerous studies have shown that early detection saves lives and increases treatment options. Steady declines in breast

Leading Sites of New Cancer Cases and Deaths – 2010 Estimates



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

cancer mortality among women since 1990 have been attributed to a combination of early detection and improvements in treatment. Mammography is a very accurate screening tool, both for women at average and increased risk; however, like most medical tests, it is not perfect. On average, mammography will detect about 80%-90% of breast cancers in women without symptoms. All suspicious abnormalities should be biopsied for a definitive diagnosis. Annual screening using magnetic resonance imaging (MRI) in addition to mammography is recommended for women at high lifetime risk of breast cancer starting at age 30. (For more information, see Saslow et al. *CA Cancer J Clin* 2007; 57:75-89.) Concerted efforts should be made to improve access to health care and to encourage all women 40 and older to receive regular mammograms.

Treatment: Taking into account tumor size, stage, and other characteristics, as well as patient preference, treatment may involve lumpectomy (surgical removal of the tumor with clear margins) or mastectomy (surgical removal of the breast). Removal of some of the axillary (underarm) lymph nodes is usually also recommended to obtain accurate information on the stage of disease. Treatment may also involve radiation therapy, chemotherapy (before or after surgery), hormone therapy (tamoxifen, aromatase inhibitors), or targeted therapy. Postmenopausal women with breast cancer that tests positive for hormone receptors benefit from treatment with an aromatase inhibitor, either after, or instead of, tamoxifen. For women whose cancer tests positive for HER2/neu, approved targeted therapies include trastuzumab (Herceptin) and, for advanced disease, lapatinib (Tykerb). The US Food and Drug Administration (FDA) approved bevacizumab (Avastin) for advanced breast cancer in 2008. Avastin slows tumor growth in women whose cancer has metastasized by blocking growth of new vessels that increase blood supply to the tumor, but it has not yet been shown to increase overall survival.

Numerous studies have shown that long-term survival rates after lumpectomy plus radiation therapy are similar to survival rates after mastectomy for women whose cancer has not spread to the skin, chest wall, or distant organs. Similarly, sentinel lymph node (the first lymph nodes to which cancer is likely to spread) biopsy is as effective and less damaging than full axillary node dissection in determining whether the tumor has spread beyond the breast in women with early stage disease. Women who elect to have sentinel lymph node biopsy should have their breast cancer surgery performed by a medical care team that is experienced with the technique. For women undergoing mastectomy, significant advances in reconstruction techniques provide several options for breast reconstruction, including the timing of the procedure (i.e., during mastectomy or in the time period following the procedure).

It is recommended that all patients with ductal carcinoma in situ (DCIS) be treated to avoid the potential development of invasive cancer. Treatment options for DCIS include lumpectomy with radiation therapy or mastectomy; either of these options may be followed by treatment with tamoxifen. Removal of axillary lymph nodes is not generally needed. A recent report by a panel of experts convened by the National Institutes of Health concluded that in light of the noninvasive nature and favorable prognosis of DCIS, the primary goal for future research is the ability to accurately group patients into risk categories that will allow the most successful outcomes with minimal necessary treatment.

Survival: The 5-year relative survival for female breast cancer patients has improved from 63% in the early 1960s to 90% today. The survival rate for women diagnosed with localized breast cancer (cancer that has not spread to lymph nodes or other locations outside the breast) is 98%. If the cancer has spread to nearby (regional stage) or distant (distant stage) lymph nodes or organs, the 5-year survival is 84% or 23%, respectively. Relative survival continues to decline after 5 years; for all stages combined, rates at 10 and 15 years after diagnosis are 82% and 75%, respectively. Caution should be used when interpreting long-term survival rates since they represent patients who were diagnosed and treated up to 22 years ago. Improvements in diagnosis and treatment may result in a better outlook for more recently diagnosed patients.

Many studies have shown that being overweight adversely affects survival for postmenopausal women with breast cancer and that women who are more physically active are less likely to die from the disease than women who are inactive. For more information about breast cancer, see the American Cancer Society's *Breast Cancer Facts & Figures 2009-2010* (8610.09), available online at cancer.org.

Childhood Cancer

New cases: An estimated 10,700 new cases are expected to occur among children aged 0 to 14 years in 2010. Childhood cancers are rare, representing less than 1% of all new cancer diagnoses.

Deaths: An estimated 1,340 deaths are expected to occur among children aged 0 to 14 years in 2010, about one-third of these from leukemia. Although uncommon, cancer is the second leading cause of death in children, exceeded only by accidents. Mortality rates for childhood cancer have declined by 55% since 1975. The substantial progress in childhood cancer survival rates is largely attributable to improvements in treatment and the high proportion of patients participating in clinical trials.

Early detection: Early symptoms are usually nonspecific. Parents should ensure that children have regular medical checkups and should be alert to any unusual symptoms that persist. Symptoms of childhood cancer include an unusual mass or swelling; unexplained paleness or loss of energy; sudden tendency to bruise; a persistent, localized pain; prolonged, unexplained fever or illness; frequent headaches, often with vomiting; sudden eye or vision changes; and excessive, rapid weight loss. According to the International Classification of Childhood Cancer, childhood cancers include:

- Leukemia (31.0% of all childhood cancers), which may be recognized by bone and joint pain, weakness, bleeding, and fever
- Brain and other nervous system (21.3%), which in early stages may cause headaches, nausea, vomiting, blurred or double vision, dizziness, and difficulty in walking or handling objects
- Neuroblastoma (7.1%), a cancer of the sympathetic nervous system that usually appears as a swelling in the abdomen
- Wilms tumor (5.2%), a kidney cancer that may be recognized by a swelling or lump in the abdomen
- Non-Hodgkin lymphoma (4.3%) and Hodgkin lymphoma (3.8%), which affect lymph nodes but may spread to bone marrow and other organs, and may cause swelling of lymph nodes in the neck, armpit, or groin; weakness; and fever
- Rhabdomyosarcoma (3.3%), a soft tissue sarcoma that can occur in the head and neck, genitourinary area, trunk, and extremities, and may cause pain and/or a mass or swelling
- Retinoblastoma (2.6%), an eye cancer that is typically recognized because of discoloration of the eye pupil and usually occurs in children younger than 4 years
- Osteosarcoma (2.5%), a bone cancer that most commonly appears as sporadic pain in the affected bone that may worsen at night or with activity, with eventual progression to local swelling; most often occurs in adolescents
- Ewing sarcoma (1.6%), another type of cancer that usually arises in bone, appears as pain at the tumor site, and most often occurs in adolescents

(Proportions are provided for all races combined and may vary according to race/ethnicity.)

Treatment: Childhood cancers can be treated by a combination of therapies (surgery, radiation, and chemotherapy) chosen based on the type and stage of cancer. Treatment is coordinated by a team of experts, including pediatric oncologists, pediatric nurses, social workers, psychologists, and others who assist children and their families. Because these cancers are uncommon, outcomes are more successful when treatment is managed by a children's cancer center. If the child is eligible, placement in a clinical trial, which compares the best current treatment to new treatment, should also be considered.

Survival: For all childhood cancers combined, the 5-year relative survival has improved markedly over the past 30 years, from less than 50% before the 1970s to 80% today, due to new and improved treatments. However, rates vary considerably, depending on cancer type; moreover, within the major catego-

ries, cancer subtypes may vary in response to treatment and/or survival characteristics. For the most recent time period (1999-2005), the 5-year survival for rhabdomyosarcoma is 66%; osteosarcoma, 69%; brain and other nervous system, 71%; neuroblastoma, 74%; leukemia, 82%; non-Hodgkin lymphoma, 85%; Wilms tumor, 88%; and Hodgkin lymphoma, 94%. Survivors of childhood cancer may experience treatment-related side effects. Late treatment effects include organ malfunction, secondary cancers, and cognitive impairments. The Children's Oncology Group (COG) has developed long-term follow-up guidelines for screening and management of late effects in survivors of childhood cancer. For more information on childhood cancer management, see the COG Web site at survivorshipguidelines.org. The Childhood Cancer Survivor Study, which has followed more than 14,000 long-term childhood cancer survivors, has also provided important and valuable new information about the late effects of cancer treatment; for more information, visit ccss.stjude.org/.

Colon and Rectum

New cases: An estimated 102,900 cases of colon and 39,670 cases of rectal cancer are expected to occur in 2010. Colorectal cancer is the third most common cancer in both men and women. Colorectal cancer incidence rates have been decreasing for most of the past two decades (from 66.3 cases per 100,000 persons in 1985 to 45.5 cases in 2006). The decline accelerated from 1998 to 2006 (3.0% per year in men and 2.2% per year in women), which has largely been attributed to increases in the use of colorectal cancer screening tests that allow the detection and removal of colorectal polyps before they progress to cancer. In contrast to the overall declines, among adults younger than 50 years, for whom screening is not recommended for those at average risk, colorectal cancer incidence rates have been increasing by about 2% per year since 1994 in both men and women.

Deaths: An estimated 51,370 deaths from colorectal cancer are expected to occur in 2010, accounting for 9% of all cancer deaths. Mortality rates for colorectal cancer have declined in both men and women over the past two decades, with steeper declines in the most recent time period (3.9% per year from 2002 to 2006 in men and 3.4% per year from 2001 to 2006 in women). This decrease reflects declining incidence rates and improvements in early detection and treatment.

Signs and symptoms: Early stage colorectal cancer does not usually have symptoms; therefore, screening is often necessary to detect colorectal cancer in its early stages. Advanced disease may cause rectal bleeding, blood in the stool, a change in bowel habits, and cramping pain in the lower abdomen. In some cases, blood loss from the cancer leads to anemia (low red blood cells), causing symptoms such as weakness and excessive fatigue. Due to an increase in colorectal cancer incidence in younger adults in recent years, timely evaluation of symptoms consistent with colorectal cancer in adults under age 50 is especially important.

Risk factors: The risk of colorectal cancer increases with age; 91% of cases are diagnosed in individuals aged 50 and older. Several modifiable factors are associated with increased risk of colorectal cancer. Among these are obesity, physical inactivity, a diet high in red or processed meat, heavy alcohol consumption, long-term smoking, and possibly inadequate intake of fruits and vegetables. Consumption of milk and calcium appears to decrease risk. Studies suggest that regular use of nonsteroidal anti-inflammatory drugs, such as aspirin, and menopausal hormone therapy may also reduce colorectal cancer risk. However, these drugs are not currently recommended for the prevention of colorectal cancer because they can have serious adverse health effects.

Colorectal cancer risk is also increased by certain inherited genetic mutations (familial adenomatous polyposis [FAP] and hereditary non-polyposis colorectal cancer [HNPCC], also known as Lynch syndrome), a personal or family history of colorectal cancer and/or polyps, or a personal history of chronic inflammatory bowel disease. Studies have also found an association between diabetes and colorectal cancer.

Early detection: Beginning at age 50, men and women who are at average risk for developing colorectal cancer should begin screening. Screening can result in the detection and removal of colorectal polyps before they become cancerous, as well as the detection of cancer that is at an early stage. Thus, colorectal cancer screening reduces mortality both by decreasing the incidence of cancer and by detecting cancers at early, more treatable stages. The American Cancer Society collaborated with several other organizations to release updated colorectal cancer screening guidelines in March 2008. These joint guidelines emphasize cancer prevention and draw a distinction between colorectal screening tests that primarily detect cancer and those that can detect both cancer and precancerous polyps. There are a number of recommended screening options that vary by the extent of bowel preparation, as well as test performance, limitations, time interval, and cost. For detailed information on colorectal cancer screening options, see *Colorectal Cancer Facts & Figures 2008-2010* on cancer.org. (See page 62 for the American Cancer Society's screening guidelines for colorectal cancer.)

Treatment: Surgery is the most common treatment for colorectal cancer. For cancers that have not spread, surgical removal may be curative. A permanent colostomy (creation of an abdominal opening for elimination of body wastes) is rarely needed for colon cancer and is infrequently required for rectal cancer. Chemotherapy alone, or in combination with radiation (for rectal cancer), is given before or after surgery to most patients whose cancer has penetrated the bowel wall deeply or spread to lymph nodes. Adjuvant chemotherapy (anticancer drugs in addition to surgery or radiation) for colon cancer in otherwise healthy patients aged 70 and older is equally effective and can be no more toxic than in younger patients. A chemotherapy combination referred to as FOLFOX (oxaliplatin, fluorouracil,

and leucovorin) is often used to treat persons with metastatic carcinoma of the colon or rectum. Three targeted monoclonal antibody therapies are approved by the FDA to treat metastatic colorectal cancer: bevacizumab (Avastin) blocks the growth of blood vessels to the tumor, and cetuximab (Erbitux) and panitumumab (Vectibix) both block the effects of hormone-like factors that promote cancer cell growth.

Survival: The 1- and 5-year relative survival for persons with colorectal cancer is 83% and 65%, respectively. Survival continues to decline beyond 5 years to 59% at 10 years after diagnosis. When colorectal cancers are detected at an early, localized stage, the 5-year survival is 91%; however, only 39% of colorectal cancers are diagnosed at this stage, in part due to underuse of screening. After the cancer has spread regionally to involve adjacent organs or lymph nodes, the 5-year survival drops to 70%. When the disease has spread to distant organs, the 5-year survival is 11%.

Kidney

New cases: An estimated 58,240 new cases of kidney (renal) cancer are expected to be diagnosed in 2010. Kidney cancer includes renal cell carcinoma (92%), renal pelvis carcinoma (7%), and Wilms tumor (1%), a childhood cancer that usually develops before age 5. (See Childhood Cancer, page 11, for information about Wilms tumor.) Incidence rates of kidney cancer have been increasing since 1975 by 1.8% per year in men and 2.4% per year in women, primarily due to increases in local stage disease.

Deaths: An estimated 13,040 deaths from kidney cancer are expected to occur in 2010. Death rates for kidney cancer have been decreasing in women by 0.6% per year since 1992 and in men by 1.5% per year since 2002.

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

Risk factors: Tobacco use is a strong risk factor for kidney cancer, with the largest increased risk for cancer of the renal pelvis, particularly for heavy smokers. Additional risk factors for renal cell carcinoma include obesity, to which an estimated 30% of cases can be attributed, and hypertension (high blood pressure). A small proportion of renal cell cancers are the result of rare hereditary conditions, such as von Hippel-Lindau disease. The only established risk factor for cancer of the renal pelvis other than smoking is long-term use of phenacetin-containing pain-relievers. Phenacetin was used extensively in fever- and pain-reducing drugs until it was implicated in kidney disease and withdrawn from the US market in 1983.

Early detection: There are no reliable screening tests for people at average risk. Nevertheless, kidney cancers have been increasingly diagnosed as a result of the increased use of medical imaging technologies during the past two decades.

Treatment: Surgery (traditional or laparoscopic) is the primary treatment for most kidney cancers. Patients who are not prime surgical candidates may be offered ablation therapy, a procedure that destroys the tumor using heat or cold energy. Kidney tumors tend to be resistant to both traditional chemotherapy and radiation therapy. Until recently, immunotherapy (interferon-alpha and interleukin-2), which has intense side effects and generally modest survival benefits, was the main treatment option for late-stage disease. However, improved understanding of the biology of kidney cancer has led to the development of new targeted therapies that block the tumor's blood supply or target other parts of kidney cancer cells. Since 2005, six of these agents have been approved by the FDA for the treatment of metastatic disease: sorafenib (Bexavarm), sunitinib (Sutent), temsirolimus (Torisel), everolimus (Afinitor), bevacizumab (Avastin), and pazopanib (Votrient).

Survival: The 1- and 5-year relative survival rates for cancers of the kidney and renal pelvis are 82% and 68%, respectively. More than half of cases are diagnosed at the local stage, for which the 5-year relative survival rate is 90%. Five-year survival is lower for renal pelvis (51%) than for renal cell (70%) carcinoma.

Leukemia

New cases: An estimated 43,050 new cases of leukemia are expected in 2010, with slightly more cases of chronic (19,860) than acute (17,660) disease. Leukemia is diagnosed 10 times more often in adults than in children. Acute lymphocytic leukemia (ALL) accounts for approximately 74% of the leukemia cases among children ages 0 to 19 years. In adults, the most common types are acute myeloid leukemia (AML) and chronic lymphocytic leukemia (CLL). The incidence of AML increased by an average of 2.1% per year from 1988 to 2000, but has since been decreasing by 2.7% per year. In contrast, the incidence of CLL has remained relatively stable since 1975.

Deaths: An estimated 21,840 deaths are expected to occur in 2010. The decline in death rates among males and females combined has increased in recent years, from 0.5% per year between 1991 and 2001 to 1.3% per year between 2001 and 2006.

Signs and symptoms: Symptoms may include fatigue, paleness, weight loss, repeated infections, fever, bruising easily, and nosebleeds or other hemorrhages. In children, these signs can appear suddenly. Chronic leukemia can progress slowly with few symptoms and is often diagnosed during routine blood tests.

Risk factors: Exposure to ionizing radiation increases risk of several types of leukemia. Medical radiation, such as that used in cancer treatment, is a substantial source of radiation exposure. Leukemia may also occur as a side effect of chemotherapy. Children with Down syndrome and certain other genetic abnor-

Probability (%) of Developing Invasive Cancers Over Selected Age Intervals by Sex, US, 2004-2006*

		Birth to 39	40 to 59	60 to 69	70 and Older	Birth to Death
All sites†	Male	1.43 (1 in 70)	8.42 (1 in 12)	15.61 (1 in 6)	37.84 (1 in 3)	44.05 (1 in 2)
	Female	2.10 (1 in 48)	8.97 (1 in 11)	10.18 (1 in 10)	26.47 (1 in 4)	37.63 (1 in 3)
Urinary bladder‡	Male	0.02 (1 in 4,741)	0.39 (1 in 257)	0.95 (1 in 106)	3.66 (1 in 27)	3.81 (1 in 26)
	Female	0.01 (1 in 10,613)	0.12 (1 in 815)	0.26 (1 in 385)	1.01 (1 in 99)	1.18 (1 in 84)
Breast	Female	0.49 (1 in 206)	3.75 (1 in 27)	3.40 (1 in 29)	6.50 (1 in 15)	12.08 (1 in 8)
Colon & rectum	Male	0.08 (1 in 1,269)	0.91 (1 in 110)	1.48 (1 in 67)	4.50 (1 in 22)	5.39 (1 in 19)
	Female	0.08 (1 in 1,300)	0.72 (1 in 139)	1.07 (1 in 94)	4.09 (1 in 24)	5.03 (1 in 20)
Leukemia	Male	0.17 (1 in 603)	0.21 (1 in 475)	0.33 (1 in 299)	1.19 (1 in 84)	1.51 (1 in 66)
	Female	0.13 (1 in 798)	0.15 (1 in 690)	0.20 (1 in 504)	0.78 (1 in 128)	1.08 (1 in 92)
Lung & bronchus	Male	0.03 (1 in 3,461)	0.95 (1 in 105)	2.35 (1 in 43)	6.71 (1 in 15)	7.73 (1 in 13)
	Female	0.03 (1 in 3,066)	0.79 (1 in 126)	1.75 (1 in 57)	4.83 (1 in 21)	6.31 (1 in 16)
Melanoma of the skin§	Male	0.16 (1 in 638)	0.64 (1 in 155)	0.72 (1 in 138)	1.77 (1 in 56)	2.67 (1 in 37)
	Female	0.28 (1 in 360)	0.55 (1 in 183)	0.36 (1 in 274)	0.79 (1 in 126)	1.79 (1 in 56)
Non-Hodgkin lymphoma	Male	0.13 (1 in 782)	0.44 (1 in 225)	0.59 (1 in 171)	1.71 (1 in 58)	2.28 (1 in 44)
	Female	0.09 (1 in 1,172)	0.32 (1 in 315)	0.44 (1 in 227)	1.39 (1 in 72)	1.92 (1 in 52)
Prostate	Male	0.01 (1 in 9,422)	2.44 (1 in 41)	6.45 (1 in 16)	12.48 (1 in 8)	15.90 (1 in 6)
Uterine cervix	Female	0.15 (1 in 648)	0.27 (1 in 374)	0.13 (1 in 755)	0.19 (1 in 552)	0.69 (1 in 145)
Uterine corpus	Female	0.07 (1 in 1,453)	0.73 (1 in 136)	0.83 (1 in 121)	1.23 (1 in 81)	2.53 (1 in 40)

*For people free of cancer at beginning of age interval. Percentages and "1 in" numbers may not be equivalent due to rounding.

†All sites excludes basal and squamous cell skin cancers and in situ cancers except urinary bladder.

‡Includes invasive and in situ cancer cases.

§Statistic is for whites only.

Source: DevCan: Probability of Developing or Dying of Cancer Software, Version 6.4.1. Statistical Research and Applications Branch, National Cancer Institute, 2009. srab.cancer.gov/devcan.

American Cancer Society, Surveillance and Health Policy Research, 2010

malities have higher incidence rates of leukemia. Some recent studies suggest that obesity may also be associated with an increased risk of leukemia. Family history is one of the strongest risk factors for CLL. Cigarette smoking and exposure to certain chemicals such as benzene, a component in gasoline and cigarette smoke, are risk factors for myeloid leukemia. Infection with human T-cell leukemia virus type I (HTLV-I) can cause a rare type of CLL called adult T-cell leukemia/lymphoma. The prevalence of HTLV-I infection is geographically localized and is most common in southern Japan and the Caribbean; infected individuals in the US tend to be descendants or immigrants from endemic regions.

Early detection: Leukemia can be difficult to diagnose early because symptoms often resemble those of other, less serious conditions. When a physician does suspect leukemia, diagnosis can be made using blood tests and a bone marrow biopsy.

Treatment: Chemotherapy is the most effective method of treating leukemia. Various anticancer drugs are used, either in combination or as single agents. Imatinib (Gleevec) is a highly specific drug used for the treatment of chronic myeloid (or myelogenous) leukemia (CML), which will be diagnosed in about 4,870 people in 2010. Two related drugs, nilotinib (Tasigna) and dasatinib (Sprycel), are often effective if imatinib stops working. Imatinib is also sometimes used to treat ALL. Gemtuzumab ozogamicin (Mylotarg) is a targeted drug approved for treatment in older AML patients whose cancer has relapsed or who are not able to receive other chemotherapy. Recent clinical trials have shown that adults with AML who are treated with twice the conventional dose of daunorubicin experience higher and more rapid rates of remission. Ofatumumab (Arzerra) was recently approved for the treatment of CLL patients if other chemotherapeutic agents can no longer control the cancer. Antibiotics and transfusions of blood components are used as supportive treatments. Under appropriate conditions, stem cell transplantation may be useful in treating certain types of leukemia.

Survival: Survival in leukemia varies by type, ranging from a 5-year relative survival of 23% for people with AML to 79% for people with CLL. Advances in treatment have resulted in a dramatic improvement in survival for most types of leukemia. The 5-year relative survival rate increased for ALL, from 42% in 1975-1977 to 66% in 1999-2005, and for AML, from 7% in 1975-1977 to 23% in 1999-2005. Survival rates for children with ALL have increased from 58% to 89% over the same time period. In large part due to the discovery of the targeted cancer drug Gleevec, survival rates for CML have more than doubled since 1975-1977, from 24% to 53% today.

Liver

New Cases: An estimated 24,120 new cases of liver cancer (including intrahepatic bile duct) are expected to occur in the US during 2010. More than 80% of these cases are hepatocellular carcinoma (HCC), originating from hepatocytes, the predominant type of cell in the liver. The incidence of liver cancer has been steadily increasing since the early 1980s. Incidence rates are highest among Asian Americans/Pacific Islanders and Hispanics (page 39).

Deaths: An estimated 18,910 liver cancer deaths (6,190 women, 12,720 men) are expected in 2010. Similar to the incidence trend, death rates for liver cancer have continued to increase since the early 1980s. Incidence and mortality rates are more than twice as high in men as in women.

Signs and symptoms: Common symptoms 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, occurring in 50%-90% of patients.

Risk factors: In the US and other western countries, alcohol-related cirrhosis and possibly non-alcoholic fatty liver disease associated with obesity account for the majority of liver cancer cases. Chronic infections with hepatitis B virus (HBV) and hepatitis C virus (HCV) are associated with less than half of liver cancer cases in the US, although they are the major risk factors for the disease worldwide. In the US, rates of HCC are higher in immigrants from areas where HBV is endemic, such as China, Southeast Asia, and sub-Saharan Africa. Other risk factors for liver cancer, particularly in economically developing countries, include consumption of food contaminated with aflatoxin and parasitic infections (schistosomiasis and liver flukes). Aflatoxin is a toxin produced by mold during the storage of agricultural products in a warm, humid environment. Treatment of cirrhosis (a disease state that precedes liver cancer in the majority of cases) with interferon may reduce the risk of progression to cancer and is the subject of ongoing research.

A vaccine that protects against HBV has been available since 1982. The HBV vaccination is recommended for all infants at birth; for all children under 18 years who were not vaccinated at birth; and for adults in high-risk groups, including health care workers. It is also recommended that all pregnant women be tested for HBV. In contrast to HBV, no vaccine is available against HCV. The Centers for Disease Control and Prevention (CDC) recommends routine HCV testing for individuals at high risk so that infected individuals can receive counseling in order to reduce the risk of HCV transmission to others. Other preventive measures for HCV infection include screening of donated blood, organs, and tissues; instituting infection control practices during all medical, surgical, and dental procedures; and needle-exchange programs for injecting drug users. For more information on hepatitis infections, including who is at risk, visit the CDC Web site at cdc.gov/hepatitis/.

Early detection: Screening for liver cancer has not been proven to improve survival. Nonetheless, many doctors in the US screen high-risk persons (for example, those chronically infected with HBV or HCV) with ultrasound or blood tests. At present, the best strategy to reduce the burden of cancer is the adoption of preventive measures, including vaccination against HBV and the avoidance of high-risk behaviors such as intravenous drug use and alcohol abuse.

Treatment: Early stage liver cancer in patients with sufficient healthy liver tissue can sometimes be successfully treated with surgery or, less often, with liver transplantation. Fewer surgical options exist for patients diagnosed at an advanced stage of the disease, often because the portion of the liver not affected by cancer is damaged as well. Patients whose tumors cannot be surgically removed may choose ablation (tumor destruction) or embolization, a procedure that cuts off blood flow to the tumor. Sorafenib (Nexavar) is a drug approved for the treatment of HCC in patients who are not candidates for surgery.

Survival: The 5-year relative survival rate for patients with liver cancer is 14%. Five-year survival is 26% among patients in whom cancer is found at an early stage, compared to only 2% when it is found after spreading to distant organs.

Lung and Bronchus

New cases: An estimated 222,520 new cases of lung cancer are expected in 2010, accounting for about 15% of cancer diagnoses. The incidence rate is declining significantly in men, from a high of 102.1 cases per 100,000 in 1984 to 71.3 cases in 2006. In women, the rate is approaching a plateau after a long period of increase. Lung cancer is classified clinically as small cell (14%) or non-small cell (85%) for the purposes of treatment.

Deaths: Lung cancer accounts for more deaths than any other cancer in both men and women. An estimated 157,300 deaths, accounting for about 28% of all cancer deaths, are expected to occur in 2010. Since 1987, more women have died each year from lung cancer than from breast cancer. Death rates among men decreased by 1.3% per year from 1990 to 1994 and by 2.0% per year from 1994 to 2006. Female lung cancer death rates have been stable since 2003 after continuously increasing for several decades. These trends in lung cancer mortality reflect historical differences in cigarette smoking between men and women and the decrease in smoking rates over the past 40 years.

Signs and symptoms: Symptoms may include persistent cough, sputum streaked with blood, chest pain, voice change, and recurrent pneumonia or bronchitis.

Risk factors: Cigarette smoking is by far the most important risk factor for lung cancer. Risk increases with quantity and duration of cigarette consumption. Cigar and pipe smoking also increase risk. Other risk factors include occupational or environmental exposure to secondhand smoke, radon, asbestos (particularly among smokers), certain metals (chromium, cadmium, arsenic),

some organic chemicals, radiation, air pollution, and a history of tuberculosis. Genetic susceptibility plays a contributing role in the development of lung cancer, especially in those who develop the disease at a younger age.

Early detection: Screening for early lung cancer detection has not yet been proven to reduce mortality. Detection by chest x-ray, analysis of cells in sputum, and fiber-optic examination of the bronchial passages has shown limited effectiveness in reducing lung cancer deaths. Newer tests, such as low-dose spiral computed tomography (CT) scans and molecular markers in sputum, have produced promising results in detecting lung cancers at earlier, more operable stages in high-risk patients, but have not yet been shown to reduce lung cancer deaths. In addition, there are considerable risks associated with lung biopsy and surgery that must be considered when evaluating the risks and benefits of screening. The National Lung Screening Trial is a clinical trial to assess whether screening individuals at high risk for lung cancer with spiral CT or standard chest x-ray can prevent lung cancer deaths. Launched in 2002, the study represents a collaboration of the National Cancer Institute and the American College of Radiology Imaging Network. The American Cancer Society contributed to the recruitment of subjects for the trial. Results from the study are expected by 2010-2011.

Treatment: Treatment options are determined by the type (small cell or non-small cell) and stage of cancer and include surgery, radiation therapy, chemotherapy, and targeted therapies such as bevacizumab (Avastin) and erlotinib (Tarceva). For localized cancers, surgery is usually the treatment of choice. Recent pooled analyses confirm that survival for all patients with early stage, non-small cell lung cancer is improved by giving chemotherapy after surgery. Because the disease has usually spread by the time it is discovered, radiation therapy and chemotherapy are often used, sometimes in combination with surgery. A recent clinical trial showed a survival advantage for advanced-stage non-small cell lung cancer patients when cetuximab (Erbitux, a monoclonal antibody) was combined with the traditional chemotherapeutic regimen. Chemotherapy alone or combined with radiation is the usual treatment of choice for small cell lung cancer; on this regimen, a large percentage of patients experience remission, though the cancer often returns.

Survival: The 1-year relative survival for lung cancer increased from 35% in 1975-1979 to 42% in 2002-2005, largely due to improvements in surgical techniques and combined therapies. However, the 5-year survival rate for all stages combined is only 16%. The 5-year survival rate is 53% for cases detected when the disease is still localized, but only 15% of lung cancers are diagnosed at this early stage. The 5-year survival for small cell lung cancer (6%) is lower than that for non-small cell (17%).

Lymphoma

New cases: An estimated 74,030 new cases of lymphoma will occur in 2010, including 8,490 cases of Hodgkin lymphoma and 65,540 cases of non-Hodgkin lymphoma (NHL). NHL encompasses a wide variety of disease subtypes for which incidence patterns vary; overall incidence has been stable since 1991 in men, but has been increasing by 1.1% per year since 1990 in women. Rates for Hodgkin lymphoma have decreased slightly in men (0.6% per year), but increased slightly in women (0.4 % per year) over the past 30 years.

Deaths: An estimated 21,530 deaths from lymphoma will occur in 2010 (Hodgkin lymphoma, 1,320; non-Hodgkin lymphoma, 20,210). Death rates for Hodgkin lymphoma have been decreasing in both men and women for more than three decades, though the decrease in men has slowed since 2000. Death rates for NHL have been decreasing since 1997 by 3.0% per year in men and by 3.7% per year in women after increasing for most of the previous two decades.

Signs and symptoms: Symptoms may include swollen lymph nodes, itching, night sweats, fatigue, unexplained weight loss, and intermittent fever.

Risk factors: Like most cancers, the risk of developing NHL increases with age. In contrast, the risk of Hodgkin lymphoma is highest during adolescence and early adulthood. In most cases of lymphoma the cause is unknown, although various risk factors associated with altered immune function have been identified. Non-Hodgkin lymphoma risk is elevated in persons with organ transplants who receive immune suppressants to prevent transplant rejection; in people with severe autoimmune conditions; and in people infected with human immunodeficiency virus (HIV), human T-cell leukemia virus type I (HTLV-I), and probably hepatitis C virus (HCV). Epstein-Barr virus (EBV) causes Burkitt lymphoma, is associated with some types of Hodgkin lymphoma, and probably plays a role in some other NHLs. *H. pylori* infection increases the risk of gastric lymphoma. A family history of lymphoma and certain common genetic variations in immune response genes are associated with a modestly increased risk. Occupational exposures to herbicides, chlorinated organic compounds, and certain other chemicals are also associated with moderately increased risk.

Treatment: Hodgkin lymphoma is usually treated with chemotherapy, radiation therapy, bone marrow or stem cell transplantation, or any combination thereof, depending on stage and cell type of the disease. Non-Hodgkin lymphoma patients are usually treated with chemotherapy; radiation, alone or in combination with chemotherapy, is used less often. Highly specific monoclonal antibodies, such as rituximab (Rituxan) and alemtuzumab (Campath), directed at lymphoma cells are used for initial treatment and recurrence of some types of non-Hodgkin

Five-year Relative Survival Rates* (%) by Stage at Diagnosis, 1999-2005

	All Stages	Local	Regional	Distant		All Stages	Local	Regional	Distant
Breast (female)	89	98	84	23	Ovary	46	94	73	28
Colon & rectum	65	91	70	11	Pancreas	6	22	9	2
Esophagus	17	37	19	3	Prostate	100	100	100	31
Kidney†	68	90	62	10	Stomach	26	63	27	3
Larynx	62	78	42	32	Testis	95	99	96	71
Liver‡	13	26	9	2	Thyroid	97	100	97	59
Lung & bronchus	16	53	24	4	Urinary bladder	80	74	36	6
Melanoma of the skin	91	98	62	15	Uterine cervix	71	92	58	17
Oral cavity & pharynx	61	83	54	32	Uterine corpus	83	96	67	17

*Rates are adjusted for normal life expectancy and are based on cases diagnosed in the SEER 17 areas from 1999-2005, followed through 2006.
†Includes renal pelvis. ‡Includes intrahepatic bile duct.

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 by way of lymphatic system; 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: Horner MJ, Ries LAG, Krapcho M, et al. (eds). *SEER Cancer Statistics Review, 1975-2006*, National Cancer Institute, Bethesda, MD, seer.cancer.gov/csr/1975_2006/, 2009.

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lymphoma, as are antibodies linked to a radioactive atom, such as ibritumomab tiuxetan (Zevalin) and tositumomab (Bexxar). High-dose chemotherapy with stem cell transplantation and low-dose chemotherapy with stem cell transplantation (called non-myeloablative) are options if non-Hodgkin lymphoma persists or recurs after standard treatment.

Survival: Survival varies widely by cell type and stage of disease. The 1-year relative survival for Hodgkin and non-Hodgkin lymphoma is 92% and 80%, respectively; the 5-year survival is 85% and 67%, respectively. Ten years after diagnosis, survival for Hodgkin and non-Hodgkin lymphoma declines to 81% and 56%, respectively.

Oral Cavity and Pharynx

New cases: An estimated 36,540 new cases of cancer of the oral cavity and pharynx are expected in 2010. Incidence rates are more than twice as high in men as in women. Incidence has been declining in men since 1975 and in women since 1980, although recent studies have shown that incidence is increasing for those cancers related to human papillomavirus (HPV) infection.

Deaths: An estimated 7,880 deaths from oral cavity and pharynx cancer are expected in 2010. Death rates have decreased by more than 2% per year since 1980 in men and since 1990 in women.

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

Risk factors: Known risk factors include all forms of smoked and smokeless tobacco products and excessive consumption of alcohol. Many studies have reported a synergism between smoking and alcohol use, resulting in more than a 30-fold increased risk in individuals who both smoke and drink heavily. HPV infection is associated with certain types of oropharyngeal cancer.

Early detection: Cancer can affect any part of the oral cavity, including the lip, tongue, mouth, and throat. Dentists and primary care physicians can detect premalignant abnormalities and cancer at an early stage, when they are most curable.

Treatment: Radiation therapy and surgery, separately or in combination, are standard treatments. In advanced disease, chemotherapy is added to surgery and/or radiation. Targeted therapy with cetuximab (Erbitux) may be combined with radiation in initial treatment or used alone to treat recurrent cancer.

Survival: For all stages combined, about 83% of persons with oral cavity and pharynx cancer survive 1 year after diagnosis. The 5-year and 10-year relative survival rates are 61% and 50%, respectively.

Ovary

New cases: An estimated 21,880 new cases of ovarian cancer are expected in the US in 2010. Ovarian cancer accounts for about 3% of all cancers among women and ranks second among gynecologic cancers, following cancer of the uterine corpus. Ovarian cancer incidence has been declining since 1985; in the most recent time period, incidence rates declined by 2.1% per year between 2001 and 2006.

Trends in 5-year Relative Survival Rates* (%) by Race and Year of Diagnosis, US, 1975-2005

	All races			White			African American		
	1975-77	1984-86	1999-2005	1975-77	1984-86	1999-2005	1975-77	1984-86	1999-2005
All sites	50	54	68†	51	55	69†	40	41	59†
Brain	24	29	36†	23	28	35†	27	32	41†
Breast (female)	75	79	90†	76	80	91†	62	65	79†
Colon	52	59	66†	52	60	67†	46	50	56†
Esophagus	5	10	19†	6	11	20†	3	8	13†
Hodgkin lymphoma	74	79	86†	74	80	87†	71	75	81†
Kidney	51	56	69†	51	56	69†	50	54	66†
Larynx	67	66	63†	67	68	66	59	53	50
Leukemia	35	42	54†	36	43	55†	34	34	46†
Liver & bile duct	4	6	14†	4	6	13†	2	5	10†
Lung & bronchus	13	13	16†	13	14	17†	12	11	13†
Melanoma of the skin	82	87	93†	82	87	93†	60‡	70§	78‡
Myeloma	26	29	37†	25	27	38†	31	32	36†
Non-Hodgkin lymphoma	48	53	69†	48	54	70†	49	48	60†
Oral cavity & pharynx	53	55	63†	55	57	64†	36	36	46†
Ovary	37	40	46†	37	39	46†	43	41	37
Pancreas	3	3	6†	3	3	6†	2	5	5†
Prostate	69	76	100†	70	77	100†	61	66	98†
Rectum	49	57	69†	49	58	69†	45	46	61†
Stomach	16	18	27†	15	18	25†	16	20	26†
Testis	83	93	96†	83	93	97†	73‡#	87‡	87
Thyroid	93	94	97†	93	94	98†	91	90	96
Urinary bladder	74	78	82†	75	79	83†	51	61	68†
Uterine cervix	70	68	72†	71	70	73	65	58	65
Uterine corpus	88	84	84†	89	85	87†	61	58	62

*Survival rates are adjusted for normal life expectancy and are based on cases diagnosed in the SEER 9 areas from 1975-77, 1984-86, 1999 to 2005, and followed through 2006. †The difference in rates between 1975-1977 and 1999-2005 is statistically significant ($p < 0.05$). ‡The standard error of the survival rate is between 5 and 10 percentage points. §The standard error of the survival rate is greater than 10 percentage points. #Survival rate is for 1978-1980.

Source: Horner MJ, Ries LAG, Krapcho M, et al (eds.). *SEER Cancer Statistics Review, 1975-2006*, National Cancer Institute, Bethesda, MD, seer.cancer.gov/csr/1975_2006/, 2009.

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Deaths: An estimated 13,850 deaths are expected in 2010. Ovarian cancer causes more deaths than any other cancer of the female reproductive system. Death rates for ovarian cancer have been decreasing by 1.4% per year since 2002.

Signs and symptoms: Early ovarian cancer usually has no obvious symptoms, although women with early stage disease occasionally experience pelvic pain. The most common sign is enlargement of the abdomen, which is caused by the accumulation of fluid. However, studies indicate that some women may experience persistent, nonspecific symptoms, such as bloating, pelvic or abdominal pain, difficulty eating or feeling full quickly, or urinary urgency or frequency. Women who experience such symptoms daily for more than a few weeks should seek prompt medical evaluation. Abnormal vaginal bleeding is rarely a symptom of ovarian cancer.

Risk factors: The most important risk factor is a strong family history of breast or ovarian cancer. Women who have had breast cancer or who have tested positive for inherited mutations in BRCA1 or BRCA2 genes are at increased risk. Studies suggest that preventive surgery to remove the ovaries and fallopian tubes in these women can decrease the risk of ovarian cancers. A genetic syndrome called hereditary nonpolyposis colon cancer (Lynch syndrome) is also associated with increased risk. The use of estrogen alone as postmenopausal hormone therapy has been shown to increase risk in several large studies. Heavier body weight appears to be associated with increased risk of ovarian cancer. Pregnancy, long-term use of oral contraceptives, and tubal ligation reduce the risk of developing ovarian cancer; hysterectomy also appears to decrease risk.

Early detection: There is currently no sufficiently accurate screening test proven to be effective in the early detection of ovarian cancer. Pelvic examination only occasionally detects ovarian cancer, generally when the disease is advanced. However, for women who are at high risk of ovarian cancer and women who have persistent, unexplained symptoms, the combination of a thorough pelvic exam, transvaginal ultrasound, and a blood test for the tumor marker CA125 may be offered. For women at average risk, transvaginal ultrasound and testing for the tumor marker CA125 may help in diagnosis but are not used for routine screening. However, a large clinical trial using these methods to assess the effect of ovarian cancer screening on mortality is currently under way in the United Kingdom.

Treatment: Treatment includes surgery and usually chemotherapy. Surgery usually involves removal of one or both ovaries, fallopian tubes (salpingo-ophorectomy), and the uterus (hysterectomy). In younger women with very early stage tumors who wish to have children, only the involved ovary and fallopian tube may be removed. In more advanced disease, surgically removing all abdominal metastases enhances the effect of chemotherapy and helps improve survival. For women with stage III ovarian cancer that has been optimally debulked (removal of as much of the cancerous tissue as possible), studies have shown that chemotherapy administered both intravenously and directly into the abdomen improves survival. Studies have found that ovarian cancer patients whose surgery is performed by a gynecologic oncologist have more successful outcomes. Clinical trials are currently under way to test two new drugs (bevacizumab and cediranib) in the treatment of ovarian cancer.

Survival: Relative survival varies by age; women younger than 65 are almost twice as likely to survive 5 years (57%) following diagnosis as women 65 and older (30%). Overall, the 1- and 5-year relative survival of ovarian cancer patients is 75% and 46%, respectively. If diagnosed at the localized stage, the 5-year survival rate is 94%; however, only 15% of all cases are detected at this stage, usually during another medical procedure. The majority of cases (62%) are diagnosed at distant stage. For women with regional and distant disease, 5-year survival rates are 73% and 28%, respectively. The 10-year relative survival rate for all stages combined is 38%.

Pancreas

New cases: An estimated 43,140 new cases of pancreatic cancer are expected to occur in the US in 2010. Incidence rates of pancreatic cancer have been stable in men since 1981, but have been increasing in women by 1.7% per year since 2000.

Deaths: An estimated 36,800 deaths are expected to occur in 2010. The death rate for pancreatic cancer has been stable in men since 2003, but has been increasing slightly (0.1% per year) since 1984 in women.

Signs and symptoms: Cancer of the pancreas often develops without early symptoms. Symptoms may include weight loss, pain in the upper abdomen that may radiate to the back, and occasionally glucose intolerance (high blood glucose levels). Tumors that develop near the common bile duct may cause a blockage that leads to jaundice (yellowing of the skin and eyes), which can sometimes allow the tumor to be diagnosed at an early stage.

Risk factors: Tobacco smoking increases the risk of pancreatic cancer; incidence rates are about twice as high for cigarette smokers as for nonsmokers. Risk also increases with a family history of pancreatic cancer and a personal history of pancreatitis, diabetes, obesity, and possibly the use of smokeless tobacco. Individuals with Lynch syndrome are at increased risk. Though evidence is still accumulating, consumption of red meat may also increase risk.

Early detection: At present, there is no method for the early detection of pancreatic cancer. The disease is usually asymptomatic; only 7% of cases are diagnosed at an early stage. Research is under way to identify better methods of early detection.

Treatment: Surgery, radiation therapy, and chemotherapy are treatment options that may extend survival and/or relieve symptoms in many patients, but seldom produce a cure. Less than 20% of patients are candidates for surgery because pancreatic cancer is usually detected after it has spread beyond the pancreas. Clinical trials have shown that for patients who do undergo surgery, adjuvant treatment with the chemotherapeutic drug gemcitabine lengthens survival. Erlotinib (Tarceva) has been approved by the FDA for the treatment of advanced pancreatic cancer. This targeted anticancer drug blocks tumor cell growth and has demonstrated a minimal improvement in pancreatic cancer survival when used along with gemcitabine. Clinical trials with several new agents, combined with radiation and surgery, may offer improved survival and should be considered as a treatment option.

Survival: For all stages combined, the 1- and 5-year relative survival rates are 25% and 6%, respectively. Even for those people diagnosed with local disease, the 5-year survival is only 22%. Obesity is associated with lower survival rates for pancreatic cancer.

Prostate

See Special Section, page 23.

Skin

New cases: More than 2 million people were treated for basal cell and squamous cell skin cancers in 2006. These types of cancer are not required to be reported to cancer registries. Most, but not all, of these forms of skin cancer are highly curable. The most common serious form of skin cancer is melanoma, which is expected to be diagnosed in about 68,130 persons in 2010. Melanoma is primarily a disease of whites; rates are more than 10 times higher in whites than in African Americans. Among whites, rates are more than 50% higher in men than in women. Melanoma incidence rates have been increasing for at least 30 years. In the most recent time period, rapid increases have occurred among young white women (3.0% per year since 1992 in those aged 15 to 39 years) and white adults 65 years and older (5.1% per year since 1985 in men and 4.1% per year since 1975 in women).

Deaths: An estimated 11,790 deaths (8,700 from melanoma and 3,090 from other nonepithelial skin cancers) will occur in 2010. The death rate for melanoma has been decreasing rapidly in whites younger than 50 by 2.9% per year since 1990 in men and by 2.2% per year since 1985 in women. In contrast, in those 50 and older death rates have been increasing by 1.0% per year since 1990 in men and have been stable since 1989 in women.

Signs and symptoms: Important warning signs of melanoma include changes in size, shape, or color of a skin lesion or the appearance of a new growth on the skin. Changes that occur over a few days are usually not cancer, but changes that progress over a month or more should be evaluated by a doctor. Basal cell carcinomas may appear as growths that are flat, or as small, raised, pink or red, translucent, shiny areas that may bleed following minor injury. Squamous cell cancer may appear as growing lumps, often with a rough surface, or as flat, reddish patches that grow slowly. Another sign of basal and squamous cell skin cancers is a sore that doesn't heal.

Risk factors: Risk factors vary for different types of skin cancer. For melanoma, major risk factors include a personal or family history of melanoma and the presence of atypical or numerous moles (more than 50). Other risk factors for all types of skin cancer include sun sensitivity (sunburning easily, difficulty tanning, natural blond or red hair color); a history of excessive sun exposure, including sunburns; use of tanning booths; diseases that suppress the immune system; and a past history of basal cell or squamous cell skin cancers.

Prevention: Skin should be protected from intense sun exposure by covering with an umbrella, clothing, and a hat, applying sunscreen that has a sun protection factor (SPF) of 15 or higher to unprotected skin, and avoiding sunbathing. Sunglasses should be worn to protect the skin around the eyes. Children in particular should be protected from the sun because severe sunburns in childhood may greatly increase risk of melanoma in later life. Tanning beds and sun lamps, which provide an additional source of UV radiation, should be avoided. In 2009, the International Agency for Research on Cancer upgraded their classification of indoor tanning devices from "probably carcinogenic to humans" to definitively "carcinogenic to humans" after a reassessment of the scientific evidence.

Early detection: The best way to detect skin cancer early is to recognize changes in skin growths or the appearance of new growths. Adults should thoroughly examine their skin on a monthly basis. New or unusual lesions or a progressive change in a lesion's appearance (size, shape, or color, etc.) should be evaluated promptly by a physician. Melanomas often start as small, mole-like growths that increase in size and may change color. A simple ABCD rule outlines the warning signals of the most common type of melanoma: **A** is for asymmetry (one half of the mole does not match the other half); **B** is for border irregularity (the edges are ragged, notched, or blurred); **C** is for color (the pigmentation is not uniform, with variable degrees of tan, brown, or black); **D** is for diameter greater than 6 millimeters (about the size of a pencil eraser). Other types of melanoma may not have these signs, so be alert for any new or changing skin growths.

Treatment: Removal and microscopic examination of all suspicious skin lesions are essential. Early stage basal and squamous cell cancers can be removed in most cases by one of several methods: surgical excision, electrodessication and curettage (tissue destruction by electric current and removal by scraping with a curette), or cryosurgery (tissue destruction by freezing). Radiation therapy and certain topical medications may be used in some cases. For malignant melanoma, the primary growth and surrounding normal tissue are removed and sometimes a sentinel lymph node is biopsied to determine stage. More extensive lymph node surgery may be needed if lymph node metastases are present. Melanomas with deep invasion or that have spread to lymph nodes may be treated with surgery, immunotherapy, chemotherapy, and/or radiation therapy. Advanced cases of melanoma are treated with palliative surgery, immunotherapy, and/or chemotherapy, and sometimes radiation therapy. Clinical trials are ongoing to evaluate drugs targeted at a particular gene mutation present in the cancer cells of about two-thirds of melanoma patients.

Survival: Most basal and squamous cell cancers can be cured, especially if the cancer is detected and treated early. Melanoma is also highly curable if detected in its earliest stages and treated properly. However, melanoma is more likely than other skin tumors to spread to other parts of the body. The 5- and 10-year relative survival rates for persons with melanoma are 91% and 90%, respectively. For localized melanoma, the 5-year survival rate is 98%; 5-year survival rates for regional and distant stage diseases are 62% and 15%, respectively. About 84% of melanomas are diagnosed at a localized stage.

Thyroid

New cases: An estimated 44,670 new cases of thyroid cancer are expected to be diagnosed in 2010 in the US, with 3 in 4 cases occurring in women. The incidence rate of thyroid cancer has been increasing sharply since the mid-1990s, and it is the fastest-increasing cancer in both men and women.

Deaths: An estimated 1,690 deaths from thyroid cancer are expected in 2010 in the US. The death rate for thyroid cancer has been increasing slightly (by 1.0% per year since 1983) in men and has been stable in women.

Signs and symptoms: The most common symptom of thyroid cancer is a lump in the neck that is noticed by a patient or felt by a health care provider in a clinical exam. Other symptoms include a tight or full feeling in the neck, difficulty breathing or swallowing, hoarseness or swollen lymph nodes, and pain in the throat or neck that does not go away. Although most lumps in the thyroid gland are not cancerous, individuals who detect an abnormality should seek timely medical attention.

Risk factors: Risk factors for thyroid cancer include being female, having a history of goiter (enlarged thyroid) or other nonmalignant thyroid condition, a family history of thyroid cancer, and radiation exposure related to medical treatment during childhood. Radiation exposure as a result of radioactive fallout

from atomic weapons testing and nuclear power plant accidents (Chernobyl) has also been linked to increased risk of thyroid cancer, especially in children. Certain rare genetic syndromes also increase risk. Individuals who test positive for an abnormal gene that causes a hereditary form of thyroid cancer can decrease the chance of developing the disease by surgical removal of the thyroid gland. Unlike other adult cancers, for which older age increases risk, more than 80% of newly diagnosed thyroid cancer patients are under age 65 years.

Early detection: At present, there is no method for the early detection of thyroid cancer. Tests used in the evaluation of thyroid nodules include: blood tests to determine levels of hormones related to normal functions of the thyroid gland; medical imaging techniques to determine the size and characteristics of the nodule and lymph nodes; and biopsy to determine if the cells in the nodule are benign or malignant.

Treatment: Most thyroid cancers are highly curable, though about 5% of cases are more aggressive and tend to spread to other organs. Treatment depends on the cell type, tumor size, and extent of the disease. The first choice of treatment is surgery. Total removal of the thyroid gland (thyroidectomy) is recommended for most patients and lymph node removal is recommended for some. Treatment with radioactive iodine (I^{131}) after surgery may be recommended to destroy any remaining thyroid tissue. Hormone therapy is given to replace hormones normally produced by the thyroid gland after thyroidectomy and to prevent the body from making thyroid-stimulating hormone, decreasing the likelihood of recurrence.

Survival: The 5-year relative survival rate for all thyroid cancer patients is 97%. However, survival varies markedly by stage, age at diagnosis, and disease subtype. The 5-year survival rate approaches 100% for localized disease, is 97% for regional stage disease, and 59% for distant stage disease. By age, the survival rate progressively decreases from 99% for patients under 45 years to 81% for those aged 75 or older.

Urinary Bladder

New cases: An estimated 70,530 new cases of bladder cancer are expected to occur in 2010. During the past two decades, bladder cancer incidence rates have been stable among men, but have been increasing slightly among women by 0.2% per year. Bladder cancer incidence is about four times higher in men than in women and two times higher in white men than in African American men.

Deaths: An estimated 14,680 deaths will occur in 2010. Mortality rates are stable in men and have been slightly declining in women (by 0.4% per year) since 1986.

Signs and symptoms: The most common symptom is blood in the urine. Other symptoms may include increased frequency or urgency of urination and irritation during urination.

Risk factors: Smoking is the most important risk factor for bladder cancer. Smokers' risk of bladder cancer is twice that of nonsmokers'. Smoking is estimated to cause about 48% of bladder cancer deaths among men and 28% among women. Workers in the dye, rubber, or leather industries and people who live in communities with high levels of arsenic in the drinking water also have increased risk. Drinking more fluids and eating more vegetables may lower the risk of bladder cancer.

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

Treatment: Surgery, alone or in combination with other treatments, is used in more than 90% of cases. Superficial, localized cancers may also be treated by administering immunotherapy or chemotherapy directly into the bladder. Chemotherapy, alone or with radiation before cystectomy (bladder removal), has improved treatment results. Timely follow-up care is extremely important because of the high rate of bladder cancer recurrence.

Survival: For all stages combined, the 5-year relative survival rate is 80%. Survival declines to 76% at 10 years and 72% at 15 years after diagnosis. Half of all bladder cancer patients are diagnosed while the tumor is in situ (noninvasive, present only in the layer of cells in which the cancer developed), for which cases 5-year survival is 97%. Patients with invasive tumors diagnosed at a localized stage have a 5-year survival rate of 74%; 36% of cancers are detected at this early stage. For regional and distant stage disease, 5-year survival is 36% and 6%, respectively.

Uterine Cervix

New cases: An estimated 12,200 cases of invasive cervical cancer are expected to be diagnosed in 2010. Incidence rates have decreased over most of the past several decades in both white and African American women.

Deaths: An estimated 4,210 deaths from cervical cancer are expected in 2010. Mortality rates have declined steadily over the past several decades due to prevention and early detection as a result of screening, although this trend has slowed since 2003.

Signs and symptoms: Symptoms usually do not appear until abnormal cervical cells become cancerous and invade nearby tissue. When this happens, the most common symptom is abnormal vaginal bleeding. Bleeding may start and stop between regular menstrual periods, or it may occur after sexual intercourse, douching, or a pelvic exam. Menstrual bleeding may last longer and be heavier than usual. Bleeding after menopause or increased vaginal discharge may also be symptoms.

Risk factors: The primary cause of cervical cancer is infection with certain types of human papillomavirus (HPV). Women who begin having sex at an early age or who have many sexual partners are at increased risk for HPV infection and cervical cancer. However, a woman may be infected with HPV even if she has had only one sexual partner. Importantly, HPV infections are common in healthy women and only rarely result in cervical cancer. Persistence of HPV infection and progression to cancer may be influenced by many factors, such as immunosuppression, high parity (number of childbirths), and cigarette smoking. Long-term use of oral contraceptives is also associated with increased risk of cervical cancer.

Prevention: The FDA has approved two vaccines for the prevention of the most common HPV infections that cause cervical cancer; Gardasil was approved for use in ages 9 to 26 in 2006, and Cervarix was approved for ages 10 to 25 in October 2009. The vaccines cannot protect against established infections, nor do they protect against all HPV types. For information on the American Cancer Society HPV vaccine guidelines, see Saslow D, et al. *CA: A Cancer Journal for Clinicians*. Jan 2007;57: 7-28.

Screening can prevent cervical cancer by detecting precancerous lesions. As screening has become more common, preinvasive lesions of the cervix are detected far more frequently than invasive cancer. The Pap test is the most widely used cervical cancer screening method. It is a simple procedure in which a small sample of cells is collected from the cervix and examined under a microscope. Pap tests are effective, but not perfect. Sometimes results are reported as normal when abnormal cells are present (false negative), and likewise, sometimes test results are abnormal when no abnormal cells are present (false positive). DNA tests to detect HPV strains associated with cervical cancer may be used in conjunction with the Pap test, either as an additional screening test or when Pap test results are equivocal. Fortunately, most cervical precancers develop slowly, so nearly all cases can be prevented if a woman is screened regularly. It is important for all women, even those who have received the HPV vaccine, to follow cervical cancer screening guidelines.

Early Detection: In addition to preventing cancer, cervical cancer screening can detect cancer early, when treatment is most successful. Liquid-based pap tests may be used as an alternative to conventional Pap tests. See page 62 for the American Cancer Society's screening guidelines for the early detection of cervical cancer.

Treatment: Preinvasive lesions may be treated by electrocoagulation (the destruction of tissue through intense heat by electric current), cryotherapy (the destruction of cells by extreme cold), laser ablation, or local surgery. Invasive cervical cancers are generally treated with surgery, radiation, or both, and with chemotherapy in selected cases.

Survival: One- and 5-year relative survival rates for cervical cancer patients are 87% and 71%, respectively. The 5-year survival rate for patients diagnosed with localized cervical cancer is 92%. Cervical cancer is diagnosed at an early stage more often in whites (51%) than in African Americans (43%) and in women younger than 50 (61%) than in women 50 and older (36%).

Uterine Corpus (Endometrium)

New cases: An estimated 43,470 cases of cancer of the uterine corpus (body of the uterus) are expected to be diagnosed in 2010. These usually occur in the endometrium (lining of the uterus). Incidence rates of endometrial cancer have been decreasing by about 0.5% per year since 1997 after increasing in the previous decade.

Deaths: An estimated 7,950 deaths are expected in 2010. Death rates from cancer of the uterine corpus have been stable since 1992 after decreasing an average of 1.5% per year from 1975 through 1992.

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

Risk factors: Estrogen is a strong risk factor for endometrial cancer. Factors that increase estrogen exposure include menopausal estrogen therapy (without use of progestin), being overweight/obese, late menopause, never having children, and a history of polycystic ovary syndrome. (Estrogen plus progestin menopausal hormone therapy does not appear to increase risk.) Lynch syndrome, also known as hereditary nonpolyposis colon cancer (HNPCC), increases risk. Tamoxifen use increases risk slightly. Infertility and diabetes have been associated with an increased risk. Pregnancy, the use of oral contraceptives, and physical activity provide protection against endometrial cancer.

Early detection: There is no standard or routine screening test for endometrial cancer. Most endometrial cancer (69%) is diagnosed at an early stage because of postmenopausal bleeding. Women are encouraged to report any unexpected bleeding or spotting to their physicians. The American Cancer Society recommends that women with Lynch syndrome, or otherwise at high risk for the disease, should be offered annual screening for endometrial cancer with endometrial biopsy and/or transvaginal ultrasound beginning at age 35.

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

Survival: The 1- and 5-year relative survival rates for uterine corpus cancer are 92% and 83%, respectively. The 5-year survival rate is 96%, 67%, or 17%, if the cancer is diagnosed at a local, regional, or distant stage, respectively. Relative survival in whites exceeds that for African Americans by more than 8 percentage points at every stage of diagnosis.

Special Section: Prostate Cancer

Excluding skin cancer, prostate cancer is the most commonly diagnosed cancer among men in the US and the second most common cause of cancer death among men. It is estimated that about 1 in 6 men in the US will be diagnosed with prostate cancer during their lifetime and 1 in 36 will die from this disease. Despite the important burden of prostate cancer cases and deaths, and extensive research on its causes, prevention, early detection, and treatment, many uncertainties remain about this cancer. This Special Section contains information about what we know about prostate cancer, what we don't know, and the research that has been done to try to answer these questions. Information in this article may be helpful to clinicians, men who are concerned about their risk of prostate cancer, who are making decisions about prostate cancer screening or treatment, or who are undergoing treatment or follow-up, as well as to anyone interested in learning more about this type of cancer.

How Many Cases and Deaths Are Estimated to Occur in 2010?

- Prostate cancer accounts for about 1 in 4 newly diagnosed cancers each year among US men. In 2010, an estimated 217,730 new cases of prostate cancer will be diagnosed in the US.
- Prostate cancer is the second most common cause of cancer death in men. In 2010, approximately 32,050 men are expected to die from prostate cancer. Only lung cancer accounts for more cancer deaths in US men.

Table 1. Probability (%) of Developing Prostate Cancer Over Selected Age Intervals by Race, US, 2004-2006*

Age	White	African American
30 to 39	0.01 (1 in 12,288)	0.02 (1 in 4,379)
40 to 49	0.27 (1 in 375)	0.60 (1 in 168)
50 to 59	2.14 (1 in 47)	3.78 (1 in 26)
60 to 69	6.23 (1 in 16)	9.75 (1 in 10)
70 to 79	8.02 (1 in 12)	11.17 (1 in 9)
Lifetime risk	**15.39 (1 in 6)**	**18.32 (1 in 5)**

*For people free of cancer at beginning of age interval. Percentages and "1 in" numbers may not be equivalent due to rounding.

Source: DevCan: Probability of Developing or Dying of Cancer Software, Version 6.4.1. Statistical Research and Applications Branch, National Cancer Institute, 2009. srab.cancer.gov/devcan.

Who Gets Prostate Cancer?

Age

- Age is the most important risk factor for prostate cancer. Prostate cancer incidence rates increase in men until about age 70 and decline thereafter. During 2002-2006, men aged 70 to 74 had the highest incidence rate, 888.6 cases per 100,000 white men and 1279.1 cases per 100,000 African American men.
- During 2002-2006, the median age at the time of prostate cancer diagnosis was 68 years. This means that about half of the men who developed prostate cancer were age 68 or younger at the time of diagnosis.
- The probability of developing prostate cancer varies greatly by age (Table 1). For white men who are cancer free at age 50, the probability of developing prostate cancer in the next 10 years is 2.14% (1 in 47); this rises to 8.02% (1 in 12) for a man whose current age is 70. For African American men, the probabilities are substantially greater; 3.78% (1 in 26) at age 50 and 11.17% (1 in 9) at age 70.
- Death rates for prostate cancer increase with age. During 2002-2006, the median age of death from prostate cancer was 80 years.

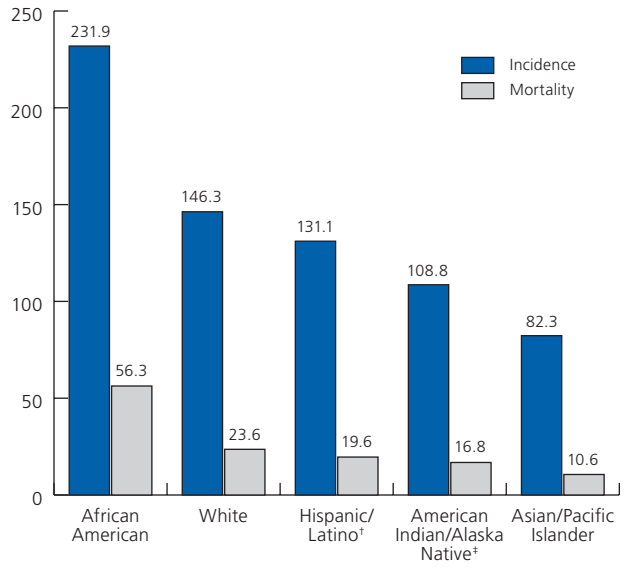
Race/Ethnicity

- African American men have a higher incidence of prostate cancer and are more likely to die from the disease than white men in every age group. In 2002-2006, the overall age-adjusted incidence rate for white men was 146.3 per 100,000, and for African American men it was 231.9 per 100,000. During the same time period, the mortality rate for white men was 23.6 per 100,000 and for African American men it was 56.3 per 100,000.[1]
- Incidence and death rates for prostate cancer are lower among men of other racial and ethnic groups than among white and African American men (Figure 1).

Socioeconomic position

- Prostate cancer death rates vary by years of education, especially among African American men. In a study of death rates among men aged 25 to 64 by level of education, American Cancer Society researchers found that the prostate cancer death rate for African American men with 12 or fewer years of education was twice that of men with more than 12 years of education.[2] In white men, the prostate cancer death rate for those with 12 or fewer years of education, was 1.5 times that of men with more than 12 years of education.
- Prostate cancer death rates declined markedly among African American and white men from 1993 to 2001. In both populations, declines were greater among men with 13 or more years of education.[3]

Figure 1. Prostate Cancer Incidence and Mortality Rates* by Race and Ethnicity, US, 2002-2006



*Per 100,000, age adjusted to the 2000 US standard population. †Persons of Hispanic/Latino origin may be of any race. ‡Data based on Contract Health Service Delivery Areas (CHSDA) counties.

Source: Edwards, et al.[1]

- A study linking data on socioeconomic factors from population surveys with cancer registries found that age-adjusted incidence rates (per 100,000) were highest among men with a college education or beyond (253.3) and lowest for men who did not complete high school (203.5). The higher incidence rates among the most educated men are likely due to higher rates of prostate-specific antigen (PSA) screening in this group. However, men with less than a high school education were significantly more likely to be diagnosed with distant-stage prostate cancer than men with a college education or beyond.[4]

Are There Geographical Differences in Prostate Cancer?

Geographical patterns within the US

- Figure 2 shows prostate cancer incidence and death rates per 100,000 men for white and African American men by state. Among white men, prostate cancer incidence rates tend to be highest in northern states, especially in the Midwest and Mountain States, while among African American men, incidence rates tend to be highest in the southeastern region. Mortality rates follow a similar pattern.
- In white men, prostate cancer incidence rates vary from 111.8 in Arizona to 184.7 in Utah. Among African American men, rates range from 113.6 in New Mexico to 277.9 in Delaware.
- Prostate cancer death rates among white men range from 19.3 in Florida to 28.4 in Idaho. Among African American men, death rates range from 35.2 in Arizona to 70.5 in Mississippi.
- A study of geographic variability in prostate cancer incidence, mortality, and PSA screening in US counties found that prostate cancer death rates were positively correlated with incidence rates of distant-stage disease for both African American and white men, suggesting a socioeconomic component to these disparities.[5]
- A study of the relationship between county-level poverty and distant-stage cancer in the US found that higher county poverty increased the odds of distant-stage prostate cancer (odds ratio = 1.7 for greater than or equal to 30% poverty compared to less than 10%).[6]

International variation

- Incidence rates vary by more than 50-fold worldwide, with the majority of cases diagnosed in economically developed countries.
- The highest incidence rates are observed in North America, Australia, and northern and central Europe.
- The lowest incidence rates are observed in southeastern and south central Asia and northern Africa.
- A 2002 study of prostate cancer incidence and mortality rates in 16 economically developed and 15 less developed countries found that incidence rates varied from < 5 per 100,000 in India, Egypt, China, and Bangladesh, to greater than 100 per 100,000 in the US and New Zealand. In the same study, the highest mortality rates were observed in Barbados (55.3 per 100,000), the Bahamas (35.6 per 100,00), Norway (28.4 per 100,000), and Sweden (27.7 per 100,000).[7] (International rates are adjusted to the 1960 world population and are not comparable to US rates presented in this publication, which are adjusted to the 2000 US population. For example, the current prostate cancer mortality rate in the US is 25.6 if age adjusted to the US standard population, but is 11.1 if age adjusted to the world standard population.)

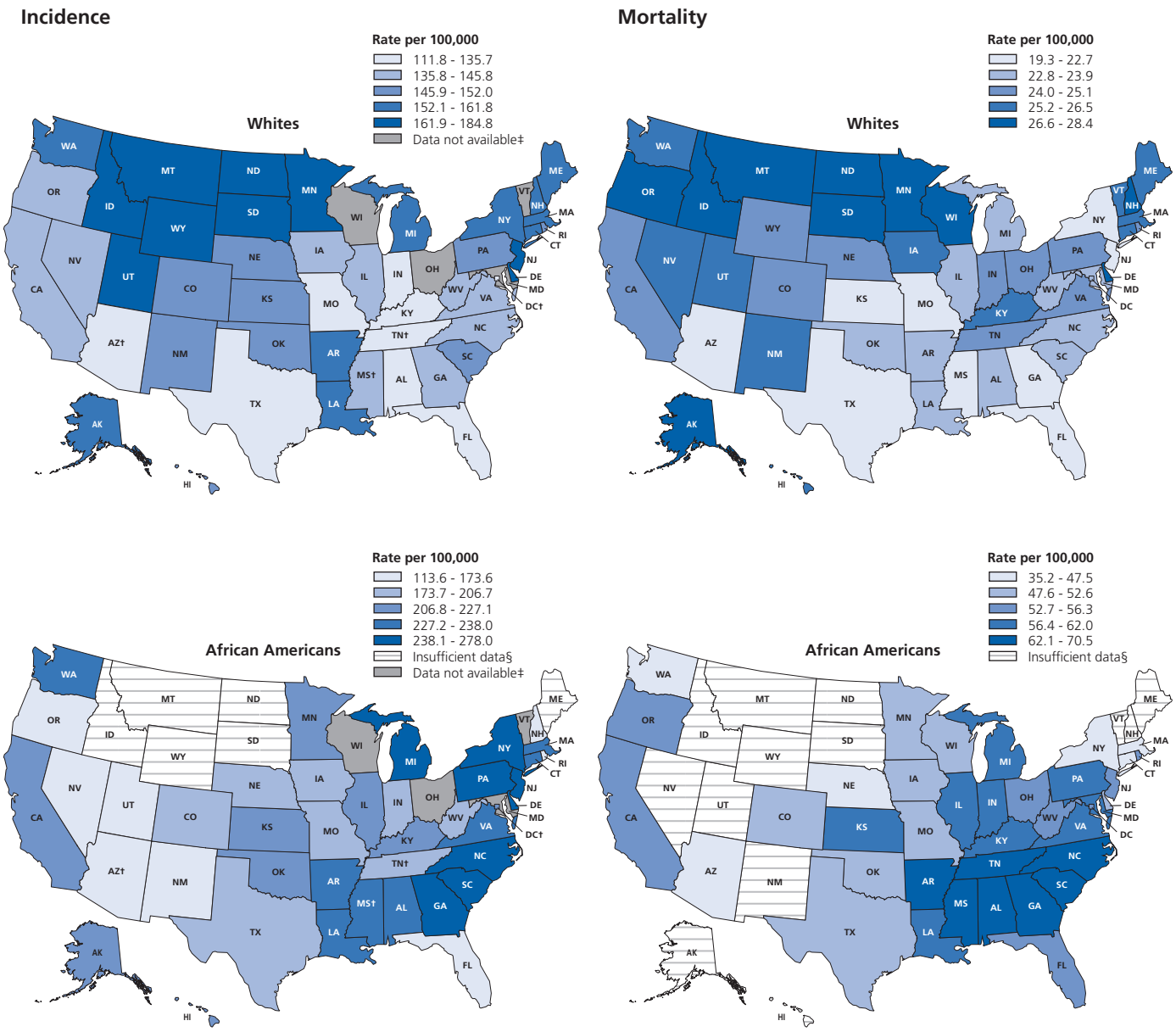
How Has the Occurrence of Prostate Cancer Changed Over Time?

Incidence trends

Incidence rates of prostate cancer for all races combined in the US show five distinct phases since 1975, when population-based surveillance of cancer began:

- Between 1975 and 1988, incidence increased by 2.6% per year.
- Between 1988 and 1992, incidence increased by 16.5% per year.
- Between 1992 and 1995, incidence decreased by 11.7% per year.
- Between 1995 and 2000, incidence was stable.
- Between 2000 and 2006, incidence rates decreased by 2.4% per year.[1]

Figure 2. Prostate Cancer Incidence and Death Rates* by State and Race, US, 2002-2006

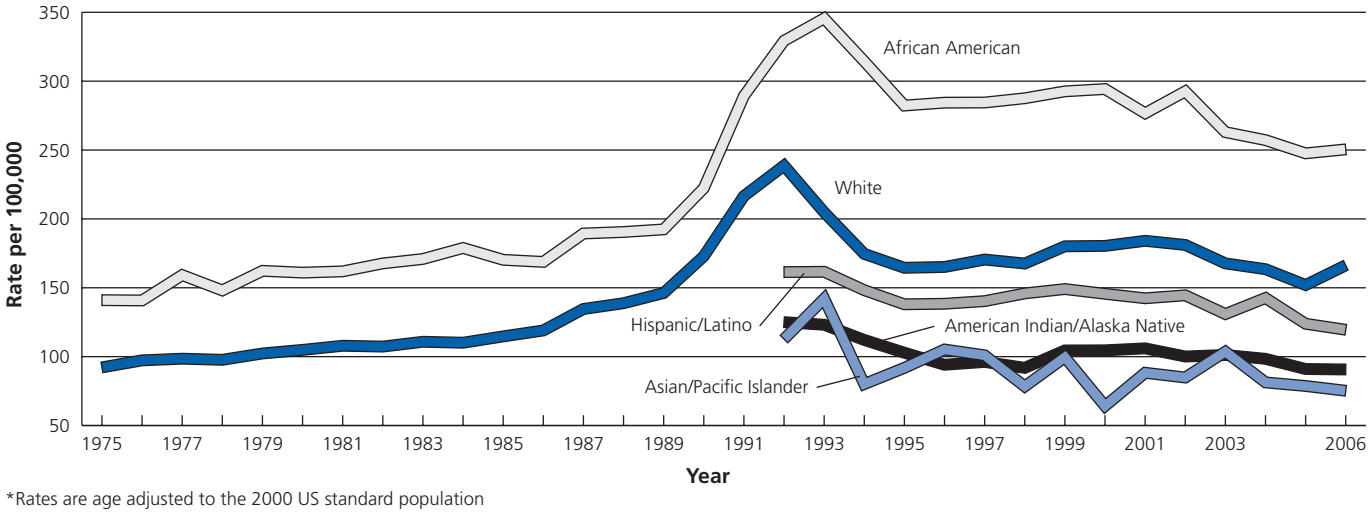


*Per 100,000 and age adjusted to the 2000 US Standard Population. †This state's registry did not achieve high-quality data standards for one or more years during 2002-2006, according to the North American Association of Central Cancer Registry (NAACCR) data quality indicators. ‡State did not submit incidence data to NAACCR for 2002-2006. §Statistic not displayed for states with fewer than 20 cases or deaths.

Source: Incidence: NAACCR, 2009. Deaths: National Center for Health Statistics, 2009.

In large part, changes in incidence rates of prostate cancer over the past 20 years reflect changes in prostate cancer detection, most importantly, the introduction of screening with the PSA blood test. PSA is a protein secreted by the prostate and normally present at low levels in blood. Elevated levels of PSA in blood can be a sign of prostate cancer, but can also be a sign of other conditions, such as benign prostatic hyperplasia (non-cancerous enlargement of the prostate) or prostatitis (inflammation of the prostate). Use of the PSA test for the diagnosis of prostate cancer increased dramatically in the US in the late 1980s, resulting in a rapid increase in prostate cancer incidence rates that peaked in 1992.[8-9] The rapid decline in prostate cancer incidence between 1992 and 1995 likely resulted from a decline in the number of men having their first PSA test (as opposed to subsequent) tests and from a reduced number of latent cases in the population due to the rapid dissemination of the test in the early 1990s. Factors associated with the more recent decline in incidence rates among men of all ages combined are less well understood. This

Figure 3. Trends in Prostate Cancer Incidence Rates* by and Race and Ethnicity, US, 1975-2006



*Rates are age adjusted to the 2000 US standard population

Data Source: Surveillance, Epidemiology, and End Results (SEER) Program, 1973-2006, Division of Cancer Control and Population Science, National Cancer Institute, 2009. Data for whites and African Americans are from the SEER 9 registries and are adjusted for delayed reporting. Data for other races/ethnicities are from the SEER 13 registries and are not adjusted for delayed reporting, and thus data for the most recent years are likely to bo underrepresented. For Hispanics, incidence data do not include cases from the Alaska Native Registry. Incidence data for American Indians/Alaska Natives are based on Contract Health Service Delivery Area (CHSDA) counties.

decline is evident among men aged 65 and older but not among younger men.

Although African American men have much higher incidence rates than whites, incidence trends have been similar for African American and white men since the 1970s (Figure 3). Incidence rates peaked in 1992 among white men (238.2 per 100,000) and in 1993 among African Americans (344.1 per 100,000). During the most recent time period (1997-2006), incidence rates decreased by 1.9% per year among African Americans and 1.7% per year among Hispanics, while remaining relatively stable among whites, Asian Americans/Pacific Islanders, and American Indians/Alaska Natives.

Mortality trends

Mortality rates for prostate cancer also show several distinct phases:

- Between 1975 and 1987, the death rate for all races combined increased by 0.9% annually.
- Between 1987 and 1991, the rate increased by 3.0% annually.
- Between 1991 and 1994, the rate remained level.
- Between 1994 and 2006, the rate decreased by 4.1% annually.

The increase in prostate cancer death rates between 1987 and 1991, coinciding with the introduction of PSA testing and rapidly rising incidence, is likely explained by attribution bias (increased likelihood of ascribing the cause of death to prostate cancer when multiple causes are present). After leveling off from 1991 to 1994, prostate cancer death rates declined in all racial/ethnic groups. From 1997 to 2006, prostate cancer death rates declined by a minimum of 3.5% per year in each major racial/ethnic group with the exception of American Indians and Alaska Natives, in which rates were stable.[1] Similar declines in prostate cancer mortality have been observed in Australia, Canada, and several countries in western Europe.[7] Some studies suggest that much of the decline in prostate cancer death rates is due to declines in the incidence of distant-stage disease due to early detection by PSA, while others suggest that improvements in prostate cancer treatment is responsible.[10-14] Improvements in surgery and radiation and the application of hormonal treatments for regional and metastatic disease may also have contributed to the decline.[15]

Can Prostate Cancer Be Prevented?

Although many epidemiological studies have been done to investigate the etiology (causes) of prostate cancer, few modifiable risk factors have been identified. Studies have investigated the role of family history, genetic factors, nutrition, dietary supplements, obesity, physical activity, infection, medication, and hormonal factors in prostate cancer risk.

Family history

Family history of prostate cancer has been widely studied, and is positively related to prostate cancer risk. Compared to men without a family history, men with one first-degree relative (a father or brother) with the disease are two to three times more likely to develop prostate cancer, and men with more than one affected first-degree relative are three to five times more likely to be diagnosed.[16]

Race/ethnicity

International variation in prostate cancer incidence and mortality, along with striking variations in incidence and mortality within the US, may in part reflect genetic factors that vary in populations originating in different parts of the world. A particularly high risk of prostate cancer is found in many populations with sub-Saharan African ancestry, while a low risk is found in many populations with Asian ancestry. Migration studies show that men of Asian heritage living in the US have a lower risk of prostate cancer than white Americans, but a higher risk than men of Asian heritage living in Asia.[16]

Genetic factors

A large number of studies have examined potential genetic factors associated with prostate cancer risk. Men with BRCA-2 mutations are at increased risk for prostate cancer that is more aggressive and develops at a younger age.[17-19] Consistent evidence from genetic studies has also identified locations on chromosome 8 (in a region called 8q24) that are associated with an increased risk of developing prostate cancer and with more aggressive prostate cancer.[20-21]

Nutrition and dietary supplements

A variety of nutritional factors have been suggested to alter the risk of prostate cancer in large prospective cohort studies, but results are inconsistent between studies. Some studies suggest that diets with very high levels of calcium (>1,500 mg/day) or consumption of red and processed meat may be associated with increased risk.[22-23] Some studies also suggest that consumption of diets high in milk and dairy products and high intake of animal and saturated fats may increase risk.[24] Factors found in some studies to decrease risk include diets high in lycopene (a substance found in tomatoes and watermelon), selenium (a nonmetallic element found in a variety of foods), and vitamin E.[24] However, a randomized, placebo-controlled trial of selenium and vitamin E supplementation found no evidence of decreased prostate cancer risk.[25] At the present time, the best dietary advice for reducing the risk of prostate cancer is to eat at least five servings of a wide variety of fruits and vegetables each day, limit intake of red meats, avoid excessive consumption (e.g. > 3 servings/day) of dairy products, maintain an active lifestyle, and consume foods that help maintain a healthy weight.[26]

Obesity and physical activity

Associations between obesity and prostate cancer vary by stage of disease. In the American Cancer Society Cancer Prevention Study-II (CPS-II) Nutrition Cohort, higher body mass index (BMI) was associated with lower risk of non-metastatic low-grade prostate cancer, but higher risk of high-grade, metastatic, and fatal prostate cancers.[27] An analysis of physical activity found no association with overall prostate cancer risk, but a 30% lower incidence of aggressive prostate cancer among the most physically active compared to inactive men.[28] Although results of studies are not completely consistent on the relationships among prostate cancer, obesity, and physical activity, the data suggest that following the American Cancer Society guidelines to maintain a healthy body weight and be physically active may reduce the risk of developing aggressive prostate cancer and improve outcomes following treatment.[29-30]

Infection

Some studies have shown associations between sexually transmitted diseases and clinical prostatitis with prostate cancer. However, most of the evidence comes from case-control studies in which information about risk factors is obtained from patients after diagnosis, raising the possibility that recall bias influences the results.[24]

Medications

Long-term use of aspirin was associated with lower risk of prostate cancer in the CPS-II Nutrition Cohort, as well as some other studies.[31-32] However, taking aspirin or other nonsteroidal anti-inflammatory drugs (NSAIDS) for the prevention of prostate cancer is not recommended due to the potential side effects of these medications. Recent studies suggest that statins, which are prescribed to lower cholesterol levels and reduce the risk of cardiovascular disease, may reduce the risk of advanced prostate cancer.[33]

Hormonal factors

Androgens influence the maturation of the prostate and are believed to contribute to the development and progression of prostate cancer. However, studies of hormones and prostate cancer risk have been complicated by measurement issues and difficulties accounting for normal changes in hormone levels as men grow older. Thus, there is still uncertainty about how hormonal factors influence prostate cancer risk.[16]

Chemoprevention

The chemoprevention of prostate cancer is an active area of research. Two drugs of interest – finasteride and dutasteride – reduce the amount of certain male hormones in the body and are already used to treat the symptoms of an enlarged prostate. In the Prostate Cancer Prevention Trial, men who received finasteride had a 25% lower risk of developing prostate cancer than men who did not take the drug.[34] Side effects from finasteride experienced by some men in this study included erectile dysfunction, loss of libido, and breast enlargement. Recently published results from the Reduction by DUtasteride of Prostate Cancer Events (REDUCE) clinical trial found that men who received dutasteride had a 23% lower risk of developing prostate cancer than men who did not take the drug.[35] Men receiving the drug also had a lower rate of surgery for benign prostatic hypertrophy (non-malignant enlargement of the prostate) and fewer urinary problems; the risk of sexual and other side effects from dutasteride was modest.

Sunlight and vitamin D

Higher prostate cancer incidence and mortality among Caucasian populations living in more northern latitudes in the US and Europe suggest that exposure to ultraviolet radiation may be protective, possibly by increasing vitamin D synthesis. Although an ecologic study in the US found that prostate cancer mortality by county is inversely related to estimated UV radiation levels,[36] and some epidemiologic studies suggest that sun exposure may be protective, most studies examining individual blood levels of vitamin D and prostate cancer risk do not show an association.[37]

Can Prostate Cancer be Detected Early?

Most prostate cancers are diagnosed before symptoms develop through PSA screening or a digital rectal exam (DRE). Early prostate cancer usually has no symptoms. With more advanced disease, individuals may experience weak or interrupted urine flow; inability to urinate or difficulty starting or stopping the urine flow; the need to urinate frequently, especially at night; blood in the urine; or pain or burning with urination. (It is important to note that these symptoms occur frequently as a result of non-cancerous conditions, such as prostate enlargement or infection and that none are specific for prostate cancer.) Advanced prostate cancer commonly spreads to the bones, which can cause pain in the hips, spine, ribs, or other areas.

PSA screening can usually detect prostate cancer years earlier than it would be detected by a DRE or the development of symptoms.[38] Although there is no absolute cutoff between a normal and an abnormal PSA level, screening programs in the US have commonly used >4 ng/mL to define a positive test. PSA screening has several limitations. Many men who do not have prostate cancer will screen positive and require a biopsy for diagnosis, and some men with prostate cancer do not have elevated PSA levels. In addition, because many prostate cancers grow so slowly that they may never threaten a patient's life, there is a danger of overtreatment. This is a particularly important issue since treatment for prostate cancer is often associated with significant side effects.

Two large randomized trials of prostate cancer screening with PSA testing have been completed. The US-based Prostate, Lung, Colorectal and Ovarian (PLCO) Cancer Screening Trial did not observe a mortality benefit from screening, while the European Randomized Study of Screening for Prostate Cancer (ERSPC) demonstrated a 20% reduction in prostate cancer mortality among men in the group invited for screening compared to those not invited.[39-40] Differences in the methods used in the US and European screening trials and differences in screening practices in the general population of men in the US may have contributed to differences in the results of the two trials. Because of continued uncertainty about the balance of benefits and risks, the Society stresses the importance of involving men in the screening decision.

American Cancer Society Guidelines for Early Detection of Prostate Cancer

The American Cancer Society released updated prostate cancer screening guidelines in March 2010.[41] These guidelines recommend that asymptomatic men who have at least a 10-year life expectancy 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 uncertainties, risks, and potential benefits associated with prostate cancer screening. Screening should not occur without an informed decision-making process. Men at average risk should receive this information beginning at age 50. Men at higher risk, including African American men and men with a first-degree relative (father or brother) diagnosed with prostate cancer before age 65, should receive this information beginning at age 45. Men at appreciably higher risk (multiple family members diagnosed with prostate cancer before age 65) should receive this information beginning at age 40. Men should either receive this information directly from their health care providers or be referred to reliable and culturally appropriate sources. Patient decision aids are helpful in preparing men to make a decision about whether to be tested (Table 2). For men who are unable to decide, the screening decision can be left to the discretion of the health care provider, who should factor into the decision his knowledge of the patient's general health preferences and values.

Asymptomatic men who have less than a 10-year life expectancy based on age and health status should not be offered prostate cancer screening. At age 75, only about half of men have a life expectancy of 10 years or more. Men in this age group with significant co-morbidities (additional unrelated health issues), as well as younger men with life-limiting conditions, are not likely to benefit from screening. Life-limiting conditions become more common as men age; thus, it is important to consider overall health status – not age alone – when making decisions about screening.

Core elements of the information to be provided to men to assist with their decision include:

- Prostate cancer is an important health concern for men.
- Screening with the PSA blood test alone or with both the PSA and the DRE detects cancer at an earlier stage than if no screening is performed.
- Prostate cancer screening may be associated with a reduction in the risk of dying from prostate cancer. However, evidence is conflicting, and experts disagree about the value of screening.
- For men whose prostate cancer is detected by screening, it is currently not possible to predict which men are likely to benefit from treatment. Some men who are treated may avoid disability and death from prostate cancer. Others who are treated would have died of unrelated causes before their cancer became serious enough to affect their health or shorten their lives.

Table 2. Decision Aids for Prostate Cancer Screening

Supporting organization	Type of decision aid	Title & online access
American Cancer Society	Downloadable Document (PDF)	"Testing for Prostate Cancer" Available at: cancer.org/downloads/PRO/Testing_Prostate.pdf
Foundation for Informed Medical Decision Making	Video and Online Interactive Resource	"Is a PSA Test Right For You?" Available through Health Dialog at healthdialog.com/
Centers for Disease Control and Prevention	Downloadable Document (PDF) Culturally targeted options	"Prostate Cancer Screening: A Decision Guide" Available at: cdc.gov/cancer/prostate/pdf/prosguide.pdf "Prostate Cancer Screening: A Decision Guide for African Americans" Available at: cdc.gov/cancer/prostate/pdf/aaprosguide.pdf "La Detección del Cáncer de Próstata: Una Guía para Hispanos en los Estados Unidos" Available at: cdc.gov/cancer/prostate/pdf/prostate_cancer_spanish.pdf
MayoClinic.com	Online Resource	"Prostate Cancer Screening: Should you get a PSA test?" Available at: mayoclinic.com/health/prostate-cancer/HQ01273
University of Cardiff, UK	Online Interactive Resource	"PROSDEX: A PSA Decision Aid" Available at: prosdex.com/

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- Treatment of prostate cancer can lead to urinary, bowel, sexual, and other health problems. These problems may be significant or minimal, permanent or temporary.
- The PSA and the DRE may have false-positive or false-negative results, meaning men without cancer may have abnormal results and get unnecessary additional testing, and clinically significant cancers may be missed. False-positive results can lead to sustained anxiety about prostate cancer risk.
- Abnormal results from screening with the PSA or the DRE require prostate biopsies to determine whether the abnormal findings are cancer. Biopsies can be painful, may lead to complications like infection or bleeding, and can miss clinically significant cancer.
- Not all men whose prostate cancer is detected through screening require immediate treatment, but they may require periodic blood tests and prostate biopsies to determine the need for future treatment.

In helping men to reach a screening decision based on their personal values, once they understand the uncertainties, risks, and potential benefits, it can be helpful to provide reasons why some men decide for or against undergoing screening. For example:

- A man who chooses to be screened might place a higher value on finding cancer early, might be willing to be treated without definite expectation of benefit, and might be willing to risk injury to urinary, sexual, and/or bowel function.
- A man who chooses not to be screened might place a higher value on avoiding the potential harms of screening and treatment, such as anxiety or risk of injury to urinary, sexual, or bowel function.

The screening decision is best made in partnership with a trusted source of regular care. Men who have no access to regular care should be tested only if high-quality, informed decision-making can be assured through community-based screening programs. Such programs also must assure that participants with abnormal screening results receive appropriate counseling and follow-up care if needed. Availability of follow-up care must not be an afterthought. Unless these program elements are in place, community-based screening should not be initiated.

Once a screening decision has been made, the decision should be readdressed when new research becomes available that significantly alters the balance between benefits and risks, as well as uncertainties regarding prostate cancer early detection. In the absence of new information, the decision should be readdressed periodically, as a man's health status, values, and preferences change over time.

For men who choose to be screened for prostate cancer after considering the possible benefits and risks:

- Screening is recommended with the PSA with or without the DRE.
- Screening should be conducted yearly for men whose PSA level is 2.5 ng/ml or higher.
- For men whose PSA is less than 2.5 ng/ml, screening intervals can be extended to every 2 years.
- A PSA level of 4.0 ng/ml or higher has historically been used to recommend referral for further evaluation or biopsy, which remains a reasonable approach for men at average risk for prostate cancer.

Table 3. Examples of Prostate Cancer Treatment Recommendations by Disease Characteristics and Life Expectancy

Risk of progression & recurrence	Clinical characteristics	Life expectancy	Recommended initial treatment options
Low	T1-T2a, and Gleason score 2-6, and Blood PSA level < 10 ng/mL	< 10 years	Active surveillance
		> 10 years	Active surveillance or radical prostatectomy or radiation therapy (external beam or brachytherapy)
Intermediate	T2b-T2c, or Gleason score 7 or PSA level 10-20 ng/mL	< 10 years	Active surveillance or radical prostatectomy or radiation therapy (external beam +/- brachytherapy) +/- ADT
		> 10 years	Radical prostatectomy or radiation therapy (external beam +/- brachytherapy) +/- ADT
High risk	T3a, or Gleason 8-10 or PSA level > 20 ng/mL	All	Radical prostatectomy (selected patients) or radiation therapy (external beam) + long-term ADT

ADT = androgen deprivation therapy

Source: Prostate Cancer. *NCCN Clinical Practice Guidelines in Oncology 2009*.[34]

For PSA levels between 2.5 and 4.0 ng/ml, health care providers should consider an individualized risk assessment that incorporates other risk factors for prostate cancer, particularly for high-grade cancer, which may be used for a biopsy recommendation. Factors that increase the risk of prostate cancer include African American race, family history of prostate cancer, increasing age, and an abnormal DRE. A prior negative biopsy lowers risk.

How is prostate cancer diagnosed?

When prostate cancer is suspected, a biopsy is performed. A biopsy is a procedure in which a sample of body tissue is removed and examined under a microscope. A core needle biopsy is the main method used to diagnose prostate cancer. Several biopsy samples are taken from the prostate and evaluated to determine whether cancer is present and what grade it is based on the degree of abnormality of the cells. Additional tests may be required to determine if the cancer has spread beyond the prostate.

What Factors Influence Prostate Cancer Survival?

Prostate cancer survival rates are strongly related to stage, with a 5-year relative survival rate approaching 100% among patients diagnosed with localized or regional disease and 31% among men diagnosed at distant stage.[42] However, prostate cancer survival rates in the US are strongly influenced by widespread screening. Most prostate cancer cases are diagnosed as the result of a PSA screening test, which advances the time by which they will be diagnosed (referred to as lead time) by as much as 5 to 7 years.[38] As a result, the majority of US men with prostate cancer are diagnosed with localized disease.[42]

Among patients with localized or regional stage disease, factors associated with disease recurrence and progression include PSA level and Gleason score.[43-44] These factors, along with tumor (T) stage, extent of lymph node involvement, and life expectancy, are used to estimate the risk of progression and recurrence and to assist with treatment decisions (Table 3).[44]

- **T stage** expresses the size and extension of the tumor. T1 tumors are so small that they can't be felt during a DRE or seen with imaging such as transrectal ultrasound. T2 tumors can be felt during a DRE but appear to be confined to the prostate gland. T3 tumors have begun to grow and spread outside the prostate and may involve the seminal vesicles. T4 tumors have grown into tissues next to the prostate (other than the seminal vesicles), such as the bladder sphincter (muscle that helps control urination), the rectum, and/or the wall of the pelvis. Patients with T3 tumors have AJCC Stage III (regional stage disease) and those with T4 tumors are considered to have AJCC Stage IV (distant stage disease).
- **PSA level** and velocity (rate of increrase over time) have been associated with the likelihood of recurrence or progression. PSA levels of less than 10 ng/mL are considered to be low risk; 10-20 ng/mL, intermediate risk; and greater than 20 ng/mL, high risk. A PSA velocity of greater than 2 ng/mL in the year prior to diagnosis is associated with both a greater risk of disease relapse and a higher risk of prostate cancer death following treatment.[45-46]
- **Gleason score** expresses the grade of the tumor, which is the degree to which it resembles normal prostate tissue. Higher Gleason scores indicate larger differences from normal tissue and more aggressive disease. Cancers with Gleason scores of 2 to 4 are sometimes called well differentiated or low grade; cancers with Gleason scores of 5 to 7 may be called moderately differentiated or intermediate grade; and cancers with Gleason scores of 8 to 10 may be called poorly differentiated or high grade.

Survival rates for prostate cancer differ by race and ethnicity. After controlling for age and stage at diagnosis, the risk of cancer death after diagnosis when compared to non-Hispanic whites is highest for American Indian and Alaska Native men (1.81), followed by African American (1.31) and Hispanic white men (1.12). Asian and Pacific Islander men are less likely than white men to die from prostate cancer (0.70).[47] Survival differences by race/ethnicity may be attributed to differences in prognostic factors and/or differences in access to care and treatment patterns. A study in the American Cancer Society Cancer Prevention Study-II (CPS-II) Nutrition Cohort found that men with at least a high school education were 50% less likely to die after prostate cancer diagnosis than those with less than a high school education, even after accounting for differences in age, race, stage, and grade.[48]

How Is Prostate Cancer Treated?

Most men with prostate cancer have several treatment options available to them and participate in treatment decisions along with their health care providers. Treatment recommendations vary by disease severity and life expectancy since the side effects of treatment may outweigh the potential benefits for men whose cancers are unlikely to progress in their lifetime (Table 3). The major treatments for clinically localized prostate cancer are active surveillance, radical prostatectomy, and radiation therapy, with active surveillance more likely to be recommended for men of any age with low risk cancer and for those with less than 10 years of life expectancy. Patients with locally advanced prostate cancer are generally recommended to receive external beam radiation along with androgen deprivation therapy (ADT); some may be eligible for radical prostatectomy as an alternative to external beam radiation. Patients with lymph node metastasis may receive ADT alone or a combination of external beam radiation and ADT, while those with metastatic disease will generally receive ADT alone.

Figure 4 shows the primary treatment selected among men diagnosed with localized prostate cancer in 2004-2006 in 17 areas covered by Surveillance, Epidemiology, and End Results (SEER) registries, by risk category and age at diagnosis. The category "no treatment" in this figure includes active surveillance, for which there is no specific treatment code, as well as ADT, which is not accurately coded in registry data and therefore not available for analysis in publically available SEER data. As would be expected when treatment recommendations are based on life expectancy, younger men (under 65) have the highest probability of receiving potentially curative treatment (radical prostatectomy or radiation therapy) across all risk categories, whereas older men (75+) are least likely to receive curative treatment.

Each type of treatment is associated with potential risks and benefits, which men should understand in order to choose treatment based on the factors most important to them.[49] The main benefit of active surveillance is that it may allow definitive treatment to be postponed indefinitely or for many years, during which time the man will not be affected by complications or side effects of treatment. On the other hand, there is a risk that if the cancer does progress, delayed treatment may make it more difficult to cure. Radical prostatectomy and radiation therapy with or without hormonal therapy are recommended for men for whom there is a reasonable chance of cure and who have a life expectancy greater than 10 years. Surgical and radiation treatment may result in urinary incontinence, problems in bowel function, and reduced ability to achieve and maintain an erection. Some of these problems may decline as time passes, but others may increase. Hormonal treatment may be offered as an adjunct (addition) to other forms of treatment, or may be used as primary treatment for advanced disease and for men with short life expectancy. Side effects of hormonal treatment may include loss of libido (interest in sex), hot flashes, osteoporosis (low bone density), and an increased risk of diabetes and cancer. The American Cancer Society recently collaborated with the American Heart Association and the American Urological Association to issue an advisory about the cardiovascular risks associated with ADT.[50]

Prostate Cancer Treament Options

Active surveillance involves monitoring the course of disease with the expectation to intervene if the cancer progresses. Active surveillance is often offered to men who have low-risk disease and/or limited life expectancy. Monitoring under active surveillance involves PSA testing every 3 to 6 months, DRE every 6 to 12 months, and may involve additional biopsies.

Radical prostatectomy involves surgical removal of the prostate along with nearby tissues. Regional lymph nodes may also be removed for examination to determine whether lymph node metastases are present. Several approaches can be used for radical prostatectomy, including conventional (open) surgery and several minimally invasive (laparoscopic) surgical techniques. Nerve-sparing surgery is done where possible to increase the likelihood that normal sexual function is preserved.

The two types of **radiation therapy** used for prostate cancer are **external beam radiation** and **brachytherapy**.

In **external beam radiation**, the patient receives radiation treatment from an external source, usually over an 8- to 9-week period. Patients with intermediate- or high-risk cancers may be recommended for pelvic lymph node irradiation and/or ADT in addition to external beam radiation to the prostate.

Brachytherapy involves placing small radioactive pellets, sometimes referred to as seeds, into the prostate tissue. Most centers use permanent, low-dose implants that gradually lose their radioactivity over time. Brachytherapy treatment alone may be recommended for low-risk cancers, and combined with external beam radiation therapy (with or without ADT) for intermediate-risk cancers.

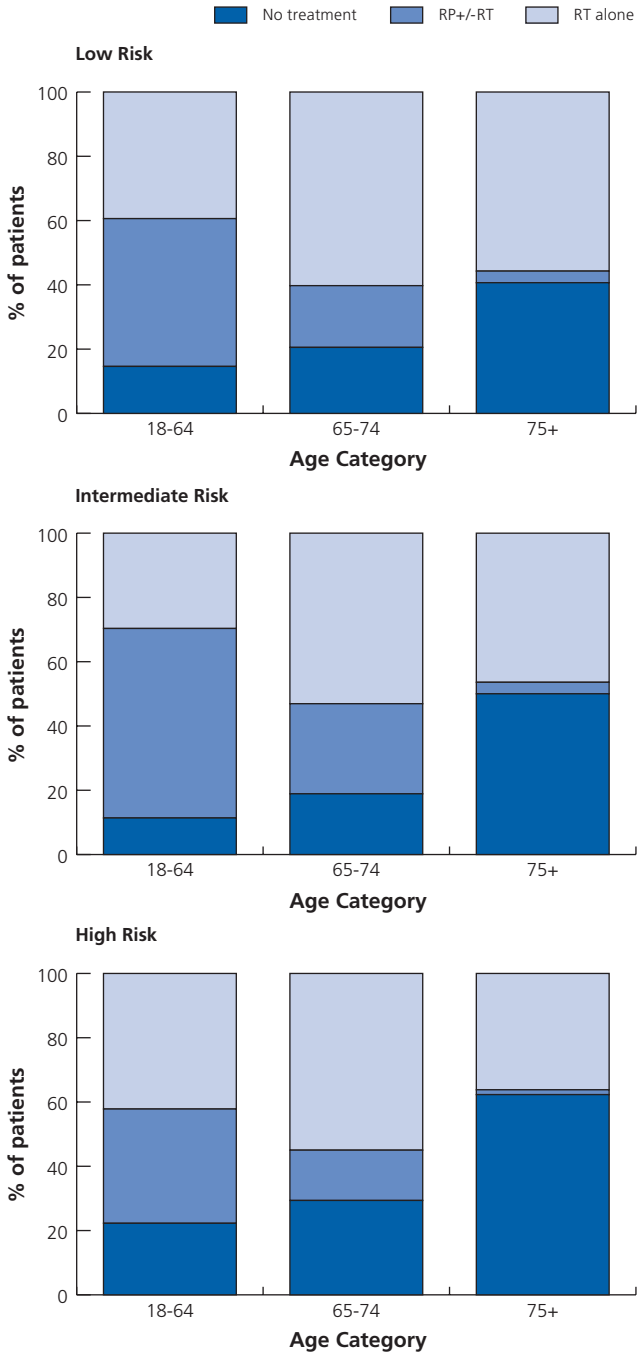
Androgen deprivation therapy (ADT), or hormone therapy, alters the effects of male hormones on the prostate through medical or surgical castration (elimination of testicular function) and/or administration of antiandrogen medications.

Men who receive curative-intent treatment with either radical prostatectomy or radiation therapy are usually monitored for cancer recurrence by measuring PSA levels every 6 to 12 months for the first 5 years and annually thereafter. Men who have radical prostatectomy are considered to have biochemical recurrence if their PSA level never falls to undetectable after surgery, or if they achieve an undetectable PSA after surgery, but have a subsequent detectable PSA that increases on two or more laboratory tests. Many men who do have a biochemical recurrence do not develop detectable metastases for many years. For example, one study found that the median time from PSA elevation to metastases was 8 years.[51] Several types of treatment options are available for patients whose prostate cancer has recurred or progressed.[52]

Disparities in stage at diagnosis and treatment

- Analyses of data from the National Cancer Database, a national hospital-based registry, found that patients without health insurance or with Medicaid insurance were more likely than those with private insurance to be diagnosed with advanced stage (AJCC Stage III-IV) prostate cancer, compared to early stage (AJCC Stage I-II) prostate cancer.[53-54] Insurance status is associated with access to preventive services and primary care. The 2006 National Health Interview Survey (NHIS) found that 53.6% of uninsured adults had no usual source of health care, compared with 9.9% of privately insured adults.
- A study of factors associated with PSA screening within the past 2 years using 2005 NHIS data found that men without a usual source of health care were significantly less likely to have had a PSA test within the past 2 years. Among men aged 50-79, 51.2% of those with a usual source of care had a recent PSA test, compared to 25.3% without.
- Previous studies have documented that African Americans were more likely than whites to be diagnosed with advanced stage prostate cancer. From 1988-1989 to 2004-2005, however, the incidence (per 100,000) of T3 and T4 prostate cancers among African American patients decreased from 90.9 to 13.3 while the incidence among whites decreased from 52.7 to 7.9.[55] Figure 5 shows trends in incidence rates by stage for African American and white men from 1988 to 2006. These figures suggest that as overall incidence rates for more advanced disease (including localized T3 and T4 tumors as well as regional and distant stage) have declined, disparities in disease severity by race have also been reduced. Table 4 compares disease severity characteristics among African American and white men diagnosed in 2004-2006. Although African American men continue to have higher PSA levels at diagnosis, the distribution of Gleason scores is now quite similar.

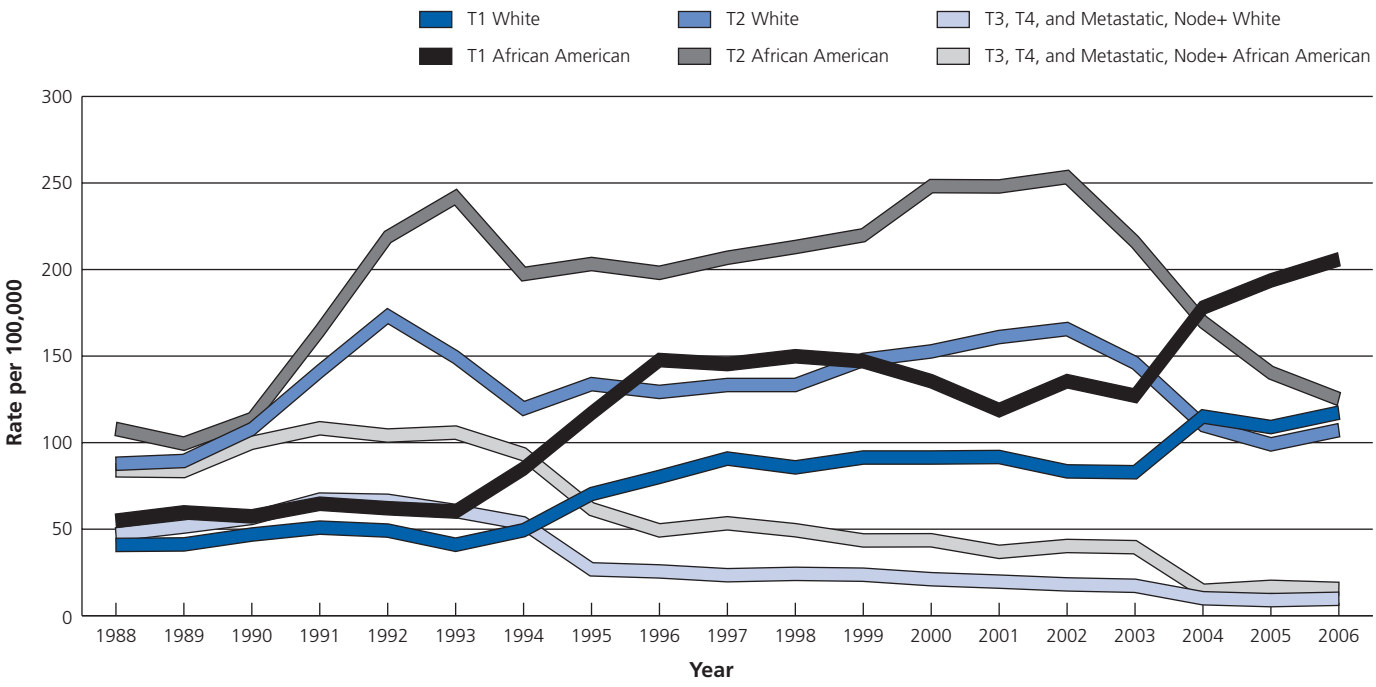
Figure 4. Prostate Cancer Treatment Patterns by Risk Category (Disease Severity) and Age, US, 2004-2006



RP = radical prostatectomy; RT = radiation therapy

Data Source: Surveillance Epidemiology and End Results (SEER) Program, SEER 17 Registries, 2004-2006, Division of Cancer Control and Population Science, National Cancer Institute, 2009.

Figure 5. Trends in Prostate Cancer Incidence by Stage and Race, US, 1988-2006



Data Source: Surveillance, Epidemiology, and End Results (SEER) Program, SEER 9 Registries, 1988-2006, Division of Cancer Control and Population Science, National Cancer Institute, 2009.

- Decreasing disparities in disease severity between African Americans and whites likely result from increased awareness of the higher prostate cancer risk among African Americans among health care providers and the general public and the uptake of PSA screening among African American men. The 2005 NHIS found that non-Hispanic African American men aged 40-49 were more likely to have had a PSA test in the past 2 years than non-Hispanic white men (25.7% and 14.6%, respectively). Men aged 40-49 with a family history of prostate cancer were more likely to have had a PSA test than men with no family history (36.6% and 14.8%, respectively). These data suggest that health care practitioners are implementing recommendations for discussing PSA screening at an earlier age with high-risk men, including African Americans and those with a family history of prostate cancer. The prevalence of recent PSA screening among 50- to 79-year-old men was 49.9% in non-Hispanic African Americans and 48.8% in non-Hispanic whites. An analysis of data from the NHIS 2000 survey found that the majority (73.8%) of African American men who had had at least one PSA test reported that they had physician discussions about the advantages and disadvantages of the test.[56]

Numerous studies have documented differences in treatment between African American and white men with prostate cancer.[57-60] In particular, African American men with localized prostate cancer are less likely to have curative treatment (radical prostatectomy or radiation therapy). Among patients receiving curative treatment, African American men are more likely to receive radiation therapy than radical prostatectomy.[57, 61] Differences in treatment patterns by race persist in the most recent years of data available from the SEER registries (Table 5). Differential treatment patterns by race/ethnicity may result from health system, physician, and patient factors, including communication and understanding of treatment options.[57, 62-65] Several studies have also found higher levels of medical mistrust among African American men with prostate cancer, particularly those who delayed seeking care.[66-67] Disparities in receipt of curative treatment among African American and Hispanic patients may contribute to poorer survival in these groups.[47, 55, 68] Previous studies have reported African American and white patients with various types of cancer have similar survival rates when recommended treatment is administered uniformly and where patients are treated in equal-access facilities.[69-70]

Table 4. Prostate Cancer Age Distribution and Clinical Characteristics (%) by Race, US, 2004-2006

Characteristic	All patients	White	Black
Age			
Mean	67.0	68.0	65.0
18-64	40.0	38.5	49.9
65-74	35.3	35.5	33.6
75+	24.8	26.0	16.5
PSA level, ng/mL			
Median	6.5	6.4	7.2
≤2.5	7.0	7.2	5.7
2.6-4	6.7	6.9	5.6
4.1-6.9	32.5	32.9	30.0
7-10	15.7	15.7	15.5
10.1-20	12.9	12.6	14.9
>20	10.9	10.3	15.0
Unknown	14.3	14.4	13.3
Gleason Score			
2-6	46.3	46.8	42.8
3+4	23.7	23.5	25.1
4+3	9.3	9.2	9.8
8-10	14.2	14.1	14.9
Unknown	6.5	6.4	7.4
Clinical Tumor Stage			
T1	52.2	51.8	55.3
T2	39.5	40.0	36.2
T3	2.3	2.4	2.2
T4	1.0	1.0	1.3
Unknown	5.0	5.0	5.0
Seer Summary Stage			
Localized	80.9	80.9	80.9
Regional	11.7	11.9	10.4
Distant	4.3	4.1	5.7
Unknown	3.1	3.1	3.0

Data Source: Surveillance, Epidemiology, and End Results (SEER) Program, SEER 17 Registries, 2004-2006, Division of Cancer Control and Population Science, National Cancer Institute, 2009.

Survivorship

The National Cancer Institute estimates that approximately 2.2 million men with a history of prostate cancer were alive in January 2006. Nearly half of all male cancer survivors in the US are prostate cancer survivors. The prominence of prostate cancer survivors results in part from the large number of men diagnosed every year (217,730 in 2010) and the very high relative survival rates for this cancer. Prostate cancer survivors face a number of challenges, including the possibility of recurrence, complications of treatment, and functional impairments, which can severely impact quality of life. Many studies are under way to improve treatment for prostate cancer and improve quality of life for survivors. Important areas of research include how to better differentiate between early cancers that need aggressive treatment and those that can be safely left untreated and how to improve existing treatments so that they are less likely to produce unwanted side effects.

The decisions regarding the treatment and management of prostate cancer are often difficult because of the significant side effects of treatment that include sexual dysfunction, incontinence, urinary irritation, and bowel problems, all of which may have a negative impact on quality of life. One of the most common and most distressing side effects of prostate cancer treatment is the impact on sexual function, with upward of 75% of prostate cancer survivors reporting some degree of post-treatment erectile dysfunction.[71-73] Sexual dysfunction and urinary problems are common among prostate cancer survivors receiving radical prostatectomy, external beam radiation, or brachytherapy.[74-75] Recent findings suggest that nerve-sparing surgical procedures may mitigate some of the sexual side effects associated with radical prostatectomy.[76] In addition to functional impairments in sexuality, men whose treatment includes androgen suppression (the suppression or blockage of male hormones through surgery or hormone therapy) may experience a feminization of the body, reduced sexual desire, and diminished intimacy with their spouse.[77]

The physical side effects of prostate cancer treatment can lead to significant emotional and psychological distress, as well as complications in spousal or partnered relationships.[78] In addition, other emotional concerns such as fears about disease progression and recurrence, anxiety, and depression may also have a negative impact on prostate cancer survivors' quality of life. Findings from the Cancer of the Prostate Strategic Urologic Research Endeavor (CaPSURE) study, a national disease registry with more than 10,000 prostate cancer patients, indicated that 2 years after completion of treatment, fears about disease recurrence remained high, particularly among those with poorer physical health.[79] Likewise, a study of prostate cancer patients using Medicare data found that elevated PSA scores and secondary androgen ablation therapy were associated with rising fears of recurrence and poorer quality of life.[80] Still other research has begun to investigate prostate cancer survivors' perceptions about the effectiveness of their treatments and satisfaction with their treatment decisions. One study reported that most men felt confident that their cancer was well controlled and were satisfied with their treatment decisions.[81] However, a different set of factors affected each of these issues; perceived cancer control was most affected by adverse medical factors such as high Gleason scores whereas confidence in treatment decisions was highest among men who received radical prostatectomy or brachytherapy. In a large, multi-center study of more than 1,200 prostate cancer patients, satisfaction with treatment outcomes was significantly associated with patients' changes in sexual and urinary function, as well as with the degree of emotional distress among their spouses.[76]

Table 5. Prostate Cancer Treatment (%) by Race and Disease Severity, US, 2004-2006

Risk of progression & recurrence	White			Black		
	No treatment	RP+/-RT	RT alone	No treatment	RP+/-RT	RT alone
Low	17.7	35.7	46.8	20.9	26.7	52.5
Intermediate	18.3	45.2	36.4	21.3	40.3	38.5
High	32.2	28.2	39.6	38.0	22.9	39.1
Total	21.2	38.6	40.4	25.4	32.3	42.3

RP = radical prostatectomy; RT = radiation therapy

Data Source: Surveillance, Epidemiology, and End Results (SEER) Program, SEER 17 Registries, 2004-2006, Division of Cancer Control and Population Science, National Cancer Institute, 2009.

An important issue when considering the side effects of prostate cancer treatment is the degree to which these symptoms occur as part of the normal aging process. Hoffman et al. compared participants in the Prostate Cancer Outcomes Study (PCOS) to age- and ethnicity-matched controls with no history of prostate cancer and found that over a 5-year period, prostate cancer survivors had significantly greater declines in both sexual and urinary function.[82] Patients also reported higher levels of distress associated with these declines, but bowel function and general quality of life scores were not affected by cancer status.[82] In summary, treatment for prostate cancer is associated with complications that may negatively impact patient quality of life. In light of the currently documented modest gains in life expectancy from aggressive treatment when compared to clinical observation (active surveillance or watchful waiting), it is important for patients and their providers to discuss potential side effects as they relate to quality of life during treatment decision-making.

American Cancer Society Research

The American Cancer Society Cancer Prevention Study-II (CPS-II) is part of a large, international consortium that includes more than 16,000 cases of prostate cancer. The mission of this consortium is to identify genetic factors that increase risk for cancer, and further to study how these genetic factors interact with lifestyle and environmental factors. Through the work of this consortium, the first genetic markers ever to be associated with risk of prostate cancer were identified. These markers are currently being used in risk prediction models to help identify men at high risk of prostate cancer.

The American Cancer Society funds individual investigators in medical schools, universities, research institutes, and hospitals throughout the country through its Extramural Grants program. The program is currently funding 97 grants in prostate cancer research, totaling $54,973,800. Ongoing studies include:

- The identification of biologic markers for the early detection of recurrent prostate cancer
- Stress management and exercise during prostate cancer treatment
- The role of inflammation in prostate cancer
- Improving magnetic resonance imaging of prostate cancer
- Racial and ethnic differences in prostate cancer risk and treatment
- Understanding the molecular mechanisms of prostate cancer

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Cancer Disparities

An overarching objective of the American Cancer Society's 2015 challenge goals is to eliminate disparities in the cancer burden among different segments of the US population defined in terms of socioeconomic status (income, education, insurance status, etc.), race/ethnicity, residence, sex, and sexual orientation. The causes of health disparities within each of these groups are complex and interrelated, but likely arise from inequities in work, wealth, income, education, housing, and overall standard of living, as well as social barriers to high-quality cancer prevention, early detection, and treatment services.

Socioeconomic Status

Persons with lower socioeconomic status (SES) have disproportionately higher cancer death rates than those with higher SES, regardless of demographic factors such as race/ethnicity. For example, all cancer mortality rates among both African American and non-Hispanic white men with 12 or fewer years of education are more than twice those in men with higher levels of education. Further, progress in reducing cancer death rates has been slower in persons with lower socioeconomic status. These disparities occur largely because persons with lower SES are at higher risk for cancer and have less favorable outcomes after diagnosis. Persons with lower socioeconomic status are more likely to engage in behaviors that increase cancer risk, such as tobacco use, physical inactivity, and poor diet, in part because of marketing strategies that target these populations and in part because of environmental or community factors that provide fewer opportunities for physical activity and less access to fresh fruits and vegetables. Lower socioeconomic status is also associated with financial, structural, and personal barriers to health care, including lack of or inadequate health insurance, reduced access to recommended preventive care and treatment services, and lower literacy rates. Individuals with no health insurance are more likely to be diagnosed with advanced cancer. For more information about the relationship between health insurance and cancer, see *Cancer Facts & Figures 2008*, Special Section, available online at cancer.org.

Racial and Ethnic Minorities

Disparities in the cancer burden among racial and ethnic minorities largely reflect obstacles to receiving health care services related to cancer prevention, early detection, and high-quality treatment, with poverty (low SES) as the overriding factor. According to the US Census Bureau, in 2008, 1 in 4 African Americans and Hispanics/Latinos lived below the poverty line, compared to 1 in 10 non-Hispanic whites. Moreover, 1 in 5 African Americans and 1 in 3 Hispanics/Latinos were uninsured, while only 1 in 10 non-Hispanic whites lacked health insurance.

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

In addition to poverty and social discrimination, cancer risks and rates in a population may also be influenced by cultural and/or inherited factors that decrease or increase risk. For example, in cultures where early marriage is encouraged, women may have a lower risk of breast cancer because they begin having children at a younger age, which decreases breast cancer risk. Higher rates of cancers related to infectious agents (stomach, liver, uterine cervix) in populations that include a large number of recent immigrants may reflect a higher prevalence of infection in the country of origin. Individuals who maintain a primarily plant-based diet or do not use tobacco because of cultural or religious beliefs have a lower risk of many cancers. Genetic factors may also explain some differences in cancer incidence. For example, women from population groups with an increased frequency of mutations in the BRCA1 and BRCA2 genes, such as women of Ashkenazi Jewish descent, have an increased risk of breast and ovarian cancer. Genetic factors may also play a role in the elevated risk of prostate cancer among African American men and the incidence of more aggressive forms of breast cancer in African American women. However, genetic differences associated with race are thought to make a minor contribution to the disparate cancer burden between different racial/ethnic populations. Below is a brief overview of the cancer burden for each of the four major nonwhite racial/ethnic groups.

African Americans: African Americans are more likely to develop and die from cancer than any other racial or ethnic group. The death rate for cancer among African American males is 34% higher than among white males; for African American females, it is 17% higher than among white females. African American men have higher incidence and mortality rates than whites for each of the cancer sites listed on page 39 with the exception of kidney cancer, for which rates are about the same. For more information on cancer in African Americans, see *Cancer Facts & Figures for African Americans 2009-2010*, available online at cancer.org/statistics.

Hispanics: Hispanics have lower incidence rates for all cancers combined and for most common types of cancer compared to whites, but they have higher rates of cancers associated with infection, such as uterine cervix, liver, and stomach. For example, incidence rates of liver cancer are about twice as high in Hispanic men and women as in whites. For more information on cancer in Hispanics, see *Cancer Facts & Figures for Hispanics/Latinos 2009-2011*, available online at cancer.org/statistics.

Cancer Incidence and Death Rates* by Site, Race, and Ethnicity, US, 2002-2006

Incidence	White	African American	Asian American and Pacific Islander	American Indian and Alaska Native†	Hispanic/ Latino‡
All sites					
Male	550.1	626.0	334.5	318.4	430.3
Female	420.0	389.5	276.3	265.1	326.8
Breast (female)	123.5	113.0	81.6	67.2	90.2
Colon & rectum					
Male	58.2	68.4	44.1	38.1	50.0
Female	42.6	51.7	33.1	30.7	35.1
Kidney & renal pelvis					
Male	19.7	20.6	9.0	16.6	18.2
Female	10.3	10.6	4.5	10.6	10.3
Liver & bile duct					
Male	8.0	12.5	21.4	8.9	15.9
Female	2.8	3.8	8.1	4.6	6.2
Lung & bronchus					
Male	85.9	104.8	50.6	57.9	49.2
Female	57.1	50.7	27.6	41.3	26.5
Prostate	146.3	231.9	82.3	82.7	131.1
Stomach					
Male	8.9	16.7	17.5	9.4	14.3
Female	4.2	8.5	9.8	4.7	8.6
Uterine cervix	7.9	11.1	7.6	6.6	12.7

Mortality	White	African American	Asian American and Pacific Islander	American Indian and Alaska Native†	Hispanic/ Latino‡
All sites					
Male	226.7	304.2	135.4	183.3	154.8
Female	157.3	183.7	95.1	140.1	103.9
Breast (female)	23.9	33.0	12.5	17.6	15.5
Colon & rectum					
Male	21.4	31.4	13.8	20.0	16.1
Female	14.9	21.6	10.0	13.7	10.7
Kidney & renal pelvis					
Male	6.1	6.0	2.4	9.0	5.2
Female	2.8	2.7	1.2	4.2	2.4
Liver & bile duct					
Male	6.8	10.8	15.0	10.3	11.3
Female	2.9	3.9	6.6	6.5	5.1
Lung & bronchus					
Male	69.9	90.1	36.9	48.0	33.9
Female	41.9	40.0	18.2	33.5	14.4
Prostate	23.6	56.3	10.6	20.0	19.6
Stomach					
Male	4.8	11.0	9.6	9.8	8.3
Female	2.4	5.3	5.8	4.6	4.8
Uterine cervix	2.2	4.6	2.2	3.4	3.1

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

†Data based on Contract Health Service Delivery Areas, comprising about 55% of the US American Indian/Alaska Native population; for more information, please see: Espey DK, Wu XC, Swan J, et al. Annual report to the nation on the status of cancer. 1975-2004, featuring cancer in American Indians and Alaska Natives. ‡Persons of Hispanic/Latino origin may be of any race.

Source: Edwards BK, Ward E, Kohler BA, et al. Annual report to the nation on the status of cancer, 1975-2006. Cancer. 2010;116:544-573.

American Cancer Society, Surveillance and Health Policy Research, 2010

Asian Americans and Pacific Islanders: Similar to Hispanics, Asian Americans and Pacific Islanders have lower incidence rates than whites for the most common cancer sites, but higher rates for many of the cancers related to infection. As shown in the table on page 39, they have the highest incidence rates for liver and stomach cancers of all racial and ethnic groups in both men and women, and among the highest death rates for these cancer sites. Liver cancer incidence among Asian American and Pacific Islander men and women is more than 30% higher than that among Hispanics, who have the second-highest rates. (For more information on cancers related to infection, see *Cancer Facts & Figures 2005*, Special Section, available online at cancer.org.)

American Indians and Alaska Natives: Mortality rates for kidney cancer in American Indian and Alaska Native men and women are higher than in any other racial or ethnic population. Cancer information for American Indians and Alaska Natives is known to be incomplete because the racial/ethnic status of many of these individuals is not correctly identified in medical and death records. Although efforts have been made to collect more accurate information through linkage with the Indian Health Service records, available statistics probably do not represent the true cancer burden in this population.

Note: It is important to recognize that although cancer data in the US are primarily reported for broad racial and ethnic minority groups, these populations are not homogenous. There are significant variations in the cancer burden within each racial/ethnic group. For example, among Asian Americans, incidence rates for cervical cancer are almost three times as high in Vietnamese women as in Chinese and Japanese women, partly because the Vietnamese, in general, immigrated more recently, are poorer, and have less access to cervical cancer screening.

Geographic Variability

Cancer rates in the US vary widely by geographic area. The figure on page 41 depicts geographic variability in lung cancer mortality by state and sex in the US. Among both men and women, lung cancer death rates are 3-fold higher in Kentucky (108 and 56 per 100,000 in men and women, respectively), the state with the highest rates, than in Utah (33 and 18 per 100,000 in men and women, respectively), which has the lowest rates. These differences reflect the large and continuing differences in smoking prevalence among states, which is influenced to some extent by state tobacco control legislative policies. Geographic variations also reflect differences in environmental exposures and socioeconomic factors in population demographics. For more information about cancer disparities, see *Cancer Facts & Figures 2004*, Special Section, available online at cancer.org.

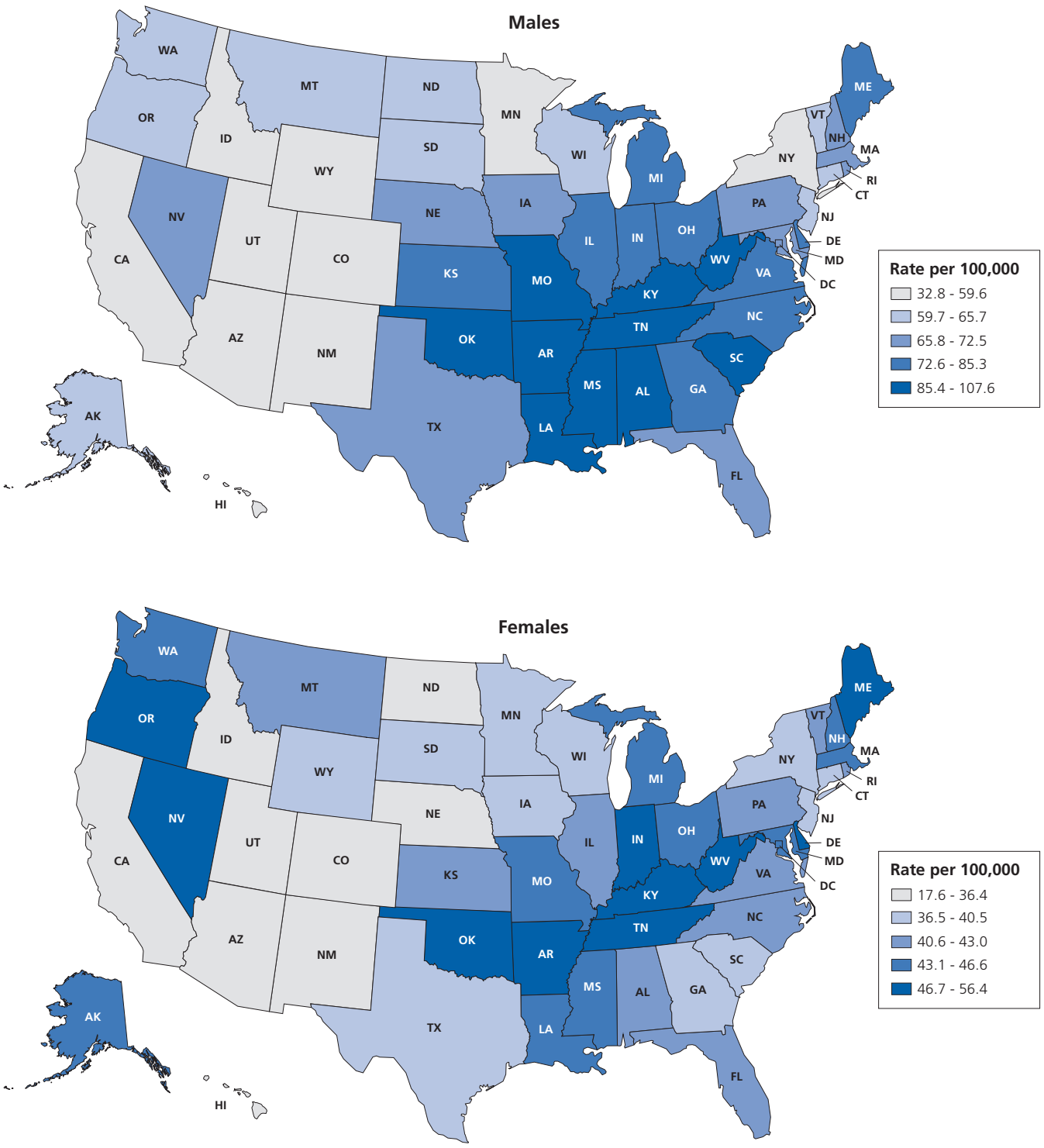
Public Policy

While the causes of cancer disparities are multifaceted, several policy initiatives seek to reduce these disparities. The National Breast and Cervical Cancer Early Detection Program (NBCCEDP), run by the Centers for Disease Control and Prevention (CDC), provides low-income, uninsured women with community-based breast and cervical cancer screening services. Medical assistance and treatment for women diagnosed with cancer through the NBCCEDP are available through Medicaid. The American Cancer Society and its nonprofit, nonpartisan advocacy affiliate, the American Cancer Society Cancer Action Network℠ (ACS CAN), work to maintain and increase funding for this program.

Similarly, ACS CAN supports legislation to create a colorectal cancer screening and treatment program administered by the CDC that will provide medically underserved communities with access to lifesaving screenings for colorectal cancer. The program will focus on low-income, uninsured men and women, as well as those at highest risk, such as African Americans, who are more likely to die of colorectal cancer than any other racial or ethnic group. Efforts also continue to secure funding for the patient navigator demonstration program to help patients navigate through the health care system, from screening to diagnosis and treatment, with culturally and linguistically competent providers and advocates. Legislation for this program was approved in 2005 and received $2.95 million in funding in 2008 and $4 million in 2009; the first round of grants was awarded in September 2008. Efforts continue to secure additional funding needed to implement this important program in communities across the country.

Finally, ACS CAN seeks increased funding for the National Center on Minority Health and Health Disparities (NCMHD) at the National Institutes of Health, along with the Disparities Center at the National Cancer Institute. The NCMHD is leading efforts to determine the causes and extent of cancer and other health disparities and is developing effective interventions to reduce these disparities, as well as exploring methods to facilitate delivery of those interventions. The American Cancer Society is committed to ensuring that all individuals have access to preventive cancer screenings and treatment. Barriers that limit access to preventive services and early detection result in cancer diagnoses at later stages, when the options for treatment and odds of survival are decreased. Opportunities to reduce disparities exist across the entire cancer continuum, from primary prevention to palliative care.

Geographic Patterns in Lung Cancer Death Rates*by State, US, 2002-2006



*Age adjusted to the 2000 US standard population.

Source: Surveillance, Epidemiology, and End Results (SEER) Program (seer.cancer.gov) SEER*Stat Database: Mortality – All COD, Aggregated With State, Total US (1969-2006) <Katrina/Rita Population Adjustment>, National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released May 2009. Underlying mortality data provided by NCHS (cdc.gov/nchs).

American Cancer Society, Surveillance and Healthy Policy Research, 2010

Tobacco Use

Smoking-related diseases remain the world's most preventable cause of death. Since the first US Surgeon General's report on smoking and health in 1964, there have been more than 12 million premature deaths attributable to smoking in the US.[1] The World Health Organization estimates that there are 5.4 million smoking-related premature deaths worldwide each year. The number of smoking-attributable deaths is almost evenly divided between industrialized and developing nations, and is greater in men (80%) than in women. More men die from smoking in developing nations than in industrialized nations.[2, 3]

Health Consequences of Smoking

Half of all those who continue to smoke will die from smoking-related diseases.[4] In the US, tobacco use is responsible for nearly 1 in 5 deaths; this equaled an estimated 443,000 premature deaths each year between 2000 and 2004.[5, 6] In addition, an estimated 8.6 million people suffer from chronic conditions related to smoking, such as chronic bronchitis, emphysema, and cardiovascular diseases.[7]

- Smoking accounts for at least 30% of all cancer deaths and 87% of lung cancer deaths.[8, 9]
- The risk of developing lung cancer is about 23 times higher in male smokers and 13 times higher in female smokers, compared to lifelong nonsmokers.[1]
- Smoking is associated with increased risk of at least 15 types of cancer: nasopharynx, nasal cavity and paranasal sinuses, lip, oral cavity, pharynx, larynx, lung, esophagus, pancreas, uterine cervix, kidney, bladder, stomach, and acute myeloid leukemia.[1]
- Recent studies suggest that smoking may also be associated with cancers of the colorectum, ovary, and female breast.
- Smoking is a major cause of heart disease, cerebrovascular disease, chronic bronchitis, and emphysema, and is associated with gastric ulcers.[1, 9]
- The risk of lung cancer is just as high in smokers of "light" or "low-tar" yield cigarettes as in those who smoke "regular" or "full-flavored" products.[10]

Reducing Tobacco Use and Exposure

The US Surgeon General in 2000 outlined the goals and components of comprehensive statewide tobacco control programs.[11] These programs seek to prevent the initiation of tobacco use among youth; promote quitting at all ages; eliminate nonsmokers' exposure to secondhand smoke; and identify and eliminate the disparities related to tobacco use and its effects among different population groups.[12] The Centers for Disease Control and Prevention (CDC) recommends funding levels for comprehensive tobacco use prevention and cessation programs for all 50 states and the District of Columbia. In 2009, only 9 states allocated 50% or more of CDC-recommended funding levels for tobacco control programs.[13] States that have invested in comprehensive tobacco control programs, such as California, Massachusetts, and Florida, have reduced smoking rates and saved millions of dollars in tobacco-related health care costs.[11, 14] Recent federal initiatives in tobacco control, including regulation of tobacco products, tax increases, and increased tobacco control funding, hold promise for reducing tobacco use. In June 2009, President Obama signed into law the Family Smoking Prevention and Tobacco Control Act, which for the first time grants the US Food and Drug Administration the authority to regulate the manufacturing, marketing, and sale of tobacco products. Also, in 2009, federal taxes on cigarettes were increased (from $0.39 per pack to slightly more than $1 per pack) as were taxes on other tobacco products (cigars, snuff, and chewing, pipe, and roll-your-own). For more information about tobacco control, see the American Cancer Society's *Cancer Prevention & Early Detection Facts & Figures 2010*, available online at cancer.org/statistics.

Trends in Smoking

- Between 1965 and 2004, cigarette smoking among adults aged 18 and older declined by half from 42% to 21%. Since 2004, smoking rates have changed little; in 2008, an estimated 21% of adults, or 46 million Americans, smoked cigarettes.[15, 16]
- Although cigarette smoking became prevalent among men before women, the gender gap narrowed in the mid-1980s and has since remained constant. As of 2008, there was a 3% absolute difference in smoking prevalence between white men (24%) and women (21%), an 8% difference between African American men (26%) and women (18%), a 10% difference between Hispanic men (21%) and women (11%), and an 11% difference between Asian men (16%) and women (5%).[16]
- Smoking is most common among the least educated. While the percentage of smokers has decreased at every level of educational attainment since 1983, college graduates had the greatest decline, from 21% to 9% in 2008. By contrast, among those with a high school diploma, prevalence decreased modestly from 34% to 28% during the same time period.[15] Adults with a GED certificate (high school equivalency diploma) had the highest smoking rate (41%) in 2008, and groups with a high school degree or less quit smoking at lower rates than higher educated groups between 1998 and 2008.[16]
- The decrease in smoking prevalence among high school students between the late 1970s and early 1990s was more rapid among African Americans than whites; consequently, lung cancer rates among adults younger than 40 years, historically substantially higher in African Americans, have converged in these two groups.[17]

- Although cigarette smoking among US high school students increased significantly from 28% in 1991 to 36% in 1997, the rate declined to 20% by 2007.[18, 19]
- In 1997, nearly one-half (48%) of male high school students and more than one-third (36%) of female students reported using some form of tobacco – cigarettes, cigars, or smokeless tobacco – in the past month. The percentages declined to 30% for male students and to 21% for female students in 2007.[18, 20]

Smokeless Tobacco Products

Smokeless tobacco products include moist snuff, chewing tobacco, snus (a "spitless," moist powder tobacco pouch), dissolvable nicotine products, and a variety of other tobacco-containing products that are not smoked. Tobacco companies are actively promoting these products both for use in settings where smoking is prohibited and as a way to quit smoking; however, there is no evidence that these products are as effective as proven cessation therapies. Use of any smokeless tobacco product is not considered a safe substitute for quitting. These products cause oral and pancreatic cancers, precancerous lesions of the mouth, gum recession, bone loss around the teeth, and tooth staining; they can also lead to nicotine addiction.[21]

- Smokers who use smokeless products as a supplemental source of nicotine to postpone or avoid quitting will increase rather than decrease their risk of lung cancer.[22]
- The risk of cancer of the cheek and gums is increased up to 50-fold among long-term snuff users.[21]
- According to the US Department of Agriculture, manufactured output of moist snuff has increased more than 83% in the past two decades, from 48 million pounds in 1991 to an estimated 88 million pounds in 2007.[23, 24]
- In 2008, 3.6% of adults 18 and older, 7% of men and 0.3% of women, used smokeless products in the past month. American Indian/Alaska Natives (6%) and whites (5%) were more likely to use smokeless tobacco than African Americans (2 %), Hispanic/Latinos (1%), or Asians (1%).[25]
- Smokeless tobacco use across states varied from 0.2% to 7.2%, with higher rates observed in the South and North-Central states.[26]
- When smokeless tobacco was aggressively marketed in the US in the 1970s, use of these products increased among adolescent males, not among older smokers trying to quit.[27 28] Nationwide, 13% of male high school students were currently using chewing tobacco, snuff, or dip in 2007.[18]

Cigars

Cigar smoking has health consequences similar to those of cigarette smoking and smokeless tobacco.[29]

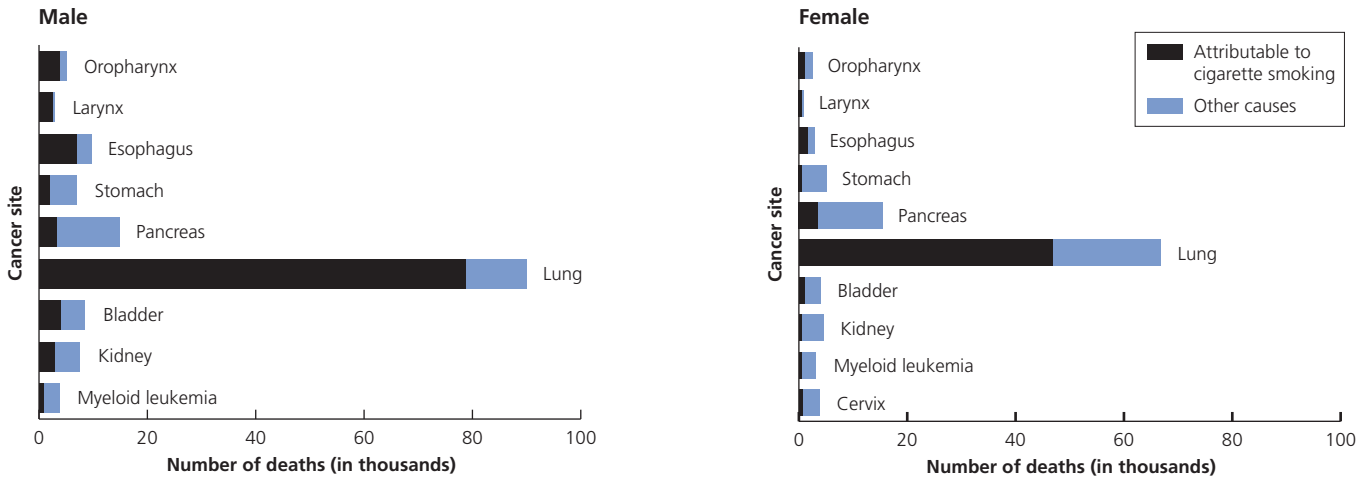
- Regular cigar smoking is associated with an increased risk of cancers of the lung, oral cavity, larynx, esophagus, and probably pancreas. Cigar smokers have 4 to 10 times the risk of dying from laryngeal, oral, or esophageal cancer, compared to nonsmokers.[29]
- While both large and small cigar consumption has increased in the past two decades, since 1998, small cigar consumption has risen at a much faster rate (154%) than large cigar (45%) consumption. Small cigars are similar in shape and size to cigarettes, but are not regulated or taxed like cigarettes, making them more affordable to youth.[30]
- In 2008, 5% of adults aged 18 and older (9% of men and 2% of women) had smoked cigars in the past month. African Americans (8%) and American Indian/Alaska Natives (6%) had the highest prevalence of past-month cigar use, followed by whites (5%), Hispanics (5%), and Asians (1%).[25]
- Among states, cigar-smoking prevalence among adults ranges from between 2.2% to 5.4%.[26]
- In 2007, 14% of US high school students had smoked cigars, cigarillos, or little cigars at least once in the past 30 days.[18]

Smoking Cessation

A US Surgeon General's report outlined the benefits of smoking cessation:[31]

- People who quit, regardless of age, live longer than people who continue to smoke.
- Smokers who quit before age 50 cut their risk of dying in the next 15 years in half, compared to those who continue to smoke.
- Quitting smoking substantially decreases the risk of lung, laryngeal, esophageal, oral, pancreatic, bladder, and cervical cancers.
- Quitting lowers the risk for other major diseases, including heart disease and stroke.
- In 2008, an estimated 48.1 million adults were former smokers, representing 51% of persons who ever smoked.[16]
- Between 1998 and 2008, rates of adult smoking cessation remained stable overall.
- Smokers with an undergraduate or graduate degree are more likely to quit than less educated smokers, probably because of greater understanding of the health hazards of smoking.[16]
- Among those who smoked in 2008, an estimated 20.8 million (or 45%) had stopped smoking at least one day during the preceding 12 months because they were trying to quit.[16]
- In 42 states and the District of Columbia, the majority of adults (50% or more) who ever smoked have quit smoking. Across states, between 52% and 67% of adult smokers tried to quit smoking in the past year, but these proportions were significantly lower among adults with less than a high school education (17% to 51%).[32]

Annual Number of Cancer Deaths Attributable to Smoking by Sex and Site, US, 2000-2004



Source: Centers for Disease Control and Prevention. Smoking-attributable mortality, years of potential life lost, and productivity losses – United States, 2000-2004. *MMWR Morb Mortal Wkly Rep*. 2008;57(45):1226-1228.

American Cancer Society, Surveillance and Health Policy Research, 2010

- In 2007, among high school students who were current cigarette smokers, national data showed that one-half (50%) had tried to quit smoking cigarettes during the 12 months preceding the survey; female students (55%) were more likely to have made a quit attempt than male students (45%).[18]
- Tobacco dependence is a chronic disease and should be treated with effective treatments that may double or triple smokers' chances of long-term abstinence.[33] Certain racial and ethnic groups (Hispanics and non-Hispanic African Americans) and those with low socioeconomic status are significantly less likely to receive cessation services.[26] Improving access to these services by promoting coverage for these treatments through government health programs, including Medicaid and Medicare, and private health insurance mandates can help reduce these disparities.

Secondhand Smoke

Secondhand smoke (SHS), or environmental tobacco smoke, contains numerous human carcinogens for which there is no safe level of exposure. It is estimated that more than 126 million nonsmoking Americans are exposed to SHS in homes, vehicles, workplaces, and public places.[34] Numerous scientific consensus groups have reviewed data on the health effects of SHS.[34-39] In 2006, the US Surgeon General published a comprehensive report titled *The Health Consequences of Involuntary Exposure to Tobacco Smoke*.[34] Public policies to protect people from SHS are based on the following detrimental effects:

- SHS contains more than 4,000 substances, more than 50 of which are known or suspected to cause cancer in humans and animals, and many of which are strong irritants.[37]
- Each year, about 3,400 nonsmoking adults die of lung cancer as a result of breathing SHS.[6]
- SHS causes an estimated 46,000 deaths from heart disease in people who are not current smokers.[6]
- SHS may cause coughing, wheezing, chest tightness, and reduced lung function in adult nonsmokers.[34]
- Some studies have reported an association between SHS exposure and breast cancer. The US Surgeon General has designated this evidence suggestive rather than conclusive.[34] In any case, women should be aware that there are many health reasons to avoid exposure to tobacco smoke.

Laws that prohibit smoking in public places and create smoke-free environments are the most effective approach to prevent exposure to – and harm from – SHS. An additional benefit of smoke-free policies is the modification of smoking behaviors among current smokers. Momentum to regulate public smoking began to increase in 1990, and these laws have become increasingly common and comprehensive. [40]

- Exposure to SHS among nonsmokers, as measured by detectable levels of cotinine (a metabolite of nicotine), declined from 84% in 1988-1994 to 46% in 1999-2004.[41]
- Presently in the US, more than 3,079 municipalities (as of January 2010) have passed smoke-free legislation and 35 states, the District of Columbia, and Puerto Rico have either implemented or enacted statewide smoking bans that prohibit smoking in workplaces and/or restaurants and/or bars.[42]
- Currently, approximately 74% of the US population is covered by a smoke-free policy or provision in workplaces and/or restaurants and/or bars.[42]

- Nationally, coverage of all indoor workers by smoke-free policies increased substantially from 1992-1993 (46%) to 2006-2007 (75%).[43]
- Workplace smoking restrictions vary by geographic area; 72% of Southern residents reported working under a smoke-free policy, compared to 81% of workers in the Northeast. [44]
- In addition to providing protection against harmful exposure to secondhand smoke, there is strong evidence that smoke-free policies decrease the prevalence of both adult and youth smoking.[45]

Costs of Tobacco

The number of people who die prematurely or suffer illness from tobacco use impose substantial health-related economic costs to society. It is estimated that in the US, between 2000 and 2004, smoking accounted for 3.1 million years of potential life lost in men and 2.0 million years of potential life lost in women. Smoking, on average, reduces life expectancy by approximately 14 years.[6]

In addition:

- Between 2001 and 2004, smoking, on average, resulted in more than $193 billion in annual health-related economic costs in the US, including smoking-attributable medical economic costs and productivity losses.[6]
- During 2001-2004, average annual smoking-attributable health care expenditures were an estimated $96 billion, up $20 billion from $76 billion in 1998.[6, 46]
- Smoking-attributable productivity losses in the US amounted to $96.8 billion annually during 2000-2004, up about $4.3 billion from the $92 billion lost annually during 1997-2001.[6, 47]

Worldwide Tobacco Use

During the past 25 years, while the prevalence of smoking has been slowly declining in the US and many other high-income countries, smoking rates have been increasing in many low- and middle-income nations, where about 85% of the world population resides.

- Low-income countries consume an increasing proportion of the world's tobacco due to population growth and tobacco industry targeting. By 2030, more than 80% of the world's tobacco-related deaths will be in low- and middle-income countries.[48]
- In 2003, the number of smokers in the world was estimated at about 1.3 billion (more than 1 billion men and 250 million women). This figure is expected to rise to at least 1.7 billion (1.2 billion men and 500 million women) by 2025, with the doubling in the number of female smokers making the greatest contribution to the increase.[2, 49]
- Female smoking prevalence rates have peaked and are decreasing in most high-income countries, such as Australia, Canada, the United Kingdom, and the US; however, in many countries female smoking rates are still increasing or show no evidence of decline.[2] Female smoking rates in developing nations are expected to converge with those of developed nations at 20%-25% by 2030.[50, 51]
- In 2010, tobacco will kill about 6 million people worldwide, 72% of whom reside in low- and middle-income countries.[2]
- Based on current patterns, smoking-attributable diseases will kill as many as 650 million of the world's 1.3 billion smokers alive today.[52, 53] Deaths from tobacco are projected to decline by 9% between 2002-2030 in high-income countries, but to double from 3.4 million to 6.8 million in low- and middle-income countries in the same time period.[54]
- Data from the Global Youth Tobacco Survey conducted during 2000-2007 found that among youth aged 13 to 15 years, 12% of boys and 7% of girls reported smoking cigarettes, and 12% of boys and 8% of girls reported using other tobacco products.[55] In every region of the world, the ratio of male to female smoking among youth was smaller than the ratio reported among adults, reflecting a global trend of increased smoking among female youth.[56]

The first global public health treaty, the Framework Convention on Tobacco Control (FCTC), was unanimously adopted by the World Health Assembly on May 21, 2003, and subsequently entered into force as a legally binding accord for all ratifying states on February 27, 2005.[57] The FCTC features specific provisions to control both the global supply and demand for tobacco, including regulation of tobacco product contents, packaging, labeling, advertising, promotion, sponsorship, taxation, smuggling, youth access, exposure to secondhand tobacco smoke, and environmental and agricultural impacts.[57] Parties to the treaty are expected to strengthen national legislation, enact effective tobacco control policies, and cooperate internationally to reduce global tobacco consumption.[58] As of November 2009, out of 195 eligible countries, 183 have signed the FCTC and 168 have ratified the treaty.[57] A number of major tobacco-producing nations, including Argentina, Indonesia, Malawi, the US, and Zimbabwe, have not ratified the treaty.[57]

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Nutrition and Physical Activity

It's been estimated that approximately one-third of the cancer deaths that occur in the US each year are due to poor nutrition and physical inactivity, including excess weight. Eating a healthy diet, being physically active on a regular basis, and maintaining a healthy body weight are as important as not using tobacco products in reducing cancer risk. Published in 2006, the American Cancer Society's most recent guidelines emphasize the importance of weight control, physical activity, and dietary patterns in reducing cancer risk and helping people stay well; unfortunately, the majority of Americans are not meeting these recommendations. Increasing trends in unhealthy eating and physical inactivity – and resultant increases in overweight and obesity – have largely been influenced by the environments in which people live, learn, work, and play. As a result, the guidelines include an explicit Recommendation for Community Action to promote the availability of healthy food choices and opportunities for physical activity in schools, workplaces, and communities.

The following recommendations reflect the best nutrition and physical activity evidence available to help Americans reduce their risk not only of cancer, but also of heart disease and diabetes.

Recommendations for Individual Choices

1. Maintain a healthy weight throughout life.

- Balance caloric intake with physical activity.
- Avoid excessive weight gain throughout life.
- Achieve and maintain a healthy weight if currently overweight or obese.

In the US, overweight and obesity contribute to 14%-20% of all cancer-related mortality. Overweight and obesity are clearly associated with increased risk for developing many cancers, including cancers of the breast in postmenopausal women, colon, endometrium, kidney, and adenocarcinoma of the esophagus. Evidence is highly suggestive that obesity also increases risk for cancers of the pancreas, gallbladder, thyroid, ovary, and cervix, as well as for myeloma, Hodgkin lymphoma, and aggressive forms of prostate cancer. Increasing evidence also suggests that being overweight increases the risk for cancer recurrence and decreases the likelihood of survival for many cancers. Recent studies suggest that losing weight may reduce the risk of breast cancer. In addition, some studies have shown that surgery to treat morbid obesity reduces mortality from major chronic diseases, including cancer. Although knowledge about the relationship between weight loss and cancer risk is incomplete, individuals who are overweight should be encouraged and supported in their efforts to reduce weight.

At the same time that evidence connecting excess weight to increased cancer risk has been accumulating, trends in overweight and obesity have been increasing. The prevalence of obesity in the US more than doubled between 1976-1980 and 2003-2004. Although rates appear to have stabilized in the most recent time period (2005-2006), more than one-third of adults – more than 72 million people – are currently obese. These trends are likely already impacting cancer trends: in the midpoint assessment of its 2015 Challenge Goals, American Cancer Society researchers reported that while the incidence of both colorectal cancer and post-menopausal breast cancer had been declining, it is likely that the declines in both would have started earlier and would have been steeper had it not been for the increasing prevalence of obesity.

Similar to adults, obesity among adolescents has tripled over the past several decades. Increases occurred across race, ethnicity, and gender. As in adults, obesity prevalence stabilized between 2003-2004 and 2005-2006. Because overweight in youth tends to continue throughout life, efforts to establish healthy body weight patterns should begin in childhood. The increasing prevalence of overweight and obesity in preadolescents and adolescents may increase incidence of cancer in the future.

2. Adopt a physically active lifestyle.

- Adults: Engage in at least 30 minutes of moderate to vigorous physical activity, in addition to usual activities, on 5 or more days of the week. Forty-five to 60 minutes of intentional physical activity is preferable.
- Children and adolescents: Engage in at least 60 minutes per day of moderate to vigorous physical activity at least 5 days per week.

Living a physically active lifestyle is important to reduce the risk of a variety of types of cancer, as well as heart disease and diabetes. Physical activity is associated with a 20% to 30% reduction in the risk of colon cancer. Studies also show that physical activity reduces the risk of breast cancer, especially vigorous activity. Physical activity also indirectly reduces the risk of developing the many types of obesity-related cancers because of its role in helping to maintain a healthy weight. Being active is thought to reduce cancer risk largely by improving energy metabolism and reducing circulating concentrations of estrogen, insulin, and insulin-like growth factors. Physical activity also improves the quality of life of cancer patients and is associated with a reduction in the risk of breast cancer recurrence, breast cancer-specific mortality, and all-cause mortality.

Despite the wide variety of health benefits from being active, 24% of adults report no leisure-time activity, and only 49% meet minimum recommendations for moderate activity. Similarly, only 35% of youth meet recommendations.

3. Consume a healthy diet with an emphasis on plant sources.

- Choose foods and beverages in amounts that help achieve and maintain a healthy weight.
- Eat 5 or more servings of a variety of vegetables and fruits each day.
- Choose whole grains in preference to processed (refined) grains.
- Limit consumption of processed and red meats.

There is strong scientific evidence that healthy dietary patterns, in combination with regular physical activity, are needed to maintain a healthy body weight and to reduce cancer risk. Many epidemiologic studies have shown that populations that eat diets high in vegetables and fruits and low in animal fat, meat, and/or calories have reduced risk of some of the most common cancers. Moreover, evidence that a diet high in red and processed meats is associated with a higher risk of developing gastrointestinal cancers has increased over the years. Despite the known benefits of a healthy diet, Americans are not following recommendations. According to the US Department of Agriculture, the majority of Americans would need to substantially lower their intake of added fats, refined grains, sodium and added sugars, and increase their consumption of fruits, vegetables, whole grains, and low-fat dairy products in order to meet the 2005 Dietary Guidelines for Americans.

At this time, individual nutritional supplements are not recommended for cancer prevention, as the results of recently completed randomized clinical trials of antioxidant supplements and selenium have shown no reduction in risk for cancer, at least in generally well-nourished populations. Results from ongoing studies of other nutrients, including calcium and vitamin D, are awaited before any recommendations can be made.

The scientific study of nutrition and cancer is highly complex, and many important questions remain unanswered. It is not presently clear how single nutrients, combinations of nutrients, over-nutrition, and energy imbalance, or the amount and distribution of body fat at particular stages of life affect a person's risk of specific cancers. Until more is known about the specific components of diet that influence cancer risk, the best advice is to consume a mostly plant-based diet emphasizing a variety of vegetables, fruits, and whole grains, while limiting red and processed meats. A special emphasis should be placed on controlling total caloric intake to help achieve and maintain a healthy weight.

4. If you drink alcoholic beverages, limit consumption.

People who drink alcohol should limit their intake to no more than two drinks per day for men and one drink per day for women. Alcohol consumption is an established cause of cancers of the mouth, pharynx, larynx, esophagus, liver, and breast. For each of these cancers, risk increases substantially with the intake of more than two drinks per day. Regular consumption of even a few drinks per week has been associated with an increased risk of breast cancer in women. The mechanism for how alcohol can affect breast cancer is not known with certainty, but it may be due to alcohol-induced increases in circulating estrogen or other hormones in the blood, reduction of folic acid levels, or a direct effect of alcohol or its metabolites on breast tissue. Alcohol consumption combined with tobacco use increases the risk of cancers of the mouth, larynx, and esophagus far more than either drinking or smoking alone.

The American Cancer Society's Recommendation for Community Action

While many Americans would like to adopt a healthy lifestyle, many encounter substantial barriers that make it difficult to make healthy food and physical activity choices. Increased portion sizes, especially of restaurant meals; marketing and advertising of foods and beverages high in calories, fat, and added sugar, particularly to kids; schools and worksites that are not conducive to good health; community design that hinders physical activity; economic and time constraints, as well as other influences, have collectively contributed to increasing trends in obesity.

Because of the tremendous influence that the surrounding environment has on individual food and activity choices, the Society's nutrition and physical activity guidelines include a Recommendation for Community Action. Acknowledging that to turn the obesity trends around will require extensive policy and environmental changes, the Society calls for public, private, and community organizations to create social and physical environments that support the adoption and maintenance of healthy nutrition and physical activity behaviors to help people stay well. This includes implementing strategies that increase access to healthy foods in schools, workplaces, and communities, and that provide safe, enjoyable, and accessible environments for physical activity in schools and for transportation and recreation in communities.

Achieving this Recommendation for Community Action will require multiple strategies and bold action, ranging from the implementation of community and workplace health promotion programs to policies that affect community planning, transportation, school-based physical education, and food services.

The Centers for Disease Control and Prevention (CDC), the Institute of Medicine, the World Health Organization (WHO), and others have outlined a variety of evidenced-based approaches in schools, worksites, and communities to halt and ultimately turn around the obesity trends. Following are some specific approaches that have been proposed:

- Limit the availability, advertising, and marketing of foods and beverages of low nutritional value, particularly in schools.
- Strengthen nutrition standards in schools for foods and beverages served as part of the school meals program and for competitive foods and beverages served outside of the program.
- Increase and enforce physical education requirements in grades K-12.
- Ensure that worksites have healthy food and beverage options and that physical environments are designed or adapted and maintained to facilitate physical activity and weight control.
- Encourage restaurants to provide nutrition information on menus, especially calories.
- Invest in community design that supports development of sidewalks, bike lanes, and access to parks and green space.

The tobacco control experience has shown that policy and environmental changes at the national, state, and local levels are critical to achieving changes in individual behavior. Measures such as clean indoor air laws and increases in cigarette excise taxes are highly effective in deterring tobacco use. To avert an epidemic of obesity-related disease, similar purposeful changes in public policy and in the community environment will be required to help individuals maintain a healthy body weight and remain physically active throughout life.

Environmental Cancer Risks

Two major classes of factors influence the incidence of cancer: hereditary factors and acquired (environmental) factors. Hereditary factors come from our parents and cannot be modified. Environmental factors, which include behavioral choices, are potentially modifiable. They include tobacco use, poor nutrition, physical inactivity, obesity, certain infectious agents, certain medical treatments, excessive sun exposure, and exposures to carcinogens (cancer-causing agents) that exist as pollutants in our air, food, water, and soil. Some carcinogens occur naturally, and some are created or concentrated by human activity. Radon, for example, is a naturally occurring carcinogen present in soil and rock; however, occupational exposure occurs in underground mines and substantial exposures also occur in poorly ventilated basements in regions where radon soil emissions are high. Environmental (as opposed to hereditary) factors account for an estimated 75%-80% of cancer cases and deaths in the US. Exposure to carcinogenic agents in occupational, community, and other settings is thought to account for a relatively small percentage of cancer deaths, about 4% from occupational exposures and 2% from environmental pollutants (man-made and naturally occurring). Although the estimated percentage of cancers related to occupational and environmental carcinogens is small compared to the cancer burden from tobacco smoking (30%) and the combination of nutrition, physical activity, and obesity (35%), the relationship between such agents and cancer is important for several reasons. First, even a small percentage of cancers can represent many deaths: 6% of cancer deaths in the US in 2010 corresponds to approximately 34,000 deaths. Second, the burden of exposure to occupational and environmental carcinogens is borne disproportionately by lower-income workers and communities, contributing to disparities in the cancer burden across the population. Third, although much is known about the relationship between occupational and environmental exposure and cancer, some important research questions remain. These include the role of exposures to certain classes of chemicals (such as hormonally active agents) during critical periods of human development and the potential for pollutants to interact with each other, as well as with genetic and acquired factors.

How Carcinogens Are Identified

The term carcinogen refers to exposures that can increase the incidence of malignant tumors (cancer). The term can apply to a single chemical such as benzene; fibrous minerals such as asbestos; metals and physical agents such as x-rays or ultraviolet

light; or exposures linked to specific occupations or industries (e.g., nickel refining). Carcinogens are usually identified on the basis of epidemiological studies or by testing in animals. Studies of occupational groups (cohorts) have played an important role in understanding many chemical carcinogens – as well as radiation – because exposures are often higher among workers, who can be followed for long periods of time. Some information has also come from studies of persons exposed to carcinogens during medical treatments (such as radiation and estrogen), as well as from studies conducted among individuals who experienced large, short-term exposure to a chemical or physical agent due to an accidental or intentional release (such as survivors of the atomic bomb explosions of Hiroshima and Nagasaki). It is more difficult to study the relationship between exposure to potentially carcinogenic substances and cancer risk in the general population because of uncertainties about exposure and the challenge of long-term follow-up. Moreover, relying upon epidemiological information to determine cancer risk does not fulfill the public health goal of prevention since, by the time the increased risk is detected, a large number of people may have been exposed. Thus, for the past 40 years, the US and many other countries have developed methods for identifying carcinogens through animal testing using the "gold standard" of a 2-year or lifetime bioassay in rodents. This test is expensive and time-consuming, but it can provide information about potential carcinogens so that human exposure can be reduced or eliminated. Many substances that are carcinogenic in rodent bioassays have not been adequately studied in humans, usually because an acceptable study population has not been identified. Among the substances that have proven carcinogenic in humans, all have shown positive results in animals when tested in well-conducted 2-year bioassays.[1]

Moreover, between 25%-30% of established human carcinogens were first identified through animal bioassays. Since animal tests necessarily use high-dose exposures, human risk assessment usually requires extrapolation of the exposure-response relationship observed in rodent bioassays to predict effects in humans at lower doses.

Typically, regulatory agencies in the US and abroad have adopted the default assumption that no threshold level (level below which there is no increase in risk) of exposure exists for carcinogenesis.

Evaluation of Carcinogens

The National Toxicology Program (NTP) plays an important role in the identification and evaluation of carcinogens in the US, and the International Agency for Research on Cancer (IARC) plays a similar role internationally. The National Toxicology Program was established in 1978 to coordinate toxicology testing programs within the federal government, including tests for carcinogenicity. The NTP is also responsible for producing the Report on Carcinogens, an informational scientific and public health document that identifies agents, substances, mixtures, or exposure circumstances that may increase the risk of developing cancer.[2] For a list of substances listed in the *11th Report on Carcinogens* as known or reasonably anticipated to be human carcinogens, see ntp.niehs.nih.gov/ntp/roc/toc11.html. The IARC is a branch of the World Health Organization that regularly convenes scientific consensus groups to evaluate potential carcinogens. After reviewing published data from laboratory, animal, and human research, these committees reach consensus about whether the evidence should be designated "sufficient," "limited," or "inadequate" to conclude that the substance is a carcinogen. For a list of substances that have been reviewed by the IARC monograph program, visit monographs.iarc.fr/ENG/Publications/internrep/07-001.pdf. The American Cancer Society does not have a formal program to review and evaluate carcinogens. However, information on selected topics can be found at cancer.org.

Although the relatively small risks associated with low level exposure to carcinogens in air, food, or water are difficult to detect in epidemiological studies, scientific and regulatory bodies throughout the world have accepted the principle that it is reasonable and prudent to reduce human exposure to substances shown to be carcinogenic at higher levels of exposure. Although much public concern about the influence of man-made pesticides and industrial chemicals has focused on cancer, pollution may adversely affect the health of humans and ecosystems in many other ways. Research to understand the short- and long-term impact of environmental pollutants on a broad range of outcomes, as well as regulatory actions to reduce exposure to recognized hazards, has contributed to the protection of the public and the preservation of the environment for future generations. It is important that this progress be recognized and sustained. For more information on environmental cancer risks, see the article published by Fontham et al. in the November/December issue of *CA: A Cancer Journal for Clinicians*.[3]

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The Global Fight against Cancer

The ultimate mission of the American Cancer Society is to eliminate cancer as a major health problem. Because cancer knows no boundaries, this mission extends around the world.

Cancer is an enormous global health burden, touching every region and socioeconomic level. Today, cancer accounts for one in every eight deaths worldwide – more than HIV/AIDS, tuberculosis, and malaria combined. In 2008, there were an estimated 12.4 million cases of cancer diagnosed and 7.6 million deaths from cancer around the world. People living in low- and middle-income countries are especially hard hit by cancer. More than 70 percent of all cancer deaths occur in these countries, many of which lack the medical resources and health systems to handle the disease burden.

The global cancer burden is growing at an alarming pace. The World Health Organization (WHO) projects that in 2010, cancer will become the leading cause of death globally, surpassing heart disease and stroke. The WHO also projects that by 2030, the number of deaths caused by cancer will grow to 12 million per year. Much of the growth of the global cancer burden will occur in low- and middle-income countries, where cancer incidence and death rates are rising rapidly.

The growing cancer burden is being driven largely by two developments: the increasing adoption of unhealthy lifestyle behaviors and the growth and aging of populations. Today, most cancers are linked to a few controllable factors, including tobacco use, poor diet, lack of exercise, and infectious diseases. Tobacco use is the most preventable cause of death worldwide, responsible for the deaths of approximately half of long-term users. Tobacco use killed 100 million people in the 20th century and, if current trends continue, will kill 1 billion people in the 21st century. In 2010, tobacco will kill 6 million people, 72% of whom will be in low- and middle-income countries. The percentage is expected to increase to 83% by 2030.

With nearly a century of experience in cancer control, the American Cancer Society is uniquely positioned to lead the global fight against cancer and tobacco, assisting and empowering the world's cancer societies and anti-tobacco advocates. The Society's global health program is working to raise awareness about the growing global cancer burden and to promote evidence-based cancer and tobacco control programs.

The American Cancer Society conducts global cancer and tobacco control activities with three overarching goals:

- **Make cancer control and tobacco control political and public health priorities.** The Society supports studies on cancer and tobacco related to development in low- and middle-income countries, and conveys global cancer information and awareness through global cancer control publications in both scientific journals and the popular press. The Society promotes the inclusion of cancer and other chronic diseases on public health agendas of global political and economic organizations. The Society also collaborates with major multilateral, bilateral, corporate, and nongovernmental stakeholders on cancer and tobacco control, including the World Health Organization, the International Union Against Cancer, the Lance Armstrong Foundation, and the Bill & Melinda Gates Foundation.
- **Increase tobacco taxes globally.** The Society supports tobacco tax campaigns that create new national tobacco taxes in low- and middle-income countries and helps those countries commit to assigning at least 10 percent of tobacco tax revenues to tobacco control activities.
- **Create smoke-free workplaces and public places globally.** The Society works with the Global Smokefree Partnership to support smoke-free campaigns for new legislation in countries worldwide. The Society also supports studies on smoke-free workplaces and public places.

The Society strives to achieve these goals through a variety of programs, such as training and seed grants for cancer and tobacco control advocates, training for journalists on health reporting, partnerships with global cancer control organizations, and participation in major global public health conferences.

In addition to print publications, the American Cancer Society provides cancer information to millions of individuals throughout the world on its Web site, cancer.org. More than 20% of the visitors to the Web site come from outside the US. Information is currently available in English, Spanish, Mandarin, and several other Asian languages.

For more information on the global cancer burden, visit the Society's global health program Web site at cancer.org/international. Also, see the following publications available on cancer.org:

- *Global Cancer Facts & Figures 2007*
- *The Tobacco Atlas, Third Edition*
- *The Cancer Atlas*

The American Cancer Society

In 1913, 10 physicians and five laypeople founded the American Society for the Control of Cancer. Its purpose was to raise awareness about cancer symptoms, treatment, and prevention; to investigate what causes cancer; and to compile cancer statistics. Later renamed the American Cancer Society, Inc., the organization now works with its more than 3 million volunteers to save lives and create a world with less cancer and more birthdays by helping people stay well, helping people get well, by working to find cures, and by fighting back against the disease. Thanks to this important work, the Society is making remarkable progress in cancer prevention, early detection, treatment, and patient quality of life. The overall cancer death rate has steadily declined since the early 1990s, and the 5-year survival rate is now 68%, up from 50% in the 1970s. Thanks to this progress, more than 11 million cancer survivors in the US will celebrate another birthday this year.

How the American Cancer Society Is Organized

The American Cancer Society consists of a National Home Office with 13 chartered Divisions and a local presence in nearly every community nationwide.

The National American Cancer Society

A National Assembly of volunteer representatives from each of the American Cancer Society's 13 Divisions approves Division charters and elects a national volunteer Board of Directors and the nominating committee. In addition, the Assembly approves corporate bylaw changes and the organization's division of funds policy. The Board of Directors sets and approves strategic goals for the Society, ensures management accountability, approves Division charters and charter requirements, and provides stewardship of donated funds. The National Home Office is responsible for overall planning and coordination of the Society's programs, provides technical support and materials to Divisions and local offices, and administers the Society's research program.

American Cancer Society Divisions

The Society's 13 Divisions are responsible for program delivery and fundraising in their regions. They are governed by Division Boards of Directors composed of both medical and lay volunteers in their regions.

Local Offices

The Society has a presence in nearly every community nationwide, with local offices responsible for raising funds at the community level and delivering programs that help people stay well and get well from cancer, as well as rally communities to fight back against the disease.

Volunteers

More than 3 million volunteers carry out the Society's work in communities across the country. These dedicated people donate their time and talents in many ways to create a world with less cancer and more birthdays. Some volunteers choose to educate people about things they can do to prevent cancer or find it early to stay well. Some choose to offer direct support to patients, like driving them to treatment or providing guidance and emotional support. Others work to make cancer a top priority for lawmakers and participate in local community events to raise funds and awareness to fight cancer. No matter how volunteers choose to fight back, they are all saving lives while fulfilling their own.

How the American Cancer Society Saves Lives

The American Cancer Society has set aggressive challenge goals to dramatically decrease cancer incidence and mortality rates by 2015 while increasing the quality of life for all cancer survivors. The Society is uniquely qualified to make a difference in the fight against cancer and save more lives by continuing its leadership position in supporting high-impact research; improving the quality of life for those affected by cancer; preventing and detecting cancer; and reaching more people, including the medically underserved, with the reliable cancer-related information they need. Simply stated, the American Cancer Society saves lives by helping people stay well and get well, by finding cures, and by fighting back against cancer.

Helping People Stay Well

The American Cancer Society helps everyone stay well by taking steps to prevent cancer or find it early, when it is most treatable.

Prevention

The Society helps people quit tobacco through the American Cancer Society Quit For Life® Program, operated by Free & Clear®. The program has helped more than one million tobacco users make a plan to quit for good through its telephone-based coaching and Web-based learning support service.

The Society's guidelines for proper nutrition, physical activity, and cancer screenings help doctors and people across the nation understand how to reduce cancer risk and what tests they need to find cancer at its earliest, most treatable stage. The Society can help people create a personalized health action plan based

on their age and gender and provide individualized cancer screening and healthy lifestyle recommendations, along with the tips, tools, and online resources to help people stay motivated to eat healthy and maintain an active lifestyle.

The Society offers many programs to companies to help their employees stay well and reduce their cancer risk. These include Choose to Change℠, a program in which trained counselors help employees achieve and maintain a healthy weight by making lasting changes in their lives; Freshstart®, a group-based tobacco cessation counseling program designed to help employees plan a successful quit attempt by providing essential information, skills for coping with cravings, and group support; and Active For Life®, a 10-week online program that uses individual and group strategies to help employees become more physically active.

Across the nation, the Society works with its nonpartisan advocacy affiliate, the American Cancer Society Cancer Action Network℠ (ACS CAN), to create healthier communities by protecting people from the dangers of secondhand smoke so they can stay well. As of January, 2010, 41% of the US population was covered by comprehensive smoke-free laws and 74% was covered by at least one law. In 2009, the Family Smoking Prevention and Tobacco Control Act was signed into law. The tobacco bill grants the Food and Drug Administration power over the sale, production, and marketing of cigarettes and other tobacco products, legislation that will save lives and help protect children from the dangers of tobacco.

For the majority of Americans who do not smoke, the most important ways to reduce cancer risk are to maintain a healthy weight, be physically active on a regular basis, and eat a mostly plant-based diet that limits saturated fat. The Society publishes guidelines on nutrition and physical activity for cancer prevention in order to review the accumulating scientific evidence on diet and cancer; to synthesize this evidence into clear, informative recommendations for the general public; to promote healthy individual behaviors, as well as environments that support healthy eating and physical activity habits; and, ultimately, to reduce cancer risk. These guidelines form the foundation for the Society's communication, worksite, school, and community strategies designed to encourage and support people in making healthy lifestyle behavior changes.

Early Detection

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

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

Throughout its history, the American Cancer Society has implemented a number of aggressive awareness campaigns targeting the public and health care professionals. Campaigns to increase usage of Pap testing and mammography have contributed to a 70% decrease in cervical cancer incidence rates since the introduction of the Pap test in the 1950s and a steady decline in breast cancer mortality rates since 1990. In the past 5 years, the Society has launched ambitious multimedia campaigns to encourage adults aged 50 and older to get tested for colorectal cancer. The Society also continues to encourage the early detection of breast cancer through public awareness and other efforts targeting poor and underserved communities.

Helping People Get Well

For almost 1.5 million cancer patients diagnosed this year and more than 11 million US cancer survivors, the American Cancer Society is here every minute of every day and night to offer free information, programs, services, and community referrals to patients, survivors, and caregivers through every step of a cancer experience. These resources are designed to help people facing cancer on their journey to getting well.

Information, 24 Hours a Day, Seven Days a Week

The American Cancer Society is available 24 hours a day, seven days a week online at cancer.org and by calling the Society's National Cancer Information Center at 1-800-227-2345. Callers are connected with a Cancer Information Specialist who can help them locate a hospital, understand cancer and treatment options, learn what to expect and how to plan, help address insurance concerns, find financial resources, find a local support group, and more. The Society can also help people who speak languages other than English or Spanish find the assistance they need, offering services in 170 languages in total.

Information on every aspect of the cancer experience, from prevention to survivorship, is also available through the Society's Web site, cancer.org. The site includes an interactive cancer resource center containing in-depth information on every major cancer type. The Society also publishes a wide variety of pamphlets and books that cover a multitude of topics, from patient education, quality-of-life, and caregiving issues to healthy living. A complete list of Society books is available for order at cancer.org/bookstore.

The Society publishes a variety of information sources for health care providers, including three clinical journals: *Cancer*, *Cancer Cytopathology*, and *CA: A Cancer Journal for Clinicians*. More

information about free subscriptions and online access to *CA* and *Cancer Cytopathology* articles is available at cancer.org/journals. The American Cancer Society also collaborates with numerous community groups, nationwide health organizations, and large employers to deliver health information and encourage Americans to adopt healthy lifestyle habits through the Society's science-based worksite programs.

Day-to-day Help and Emotional Support

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

Help with the health care system: Learning how to navigate the cancer journey and the health care system can be overwhelming for anyone, but it is particularly difficult for those who are medically underserved, those who experience language or health literacy barriers, or those with limited resources. The American Cancer Society Patient Navigator Program was designed to reach those most in need. As the largest oncology-focused patient navigator program in the country, the Society has specially trained patient navigators at 140 cancer treatment facilities across the nation. Patient navigators work in cooperation with these facilities' staff to connect patients with information, resources, and support to decrease barriers and ultimately to improve health outcomes. The Society collaborates with a variety of organizations, including the National Cancer Institute's Center to Reduce Cancer Health Disparities, the Center for Medicare and Medicaid Services, numerous cancer treatment centers, and others to implement and evaluate this program.

Transportation to treatment: Cancer patients cite transportation to and from treatment as a critical need, second only to direct financial assistance. Through its Road to Recovery® program, the American Cancer Society matches cancer patients with specially trained volunteer drivers. This program offers patients an additional key benefit of companionship and moral support during the drive to medical appointments.

The Society's transportation grants program allows hospitals and community organizations to apply for resources to administer their own transportation programs. In some areas, primarily where Road to Recovery programs are difficult to sustain, the Society provides transportation assistance to patients or their drivers via pre-paid gas cards to help defray costs associated with transportation to treatment.

Lodging during treatment: When someone diagnosed with cancer must travel far from home for the best treatment, where to stay and how to afford accommodations are immediate concerns and can sometimes affect treatment decisions. American Cancer Society Hope Lodge® facilities provide free, home-like, temporary lodging for patients and their caregivers close to treatment centers, thereby easing the emotional and financial burden of finding affordable lodging. In fiscal year 2009, the 29 American Cancer Society Hope Lodge locations provided more than 220,000 nights of free lodging to nearly 50,000 patients and caregivers, saving them more than $19 million in lodging expenses.

Breast cancer support: Breast cancer survivors provide one-on-one support, information, and inspiration to help people facing the disease cope with breast cancer through the Society's Reach to Recovery® program. Volunteer survivors are trained to respond in person or by telephone to people facing breast cancer diagnosis, treatment, recurrence, or recovery.

Prostate cancer support: Men facing prostate cancer can find one-on-one or group support through the Society's Man to Man® program. The program also offers men the opportunity to educate their communities about prostate cancer and to advocate with lawmakers for stronger research and treatment policies.

Cancer education classes: People with cancer and their caretakers need help coping with the challenges of living with the disease. Doctors, nurses, social workers, and other health care professionals provide them with that help by conducting the Society's I Can Cope® educational classes to guide patients and their families through their cancer journey.

Hair-loss and mastectomy products: Some women wear wigs, hats, breast forms, and bras to help cope with the effects of mastectomy and hair loss. The Society's *"tlc" Tender Loving Care®*, which is a magazine and catalog in one, offers helpful articles and a line of products to help women battling cancer restore their appearance and dignity at a difficult time. All proceeds from product sales go back into the American Cancer Society's programs and services for patients and survivors.

Support during treatment: When women are in active cancer treatment, they want to look their best, and Look Good...Feel Better® helps them do just that. The free program, which is a collaboration of the American Cancer Society, the Personal Care Products Council Foundation, and the National Cosmetology Association, helps women learn beauty techniques to restore their self-image and cope with appearance-related side effects of cancer treatment. Certified beauty professionals provide tips on makeup, skin care, nail care, and head coverings. Additional information and materials are available for men and teens.

Finding hope and inspiration: People with cancer and their loved ones do not have to face their cancer experience alone. They can connect with others who have "been there" through the Society's Cancer Survivors Network℠. The online community is a welcoming and safe place that was created by and for cancer survivors and their families.

Finding Cures

The goals of the American Cancer Society's research program are to determine the causes of cancer and to support efforts to prevent, detect, and cure the disease. The Society is the largest source of private, nonprofit cancer research funds in the US, second only to the federal government in total dollars spent. The Society spends an estimated $130 million on research each year and has invested approximately $3.4 billion in cancer research since the program began in 1946. The Society's comprehensive research program consisting of extramural grants, as well as intramural programs in epidemiology, surveillance and health policy research, behavioral research, and statistics and evaluation. Intramural research programs are led by the Society's own staff scientists.

Extramural Grants

The American Cancer Society's extramural grants program supports research in a wide range of cancer-related disciplines at about 230 US medical schools and universities.

Grant applications are solicited through a nationwide competition and are subjected to a rigorous external peer review, ensuring that only the most promising research is funded. The Society primarily funds investigators early in their research careers, a time when they are less likely to receive funding from the federal government, thus giving the best and the brightest a chance to explore cutting-edge ideas at a time when they might not find funding elsewhere. In addition to funding research across the continuum of cancer research, from basic science to clinical and quality-of-life research, the Society also focuses on needs that are unmet by other funding organizations, such as the current targeted research program to address the causes of the higher cancer mortality in the poor and medically underserved. To date, 44 Nobel Prize winners have received grant support from the Society early in their careers, a number unmatched in the nonprofit sector, and proof that the organization's approach to funding young researchers truly helps launch high-quality scientific careers.

Epidemiology and Surveillance Research

For more than 60 years, the Society's intramural epidemiology and surveillance research program has conducted and published high-quality epidemiologic research to advance understanding of the causes and prevention of cancer and monitored and disseminated surveillance information on cancer occurrence, risk factors, and screening. However, over time, the functions of the epidemiology and surveillance programs have grown and become more distinct. As a result, in 2009 the program formally split into two components: the Epidemiology program and the Surveillance and Health Policy Research program.

Epidemiology

As a leader in cancer research, the Society's Epidemiology Research program has been conducting studies to identify factors that cause or prevent cancer since 1951. The first of these, the Hammond-Horn Study, helped to establish cigarette smoking as a cause of death from lung cancer and coronary heart disease, and also demonstrated the Society's ability to conduct very large prospective cohort studies. The Cancer Prevention Study (CPS) I was launched in 1959 and included more than 1 million men and women recruited by 68,000 volunteers. Results from CPS-I clearly demonstrated that the sharp increase in lung cancer death rates among US women between 1959-1972 occurred only in smokers, and was the first to show a relationship between obesity and shortened overall survival.

In 1992, Cancer Prevention Study II (CPS-II) was established through the recruitment of 1.2 million men and women by 77,000 volunteers. The more than 480,000 lifelong nonsmokers in CPS-II provide the most stable estimates of lung cancer risk in the absence of active smoking. CPS-II data are used extensively by the Centers for Disease Control and Prevention (CDC) to estimate deaths attributable to smoking. The CPS-II study has also made important contributions in establishing the link between obesity and cancer. A subgroup of CPS-II participants, the CPS-II Nutrition Cohort has been particularly valuable for clarifying associations between cancer risk and obesity, physical activity, diet, use of aspirin, and hormone use. Blood samples from this group allow Society investigators and their collaborators at other institutions to study how genetic, hormonal, nutritional, and other factors measured in blood are related to the occurrence and/or progression of cancer.

The Cancer Prevention Studies have resulted in more than 400 scientific publications and have provided unique contributions both within the Society and the global scientific community. In addition to the key contributions to the effects of the tobacco epidemic over the past half-century, other important findings from these studies include:

- The association of obesity with increased death rates for at least 10 cancer sites, including colon and postmenopausal breast cancer
- The link between aspirin use and lower risk of colon cancer, opening the door to research on chronic inflammation and cancer
- The relationships between other potentially modifiable factors, such as physical inactivity, prolonged hormone use, and certain dietary factors, with cancer risk
- The association between air pollution, especially small particulates and ozone, with increased death rates from heart and lung conditions, which helped to motivate the Environmental Protection Agency to propose more stringent limits on air pollution

While landmark findings from the CPS-II Nutrition Cohort have informed multiple areas of public health policy and clinical practice, the cohort is aging. A new cohort is needed to explore the effects of changing exposures and provide greater opportunity to integrate biological measurements into studies of genetic and environmental risk factors. In 2006, Society epidemiologists began the enrollment of a new cohort, CPS-3, with the goal of recruiting and following approximately 500,000 men and women. All participants are providing blood samples at the time of enrollment. Following on the long history of partnering with Society volunteers and supporters for establishing a cohort, the Society's community-based Relay For Life® events are the primary venue for recruiting and enrolling participants. Although similar large cohorts are being established in some European and Asian countries, there are currently no studies of this magnitude in the US; therefore, the data collected from CPS-3 participants will provide unique opportunities for research in the US.

Surveillance and Health Policy Research

Through the Surveillance and Health Policy Research (SHPR) program, the Society publishes the most current statistics and trend information in *CA: A Cancer Journal for Clinicians* (caonline.amcancersoc.org), as well as a variety of *Cancer Facts & Figures* publications. These publications are the most widely cited sources for cancer statistics and are available in hard copy from Division offices and online through the Society's Web site at cancer.org/statistics. Society scientists also monitor trends in cancer risk factor and screening prevalence and publish these results annually – along with Society recommendations, policy initiatives, and evidence-based programs – in *Cancer Prevention & Early Detection Facts & Figures*. In addition, in 2007 the Surveillance Research department collaborated with the Department of International Affairs to publish the first edition of *Global Cancer Facts & Figures*, an international companion to *Cancer Facts & Figures*.

Since 1998, the Society has collaborated with the National Cancer Institute, the Centers for Disease Control and Prevention, the National Center for Health Statistics, and the North American Association of Central Cancer Registries to produce the Annual Report to the Nation on the Status of Cancer, a peer-reviewed journal article that reports current information related to cancer rates and trends in the US.

Epidemiologists in SHPR also conduct and publish high-quality epidemiologic research in order to advance understanding of cancer. Research topics include the causes of cancer, the population burden both in the US and abroad, and how differences in patient characteristics, such as health insurance status and comorbities, affect cancer outcomes. Recent studies have focused on the relationship between education and cancer mortality, temporal trends in breast cancer mortality by state, and trends in colorectal cancer internationally and by socioeconomic status and age in the US. The Health Policy Research program analyzes cancer treatment and outcomes and has focused on defining the role of health insurance in cancer disparities. Recent studies include examining the relationships between insurance status, race/ethnicity, stage at cancer diagnosis, quality of care, and cancer outcomes. The International Tobacco Control Research program conducts original research in international tobacco control with particular interest in the economics of tobacco control and collaborates to produce service publications such as *The Tobacco Atlas*.

Behavioral Research Center

The American Cancer Society was one of the first organizations to recognize the importance of behavioral and psychosocial factors in the prevention and control of cancer and to fund extramural research in this area. In 1995, the Society established the Behavioral Research Center (BRC) as an intramural department. The BRC's work focuses on five aspects of the cancer experience: prevention, detection and screening, treatment, survivorship, and end-of-life issues. It also focuses on special populations, including minorities, the poor, rural populations, and other underserved groups. The BRC's ongoing research projects include:

- Studies of the quality of life of cancer survivors. These studies include an ongoing, nationwide longitudinal study and a cross-sectional study, both of which explore the physical and psychosocial adjustment to cancer and identify factors affecting quality of life.
- Studies of family caregivers that explore the impact of the family's involvement in cancer care on the quality of life of the cancer survivor and the caregiver.
- Studies designed to reduce African American-white disparities in cancer-related behaviors among Georgians. One study investigates the role of sociocultural factors and neighborhood barriers in disparities in smoking, poor diet, lack of exercise, and cancer screening among a statewide sample of 7,200 African Americans. The other studies are community- and faith-based interventions to improve those cancer-related behaviors among African Americans.
- Studies being conducted in collaboration with other American Cancer Society departments with the goal of improving existing Society programs (e.g., FreshStart®, Quit For Life®) for smoking cessation, or develop new interventions for smokers who seek cessation assistance. Examples include a survey of smokers' preferences for cessation methods completed by smokers using the Society's Great Americans Web site, and testing of a system to provide tailored email messages to smokers timed around their quit date.
- Two randomized controlled studies funded by the National Institute of Drug Abuse that are examining the role of emotional support to smokers experiencing stress during a quit attempt.

Statistics and Evaluation Center

The Statistics & Evaluation Center (SEC) was created in 2005 to be a core resource for the American Cancer Society National Home Office and the Divisions. The SEC's mission is to deliver valid, reliable, accurate, and timely information to stakeholders from programs, projects, and business units so that they can make reliable and high-quality decisions that are evidence-based and cost-effective, thereby honoring the Society's fiduciary responsibility to its donors. The SEC provides valuable methods that can be used to generate new revenue streams or optimize processes to increase current revenue streams. In its short history, the SEC has collaborated with nearly every Society department/group, including the American Cancer Society Cancer Action Network (ACS CAN) and a number of Society Divisions across the country. The work of the SEC includes:

- Building rigorous study designs to produce valid and robust results for research or business
- Conducting all facets of program evaluation
- Creating and implementing survey instruments
- Collecting, archiving, managing, and statistically analyzing data and reporting results
- Conducting predictive statistical modeling to discover and understand patterns of cancer incidence, prevalence, morbidity, mortality, and cost
- Cancer clinical trials design

Fight Back

Conquering cancer is as much a matter of public policy as scientific discovery. Whether it's advocating for quality, affordable health care for all Americans, increasing funding for cancer research and programs, or enacting laws and policies that help decrease tobacco use, government action is constantly required. The American Cancer Society and its nonprofit, nonpartisan advocacy affiliate, the American Cancer Society Cancer Action Network (ACS CAN), use applied policy analysis, direct lobbying, grassroots action, and media outreach to ensure elected officials nationwide pass laws furthering the organizations' shared mission to create a world with less cancer. Created in 2001, ACS CAN is the force behind a new movement uniting and empowering cancer patients, survivors, caregivers, and their families. ACS CAN is a community-based grassroots movement that unites cancer survivors and caregivers, volunteers and staff, health care professionals, public health organizations, and other partners. ACS CAN gives ordinary people extraordinary power to fight back against cancer. In recent years, the Society and ACS CAN have successfully partnered to:

- Advocate for the patient voice to ensure that health care reform will provide affordable, adequate care for every American.
- Lead the fight to enact legislation that gives the US Food and Drug Administration the authority to regulate tobacco product manufacturing and marketing.
- Secure millions of dollars in new federal and state funding for cancer research, prevention, early detection, and education, and implement comprehensive state cancer control plans and fight efforts to cut funding.
- Help enact Michelle's Law, federal legislation that will ensure that insurance companies continue covering college students who take medical leave for up to 12 months.
- Advocate for expansion of the State Children's Health Insurance Program (SCHIP) to provide millions of uninsured children with critical health care coverage. (ACS CAN took the lead on proposing to pay for improving access to SCHIP with a cigarette tax increase that will help encourage millions of people to give up their deadly smoking habit.)
- Build support for new legislation to create a National Cancer Fund, which would serve as a dedicated funding source to meet broad cancer research prevention, early detection, and treatment needs in a comprehensive way.
- Pass and protect state and federal laws that guarantee insurance coverage of critical cancer screenings and treatments, including clinical trials.
- Help enact a new law that not only eliminated deductibles for the Welcome to Medicare benefit and expanded eligibility from six months to a year, but also empowered the US secretary of health and human services to approve new Medicare preventive services without need for congressional authorization.
- Lead the fight to reauthorize and seek full funding for the National Breast and Cervical Cancer Early Detection Program, which helps low-income, uninsured, and medically underserved women gain access to lifesaving breast and cervical cancer screenings and offers a gateway to treatment upon diagnosis.
- Pass state laws that will help all eligible Americans get screened and treated for colon cancer.
- Advocate for legislation to create a new nationwide colorectal screening and treatment program modeled after the National Breast and Cervical Cancer Early Detection Program.
- Increase the number of states and communities covered by comprehensive smoke-free workplace laws.

- Push for higher cigarette taxes and sufficient funding for tobacco prevention and cessation programs.
- Serve as the leading public health organization in the battle to increase the federal cigarette tax and use the revenue to expand the State Children's Health Insurance Program.
- Enact and seek full funding for the federal patient navigator program, which supports health care outreach in medically underserved communities for cancer patients and others suffering from chronic diseases.
- Eliminate statutory and regulatory barriers to effective management of pain and other side effects of cancer and its treatment at the state level, and seek passage of federal legislation that will improve pain care research, education, training, and access.
- Pursue expanded access to care through systemic change so that all Americans, regardless of income level or insurance status, have access to lifesaving prevention, early detection, and treatment opportunities.
- Create and launch the Judicial Advocacy Initiative (JAI), a program that will affect public policy through the legal system. With the help of pro bono representation, the JAI will monitor court cases and decisions that will impact the rights of cancer patients and survivors.
- Put federal and state lawmakers on the record in support of legislative action that helps the cancer community by having them sign the ACS CAN Congressional Cancer Promise and the American Cancer Society State Cancer Promise, respectively.
- Support legislation that allows volunteers to be reimbursed for the transportation expenses they incur helping cancer patients get to the doctor.

Some efforts in the fight against cancer are more visible than others, but each successful battle is an important contribution to what will ultimately be victory over the disease. The Society, working together with ACS CAN and its grassroots movement, is making sure the voice of the cancer community is heard in the halls of government and is empowering communities everywhere to fight back.

Sources of Statistics

New cancer cases. The estimated numbers of new US cancer cases are projected using a spatio-temporal model based on incidence data from 44 states and the District of Columbia for the years 1995-2006 that met the North American Association of Central Cancer Registries' (NAACCR) high-quality data standard for incidence, which covers about 89% of the US population. This method considers geographic variations in socio-demographic and lifestyle factors, medical settings, and cancer screening behaviors as predictors of incidence, as well as accounting for expected delays in case reporting. (See "B" in Additional Information on page 60 for more detailed information.)

Incidence rates. Incidence rates are defined as the number of people per 100,000 who are diagnosed with cancer during a given time period. State incidence rates presented in this publication are published in NAACCR's publication *Cancer Incidence in North America, 2002-2006*. Trends in cancer incidence rates and incidence rates by race/ethnicity were originally published in the 2009 Annual Report to the Nation on the Status of Cancer. (See "D" in Additional Information on page 60 for full reference.) Unless otherwise indicated, incidence rates in this publication are age adjusted to the 2000 US standard population to allow comparisons across populations with different age distributions. Incidence trends described in this publication are based on delay-adjusted incidence rates. Incidence rates that are not adjusted for delays in reporting may underestimate the number of cancer cases in the most recent time period. Cancer rates most affected by reporting delays are melanoma of the skin, leukemia, and prostate because these cancers are frequently diagnosed in non-hospital settings.

Cancer deaths. The estimated numbers of US cancer deaths are calculated by fitting the numbers of cancer deaths for 1969-2007 to a statistical model that forecasts the numbers of deaths expected to occur in 2010. The estimated numbers of cancer deaths for each state are calculated similarly, using state-level data. For both US and state estimates, data on the numbers of deaths are obtained from the National Center for Health Statistics (NCHS) at the Centers for Disease Control and Prevention.

Mortality rates. Mortality rates or death rates are defined as the number of people per 100,000 dying of a disease during a given year. In this publication, mortality rates are based on counts of cancer deaths compiled by NCHS for 1930-2006 and population data from the US Census Bureau. Unless otherwise indicated, death rates in this publication are age adjusted to the 2000 US standard population to allow comparisons across populations with different age distributions. These rates should be

compared only to other statistics that are age adjusted to the US 2000 standard population. The trends in cancer mortality rates reported in this publication were first published in the 2009 Annual Report to the Nation on the Status of Cancer. (See "D" in Additional Information for full reference.)

Important note about estimated cancer cases and deaths for the current year. The estimated numbers of new cancer cases and deaths in the current year are model-based and may produce numbers that vary considerably from year to year. For this reason, the use of our estimates to track year-to-year changes in cancer occurrence or deaths is strongly discouraged. Incidence and mortality rates reported by the Surveillance, Epidemiology, and End Results (SEER) program and NCHS are more informative statistics to use when tracking cancer incidence and mortality trends for the US. Rates from state cancer registries are useful for tracking local trends.

Survival. Unless otherwise specified, 5-year relative survival rates are presented in this report for cancer patients diagnosed between 1999 and 2005, followed through 2006.

Relative survival rates are used to adjust for normal life expectancy (and events such as death from heart disease, accidents, and diseases of old age). Relative survival is calculated by dividing the percentage of observed 5-year survival for cancer patients by the 5-year survival expected for people in the general population who are similar to the patient group with respect to age, sex, race, and calendar year of observation. Five-year survival statistics presented in this publication were originally published in *CSR 1975-2006*. In addition to 5-year survival rates, 1-year, 10-year, and 15-year survival rates are presented for selected cancer sites. These survival statistics are generated using the National Cancer Institute's SEER 17 database and SEER*Stat software version 6.5.2. (See "G" in Additional Information.) One-year survival rates are based on cancer patients diagnosed between 2002 and 2005, 10-year survival rates are based on diagnoses between 1993 and 2005, and 15-year survival rates are based on diagnoses between 1988 and 2005. All patients were followed through 2006.

Probability of developing cancer. Probabilities of developing cancer are calculated using DevCan (Probability of Developing Cancer) software version 6.4.0, developed by the National Cancer Institute. (See "H" in Additional Information.) These probabilities reflect the average experience of people in the US and do not take into account individual behaviors and risk factors. For example, the estimate of 1 man in 13 developing lung cancer in a lifetime underestimates the risk for smokers and overestimates 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. For information on data collection methods used by the North American Association of Central Cancer Registries: Copeland G, Lake A, Firth R, et al. (eds). *Cancer in North America, 2002-2006. Volume One: Combined Cancer Incidence for the United States and Canada.* Springfield, IL: North American Association of Central Cancer Registries, Inc. June 2009. Available at naaccr.org/filesystem/pdf/CINA2009.v1.combined-incidence.pdf.

B. For information on the methods used to estimate the numbers of new cancer cases: Pickle L, Hao Y, Jemal A, et al. *CA Cancer J Clin*. 2007; 57:30-42.

C. For information on data collection methods used by the SEER program: Horner MJ, Ries LAG, Krapcho M, et al. (eds). *SEER Cancer Statistics Review, 1975-2006*. National Cancer Institute. Bethesda, MD, 2009. Available at: seer.cancer.gov/csr/1975_2006/.

D. For information on cancer incidence trends reported herein: Edwards BK, Ward EM, Kohler BA, et al. *Cancer*. 2010; 116:544-573.

E. For information on data collection and processing methods used by NCHS: cdc.gov/nchs/deaths.htm. Accessed December 9, 2009.

F. For information on the methods used to estimate the number of cancer deaths: Tiwari, et al. *CA Cancer J Clin*. 2004; 54:30-40.

G. For information on the methods used to calculate relative survival rates: software – Surveillance Research Program, National Cancer Institute SEER*Stat software (seer.cancer.gov/seerstat) version 6.5.2; database – Surveillance, Epidemiology, and End Results (SEER) Program (seer.cancer.gov) SEER*Stat Database: Incidence – SEER 17 Regs Limited-Use, Nov 2008 Sub (1973-2006 varying) – Linked to County Attributes – Total US, 1969-2006 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2009, based on the November 2008 submission.

H. For information on the methods used to calculate the probability of developing cancer: DevCan 6.4.0. Probability of developing or dying of cancer. Statistical Research and Applications Branch, NCI, 2009. Available at: srab.cancer.gov/devcan/.

Factors That Influence Cancer Rates

Age Adjustment to the Year 2000 Standard

Epidemiologists use a statistical method called "age adjustment" to compare groups of people with different age compositions. This is especially important when examining cancer rates, since cancer is generally a disease of older people. For example, without adjusting for age, it would be inaccurate to compare the cancer rates of Florida, which has a large elderly population, to that of Alaska, which has a younger population. Without adjusting for age, it would appear that the cancer rates in Florida are much higher than Alaska. However, once the ages are adjusted, it appears their rates are similar.

Since the publication of *Cancer Facts & Figures 2003*, the American Cancer Society has used the Year 2000 Standard for age adjustment. This is a change from statistics previously published by the Society. Prior to 2003, most age-adjusted rates were standardized to the 1970 census, although some were based on the 1980 census or even the 1940 census. This change has also been adopted by federal agencies that publish statistics. The new age standard applies to data from calendar year 1999 forward. The change also requires a recalculation of age-adjusted rates for previous years to allow valid comparisons between current and past years.

The purpose of shifting to the Year 2000 Standard is to more accurately reflect contemporary incidence and mortality rates, given the aging of the US population. On average, Americans are living longer because of the decline in infectious and cardiovascular diseases. Greater longevity allows more people to reach the age when cancer and other chronic diseases become more common. Using the Year 2000 Standard in age adjustment instead of the 1970 or 1940 standards allows age-adjusted rates to be closer to the actual, unadjusted rate in the population.

The effect of changing to the Year 2000 Standard will vary from cancer to cancer, depending on the age at which a particular cancer usually occurs. For all cancers combined, the average annual age-adjusted incidence rate for 2000-2004 will increase approximately 20% when adjusted to the Year 2000, compared to the Year 1970 Standard. For cancers that occur mostly at older ages, such as colon cancer, the Year 2000 Standard will increase incidence by up to 25%, whereas for cancers such as acute lymphocytic leukemia, the new standard will decrease the incidence by about 7%. These changes are caused by the increased representation of older ages (for all cancers combined and colon cancer) or by the decreased representation of younger ages (for acute lymphocytic leukemia) in the Year 2000 Standard, compared to the Year 1970 Standard.

It is important to note that in no case will the actual number of cases/deaths or age-specific rates change, only the age-standardized rates that are weighted to the different age distribution.

Change in Population Estimates

Cancer rates are also affected by changes in population estimates, which are the basis for calculating rates for new cancer cases and deaths. The US Census Bureau updates and revises population estimates every year. The Bureau calculates "intercensal" estimates after a new census is completed – for example, using information from both the 1990 and 2000 censuses, the Bureau obtains better estimates for the 1990s. These revisions are based on the most recent census information and on the best available demographic data reflecting components of population change (e.g., births, deaths, net internal migration, and net international immigration). Thus, it is customary to recalculate cancer rates based on the revised population estimates. In less populated areas, such as rural counties, or in adjacent urban and suburban areas where there is substantial migration of residents from a more populous urban area to a less populous suburban one between censuses, a change in the population estimates can affect the county rate by as much as 20%. This is in contrast to large counties, where a small change in a large population estimate will not affect rates nearly as much. More information about the influence of change in population count on US cancer rates is available on the National Cancer Institute Web site (cancer.gov/newscenter/pressreleases/Census2000).

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

Cancer Site	Population	Test or Procedure	Frequency
Breast	Women, age 20+	Breast self-examination	Beginning in their early 20s, women should be told about the benefits and limitations of breast self-examination (BSE). The importance of prompt reporting of any new breast symptoms to a health professional should be emphasized. Women who choose to do BSE should receive instruction and have their technique reviewed on the occasion of a periodic health examination. It is acceptable for women to choose not to do BSE or to do BSE irregularly.
		Clinical breast examination	For women in their 20s and 30s, it is recommended that clinical breast examination (CBE) be part of a periodic health examination, preferably at least every three years. Asymptomatic women aged 40 and over should continue to receive a clinical breast examination as part of a periodic health examination, preferably annually.
		Mammography	Begin annual mammography at age 40.*
Colorectal†	Men and women, age 50+	*Tests that find polyps and cancer:* Flexible sigmoidoscopy,‡ or	Every five years, starting at age 50
		Colonoscopy, or	Every 10 years, starting at age 50
		Double-contrast barium enema (DCBE),‡ or	Every five years, starting at age 50
		CT colonography (virtual colonoscopy)‡	Every five years, starting at age 50
		Tests that mainly find cancer: Fecal occult blood test (FOBT) with at least 50% test sensitivity for cancer, or fecal immunochemical test (FIT) with at least 50% test sensitivity for cancer‡§ or	Annual, starting at age 50
		Stool DNA test (sDNA)‡	Interval uncertain, starting at age 50
Prostate	Men, age 50+	Prostate-specific antigen test (PSA) with or without digital rectal exam (DRE)	Asymptomatic 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 screening for prostate cancer after receiving information about the uncertainties, risks, and potential benefits associated with screening. Men at average risk should receive this information beginning at age 50. Men at higher risk, including African American men and men with a first degree relative (father or brother) diagnosed with prostate cancer before age 65, should receive this information beginning at age 45. Men at appreciably higher risk (multiple family members diagnosed with prostate cancer before age 65) should receive this information beginning at age 40.
Cervix	Women, age 18+	Pap test	Cervical cancer screening should begin approximately three years after a woman begins having vaginal intercourse, but no later than 21 years of age. Screening should be done every year with conventional Pap tests or every two years using liquid-based Pap tests. At or after age 30, women who have had three normal test results in a row may get screened every two to three years with cervical cytology (either conventional or liquid-based Pap test) alone, or every three years with an HPV DNA test plus cervical cytology. Women 70 years of age and older who have had three or more normal Pap tests and no abnormal Pap tests in the past 10 years and women who have had a total hysterectomy may choose to stop cervical cancer screening.
Endometrial	Women, at menopause	At the time of menopause, women at average risk should be informed about risks and symptoms of endometrial cancer and strongly encouraged to report any unexpected bleeding or spotting to their physicians.	
Cancer-related checkup	Men and women, age 20+	On the occasion of a periodic health examination, the cancer-related checkup should include examination for cancers of the thyroid, testicles, ovaries, lymph nodes, oral cavity, and skin, as well as health counseling about tobacco, sun exposure, diet and nutrition, risk factors, sexual practices, and environmental and occupational exposures.	

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

†Individuals with a personal or family history of colorectal cancer or adenomas, inflammatory bowel disease, or high-risk genetic syndromes should continue to follow the most recent recommendations for individuals at increased or high risk.

‡Colonoscopy should be done if test results are positive.

§For FOBT or FIT used as a screening test, the take-home multiple sample method should be used. A FOBT or FIT done during a digital rectal exam in the doctor's office is not adequate for screening.

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