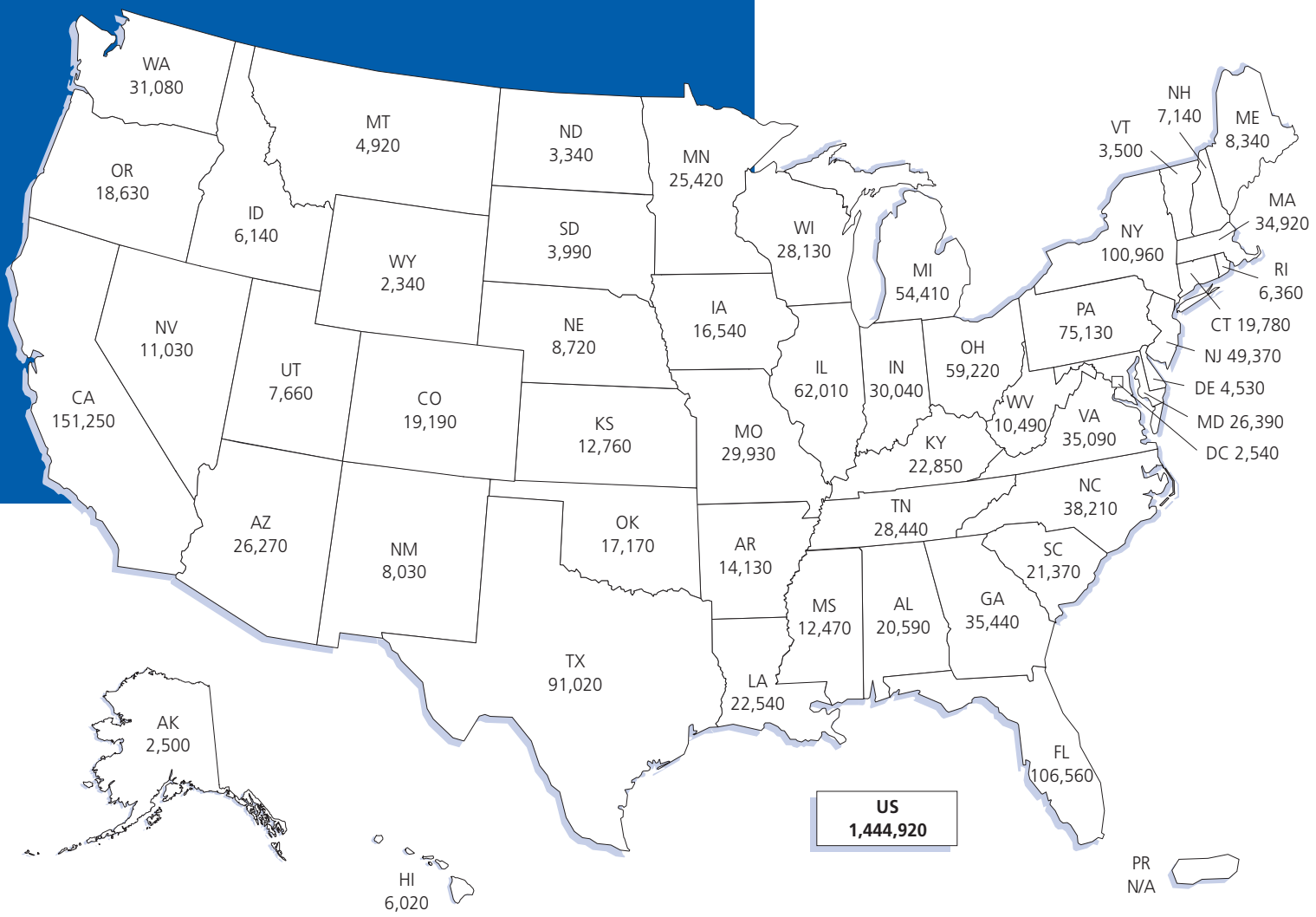
Cancer Facts & Figures 2007



Due to a change in the method, estimates may be significantly different from previous years.
Estimated number of new cancer cases for 2007, 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.

American Cancer Society®

Special Section:
Cancer-Related Pain
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**Indicates a figure or table*

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

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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, chemicals, radiation, and infectious organisms) 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 2007 about 168,000 cancer deaths are expected to be caused by tobacco use.

Scientific evidence suggests that about one-third of the 559,650 cancer deaths expected to occur in 2007 will be related to overweight or obesity, physical inactivity, and 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 2007 could have been prevented by protection from the sun's rays.

Regular screening examinations by a health care professional can result in the prevention of cervical and colorectal cancers through the discovery and removal of precancerous lesions. Screening can detect cancers of the breast, colon, rectum, cervix, prostate, oral cavity, and skin at early stages. For most of these cancers, 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. The 5-year relative survival rate for these cancers is about 86%, a reflection of real reductions in mortality as well as earlier diagnosis because of screening.

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 77% of all cancers are diagnosed in persons 55 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 with women who do not have a 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 (mutation) to genes that occurs during one's lifetime. Mutations may result from internal factors such as hormones or the digestion of nutrients within cells, or external factors such as tobacco, chemicals, and sunlight. (These nonhereditary mutations are called somatic mutations.)

How Many People Alive Today Have Ever Had Cancer?

The National Cancer Institute estimates that approximately 10.5 million Americans with a history of cancer were alive in January 2003. 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 1,444,920 new cancer cases are expected to be diagnosed in 2007. 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. More than 1 million cases of basal and squamous cell skin cancers are expected to be diagnosed this year.

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

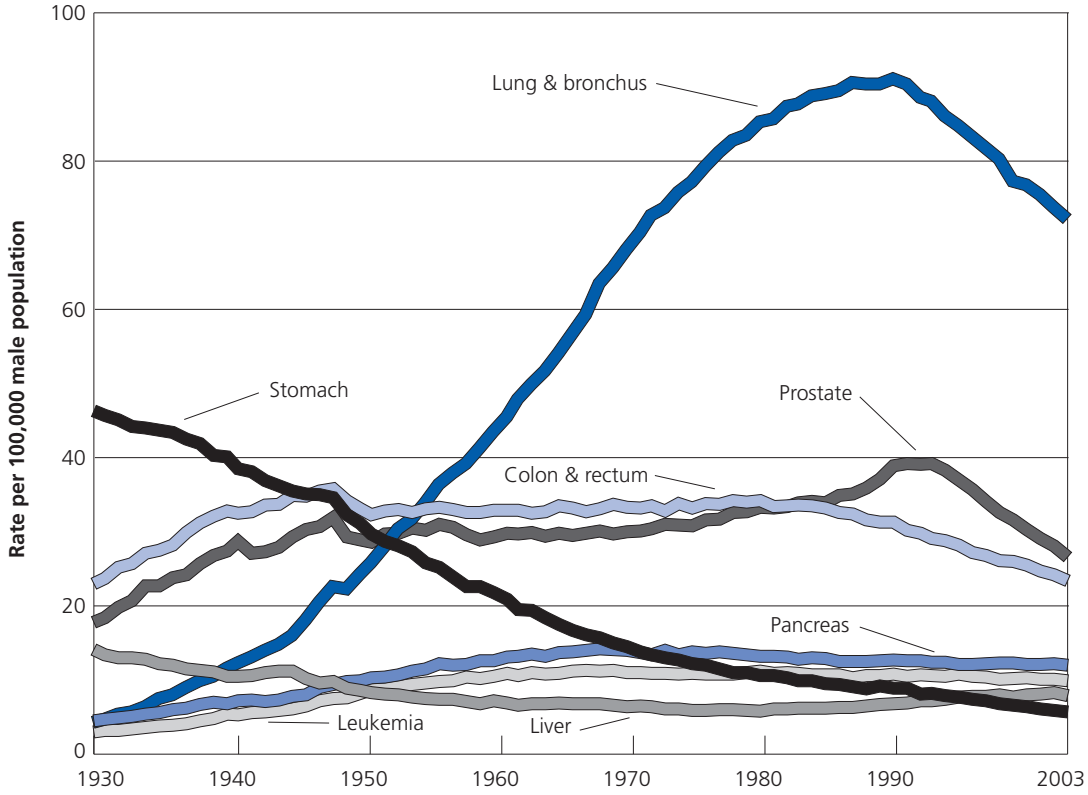
This year about 559,650 Americans are expected to die of cancer, more than 1,500 people a day. Cancer is the second most common cause of death in the US, exceeded only by heart disease. In the US, cancer accounts for 1 of every 4 deaths.

What Percentage of People Survive Cancer?

The 5-year relative survival rate for all cancers diagnosed between 1996 and 2002 is 66%, up from 51% in 1975-1977 (see page 18). The improvement in survival reflects progress in diagnosing certain cancers at an earlier stage and improvements in treatment. Rates 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 is less informative when used to predict individual prognosis and should be interpreted with caution. First, 5-year relative survival rates are based on patients who were diagnosed from 1996-2002 and do not reflect recent advances in detection and treatment. Second, information about prognostic factors other than stage at diagnosis that influence survival, including 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 50.)

Age-Adjusted Cancer Death Rates,* Males by Site, US, 1930-2003



*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 Public Use Data Tapes 1960 to 2003, US Mortality Volumes 1930 to 1959, National Center for Health Statistics, Centers for Disease Control and Prevention, 2006.

American Cancer Society, Surveillance Research, 2007

How Is Cancer Staged?

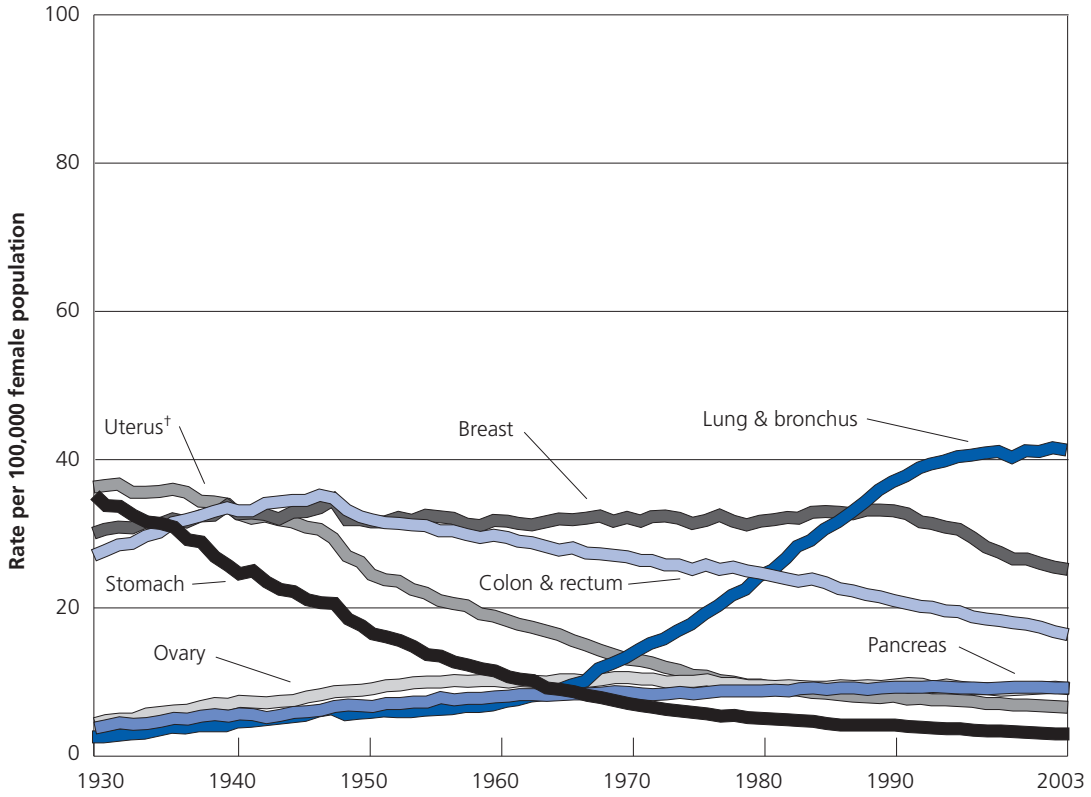
Staging describes the extent or spread of the disease at the time of diagnosis. It is essential in determining the choice of therapy and in assessing prognosis. A cancer's stage is based on the primary tumor's size and location and whether it has spread to other areas of the body. A number of different 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 stage and IV being advanced. 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 spread beyond the original layer of tissue, the cancer is invasive. (See 5-Year Relative Survival Rates by Stage at Diagnosis, 1996-2002, page 17, for a description of the other summary stage categories.)

What Are the Costs of Cancer?

The National Institutes of Health estimate overall costs for cancer in 2006 at $206.3 billion: $78.2 billion for direct medical costs (total of all health expenditures); $17.9 billion for indirect morbidity costs (cost of lost productivity due to illness); and $110.2 billion for indirect mortality costs (cost of lost productivity due to premature death).

Lack of health insurance and other barriers prevent many Americans from receiving optimal health care. According to National Health Interview Survey data, in 2004 about 17% of Americans younger than age 65 had no health insurance coverage and 27% of persons 65 and older had Medicare coverage only. Persons in the lowest income group were 10 times as likely as persons in the highest income group not to receive needed medical care because of cost. Almost 16 million citizens (6%) were unable to obtain needed medical care due to cost.

Age-Adjusted Cancer Death Rates,* Females by Site, US, 1930-2003



*Per 100,000, age-adjusted to the 2000 US standard population. †Uterus cancer death rates are for 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 Public Use Data Tapes 1960 to 2003, US Mortality Volumes 1930 to 1959, National Center for Health Statistics, Centers for Disease Control and Prevention, 2006.

American Cancer Society, Surveillance Research, 2007

Estimated New Cancer Cases and Deaths by Sex for All Sites, US, 2007*

	Estimated New Cases			Estimated Deaths		
	Both Sexes	**Male**	**Female**	**Both Sexes**	**Male**	**Female**
All sites	1,444,920	766,860	678,060	559,650	289,550	270,100
Oral cavity & pharynx	34,360	24,180	10,180	7,550	5,180	2,370
Tongue	9,800	6,930	2,870	1,830	1,180	650
Mouth	10,660	6,480	4,180	1,860	1,110	750
Pharynx	11,800	9,310	2,490	2,180	1,620	560
Other oral cavity	2,100	1,460	640	1,680	1,270	410
Digestive system	271,250	147,390	123,860	134,710	74,500	60,210
Esophagus	15,560	12,130	3,430	13,940	10,900	3,040
Stomach	21,260	13,000	8,260	11,210	6,610	4,600
Small intestine	5,640	2,940	2,700	1,090	570	520
Colon†	112,340	55,290	57,050	52,180	26,000	26,180
Rectum	41,420	23,840	17,580			
Anus, anal canal, & anorectum	4,650	1,900	2,750	690	260	430
Liver & intrahepatic bile duct	19,160	13,650	5,510	16,780	11,280	5,500
Gallbladder & other biliary	9,250	4,380	4,870	3,250	1,260	1,990
Pancreas	37,170	18,830	18,340	33,370	16,840	16,530
Other digestive organs	4,800	1,430	3,370	2,200	780	1,420
Respiratory system	229,400	127,090	102,310	164,840	92,910	71,930
Larynx	11,300	8,960	2,340	3,660	2,900	760
Lung & bronchus	213,380	114,760	98,620	160,390	89,510	70,880
Other respiratory organs	4,720	3,370	1,350	790	500	290
Bones & joints	2,370	1,330	1,040	1,330	740	590
Soft tissue (including heart)	9,220	5,050	4,170	3,560	1,840	1,720
Skin (excluding basal & squamous)	65,050	37,070	27,980	10,850	7,140	3,710
Melanoma-skin	59,940	33,910	26,030	8,110	5,220	2,890
Other non-epithelial skin	5,110	3,160	1,950	2,740	1,920	820
Breast	180,510	2,030	178,480	40,910	450	40,460
Genital system	306,380	228,090	78,290	55,740	27,720	28,020
Uterine cervix	11,150		11,150	3,670		3,670
Uterine corpus	39,080		39,080	7,400		7,400
Ovary	22,430		22,430	15,280		15,280
Vulva	3,490		3,490	880		880
Vagina & other genital, female	2,140		2,140	790		790
Prostate	218,890	218,890		27,050	27,050	
Testis	7,920	7,920		380	380	
Penis & other genital, male	1,280	1,280		290	290	
Urinary system	120,400	82,960	37,440	27,340	18,100	9,240
Urinary bladder	67,160	50,040	17,120	13,750	9,630	4,120
Kidney & renal pelvis	51,190	31,590	19,600	12,890	8,080	4,810
Ureter & other urinary organs	2,050	1,330	720	700	390	310
Eye & orbit	2,340	1,310	1,030	220	110	110
Brain & other nervous system	20,500	11,170	9,330	12,740	7,150	5,590
Endocrine system	35,520	9,040	26,480	2,320	1,030	1,290
Thyroid	33,550	8,070	25,480	1,530	650	880
Other endocrine	1,970	970	1,000	790	380	410
Lymphoma	71,380	38,670	32,710	19,730	10,370	9,360
Hodgkin lymphoma	8,190	4,470	3,720	1,070	770	300
Non-Hodgkin lymphoma	63,190	34,200	28,990	18,660	9,600	9,060
Multiple myeloma	19,900	10,960	8,940	10,790	5,550	5,240
Leukemia	44,240	24,800	19,440	21,790	12,320	9,470
Acute lymphocytic leukemia	5,200	3,060	2,140	1,420	820	600
Chronic lymphocytic leukemia	15,340	8,960	6,380	4,500	2,560	1,940
Acute myeloid leukemia	13,410	7,060	6,350	8,990	5,020	3,970
Chronic myeloid leukemia	4,570	2,570	2,000	490	240	250
Other leukemia‡	5,720	3,150	2,570	6,390	3,680	2,710
Other & unspecified primary sites‡	32,100	15,720	16,380	45,230	24,440	20,790

*Rounded to the nearest 10; estimated new cases exclude basal and squamous cell skin cancers and in situ carcinomas except urinary bladder. About 62,030 female carcinoma in situ of the breast and 48,290 melanoma in situ will be newly diagnosed in 2007. †Estimated deaths for colon and rectum cancers are combined. ‡More deaths than cases suggests lack of specificity in recording underlying causes of death on death certificates.

Source: Estimated new cases are based on 1995-2003 incidence rates from 41 states as reported by the North American Association of Central Cancer Registries (NAACCR), representing about 86% of the US population. Estimated deaths are based on data from US Mortality Public Use Data Tapes, 1969 to 2004, National Center for Health Statistics, Centers for Disease Control and Prevention, 2006.

Estimated New Cancer Cases for Selected Cancer Sites by State, US, 2007*

State	All Cases	Female Breast	Uterine Cervix	Colon & Rectum	Uterine Corpus	Leukemia	Lung & Bronchus	Melanoma of the Skin	Non-Hodgkin Lymphoma	Prostate	Urinary Bladder
Alabama	20,590	2,750	170	2,350	460	550	3,850	740	860	3,010	850
Alaska	2,500	340	†	270	60	70	330	80	110	420	110
Arizona	26,270	3,220	190	2,750	550	740	3,740	1,300	1,080	3,400	1,360
Arkansas	14,130	1,830	130	1,640	320	510	2,420	550	600	1,960	560
California	151,250	19,790	1,350	15,000	3,870	4,610	17,920	6,860	7,190	24,590	6,590
Colorado	19,190	2,660	150	1,790	490	670	2,100	1,210	880	3,160	880
Connecticut	19,780	2,510	100	2,190	650	610	2,720	1,120	870	2,890	1,090
Delaware	4,530	560	†	480	130	110	770	190	170	800	220
Dist. of Columbia	2,540	320	†	270	70	60	380	60	100	540	90
Florida	106,560	11,710	850	11,420	2,490	3,360	17,490	4,380	4,530	15,710	5,460
Georgia	35,440	4,520	330	3,690	810	960	5,780	1,460	1,370	5,850	1,360
Hawaii	6,020	820	50	790	170	170	690	270	250	780	200
Idaho	6,140	780	†	600	150	220	760	350	280	1,080	310
Illinois	62,010	7,030	530	6,890	1,730	2,030	9,550	2,050	2,670	8,060	2,880
Indiana	30,040	3,560	240	3,390	880	910	5,210	1,220	1,310	3,710	1,390
Iowa	16,540	2,000	100	1,930	500	620	2,290	690	800	2,140	820
Kansas	12,760	1,750	100	1,360	360	420	1,870	430	600	1,490	570
Kentucky	22,850	2,590	200	2,570	560	680	4,450	1,050	900	2,880	970
Louisiana	22,540	2,820	200	2,520	420	680	3,510	670	920	3,640	850
Maine	8,340	980	†	880	270	250	1,360	410	330	1,210	470
Maryland	26,390	3,560	190	2,870	810	630	4,130	1,150	1,160	4,690	1,150
Massachusetts	34,920	4,260	180	3,850	1,110	1,010	5,060	1,820	1,550	5,180	1,950
Michigan	54,410	5,900	370	5,570	1,610	1,680	8,210	2,080	2,250	8,200	2,700
Minnesota	25,420	3,240	150	2,650	750	920	3,160	1,130	1,170	4,800	1,250
Mississippi	12,470	1,620	120	1,440	230	340	2,190	320	480	2,010	480
Missouri	29,930	3,730	240	3,380	830	890	5,350	870	1,260	3,910	1,350
Montana	4,920	630	†	520	120	170	690	190	220	940	260
Nebraska	8,720	1,160	60	920	260	290	1,190	340	400	1,260	430
Nevada	11,030	1,180	80	1,120	230	330	1,750	390	420	1,550	570
New Hampshire	7,140	890	†	800	230	190	1,010	370	290	1,050	390
New Jersey	49,370	6,080	350	5,160	1,550	1,520	6,310	2,210	2,200	8,070	2,450
New Mexico	8,030	1,080	70	790	200	310	940	420	350	1,410	350
New York	100,960	12,580	790	10,710	3,240	3,080	13,390	3,070	4,540	15,770	4,980
North Carolina	38,210	4,870	280	4,290	1,020	1,070	6,290	1,630	1,610	6,040	1,690
North Dakota	3,340	440	†	410	100	110	390	120	150	520	200
Ohio	59,220	6,710	390	6,410	1,800	1,710	9,790	2,390	2,560	8,260	2,940
Oklahoma	17,170	2,200	160	1,880	400	570	3,180	720	770	2,510	710
Oregon	18,630	2,460	110	1,830	470	500	2,520	990	890	2,870	970
Pennsylvania	75,130	8,860	420	8,220	2,400	2,240	10,500	3,120	3,330	12,230	4,030
Rhode Island	6,360	730	†	690	190	170	920	300	260	920	370
South Carolina	21,370	2,600	190	2,230	480	550	3,460	870	780	3,380	840
South Dakota	3,990	510	†	470	120	130	490	160	180	710	220
Tennessee	28,440	3,690	250	3,100	660	800	5,110	980	1,180	3,000	1,230
Texas	91,020	12,120	940	9,510	2,040	3,130	13,520	3,860	4,140	13,280	3,300
Utah	7,660	920	50	740	220	300	600	500	380	1,510	340
Vermont	3,500	420	†	390	110	80	440	150	140	550	170
Virginia	35,090	4,570	280	3,530	970	900	5,360	1,510	1,390	5,330	1,380
Washington	31,080	4,090	150	2,920	800	960	3,970	1,630	1,500	5,000	1,490
West Virginia	10,490	1,180	80	1,210	310	300	2,110	410	430	1,430	500
Wisconsin	28,130	3,340	170	3,090	860	1,040	3,930	1,070	1,300	4,770	1,350
Wyoming	2,340	310	†	260	60	70	290	100	110	410	110
United States	1,444,920	178,480	11,150	153,760	39,080	44,240	213,380	59,940	63,190	218,890	67,160

*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 add up to US total due to rounding and exclusion of state estimates fewer than 50 cases.

Estimated Cancer Deaths for Selected Cancer Sites by State, US, 2007*

State	All Sites	Brain/ Nervous System	Female Breast	Colon & Rectum	Leukemia	Liver	Lung & Bronchus	Non-Hodgkin Lymphoma	Ovary	Pancreas	Prostate
Alabama	9,740	210	680	880	350	300	3,240	330	290	530	480
Alaska	810	†	50	70	†	†	230	†	†	50	†
Arizona	10,120	250	710	970	400	330	2,850	320	300	590	520
Arkansas	6,240	140	410	610	240	200	2,220	200	140	310	300
California	54,890	1,460	4130	5,230	2150	2,270	13,220	1,830	1,680	3,480	3,040
Colorado	6,660	190	520	630	290	200	1,650	240	220	410	330
Connecticut	6,990	150	490	590	270	190	1,860	230	190	480	390
Delaware	1,810	†	120	160	70	†	580	60	50	100	90
Dist. of Columbia	1,020	†	80	100	†	†	260	†	†	60	60
Florida	40,430	790	2700	3,530	1630	1,190	12,360	1,300	1,040	2,350	2,180
Georgia	14,950	280	1120	1,340	540	360	4,500	470	420	820	630
Hawaii	2,260	†	130	210	80	110	530	90	50	170	130
Idaho	2,370	80	180	200	120	50	570	100	50	140	150
Illinois	23,870	490	1740	2,380	990	650	6,690	750	620	1,480	990
Indiana	12,730	280	860	1,180	510	290	3,800	430	350	740	600
Iowa	6,510	160	410	600	310	140	1,750	300	190	390	350
Kansas	5,290	140	380	520	230	120	1,530	220	150	310	220
Kentucky	9,390	150	600	860	320	220	3,450	290	220	460	310
Louisiana	9,550	200	730	960	330	330	3,020	310	220	530	400
Maine	3,190	80	190	280	100	70	970	110	80	190	180
Maryland	10,210	230	830	970	390	250	2,900	320	270	640	540
Massachusetts	13,240	270	890	1,180	490	380	3,630	420	360	860	560
Michigan	19,180	450	1320	1,750	770	560	5,840	660	540	1,180	850
Minnesota	9,380	240	600	810	400	240	2,460	350	250	550	490
Mississippi	5,990	160	450	610	210	180	2,040	170	150	340	290
Missouri	12,610	270	870	1,170	460	330	4,120	500	320	690	510
Montana	1,920	50	130	160	80	†	520	80	60	110	110
Nebraska	3,320	90	220	350	150	70	900	110	90	180	170
Nevada	4,660	100	330	490	160	140	1,330	130	130	260	230
New Hampshire	2,630	70	180	220	100	70	740	90	60	150	140
New Jersey	17,140	320	1350	1,680	680	530	4,380	600	490	1,070	750
New Mexico	3,270	80	240	320	120	140	720	120	90	190	200
New York	35,270	720	2670	3,350	1360	1,090	9,500	1,030	1,020	2,330	1,630
North Carolina	16,880	360	1240	1,480	610	420	5,150	570	450	980	800
North Dakota	1,220	†	90	120	†	†	350	†	†	80	100
Ohio	24,600	540	1820	2,350	950	600	7,310	610	650	1,370	1,350
Oklahoma	7,380	170	510	720	290	180	2,390	210	170	370	280
Oregon	7,370	200	530	640	260	190	2,140	360	230	440	340
Pennsylvania	29,140	560	2470	2,730	1070	790	7,780	1,140	790	1,780	1,310
Rhode Island	2,370	50	140	210	80	70	640	60	60	140	110
South Carolina	8,940	190	570	790	330	230	2,750	260	220	510	420
South Dakota	1,600	50	100	160	70	†	420	80	50	100	110
Tennessee	12,920	350	890	1,160	480	330	4,340	410	320	700	550
Texas	34,170	840	2480	3,220	1410	1,490	9,920	1,160	860	2,010	1,620
Utah	2,690	90	240	240	130	70	470	140	90	170	140
Vermont	1,160	†	100	120	50	†	350	50	†	70	80
Virginia	13,740	280	1100	1,320	500	370	4,290	360	390	800	600
Washington	11,370	370	770	990	490	380	3,170	440	370	740	630
West Virginia	4,610	90	280	480	130	110	1,450	170	140	220	160
Wisconsin	10,870	260	770	960	490	310	2,890	320	290	680	540
Wyoming	980	†	60	110	†	†	260	†	†	60	60
United States	559,650	12,740	40,460	52,180	21,790	16,780	160,390	18,660	15,280	33,370	27,050

*Rounded to nearest 10. †Estimate is fewer than 50 deaths. **Note:** State estimates may not add up to US total due to rounding and exclusion of state estimates fewer than 50 deaths.

Source: US Mortality Public Use Data Tapes, 1969-2004, National Center for Health Statistics, Centers for Disease Control and Prevention, 2006.

Cancer Incidence Rates by Site and State, US, 1999-2003*

	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†	526.5	365.2	115.3	60.6	41.8	108.9	49.9	18.8	13.3	140.4	30.0	7.1
Alaska†	556.8	421.2	134.2	65.5	50.3	87.6	60.9	23.7	15.7	167.7	39.5	8.4
Arizona	462.4	364.1	116.7	53.1	38.2	71.8	48.7	18.7	13.4	118.2	36.0	8.8
Arkansas	544.1	377.1	121.0	60.1	43.4	114.9	56.1	20.8	15.1	154.2	34.3	8.2
California†	520.9	398.5	129.8	56.6	41.5	70.8	48.4	22.4	15.3	158.3	34.4	8.3
Colorado†	516.2	400.3	134.2	53.7	40.7	66.6	44.7	21.7	16.7	164.8	35.4	9.3
Connecticut†	597.3	448.3	140.4	68.8	50.3	84.2	57.1	24.4	17.0	179.8	45.0	12.3
Delaware†	586.8	433.4	128.8	66.6	48.8	97.4	63.0	21.6	15.9	176.1	38.5	10.2
Dist. of Columbia†	635.6	422.6	135.3	65.6	52.0	96.4	50.1	21.0	11.9	227.1	25.3	9.8
Florida†	562.2	415.6	123.0	62.8	46.6	94.4	60.5	22.3	15.5	152.7	40.4	10.4
Georgia†	565.8	391.5	124.0	61.5	43.7	108.6	52.8	19.6	13.8	166.2	32.7	8.0
Hawaii†	481.8	375.2	127.3	65.4	42.3	68.0	37.2	18.7	13.1	132.3	23.4	5.2
Idaho†	530.0	396.0	128.2	52.4	39.5	71.1	44.8	20.8	17.6	171.9	38.2	7.6
Illinois†	580.9	425.5	129.7	71.1	49.8	96.1	56.6	23.2	16.2	165.6	40.2	10.5
Indiana†	545.7	414.4	124.8	67.6	48.5	107.1	60.3	22.0	15.7	138.6	36.1	9.2
Iowa†	557.1	424.2	128.7	71.6	53.0	90.2	50.4	22.6	16.7	154.2	39.1	9.8
Kansas‡	–	–	–	–	–	–	–	–	–	–	–	–
Kentucky†	616.9	440.5	124.8	72.0	53.1	137.9	73.5	21.6	16.5	155.1	37.8	9.5
Louisiana†	613.8	402.3	122.8	72.7	49.6	114.0	56.8	22.4	15.7	179.5	34.2	8.2
Maine†	609.9	447.6	131.4	69.1	51.4	101.0	62.8	22.5	16.9	171.3	48.9	13.2
Maryland†	581.6	428.3	131.9	63.2	47.2	87.2	57.1	20.9	14.4	185.2	34.0	9.4
Massachusetts†	591.6	451.8	138.8	68.7	50.3	84.0	61.4	23.1	16.8	178.2	45.8	12.5
Michigan†	608.6	429.9	129.4	62.4	46.5	94.8	58.6	23.6	17.3	199.1	42.0	10.7
Minnesota†	559.4	412.3	135.9	60.3	44.6	72.1	47.8	25.4	18.0	188.6	38.4	10.2
Mississippi‡	–	–	–	–	–	–	–	–	–	–	–	–
Missouri†	537.4	408.8	125.4	67.9	48.5	104.7	59.5	21.9	15.9	136.8	35.9	9.0
Montana†	558.8	412.0	128.4	59.0	43.9	81.2	56.0	22.6	15.1	183.6	40.8	10.1
Nebraska†	551.0	413.4	131.4	70.8	49.7	81.6	47.4	22.6	17.3	165.7	38.3	9.2
Nevada†	541.3	414.2	120.8	60.7	44.1	91.5	71.2	20.7	14.3	150.6	44.0	11.0
New Hampshire†	571.7	436.6	135.2	62.4	48.5	81.9	59.3	24.2	16.4	165.3	46.2	12.7
New Jersey†	623.9	448.7	133.9	73.1	52.3	85.0	55.7	25.7	18.0	200.3	45.3	12.0
New Mexico	485.0	357.3	115.0	52.0	35.2	60.1	36.8	17.9	13.6	152.2	28.7	7.1
New York†	565.4	424.8	126.7	68.0	50.2	82.8	53.5	23.4	16.6	168.1	41.0	11.1
North Carolina	519.2	372.6	121.5	57.0	41.8	96.2	49.9	19.0	13.4	152.4	32.7	8.4
North Dakota	518.0	366.9	123.1	64.8	43.4	70.8	41.0	21.6	14.6	181.8	37.2	9.1
Ohio	551.9	412.6	126.6	65.7	47.7	99.5	57.8	22.9	16.1	154.1	39.5	10.1
Oklahoma†	547.0	399.6	128.3	64.6	44.6	111.2	62.1	21.9	15.1	148.8	32.6	8.0
Oregon†	545.4	436.5	142.6	56.9	44.3	82.6	61.0	23.4	17.3	164.1	41.1	10.2
Pennsylvania†	594.4	436.5	129.4	72.2	51.1	92.9	53.9	24.5	17.0	172.3	44.2	11.6
Rhode Island†	627.2	448.6	130.7	72.9	50.2	98.7	60.9	23.5	17.3	177.9	51.6	14.8
South Carolina†	590.1	389.4	123.5	65.4	45.6	107.4	51.1	20.4	14.3	176.9	33.9	7.6
South Dakota (2001-2003)	564.1	395.7	128.6	66.2	48.9	78.4	41.8	22.2	15.5	190.1	43.2	8.6
Tennessee§	442.0	351.2	113.7	54.7	40.2	95.5	50.9	17.8	12.9	108.7	28.3	7.3
Texas†	530.7	383.4	118.6	59.2	41.4	91.8	50.7	21.3	15.6	148.3	29.6	7.3
Utah†	490.2	346.3	117.1	48.3	36.6	41.8	21.5	23.1	15.3	186.5	31.3	7.0
Vermont‡	–	–	–	–	–	–	–	–	–	–	–	–
Virginia	510.5	367.6	122.2	58.3	43.1	83.5	48.7	19.1	13.0	161.4	32.4	8.2
Washington†	573.7	448.0	146.7	57.9	43.5	84.4	60.5	26.0	18.1	177.1	41.7	10.3
West Virginia†	574.6	427.8	116.9	71.5	53.6	118.0	68.4	21.3	16.2	148.2	39.9	12.1
Wisconsin†	562.0	424.4	133.9	66.5	47.2	84.5	52.2	22.9	16.8	169.1	37.9	10.5
Wyoming	524.9	390.3	125.2	52.1	45.1	65.6	44.7	17.3	16.9	182.2	40.5	9.2
United States	562.1	415.3	128.2	64.2	46.7	89.6	54.7	22.6	16.0	165.0	38.2	9.8

*Per 100,000, age-adjusted to the 2000 US standard population. † This state's registry has submitted 5 years of data and passed rigorous criteria for each single year's data, including: completeness of reporting, non-duplication of records, percent unknown in critical data fields, percent of cases registered with information from death certificates only, and internal consistency among data items. ‡This state's registry did not submit incidence data to the North American Association of Central Cancer Registries (NAACCR) for 1999-2003. §Completeness of case assertainment for this state's registry is 77%-84% for the years 1999-2003.

Source: CINA+ Online and *Cancer in North America: 1999-2003, Volume One: Incidence*, NAACCR, 2006. Data are collected by cancer registries participating in the National Cancer Institute's SEER Program and the Centers for Disease Control's National Program of Cancer Registries.

American Cancer Society, Surveillance Research, 2007

Cancer Death Rates by Site and State, US, 1999-2003*

	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	282.2	165.3	26.3	23.9	15.7	97.6	40.0	9.1	6.4	13.0	9.4	36.9
Alaska	237.5	165.8	23.0	23.9	17.7	70.6	43.4	9.4	5.9	12.2	10.0	27.4
Arizona	211.3	148.3	24.1	20.9	14.5	60.6	38.0	9.0	6.4	10.5	8.1	25.5
Arkansas	275.4	167.0	24.4	26.1	18.0	101.0	45.2	10.4	6.3	12.1	8.9	31.9
California	213.9	155.3	24.6	20.7	15.0	58.3	37.5	9.3	5.8	11.3	9.0	26.4
Colorado	208.1	148.2	23.4	21.0	15.2	53.3	33.3	9.3	6.4	11.3	8.7	28.4
Connecticut	228.5	160.2	25.3	23.7	16.6	62.7	40.2	9.7	6.3	12.8	9.4	27.1
Delaware	255.8	175.6	26.8	26.0	17.5	81.3	47.3	10.2	5.9	13.2	9.0	28.3
Dist. of Columbia	299.1	187.8	33.7	30.4	21.5	79.3	39.4	9.0	5.1	15.2	11.4	49.2
Florida	229.4	154.2	23.7	21.9	15.1	73.0	42.0	9.4	5.8	11.5	8.7	24.5
Georgia	264.5	163.8	25.7	23.6	16.5	90.6	40.5	8.6	5.9	12.6	9.4	34.8
Hawaii	192.5	122.7	18.3	20.5	12.6	49.4	24.1	8.2	4.6	11.5	9.5	20.3
Idaho	216.0	151.6	24.7	20.4	13.5	57.5	34.7	9.4	6.9	10.6	9.2	31.1
Illinois	256.1	172.6	27.8	27.7	18.6	77.7	41.8	10.3	6.5	13.0	9.8	30.6
Indiana	268.0	176.2	26.6	27.1	18.2	90.9	47.6	11.0	7.2	12.7	9.2	30.5
Iowa	237.2	157.1	24.3	25.5	17.5	73.1	36.4	10.7	7.1	11.7	9.0	29.7
Kansas	235.2	159.3	25.7	23.3	16.6	74.4	39.3	10.7	7.2	12.2	8.5	27.2
Kentucky	296.6	182.0	26.6	28.9	19.5	114.0	54.1	10.4	6.6	12.2	8.7	29.9
Louisiana	296.1	181.1	30.1	30.2	18.9	97.8	45.2	9.8	6.9	14.5	10.5	34.9
Maine	259.4	178.8	24.8	25.6	18.8	79.6	47.7	10.2	6.5	13.1	9.7	28.8
Maryland	252.5	172.2	27.9	25.8	18.5	76.8	44.7	9.7	5.8	12.8	9.7	31.3
Massachusetts	249.1	171.0	26.2	26.0	17.7	70.4	44.2	9.6	6.8	13.0	10.0	29.4
Michigan	247.4	168.7	26.6	23.9	16.6	75.4	43.6	11.0	6.9	12.3	9.5	29.4
Minnesota	229.1	157.0	24.4	21.7	16.2	61.0	36.8	10.9	7.1	11.6	9.2	30.9
Mississippi	298.4	169.7	27.9	27.0	18.8	106.5	42.7	9.2	5.4	13.7	10.3	41.9
Missouri	256.1	171.8	26.7	25.4	18.1	86.5	45.6	10.5	7.1	12.5	9.0	27.1
Montana	232.7	163.2	23.8	22.6	15.1	67.9	43.1	9.5	6.3	11.1	8.2	29.6
Nebraska	226.9	156.8	23.8	25.3	18.1	68.3	36.1	10.0	6.9	11.1	8.6	26.2
Nevada	245.4	176.2	26.3	27.0	17.6	74.7	53.2	8.6	5.7	11.8	9.6	28.5
New Hampshire	245.8	167.6	25.6	25.6	17.8	68.4	44.3	10.4	6.6	12.0	9.8	29.3
New Jersey	244.5	175.0	29.1	27.1	19.1	68.7	40.7	10.5	6.6	12.8	10.1	28.4
New Mexico	210.7	142.9	22.5	20.8	14.4	51.2	29.4	8.6	5.4	11.0	8.5	29.3
New York	228.0	162.5	27.0	25.5	17.8	64.1	38.0	9.3	5.9	12.5	9.9	28.2
North Carolina	263.8	163.2	25.6	23.7	16.6	89.0	40.7	9.6	6.1	12.7	9.2	33.7
North Dakota	227.3	151.1	24.8	22.8	17.1	60.8	31.7	10.9	6.4	11.1	8.9	29.4
Ohio	261.9	175.2	28.5	26.5	18.9	84.4	44.5	10.9	7.2	11.8	9.1	29.3
Oklahoma	260.8	168.5	26.4	25.4	17.1	89.3	45.8	10.2	6.9	12.5	8.2	27.7
Oregon	234.7	170.2	25.7	22.1	15.6	68.4	47.3	10.6	7.3	12.2	9.3	29.7
Pennsylvania	252.9	171.2	27.9	27.3	18.6	75.0	40.2	10.7	6.9	12.5	9.3	29.2
Rhode Island	248.1	171.2	25.0	24.5	19.0	77.3	43.8	10.0	7.1	12.2	10.2	27.4
South Carolina	276.6	163.8	26.8	25.6	17.3	91.5	39.8	8.7	6.0	13.1	9.8	36.3
South Dakota	236.6	156.2	24.0	25.4	18.3	68.9	32.8	10.9	7.3	11.3	10.2	31.4
Tennessee	281.6	171.6	26.4	25.7	17.6	102.1	44.7	10.7	6.8	12.6	9.3	32.5
Texas	243.4	159.1	24.9	23.2	15.9	76.4	39.2	9.3	6.4	12.0	8.7	28.2
Utah	182.2	124.1	23.0	18.0	13.6	35.2	17.1	10.2	5.7	10.9	7.0	29.4
Vermont	237.5	163.3	26.1	23.7	18.3	69.2	39.2	11.6	7.6	11.7	8.2	29.4
Virginia	256.5	169.0	27.6	24.4	17.5	79.6	42.5	9.6	6.2	12.4	9.3	33.4
Washington	232.0	166.9	24.0	21.0	15.4	69.1	46.6	11.2	6.5	12.3	9.7	27.9
West Virginia	273.7	182.7	25.3	28.4	19.9	97.4	51.8	9.9	7.0	10.9	7.7	28.3
Wisconsin	237.1	158.9	25.1	24.3	16.2	65.3	37.0	10.4	6.4	12.3	9.7	30.4
Wyoming	227.1	160.9	23.0	22.0	19.1	63.9	39.2	7.1	6.2	12.2	8.4	31.8
United States	243.7	164.3	26.0	24.3	17.0	74.8	41.0	9.9	6.4	12.2	9.2	29.1

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

Source: US Mortality Public Use Tapes 1960-2003, National Center for Health Statistics, Centers for Disease Control and Prevention, 2006.

American Cancer Society, Surveillance Research, 2007

Selected Cancers

Breast

New cases: An estimated 178,480 new cases of invasive breast cancer are expected to occur among women in the US during 2007. Breast cancer is the most frequently diagnosed cancer in women. After continuously increasing for more than two decades, female breast cancer incidence rates leveled off from 2001-2003. About 2,030 new cases of breast cancer are expected in men in 2007.

In addition to invasive breast cancer, 62,030 new cases of in situ breast cancer are expected to occur among women in 2007. Of these, approximately 85% will be ductal carcinoma in situ (DCIS). Similar to trends in invasive female breast cancer, in situ breast cancer incidence rates have stabilized since the late 1990s, which may reflect the recent plateau in mammagraphy utilization.

Deaths: An estimated 40,910 breast cancer deaths (40,460 women, 450 men) are expected in 2007. Breast cancer ranks second among cancer deaths in women (after lung cancer). Death rates from breast cancer have steadily decreased in women since 1990, with larger decreases in women younger than 50 (a decrease of 3.3% per year) than in those 50 years and older (2.0% per year). These decreases are due to a combination of earlier detection and improved treatment.

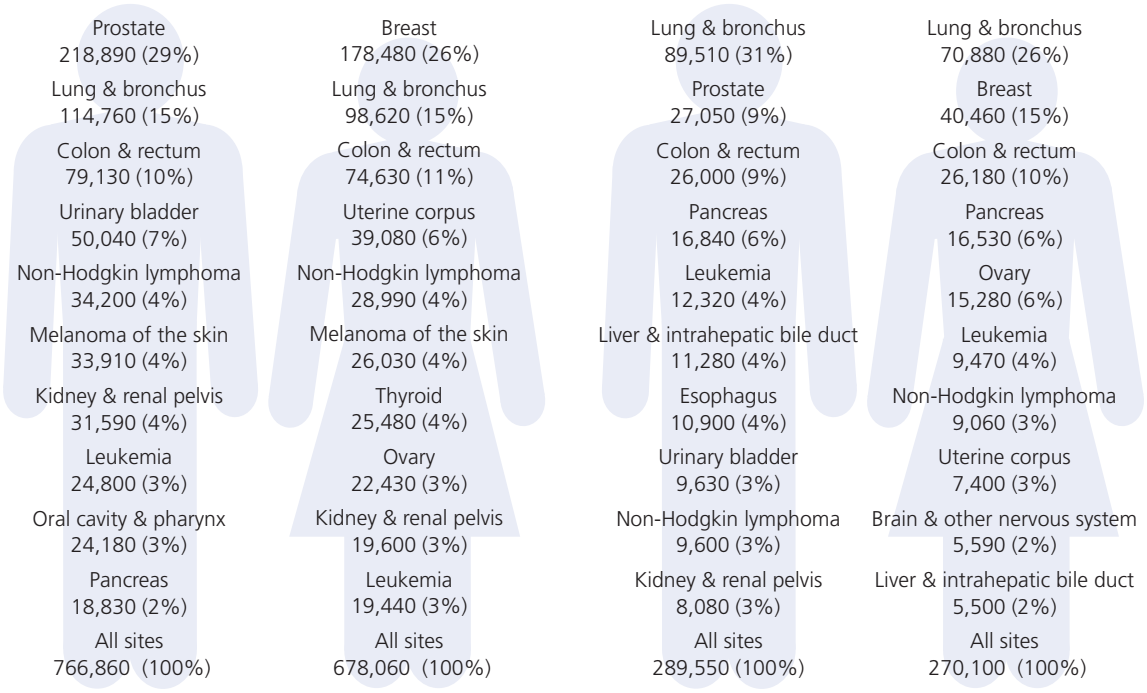
Signs and symptoms: The earliest sign of breast cancer is usually an abnormality detected on a mammogram before it can be felt by the woman or a health care professional. Larger tumors may become evident as a painless mass. Less common symptoms include persistent changes to the breast, such as thickening, swelling, distortion, tenderness, skin irritation, 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 factor affecting breast cancer risk. Risk is also increased by inherited genetic mutations in the BRCA1 and BRCA2 genes, a personal or family history of breast cancer, high breast tissue density (a mammographic measure of the amount of glandular tissue relative to fatty tissue in the breast), biopsy-confirmed hyperplasia (especially atypical hyperplasia), and high-dose radiation to the chest as a result of medical procedures. Reproductive factors that increase risk include a long menstrual history (menstrual periods that start early and/or end late in life), never having children, recent use of oral contraceptives, and having one's first child after age 30. Some potentially modifiable factors that increase risk include being overweight or obese after menopause, use of postmenopausal hormone therapy (especially combined estrogen and progestin therapy), physical inactivity, and consumption of one or more alcoholic beverages per day. Many studies have shown that being overweight also adversely affects survival for postmenopausal women with breast cancer.

Breastfeeding, moderate or vigorous physical activity, and maintaining a healthy body weight are all associated with a lower risk of breast cancer. A medication called tamoxifen decreases breast cancer risk in women at increased risk. A recent study confirmed that another medication, raloxifene, is as effective as tamoxifen in reducing the risk of invasive breast cancer in postmenopuasal women and may have fewer side effects. However, raloxifene is not yet recommended for the prevention of breast cancer. Cancer-causing mutations in the inherited susceptibility genes BRCA1 and BRCA2 account for approximately 5%-10% of all breast cancer cases. Widespread testing for these mutations is not recommended because they are present in far less than 1% of the general population. However, women with a strong family history of breast and/or ovarian cancer should be offered counseling to determine if genetic testing is appropriate. Recent studies suggest that prophylactic removal of the breasts and/or ovaries in BRCA1 and BRCA2 mutation carriers decreases the risk of breast cancer considerably, although not all women who choose this surgery would have developed these cancers. Women who consider these options should undergo counseling before reaching a decision.

Early detection: Mammography can detect breast cancer at an early stage when treatment may be more effective. Numerous studies have shown that early detection saves lives and increases treatment options. The recent declines in breast cancer mortality among women have been attributed to a combination of early detection and improvements in treatment. Mammography is highly accurate but 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 lumps should be biopsied for a definitive diagnosis. Several recent studies have shown that magnetic resonance imaging appears to be more sensitive than mammography in detecting tumors in women with an inherited susceptibility to breast cancer.

Leading Sites of New Cancer Cases and Deaths – 2007 Estimates



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

(See page 52 for the American Cancer Society's screening guidelines for the early detection of breast cancer.)

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) with removal of some of the axillary (underarm) lymph nodes (to obtain accurate information on stage of disease). It may also involve radiation therapy, chemotherapy, hormone therapy (tamoxifen, aromatase inhibitors), or targeted biologic therapy (trastuzumab). Monoclonal antibody immunotherapy with trastuzumab (Herceptin®) is sometimes used in women whose cancer tests positive for HER2/neu, the protein that Herceptin® is directed against. Two or more methods are often used in combination.

Numerous studies have shown that, unless cancer has spread to the skin, chest wall, or distant organs, long-term survival rates after lumpectomy plus radiation therapy are similar to survival rates after mastectomy. To ascertain whether cancer has spread beyond the original tumor site, a relatively new technique called sentinel lymph node biopsy is reducing the need for full axillary lymph node dissection in women with early-stage breast cancer. Lymph nodes draining the tumor site are tested and only those nodes that are suspected to be cancerous are removed. Sentinel lymph node biopsy is preferable to axillary lymph node dissection (removal of lymph nodes in the underarm area) because fewer lymph nodes are removed, so there is a lower risk for side effects such as lymphedema, a swelling of the arm that can be painful and disabling. Eligible women who elect to have sentinel lymph node biopsy should have their breast cancer surgery at a facility with 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).

The exact percentage of mammographically detected ductal carcinoma in situ (DCIS) that would progress to invasive breast cancer without treatment is not known. However, data from mammography screening trials suggest that the majority of such cancers will progress.

Since there are no tests at this time that can reliably predict which cases will progress, it is recommended that all patients with DCIS be treated. Treatment options include lumpectomy with radiation therapy or mastectomy; either of these options may be followed by treatment with tamoxifen.

Survival: The 5-year relative survival for localized breast cancer (malignant cancer that has not spread to lymph nodes or other locations outside the breast) has increased from 80% in the 1950s to 98% today. If the cancer has spread regionally, the 5-year survival is 83%. For women with distant spread (metastases), the survival is 26%. Survival after a diagnosis of breast cancer continues to decline after 5 years. The survival rate at 10 years for all stages combined is 80% compared to 89% at 5 years. Caution should be used when interpreting 10-year survival rates since they represent detection and treatment circumstances 5-15 years ago and may underestimate the expected survival based on current conditions.

(For more information about breast cancer, please see the American Cancer Society's *Breast Cancer Facts & Figures 2005-2006* (8610.05), available online at www.cancer.org.)

Childhood Cancer

New cases: An estimated 10,400 new cases are expected to occur among children aged 0-14 years in 2007. Childhood cancers are rare.

Deaths: An estimated 1,545 deaths are expected to occur among children aged 0-14 years in 2007, 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 48% since 1975.

Early detection: Early symptoms are usually nonspecific. Parents should make sure their children have regular medical checkups and should be alert to any unusual symptoms that persist. These 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.

Childhood cancers include:

- Leukemia (30% of all childhood cancers), which may be recognized by bone and joint pain, weakness, bleeding, and fever
- Brain and other nervous system (22.3%), which in early stages may cause headaches, nausea, vomiting, blurred or double vision, dizziness, and difficulty in walking or handling objects
- Neuroblastoma (7.3%), a cancer of the sympathetic nervous system that can appear anywhere but usually occurs as a swelling in the abdomen
- Wilms tumor (5.6%), a kidney cancer that may be recognized by a swelling or lump in the abdomen
- Non-Hodgkin lymphoma (4.5%) and Hodgkin lymphoma (3.5%), 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 (3.1%), 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 (2.8%), an eye cancer that usually occurs in children under the age of 4 years
- Osteosarcoma (2.4%), a bone cancer that often has no initial pain or symptoms until local swelling begins
- Ewing sarcoma (1.4%), another type of cancer that usually arises in bone

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 cancer center. If the patient is eligible, placement in a clinical trial should also be considered.

Survival: For all childhood cancers combined, 5-year relative survival has improved markedly over the past 30 years, from less than 50% before the 1970s to nearly 80% today, due to new and improved treatments. Rates vary considerably, however, depending on cancer type. For the most recent time period (1996-2002), 5-year survival for neuroblastoma is 69%; bone and joint, 72%; brain and other nervous system, 74%; leukemia, 81%; non-Hodgkin lymphoma, 86%; Wilms tumor, 92%; and Hodgkin lymphoma, 95%. 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 on childhood cancer management, see the COG Web site at: www.survivorshipguidelines.org.

Colon and Rectum

New cases: An estimated 112,340 cases of colon and 41,420 cases of rectal cancer are expected to occur in 2007. Colorectal cancer is the third most common cancer in both men and women. Colorectal cancer incidence rates have been decreasing for most of the last 2 decades, from 66.3 cases per 100,000 population in 1985 to 49.5 in 2003. The more rapid decrease in the most recent time period (2.1% per year from 1998-2003) partly reflects an increase in screening, which can detect and remove colorectal polyps before they progress to cancer.

Deaths: An estimated 52,180 deaths from colon and rectum cancer are expected to occur in 2007, accounting for almost 10% of all cancer deaths. Mortality rates from colorectal cancer have declined in both men and women over the past two decades. This decrease reflects declining incidence rates and improvements in early detection and treatment.

Signs and symptoms: Screening is 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.

Risk factors: The risk of colorectal cancer increases with age; more than 90% of cases are diagnosed in individuals aged 50 years and older. Risk is also increased by certain inherited genetic mutations [familial adenomatous polyposis (FAP) and hereditary non-polyposis colorectal cancer (HNPCC)], a personal or family history of colorectal cancer and/or polyps, or a personal history of chronic inflammatory bowel disease. Several modifiable factors are associated with increased risk of colorectal cancer. Among these are obesity, physical inactivity, smoking, heavy alcohol consumption, a diet high in red or processed meat, and inadequate intake of fruits and vegetables. Studies indicate that men and women who are overweight are more likely to develop and die from colorectal cancer. Some studies suggest that regular use of nonsteroidal anti-inflammatory drugs such as aspirin or hormones such as estrogen and progestin may possibly reduce colorectal cancer risk. However, these drugs are not currently recommended for the prevention of 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, screening reduces mortality both by decreasing incidence and by detecting a higher proportion of cancers at early, more treatable stages. (See page 52 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 very 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. Oxaliplatin in combination with 5-fluorouracil (5-FU) followed by leucovorin (LV) is one chemotherapeutic regimen for persons with metastatic carcinoma of the colon or rectum. Adjuvant chemotherapy (anticancer drugs in addition to surgery or radiation) for colon cancer is equally effective and no more toxic in otherwise healthy patients aged 70 years and older than in younger patients. Two new targeted therapies approved by the US Food and Drug Administration (FDA) to treat metastatic colorectal cancer are bevacizumab (Avastin®), which blocks the growth of blood vessels to the tumor, and cetuximab (Erbitux®), which blocks 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 84% and 64%, respectively. Survival continues to decline beyond 5 years to 57% at 10 years after diagnosis. When colorectal cancers are detected at an early, localized stage, the 5-year survival is 90%; however, only 39% of colorectal cancers are diagnosed at this stage, mostly due to low rates of screening. After the cancer has spread regionally to involve adjacent organs or lymph nodes, the 5-year survival drops to 68%. For persons with distant metastases, 5-year survival is 10%.

Leukemia

New cases: An estimated 44,240 new cases are expected in 2007, with slightly more cases of chronic (19,910) than acute (18,610) disease. Leukemia is diagnosed 10 times

more often in adults than in children, although it is often thought of as primarily a childhood disease. Acute lymphocytic leukemia accounts for approximately 73% (2,790/3,800) of the leukemia cases among children (ages 0-19 years). In adults, the most common types are acute myeloid leukemia (approximately 12,700 cases) and chronic lymphocytic leukemia (approximately 15,100 cases). The incidence of acute myeloid leukemia increased by an average of 2.1% per year from 1988-2001; from 2001-2003, incidence was stable. In contrast, the incidence of chronic lymphocitic leukemia has decreased by an average of 1% per year since 1990.

Deaths: An estimated 21,790 deaths are expected to occur in 2007. Death rates in males and females combined have decreased by about 0.6% per year since 1991.

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.

Risk factors: Leukemia more commonly occurs in males than in females. People with Down syndrome and certain other genetic abnormalities have higher incidence rates of leukemia. Cigarette smoking and exposure to certain chemicals such as benzene, a component in gasoline and cigarette smoke, are risk factors for myeloid leukemia. Exposure to ionizing radiation is a risk factor for several types of leukemia. Leukemia also may occur as a side effect of cancer treatment. Certain leukemias and lymphomas are caused by a retrovirus – human T-cell leukemia/lymphoma virus-I (HTLV-I).

Early detection: Because symptoms often resemble those of other, less serious conditions, leukemia can be difficult to diagnose early. 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 mesylate (Gleevec®) is a highly specific drug used for the treatment of chronic myeloid (or myelogenous) leukemia, which will be diagnosed in about 4,570 people this year. Recent studies have found that two related drugs (nilotinib and dasatinib) are often effective when imatinib stops working. Antibiotics and transfusions of blood components are used as supportive treatments. Under appropriate conditions, bone marrow transplantation may be useful in treating certain leukemias.

Survival: Survival in leukemia varies by type, ranging from a 5-year relative survival of 20% for people with acute myeloid leukemia to 74% for people with chronic lymphocytic leukemia. Advances in treatment have resulted in a dramatic improvement in survival for people with acute lymphocytic leukemia, from a 5-year relative survival rate of 42% in 1975-1977 to 65% in 1996-2002. Survival rates for children with acute lymphocytic leukemia have increased from 58% to 87% over the same time period.

Lung and Bronchus

New cases: An estimated 213,380 new cases are expected in 2007, accounting for about 15% of cancer diagnoses. The incidence rate is declining significantly in men, from a high of 102 cases per 100,000 in 1984 to 78.5 in 2003. In women, the rate is approaching a plateau after a long period of increase. Lung cancer is classified clinically as small cell (13%) or non-small cell (87%) for the purposes of treatment.

Deaths: Lung cancer accounts for the most cancer-related deaths in both men and women. An estimated 160,390 deaths, accounting for about 29% of all cancer deaths, are expected to occur in 2007. Since 1987, more women have died each year from lung cancer than from breast cancer. Death rates have continued to decline significantly in men from 1991-2003 by about 1.9% per year. Female lung cancer death rates are approaching a plateau after continuously increasing for several decades. These trends in lung cancer mortality reflect the decrease in smoking rates over the past 30 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 of cigarette consumption and years of smoking duration. 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: Efforts at early detection have not yet been demonstrated to reduce mortality. Chest x-ray, analysis of cells in sputum, and fiberoptic examination of

Probability of Developing Invasive Cancers Over Selected Age Intervals by Sex, US, 2001 to 2003*

		Birth to 39 (%)	40 to 59 (%)	60 to 69 (%)	70 and Older (%)	Birth to Death (%)
All sites†	Male	1.42 (1 in 70)	8.69 (1 in 12)	16.58 (1 in 6)	39.44 (1 in 3)	45.31 (1 in 2)
	Female	2.03 (1 in 49)	9.09 (1 in 11)	10.57 (1 in 9)	26.60 (1 in 4)	37.86 (1 in 3)
Urinary bladder‡	Male	.02 (1 in 4381)	.41 (1 in 241)	.96 (1 in 105)	3.41 (1 in 29)	3.61 (1 in 28)
	Female	.01 (1 in 9527)	.13 (1 in 782)	.26 (1 in 379)	.96 (1 in 105)	1.14 (1 in 87)
Breast	Female	.48 (1 in 210)	3.98 (1 in 25)	3.65 (1 in 27)	6.84 (1 in 15)	12.67 (1 in 8)
Colon & rectum	Male	.07 (1 in 1342)	.93 (1 in 107)	1.67 (1 in 60)	4.92 (1 in 20)	5.79 (1 in 17)
	Female	.07 (1 in 1469)	.73 (1 in 138)	1.16 (1 in 86)	4.45 (1 in 22)	5.37 (1 in 19)
Leukemia	Male	.16 (1 in 640)	.22 (1 in 452)	.35 (1 in 286)	1.17 (1 in 86)	1.49 (1 in 67)
	Female	.12 (1 in 820)	.14 (1 in 694)	.20 (1 in 491)	.75 (1 in 132)	1.05 (1 in 95)
Lung & bronchus	Male	.03 (1 in 3146)	1.09 (1 in 92)	2.61 (1 in 38)	6.76 (1 in 15)	8.02 (1 in 12)
	Female	.04 (1 in 2779)	.85 (1 in 117)	1.84 (1 in 54)	4.52 (1 in 22)	6.15 (1 in 16)
Melanoma of the skin	Male	.13 (1 in 775)	.53 (1 in 187)	.56 (1 in 178)	1.32 (1 in 76)	2.04 (1 in 49)
	Female	.21 (1 in 467)	.42 (1 in 237)	.29 (1 in 347)	.62 (1 in 163)	1.38 (1 in 73)
Non-Hodgkin lymphoma	Male	.14 (1 in 735)	.45 (1 in 222)	.57 (1 in 176)	1.56 (1 in 64)	2.14 (1 in 47)
	Female	.08 (1 in 1200)	.32 (1 in 313)	.44 (1 in 229)	1.30 (1 in 77)	1.83 (1 in 55)
Prostate	Male	.01 (1 in 10373)	2.59 (1 in 39)	7.03 (1 in 14)	13.83 (1 in 7)	17.12 (1 in 6)
Uterine cervix	Female	.16 (1 in 631)	.29 (1 in 346)	.14 (1 in 695)	.20 (1 in 512)	.73 (1 in 138)
Uterine corpus	Female	.06 (1 in 1652)	.70 (1 in 142)	.81 (1 in 124)	1.28 (1 in 78)	2.49 (1 in 40)

*For people free of cancer at beginning of age interval. †All sites exclude basal and squamous cell skin cancers and in situ cancers except urinary bladder. ‡Includes invasive and in situ cancer cases.

Source: DevCan: Probability of Developing or Dying of Cancer Software, Version 6.1.0. Statistical Research and Applications Branch, National Cancer Institute, 2006. www.srab.cancer.gov/devcan

American Cancer Society, Surveillance Research, 2007

the bronchial passages have shown limited effectiveness in improving survival. 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 when survival is better. However, 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 reduce lung cancer deaths. The study, launched in 2002, represents a collaboration of the National Cancer Institute (NCI), the American College of Radiology Imaging Network, and the American Cancer Society. Results from the study are expected by 2010.

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 biological therapies such as bevacizumab (Avastin®) and erlotinib (Tarceva®). For localized cancers, surgery is usually the treatment of choice. Recent studies indicate that survival with early-stage, non-small cell lung cancer is improved by chemotherapy following 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. 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, which is long lasting in some cases.

Survival: The 1-year relative survival for lung cancer has slightly increased from 37% in 1975-1979 to 42% in 2002, largely due to improvements in surgical techniques and combined therapies. However, the 5-year survival rate for all stages combined is only 16%. The survival rate is 49% for cases detected when the disease is still localized; however, only 16% of lung cancers are diagnosed at this early stage.

Lymphoma

New cases: An estimated 71,380 new cases of lymphoma will occur in 2007, including 8,190 cases of Hodgkin lymphoma and 63,190 cases of non-Hodgkin lymphoma (NHL). Since the early 1970s, incidence rates for NHL have nearly doubled. Although some of this increase is due to AIDS-related NHL, for the most part the rise is

unexplained. Since 1991, increasing NHL incidence has been confined to women. Over the past 30 years, incidence rates for Hodgkin lymphoma have decreased in men (0.7% per year) while they slightly increased in women (0.3 % per year).

Deaths: An estimated 19,730 deaths will occur in 2007 (Hodgkin lymphoma, 1,070; non-Hodgkin lymphoma, 18,660).

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

Risk factors: Though a variety of risk factors have been identified, most of them associated with severely reduced immune function, the causes of the majority of lymphomas are unknown. 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/lymphoma virus-I (HTLV-I), and probably hepatitis C virus (HCV). Epstein-Barr virus (EBV) causes Burkitt and some non-Hodgkin lymphomas and may be related to other lymphomas. *H. pylori* infection increases the risk of gastric lymphoma. A family history of lymphoma is linked to higher risk, as well as occupational exposures to herbicides, chlorinated organic compounds, and certain other chemicals.

Treatment: Hodgkin lymphoma: chemotherapy and/or radiotherapy is used for most patients, depending on stage and cell-type of the disease. Non-Hodgkin lymphoma: patients are usually treated with chemotherapy. Radiation, alone or 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 lymphoma. High-dose chemotherapy with stem cell transplantation or 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 93% and 81%, respectively; the 5-year survival is 86% and 63%. Ten years after diagnosis, survival for Hodgkin and non-Hodgkin lymphoma declines to 81% and 49%, respectively.

Oral Cavity and Pharynx

New cases: An estimated 34,360 new cases are expected in 2007. 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.

Deaths: An estimated 7,550 deaths from oral cavity and pharynx cancer are expected in 2007. Death rates have been decreasing since at least 1975 in men and women combined, with rates declining more rapidly in the last decade.

Signs and symptoms: Symptoms may include a sore that bleeds easily and does not heal, a lump or thickening, ear pain, a neck mass, coughing up blood, and 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 cigarette, cigar, or pipe smoking; use of smokeless tobacco; and excessive consumption of alcohol.

Early detection: Cancer can affect any part of the oral cavity, including the lip, tongue, mouth, and throat. Dentists and primary care physicians can identify abnormal changes in oral tissues and diagnose cancer at an early, curable stage.

Treatment: Radiation therapy and surgery, separately or in combination, are standard treatments. In advanced disease, chemotherapy is added to surgery and/or radiation.

Survival: For all stages combined, about 84% of persons with oral cavity and pharynx cancer survive 1 year after diagnosis. The 5-year and 10-year relative survival rates are 60% and 48%, respectively.

Ovary

New cases: An estimated 22,430 new cases are expected in the US in 2007. Ovarian cancer accounts for about 3% of all cancers among women and ranks second among gynecologic cancers, following cancer of the uterine corpus. During 1985-2003, ovarian cancer incidence declined at a rate of 0.7% per year.

Deaths: An estimated 15,280 deaths are expected in 2007. Ovarian cancer causes more deaths than any other cancer of the female reproductive system.

Signs and symptoms: The most common sign is enlargement of the abdomen, which is caused by accumulation of fluid. Abnormal vaginal bleeding occurs rarely. In women older than 40, persistent digestive

disturbances (stomach discomfort, gas, distention) may indicate the need for an evaluation for ovarian cancer. Recent research has suggested that urinary symptoms may be another sign of ovarian cancer.

Risk factors: Risk for ovarian cancer increases with age and peaks in the late 70s. Pregnancy and the long-term use of oral contraceptives reduce the risk of developing ovarian cancer. Tubal ligation and hysterectomy may also decrease risk. The use of estrogen alone as postmenopausal hormone therapy has been shown to increase risk in several large studies. Heavier body weight may be associated with increased risk of ovarian cancer. Women who have had breast cancer or who have a family history of breast or ovarian cancer are at increased risk. Inherited mutations in BRCA1 or BRCA2 genes increase risk. Studies suggest that preventive surgery to remove the ovaries and fallopian tubes can decrease the risk of ovarian cancers in women with BRCA1 and BRCA2 mutations. Another genetic syndrome, hereditary nonpolyposis colon cancer, also has been associated with endometrial and ovarian cancer. Ovarian cancer incidence rates are highest in Western industrialized countries.

Early detection: Routine screening for women at average risk is not recommended because no sufficiently accurate screening test is currently available. The pelvic examination can only occasionally detect ovarian cancer, generally when the disease is already in advanced stages. However, the combination of a thorough pelvic exam, transvaginal ultrasound, and a blood test for the tumor marker CA125 should be offered to women who are at high risk of ovarian cancer and to women who have symptoms. 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. Promising research on specific patterns of proteins in the blood (proteomics) may lead to more sensitive screening tests in the future for women at high risk.

Treatment: Treatment options include surgery, chemotherapy, and occasionally radiation therapy. Surgery usually involves removal of the uterus (hysterectomy) and one or both ovaries and fallopian tubes (salpingo-oophorectomy). In some very early tumors, only the involved ovary will be removed, especially in younger women who wish to have children. In advanced disease, an aggressive attempt is made to remove all abdominal metastases to enhance the effect of chemotherapy. For advanced ovarian cancer, studies have shown that chemotherapy administerd both intravenously and directly into the abdomen improves survival.

Survival: Relative survival varies by age; women younger than 65 years are about twice as likely to survive 5 years (56%) following diagnosis as women 65 years and older (28%). Overall, the 1- and 5-year relative survival of ovarian cancer patients is 76% and 45%, respectively. If diagnosed at the localized stage, the 5-year survival rate is 93%; however, only about 19% of all cases are detected at this stage. For women with regional and distant disease, 5-year survival rates are 69% and 30%, respectively. The 10-year relative survival rate for all stages combined is 38%. Apparent declines in survival rates from previous years are due to recent changes in the classification of malignant ovarian tumors rather than true reductions in survival.

Pancreas

New cases: An estimated 37,170 new cases are expected to occur in the US in 2007. For both sexes combined, incidence rates of pancreatic cancer slightly increased (by 0.4% per year) from 1993-2003.

Deaths: An estimated 33,370 deaths are expected to occur in 2007. The death rate from pancreatic cancer has continued to decline since the 1970s in men, while it has leveled off in women after increasing from 1975-1984.

Signs and symptoms: Cancer of the pancreas often develops without early symptoms which, when present, can include weight loss, discomfort in the abdomen, and occasionally glucose intolerance. Tumors that develop near the common bile duct may cause a blockage that leads to jaundice (yellowing of the skin and eyes due to pigment accumulation). Sometimes this symptom allows the tumor to be diagnosed at an early stage.

Risk factors: Tobacco smoking increases the risk of pancreatic cancer; incidence rates are more than twice as high for cigarette smokers than for nonsmokers. Risk also appears to increase with obesity, chronic pancreatitis, diabetes, and cirrhosis. Pancreatic cancer rates are slightly higher in men than in women. Countries whose populations eat a diet high in fat have higher rates of pancreatic cancer.

Early detection: At present there is no method for the early detection of pancreatic cancer and the early stages of the disease are usually asymptomatic. Researchers are focusing on ways to diagnose pancreatic cancer before symptoms occur.

Five-Year Relative Survival Rates* by Stage at Diagnosis, 1996-2002

Site	All Stages %	Local %	Regional %	Distant %	Site	All Stages %	Local %	Regional %	Distant %
Breast (female)	88.5	98.1	83.1	26.0	Ovary‡	44.7	93.1	69.0	29.6
Colon & rectum	64.1	90.4	68.1	9.8	Pancreas	5.0	19.6	8.2	1.9
Esophagus	15.6	33.6	16.8	2.6	Prostate§	99.9	100.0	--	33.3
Kidney	65.6	90.4	61.7	9.5	Stomach	23.9	61.9	22.2	3.4
Larynx	64.1	83.5	50.4	13.7	Testis	95.7	99.5	96.3	70.1
Liver†	10.5	21.9	7.2	3.3	Thyroid	96.7	99.7	96.9	56.4
Lung & bronchus	15.0	49.3	15.5	2.1	Urinary bladder	80.8	93.7	46.0	6.2
Melanoma of the skin	91.5	99.0	64.9	15.3	Uterine cervix	71.6	92.0	55.5	14.6
Oral cavity & pharynx	58.8	81.3	51.7	26.4	Uterine corpus	83.2	95.7	66.9	23.1

*Rates are adjusted for normal life expectancy and are based on cases diagnosed in the SEER 17 areas from 1996-2002, followed through 2003. †Includes intrahepatic bile duct. ‡Recent changes in classification of ovarian cancer, specifically excluding borderline tumors, has affected survival rates. §The rate for local stage represents local and regional stages combined.

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: Surveillance, Epidemiology, and End Results Program, 1975-2003, Division of Cancer Control and Population Sciences, National Cancer Institute, Bethesda, MD, 2006.

American Cancer Society, Surveillance Research, 2007

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. Clinical trials with several new agents, combined with radiation and surgery, may offer improved survival and should be considered an option.

Survival: For all stages combined, the 1- and 5-year relative survival rate is 26% and 5%, respectively. Even for those people diagnosed with local disease, the 5-year survival is only 20%.

Prostate

New cases: An estimated 218,890 new cases will occur in the US during 2007. Prostate cancer is the most frequently diagnosed cancer in men. For reasons that remain unclear, incidence rates are significantly higher in African American men than in white men. Incidence rates of prostate cancer have changed substantially over the last 20 years: rapidly increasing from 1988-1992, declining sharply from 1992-1995, and increasing modestly since 1995. These trends in large part reflect increased prostate cancer screening with the prostate-specific antigen (PSA) blood test. Moderate incidence increases in the last decade are most likely attributable to widespread PSA screening among men younger than 65. Prostate cancer incidence rates have leveled off in men aged 65 years and older. Rates peaked in white men in 1992 (237.6 per 100,000 men) and in African American men in 1993 (342.8 per 100,000 men).

Deaths: With an estimated 27,050 deaths in 2007, prostate cancer is a leading cause of cancer death in men. Although death rates have been declining among white and African American men since the early 1990s, rates in African American men remain more than twice as high as those in white men.

Signs and symptoms: 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. Continual pain in the lower back, pelvis, or upper thighs may be an indication of metastatic disease. Many of these symptoms, however, are similar to those caused by benign conditions.

Risk factors: The only well-established risk factors for prostate cancer are age, ethnicity, and family history of the disease. More than 65% of all prostate cancer cases are diagnosed in men 65 years and older. African American men and Jamaican men of African descent have the highest prostate cancer incidence rates in the world. The disease is common in North America and northwestern Europe but is rare in Asia and South America. Recent genetic studies suggest that strong familial predisposition may be responsible for 5%-10% of prostate cancers. International studies suggest that a diet high in saturated fat may also be a risk factor. There

Trends in 5-Year Relative Survival* Rates (%) by Race and Year of Diagnosis, US, 1975-2002

Site	White			African American			All Races		
	1975-77	1984-86	1996-2002	1975-77	1984-86	1996-2002	1975-77	1984-86	1996-2002
All sites	51	55	68†	40	41	57†	50	53	66†
Brain	23	28	34†	26	32	37†	24	29	34†
Breast (female)	76	80	90†	63	65	77†	75	79	89†
Colon	52	60	66†	46	50	54†	51	59	65†
Esophagus	6	11	17†	3	8	12†	5	10	16†
Hodgkin lymphoma	74	80	87†	71	75	81†	73	79	86†
Kidney	51	56	66†	50	54	66†	51	56	66†
Larynx	67	68	67	59	53	52	66	66	65
Leukemia	36	43	50†	33	34	39	35	42	49†
Liver#	4	6	10†	2	5	7†	4	6	10†
Lung & bronchus	13	14	16†	12	11	13†	13	13	16†
Melanoma of the skin	82	86	93†	58‡	71§	75‡	82	86	92†
Multiple myeloma	25	28	33†	31	32	32	26	29	33†
Non-Hodgkin lymphoma	48	54	64†	48	48	56	48	53	63†
Oral cavity	55	57	62†	36	36	40	53	55	60†
Ovary¶	36	39	45†	43	41	39	37	40	45†
Pancreas	3	3	5†	2	5	5†	2	3	5†
Prostate	70	77	100†	61	66	98†	69	76	100†
Rectum	49	58	66†	45	46	59†	49	57	66†
Stomach	15	18	22†	16	20	23†	16	18	24†
Testis	83	93	96†	82‡	87‡	89	83	93	96†
Thyroid	93	94	97†	91	90	94	93	94	97†
Urinary bladder	74	79	83†	50	61	65†	73	78	82†
Uterine cervix	71	70	75†	65	58	66	70	68	73†
Uterine corpus	89	85	86†	61	58	61	87	83	84†

*Survival is adjusted for normal life expectancy and based on cases diagnosed in the SEER 9 areas from 1975-1977, 1984-1986, and 1996-2002, and followed through 2003. †The difference in rates between 1975-1977 and 1996-2002 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. #Includes intrahepatic bile duct. ¶Recent changes in classification of ovarian cancer, namely exclusion of borderline tumors, have affected 1996-2002 survival.

Source: Surveillance, Epidemiology, and End Results Program, 1975-2003, Division of Cancer Control and Population Sciences, National Cancer Institute, Bethesda, MD, 2006.

American Cancer Society, Surveillance Research, 2007

is some evidence that the risk of dying from prostate cancer may increase with obesity.

Early detection: At this time, there are insufficient data to recommend for or against prostate cancer testing in men at average risk of developing the disease. The American Cancer Society recommends that beginning at age 50, the PSA blood test (which detects a protein made by the prostate called prostate-specific antigen) and the digital rectal examination should be offered to men at average risk. Individuals at high risk of developing prostate cancer (African Americans or men with a strong family history) should begin screening at age 45. All men should be given information about the benefits and limitations of testing so they can make informed decisions. Two large clinical trials designed to determine the efficacy of PSA testing are underway in the US and Europe. (See page 52 for the American Cancer Society's screening guidelines for the early detection of prostate cancer.)

Treatment: Treatment options vary depending on age, stage of the cancer, and other medical conditions, and should be discussed with the individual's physician. Surgery, external beam radiation, or radioactive seed implants (brachytherapy) may be used to treat early-stage disease; hormonal therapy may be added in some cases. Hormonal therapy, chemotherapy, radiation, or a combination of these treatments is used to treat metastatic disease. Hormone treatment may control prostate cancer for long periods by shrinking the size of the tumor, thus relieving pain and other symptoms. Careful observation ("watchful waiting") rather than immediate treatment may be appropriate for older men with limited life expectancy and/or less aggressive tumors, as determined by cell type.

Survival: More than 90% of all prostate cancers are discovered in the local and regional stages; the 5-year relative survival rate for patients whose tumors are diagnosed at these stages approaches 100%. Over the past 25 years, the 5-year survival rate for all stages combined has increased from 69% to nearly 100%. According to the most recent data, relative 10-year survival is 93% and 15-year survival is 77%. The dramatic improvements in survival, particularly at 5 years, are partly attributable to earlier diagnosis and improvements in treatment.

Skin

New cases: More than 1 million cases of basal cell or squamous cell cancers occur annually. Most, but not all, of these forms of skin cancer are highly curable. The most serious form of skin cancer is melanoma, which is expected to be diagnosed in about 59,940 persons in 2007. During the 1970s, the incidence rate of melanoma increased rapidly by about 6% per year. Since 1980, however, the rate of increase has slowed to a little less than 3% per year. Melanoma is primarily a disease of whites; rates are more than 10 times higher in whites than in African Americans. Another form of skin cancer, Kaposi sarcoma, was once common among AIDS patients but has become rare since the introduction of protease inhibitors.

Deaths: An estimated 10,850 deaths (8,110 from melanoma and 2,740 from other non-epithelial skin cancers) will occur in 2007. After increasing for several decades, the death rate for melanoma has stabilized since 1990 in white men and has been decreasing since 1988 in white 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 generally innocuous but changes that progress over a month or more should be evaluated by your doctor. Basal cell carcinomas may appear as flat, firm, pale areas 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 moles (especially if there are many, or if they are unusual or large). Other risk factors for all types of skin cancer include sun sensitivity (sunburning easily, difficulty tanning, natural blonde or red hair color); a history of excessive sun exposure, including sunburns; use of tanning booths; diseases that suppress the immune system; a past history of basal cell or squamous cell skin cancers; and occupational exposure to coal tar, pitch, creosote, arsenic compounds, or radium.

Prevention: Limit or avoid exposure to the sun during the midday hours (10 a.m. to 4 p.m.). When outdoors, wear a hat that shades the face, neck, and ears; a long-sleeved shirt; and long pants. Wear sunglasses to protect the skin around the eyes. Use a sunscreen with a sun protection factor (SPF) of 15 or higher. Children in particular should be protected from the sun because severe sunburns in childhood may greatly increase risk of melanoma in later life. Avoid tanning beds and sun lamps, which provide an additional source of UV radiation.

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 examine their skin regularly. Suspicious lesions or progressive change in a lesion's appearance or size should be evaluated promptly by a physician. Melanomas often start as small, mole-like growths that increase in size and 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).

Treatment: Removal and microscopic examination of all suspicious skin lesions is 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 is also an option in some cases. For malignant melanoma, the primary growth must also be adequately excised. Depending on the extent of local growth, one or more nearby lymph nodes may be removed. Melanomas with deep invasion or that have spread to lymph nodes may be treated with immunotherapy or radiation therapy. Advanced cases of

melanoma are treated with palliative surgery, immunotherapy, and/or chemotherapy.

Survival: Most basal and squamous cell cancers can be cured if the cancer is detected and treated early. If detected in its earliest stages and treated properly, melanoma is also highly curable. 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 92% and 89%, respectively. For localized melanoma, the 5-year survival rate is 99%; 5-year survival rates for regional and distant stage diseases are 65% and 15%, respectively. About 80% of melanomas are diagnosed at a localized stage.

Urinary Bladder

New cases: An estimated 67,160 new cases are expected to occur in 2007. Bladder cancer incidence rates among men and women combined leveled off from 1987-2003, after increasing by 0.8% per year from 1975-1987. Bladder cancer incidence is nearly four times higher in men than in women and almost two times higher in whites than in African Americans.

Deaths: An estimated 13,750 deaths will occur in 2007. Mortality rates have continued to decrease since the late 1970s, although the rate of decrease slowed in the most recent time period (by 0.2% per year from 1987-2003 compared to 2.1% per year from 1977-1987).

Signs and symptoms: Symptoms may include blood in the urine and increased frequency of urination.

Risk factors: Smoking is the most important risk factor for bladder cancer. Smokers have twice the risk of bladder cancer than 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 communities with high levels of arsenic in drinking water also have increased risk. Drinking more fluids and eating more vegetables may lower the risk of bladder cancer.

Early detection: Bladder cancer is diagnosed by examination of cells in the urine under a microscope 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 are not recommended for screening people at average risk but are used for 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.

Survival: For all stages combined, the 5-year relative survival rate is 82%. Survival declines to 78% at 10 years and 73% at 15 years after diagnosis. When diagnosed at a localized stage, the 5-year survival is 94%; 74% of cancers are detected at this early stage. For regional and distant stages, 5-year survival is 46% and 6%, respectively.

Uterine Cervix

New cases: An estimated 11,150 cases of invasive cervical cancer are expected to be diagnosed in 2007. Incidence rates have decreased steadily over the past several decades in both white and African American women. As Pap screening has become more common, pre-invasive lesions of the cervix are detected far more frequently than invasive cancer.

Deaths: An estimated 3,670 deaths from cervical cancer are expected in 2007. Mortality rates have declined steadily over the past several decades due to prevention and early detection as a result of screening.

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. 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 the infection and progression to cancer may be influenced by many factors, such as immunosuppression, high parity, cigarette smoking, and nutritional factors. Long-term

use of oral contraceptives is also associated with increased risk of cervical cancer.

Prevention: The US Food and Drug Administration (FDA) has approved Gardasil®, the first vaccine developed to prevent the most common HPV infections that cause cervical cancer, for use in females aged 9-26 years. Another vaccine (Cervarix) is currently awaiting approval by the European Agency for the Evaluation of Medicinal Products.

Early detection: The Pap test 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. Their results sometimes appear normal even when a woman has abnormal cells of the cervix, and likewise, sometimes appear abnormal when there are no abnormal lesions on the cervix. DNA tests to detect HPV strains associated with cervical cancer may be used in conjunction with the Pap test, particularly when results are equivocal. Fortunately, most cervical precancers develop slowly, so nearly all cases can be prevented if a woman is screened regularly. (See page 52 for the American Cancer Society's screening guidelines for the early detection of cervical cancer.)

Treatment: Pre-invasive 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, as well as chemotherapy in selected cases.

Survival: One- and 5-year relative survival for cervical cancer patients is 88% and 73%, respectively. When detected at an early stage, invasive cervical cancer is one of the most successfully treated cancers with a 5-year survival rate of 92% for localized cancers. Cervical cancer is diagnosed at an early stage more often in whites (53%) than in African Americans (45%) and in women younger than 50 (63%) than in women 50 and older (38%).

Uterine Corpus (Endometrium)

New cases: An estimated 39,080 cases of cancer of the uterine corpus (body of the uterus), most often in the endometrium (lining of the uterus), are expected to be diagnosed in 2007. Incidence rates of endometrial cancer have been decreasing by about 1% per year since 1998 after a period of increase during the previous decade.

Deaths: An estimated 7,400 deaths are expected in 2007. Death rates from cancer of the uterine corpus have been stable since 1991 after decreasing an average of 1.6 % per year from 1975-1991.

Signs and symptoms: Abnormal uterine bleeding or spotting is a frequent early sign. Pain and systemic symptoms are late signs.

Risk factors: Estrogen is a strong risk factor for endometrial cancer. Factors that dramatically increase estrogen exposure include estrogen replacement therapy (without use of progestin) and obesity. In addition, risk is increased slightly by tamoxifen use, early menarche (onset of menstruation), late menopause, never having children, and a history of polycystic ovary syndrome. Progesterone plus estrogen replacement therapy (called hormone replacement therapy, or HRT) does not appear to increase risk. Research has not implicated estrogen exposures in the development of other types of uterine corpus cancer that are more aggressive and have a poorer prognosis. Other risk factors for uterine corpus cancer include infertility and hereditary nonpolyposis colon cancer (HNPCC). Pregnancy and the use of oral contraceptives provide protection against endometrial cancer.

Early detection: Most endometrial cancer is diagnosed at an early stage because of postmenopausal bleeding. Women are encouraged to report any unexpected bleeding or spotting to their physicians. Annual screening for endometrial cancer with endometrial biopsy beginning at age 35 should be offered to women with or at risk for HNPCC.

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 for uterine corpus cancer is 92% and 84%, respectively. The 5-year survival rate is 96%, 67%, and 23%, if the cancer is diagnosed at local, regional, or distant stages, respectively. Relative survival in whites exceeds that for African Americans by more than 10 percentage points at every stage.

Special Section: Cancer-Related Pain

Introduction

Pain is an important concern among people with cancer and their caregivers. Cancer patients may experience pain at diagnosis, during treatment, and after treatment has ended, even if their cancer does not recur. Pain is common and often more severe among people with advanced disease. It is one of the most important negative factors affecting the quality of life of people with cancer. Pain can interfere with normal daily activities; diminish enjoyment of everyday pleasures; prevent relaxation and sleep; and increase anxiety, depression, stress, and fatigue. It can also make people withdraw from others, decrease their social activities, and have less contact with friends or family.

Regardless of the stage of disease or recovery, pain associated with cancer can almost always be relieved by proper treatment.[1-4] Pain control is an important component of quality cancer care. All patients with cancer should be assessed for pain each time they are seen throughout the course of cancer treatment and continuing care. Cancer patients play an important role in describing the severity and nature of their pain so that the most effective treatment(s) can be given. Understanding the reasons for pain at different stages of cancer, the importance of reporting it, how to describe it, and the many ways it can be treated can be helpful to patients and caregivers when discussing pain issues with doctors and other health care providers.

This special section will describe the types of cancer-related pain and methods of pain assessment and treatment. It will also address the problem of under treatment of cancer pain and educational and legislative initiatives to ensure that all cancer patients receive adequate pain control.

What Is Pain?

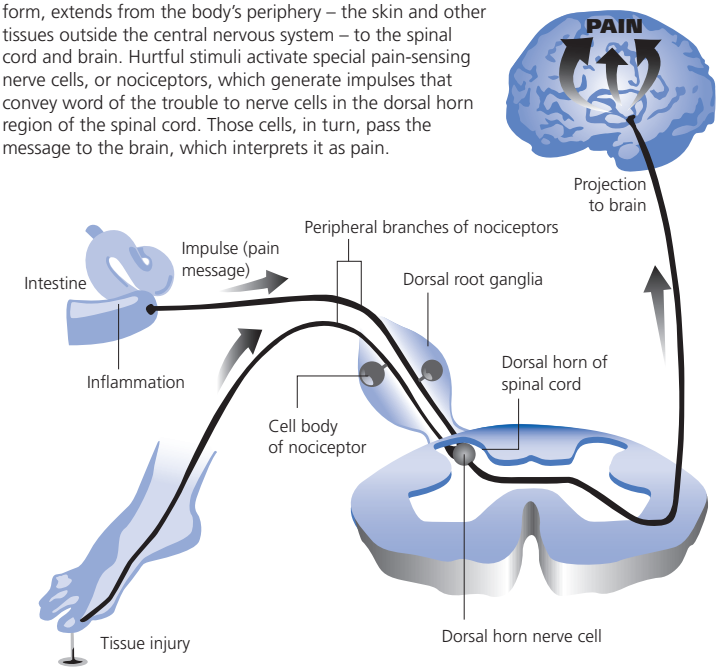
Everyone has experienced pain as a sensation that hurts. Pain serves as a protective alarm that keeps us from hurting ourselves or alerts us to the fact that something is wrong. Stubbing a toe or leaning against a hot stove activates specialized sensory neurons (nociceptors) that respond specifically to hurtful stimuli, such as extreme temperature or mechanical pressure, or to chemicals generated in response to injury or inflammation (Figure 1). When the nociceptor encounters a noxious stimulus, it sends a message into the spinal cord. This message activates nerves that carry the pain signal to the brain. When pain signals reach the brain, they may or may not reach the level of conscious thought; if they do, the person experiences pain.[5,6]

Not only does pain affect people differently, but it can also affect the same person differently at different times. Factors that may influence pain perception include complex processing of sensory information within the central nervous system, the strength of the stimulus that generates the pain sensation, the presence of other stimuli in the environment, and the person's emotional and psychological state.[6,7] Cultural factors may modify the response to pain, resulting in a range of responses to the same stimulus from stoicism to intolerance. Cultural factors may also influence communication about pain among patients, caregivers, and health care providers.[8,9]

There are many possible causes of pain associated with cancer, the most common being pain caused by the cancer itself. Pain can also be caused by the cancer treatment or may have nothing to do with the cancer.[4,3]

Figure 1. The Pain Circuit

Feeling the pain. The pain circuit, shown here in simplified form, extends from the body's periphery – the skin and other tissues outside the central nervous system – to the spinal cord and brain. Hurtful stimuli activate special pain-sensing nerve cells, or nociceptors, which generate impulses that convey word of the trouble to nerve cells in the dorsal horn region of the spinal cord. Those cells, in turn, pass the message to the brain, which interprets it as pain.



Recreated with permission of Amadeo Bachar; from Toward Better Pain Control, *Scientific American*, June 2006; 61-67.

Experts divide pain into two basic types: **nociceptive** and **neuropathic**. It is important to distinguish between the two types of pain because the causes and treatments are different.

Nociceptive describes pain that accompanies damage to tissues of the body. It results from activation of nociceptors and can be further classified as **somatic** or **visceral**.

- **Somatic** pain arises from activation of nociceptive neurons in either the body surface (skin) or musculoskeletal tissues (bone, joint, muscle, and connective tissue). Common causes of somatic pain in cancer patients include metastases in the bone and pain related to surgery. Somatic pain is localized to a specific area and is often described as stabbing, throbbing, dull, or aching.
- **Visceral** pain arises from the soft internal organs and tissues of the body that are enclosed within a cavity, the so-called "viscera." It occurs because of compression or stretching of pain receptors in the thoracic (chest), abdominal, or pelvic organs. Visceral pain is common in pancreatic cancer patients, as well as patients who have cancer metastases to the abdomen. Visceral pain is difficult to pinpoint and is usually described as pressure-like cramping, gnawing, or squeezing. Sometimes visceral pain is experienced at the surface of the body (referred pain); for example, pain resulting from irritation of the diaphragm (the muscle partition separating the chest and abdominal cavities) may be experienced as shoulder pain.[4]

Neuropathic pain is caused by injury to the nervous system rather than stimulation of nerve endings. It may result from a tumor compressing or infiltrating the nerves or spinal cord. It also results from chemical damage to the nervous system caused by cancer treatment (chemotherapy, radiation, or surgery). This type of pain is typically described as sharp, burning, or shooting and is often accompanied by numbness or tingling in the extremeties. Patients may also report allodynia, which refers to pain provoked by a normally non-painful stimulus such as a light touch. Neuropathic pain is often more resistant to treatment with conventional pain-relieving medications than nociceptive pain.[10]

How Common is Pain in Cancer Patients?

Pain is one of the most common symptoms associated with cancer. Approximately 30% of patients newly diagnosed with cancer, 30%-50% of patients undergoing treatment, and 70%-90% of patients with advanced disease experience pain.[11,12,13]

Pain is generally not the first sign of cancer. Early-stage cancers of the lung, breast, uterus, and ovary rarely produce pain. However, prostate and colon cancers may produce pain even in the early stages by obstructing the urinary or digestive tract. Solid tumors generally are a more common source of pain than leukemia and lymphoma.

Pain among patients undergoing active treatment may be associated with the treatment itself. Pain is a potential side effect of surgery, radiation therapy, and chemotherapy. For example, patients receiving certain

The Cancer Continuum

The terms supportive care, continuing care, and palliative care all describe care that treats the whole patient and his/her symptoms throughout the course of disease with the goal of relieving suffering and maintaining the highest possible quality of life. This care should begin at the time of diagnosis and continue through active treatment and survivorship. Supportive care may refer to care following treatment when antibiotics, hematologic growth factors, transfusions, or pain management are necessary. It may also include a host of important services offered by health care providers, such as physical therapy, individual or group counseling, nutritional guidance, and support groups. Although many patients, caregivers, and some medical professionals associate palliative care solely with end-of-life care, this term is increasingly used to refer to pain control and other interventions to relieve symptoms, reduce suffering, and enhance quality of life throughout the cancer experience. For patients who will ultimately die of their cancer, care should extend into the period when it is no longer possible to alter the course of the disease.

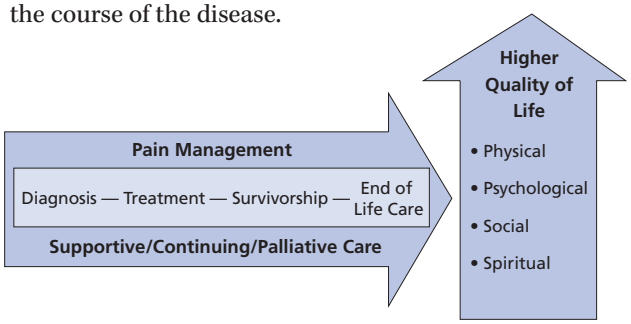
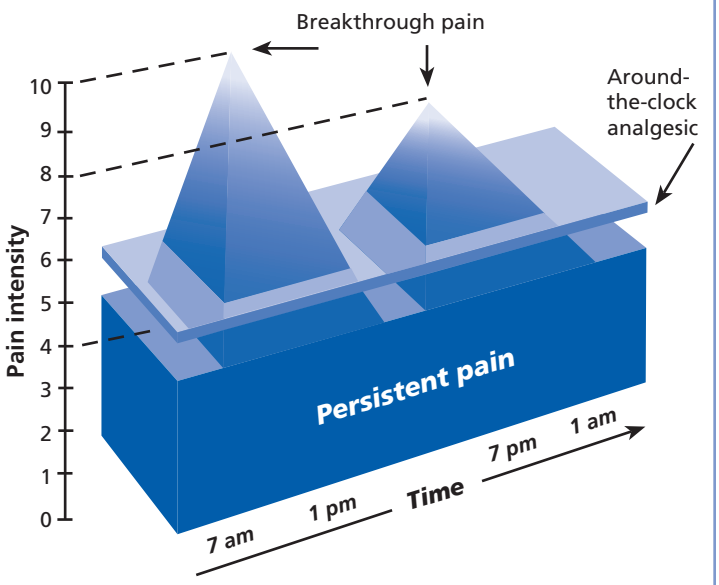


Figure 2. Breakthrough Cancer Pain



types of chemo- and radiation therapy may develop mucositis (painful mouth sores).[14]

For about half of the people diagnosed with cancer, the initial course of therapy is successful and the cancer never recurs.[15] Although they remain cancer-free, some of these patients continue to experience pain. Such pain may result from long-term side effects of treatment. For example, 2%-20% of women experience pain after breast surgery, which is caused by injury to the intercostal-brachial nerve.[10,16] Damage to the nervous system is also a serious side effect of treatment with some commonly used chemotherapy drugs, including the taxanes (such as paclitaxel and docetaxel), vinca alkaloids (such as vincristine and vinblastine), and platinum-based compounds (such as cisplatin and oxaliplatin).[6] When chemotherapy damages the nervous system, it results in a condition called peripheral neuropathy. The symptoms include tingling, burning, weakness, or numbness in the hands or feet or both.[15] Although painful peripheral neuropathy from chemotherapy usually subsides over time, some patients develop persistent or chronic pain. The neuropathy associated with cisplatin, for example, may progress for a long period of time even after therapy has concluded.[17]

For some patients, either the initial course of therapy does not eliminate the cancer entirely, or the therapy produces a cancer-free period but eventually the cancer recurs. Patients are said to have advanced cancer when treatment no longer controls disease progression.

Most patients with advanced cancer have an increased frequency and intensity of pain. Many of these patients experience both nociceptive and neuropathic pain.[10] One of the most common types of pain in advanced cancer results from metastases to the bones.[17] Because the vertebra composing the spine are commonly involved, compression of the nerve roots as they come out of the spine may cause nerve pain secondary to bony metastases. Cancers of the lung, breast, prostate, colon, and kidney are most commonly associated with painful bone metastases.[18]

There are two general categories of pain: acute and chronic. Acute pain is severe and lasts a short time. It generally goes away when the cause of the pain is relieved. For example, the surgical incision heals or the broken bone mends. Chronic or persistent pain lasts for a long period of time. People with chronic pain that is controlled with medicine can still have breakthrough pain. Breakthrough pain is characterized as a transient increase or episode of pain that exceeds the level managed by pain medications used on a continuous basis (Figure 2). Many patients with advanced cancer experience breakthrough pain on a recurring basis.[19,20]

How Is Cancer Pain Treated?

Pain assessment

Regular pain assessment and pain management should have the highest priority in the routine care of patients with cancer. Adequate pain assessment is essential to effective pain control; pain whose severity is underestimated will not be treated aggressively enough. Guidelines for cancer pain treatment from the Agency for Health Care Policy and Reseach, the American Pain Society,[21] the National Comprehensive Cancer Network,[22] and the World Health Organization (WHO) all use assessment of pain intensity through patient report as the most important consideration in determining treatment.[23]

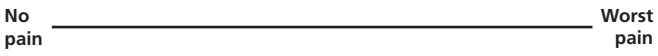
Pain rating scales

Many standardized pain questionnaires assess pain intensity as well as other factors related to pain. Questionnaires currently in use for research and clinical practice include the Brief Pain Inventory,[23] the Memorial Symptom Assessment Scale,[24,23] the Edmonton Symptom Assessment Scale,[25] and specific pain visual analog scales.[23] A scale used in the clinical setting should assist in assessing patient pain and the impact it has on daily living by providing a measure of pain severity.

Clinicians using a visual analog scale (VAS) ask the patient to locate the position on the scale (usually a straight line) that is equivalent to the intensity of pain. One end of the line represents no pain and the other end represents the worst possible pain (Figure 3). In addition, some clinicians use a numerical rating scale (NRS). The most commonly used NRS uses an 11-point scale of 0 to 10. As with a VAS, the numbers are typically arranged along a horizontal line ranging from no pain (0) to the worst pain imaginable (10). Another alternative, the simple descriptive pain intensity scale is especially useful for a quick estimate of pain intensity (Figure 3). Pain assessment instruments may alert clinicians to moderate pain (i.e., 5-6 on the NRS) that requires immediate intervention, which should then be continuously monitored to determine the effectiveness of the treatment. Severe pain, defined as 7 to 10 on the NRS, requires emergency evaluation and treatment. Cancer patients reporting severe pain usually require rapid treatment with a very effective opioid, such as morphine.[23]

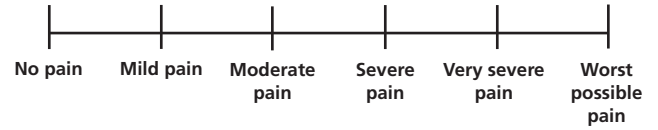
Figure 3. Examples of Pain Rating Scales

Visual Analog Scale



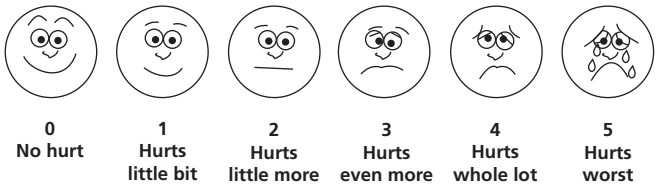
Directions: Ask the patient to indicate on the line where the pain is in relation to the two extremes. Qualification is only approximate; for example, a midpoint mark would indicate that the pain is approximately half of the worst possible pain.

Simple Descriptive Pain Intensity Scale



Source: Jacox A., Carr D. B., Payne R., et al. 1994. *Management of Cancer Pain Quick Reference Guide for Clinicians. Number 9*. AHCPR Publications No. 94-0593. Rockville, MD: Agency for Health Care Policy Research, US Department of Health and Human Services, Public Health Service.

Wong-Baker FACES Pain Rating Scale



Source: Wong D. L., Hockenberry-Eaton M., Wilson D., Winkelstein M. L., Schwartz P. 2001. *Wong's Essentials of Pediatric Nursing*, ed. 6. St. Louis, Mosby, p. 1301. Copyright Mosby. Reprinted with permission.

The description of pain can provide valuable clues to its origin and help in identifying the best treatment. Information on the location, quality (e.g., sharp, aching, tingling), temporal pattern, and exacerbating factors (such as position or movement) of the pain is helpful in understanding the potential causes and best approach to treatment. When a patient reports a new or intensifying pain, a physical examination and other tests such as x-rays, magnetic resonance imaging (MRI), and blood tests may also be needed.[23] Once the necessary information has been collected, a treatment plan can be developed and discussed with the patient and caregivers.

Pharmacological treatment of pain

A useful model for the pharmacological treatment of cancer pain is provided by WHO's Three-Step Analgesic Ladder (Figure 4). Non-opioid analgesics, such as non-steroidal anti-inflammatory agents (NSAIDs) and acetaminophen, are used to treat mild to moderate pain (Step 1). When pain is not relieved by these medicines, opioids are added (Step 2). Higher doses or more effective opioids, combined with NSAIDs or acetaminophen, are used in Step 3 to control severe or persistent pain. Supplemental therapies, such as corticosteroids, antidepressants, and anticonvulsants can be used in each of the three steps to treat symptoms that are exacerbating the pain or to provide independent pain relief activity.[2]

NSAIDs and acetaminophen: The first choice for treatment of mild pain involves non-opioid medicines such as acetaminophen (Tylenol®) and non-steroidal anti-inflamatory agents (NSAIDS) such as ibuprofen and the selective COX-2 inhibitor celecoxib. These medicines are excellent at relieving bone pain, superficial pain, muscle pain, and some other types of pain, and are also used with other types of pain medications to provide greater pain relief.[2]

NSAIDs largely influence pain by acting at the pain-sensing ends of nociceptors. When a tissue is injured, a variety of cells in the area release prostaglandins that make the nociceptors more sensitive to stimulation. Aspirin and other NSAIDs inhibit the activity of a family of enzymes (cyclooxygenases) that cells use to generate the prostaglandins. Because NSAIDs also inhibit prostaglandin production elsewhere in the body, they can have serious side effects, including ulcers and bleeding. They also slow blood clotting, so they must be used cautiously in patients with bleeding or clotting disorders. The mechanism by which acetaminophen

reduces pain is not fully understood. Although acetaminophen does not slow blood clotting, high doses can damage the liver.[2,26] Patients must be cautioned about combining prescription and non-prescription pain medications that contain acetaminophen.

Some non-opioid medications are available without prescription. A maximum daily dose is recommended for each of these medicines because of the potential for serious side effects.

Opioids: Opioids are the most effective pain-relieving medicines and are available only by prescription. Opioids are sometimes classified as short-acting or long-acting. It is common for opioids to have a non-opioid pain-relieving medicine, such as acetaminophen, mixed with them.[27]

In contrast to non-opioid pain medicines, opioids relieve pain by inhibiting transmission of the pain message from the spinal cord to the brain. Opioids also cause the neurons within the spinal cord to be less responsive to pain signals.[5,27]

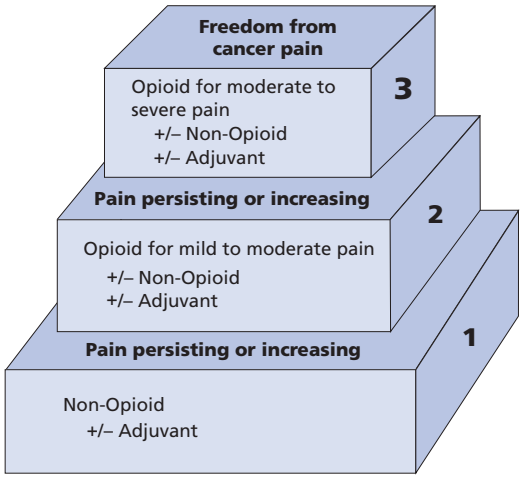
Although the role of opioids in blocking pain is primarily in the spinal cord, other neurons in the body have opioid receptors, including neurons in the brain and the digestive system. This explains why opioids can cause a range of undesirable side effects including drowsiness, constipation, and respiratory depression. Though most of these side effects can be treated, a patient's level of tolerance may limit the dosage that can be comfortably administered. Patients taking opioids must be monitored closely in order to maintain maximum pain relief while minimizing side effects.[28]

Opioids commonly used in the treatment of cancer pain are morphine, hydromorphone, oxycodone, fentanyl, and methadone. Morphine is usually administered orally or intravenously. Fentanyl is available as a patch worn on the skin for the treatment of persistent pain. The drug is absorbed slowly into the blood stream and can give the patient pain relief for up to 72 hours. Fentanyl is also available as a lozenge and an effervescent tablet for breakthrough pain.

In part to avoid some of the undesirable side effects, opioids are sometimes delivered directly to the spinal cord (epidural or intrathecal administration).[30] Medicine may also be administered via an indwelling pump (usually used for chronic pain).

Adjuvant analgesics: These are medicines that are typically used to treat illnesses other than cancer, but

Figure 4. Pain Relief Ladder



Source: World Health Organization, 1990.

that have been found to provide relief of certain kinds of cancer-related pain.[31] They include:

- Antidepressants: some antidepressants have been found to relieve pain as well as decrease depression. They may be particularly effective in reducing neuropathic pain.
- Anticonvulsants: these medicines are generally used for seizure disorders and are also effective for the treatment of neuropathic pain.
- Steroids: steroids may be used to relieve pain associated with swelling and for bone pain.
- Local anesthetics: these medicines can be applied in the form of a cream or ointment and may be used to prevent pain from a needle stick or from lesions on the skin and mucous membranes. When local anesthetics are administered epidurally (around the spinal nerves), they can block pain in specific regions of the body. A lidocaine patch for topical administration of this drug is effective for the treatment of "shingles" pain.

Bisphosphonates: Drugs called bisphosphonates are used to treat bone metastases and multiple myeloma. They reduce pain by preventing fractures. In rare instances, long-term use of bisphosphonates can cause osteonecrosis (bone death) of the jaw.[32]

Radiotherapy: Radiation therapy is often used as part of the initial treatment of cancer, but it can also be used to relieve pain when cancer has spread to the bone. Radiation may be delivered over several days to the areas that are most painful, such as boney metastases. Radiation therapy decreases the cancer cell's ability to

grow and divide. By shrinking the size of the tumor, radiation may decrease the discomfort of cancer cell invasion of critical tissues. Fatigue is a common side effect of radiation treatment.[33]

Non-pharmacological and complementary methods: Although medication is the mainstay of cancer pain management, a number of other methods can be helpful and can generally be used in conjunction with pain medications. Cognitive and behavioral techniques can help to divert attention from pain, improve pain tolerance, and increase a person's sense of control. Education about pain origin and treatment can also be helpful to patients and caregivers. Many different approaches are used, including videos, books, special tutorials, and educational sessions with an expert. Some individuals with cancer pain can be assisted through telephone counseling and Internet-based educational approaches.[34,35]

Non-traditional approaches to pain management include acupuncture, mind-body imaging techniques, and therapeutic massage. Acupuncture involves application of small needles (or in the case of acupressure, pressure with fingers) along points of the body "meridians." Mind-body techniques include hypnosis and progressive muscle relaxation. Pain reduction using these methods may occur by distracting and refocusing on more positive perceptions. Therapeutic massage is thought to alter pain impulses through the relaxation induced by surface sensory input. The relaxation and sleep associated with massage may reduce perceived pain levels.[34]

Interventional treatments: Some patients experience inadequate pain control despite medications or cannot tolerate the side effects of these drugs. Approaches that may be used to relieve pain in these individuals include regional infusion of medications (similar to epidural anesthesia) and neurosurgical approaches (interrupting the pain pathways by injecting blocking substances or cutting the nerves responsible for the pain).[4] The choice of a neurosurgical procedure is based on the location and type of pain, the general condition of the patient, the patient's life expectancy, and the nature of the expertise available. Another approach is transcutaneous electrical nerve stimulation (TENS), which uses a small battery-powered device with superficial electrodes to stimulate painful areas.[4]

Inequities in Treatment of Cancer Pain

Although control of pain can improve a person's quality of life, cancer pain often goes untreated, under treated, or improperly treated. Some population groups – including the elderly, women, and members of racial and ethnic minorities – are more likely to be under treated for cancer pain than others. For example, a study of under treatment of pain among cancer patients in nursing homes found that while half of all patients in pain were receiving opioids, only 13% of patients aged 85 or older were receiving these medications. The study also found that African American patients in daily pain were 1.6 times as likely to receive no medication for pain relief.[36] A study of pain management in adult outpatients of all ages with advanced cancer found that the likelihood of receiving inadequate pain relief varied by race/ethnicity, age, and sex.[37] Predictors of inadequate pain management included minority status, age of 70 years or older, and female sex. The same study also found that patients seen at centers that mostly treated minorities were 3 times as likely as those treated elsewhere to have inadequate pain management.[37] A study of opioid availability in New York area pharmacies in 1998 found that pharmacies located in predominantly Hispanic and African American neighborhoods were significantly less likely to stock opioid analgesics than those in predominantly non-Hispanic white neighborhoods.[38]

Cancer Pain in Children

Treatment of cancer pain in children is a special concern. Although children with cancer experience pain from the same general causes as adults, they have a different spectrum of cancers than adults. Specifically, children tend to have fewer solid tumors, so they are less likely to experience tumor-related pain and more likely to have pain as a result of diagnostic or therapeutic procedures and treatment toxicities.[39] The prevalence of pain in children who are hospitalized for cancer reaches 50% in some surveys, while the prevalence of pain in outpatients is about 25%.[40] Children may be under treated for pain because of the misconception that pain is not experienced by the very young.

Pain evaluation is particularly difficult in children younger than 3 years, for whom behavioral and observational assessment approaches are used. Use of visual analog scales has been validated in children as young as 8 years and the use of "happy/sad faces" has been used in patients as young as 3 years (Figure 3).[23] Although the techniques for pain management in children are similar to those in adults, there is less information on the effectiveness of specific pain treatments in children.[41]

Barriers to Effective Treatment of Cancer-related Pain

Studies have identified a number of barriers to effective treatment for cancer pain.[42]

Barriers among patients and families

Many patients and caregivers have misconceptions about cancer pain. They may believe that pain is inevitable with cancer or that reporting pain will distract the physician from treating or curing the cancer. They may fear that they will not be considered "good patients" if they complain about pain. Other common misconceptions are that people inevitably become addicted to strong pain medications and that people are given morphine only near the time of death. Many patients and caregivers are concerned that opioid medications inevitably make a person drowsy and "out-of-it." None of these beliefs are true.[15,42]

Although pain is not inevitable with cancer, many patients with cancer do experience pain. When pain occurs, open communication with health care providers can lead to earlier identification of treatable problems and adequate relief of symptoms. Control of pain and other symptoms does not reduce the effectiveness of cancer treatment.

Although concern about addiction to opioid medications is common, opioid addiction is extremely rare among cancer patients. Patients may experience **tolerance** and **physical dependence**, but this is not the same as addiction.[43]

- **Tolerance** is the need for an increase in the amount of drug to achieve the same level of pain relief. Not every patient taking opioids develops tolerance. When it does occur, it can usually be managed by increasing the frequency of administration or switching to another opioid medication.
- **Physical dependence** is the occurrence of withdrawal symptoms if the drug is stopped suddenly. This is not the same as drug addiction. When opioids are no longer needed for pain relief, physical withdrawal symptoms can be avoided by reducing the dose of opioids slowly over time.

Although many people feel sedated when they start to take opioids, this side effect often subsides in a few days. If it does not, the dose of medication can generally be adjusted to obtain adequate pain relief without drowsiness. A stimulant may also be used to counteract a lingering sedative effect.

Barriers to adequate pain treatment among health care professionals

Health care providers may lack basic knowledge of pain control because of inadequate education in pain assessment and management. Lack of cultural awareness and/or language barriers may also contribute to inequities in cancer pain management. Many health care providers have unwarranted fears about opioid side effects and are confused about the meaning of tolerance and addiction. Health care professionals also cite lack of time and inadequate reimbursement as barriers to pain assessment and management. Health care professionals – including physicians, nurses, pharmacists, and others – often cite concerns about legal prosecution or revocation of their professional licenses as a barrier to pain management with opioids.[40,44,45]

Restrictive laws and regulations and their enforcement

Because opioid medications can be diverted and abused, they are controlled substances that are subject to laws and regulations governing how they are prescribed and dispensed. The Federal Controlled Substance Act was written to ensure the availability of opioid medicines for legitimate use in treating pain while still controlling illegal uses (abuse and diversion). The Drug Enforcement Agency (DEA) has sole jurisdiction over this Act's enforcement. Despite the absence of evidence to show that the prescription of opioid medications for pain management is the source of drug diversion and the resulting abuse problem,[47] the DEA's rigorous enforcement of national drug policy, coupled with confusion about the law, may have the unintended consequence of reducing access for patients in pain who legitimately need these drugs.[46,48]

State laws and pain policies designed to prevent abuse and diversion of prescription medications vary tremendously. In recent years, several states have made great strides toward improving the balance between limiting abuse and ensuring access to pain management.[46] For example, many state medical licensing boards have adopted all or part of the Federation of State Medical Boards *Model Policy for the Use of Controlled Substances for the Treatment of Pain* to address the professional barriers to pain management.[46] Despite these improvements, some state agency and medical board policies still contain outdated language reinforcing misperceptions, such as the confusion between physical dependence and addiction, as well as

provisions limiting the amount of opioids that can be prescribed for the treatment of cancer pain.[48]

Overcoming Barriers to Cancer Pain Management

Professional education and training

Steps have been taken to improve opportunities for professional education about cancer pain and its treatment. Excellent, evidence-based pain management clinical practice guidelines for practitioners are available through the American Pain Society and the National Comprehensive Cancer Network (NCCN).[21,22] As a companion piece for patients, the American Cancer Society and NCCN collaboratively developed *Cancer Pain: Treatment Guidelines for Patients* in lay language to help cancer patients and their families talk with their health care providers and make decisions about pain issues and treatment options.[49] The American Cancer Society will continue working with its many partners in the pain community to consider expansion of these existing activities and development of new initiatives to help fill professional training gaps.

Improving state policy

Improving state policy is a necessary complement to the many ongoing state-level initiatives designed to educate health care professionals about the appropriate use of pain medications and to inform the general public about the availability of pain treatment options.[50] State pain initiatives are voluntary, grassroots organizations that provide education and advocacy to health care providers as well as cancer patients and their families. They are composed of nurses, physicians, pharmacists, social workers, psychologists, patient advocates, and representatives of clergy, higher education, and government.[51] Through its involvement in several state pain initiatives, the American Cancer Society has worked with the Alliance of State Pain Initiatives (ASPI) and other partners to develop initiatives for improving state pain policies and communicating these policies to health care providers to help promote better pain control practice. In September 2006, the Pain and Policy Studies Group at the University of Wisconsin Comprehensive Cancer Center released a comprehensive review of pain management policies in all 50 states. Funded by the American Cancer Society, the Lance Armstrong Foundation, and the Susan G. Komen Breast Cancer Foundation, the study found that states have made significant improvements in balancing policies that prevent the abuse of pain medication without restricting legitimate medical use since the initial evaluation in 2000. Michigan and Virginia were reported to have the most balanced pain policies in the country and 19 states had made improvements in the language of pain policies in the past 3 years that enable enhanced pain management. These reports are important tools for identifying where progress is needed to encourage continued momentum for ensuring delivery of adequate pain relief.

Inadequate reimbursement

The US system of reimbursing the costs of health care leaves many cancer patients without the means to cover the costs of cancer treatment and care, including pain management. Health insurance reimbursement, or lack of reimbursement, plays a significant role in the way in which pain is treated, where it is treated, and what level of care is available. Reimbursement policies vary substantially among third-party payers, which results in some patients having full access to adequate pain management while others do not.

More than 47 million Americans have no health insurance and many cancer patients with health insurance find that their insurance pays for only a portion of the costs, leaving them with medical bills that are difficult or impossible to pay. Sometimes health insurance coverage of pain relief medication is limited, so the most appropriate treatment may be unaffordable for patients and their families. These problems are compounded among the most vulnerable populations – including low-income individuals and racial and ethnic minorities – who have been shown to have a greater degree of pain and suffering from cancer than do other Americans.[46]

The American Cancer Society is monitoring and studying the size and scope of these and other reimbursement issues as barriers to the provision of quality cancer care. We will continue working with partners to evaluate options for action to better integrate cancer pain and symptom management within the health system.

International perspective

Although inadequate pain management is a serious problem in most developed countries, this problem is even more serious in developing countries.[52] The World Health Organization (WHO) has developed guidelines for assessing national drug policies for the degree of balance. In many countries, national drug laws have been evaluated and found to interfere with cancer pain relief. In many developing countries, cancer pain management is also limited by geographical barriers,

medical infrastructure, and financial resources. In some countries, stringent regulations and negative perceptions associated with heroin trafficking further limit appropriate medical use of opioids.[52] The WHO has played an important role in encouraging effective pain management and monitoring the availability of opioids internationally.[53]

Looking Ahead: Advocating for Better Pain Control

The American Cancer Society seeks to limit the negative impact that cancer and its treatment can have on a person's quality of life. This includes efforts to ensure that the lives of patients, survivors, and their families are not overpowered by pain and that pain related to cancer and its treatment is addressed during all phases of the cancer experience. We are dedicated to working with state pain initiatives and other partners to advocate for needed policy change and to raise awareness about the importance of treating cancer pain and suffering for all patients and survivors from the time of diagnosis throughout the balance of life.

Helpful Online Resources:

American Cancer Society: http://www.cancer.org

American Pain Foundation:
http://www.painfoundation.org

Alliance of State Pain Initiatives (ASPI):
http://www.aspi.wisc.edu

Pain and Policy Studies Group (PPSG):
http://www.medsch.wisc.edu/painpolicy

National Comprehensive Cancer Network (NCCN):
http://www.nccn.org

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Cancer in Racial and Ethnic Minorities

Eliminating disparities in the cancer burden is one of the overarching themes of the American Cancer Society's 2015 challenge goals. Many different demographic and socioeconomic characteristics are associated with health-related disparities. Cultural and genetic factors may also play a role in the cancer incidence and mortality experienced by various racial and ethnic populations.

African Americans: African Americans are more likely to develop and die from cancer than any other racial or ethnic population. The death rate from cancer among African American males is about 38% higher than among white males; for African American females, it is about 17% higher. African Americans have a higher mortality rate than whites for each of the major cancer sites (colorectal, male lung, female breast, and prostate), as well as a higher incidence rate for all of these cancers, except female breast.

Hispanics: Hispanics have lower incidence rates for all cancers combined and the major cancer sites compared to whites, but generally have higher rates of cancers associated with infection, such as uterine cervix, liver, and stomach. For example, incidence rates of liver cancer are twice as high in Hispanic men and women as in whites.

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 have a higher incidence of many of the cancers related to infection. Specifically, as seen in the table on page 33, they have the highest incidence and deaths rates from liver and stomach cancers of all racial and ethnic groups in both men and women, with the exception of deaths from stomach cancer in men. (For more information on causes of stomach, cervix, and liver cancer, see *Cancer Facts & Figures 2005* (5008.05), Special Section, available online at www.cancer.org.)

American Indians and Alaska Natives: Incidence and death rates from kidney cancer in American Indian and Alaska Native men and women are higher than in any other racial or ethnic population. Incidence rates for American Indians and Alaska Natives should be interpreted with caution because available data are not considered representative. To resolve this issue, a linkage of cancer registry data and the Indian Health Service patient database is in progress.

In addition to the variation in cancer burden between different racial and ethnic groups, it is also important to recognize that significant disparities exist within these populations that require targeted cancer control and prevention strategies. For example, incidence rates for cervical cancer are about four times higher in Vietnamese women than in all Asian American and Pacific Islander women, partly because Vietnamese women are relatively recent immigrants, poorer, and have reduced access to medical care.

Overall, racial and ethnic minorities face numerous obstacles in receiving health care services, including cancer prevention, early detection, and quality treatment. Factors that contribute to disparities in health care access include low income; inadequate health insurance; geographic, cultural, and language barriers; racial bias; and stereotyping. Poverty is a critical factor because it influences the prevalence of underlying risk factors for cancer (such as tobacco use and obesity) as well as access to services. Compared with 11% of whites, 24% of African Americans and 23% of Hispanics/Latinos live below the poverty line. Moreover, 18% of African Americans and 35% of Hispanics/Latinos are uninsured, while 12% of whites lack health insurance. Low-income and uninsured people in particular are more likely to be diagnosed with cancer at late stages of disease, to receive substandard clinical care and services, and to die from cancer. Consequently, the 5-year relative survival rate for all cancers combined is lower for African Americans (57%) than it is for whites (68%).

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. Social inequalities, such as racial discrimination, can affect interactions between patient and physician and contribute to miscommunication or delivery of substandard care. Opportunities to reduce cancer disparities exist across the entire cancer spectrum, from primary prevention to palliative care. (For more information about cancer disparities, please see *Cancer Facts & Figures 2004*, Special Section (5008.04), available online at www.cancer.org.)

Not all cancer disparities among population groups result from the inequities described above. Cancer risks and rates may also be influenced by cultural and genetic factors that decrease or increase risk. For example, women from cultures where early marriage is encouraged may have a lower risk of breast cancer because they begin having children at an earlier age, which decreases breast cancer risk. Individuals who maintain a vegetar-

Incidence and Mortality Rates* by Site, Race, and Ethnicity, US, 1999-2003

Incidence	White	African American	Asian American and Pacific Islander	American Indian and Alaska Native	Hispanic/ Latino†
All sites					
Males	555.0	639.8	385.5	359.9	444.1
Females	421.1	383.8	303.3	305.0	327.2
Breast (female)	130.8	111.5	91.2	74.4	92.6
Colon & rectum					
Males	63.7	70.2	52.6	52.7	52.4
Females	45.9	53.5	38.0	41.9	37.3
Kidney & renal pelvis					
Males	18.0	18.5	9.8	20.9	16.9
Females	9.3	9.5	4.9	10.0	9.4
Liver & bile duct					
Males	7.2	11.1	22.1	14.5	14.8
Females	2.7	3.6	8.3	6.5	5.8
Lung & bronchus					
Males	88.8	110.6	56.6	55.5	52.7
Females	56.2	50.3	28.7	33.8	26.7
Prostate	156.0	243.0	104.2	70.7	141.1
Stomach					
Males	9.7	17.4	20.0	21.6	16.1
Females	4.4	9.0	11.4	12.3	9.1
Uterine cervix	8.6	13.0	9.3	7.2	14.7

Mortality	White	African American	Asian American and Pacific Islander	American Indian and Alaska Native	Hispanic/ Latino†‡
All sites					
Males	239.2	331.0	144.9	153.4	166.4
Females	163.4	192.4	98.8	111.6	108.8
Breast (female)	25.4	34.4	12.6	13.8	16.3
Colon & rectum					
Males	23.7	33.6	15.3	15.9	17.5
Females	16.4	23.7	10.5	11.1	11.4
Kidney & renal pelvis					
Males	6.2	6.1	2.6	6.8	5.3
Females	2.8	2.8	1.2	3.3	2.4
Liver & bile duct					
Males	6.3	9.6	15.5	7.8	10.7
Females	2.8	3.8	6.7	4.0	5.0
Lung & bronchus					
Males	73.8	98.4	38.8	42.9	37.2
Females	42.0	39.8	18.8	27.0	14.7
Prostate	26.7	65.1	11.8	18.0	22.1
Stomach					
Males	5.4	12.4	11.0	7.1	9.2
Females	2.7	6.0	6.7	3.7	5.2
Uterine cervix	2.4	5.1	2.5	2.6	3.4

*Per 100,000, age-adjusted to the 2000 US standard population. †Persons of Hispanic/Latino origin may be of any race. ‡Excludes deaths from Minnesota, New Hampshire, and North Dakota due to unreliable data.

Source: Incidence (except American Indian and Alaska Native): Howe HL, Wu X, Ries LAG, et al. Annual report to the nation on the status of cancer 1975-2003, featuring cancer among US Hispanic/Latino populations. *Cancer*. 2006;107:1643-1658. Incidence (American Indian and Alaska Native 1999-2002): Ries LAG, Harkins D, Krapcho M, et al.(eds). SEER Cancer Statistics Review, 1975-2003, National Cancer Institute, Bethesda, MD, www.seer.cancer.gov/csr/1975_2003/, 2006. Mortality:SEER Program (www.seer.cancer.gov) SEER*Stat Database: Mortality – All COD, Public-Use With State, Total US (1990-2003), National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2006. Underlying mortality data provided by NCHS.

American Cancer Society, Surveillance Research, 2007

ian diet or don't 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.

Tobacco Use

Smoking-related diseases remain the most preventable cause of death in our society. Since the first US Surgeon General's report on smoking and health was published in 1964, there have been more than 12 million premature deaths attributable to smoking in the US.[1] In 2000 alone, about 4.8 million smoking-related premature deaths occurred worldwide. The number of deaths was almost evenly divided between industrialized and developing nations, and was greater in men (80% of smoking-attributable deaths) than in women. More men die from smoking in developing nations (2 million) than in industrialized nations (1.8 million).[2,3]

Health Consequences of Smoking

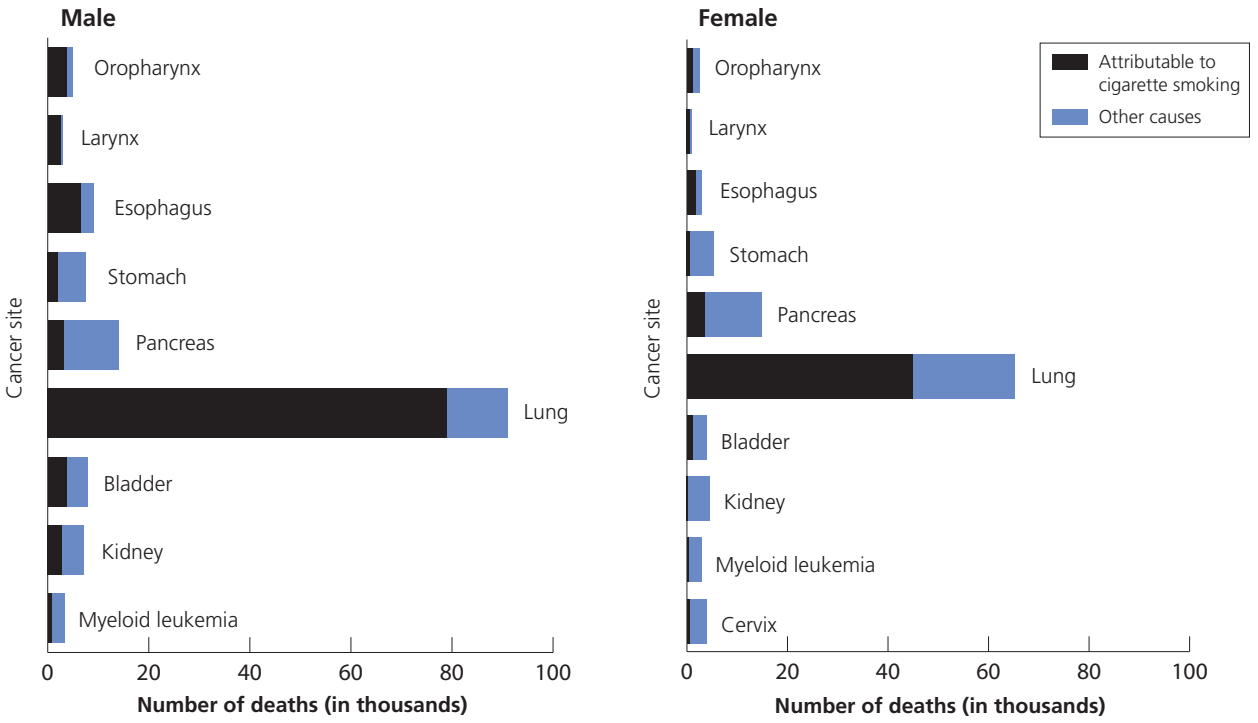
Half of all Americans who continue to smoke will die from smoking-related diseases.[4] In the US, tobacco use is responsible for nearly one in five deaths; this amounted to an estimated 438,000 premature deaths each year between 1997-2001.[5-7] In addition, an estimated 8.6 million people suffer from smoking-related chronic conditions (i.e., chronic bronchitis, emphysema, and other cardiovascular diseases).[8]

- Smoking accounts for at least 30% of all cancer deaths and 87% of lung cancer deaths.[9,10]
- The risk of developing lung cancer is about 23 times higher in male smokers and 13 times higher in female smokers compared to lifelong non-smokers.[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]
- Smoking is a major cause of heart disease, cerebrovascular disease, chronic bronchitis, and emphysema, and is associated with gastric ulcers.[1,10]
- The risk of lung cancer is no different in smokers of "light" or "low-tar" yield cigarettes.[11]

Reducing Tobacco Use and Exposure

A US Surgeon General's report outlined the goals and components of comprehensive statewide tobacco control programs.[12] The goal of comprehensive tobacco control programs is to reduce disease, disability, and death related to tobacco use by preventing the initiation of tobacco use among youth, promoting quitting among

Annual Number of Cancer Deaths Attributable to Smoking, Males and Females, by Site, US, 1997-2001



Source: Centers for Disease Control and Prevention, Annual smoking-attributable mortality, years of potential life lost, and productivity losses – United States, 1997-2001. *MMWR Morb Mortal Wkly Rep*. 2005;54(25):625-628.

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young people and adults, eliminating nonsmokers' exposure to secondhand smoke, and identifying and eliminating the disparities related to tobacco use and its effects among different population groups.[13] The Centers for Disease Control and Prevention have recommended funding guidelines for comprehensive tobacco use prevention and cessation programs for all 50 states and the District of Columbia. In 2006, only four states (Colorado, Delaware, Maine, and Mississippi) invested at least the minimum per capita amount recommended for tobacco control programs.[14] With adequate funding levels, comprehensive tobacco control programs in some states (e.g., California, Massachusetts, Florida, and Maine) have reduced smoking rates and saved states millions of dollars in tobacco-related health care costs.[12,15] (For more information about tobacco control, please see the American Cancer Society's *Cancer Prevention and Early Detection Facts & Figures 2006* (8600.06) available online at www.cancer.org)

Trends in Smoking

- Cigarette smoking among adults aged 18 and older declined 50% from 1965-2005 – from 42% to 21%; nevertheless, an estimated 45 million Americans are current smokers.[16,17]
- Although cigarette smoking became prevalent among men before women, the gender gap narrowed in the mid-1980s and has since remained constant.[18] As of 2005, there was a 4% difference in smoking prevalence between white men and women, and a 9% difference between African American men and women.[17]
- Smoking prevalence generally decreases with increasing years of education. While the percentage of smokers decreased for all levels of educational attainment during 1983-2005, college graduates achieved the greatest percentage decrease of 43% (21% to 12%).[16,17]
- Annual cigarette consumption among US adults continues to decline, peaking in 1963 at 4,345 cigarettes per capita and decreasing to an estimated 1,716 in 2005 – a net reduction of 61%.[19,20]
- Although cigarette smoking among US high school students increased significantly from 1991-1997 (28% to 36%), it declined to 23% by 2005.[21,22,23]
- 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 32% for male students and to 25% for female students in 2005.[23,24]

Spit Tobacco

In 1986, the US Surgeon General concluded that chewing tobacco and snuff are not safe substitutes for smoking cigarettes or cigars, as these products cause various cancers and non-cancerous oral conditions and can lead to nicotine addiction.[25]

- There is no evidence that switching to snuff or chewing tobacco is more effective or as safe as conventional cessation therapies in helping smokers quit.[26]
- The risk of cancer of the cheek and gums may increase nearly 50-fold among long-term snuff users.[25]
- According to the US Department of Agriculture, US output of moist snuff has increased more than 76% in the past decade, from 48 million pounds in 1991 to an estimated 85 million pounds in 2005.[19,20]
- In 2004, about 3% of US adults used smokeless tobacco in the past month, 6% of men and 1% of women. Whites (4%) and American Indian/Alaska Natives (4%) were more likely to use smokeless tobacco than African Americans (2%), Asians (1%), or Hispanic/Latinos (1%).[27]
- Nationwide, 14% of male high school students and 2% of female high school students were currently using chewing tobacco, snuff, or dip in 2005. White students (10%) were more likely to use smokeless tobacco than Hispanic/Latino (5%) or African American (2%) students.[23]

Cigars

The consumption of large cigars and cigarillos increased by an estimated 138% from 1993-2005.[20,28] An estimated 5.1 billion large cigars and cigarillos were consumed in 2005.[20] Small cigar production increased from 1.5 billion cigars in 1997 to an estimated 4.7 billion cigars in 2005.[20]

- According to a state-based survey in 1998, the median percentage of adults aged 18 years and older who had ever smoked cigars was 40%. More men than women had ever smoked cigars in all 50 states.[29]
- In 2004, the percentage of adults aged 18 years and older who had smoked cigars in the past month was 6%.[27]
- In 2005, 14% of US high school students had smoked cigars, cigarillos, or little cigars on at least one of the past 30 days.[23] In 2001, seven major cigar manufacturers began to provide five rotating health warnings on labels of cigars sold in the US. The companies agreed to the warnings in June 2000 to settle a lawsuit brought by the Federal Trade Commission for failure to

warn consumers of the dangers of cigar smoking. Cigar smoking has health consequences similar to those of cigarettes and smokeless tobacco, such as:[30]

- Cancers of the lung, oral cavity, larynx, esophagus, and probably pancreas
- Four to 10 times the risk of dying from laryngeal, oral, or esophageal cancer compared with nonsmokers

Smoking Cessation

In 1990, the US Surgeon General 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 with 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.

Among adults aged 18 years and older in 2004, national and state data showed:[17,32]

- An estimated 46.5 million adults were former smokers, representing 50.8% of persons who ever smoked.
- Among those who smoked, an estimated 19.2 million (or 42.5%) had stopped smoking at least one day during the preceding 12 months because they were trying to quit.[17]
- In 34 states, Puerto Rico, and the US Virgin Islands, the majority of adults (50% or more) who ever smoked have now quit smoking.[32]

In 2005, among high school students who were current cigarette smokers, national data showed that more than one-half (54.6%) had tried to quit smoking cigarettes during the 12 months preceding the survey; female students (60.3%) were more likely to have made a quit attempt than male students (48.9%).[23]

Secondhand Smoke

Secondhand smoke, or environmental tobacco smoke (ETS), 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 secondhand smoke in homes, vehicles, workplaces, and public places.[33] Numerous scientific consensus groups have reviewed data on the health effects of ETS.[33-38] In 2006, the US Surgeon General published a comprehensive report entitled *The Health Consequences of Involuntary Exposure to Tobacco Smoke*.[33] Public policies to protect people from secondhand smoke are based on the following detrimental effects:

- Secondhand smoke 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.[35]
- Each year, about 3,000 nonsmoking adults die of lung cancer as a result of breathing secondhand smoke.[7]
- ETS causes an estimated 35,000 deaths from heart disease in people who are not current smokers.[7]
- ETS may cause coughing, wheezing, chest tightness, and reduced lung function in adult nonsmokers.[33]
- Exposure to secondhand smoke causes an estimated 150,000 to 300,000 lower respiratory tract infections (i.e., pneumonia and bronchitis) each year in US infants and children younger than 18 months of age. These infections result in 7,500 to 15,000 hospitalizations annually.[35]
- Secondhand smoke increases the number and severity of asthma attacks in about 200,000 to 1 million asthmatic children.[35]
- Some studies report an association between ETS exposure and increased risk of breast cancer. According to the US Surgeon General's report, the evidence on the link between ETS and breast cancer is suggestive but not sufficient to infer a causal relationship.[33] While more research is necessary to resolve this issue, women should be aware of the possible link between ETS exposure and breast cancer, as it is yet another reason to avoid contact with secondhand smoke.

Implementing policies that establish smoke-free environments is the most effective approach to prevent exposure and harm from ETS. Momentum to regulate public smoking began to increase in 1990. Government and private business policies that limit smoking in public workplaces have become increasingly common and restrictive.[39] Presently in the US, more than 2,344 municipalities have passed smoke-free legislation and 19 states (California, Colorado, Connecticut, Delaware, Florida, Hawaii, Idaho, Louisiana, Maine, Massachusetts, Montana, New Jersey, New York, North Dakota, Rhode Island, South Dakota, Vermont, Utah, and Washington), 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.[40]

- Currently, approximately 44% of the US population is covered by a smoke-free policy or provision in the workplace and/or restaurants and/or bars.[40]
- Nationally, coverage of all indoor workers by smoke-free policies increased substantially from 1993-2002; 71% of workers were covered in 2002, compared to 47% in 1993.[33]
- Workplace smoking restrictions vary by occupation: in 2002, more than 77% of employees in an office environment reported working under a smoke-free policy compared to 60% of service occupation workers.[33]

Worldwide Tobacco Use

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

- Developing countries consume an increasing proportion of the world's tobacco. In 1998, developing countries consumed 67% of the world's tobacco. If recent trends continue, the developing world will consume 71% of the world's tobacco by 2010. About 80% of the projected increase will occur in East Asia, particularly China.[41]
- 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.[42]
- Female smoking prevalence rates have peaked and are decreasing in a handful of economically developed countries, such as Australia, Canada, the United Kingdom, and the United States; but in most countries female smoking rates are still increasing or show no evidence of decline.[43] Female smoking rates in both developing and developed nations are expected to converge at 20%-25% by 2030.[43,44]
- Based on current patterns, smoking-attributable diseases will kill about 650 million of the world's 1.3 billion smokers alive today.[45,46]
- In 2000, there were about 4.8 million smoking-related premature deaths worldwide, almost evenly divided between developed (2.4 million deaths) and developing (2.4 million deaths) nations.[2,3]
- In a series of surveys among youth aged 13-15 years conducted in 93 countries and territories between 1999-2005, 11% of boys and 7% of girls reported smoking cigarettes, and 14% of boys and 8% of girls reported using other tobacco products.[47] In every region of the world, the ratio of male to female smoking among youth was lower than the ratio reported among adults, reflecting a global trend of increased smoking among female youth.[48]

To curtail the tobacco pandemic, the 192 Member States of the World Health Assembly unanimously adopted the first global public health treaty, the Framework Convention on Tobacco Control (FCTC) on May 21, 2003. The treaty was ratified by a requisite of 40 countries on November 30, 2004, and subsequently entered into force as a legally binding accord for all ratifying states on February 27, 2005.[49] 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.[50] Parties to the treaty are expected to strengthen national legislation, enact effective tobacco control policies, and cooperate internationally to reduce global tobacco consumption.[51]

Costs of Tobacco

The number of people who prematurely die or suffer illness from tobacco use results in substantial health-related economic costs to society. In the US, smoking causes 3.3 million years of potential life lost in men and 2.2 million years of potential life lost in women. Smoking, on average, reduces life expectancy by approximately 14 years.[7] In addition:

- Smoking caused more than $167 billion in annual health-related economic costs, including adult mortality-related productivity costs, adult medical expenditures, and medical expenditures for newborns.[7]
- Mortality-related productivity losses in the US amounted to $92 billion annually during 1997-2001, up about $10 billion from the $81.9 billion lost annually during 1995-1999.[6,7]
- Smoking-related medical costs totaled $75.5 billion in 1998 and accounted for 8% of personal health care medical expenditures. This translates to $1,623 in excess medical expenditures per adult smoker in 1999.[7]
- Smoking-attributable costs for newborns were $366 million in 1996, or $704 per maternal smoker.[6]

- In 2001, states spent an estimated $12 billion treating smoking-attributable diseases.[52]
- For each pack of cigarettes sold in 1999, $3.45 was spent on medical care due to smoking and $3.73 was lost in productivity, for a total cost to society of $7.18 per pack.[7]
- Recent reviews of the cost of treating smoking-attributable diseases in the US have shown that they range from 6%-14% of personal health expenditures.[53,54]

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Nutrition and Physical Activity

Scientific evidence suggests that about one-third of the cancer deaths that occur in the US each year are due to nutrition and physical activity factors, including excess weight. For the majority of Americans who do not use tobacco, dietary choices and physical activity are the most important modifiable determinants of cancer risk.

Although inherited genes do influence cancer risk, heredity alone explains only a fraction of all cancers. Most of the variation in cancer risk across populations cannot currently be explained by inherited factors; behavioral factors such as cigarette smoking, certain dietary patterns, physical activity, and weight control can substantially affect the risk of developing cancer. These factors modify cancer at all phases of development.

The American Cancer Society reviews and updates its nutrition and physical activity guidelines every 5 years. The Society's most recent guidelines, published in 2006, emphasize the importance of weight control, physical activity, and dietary patterns in reducing cancer risk. Because it is clear that the social environment in which people live, work, play, and go to school is a powerful influence on diet and activity habits, the guidelines include an explicit Recommendation for Community Action to promote the availability of healthy food choices and opportunities for physical activity in schools, worksites, 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 of heart disease and diabetes as well.

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, adenocarcinoma of the esophagus, and kidney. Evidence is highly suggestive that obesity also increases risk for cancers of the pancreas, gallbladder, thyroid, ovary, and cervix, as well as for multiple myeloma, Hodgkin lymphoma, and aggressive prostate cancer. The best way to achieve a healthy body weight is to balance energy intake (food intake) with energy expenditure (metabolism and physical activity). Excess body fat can be reduced by restricting caloric intake and increasing physical activity. Caloric intake can be reduced by decreasing the size of food portions and limiting the intake of high-calorie foods (e.g., those high in fat and refined sugars such as fried foods, cookies, cakes, candy, ice cream, and soft drinks). Such foods should be replaced with more healthy vegetables and fruits, whole grains, and beans. While too few people lose and maintain significant weight loss to directly study the impact of weight loss on subsequent cancer risk, weight loss is associated with reduced levels of circulating hormones, which are associated with increased cancer risk. Therefore, people who are overweight should be encouraged to achieve and maintain a healthy weight.

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 pre-adolescents 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 are preferable.
- **Children and adolescents:** Engage in at least 60 minutes per day of moderate to vigorous physical activity at least 5 days per week.

Scientific evidence indicates that physical activity may reduce the risk of certain cancers as well as provide other important health benefits. Regular physical activity contributes to the maintenance of a healthy body weight by balancing caloric intake with energy expenditure. Other mechanisms by which physical activity may help to prevent certain cancers may involve both direct and indirect effects. For colon cancer, physical activity accelerates the movement of food through the intestine, thereby reducing the length of

time that the bowel lining is exposed to potential carcinogens. For breast cancer, vigorous physical activity may decrease the exposure of breast tissue to circulating estrogen. Physical activity may also affect cancers of the colon, breast, and other sites by improving energy metabolism and reducing circulating concentrations of insulin and related growth factors. Physical activity helps to prevent type 2 diabetes, which is associated with increased risk of cancers of the colon, pancreas, and possibly other sites. The benefits of physical activity go far beyond reducing the risk of cancer. They include reducing the risk of heart disease, high blood pressure, diabetes, osteoporosis, falls, stress, and depression.

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. 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, overnutrition and energy imbalance, or the amount and distribution of body fat at particular stages of life affect one'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 wholesome foods following an overall healthy dietary pattern as outlined, with special emphasis 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 2 drinks per day for men and 1 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 intake of more than 2 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 Recommendation for Community Action

Because the Society recognizes that individual choices about diet and physical activity are strongly affected by the surrounding environment, the guidelines include an explicit Recommendation for Community Action. Public, private, and community organizations should work to create social and physical environments that support the adoption and maintenance of healthy nutrition and physical activity behaviors.

- Increase access to healthy foods in schools, worksites, and communities.
- Provide safe, enjoyable, and accessible environments for physical activity in schools and for transportation and recreation in communities.

Achieving this recommendation will require multiple strategies and bold action, ranging from the implementation of community and worksite health promotion programs to policies that affect community planning, transportation, school-based physical education, and food services. The tobacco control experience has shown that policy and environmental changes at national, state, and local levels are critical to achieving changes in individual behavior. Measures such as clean 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 are potentially modifiable. They include tobacco use, poor nutrition, inactivity, obesity, certain infectious agents, certain medical treatments, sunlight, cancer-causing agents that occur naturally in food, cancer-causing agents in the workplace, and cancer-causing agents that exist as pollutants in our air, water, and soil.

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 United States each year corresponds to approximately 33,600 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 and they 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).

Studies have been done to examine the relationship between exposure to potentially carcinogenic substances in the general population and cancer risk, but such studies are much more difficult, often because of uncertainties about exposure and the challenge of long-term followup. Moreover, relying upon epidemiological information to determine cancer risks 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 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 when tested in well-conducted 2-year bioassays.[1] Moreover, between 25% and 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 http://ntp.niehs.nih.gov/ntp/roc/toc11.html.

The International Agency for Research on Cancer is a branch of the World Health Organization that regularly convenes scientific consensus groups to evaluate the carcinogenic potential of chemicals. 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 www-cie.iarc.fr/.

The American Cancer Society does not have a formal program to review and evaluate carcinogens. However, information on selected topics can be found at www.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.[2]

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.

References

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The International 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. Better prevention, early detection, and advances in treatment have helped some developed nations lower incidence and mortality rates for certain cancers, but in most parts of the world cancer is a growing problem. Cancer killed 6.7 million people around the world in 2002 and this figure is expected to rise to 10.1 million in 2020.

Today, most cancers are linked to a few controllable factors – tobacco use, poor diet, lack of exercise, and infectious diseases. Tobacco use is the number one cause of cancer and the number one cause of preventable death throughout the world. If current trends continue, 650 million people alive today will eventually die of tobacco-related diseases, including cancers of the lung, esophagus, and bladder. In the developed world, poor diets, inadequate physical activity, and obesity are second only to tobacco as causes of cancer. As these unhealthy lifestyle behaviors spread to other parts of the world, cancers of the colon, breast, and prostate are rising to levels now seen in industrialized countries. At the same time, cancers linked to infectious agents – including cervix, stomach, and liver cancers – remain a

serious threat throughout the developing world. Although the vast majority of these deaths could be avoided with the implementation of widespread programs in prevention, early detection, and access to effective treatment, the resources necessary to achieve this are not available in developing countries.

The American Cancer Society addresses the global cancer burden through three key initiatives aimed at building effective, sustainable programs in cancer control in low- and middle-income countries: American Cancer Society University, International Relay For Life®, and the International Partners Program.

The American Cancer Society also collaborates with other cancer-related organizations worldwide in the global fight against cancer, especially in the developing world where survival rates are low and resources are limited. Its international mission includes:

- Capacity building for cancer organizations
- Tobacco control
- Information exchange and delivery
- Cancer research

Working with key partners such as the International Union Against Cancer (UICC), the World Health Organization (WHO), and the International Network for Cancer Treatment and Research (INCTR), the American Cancer Society is expanding its efforts to address the rising cancer burden throughout the world.

The American Cancer Society

In 1913, 10 physicians and 5 laypeople founded the American Society for the Control of Cancer. Its stated purpose was to disseminate knowledge about cancer symptoms, treatment, and prevention; to investigate conditions under which cancer was found; and to compile cancer statistics. Later renamed the American Cancer Society, Inc., the organization now includes more than 3 million American volunteers working together to conquer cancer.

Since its inception nearly a century ago, the American Cancer Society has made significant contributions to progress against cancer in the US. The Society's work in cancer research, education, advocacy, and service has yielded remarkable strides in cancer prevention, early detection, treatment, and patient quality of life. As a result, overall cancer mortality has steadily declined since the early 1990s, and the 5-year survival rate is now 66%, up from 50% in the 1970s. Today, more than ever, our goal of eliminating cancer as a major public health threat is within reach.

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 Society. A National Assembly of volunteer representatives from each Division approves Division charters and elects a national volunteer Board of Directors. The Board of Directors sets and approves strategic goals for the Society, ensures management accountability, 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. More than 3,400 local offices nationwide raise funds at the community level and deliver cancer prevention, early detection, and patient services programs.

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 to further cancer research; educate the public about early detection and prevention; advocate for responsible cancer legislation at the local, state, and federal levels; serve cancer patients and their families; and raise funds for the fight against cancer.

How the American Cancer Society Fights Cancer

The Society has set challenge goals for 2015 to dramatically decrease cancer incidence and mortality rates while increasing the quality of life for all cancer survivors. The Society is uniquely qualified to make a difference in the fight against cancer 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.

Research

The aim of the American Cancer Society's research program is 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 year 2006 marks the 60th anniversary of the founding of the Society's research department.

In 2006, the Society spent an estimated $121 million on research and health professional training and has invested approximately $3 billion in cancer research since the program began in 1946. The Society's comprehensive research program consists of extramural grants, as well as intramural programs in epidemiology and surveillance 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 the best research in a wide range of cancer-related disciplines at more than 110 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 usually funds investigators early in their research careers, a time when they are less likely to receive funding from the federal government. The Society's priorities focus on needs that are unmet by other funding organizations, such as the current targeted research area of cancer in the poor and medically underserved. To date, 40 Nobel Prize winners received grant support from the Society early in their careers.

Epidemiology and Surveillance Research

For 60 years, the Society's intramural epidemiologic research program has evaluated trends in cancer incidence, mortality, and survival. Through this program, the Society publishes the most current statistics and trend information in a variety of *Cancer Facts & Figures* publications. These publications are the most widely cited source for cancer statistics and are available in hard copy or online through the Society's Web site at www.cancer.org.

Over the past 55 years, Society researchers have conducted three large prospective studies to identify factors that cause or prevent cancer:

- Hammond-Horn Study (188,000 men followed from 1952-1955 in 9 states)
- Cancer Prevention Study I (CPS-I, 1 million people followed from 1959-1972 in 25 states)
- Cancer Prevention Study II (CPS-II, an ongoing study of 1.2 million people enrolled in 1982 in 50 states)

More than 300 scientific publications resulting from these studies have identified the contributions of lifestyle (smoking, nutrition, obesity, etc.), family history, illness, medications, and environmental exposures to various cancers. Recruitment into a new Cancer Prevention Study (CPS-III) that includes an ethnically and geographically diverse population of 500,000 adults began in 2006 and will continue through 2011.

Additional information about the Cancer Prevention Studies, including copies of questionnaires and publication citations, is available at www.cancer.org.

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.

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 as an intramural department.

The Center's research has focused 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 Center's ongoing research projects include:

- An extensive, nationwide longitudinal study of adult cancer survivors to determine the unmet psychosocial needs of survivors and their loved ones, to identify factors that affect their quality of life, to evaluate programs intended to meet their needs, and to examine late effects, including second cancers.
- A large-scale, nationwide, cross-sectional study of cancer survivors who are 2, 5, and 10 years from their initial diagnosis and treatment. This study will evaluate cancer survivors' quality of life and provide data on survivors at several different time points since diagnosis.
- Two 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. The first study identifies the prevalence of the family's involvement in cancer care and the unmet needs of caregivers at 2 and 5 years after diagnosis; it also examines the impact on the caregiver's quality of life and health behaviors. The second longitudinal study follows cancer patients and their caregivers from the time of diagnosis and examines the behavioral, physical, psychological, and spiritual adjustment of the patients and their family caregivers across various ethnic groups.
- A study to test the Patient/Provider/System Theoretical Model (PPSTM) for cancer screening in federally funded primary care centers that provide care for many underserved populations. Through partnerships with researchers from the National Center for Primary Care, this project seeks to identify factors that influence screening behaviors (patients) and screening recommendations (providers and health care systems).
- A study of cancer knowledge, attitudes, beliefs, and risk perceptions among college students. Through partnerships with selected historically black colleges/universities and faculty liaisons, this study gathers baseline information from students and campus health centers. The long-term goal of this research is to enhance knowledge and awareness of cancer risk reduction strategies and early detection.

Statistics and Evaluation Center

In August 2005, the American Cancer Society inaugurated the Statistics and Evaluation Center (SEC), a shared resource that provides consultation to investigators in the research department, health promotions experts at the National Home Office, and mission delivery staff throughout the Society. The SEC has three main responsibilities: 1) to assist Society researchers in the design, analysis, and preparation of manuscripts for publication in peer-reviewed scientific journals; 2) to function as part of the Society team that evaluates selected mission delivery interventions; and 3) to conduct methods research on cancer-related problems for publication in peer-reviewed journals.

Education

The American Cancer Society's education efforts are aimed at informing the public and health professionals about opportunities to reduce cancer risk and increase cancer survival.

Prevention

Primary cancer prevention means taking the necessary precautions to prevent the occurrence of cancer. The Society's prevention programs focus on preventing the use of tobacco products; educating individuals and policymakers about the relationship between weight control, diet, physical activity, and cancer; and reducing excessive sun exposure.

The American Cancer Society collaborates with several national groups to implement comprehensive tobacco control programs. The Society's tobacco control efforts include:

- Reducing tobacco advertising and promotions directed at young people
- Increasing funding to support comprehensive tobacco control programs and tobacco-related research
- Reducing secondhand smoke exposure by supporting clean indoor air laws

- Providing access to cessation programs for people who wish to quit, including a science-based, telephone counseling service
- Increasing tobacco taxes to offset the health care costs associated with tobacco use
- Supporting global partnerships to reduce tobacco-related deaths and diseases

Maintaining a healthy weight, being physically active, and eating well are also important ways to reduce cancer risk. The Society publishes *Guidelines on Nutrition and Physical Activity for Cancer Prevention* to help people reduce their cancer risk through a healthy diet and physical activity. The Society has also developed a number of science-based programs that encourage people to maintain a healthy weight through proper diet and exercise.

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 recommendations for cancers of the breast, cervix, colon and rectum, and endometrium; information and guidance on testing for early prostate cancer; and general recommendations for a cancer-related 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 public awareness campaigns targeting the public and health care professionals. Campaigns to increase usage of Pap testing and mammography have led 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 last 5 years, the Society has launched ambitious multimedia campaigns to encourage adults aged 50 and older to get tested for colon cancer. The Society also continues to encourage the early detection of breast cancer through public awareness and other efforts targeting poor and underserved communities.

Treatment

In addition to providing comprehensive information about all available cancer treatments, the Society collaborates with organizations such as the National Comprehensive Cancer Network (NCCN), an alliance of 19 of the country's leading cancer centers, to ensure that people with cancer receive the highest quality care. Through this alliance, the Society produces treatment guidelines for cancer patients and physicians and works with the NCCN to translate Clinical Practice Guidelines in Oncology into easy-to-understand booklets for patients and their families. These booklets help guide cancer patients to appropriate treatment and assist them in understanding the treatment process so they become well-informed partners in their treatment.

Information Delivery

Information on every aspect of the cancer experience, from prevention to survivorship, is available to the public 24 hours a day, seven days a week, through the Society's call center (1-800-ACS-2345) and Web site (www.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 online at www.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* – as well as several cancer-related and clinical oncology books. More information about free subscriptions and online access to *CA* and *Cancer Cytopathology* articles can be found at www.cancer.org/bookstore.

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.

Advocacy

Many of the most important cancer decisions are made not just in the doctor's office, but also in state legislatures, in Congress, and in the White House. Policymakers

and government officials make decisions every day about health issues that affect people's lives. The American Cancer Society works with all levels of government to advocate for stronger policies, laws, and regulations that will reduce the burden of cancer in all populations.

The Society's advocacy initiatives rely on the combined efforts of a community-based grassroots network of cancer survivors and caregivers, Society volunteers and staff, health care professionals, public health organizations, and other collaborative partners. Through grassroots action, direct lobbying, and applied policy analysis, the Society has become an established leader on cancer issues and a respected voice for the cancer community before Congress, the Administration, and state legislatures.

In coordination with its sister advocacy organziation, the American Cancer Society Cancer Action Network℠ (ACS CAN), the Society is promoting the "Congressional Cancer Promise." The Congressional Cancer Promise is a statement of support for concrete steps Congress should take in the short term to put the fight against cancer back on track. Thanks to the nation's historical commitment to cancer research and prevention programs, the conquest of cancer is within our grasp if we adopt bold new policies and make the necessary investments. The Congressional Cancer Promise identifies policy changes and investments in four broad areas that should be made now as we look toward a time when cancer patients live fuller lives.

- **Make health care system reform a priority.** The Society recognizes that many of the challenges that cancer patients confront are the result of systemic problems not specific to cancer. The Society is urging members of Congress to educate themselves about the health care gaps that affect our fight against cancer and to commit to comprehensive, meaningful, and bipartisan solutions.
- **Elevate prevention, early detection, and survivorship.** The Society is advocating for waiving breast and colorectal cancer screening copays in Medicare, expanding the current eligibility window for the Welcome to Medicare physical from 6 months to 1 year, expanding smoking cessation coverage in Medicaid, and providing funding for implementation grants to be given under the state comprehensive cancer control planning program at the Centers for Disease Control and Prevention (CDC).
- **Increase commitment to cancer research.** Our investment in research through the National Cancer Institute (NCI) has produced remarkable advances and built a powerful research infrastructure. The Society is advocating that we sustain past progress and continued modernization of cancer research by providing annual funding increases of at least 5% for NCI.
- **Expand access to care.** Increasing preventive health services is critical to ensuring earlier detection and better outcomes. The American Cancer Society advocates for local, state, and federal programs and policies that ensure that all Americans, regardless of income level or insurance status, have access to lifesaving prevention, early detection, and treatment programs. Key priorities for the Society in this area are funding for the Patient Navigator program that was signed into law in 2005 as a result of the Society's advocacy efforts, and reauthorization of and increased funding for the CDC's National Breast and Cervical Cancer Early Detection Program (NBCCEDP). NBCCEDP helps low-income, uninsured, and medically underserved women gain access to lifesaving breast and cervical cancer screenings and provides a gateway to treatment upon diagnosis. As currently funded, however, it reaches only 1 in 5 eligible women nationwide between the ages of 50 and 64. The Society is also working with Congress to authorize a community colorectal cancer screening and treatment program that would increase colorectal cancer screening rates, particularly among medically underserved populations.

The Society also continues to be an active advocate at the state level for programs and policies that advance the fight against cancer. The Society has been instrumental in the adoption of smoke-free laws in many states and in thousands of local communities, as well as supporting increases in state tobacco taxes. Smoke-free laws and tobacco tax increases are key tools in the fight to reduce smoking rates and protect citizens from secondhand smoke. The Society is also a champion for state funding of tobacco and cancer control programs, state laws that guarantee insurance coverage of critical cancer screenings and treatments (including access to clinical trials), and the elimination of state-level statutory and regulatory barriers to effective management of pain and other side effects of cancer and its treatment.

Patient/Survivor Services

For more than 1.4 million cancer patients diagnosed this year and more than 10 million American cancer survivors, the American Cancer Society offers a range of services to help patients and their families through cancer treatment, recovery, and beyond. From comprehensive cancer information that helps patients understand their disease and their treatment options to community programs that ease the physical, psychological, and financial burdens of cancer, the American Cancer Society stands ready to help 24 hours a day via 1-800-ACS-2345 and www.cancer.org.

The following are American Cancer Society programs that can be found in many communities across the country:

Cancer Survivors Network℠: created by and for cancer survivors and their families, this online community offers unique opportunities for people with cancer and their loved ones to find and connect with others like themselves. It's a welcoming, safe place for people to find hope and inspiration from others who have "been there."

I Can Cope®: educational classes for adults with cancer and their loved ones are conducted in a supportive environment by doctors, nurses, social workers, and other health care professionals. Participants gain practical knowledge and skills to help them cope with the challenges of living with cancer.

Hope Lodge®: for patients whose best hope for a cure is far from home, this nurturing, home-like environment provides free housing close to major hospitals and cancer centers for cancer patients undergoing treatment and their caregivers.

"tlc"™ or **Tender Loving Care®**: a magazine and catalog in one, *"tlc"* helps women battling cancer restore their appearance and dignity with information and one-stop, private shopping for products that address special appearance-related needs such as wigs, prostheses, hats, and other products.

Look Good...Feel Better®: a collaboration of the American Cancer Society; the Cosmetic, Toiletry, and Fragrance Association Foundation; and the National Cosmetology Association, this free service helps women in active treatment learn beauty techniques to restore their self-image and cope with appearance-related side effects. Certified beauty professionals provide tips on makeup, skin care, nail care, and head coverings. Additional information and materials are available for men and teens.

Transportation solutions: the American Cancer Society can assist cancer patients and their families with finding transportation to and from treatment facilities. In some areas, trained American Cancer Society volunteer drivers donate their time and resources to take patients to and from their appointments.

Reach to Recovery®: breast cancer survivors provide one-on-one support, information, and inspiration to help individuals cope with breast cancer. Volunteer survivors are trained to respond in person or by telephone to individuals facing breast cancer diagnosis, treatment, recurrence, or recovery.

Man to Man®: this comfortable, community-based education and support program offers individual and group support and information to men with prostate cancer. Man to Man also offers men the opportunity to educate their communities about prostate cancer and advocate with lawmakers for stronger research and treatment policies.

Children's camps: in some areas, the Society sponsors camps for child cancer survivors. These camps are equipped to handle the special needs of children undergoing treatment and the needs of the cancer survivor.

Scholarships: fighting cancer can be an enormous financial and emotional hardship, especially on young people. In an effort to ease this burden, many American Cancer Society Divisions offer college scholarships to young cancer survivors to help them pursue higher education.

Sources of Statistics

New cancer cases. The method for estimating new cancer cases in the current year has been refined several times over the years to take advantage of improvements in data and statistical methods. Beginning with 2007, the American Cancer Society is using a new projection method. The new method is a spatio-temporal model based on incidence data from 1995-2003 from 41 states that met the North American Association of Central Cancer Registries's (NAACCR) high quality data standard for incidence, covering about 86% of the US population. This contrasts with the previous quadratic autoregressive model based on incidence data from the 9 oldest SEER registries, covering about 10% of the US population. Furthermore, the new method considers geographic variations in socio-demographic and lifestyle factors, medical settings, and cancer screening behaviors as predictors of incidence. Additionally, this method accounts for expected delays in case reporting.

Comparisons of estimates from the new and old methods showed that estimates were generally similar for all cancers combined but differ substantially for some specific cancer sites, particularly for leukemia and female breast and lung cancers. For the reasons listed above, however, the estimates from the new method are likely to be more accurate than those from the old method (see "E" in **Additional Information** for details on this subject).

The methods used to estimate new US and state cases for the upcoming year can produce numbers that vary considerably from year to year, particularly for less common cancers and for smaller states. For this reason, we discourage the use of our estimates to track year-to-year changes in cancer occurrence. Incidence rates reported by SEER are generally more informative statistics to use when tracking cancer incidence trends for the US, and rates from state cancer registries are useful for tracking local trends.

Incidence rates. Incidence rates are defined as the number of people per 100,000 who are diagnosed with cancers during a given time period. State incidence rates presented in this publication are published in NAACCR's publication *Cancer Incidence in North America, 1999-2003*. Incidence rates for the US by race/ethnicity (with the exception of American Indians and Alaska Natives) were originally published by Howe, et al., in the *Annual Report to the Nation on the Status of Cancer 1975-2003, Featuring Cancer Among US Hispanic/Lation Populations* in *Cancer*, October 15, 2006. American Indian and Alaska Native incidence rates were originally published in *SEER Cancer Statistics Review, 1975-2003* (*CSR*). Unless otherwise indicated, incidence rates in this publication are age-adjusted to the 2000 US standard population to allow comparisons across populations that have different age distributions. Note that because of delays in reporting cancer cases to the National Cancer Institute (NCI), cancer incidence rates for the most recent diagnosis years may be underestimated. Cancers most affected by reporting delays are melanoma of the skin and prostate, which are frequently diagnosed in non-hospital settings. Incidence trends described in this publication are based on delay-adjusted incidence rates. Delay-adjusted trends for selected cancer sites are reported in *CSR 1975-2003*.

Cancer deaths. The estimated numbers of US cancer deaths are calculated by fitting the numbers of cancer deaths for 1969-2004 to a statistical model that forecasts the numbers of deaths expected to occur in 2007. 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 (CDC).

We discourage the use of our estimates to track year-to-year changes in cancer deaths because the numbers are model-based and can vary considerably from year to year, particularly for less common cancers and for smaller states. Mortality rates reported by NCHS are generally more informative statistics to use when tracking cancer mortality trends because they are based on the actual number of deaths for the most recent year available.

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 1930-2003 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 only be compared to other statistics that are age-adjusted to the US 2000 standard population.

Survival. Unless otherwise specified, 5-year relative survival rates are presented in this report for cancer patients diagnosed between 1996-2002, followed through 2003. 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 *SEER Cancer Statistics Review, 1975-2003*. In addition to 5-year survival rates, we also presented 1-year, 10-year, and 15-year survival rates for selected cancer sites. One-year survival rates are based on cancer patients diagnosed between 2000-2002, 10-year survival rates are based on diagnoses between 1991-2002, and 15-year survival rates are based on diagnoses between 1986-2002. All patients were followed through 2003.

Probability of developing cancer. Probabilities of developing cancer are calculated using DevCan (Probability of Developing Cancer Software) developed by the NCI. 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 over-estimates 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 and processing methods used by NCHS: www.cdc.gov/nchs/deaths.htm. Accessed October 3, 2006.

B. For information on data collection methods used by the SEER program: Ries LAG, Eisner MP, Kosary CL, et al. (eds). *SEER Cancer Statistics Review, 1975-2003*. National Cancer Institute. Bethesda, MD, 2006. Available at: www.seer.cancer.gov/csr/1975_2003/. Accessed October 3, 2006.

C. For information on data collection methods used by the North American Association of Central Cancer Registries: Ellison JH, Wu XC, McLaughlin CC, et al. (eds). Cancer in North America, 1999-2003. Volume One: Incidence. Springfield, IL: North American Association of Central Cancer Registries, Inc. May 2006. Available at www.naaccr.org/filesystem/pdf/2006%20Publication/Volume%20I/CINA2006.incd.v1.pdf

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

E. 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.

F. For information on the methods used to calculate the probability of developing cancer: DevCan 6.1.0. Probability of developing or dying of cancer. Statistical Research and Applications Branch, NCI. Available at: www.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 Society has used the Year 2000 Standard for age adjustment. This is a change from statistics previously published by the American Cancer 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 1995-1999 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 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 NCI Web site (www.cancer.gov/newscenter/pressreleases/Census2000).

Screening Guidelines

For the Early Detection of Cancer in Asymptomatic People

Site	Recommendation
Breast	• Yearly mammograms are recommended starting at age 40. The age at which screening should be stopped should be individualized by considering the potential risks and benefits of screening in the context of overall health status and longevity. • Clinical breast exam should be part of a periodic health exam about every 3 years for women in their 20s and 30s, and every year for women 40 and older. • Women should know how their breasts normally feel and report any breast change promptly to their health care providers. Breast self-exam is an option for women starting in their 20s. • Women at increased risk (e.g., family history, genetic tendency, past breast cancer) should talk with their doctors about the benefits and limitations of starting mammography screening earlier, having additional tests (i.e., breast ultrasound and MRI), or having more frequent exams.
Colon & rectum	Beginning at age 50, men and women should begin screening with 1 of the examination schedules below: • A fecal occult blood test (FOBT) or fecal immunochemical test (FIT) every year • A flexible sigmoidoscopy (FSIG) every 5 years • Annual FOBT or FIT and flexible sigmoidoscopy every 5 years* • A double-contrast barium enema every 5 years • A colonoscopy every 10 years **Combined testing is preferred over either annual FOBT or FIT, or FSIG every 5 years, alone. People who are at moderate or high risk for colorectal cancer should talk with a doctor about a different testing schedule.*
Prostate	The PSA test and the digital rectal examination should be offered annually, beginning at age 50, to men who have a life expectancy of at least 10 years. Men at high risk (African American men and men with a strong family history of 1 or more first-degree relatives diagnosed with prostate cancer at an early age) should begin testing at age 45. For both men at average risk and high risk, information should be provided about what is known and what is uncertain about the benefits and limitations of early detection and treatment of prostate cancer so that they can make an informed decision about testing.
Uterus	**Cervix:** Screening should begin approximately 3 years after a woman begins having vaginal intercourse, but no later than 21 years of age. Screening should be done every year with regular Pap tests or every 2 years using liquid-based tests. At or after age 30, women who have had 3 normal test results in a row may get screened every 2 to 3 years. Alternatively, cervical cancer screening with HPV DNA testing and conventional or liquid-based cytology could be performed every 3 years. However, doctors may suggest a woman get screened more often if she has certain risk factors, such as HIV infection or a weak immune system. Women aged 70 years and older who have had 3 or more consecutive normal Pap tests in the last 10 years may choose to stop cervical cancer screening. Screening after total hysterectomy (with removal of the cervix) is not necessary unless the surgery was done as a treatment for cervical cancer. **Endometrium:** The American Cancer Society recommends that at the time of menopause all women should be informed about the risks and symptoms of endometrial cancer, and strongly encouraged to report any unexpected bleeding or spotting to their physicians. Annual screening for endometrial cancer with endometrial biopsy beginning at age 35 should be offered to women with or at risk for hereditary nonpolyposis colon cancer (HNPCC).
Cancer-related checkup	For individuals undergoing periodic health examinations, a cancer-related checkup should include health counseling and, depending on a person's age and gender, might include examinations for cancers of the thyroid, oral cavity, skin, lymph nodes, testes, and ovaries, as well as for some nonmalignant diseases.

American Cancer Society guidelines for early cancer detection are assessed annually in order to identify whether there is new scientific evidence sufficient to warrant a reevaluation of current recommendations. If evidence is sufficiently compelling to consider a change or clarification in a current guideline or the development of a new guideline, a formal procedure is initiated. Guidelines are formally evaluated every 5 years regardless of whether new evidence suggests a change in the existing recommendations. There are 9 steps in this procedure, and these "guidelines for guideline development" were formally established to provide a specific methodology for science and expert judgment to form the underpinnings of specific statements and recommendations from the Society. These procedures constitute a deliberate process to ensure that all Society recommendations have the same methodological and evidence-based process at their core. This process also employs a system for rating strength and consistency of evidence that is similar to that employed by the Agency for Health Care Research and Quality (AHCRQ) and the US Preventive Services Task Force (USPSTF).

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