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Annual Report to the Nation on the Status of Cancer, 1975–2001, with a Special Feature Regarding Survival

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COMMENTARY

Annual Report to the Nation on the Status of Cancer, 1975–2001, with a Special Feature Regarding Survival

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BACKGROUND. The American Cancer Society (ACS), the Centers for Disease Control and Prevention (CDC), the National Cancer Institute (NCI), and the North American Association of Central Cancer Registries (NAACCR) collaborate annually to provide updated information regarding cancer occurrence and trends in the U.S. This year's report features a special section on cancer survival.

METHODS. Information concerning cancer cases was obtained from the NCI, CDC, and NAACCR and information concerning recorded cancer deaths was obtained from the CDC. The authors evaluated trends in age-adjusted cancer incidence and death rates by regression models and described and compared survival rates over time and across racial/ethnic populations.

RESULTS. Incidence rates for all cancers combined decreased from 1991 through 2001, but stabilized from 1995 through 2001 when adjusted for delay in reporting. The incidence rates for female lung cancer decreased (although not statistically significant for delay adjusted) and mortality leveled off for the first time after increasing for many decades. Colorectal cancer incidence rates also decreased. Death rates decreased for all cancers combined (1.1% per year since 1993) and for many of the top 15 cancers occurring in men and women. The 5-year relative survival rates improved for all cancers combined and for most, but

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not all, cancers over 2 diagnostic periods (1975–1979 and 1995–2000). However, cancer-specific survival rates were lower and the risk of dying from cancer, once diagnosed, was higher in most minority populations compared with the white population. The relative risk of death from all cancers combined in each racial and ethnic population compared with non-Hispanic white men and women ranged from 1.16 in Hispanic white men to 1.69 in American Indian/Alaska Native men, with the exception of Asian/Pacific Islander women, whose risk of 1.01 was similar to that of non-Hispanic white women.

CONCLUSIONS. The continued measurable declines for overall cancer death rates and for many of the top 15 cancers, along with improved survival rates, reflect progress in the prevention, early detection, and treatment of cancer. However, racial and ethnic disparities in survival and the risk of death from cancer, and geographic variation in stage distributions suggest that not all segments of the U.S. population have benefited equally from such advances. ***Cancer* 2004;101:3–27.**
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KEYWORDS: cancer; incidence; mortality; survival; Surveillance, Epidemiology, and End Results (SEER); National Program of Cancer Registries (NPCR); North American Association of Central Cancer Registries (NAACCR); vital statistics; U.S.

The American Cancer Society (ACS), the Centers for Disease Control and Prevention (CDC), the National Cancer Institute (NCI), and the North American Association of Central Cancer Registries (NAACCR) collaborate each year to produce an annual report to the nation regarding the current status of cancer in the U.S. The initial report in 1998 documented the first sustained decline in cancer death rates since national record-keeping was instituted in the 1930s.[1] Subsequent reports generally confirmed this finding and provided updates.[2–6] Last year's report focused on the use of surveillance data for cancer control. The current report provides incidence and mortality data for all cancers and the top 15 cancers among all races combined and in each major racial/ethnic population (whites, blacks, Asians/Pacific Islanders [API], American Indians/Alaska Natives [AI/AN], and Hispanics/Latinos). It also features a special section concerning cancer survival over time and by race/ethnicity (non-Hispanic whites, Hispanic whites, blacks, API, and AI/AN).

MATERIALS AND METHODS

Cancer Cases and Deaths

Information regarding newly diagnosed cancer cases in the U.S. is based on data collected by cancer registries participating in the NCI's Surveillance, Epidemiology, and End Results (SEER) Program or the CDC's National Program of Cancer Registries (NPCR). All registries are members of the NAACCR.[7] With the exception of bladder cancer, the data regarding incidence refer to invasive but not in situ cancers. Beginning with incident cases in 2001, all information concerning primary cancer site and histology was coded according to the third edition of the International Classification of Diseases for Oncology (ICD-O)[8] and categorized according to SEER site groups.[9] To ensure as much comparability as possible between the second and third revisions of the ICD-O, the following inclusions/exclusions were made: borderline tumors of the ovary, refractory anemias, and other myelodysplastic syndromes were excluded, whereas pilocytic astrocytomas were included. The site/histology categories presented for childhood survival are based on site first and then histology to be more comparable to the adult cancers; therefore, this listing is not equivalent to the International Classification of Childhood Cancer.[10] We defined childhood as age $<$ 20 years. When applicable, cancer cases were staged as either localized, regional, distant, or unknown according to SEER Summary Stage 1977.[11,12] Cases identified by death certificate or autopsy only were excluded from staging and survival.

Cancer deaths in the U.S., reported to state vital statistics offices and consolidated into a database by the CDC, through the National Vital Statistics System,[13] were coded according to the version of the International Classification of Diseases (ICD) in use in the U.S. at the time of death.[14–16] Beginning with 1999 mortality data, the tenth revision of the ICD (ICD-10) was used to code the cause of death. Under ICD-10 rules, cancer was slightly more likely to be selected as the underlying cause of death than under previous ICD rules.[17] Sites were grouped by SEER to allow for maximum comparability between versions of ICD codes.[9]

For the long-term trend analyses of the rates for all cancers and the 15 most common cancers among

all races/ethnicity combined, we used SEER incidence data from the 9 original registries (covering approximately 10% of the U.S. population)[18] and U.S. mortality data for 1975–2001. For the short-term trend analyses of the incidence and death rates for the 15 most common cancers in each major racial and ethnic population (whites, blacks, API, AI/AN, and Hispanics/Latinos), we used incidence data from 12 SEER cancer registries (covering approximately 14% of the U.S. population, including 12% of whites, 12% of blacks, 36% of API, 21% of AI/AN, and 22% of Hispanics/Latinos) and 100% of the U.S. population for cancer mortality data for 1992–2001. We examined incidence data for 23 cancers and mortality data for 22 cancers to accommodate the top 15 cancers for incidence rates and for death rates in each racial and ethnic population. Information regarding cancer incidence and death is collected on groups within the API and Hispanic/Latino populations but rates cannot be calculated because of the lack of intercensal county population estimates from the U.S. Census Bureau.

Changes in survival rates over time were examined for the top 15 cancers in males and females and for cancers common in children and adolescents (ages birth–19 years) using cancer cases diagnosed during 1975–1979 and 1995–2000 in the 9 SEER areas. For describing and comparing cancer survival rates among racial and ethnic populations, cancer cases diagnosed between 1992–2000 in the 12 SEER areas were used. For assessing geographic variations in stage distribution for cancers of the colon/rectum, female breast, cervix uteri, and prostate, we used incidence data reported to the NAACCR from 29 SEER and NPCR registries for 1996–2000 that met NAACCR criteria for high quality incidence data as of December 2003, covering 43% of the U.S. population.

Cancer Incidence and Death Rates

Rates were age-adjusted to the 2000 U.S. standard million population and expressed per 100,000 populations by use of population estimates from the U.S. Census Bureau. Estimates of rates, standard errors, and 95% confidence intervals were generated using SEER*Stat software.[18]

Statistical Analysis

The long-term trends (1975–2001) in cancer incidence and death rates among all races combined were described by joinpoint regression analysis, which involves fitting a series of joined straight lines on a log scale to the trends in the age-adjusted rates.[19] The resultant trends of varying time periods were described by annual percent change (i.e., the slope of the line segment). We present the incidence trends based on both the observed data and data with reporting adjustment. Reporting adjustment refers to the adjustment for the late arrival of new cancer cases to cancer registries after the standard reporting period for a diagnosis year as well as to changes and updates of data items such as demography and tumor characteristics for previously reported cases. This adjustment, which will be referred to as delay adjustment hereafter, is important because the most recent diagnosis year will have the largest underreporting of cases, with smaller amounts of underreporting for earlier diagnosis years. We use statistical models to adjust the current cancer count to account for anticipated future improvements to the data based on observed patterns in SEER registries.[20] Delay adjustment may affect the interpretation of current trends, especially for cancers frequently diagnosed in nonhospital settings such as melanoma, breast cancer, and prostate cancer. However, descriptions of long-term trends in the text are based on the observed data, except when specifically noted. For the short-term trend analyses in each racial and ethnic population, annual percent changes for a fixed time period (1992–2001) were estimated by fitting a linear regression line to the natural logarithms of the rates using calendar year as the independent variable.[3] In describing trends, the terms "increase" or "decrease" were used when the slope (coefficient) of the trend was statistically significant (two-sided $P < 0.05$) and the terms "stable" or "level" were used otherwise.

Changes in the 5-year relative survival rates for the top 15 cancers and childhood cancers were examined by a life table method for cases diagnosed between 1975–1979 and 1995–2000 and followed for vital status through December 31, 2001. We compared survival rates between these two periods by calculating absolute (1995–2000 rate minus 1975–1979 rate) and proportional (absolute change divided by the 1975–1979 rate) changes. Survival rates by race/ethnicity for the 23 cancers were described using cancer-specific survival rates instead of relative survival rates because reliable expected life tables are not available for the Hispanic white, AI/AN, and API populations to generate valid relative survival estimates. The Kaplan–Meier estimator[21] was used to estimate the 5-year cancer-specific survival. Both relative and cause-specific survival rates provide an estimate of the likelihood of surviving 5 years if the index cancer was the only cause of death, although the estimation methods differ as described elsewhere.[22] Differences in cancer survival among racial and ethnic populations (with non-Hispanic whites as the reference group) were assessed by computing relative risks (RRs) (i.e., hazard ratios) of cancer death, after controlling for age (all sites, brain

cancer, myeloma, and leukemia) or controlling for both age and tumor stage at the time of diagnosis (remaining sites) using Cox regression models, with a maximum of 5 years of follow-up.[23] Stratified Cox models were used to avoid the assumption of proportional hazards for age and tumor stage. SAS statistical software was used in the analysis, with two-sided P values < 0.05 considered to indicate statistical significance.[24] Note that the duration of survival was measured from date of diagnosis and that cases identified by death certificate or autopsy only were excluded from survival analyses because the survival duration was unknown or not applicable.

Additional data concerning cancer incidence and mortality are available from the following URL addresses: www.cancer.org (ACS); www.cdc.gov/cancer/npcr/index.htm and www.cdc.gov/nchs/about/major/dvs/mortdata.htm (CDC); and www.naaccr.org/CINAP/index.htm (NAACCR).

RESULTS

Update on the Long-Term Incidence Trends for All Cancers Combined and the Top 15 Cancer Sites for All Races

Overall cancer incidence rates for all racial and ethnic populations combined declined by 0.5% per year between 1991–2001 but stabilized between 1995–2001 when adjusted for delay in reporting (Table 1). Incidence rates for all cancers combined stabilized from 1995–2001 both in men and in women, but these rates increased in women by 0.3% per year since 1987 when adjusted for delay in reporting. For males, cancer incidence rates increased during the last time segment for prostate cancer, melanoma of the skin (melanoma), kidney and renal pelvis (kidney) cancer, and cancer of the esophagus and remained the same for urinary bladder (bladder) cancer, non-Hodgkin lymphoma (NHL), liver and intrahepatic bile duct (liver) cancer, and brain and other nervous system (brain) cancers. Incidence declined for the remaining top 15 cancer sites, which include lung and bronchus (lung), colon/rectum, oral cavity and pharynx (oral cavity), leukemia, stomach, pancreas, and larynx. When rates were adjusted for delayed reporting, the directions of trend changed, with a significant increase noted for bladder cancer and a stabilized trend for leukemia and pancreatic cancer reported. The incidence rates for prostate cancer have had large fluctuations in trend. Rates increased 2.6% per year between 1975–1988 with a more dramatic increase of 16.4% per year between 1988–1992. Between 1992–1995, rates decreased by 11.4% per year, followed by a much smaller increase of 1.4% per year from 1995 through 2001.

For females, increases in incidence among the top 15 cancers were limited to breast cancer, melanoma, thyroid cancer, bladder cancer, and kidney cancer. Female breast cancer increased 0.4% per year between 1987–2001, which is a slower rate of increase compared with that of the previous time period (1980–1987) of 3.7% per year. Trends in the remaining sites were declining or stable, except the NHL trend, which increased by 1.1% per year when rates were adjusted for delayed reporting. The increase in female lung cancer incidence slowed from 4.6% per year between 1975–1988 to 1.3% from 1988–1998, and most important, recently declined (1998–2001), although stabilizing rather than declining when rates were adjusted for reporting delay. Female colorectal cancer rates declined rapidly between 1985–1995, and then had a short period of stabilization followed by a recent (1998–2001) decline of 2.8% per year.

Update on the Long-Term Mortality Trends for All Cancers Combined and the Top 15 Cancer Sites for All Races

Overall cancer death rates for all racial and ethnic populations combined decreased by 1.1% per year from 1993–2001, with the decline found to be more pronounced in men (1.5% per year from 1993–2001) than in women (0.8% per year from 1992–2001) (Table 2). Mortality trends for the top 15 cancers differed slightly between men and women. Death rates decreased for 11 of the top 15 cancers in men and for 8 of the top 15 cancers in women. Rates increased for esophageal cancer (0.5% per year between 1994–2001) and liver cancer (1.4% per year between 1995–2001) in males, but for none of the top 15 cancers in females. Death rates leveled off for kidney cancer and melanoma in men and for 7 of the top 15 cancers in women. It is interesting to note that female lung cancer death rates between 1995–2001 leveled off for the first time after continuously increasing for many decades. Age-adjusted female lung cancer death rates (deaths per 100,000 females) were virtually unchanged in the last 5 years (40.3 in 1995 and 40.9 in 2001), in contrast with the greater than 2-fold increase reported from 17.6 in 1975 to 39.3 in 1994.

Incidence and Mortality by Race and Ethnicity (Whites, Blacks, API, AI/AN, and Hispanics/Latinos) between 1992–2001

The 15 most frequently occurring cancers by sex for incidence and mortality between 1992–2001 were ranked for all races combined and for each racial and ethnic population separately (Tables 3 and 4). Among men, cancers of the prostate, lung, and colon/rectum were the three most common incident cancers in rank order for every racial and ethnic population, except His-

TABLE 1
SEER Incidence Rate Trends with Joinpoint[a] Analyses for 1975 through 2001 for the Top 15 Cancers,[b] All Races

	Joinpoint analyses (1975–2001)[c]							
	Trend 1		Trend 2		Trend 3		Trend 4	
	Years	APC[d]	Years	APC[d]	Years	APC[d]	Years	APC[d]
All sites[e]								
Both sexes	1975–1983	0.9[f]	1983–1991	1.8[f]	1991–2001	−0.5[f]		
(Delay-adjusted)	1975–1989	1.2[f]	1989–1992	2.8	1992–1995	−2.1	1995–2001	0.4
Male	1975–1989	1.3[f]	1989–1992	5.1[f]	1992–1995	−4.6[f]	1995–2001	−0.2
(Delay-adjusted)	1975–1989	1.3[f]	1989–1992	5.2[f]	1992–1995	−4.7[f]	1995–2001	0.2
Female	1975–1979	−0.2	1979–1987	1.5[f]	1987–1999	0.3[f]	1999–2001	−1.8
(Delay-adjusted)	1975–1979	−0.2	1979–1987	1.5[f]	1987–2001	0.3[f]		
Top 15 for males								
Prostate	1975–1988	2.6[f]	1988–1992	16.4[f]	1992–1995	−11.4[f]	1995–2001	1.4[f]
(Delay-adjusted)	1975–1988	2.6[f]	1988–1992	16.5[f]	1992–1995	−11.5[f]	1995–2001	2.0[f]
Lung and bronchus	1975–1982	1.5[f]	1982–1992	−0.5[f]	1992–2001	−2.2[f]		
(Delay-adjusted)	1975–1982	1.4[f]	1982–1991	−0.4	1991–2001	−1.9[f]		
Colon and rectum	1975–1986	1.1[f]	1986–1995	−2.1[f]	1995–1998	1.0	1998–2001	−3.5[f]
(Delay-adjusted)	1975–1986	1.1[f]	1986–1995	−2.1[f]	1995–1998	1.1	1998–2001	−2.9[f]
Urinary bladder	1975–1987	0.9[f]	1987–2001	−0.1				
(Delay-adjusted)	1975–1987	1.0[f]	1987–1995	−0.5	1995–2001	0.9[f]		
Non-Hodgkin lymphoma	1975–1991	4.3[f]	1991–2001	−0.1				
(Delay-adjusted)	1975–1991	4.3[f]	1991–2001	0.1				
Melanoma of the skin	1975–1985	5.6[f]	1985–2001	3.1[f]				
Oral cavity and pharynx	1975–1993	−0.7[f]	1993–2001	−2.8[f]				
Leukemia	1975–1988	0.2	1988–2001	−0.7[f]				
(Delay-adjusted)	1975–2001	0.1						
Kidney and renal pelvis	1975–1987	2.3[f]	1987–2001	1.2[f]				
(Delay-adjusted)	1975–2001	1.8[f]						
Stomach	1975–1989	−1.2[f]	1989–2001	−2.2[f]				
(Delay-adjusted)	1975–1988	−1.1[f]	1988–2001	−2.1[f]				
Pancreas	1975–1978	−2.8	1978–2001	−0.5[f]				
(Delay-adjusted)	1975–1993	−0.8[f]	1993–2001	0.2				
Liver and intrahepatic bile duct	1975–1984	1.7	1984–1999	4.5[f]	1999–2001	−4.9		
(Delay-adjusted)	1975–1984	1.7	1984–1999	4.6[f]	1999–2001	−2.7		
Brain and other nervous system	1975–1989	1.2[f]	1989–2001	−0.5				
(Delay-adjusted)	1975–1989	1.2[f]	1989–2001	−0.3				
Esophagus	1975–2001	0.8[f]						
(Delay-adjusted)	1975–2001	0.8[f]						
Larynx	1975–1988	−0.2	1988–2001	−2.8[f]				
Top 15 for females								
Breast	1975–1980	−0.4	1980–1987	3.7[f]	1987–2001	0.4[f]		
(Delay-adjusted)	1975–1980	−0.4	1980–1987	3.7[f]	1987–2001	0.5[f]		
Lung and bronchus	1975–1988	4.6[f]	1988–1998	1.3[f]	1998–2001	−2.3[f]		
(Delay-adjusted)	1975–1982	5.5[f]	1982–1990	3.5[f]	1990–1998	1.1[f]	1998–2001	−1.3
Colon and rectum	1975–1985	0.3[f]	1985–1995	−1.9[f]	1995–1998	1.7	1998–2001	−2.8[f]
(Delay-adjusted)	1975–1985	0.3[f]	1985–1995	−1.9[f]	1995–1998	1.8	1998–2001	−2.3[f]
Corpus and uterus, NOS	1975–1979	−6.0[f]	1979–1988	−1.7[f]	1988–1998	0.6[f]	1998–2001	−1.5
Non-Hodgkin lymphoma	1975–1988	3.0[f]	1988–1998	1.5[f]	1998–2001	−1.6		
(Delay-adjusted)	1975–1990	2.9[f]	1990–2001	1.1[f]				
Ovary[e]	1975–1985	0.2	1985–2001	−0.8[f]				
(Delay-adjusted)[e]	1975–1985	0.2	1985–2001	−0.7[f]				
Melanoma of the skin	1975–1981	5.1[f]	1981–2001	2.2[f]				
Cervix uteri	1975–1982	−4.6[f]	1982–1990	−0.2	1990–2001	−2.5[f]		
(Delay-adjusted)	1975–1982	−4.5[f]	1982–1990	−0.2	1990–2001	−2.4[f]		
Pancreas	1975–1984	1.4[f]	1984–2001	−0.4[f]				
(Delay-adjusted)	1975–1984	1.3[f]	1984–2001	−0.3[f]				

(*continued*)

TABLE 1
(*continued*)

	Joinpoint analyses (1975–2001)[c]							
	Trend 1		Trend 2		Trend 3		Trend 4	
	Years	APC[d]	Years	APC[d]	Years	APC[d]	Years	APC[d]
Leukemia	1975–2001	−0.1						
(Delay-adjusted)	1975–1999	0.2[f]	1999–2001	5.0				
Thyroid	1975–1981	−1.3	1981–1993	2.1[f]	1993–2001	4.5[f]		
Urinary bladder	1975–2001	0.2[f]						
(Delay-adjusted)	1975–2001	0.2[f]						
Kidney and renal pelvis	1975–1992	2.7[f]	1992–2001	1.1[f]				
(Delay-adjusted)	1975–2001	2.3[f]						
Oral cavity and pharynx	1975–1980	2.6[f]	1980–2001	−1.0[f]				
Stomach	1975–1996	−1.9[f]	1996–1999	2.4	1999–2001	−9.0		
(Delay-adjusted)	1975–1996	−1.9[f]	1996–1999	2.5	1999–2001	−8.3		

Source: Nine SEER areas (San Francisco-Oakland, Connecticut, Detroit-Metropolitan, Hawaii, Iowa, New Mexico, Seattle-Puget Sound, Utah, and Atlanta-Metropolitan).

SEER: Surveillance, Epidemiology, and End Results Program; APC: annual percent change; NOS: not otherwise specified.

[a] Joinpoint (JP) Regression Program, Version 2.7. Sept. 2003, National Cancer Institute.

[b] The top 15 cancers were selected based on the sex-specific age-adjusted rate for 1992–2001 for all races combined.

[c] Joinpoint analyses with up to three joinpoints are based on rates per 100,000 age-adjusted to the 2000 U.S. standard population.

[d] Annual percent change based on rates that were age-adjusted to the 2000 U.S. standard population using joinpoint regression analysis.

[e] All sites excludes myelodysplastic syndromes and borderline tumors; ovary excludes borderline tumors.

[f] The annual percent change is statistically significantly different from zero (two-sided $P < 0.05$).

panics/Latinos, for whom colorectal cancer ranked ahead of lung cancer (Table 3). The same three sites (with lung first and prostate second) were the leading causes of cancer death among men in each population, except in API men, in whom colon/rectum and liver cancers ranked second and third, respectively (Table 4). Among women, the three leading cancer sites in rank order for incidence in each racial and ethnic population were breast, colon/rectum, and lung, except in white women, in whom lung cancer ranked second (Table 3). The same three sites (with lung first and breast second) were the leading causes of cancer death among women in each population, except Hispanic/Latina women, whose death rates for breast cancer were higher than for cancer of the lung (Table 4).

Examination of short-term trends in incidence by race and ethnicity between 1992–2001 revealed that rates for lung and prostate cancer were decreasing among men in all populations, except API men (only lung decreasing); colorectal cancer rates were decreasing only for white and API men (Table 3). Among females, breast cancer incidence rates were increasing in white and API women and were decreasing among AI/AN women; lung cancer rates also were decreasing in AI/AN women and were stable for the other populations.

Incidence trends for other cancer sites also varied by race/ethnicity and sex (Table 3). Trends for many sites cannot be examined among AI/AN men and women because of small numbers; these sites are not noted in the results. Among men, declines in stomach cancer and nonepithelial skin cancers were observed in all populations; cancers of the oral cavity and larynx also were reported to decrease in all populations except among API men. Cervical cancer rates were reportedly decreasing for women of all racial and ethnic populations except AI/AN women (annual percent change = -7.0; $P > 0.05$). Thyroid cancer rates were increasing among white, black, and Hispanic/Latina women, and kidney cancer increased among women of all racial and ethnic populations except among AI/AN women.

Analyses of short-term mortality trends revealed that death rates decreased in men for cancers of the lung, prostate, and colon/rectum in each racial and ethnic population, except for the lung in AI/AN men and the colon/rectum in AI/AN and Hispanic/Latino men (Table 4). Among women, death rates decreased for colorectal cancer in white, black, and API women and for breast cancer in white, black and Hispanic/Latina women, whereas rates increased for lung cancer in white women.

Mortality trends for cancer sites other than the top three sites also varied by race/ethnicity and sex (Table 4). Death rates for esophageal cancer increased among white men between 1992–2001 and decreased among black and Hispanic/Latino men. Stomach cancer death rates decreased in men and women of all racial and

TABLE 2
U.S. Death Rate Trends with Joinpoint[a] Analyses for 1975 through 2001 for the Top 15 Cancers,[b] All Races

	Joinpoint analyses (1975–2001)[c]							
	Trend 1		Trend 2		Trend 3		Trend 4	
	Years	APC[d]	Years	APC[d]	Years	APC[d]	Years	APC[d]
All sites								
Both sexes	1975–1990	0.5[e]	1990–1993	−0.3	1993–2001	−1.1[e]		
Male	1975–1979	1.0[e]	1979–1990	0.3[e]	1990–1993	−0.4	1993–2001	−1.5[e]
Female	1975–1992	0.5[e]	1992–2001	−0.8[e]				
Top 15 for males								
Lung and bronchus	1975–1982	1.8[e]	1982–1991	0.4[e]	1991–2001	−1.9[e]		
Prostate	1975–1987	0.9[e]	1987–1991	3.0[e]	1991–1994	−0.6	1994–2001	−4.1[e]
Colon and rectum	1975–1984	−0.1	1984–1990	−1.4[e]	1990–2001	−2.0[e]		
Pancreas	1975–1986	−0.8[e]	1986–2001	−0.3[e]				
Non-Hodgkin lymphoma	1975–1996	2.5[e]	1996–2001	−2.4[e]				
Leukemia	1975–1995	−0.2[e]	1995–2001	−0.8[e]				
Urinary bladder	1975–1983	−1.4[e]	1983–1987	−2.8[e]	1987–1993	0.1	1993–2001	−0.7[e]
Esophagus	1975–1985	0.7[e]	1985–1994	1.2[e]	1994–2001	0.5[e]		
Stomach	1975–1994	−2.1[e]	1994–2001	−3.7[e]				
Liver and intrahepatic bile duct	1975–1986	1.6[e]	1986–1995	4.0[e]	1995–2001	1.4[e]		
Kidney and renal pelvis	1975–1991	1.1[e]	1991–2001	−0.1				
Brain and other nervous system	1975–1977	4.4	1977–1982	−0.4	1982–1990	1.5[e]	1990–2001	−0.7[e]
Myeloma	1975–1994	1.5[e]	1994–2001	−1.1[e]				
Oral cavity and pharynx	1975–1993	−1.9[e]	1993–2001	−3.0[e]				
Melanoma of the skin	1975–1990	2.2[e]	1990–2001	0.1				
Top 15 for females								
Lung and bronchus	1975–1982	6.0[e]	1982–1990	4.2[e]	1990–1995	1.7[e]	1995–2001	0.2
Breast	1975–1990	0.4[e]	1990–2001	−2.3[e]				
Colon and rectum	1975–1984	−1.0[e]	1984–2001	−1.8[e]				
Pancreas	1975–1984	0.8[e]	1984–2001	0.1				
Ovary	1975–1982	−1.2[e]	1982–1992	0.3	1992–1998	−1.2[e]	1998–2001	0.8
Non-Hodgkin lymphoma	1975–1996	2.2[e]	1996–2001	−2.5[e]				
Leukemia	1975–1980	0.8	1980–2001	−0.4[e]				
Corpus and uterus, NOS	1975–1991	−1.6[e]	1991–2001	−0.2				
Brain and other nervous system	1975–1992	0.9[e]	1992–2001	−1.0[e]				
Stomach	1975–1987	−2.8[e]	1987–1990	−0.5	1990–2001	−2.6[e]		
Myeloma	1975–1993	1.5[e]	1993–2001	−0.4				
Cervix uteri	1975–1982	−4.4[e]	1982–1996	−1.6[e]	1996–2001	−3.8[e]		
Liver and intrahepatic bile duct	1975–1987	0.8[e]	1987–1995	3.8[e]	1995–2001	0.3		
Kidney and renal pelvis	1975–1992	1.3[e]	1992–2001	−0.5				
Urinary bladder	1975–1977	2.1	1977–1985	−2.2[e]	1985–2001	−0.4[e]		

Source: National Center for Health Statistics public-use data file for the total U.S.

APC: annual percent change; NOS: not otherwise specified.

[a] Joinpoint Regression Program, Version 2.7. Sept. 2003, National Cancer Institute.

[b] The top 15 cancers were selected based on the sex-specific age-adjusted rate for 1992–2001 for all races combined.

[c] Joinpoint analyses with up to three joinpoints are based on rates per 100,000 age-adjusted to the 2000 U.S. standard population.

[d] Annual percent change based on rates that were age-adjusted to the 2000 U.S. standard population using joinpoint regression analysis.

[e] The annual percent change is statistically significantly different from zero (two-sided $P < 0.05$).

ethnic populations except for Hispanic/Latina women and AI/AN men and women. Similarly, cancers of the oral cavity among men and women decreased in all populations, except for AI/AN men and women, API women, and Hispanic/Latina women. Finally, death rates for cancers of the gallbladder decreased among white, API, and Hispanic/Latina women, and cervical cancer death rates decreased in all populations.

Cancer in the white population

Among women, white women had the highest cancer incidence rates for all cancer sites combined (Table 3). The incidence rates for cancers of the

TABLE 3
SEER Incidence Rates and Trends for the Top 15 Cancers[a] by Sex and Race/Ethnicity for 1992–2001

	All races			Whites			Blacks			API			AI/AN			Hispanics/Latinos[b]		
Sex/cancer site	Rank	Rate	APC	Rank	Rate	APC	Rank	Rate	APC	Rank	Rate	APC	Rank	Rate	APC	Rank	Rate	APC
Male																		
All sites[c]		572.0	−1.6[d]		573.5	−1.5[d]		719.0	−1.9[d]		395.8	−1.3[d]		286.3	−3.9[d]		431.3	−1.2[d]
Prostate	1	180.3	−2.5[d]	1	175.6	−2.6[d]	1	284.6	−2.3[d]	1	105.0	−1.9	1	62.9	−7.9[d]	1	143.0	−1.1[d]
Lung and bronchus	2	83.5	−2.3[d]	2	82.2	−2.3[d]	2	124.5	−2.6[d]	2	61.6	−1.3[d]	2	51.7	−4.3[d]	3	47.9	−2.7[d]
Colon and rectum	3	64.5	−1.1[d]	3	64.4	−1.2[d]	3	72.9	−0.6	3	56.9	−0.7[d]	3	40.8	−2.8	2	48.8	0.5
Urinary bladder	4	36.1	−0.1	4	39.7	0.0	5	20.2	−0.3	7	16.3	0.1	8	8.9	—	5	18.9	−0.6
Non-Hodgkin lymphoma	5	23.7	−0.5	5	24.8	−0.5	7	18.8	−1.5	6	16.7	0.3	7	9.4	—	4	19.4	−1.4
Melanoma of the skin	6	20.2	2.7[d]	6	23.6	3.2[d]	23	1.3	—	21	1.6	1.7	19	2.2	—	17	4.1	3.4[d]
Oral cavity and pharynx	7	16.7	−2.4[d]	8	16.5	−2.2[d]	4	21.4	−3.4[d]	8	12.7	−2.3	6	12.3	−7.8[d]	11	10.6	−3.4[d]
Leukemia	8	16.3	−1.3[d]	7	17.3	−1.3[d]	11	13.0	−1.2	10	9.8	−0.1	12	5.3	—	9	11.8	−0.9
Kidney and renal pelvis	9	15.3	1.3[d]	9	15.7	1.4[d]	8	18.1	1.9	11	8.8	0.4	4	15.0	−5.9[d]	7	14.4	1.4
Stomach	10	13.3	−2.3[d]	11	11.5	−2.3[d]	6	20.0	−2.6[d]	4	23.5	−3.5[d]	5	14.3	—	6	18.8	−2.8[d]
Pancreas	11	12.7	−0.4	10	12.4	0.0	9	17.9	−2.0[d]	9	10.8	−2.9[d]	10	7.6	—	10	10.7	−1.3
Liver and intrahepatic bile duct	12	8.5	3.2[d]	15	6.7	3.2[d]	14	10.7	4.6[d]	5	20.7	0.8	9	8.7	—	8	13.1	1.9
Brain and other nervous system	13	7.7	−0.7	12	8.5	−0.5	16	4.7	0.1	14	4.2	−0.9	15	3.0	—	14	5.7	0.4
Esophagus	14	7.6	0.5	13	7.3	1.9[d]	13	12.6	−5.8[d]	12	5.2	−1.3	11	5.7	—	13	6.0	−0.4
Larynx	15	7.3	−3.4[d]	14	7.2	−3.3[d]	12	12.9	−2.9[d]	16	3.5	−2.8	20	2.0	—	15	5.7	−1.5[d]
Myeloma	16	7.0	−1.0	16	6.7	−0.7	10	13.3	−1.7	13	4.2	−2.1	13	4.1	—	12	6.4	−1.8
Other nonepithelial skin[e]	17	6.3	−13.3[d]	17	6.5	−14.2[d]	15	6.9	−10.4[d]	20	2.0	−9.9[d]	18	2.4	—	16	5.4	−19.1[d]
Thyroid	19	3.6	2.4[d]	19	3.8	2.8[d]	20	2.1	0.8	15	3.8	0.7	21	1.9	—	21	2.8	1.8
Gallbladder	29	0.9	−2.2	31	0.8	−1.7	30	0.8	—	22	1.4	−5.7	14	3.0	—	25	1.3	−0.2
Female																		
All sites[c]		411.8	0.1		425.1	0.3		401.9	−0.4		300.0	0.2		228.7	−1.7[d]		309.4	−0.1
Breast	1	132.5	0.6[d]	1	138.3	0.8[d]	1	120.3	−0.3	1	92.2	1.7[d]	1	60.4	−3.7[d]	1	88.3	0.7
Lung and bronchus	2	49.2	−0.2	2	51.3	−0.2	3	53.7	0.5	3	28.3	−0.1	3	25.9	−3.1[d]	3	24.4	−1.5
Colon and rectum	3	46.6	−0.5	3	46.1	−0.6	2	56.1	0.0	2	39.0	−0.4	2	32.1	−0.9	2	32.5	−0.1
Corpus and uterus, NOS	4	24.5	−0.1	4	26.1	−0.1	4	18.0	0.9	4	16.8	1.4[d]	4	9.9	—	5	16.5	0.5
Non-Hodgkin lymphoma	5	15.4	0.8[d]	5	16.2	0.8[d]	7	10.8	2.9[d]	7	11.1	1.3	10	6.9	—	6	13.3	0.6
Ovary[c]	6	14.2	−1.0[d]	7	15.1	−0.8[d]	8	10.3	−1.6	9	10.2	−0.6	5	9.2	—	7	11.7	−1.0
Melanoma of the skin	7	13.0	2.5[d]	6	15.6	3.2[d]	29	0.8	—	21	1.3	4.5	19	1.9	—	17	4.1	3.3[d]
Cervix uteri	8	9.9	−2.6[d]	12	9.4	−2.2[d]	6	12.8	−3.1[d]	8	10.9	−4.7[d]	9	6.9	−7.0	4	17.7	−3.3[d]
Pancreas	9	9.9	−0.6	11	9.6	−0.6	5	14.7	−2.5[d]	10	8.2	2.3[d]	8	7.1	—	10	9.3	−0.4
Leukemia	10	9.6	−0.8[d]	8	10.1	−0.5	12	8.1	−0.5	12	6.3	−2.9[d]	13	4.4	—	12	7.6	−1.3
Thyroid	11	9.5	4.3[d]	10	9.8	4.8[d]	15	5.2	3.8[d]	6	11.4	1.3	12	5.8	2.6	9	9.5	2.5[d]
Urinary bladder	12	9.2	−0.5[d]	9	9.9	−0.4[d]	13	7.5	0.3	14	4.4	0.2	18	2.1	—	14	5.1	−1.1
Kidney and renal pelvis	13	7.6	1.5[d]	13	7.8	1.4[d]	11	9.0	2.8[d]	15	4.1	3.1[d]	6	8.1	—	11	7.7	3.0[d]
Oral cavity and pharynx	14	6.7	−1.4[d]	14	6.7	−1.5[d]	14	6.5	−2.1	13	5.8	−0.2	14	4.0	—	18	4.0	−1.5
Stomach	15	6.2	−0.9	16	5.1	−1.3	10	9.7	0.0	5	13.2	−2.7[d]	7	7.6	—	8	10.2	−1.2
Brain and other nervous system	16	5.4	−0.6	15	5.9	−0.3	18	3.5	−0.9	16	2.9	−3.6[d]	20	1.7	—	15	4.5	−0.1
Myeloma	17	4.7	−0.6	17	4.3	−0.7	9	10.3	−1.6	17	2.8	2.7	16	3.1	—	16	4.4	−0.7
Liver and intrahepatic bile duct	18	3.2	3.3[d]	19	2.6	3.9[d]	17	3.6	1.9	11	7.8	−0.9	11	5.8	—	13	5.3	4.3[d]
Gallbladder	23	1.6	−1.8[d]	23	1.6	−1.6	24	1.6	−1.5	20	1.7	−3.8	15	3.8	—	19	4.0	−4.2[d]

Source: 12 SEER areas (San Francisco-Oakland SMSA, Connecticut, Detroit-Metropolitan, Hawaii, Iowa, New Mexico, Seattle-Puget Sound, Utah, Atlanta-Metropolitan, San Jose-Monterey, Los Angeles, and Alaska).
SEER: Surveillance, Epidemiology, and End Results Program; APC: annual percent change, API: Asian/Pacific Islander; AI/AN: American Indian/Alaska Native; NOS: not otherwise specified.

[a] Cancers are sorted in descending order according to sex-specific rates for all races. More than 15 cancers may appear under male and female to include the top 15 cancers in every racial and ethnic group.

[b] Data for Hispanics/Latinos excludes cases diagnosed in Detroit and Hawaii.

[c] All sites excludes myelodysplastic syndromes and borderline tumors; ovary excludes borderline tumors.

[d] The annual percent change is statistically significantly different from zero (two-sided $P < 0.05$).

[e] For other nonepithelial skin for males, 70% is Kaposi sarcoma, 68% for white males and 86% for black males.

–Statistic could not be calculated. The annual percent change is based on fewer than 10 cases for at least 1 year within the time interval.

TABLE 4
U.S. Death Rates and Trends for the Top 15 Cancers[a] by Sex and Race/Ethnicity for 1992–2001

	All races			Whites			Blacks			API			AI/AN			Hispanics/Latinos[b]		
Sex/cancer site	Rank	Rate	APC	Rank	Rate	APC	Rank	Rate	APC	Rank	Rate	APC	Rank	Rate	APC	Rank	Rate	APC
Male																		
All sites		260.6	−1.5[c]		254.3	−1.4[c]		364.7	−1.9[c]		157.9	−1.9[c]		168.1	−0.7		177.1	−0.8[c]
Lung and bronchus	1	81.6	−1.9[c]	1	80.0	−1.7[c]	1	110.7	−2.4[c]	1	41.6	−1.7[c]	1	51.0	−1.8	1	40.9	−1.4[c]
Prostate	2	34.6	−3.6[c]	2	31.8	−3.7[c]	2	74.9	−2.3[c]	4	14.7	−4.8[c]	2	22.3	−3.9[c]	2	25.0	−2.3[c]
Colon and rectum	3	26.6	−2.1[c]	3	26.1	−2.2[c]	3	35.0	−0.8[c]	2	16.4	−1.8[c]	3	16.1	2.5	3	18.1	−0.1
Pancreas	4	12.3	−0.3[c]	4	12.0	−0.1	4	16.6	−1.6[c]	6	8.5	−2.2[c]	7	6.2	1.8	6	9.5	−0.5
Non-Hodgkin lymphoma	5	10.5	−0.3	5	10.9	−0.3	11	7.5	−0.3	7	6.8	−1.4	8	5.4	5.0[c]	7	8.1	−0.4
Leukemia	6	10.4	−0.7[c]	6	10.7	−0.6[c]	7	9.4	−1.1[c]	8	5.5	−1.2	9	5.2	−3.9	8	6.7	0.7
Urinary bladder	7	7.7	−0.6[c]	7	8.0	−0.5[c]	13	5.9	−2.2[c]	11	2.9	0.3	13	2.5	1.1	11	4.2	−0.8
Esophagus	8	7.6	0.7[c]	8	7.1	1.7[c]	6	13.2	−4.3[c]	10	3.7	−3.1	10	4.7	0.9	10	4.5	−1.2[c]
Stomach	9	7.2	−3.4[c]	9	6.4	−3.6[c]	5	14.3	−2.9[c]	5	13.0	−3.5[c]	5	7.6	−1.2	5	10.1	−2.0[c]
Liver and intrahepatic bile duct	10	6.4	2.0[c]	12	5.8	2.1[c]	9	9.1	1.1	3	15.9	−0.8	4	7.7	2.5	4	10.1	1.7[c]
Kidney and renal pelvis	11	6.2	−0.1	10	6.2	−0.1	12	6.2	0.5	12	2.7	0.8	6	6.7	−0.4	9	5.5	0.8
Brain and other nervous system	12	5.7	−0.7[c]	11	6.1	−0.6[c]	15	3.3	−0.8[c]	13	2.3	1.8	14	2.5	3.0	13	3.5	0.6
Myeloma	13	4.8	−0.6	13	4.5	−0.4	8	9.2	−1.0[c]	14	2.2	−1.8	12	3.5	−1.8	12	3.8	0.5
Oral cavity and pharynx	14	4.6	−2.8[c]	15	4.2	−2.5[c]	10	8.4	−4.4[c]	9	3.9	−2.5[c]	11	3.7	−1.0	14	3.3	−4.2[c]
Melanoma of the skin	15	3.9	0.0	14	4.4	0.2	23	0.5	−0.7	20	0.5	−3.8	19	0.8	0.3	17	1.1	0.5
Larynx	16	2.7	−2.3[c]	16	2.5	−2.2[c]	14	5.8	−2.8[c]	16	1.0	1.1	15	2.0	5.7	15	2.3	−2.0
Soft tissue including heart	17	1.6	−0.9	17	1.6	−0.9	16	1.6	0.3	15	1.1	−3.4	18	0.9	−7.0	16	1.2	−1.7
Female																		
All sites		169.9	−0.7[c]		168.6	−0.7[c]		200.1	−0.8[c]		103.0	−1.1[c]		115.1	−0.4		112.4	−0.3[c]
Lung and bronchus	1	40.2	0.6[c]	1	41.0	0.7[c]	1	39.2	0.4	1	19.2	0.1	1	26.2	1.0	2	14.8	0.1
Breast	2	28.8	−2.4[c]	2	28.3	−2.6[c]	2	36.4	−1.2[c]	2	12.9	−0.9	2	14.5	−1.8	1	17.9	−1.8[c]
Colon and rectum	3	18.5	−1.7[c]	3	18.0	−1.8[c]	3	24.9	−0.7[c]	3	11.4	−2.1[c]	3	12.0	−0.8	3	11.5	0.2
Pancreas	4	9.2	−0.1	5	8.9	0.0	4	12.9	−0.7[c]	5	6.7	0.6	4	6.0	−0.9	4	7.5	0.1
Ovary	5	9.0	−0.6[c]	4	9.3	−0.5[c]	5	7.6	−0.9[c]	7	4.7	−0.5	5	5.1	−0.1	5	6.3	−0.6
Non-Hodgkin lymphoma	6	6.9	−0.5	6	7.2	−0.5	11	4.5	−0.2	8	4.2	−0.6	8	4.0	5.1[c]	7	5.3	0.1
Leukemia	7	6.0	−0.5[c]	7	6.1	−0.4[c]	10	5.5	−0.8[c]	9	3.4	−1.4	10	3.4	−1.2	9	4.4	−0.4
Corpus and uterus, NOS	8	4.1	−0.2	9	3.9	−0.2	6	7.0	−0.1	11	2.2	0.4	13	2.5	−1.8	11	3.2	0.4
Brain and other nervous system	9	3.8	−1.1[c]	8	4.1	−1.0[c]	16	2.3	−0.5	12	1.6	−3.1	15	1.6	2.1	13	2.5	0.8
Stomach	10	3.5	−2.6[c]	10	3.0	−2.8[c]	7	6.7	−2.3[c]	4	7.7	−3.6[c]	6	4.1	−1.4	6	5.5	−1.6
Myeloma	11	3.2	−0.3	11	2.9	−0.3	8	6.6	−0.1	13	1.5	0.9	12	2.7	3.1	12	2.7	1.6
Cervix uteri	12	3.1	−3.0[c]	13	2.7	−2.5[c]	9	6.3	−5.1[c]	10	3.0	−2.7[c]	11	3.2	−5.9[c]	10	3.9	−2.9[c]
Liver and intrahepatic bile duct	13	2.9	1.2[c]	14	2.7	1.1[c]	12	3.7	1.1	6	6.6	−0.4	7	4.1	2.5	8	4.8	2.4[c]
Kidney and renal pelvis	14	2.8	−0.4	12	2.9	−0.4	15	2.8	−0.1	15	1.2	1.6	9	3.4	−1.7	14	2.5	−0.6
Urinary bladder	15	2.3	−0.6[c]	15	2.3	−0.5	14	3.0	−1.0	16	1.1	−3.0	18	1.0	−3.0	16	1.3	0.4
Esophagus	17	1.8	0.0	18	1.6	0.8[c]	13	3.5	−3.3[c]	18	0.9	−1.9	17	1.1	7.8	18	0.9	2.2
Oral cavity and pharynx	18	1.7	−2.5[c]	17	1.7	−2.3[c]	17	2.2	−3.3[c]	14	1.4	−2.7	16	1.2	−2.6	19	0.9	0.0
Gallbladder	20	1.0	−2.4[c]	20	0.9	−2.5[c]	19	1.0	−1.0	17	1.1	−5.8[c]	14	1.8	−2.3	15	1.9	−2.7[c]

Source: National Center for Health Statistics public-use data file for the total U.S.

APC: annual percent change; API: Asian/Pacific Islander; AI/AN: American Indian/Alaska Native; NOS: not otherwise specified.

[a] Cancers are sorted in descending order according to sex-specific rates for all races. More than 15 cancers may appear under male and female to include the top 15 cancers in every racial and ethnic group.

[b] Data for Hispanics/Latinos excludes Connecticut, Maine, Maryland, New Hampshire, New York, North Dakota, Oklahoma, and Vermont.

[c] The annual percent change is statistically significantly different from zero (two-sided $P < 0.05$).

–Statistic could not be calculated. The annual percent change is based on fewer than 10 cases for at least 1 year within the time interval.

female breast and bladder, NHL, melanoma, leukemia, brain cancer, cancer of the corpus uterus (corpus), cancer of the ovary, and cancer of the oral cavity (females only) were higher in white men and women than in other racial and ethnic populations, with melanoma rates being substantially higher. The rate of bladder cancer in white men (39.7 cases per 100,000 men) was nearly twice that of black men (20.2 cases). Of the top 15 causes of cancer deaths in white men and women, rates of lung cancer (women only), cancer of the ovary, bladder cancer (men only), NHL, leukemia, brain cancer, and melanoma were higher than in all other racial and ethnic populations (Table 4).

Cancer in the black population

Among men, black men had the highest cancer incidence and death rates for all cancer sites combined and for cancers of the prostate, lung, colon/rectum, oral cavity, stomach (mortality only), kidney (incidence only), pancreas, esophagus, larynx, and myeloma (Tables 3 and 4). The age-adjusted rate of prostate cancer incidence in black men was 62% higher, and the death rate was more than twice that of white men, who have the second highest incidence and death rates of all racial and ethnic populations studied. Black women had the highest death rates for all sites combined and the highest incidence and death rates for the following sites: breast (mortality only), colon/rectum, lung (incidence only), kidney (incidence only), oral cavity (mortality only), pancreas, esophagus, myeloma, corpus (mortality only), cervix uteri (mortality only), and bladder (mortality only). The incidence and death rates for myeloma in black men and women were approximately double the rates for white men and women. Female breast cancer death rates were nearly 30% higher in the black population than in the white population, despite lower incidence rates.

Cancer in the API population

The incidence rates for cancers of the stomach, liver, and thyroid (women only) were higher in API populations than in other racial and ethnic populations. Cancer death rates were higher for cancers of the liver and stomach (women only). The liver cancer incidence rate for males was 20.7 compared with 13.1 for Hispanics/Latinos, the population with the next highest rate.

Cancer in the AI/AN population

The death rate for kidney cancer in AI/AN men and women was higher than in other racial and ethnic populations. Although death rates from cancers of the liver and stomach among AI/AN men were lower than for other populations (with the exception of white men), these sites had ranks of 4 and 5, respectively, for cancer mortality among AI/AN men. Similarly, although the rates of ovarian cancer incidence in AI/AN women were lower than in other populations, ovarian cancer was the fifth most common cancer type in AI/AN women, the highest ranking for ovarian cancer in any racial or ethnic population.

Cancer in the Hispanic/Latino population

The incidence rates for cancers of the cervix uteri and gallbladder and the death rate for cancer of the gallbladder were higher in Hispanic/Latina women than among other racial and ethnic populations. The incidence rate for cancer of cervix uteri in this population (17.7) ranked 4th and was 38% higher than the rate for black women (12.8), the population with the next highest rate.

Changes in Survival Rates over Time

The absolute and proportional changes in survival for cancer of all sites combined, all ages, was substantially greater for men than for women, although the current survival rates generally were similar (Table 5). In men, cancers that demonstrated a large absolute gain ($\geq$ 10%) in survival were all sites combined, cancer of the prostate, colon/rectum cancer, NHL, melanoma, leukemia, and kidney cancer; survival for cancers of the bladder, oral cavity, stomach, liver, brain, and esophagus showed gains of 5–9.9%. In women, cancers that demonstrated a large absolute gain ($\geq$ 10%) in survival were cancer of the colon/rectum, NHL, kidney cancer, and breast cancer; survival for cancer of all cancers combined, bladder cancer, melanoma, oral cavity cancer, leukemia, stomach cancer, brain cancer, cancer of the esophagus, and cancer of the ovary demonstrated gains of 5–9.9%. Improvement in survival was limited for the most fatal cancers in adults (a 5-year survival rate of $<$ 20%), which included cancers of the lung, pancreas, liver, and esophagus. These cancers are characterized by a late stage at the time of diagnosis and/or relatively poor survival even when diagnosed at localized stage (Table 6). Several sites with high survival rates (larynx and thyroid) and cancers of the corpus and cervix uteri showed little or no gain. Between 1975–1979 and 1995–2000, survival also improved for several less common cancers not listed in Table 5, including testicular cancer (85–96%) and Hodgkin lymphoma (74–85%).

Survival rates for childhood cancers demonstrated some of the largest improvements, with an absolute survival increase of 20% in boys and 13% in girls between 1975–1979 and 1995–2000 (Table 5). The 5-year relative survival rates in 1995–2000 varied according to type of cancer, from $<$ 50% for acute myeloid leukemia in boys to $>$ 95% for Hodgkin lymphoma in both boys and girls.

Stage-Specific Survival and Stage Distributions and Geographic Variations

For most specific cancers, patients diagnosed at an earlier stage of disease had higher 5-year survival rates than those diagnosed at more advanced stages in the 9 SEER areas (Table 6). There were 9 cancer sites in which $\geq$ 50% of cases were diagnosed at a localized stage, including the prostate, urinary bladder, melanoma, kidney, larynx, thyroid, breast, corpus, and cervix uteri. In contrast, the majority of lung (53%) and ovarian (68%) cancers were diagnosed at a distant stage.

TABLE 5
Trends in SEER 5-Year Relative Survival Rates[a] for the Top 15 Cancers[b] for All Ages and Childhood Cancers, by Sex, 1975–1979 to 1995–2000

	Male				Female			
	Survival rate (%)		Change (%)		Survival rate (%)		Change (%)	
Cancer site	1975–1979	1995–2000	Absolute[c]	Proportional[c]	1975–1979	1995–2000	Absolute[c]	Proportional[c]
All ages								
All sites[d]	42.7	64.0[e]	21.3	49.9	56.6	64.3[e]	7.7	13.6
Prostate	70.0	99.3[e]	29.3	41.9	—	—	—	—
Lung and bronchus	11.6	13.6[e]	2.0	17.2	16.6	17.2[e]	0.6	3.6
Colon and rectum	50.3	63.7[e]	13.4	26.6	52.3	63.1[e]	10.8	20.7
Urinary bladder	75.7	83.7[e]	8.0	10.6	70.6	76.2[e]	5.6	7.9
Non-Hodgkin lymphoma	46.8	57.0[e]	10.2	21.8	49.9	61.7[e]	11.8	23.6
Melanoma of the skin	77.5	89.0[e]	11.5	14.8	86.5	92.2[e]	5.7	6.6
Oral cavity and pharynx	51.8	57.4[e]	5.6	10.8	56.1	61.5[e]	5.4	9.6
Leukemia	34.8	47.0[e]	12.2	35.1	37.2	45.7[e]	8.5	22.8
Kidney and renal pelvis	51.8	63.9[e]	12.1	23.4	51.3	63.9[e]	12.6	24.6
Stomach	15.2	22.1[e]	6.9	45.4	17.8	25.4[e]	7.6	42.7
Pancreas	2.6	4.2[e]	1.6	61.5	2.5	4.6[e]	2.1	84.0
Liver and intrahepatic bile duct	2.2	7.7[e]	5.5	250.0	6.4	9.6[e]	3.2	50.0
Brain and other nervous system	22.8	32.7[e]	9.9	43.4	26.0	33.4[e]	7.4	28.5
Esophagus	4.3	14.2[e]	9.9	230.2	6.4	14.7[e]	8.3	129.7
Larynx	66.4	66.7	0.3	0.5	63.5	59.6	−3.9	−6.1
Breast (female)	—	—	—	—	74.9	87.7[e]	12.8	17.1
Corpus and uterus, NOS	—	—	—	—	86.4	84.4[e]	−2.0	−2.3
Ovary[d]	—	—	—	—	37.6	44.0[e]	6.4	17.0
Cervix uteri	—	—	—	—	69.0	72.7[e]	3.7	5.4
Thyroid	91.4	93.4	2.0	2.2	93.5	97.3[e]	3.8	4.1
Age 0–19 years (childhood cancers)								
All sites[d]	57.6	77.1[e]	19.5	33.9	68.3	81.0[e]	12.7	18.6
Bone and joint	43.3	71.1[e]	27.8	64.2	56.5	63.6	7.1	12.6
Brain and ONS	56.8	71.8[e]	15.0	26.4	60.2	75.3[e]	15.1	25.1
Hodgkin lymphoma	85.8	96.4[e]	10.6	12.4	88.2	95.8[e]	7.6	8.6
Leukemia	44.2	74.5[e]	30.3	68.6	53.3	77.5[e]	24.2	45.4
ALL	52.0	82.0[e]	30.0	57.7	63.5	83.8[e]	20.3	32.0
AML	22.8	45.5[e]	22.7	99.6	20.5	54.2[e]	33.7	164.4
Neuroblastoma	51.6	65.5[e]	13.9	26.9	56.6	65.7[e]	9.1	16.1
Non-Hodgkin lymphoma	42.1	78.5[e]	36.4	86.5	57.9	82.4[e]	24.5	42.3
Soft tissue	62.4	73.2[e]	10.8	17.3	69.6	70.8	1.2	1.7
Wilms tumor	72.7	92.2[e]	19.5	26.8	76.3	91.9[e]	15.6	20.4

Source: 9 SEER areas (San Francisco-Oakland, Connecticut, Detroit-Metropolitan, Hawaii, Iowa, New Mexico, Seattle-Puget Sound, Utah, and Atlanta-Metropolitan).

SEER: Surveillance, Epidemiology, and End Results Program; NOS: not otherwise specified; ONS: other nervous system; ALL: acute lymphocytic leukemia; AML: acute myeloid leukemia.

[a] Survival rates are based on follow-up of patients through 2001.

[b] Top 15 cancers includes the top 15 cancers for males and the top 15 cancers for females based on the age-adjusted rate for 1992–2001 for all races combined.

[c] Absolute change refers to 1995–2000 rate minus 1975–1979 rate whereas proportional change refers to the absolute change divided by the 1975–1979 rate.

[d] All sites excludes myelodysplastic syndromes and borderline tumors; ovary excludes borderline tumors.

[e] The difference in rates between 1975–1979 and 1995–2000 is statistically significant ($P < 0.05$).

–Survival rate not applicable.

The stage distributions for colorectal, breast, cervical, and prostate cancers are shown by state in Table 7. The combined stage distributions for the 4 specific cancers among these 29 registries showed lower proportions of early stages and higher proportions of distant and unknown stages (Table 7) than those reported in the SEER Program (Table 6). Furthermore, the stage distributions varied by geographic area for each of the four cancers. The proportion of localized disease ranged from 28.5% in Nebraska to 44.4% in Hawaii for colorectal cancer, from 56.5% in Wyoming to 70.2% in Hawaii for female breast cancer, from 44.7% in Arizona to 62.5% in Utah for cervical cancer, and from 68.1% in Rhode Island to 95.5% in Utah for prostate cancer. The proportion of unknown stages of disease also varied by state for each of the four cancers.

TABLE 6
SEER 5-Year Relative Survival Rates[a] and Stage Distribution[b] for the Top 15 Cancer Sites,[c] 1995–2000

	5-year relative survival rate (%)					Stage distribution				
	All stages 5-yr rate(%)	Localized 5-yr rate(%)	Regional 5-yr rate(%)	Distant 5-yr rate(%)	Unstaged 5-yr rate(%)	All stages cases	Localized %	Regional %	Distant %	Unstaged %
All sites[d]	64.1	—	—	—	—	581,649	—	—	—	—
Prostate	99.3	100.0	e	33.5	81.3	96,225	90.2	e	5.2	4.5
Lung and bronchus	15.2	48.8	22.8	3.3	8.7	75,341	16.4	20.3	53.0	10.3
Colon and rectum	63.4	90.5	67.9	9.4	35.2	63,334	37.0	39.0	18.9	5.1
Urinary bladder	81.7	89.7	36.9	5.5	59.0	23,885	85.2	7.9	3.3	3.5
Non-Hodgkin lymphoma	59.1	71.5	63.5	47.7	66.3	24,126	32.0	13.4	45.4	9.2
Melanoma of the skin	90.5	95.8	52.4	16.2	76.1	21,045	87.9	4.4	3.4	4.4
Oral cavity and pharynx	58.7	80.4	50.2	31.6	46.5	13,249	36.4	43.5	11.7	8.4
Leukemia	46.4	—	—	—	—	15,233	—	—	—	—
Kidney and renal pelvis	63.9	90.9	59.7	9.5	31.6	13,092	52.4	19.8	22.0	5.8
Stomach	23.3	59.9	23.9	3.3	12.6	10,067	22.5	31.2	33.3	13.0
Pancreas	4.4	15.2	6.3	1.6	3.8	13,212	7.5	29.3	47.2	15.9
Liver and intrahepatic bile duct	8.3	18.4	6.8	4.0	3.1	6,457	29.5	11.9	35.5	23.1
Brain and other nervous system	33.0	—	—	—	—	8,758	—	—	—	—
Esophagus	14.3	29.3	13.6	3.1	11.0	5,485	26.1	28.4	27.2	18.2
Larynx	65.1	80.0	42.3	37.5	54.5	4,937	61.7	18.3	16.1	3.9
Thyroid	96.5	99.6	95.8	68.3	87.8	9,436	65.4	23.8	7.7	3.1
Breast (females)	87.7	97.5	79.1	20.4	56.7	91,516	63.4	29.7	4.4	2.5
Corpus and uterus, NOS	84.4	95.8	67.0	22.5	56.0	17,250	72.0	16.1	7.5	4.4
Ovary[c]	44.0	94.2	77.6	28.5	23.9	9,645	15.0	10.3	68.0	6.6
Cervix uteri	72.7	92.2	55.1	17.2	59.2	6,321	55.2	30.0	8.7	6.1

Source: 9 SEER areas (San Francisco-Oakland, Connecticut, Detroit-Metropolitan, Hawaii, Iowa, New Mexico, Seattle-Puget Sound, Utah, and Atlanta-Metropolitan).

SEER: Surveillance, Epidemiology, and End Results Program; NOS: not otherwise specified.

[a] Survival rates are based on follow-up of patients through 2001.

[b] Cases were staged according to SEER Summary Stage 1977. Cases based on death certificate only and autopsy were excluded.

[c] Top 15 cancers includes the top 15 cancers for males and the top 15 cancers for females based on the age-adjusted rate for 1992–2001 for all races combined.

[d] All sites excludes myelodysplastic syndromes and borderline tumors; ovary excludes borderline tumors.

[e] Localized/regional stages are combined for prostate cases and reported under the "Localized" heading.

–Stage not applicable.

Survival Rates by Race and Ethnicity

For all cancers combined, cancer-specific survival rates at 5 years after diagnosis ranged from 53.9% (AI/AN) to 67.6% (non-Hispanic whites) among men and from 57.0% (blacks) to 68.7% (API) among women in the 5 racial/ethnic populations studied (Table 8). For both men and women, non-Hispanic white and API patients tended to have higher survival rates than their counterparts for the cancer sites examined, except non-Hispanic white patients, who had the lowest survival rates for cancer of the brain (33.5% for men and 35.1% for women) and API patients, who experienced the lowest survival rates for leukemia (39.1% for men and 38.9% for women).

Adjusted RRs of cancer death, accounting for age or age and stage, were calculated using non-Hispanic white population as the reference group. Except for myeloma and cancers of the kidney, thyroid, and gallbladder for both sexes, melanoma and other nonepithelial skin cancers for men, and cancer of the liver for women, the overall test for racial/ethnic differences in risk of cancer death was statistically significant for each other cancer site examined and for all cancers combined. The risk of cancer death in every minority group was statistically significantly higher than that of non-Hispanic white patients for all cancers combined, except for API women, who had a similar risk of cancer death as their non-Hispanic white counterparts. Black men experienced 9–67% higher adjusted risks of dying of the index cancer than non-Hispanic white men for 12 of 13 individual cancer sites with statistically significant racial/ethnic differences; black women experienced 7–82% higher adjusted risks for 12 of 14 such individual cancers, except for cancers of the brain (both sexes) and stomach (women), which were lower. Hispanic white and AI/AN patients generally had higher risks of dying from the index cancer than their non-Hispanic white and API counterparts. Both API men and women experienced the lowest RRs for each of the sex-specific major cancers (prostate, female breast,

TABLE 7
Stage Distribution[a] for Selected Cancers by State and Regional Registries in the U.S.,[b,c] 1996–2000

	Colon and rectum (both sexes)					Female breast					Cervix uteri					Prostate			
States and areas	Total cases	Localized %	Regional %	Distant %	Unstaged %	Total cases	Localized %	Regional %	Distant %	Unstaged %	Total cases	Localized %	Regional %	Distant %	Unstaged %	Total cases	Localized/ Regional %	Distant %	Unstaged %
NAACCR combined[b,c]	322,947	34.3	40.5	16.9	8.2	410,392	62.3	28.5	4.5	4.7	30,428	52.4	29.8	8.8	8.9	415,304	83.7	4.7	11.6
SEER[b,d]	130,233	36.4	39.0	18.0	6.6	171,479	62.1	29.9	4.8	3.3	13,431	52.5	30.7	8.9	7.9	172,324	86.0	5.0	9.0
NPCR[b,e]	264,455	33.6	40.9	16.6	9.0	328,234	62.0	28.0	4.6	5.4	23,859	52.0	29.4	8.6	10.0	336,764	82.7	4.6	12.7
Alaska	975	36.3	37.1	20.4	6.2	1,525	57.6	33.2	4.2	4.9	125	60.8	24.0	7.2	8.0	1,258	70.1	4.0	25.9
Arizona	11,210	33.7	40.3	16.5	9.5	15,400	61.0	28.5	3.7	6.9	931	44.7	29.9	13.2	12.2	14,850	74.2	3.8	22.1
Greater Bay Area	14,507	38.0	39.4	18.7	3.9	22,289	64.8	29.2	4.2	1.8	1,404	58.3	27.4	9.8	4.6	19,835	90.4	5.7	4.0
Los Angeles	18,947	36.2	38.5	19.1	6.2	26,561	60.6	32.5	4.4	2.5	2,783	48.9	33.6	11.4	6.1	26,161	83.7	5.5	10.8
Colorado	8,016	36.8	37.9	19.5	5.8	13,046	63.1	28.7	3.7	4.6	808	59.7	28.0	8.0	4.3	11,941	78.1	4.5	17.4
Florida	55,361	31.1	40.8	14.8	13.4	61,167	61.2	25.7	4.5	8.5	4,800	47.5	31.1	9.6	11.8	68,427	81.5	3.6	14.9
Atlanta	4,652	33.0	44.1	19.6	3.3	8,103	62.2	31.3	4.8	1.7	672	60.0	28.3	7.7	4.0	7,186	88.8	3.5	7.8
Hawaii	3,259	44.4	37.1	15.4	3.1	4,118	70.2	24.9	3.6	1.3	309	57.9	32.4	7.8	1.9	3,550	87.3	8.3	4.5
Idaho	2,649	35.7	39.7	18.5	6.0	3,860	63.0	30.1	4.2	2.8	226	46.9	32.7	14.6	5.8	4,095	79.3	5.0	15.7
Illinois	34,994	32.5	42.4	17.6	7.5	42,600	60.8	29.4	5.4	4.4	3,569	52.7	32.3	7.9	7.1	38,576	85.2	5.8	8.9
Iowa	10,568	38.1	38.7	18.1	5.1	11,058	66.0	26.9	4.9	2.2	682	54.1	31.8	7.8	6.3	10,557	87.4	6.4	6.2
Kentucky	11,917	37.1	37.2	17.5	8.2	13,748	60.3	29.7	4.9	5.1	1,288	54.5	28.8	7.5	9.2	12,495	73.9	5.7	20.4
Louisiana	11,766	36.3	37.9	18.9	7.0	13,811	59.1	32.1	5.5	3.4	1,286	52.4	30.2	6.8	10.5	14,603	88.3	6.0	5.7
Maine	4,119	38.8	39.2	16.3	5.8	4,766	66.6	27.2	4.2	2.0	297	54.2	32.3	6.7	6.7	4,809	88.1	5.0	6.9
Michigan	26,567	36.0	37.1	16.4	10.6	34,564	61.6	26.3	4.3	7.7	2,436	54.1	24.1	7.7	14.2	39,723	82.1	3.5	14.4
Detroit	11,419	38.2	36.6	20.0	5.2	14,740	62.4	29.8	5.0	2.8	1,085	49.7	29.9	9.7	10.8	17,980	89.3	4.0	6.6
Minnesota	12,191	35.9	45.4	15.8	2.9	16,920	66.0	29.1	3.6	1.3	866	61.0	27.8	9.6	1.6	17,520	91.2	5.1	3.7
Montana	2,411	36.1	42.4	15.4	6.1	3,260	63.2	29.2	3.4	4.1	202	57.9	21.8	8.4	11.9	3,512	78.9	4.8	16.3
Nebraska	5,266	28.5	46.1	17.3	8.1	6,017	63.6	27.5	4.4	4.5	383	58.2	26.9	7.6	7.3	6,201	87.0	5.3	7.7
New Jersey	27,463	32.9	40.3	16.2	10.6	32,306	58.7	29.5	5.7	6.1	2,462	47.2	31.3	8.4	13.1	35,256	80.2	4.1	15.7
New Mexico	3,379	39.1	38.7	18.0	4.2	5,205	65.3	28.4	4.5	1.8	402	54.2	32.6	9.2	4.0	5,320	92.0	5.4	2.6
Oregon	8,459	32.9	44.7	18.0	4.3	13,001	67.3	27.1	3.5	2.0	722	59.6	29.9	7.9	2.6	12,006	85.3	4.9	9.9
Rhode Island	3,715	38.9	39.4	16.1	5.6	4,023	63.8	27.2	4.3	4.7	268	52.6	24.6	14.9	7.8	4,098	68.1	4.3	27.6
Utah	3,180	43.8	35.7	17.0	3.5	4,824	61.4	32.9	4.0	1.7	317	62.5	29.3	6.9	1.3	5,931	95.5	4.0	0.5
Washington	13,697	30.6	46.5	17.1	5.7	21,046	65.3	28.4	3.6	2.6	1,146	57.9	29.1	8.5	4.6	19,870	88.5	4.7	6.8
Seattle	9,176	35.9	41.8	17.2	5.1	14,716	65.9	27.9	3.6	2.6	741	56.8	30.0	8.4	4.9	13,450	93.4	4.8	1.8
West Virginia	6,255	35.0	40.7	16.6	7.8	6,667	62.0	27.9	4.9	5.1	630	54.6	29.5	7.6	8.3	6,513	80.4	6.2	13.4
Wisconsin	16,290	34.5	41.5	16.2	7.8	18,965	64.2	27.0	4.5	4.3	1,307	49.1	25.9	7.1	17.9	19,174	88.1	5.6	6.4
Wyoming	1,134	31.2	36.8	19.4	12.6	1,542	56.5	27.4	5.8	10.4	107	57.0	20.6	11.2	11.2	1,837	71.7	4.1	24.2

NAACCR: North American Association of Central Cancer Registries; SEER: Surveillance, Epidemiology, and End Results Program; NPCR: National Program of Cancer Registries (Centers for Disease Control).

[a] Cases were staged according to SEER Summary Stage 1977. Cases based on death certificate only and autopsy were excluded.

[b] State and metropolitan area registries meeting the North American Association of Central Cancer Registries (NAACCR) high-quality criteria for incidence during 1996–2000.

[c] All registries in table combined cover approximately 43% of the U.S. population.

[d] SEER Program rates are based on data from Greater Bay Area (California), Los Angeles (California), Atlanta metropolitan area (Georgia), Hawaii, Iowa, Detroit metropolitan area (Michigan), Kentucky, Louisiana, New Jersey, New Mexico, Utah, and Seattle-Puget Sound (Washington).

[e] NPCR (National Program of Cancer Registries at CDC) rates are based on data from Alaska, Arizona, Colorado, Florida, Idaho, Illinois, Kentucky, Louisiana, Maine, Michigan, Minnesota, Montana, Nebraska, New Jersey, Oregon, Rhode Island, Washington, West Virginia, Wisconsin, and Wyoming.

TABLE 8
SEER 5-Year Cancer-Specific Survival and Stage-Adjusted and Age-Adjusted Relative Risk of Cancer Death by Cancer Type, Race/Ethnicity, and Sex, 1992–2000

	Cause-specific survival (%)					Adjusted relative risk (95% CI) of cancer deaths[a]				
	NH whites	H whites	Blacks	API	AI/AN	NH whites	H whites	Blacks	API	AI/AN
Male						(Ref.)				
All sites	67.6	65.1	62.1	60.5	53.9	1.0	1.16 (1.14–1.18)	1.26 (1.24–1.28)	1.26 (1.23–1.28)	1.69 (1.59–1.79)
Brain and other nervous system	33.5	46.0	45.2	42.6	59.7	1.0	0.97 (0.88–1.07)	0.98 (0.87–1.10)	0.79 (0.68–0.92)	0.77 (0.48–1.24)
Colon and rectum	64.0	60.9	56.1	66.7	62.3	1.0	1.05 (0.99–1.11)	1.26 (1.20–1.32)	0.95 (0.90–1.00)	1.14 (0.95–1.35)
Esophagus	18.9	20.6	13.4	17.4	18.6	1.0	1.05 (0.94–1.17)	1.29 (1.19–1.40)	1.14 (1.01–1.28)	1.13 (0.80–1.60)
Gallbladder	29.1	26.9	39.2	36.2	38.4	1.0	1.20 (0.91–1.60)	1.18 (0.81–1.74)	1.24 (0.90–1.72)	1.26 (0.66–2.41)
Kidney and renal pelvis	66.1	65.4	69.7	62.6	70.2	1.0	1.03 (0.94–1.14)	1.06 (0.95–1.18)	0.96 (0.84–1.09)	1.14 (0.83–1.58)
Larynx	81.1	75.1	72.6	81.8	63.8[b]	1.0	1.37 (1.13–1.66)	1.44 (1.25–1.65)	0.88 (0.65–1.20)	2.56[b] (1.21–5.40)
Leukemia	53.3	53.0	46.2	39.1	45.7	1.0	1.37 (1.27–1.48)	1.40 (1.28–1.52)	1.71 (1.56–1.89)	1.43 (1.03–1.99)
Liver and intrahepatic bile duct	12.7	15.1	7.8	15.6	20.1	1.0	1.09 (1.01–1.18)	1.20 (1.10–1.31)	0.91 (0.85–0.98)	1.08 (0.83–1.39)
Lung and bronchus	16.0	14.4	13.7	17.3	14.0	1.0	1.08 (1.04–1.12)	1.09 (1.06–1.11)	0.90 (0.87–0.93)	1.23 (1.10–1.36)
Melanoma of the skin	86.5	77.1	77.7	76.5	80.1	1.0	1.08 (0.88–1.34)	0.88 (0.55–1.41)	1.11 (0.75–1.64)	1.29 (0.53–3.12)
Myeloma	36.2	39.7	40.4	46.6	33.1	1.0	1.00 (0.89–1.13)	1.01 (0.92–1.11)	0.80 (0.68–0.94)	1.25 (0.80–1.94)
Non-Hodgkin lymphoma	63.2	61.6	65.0	55.5	56.1	1.0	1.32 (1.22–1.42)	1.21 (1.10–1.32)	1.32 (1.21–1.45)	1.57 (1.12–2.21)
Oral cavity and pharynx	77.5	73.2	63.3	71.2	60.7	1.0	1.25 (1.09–1.42)	1.67 (1.52–1.83)	1.22 (1.07–1.38)	1.56 (1.15–2.12)
Other nonepithelial skin[d]	97.8	99.4	98.2	98.6	100.0	1.0	0.55 (0.22–1.38)	1.28 (0.63–2.63)	0.92 (0.29–2.97)	c
Pancreas	5.6	7.5	5.5	7.6	9.6	1.0	1.08 (1.00–1.16)	1.15 (1.08–1.22)	0.97 (0.90–1.05)	1.07 (0.82–1.41)
Prostate	92.0	90.0	88.3	92.3	83.0	1.0	1.12 (1.05–1.19)	1.31 (1.25–1.36)	0.70 (0.65–0.76)	1.81 (1.46–2.24)
Stomach	34.9	28.0	27.3	32.7	18.8	1.0	1.26 (1.18–1.36)	1.33 (1.24–1.43)	1.10 (1.02–1.18)	1.87 (1.52–2.30)
Thyroid	92.3	92.8	91.5	94.3	96.0	1.0	0.99 (0.68–1.44)	1.15 (0.69–1.90)	0.79 (0.51–1.22)	0.87 (0.28–2.75)
Urinary bladder	85.1	84.0	75.5	84.3	75.5	1.0	1.09 (0.95–1.26)	1.43 (1.27–1.61)	0.86 (0.73–1.01)	1.14 (0.70–1.87)
Female										
All sites	67.0	66.8	57.0	68.7	60.4	1.0	1.20 (1.18–1.22)	1.52 (1.50–1.55)	1.01 (0.99–1.03)	1.54 (1.45–1.64)
Brain and other nervous system	35.1	46.2	43.9	45.4	49.2	1.0	1.05 (0.95–1.17)	0.88 (0.78–1.00)	0.75 (0.63–0.89)	0.78 (0.44–1.38)
Breast	87.5	83.0	75.0	89.4	79.6	1.0	1.22 (1.16–1.28)	1.75(1.68–1.82)	0.90 (0.85–0.97)	1.55 (1.32–1.81)
Cervix uteri	77.2	81.1	69.5	78.0	75.8	1.0	0.77 (0.69–0.85)	1.21 (1.09–1.34)	0.83 (0.71–0.96)	0.97 (0.64–1.47)
Colon and rectum	63.4	61.3	57.0	68.2	58.2	1.0	1.05 (0.99–1.11)	1.18 (1.13–1.23)	0.90 (0.85–0.96)	1.38 (1.16–1.64)
Corpus and uterus	86.6	85.4	69.9	87.4	83.2	1.0	1.22 (1.09–1.38)	1.82 (1.66–1.99)	1.08 (0.94–1.24)	1.69 (1.09–2.63)
Gallbladder	25.6	32.3	30.2	27.7	32.3	1.0	1.05 (0.91–1.21)	0.91 (0.73–1.14)	0.89 (0.70–1.13)	0.82 (0.52–1.28)
Kidney and renal pelvis	66.4	69.6	70.1	68.4	64.2	1.0	0.94 (0.83–1.07)	0.99 (0.87–1.12)	0.78 (0.64–0.96)	1.16 (0.83–1.62)
Leukemia	51.7	53.0	43.9	38.9	46.5	1.0	1.33 (1.21–1.45)	1.36 (1.24–1.49)	1.75 (1.57–1.96)	1.48 (1.07–2.06)
Liver and intrahepatic bile duct	15.9	18.5	11.8	14.8	25.0	1.0	1.07 (0.96–1.20)	1.14 (1.00–1.30)	0.99 (0.89–1.11)	0.94 (0.66–1.33)
Lung and bronchus	20.2	18.1	18.1	19.8	17.2	1.0	1.04 (1.00–1.09)	1.07 (1.04–1.11)	0.89 (0.85–0.93)	1.22 (1.06–1.40)
Melanoma of the skin	92.2	86.8	71.5	78.8	80.1	1.0	1.23 (0.97–1.55)	1.82 (1.20–2.77)	1.43 (0.89–2.32)	0.98 (0.41–2.39)
Myeloma	32.2	31.8	35.2	40.5	23.4	1.0	1.08 (0.96–1.23)	1.00 (0.92–1.10)	0.84 (0.70–1.00)	1.43 (0.93–2.20)
Non-Hodgkin lymphoma	62.9	62.1	64.0	64.2	63.0	1.0	1.21 (1.11–1.31)	1.29 (1.17–1.42)	1.09 (0.98–1.21)	1.42 (0.99–2.05)
Oral cavity and pharynx	75.8	76.3	70.6	75.9	69.0	1.0	1.04 (0.86–1.27)	1.32 (1.14–1.54)	1.02 (0.84–1.23)	1.29 (0.73–2.28)
Ovary	43.6	53.2	46.3	57.4	45.5	1.0	1.01 (0.94–1.08)	1.19 (1.10–1.29)	0.96 (0.87–1.07)	1.10 (0.84–1.43)
Pancreas	5.0	8.9	5.4	8.4	c	1.0	1.01 (0.94–1.08)	1.09 (1.03–1.15)	0.87 (0.80–0.94)	1.14 (0.89–1.47)
Stomach	31.0	29.0	32.7	33.0	21.6	1.0	1.12 (1.03–1.22)	0.96 (0.88–1.05)	0.98 (0.90–1.07)	1.53 (1.19–1.97)
Thyroid	96.5	95.6	96.3	94.9	98.1	1.0	1.22 (0.95–1.58)	0.94 (0.64–1.37)	1.24 (0.95–1.63)	1.12 (0.28–4.54)
Urinary bladder	79.1	75.5	62.9	76.1	76.7[b]	1.0	1.12 (0.93–1.34)	1.38 (1.20–1.58)	0.98 (0.79–1.23)	1.79[b] (0.67–4.77)

Source: 12 SEER areas (San Francisco-Oakland, Connecticut, Detroit-Metropolitan, Hawaii, Iowa, New Mexico, Seattle-Puget Sound, Utah, Atlanta-Metropolitan, San Jose-Monterey, Los Angeles, and AI/AN in Alaska).

SEER: Surveillance, Epidemiology, and End Results Program of the National Cancer Institute, NH whites: non-Hispanic whites; H whites: Hispanic whites; API: Asian/Pacific Islander; AI/AN: American Indian/Alaska Native; 95% CI: 95% confidence interval.

[a] Up to 5 years of follow-up. Using stratified Cox models, the relative risks for all cancers combined are adjusted for age at diagnosis, and those for individual cancer sites are adjusted for age and tumor stage. *P* values are < 0.05 for the overall test of racial/ethnic differences in the relative risks of cancer deaths using stratified Cox models by cancer site and sex; except for Kidney and renal pelvis, Thyroid, Myeloma, and Gallbladder for both sexes, for Liver and Intrahepatic bile duct for female, and for Melanoma of the skin and Other nonepithelial skin for male (all have *P* values > 0.06 and are marked with gray background).

[b] Cohort size < 25 (24 for male AI/AN Larynx and 18 for female AI/AN Urinary bladder).

[c] Statistic could not be calculated for female AI/AN diagnosed with cancer of pancreas because the last patient was censored before the end of 5-year follow-up (censored at 35 months) and for male AI/AN diagnosed with other nonepithelial skin because none of the 39 patients died of Other nonepithelial skin cancer at the end of 5-year follow-up.

[d] For male cancer of other nonepithelial skin, nearly 70% were Kaposi sarcoma and, of those who died, 80% had acquired immunodeficiency syndrome (AIDS) as the underlying cause of death. These were not considered cancer deaths.

lung, and colon/rectum), with RRs ranging from 0.70–0.95. In addition, API patients had the lowest RRs for cancers of the brain (women), liver (men), and pancreas (both sexes). However, non-Hispanic white men and women experienced the highest risks of brain cancer death whereas API men and women had the highest risks of leukemia death.

DISCUSSION

Overall Cancer Incidence, Mortality, and Survival Trends

The current study data show considerable progress in reducing the cancer burden in the U.S. Overall cancer death rates have continued to decrease since the early 1990s in both men and women and for many of the top 15 cancer sites, including lung, colon/rectum, and prostate in men and colon/rectum and breast in women. Overall incidence rates also have decreased, although they stabilized when adjusted for a delay in reporting. Survival rates have increased for many cancers over the last 20 years.

The decrease in overall cancer death rates represents a change from last year's annual report, when the declines were reported to have leveled off in the most recent time period in women and both sexes combined.[6] With the additional data for 2001, it appears that the declines in mortality rates that began in the early 1990s are continuing, supporting an earlier interpretation that the apparent change in trend may be a consequence of changes in coding rules for underlying cause of death in the ICD-10, which were implemented with 1999 mortality data and revised population.[25]

Changes in incidence may result from changes in the prevalence of risk factors and/or changes in detection practices due to the introduction or increased use of screening/diagnostic techniques. Furthermore, incidence trends can be affected by reporting delay. The overall trend in incidence for both sexes combined appears to have been heavily influenced by reporting delay and rapidly changing prostate cancer trends; prostate cancer decreased quickly between 1992–1995, after a period of rapid increase. When prostate cancer incidence rates were excluded from the trend analysis, the incidence rates for both sexes combined were stable during 1987–2001. Overall incidence rates also became stable between 1995–2001 when adjusted for reporting delay.

The gains in survival rates for all cancer sites combined and for the most common cancers over the last 20 years, which have been accompanied by decreases in death rates, may reflect improved treatment, earlier detection of cancers with effective treatments, and improved supportive and general medical care. However, the introduction of or improvements in early detection or diagnostic tests may increase observed survival rates spuriously by advancing the time of diagnosis of disease without prolonging life (lead-time bias), by the preferential detection of slower growing tumors (length-time bias), or by the detection of indolent cases that never would have been diagnosed in the absence of such diagnostic techniques (overdiagnosis bias).[9,26,27] Although examining temporal changes in disease stage at diagnosis and stage-specific survival may be helpful in understanding temporal trends in survival, they must be interpreted with caution because changes in stage-specific survival, especially for localized stage disease, also can be affected by lead-time, length-time, and overdiagnosis biases.[9,26,27] In addition, improvements in staging techniques or changes in staging systems can influence stage-specific survival.[28] Assessing the relative contribution of changes in disease detection, classification, and treatment is difficult when explaining temporal survival changes.

Survival rates for all cancers combined also may change over time or differ across racial and ethnic populations because of changes or differences in the mix of cancers. For example, the absolute change in survival for cancers of all sites in the last 20 years was substantially greater for men than for women. Much of the increase in survival for men reflects the increasing incidence and survival rate for prostate cancer during the period. When prostate cancer cases were excluded, the all cancers combined relative survival rate for men was 37.5% between 1975–1979 and 48.1% between 1995–2000, an absolute gain of 10% compared with approximately 20% with the inclusion of prostate cancer. The lower survival rate for men compared with women in the recent period, after the exclusion of prostate cancer, primarily results from a different mix of cancers, although women have a slight survival advantage for a number of cancers. The survival rate for a specific cancer also may be affected if there is variation by histologic type and the distribution of histologic types changes over time.

Differences in survival between racial and ethnic populations may be influenced by stage at diagnosis, the measurement biases discussed earlier, the prevalence of comorbidities, and the quality of cancer treatment and supportive care. Socioeconomic differences undoubtedly play a role; members of most racial and ethnic minorities are more likely to be poor, to have a lower level of income, and to lack health insurance compared with non-Hispanic white populations.[29] Historically, the prevalence of screening for breast, colorectal, and cervical cancers has been lower for members of racial and ethnic minorities compared with non-Hispanic white populations.[30] As a result,

minority populations are more likely to be diagnosed at a more advanced stage of disease, when treatment is either not recommended or is less effective.

Differences in cause-specific survival rates by race and ethnicity may be influenced by differences in stage and age distribution; however, analyses of the RR of cancer death controlled for these factors. Even with control for stage, residual effects of screening, such as differences in the extent of disease within stage and lead-time, length-time, and overdiagnosis biases, may play a role. Other possible explanations for differential survival after a cancer diagnosis include socioeconomic barriers to timely and high-quality cancer care, cultural barriers and beliefs that may influence the treatment decision, and the presence of comorbidities.[29,31–33] For many cancers, there are limited or no data available to explain survival differences, with much of the available data pertaining only to white and black patients. The limited data available frequently document differences in the receipt of optimal treatment based on socioeconomic status and race/ethnicity, with little evidence that response to treatment varies among racial and ethnic groups when accounting for stage of disease and other important prognostic variables.[33]

The following sections describe possible reasons for temporal trends and variations in the incidence, mortality, and survival by race and ethnicity for the 4 common cancers and for cancers with an at least 10% absolute gain in the survival rate over the past 20 years in either men or women.

Prostate Cancer

The recent increase in prostate cancer incidence most likely reflects a return to baseline trends after a period of rapidly increasing, then decreasing, rates due to the introduction of the prostate-specific antigen (PSA) test.[34] Both PSA-related early detection and improved treatments may have contributed to the remarkable decreases in prostate cancer mortality noted since the early 1990s.[6] Reasons for the disproportionately higher prostate cancer incidence and death rates in black men compared with other racial ethnic populations are unknown. Age, race, and family history are the only well-documented risk factors.[35] Although one recent study linked agricultural chemical exposure to prostate cancer,[36] population-attributable risk differences in chemical exposure are unlikely to explain the large differences in prostate cancer incidence and death rates observed between black and white men.

The 5-year relative survival rate for prostate cancer increased significantly from 70% in the mid-1970s to 99% between 1995–2000, the largest absolute increase (29%) reported for any cancer. A shift in the detection of new prostate cancer cases from distant-stage to early-stage disease through the widespread use of PSA testing has been reported[37] and most likely contributed to the improved survival. However, because a high proportion of men are found to have clinically occult cancer at autopsy,[38,39] it is assumed that some prostate cancers identified by PSA would not have otherwise presented as clinical disease.[40] The extent to which overdiagnosis, length-time, and lead-time biases have contributed to improvements in survival is unknown, but believed to be substantial.

Improved survival from prostate cancer also may be due to the dissemination of hormonal therapy for early-stage and advanced stage disease.[41,42] A recent pooled analysis of prostate cancer randomized trials found that the 10-year survival rate was significantly higher in men treated immediately with hormonal therapy (74%) compared with those who deferred such treatment (62%).[43] Substantial advances in radiation therapy techniques in the past decade also may have contributed to gains in survival.[44] The role of radical prostatectomy for localized disease has yet to be clarified.

After controlling for age and stage of diagnosis, the RR of cancer death once prostate cancer is diagnosed is highest for AI/AN men, followed by black and Hispanic white men; API men have a significantly lower risk than non-Hispanic white men. Low socioeconomic status, lack of health insurance, and low literacy rates can delay diagnosis and reduce access to optimal therapies.[45] Treatment differences such as a higher rate of radical prostatectomy for early-stage prostate cancer in white patients compared with black patients have been documented;[46] however, the impact on survival differences is unknown.

Lung Cancer

Changing temporal patterns in the occurrence of lung cancer are closely tied to historic cigarette smoking patterns, with the regular uptake of smoking and subsequent smoking reductions occurring later in women compared with men.[47] Among men, lung cancer incidence and mortality have been declining since the early 1980s and 1990s, respectively. In women, incidence rates have declined since 1998 and mortality rates have stabilized since 1995 for the first time, after increasing for several decades. This first-time decrease in the incidence rates in women in the SEER areas appears to be an early indication of the national trend because reductions in cigarette consumption started earlier in some areas covered by SEER compared with the other parts of the U.S.[48]

Progress in the treatment of lung cancer has been extremely limited.[49,50] Greater than 50% of cases are

diagnosed at a distant stage, for which the 5-year relative survival is only 3.3% (Table 6). Surgical resection may be curative for early-stage nonsmall cell lung cancer (NSCLC), with recent clinical studies showing improved survival with neoadjuvant chemotherapy.[49] With the exception of API patients, the RR of dying from lung cancer after diagnosis was 4–23% higher in minority populations compared with non-Hispanic white patients. Differences in survival between black and white patients with NSCLC are largely explained by treatment differences, with 64.0% of black patients who are diagnosed at an early stage undergoing surgery compared with 76.7% of whites[51] and 28% of black patients diagnosed with metastatic disease receiving chemotherapy after seeing an oncologist compared with 35% of white patients.[52] In addition to ensuring equal access to high-quality treatment, improved survival from lung cancer may be achieved by earlier detection. Important research efforts include the National Lung Screening Trial, which has enrolled nearly 50,000 current or former smokers in a study to compare whether screening with spiral computed tomography or chest X-rays is better at reducing deaths from lung cancer (available from URL: http://www.nci.nih.gov/nlst).

Colorectal Cancer

Decreases in colorectal cancer incidence and mortality rates have been largely attributed to the detection and removal of precancerous polyps, the early detection of tumors through screening, and improved treatments.[4,6] They also may reflect the increased use of hormone replacement therapy in women and antiinflammatory drugs, both of which appear to reduce the risk of colon cancer.[53,54] A recent publication found a decreased risk of colorectal cancer but a more advanced stage of disease (increased lymph node and metastatic disease) among women receiving estrogen and progestin regimens.[55] The elevated incidence and death rates in the black population may reflect cultural and socioeconomic differences in physical inactivity, dietary habits, use of tobacco, and access to and utilization of preventive services.[56]

From the mid-1970s until 1995–2000, the 5-year relative survival rate increased from 52% to 63% in women and from 50% to 64% in men, an increase that was second only to prostate cancer. The rate of colorectal screening remains low nationally (< 45% based on the 2000 National Health Interview survey[30]) and the potential benefit with broader utilization has yet to be achieved. However, the use of colorectal screening is higher in non-Hispanic white men and women than in other racial and ethnic populations.

A significant advance in colorectal cancer treatment was the introduction of 5-fluoroucil-based adjuvant chemotherapy for patients with surgically resectable Stage III colon cancer in the late 1980s, which reduced mortality by as much as 30%.[57,58] Lower rates of adjuvant therapy among black patients[59–62] may contribute to differences in cancer survival. Other studies have documented disparities between black and non-Hispanic white patients with regard to the receipt of surgical and radiation treatments for colorectal cancer.[62,63]

Female Breast Cancer

Recent increases in female breast cancer incidence reflect the increased use of mammography,[6,64] and perhaps an increased prevalence of obesity and the use of hormone replacement therapy.[64] The steady decline in female breast cancer mortality since 1990 has been attributed, in part, to early detection[6] and the increased use of hormonal and adjuvant chemotherapies[65,66] and the resulting improved survival, which increased by 13% since the mid-1970s.

Mammography screening increased in all segments of the U.S. population, although rates among minority populations lagged behind rates in white women.[30] White and API women are more likely to be diagnosed at a localized stage than women of other racial and ethnic populations.[67] Even when controlled for age and stage at diagnosis, black, Hispanic white, and AI/AN women had an increased RR of mortality after diagnosis compared with white and API women. Reasons for differential breast cancer survival between white and black women have been studied extensively. Several studies documented treatment differences between black and white women,[68–70] and others found treatment and survival differences between black and white patients diminished when controlling for socioeconomic factors, such as lack of insurance coverage.[71,72] Tumor and clinical characteristics such as estrogen receptor status, tumor size, tumor stage at diagnosis, and neutropenia also may influence the types and courses of treatment and survival,[64,73–76] although the differential availability of more biologically targeted treatment options also may contribute to variations in outcome.

Non-Hodgkin Lymphoma

NHL incidence trends partly reflect an increase in acquired immunodeficiency syndrome-associated NHL cases that began in the early 1980s and decreased in the 1990s.[77] The increased incidence in white compared with black populations in the U.S. precedes the rise in human immunodeficiency virus (HIV)-related NHL, and has remained remarkably consistent over time.[18] Recent declines in NHL mortality may reflect

decreases in HIV-associated NHL incidence rates[77] and improved treatments.[78]

NHL comprises a range of pathologic types with varying prognoses.[79,80] Survival trends are influenced by the increase in HIV-related NHL cases, which have a poorer prognosis.[80] Nonetheless, modest gains in overall survival have been observed. Improved treatments for indolent NHL include radiotherapy for early-stage disease[81,82] and single-agent and multiagent chemotherapy for advanced-stage disease.[83–85] For large cell lymphoma, an aggressive NHL, multiagent chemotherapy was shown in the 1970s and 1980s to achieve disease remission and long-term, disease-free survival in 35% of patients.[86,87] More recently, rituximab, a monoclonal antibody directed against the CD20 antigen, was found to have activity against both indolent and aggressive NHL,[88] and autologous bone marrow transplantation was found to increase survival among patients with recurrent, aggressive NHL.[89,90] Although all racial and ethnic minority groups have a higher RR of cancer death from NHL once diagnosed compared with non-Hispanic whites, no published study to date has assessed prognostic or treatment variations that may underlie these differences.

Melanoma

The continued increase in melanoma incidence rates may reflect increased recreational sun exposure as well as early detection, resulting mainly from increased awareness by health providers and the general public.[91] The markedly higher incidence and mortality for white patients reflects their enhanced susceptibility to the harmful effects of sun exposure.[92] The absolute gain in melanoma survival in males (12%) and females (6%) may be related both to early detection and improved treatment. Proportions and rates of melanomas diagnosed at a localized stage and as thin lesions have increased in the U.S.[91,93] Surgical resection, the major curative therapy for melanoma at the current time, has undergone significant improvements as a result of documenting optimal margins based on the depth of the primary lesion.[94] The benefits of immunotherapy (interferon and interleukin-2) in recurrence-free survival and overall survival have been demonstrated in clinical trials,[95] and the use of recombinant interleukin-2 for patients with metastatic melanoma recently was approved.[96]

Leukemia

The incidence of leukemia was stable for both males and females between 1975–1995, when rates began to decline for males only. Leukemia is more common in white populations than in other racial and ethnic groups, paralleling international patterns of increased incidence in Western and Northern Europe, North America, and Australia. Long-term decreases in leukemia death rates reflect dramatic improvements in survival from childhood leukemia, as well as modest improvements in survival for some leukemia subtypes in adults. Among children and adults combined, leukemia survival rose from 35.9% in 1975–1979 to 46.4% in 1995–2000, whereas for leukemia patients diagnosed at age $\geq$ 20 years, relative survival rates improved from 34% to 42%.[18] As a result of multiagent chemotherapy and central nervous system prophylaxis, relative survival for adult patients with acute lymphocyte leukemia (ALL) has improved from 11% in 1975–1979 to 28% in 1995–2000,[18,97,98] whereas survival among adults with chronic lymphocyte leukemia improved only slightly from the 1970s to the 1990s (69% vs. 73%).[18] Acute myeloid leukemia remains a highly fatal malignancy, although the 5-year relative survival improved from 6% to 17% over the last 20 years. Combined chemotherapy with daunorubicin and cytarabine remains the treatment of choice for most patients,[99] and improvements in survival may be attributed in part to improvements in supportive care, including the treatment of infections.[99] The 5-year relative survival for patients with chronic myelocytic leukemia (CML) also has increased. Historic treatment advances include chemotherapy with hydroxyurea and busulfan, and chemotherapy combined with interferon-α.[100] More recent advances include allogeneic bone marrow transplant and treatment with imatinib mesylate, which has been demonstrated to be highly effective in inducing and sustaining disease remission when used as a first course of treatment.[101,102] Survival improvements resulting from imatinib mesylate are too recent to be reflected in 1995–2000 statistics.

The RR of death among leukemia patients is markedly higher for all racial and ethnic minority populations compared with non-Hispanic white populations. The lowest survival rates observed in the API leukemia patients might be attributable to the 62% of API leukemia patients in SEER areas who were diagnosed with the more lethal subtypes of myeloid and monocytic leukemia compared with 44–50% of other racial/ethnic populations. Treatment differences that may contribute to differential survival by race and ethnicity have not been studied. In the nine SEER areas, black, Hispanic, and AI/AN children with ALL have poorer survival than white and API children;[103] other reports have demonstrated that black children with ALL are more likely to present with unfavorable prognostic features.[104] However, in a single pediatric cancer hospital in which all patients received the same

treatment without regard to ability to pay, black and white children had the same rate of survival and cure.[105]

Kidney Cancer

Reasons for the increasing incidence of kidney cancer are not clear,[106] but may reflect newer diagnostic techniques[107,108] and an increased prevalence of obesity,[109,110] which is a known risk factor for kidney cancer.[111] Despite the rising incidence, mortality rates have been stable since 1991 for men and since 1992 for women. Black men and women have the highest incidence rates among all racial and ethnic populations, but mortality rates are approximately equal for white and black populations and highest for AI/AN patients. Reasons for increased mortality among the AI/AN population are unknown. There is considerable variation in kidney cancer mortality in AI/AN persons by region, with death rates being particularly high in the Northern plains.[112] Approximately 50% of cancers of the kidney are diagnosed at the localized stage, for which the 5-year relative survival is $>$ 90% (Table 6). Surgery remains the primary treatment, with the benefit of adjuvant chemotherapy and radiotherapy considered to be unproven.[113] Improved survival may result in part from lowered surgical mortality rates due to advances in anesthesia and presurgical and postsurgical management.[113] When adjusted for age and stage of disease, no significant differences in the RRs of cancer death once diagnosed were noted between racial and ethnic groups.

Childhood Cancers

Since the introduction of chemotherapy for the treatment of childhood leukemia in the 1940s, the prognosis for childhood cancers has improved remarkably, from almost uniformly fatal before the mid-1960s to a 55% survival rate in the mid-1970s, to $>$ 75% survival in the late 1990s. This improvement has been attributed to the success of chemotherapy for childhood ALL and the incorporation of chemotherapy into treatment regimens that previously relied on surgery or radiotherapy for common forms of childhood cancers such as Wilms' tumor, lymphoma, and osteosarcoma.[114] Increased survival from childhood cancers also may be correlated in part with improved quality of care through the pediatric cancer cooperative groups. Currently 70% of pediatric cancer patients age $<$ 15 years receive their care in pediatric cancer treatment centers.[115]

Although the 5-year survival has improved remarkably for most childhood cancers over the past two decades, with nearly all children with Hodgkin lymphoma surviving their disease, the survival rate is still low ($<$ 50%) for some childhood cancers such as acute myeloid leukemia, reflecting a need for an improved understanding of the mechanism of resistance to therapy.[116]

Age-specific analyses demonstrated that survival rates did not vary by age for all sites combined, but some variations were evident for individual sites. For example, the survival rates for ALL were 91% for patients ages 1–4 years but only approximately 60% for infants and patients ages 15–19 years. This may in part be related to the lower enrollment rates of adolescents and young adults in clinical trails compared with that of children.[117] In general, survival rates improved more for boys than girls, removing much of the advantage in girls' overall survival noted between 1975–1979.

Variations in Disease Stage at Diagnosis by Cancer Registry

Geographic variation in the stage of disease at diagnosis was most evident for cancers of the colon/rectum, cervix, and prostate, whereas much less variation was noted for female breast cancer. The percentages in Table 7 are not adjusted for age, which may influence stage distribution. Other differences in cancer stage at diagnosis may be related to differences in the population composition by race, ethnicity,[118,119] socioeconomic status,[120–123] and health insurance status,[124,125] all of which can influence access to and utilization of cancer screening services. As was discussed in last year's Annual Report to the Nation, the prevalence of mammography and cervical and colorectal cancer screening at recommended intervals also varies across the states.[6]

Marked variation among states was noted in the percentage of unstaged cases for all four cancers. These variations could be related to differences in medical practice, varying socioeconomic characteristics in the population, registry operations, or a combination of these factors. It is important to better understand the reasons for these differences because inadequate staging may result in suboptimal treatment.

Limitations

There are certain limitations in the data and methods that may influence the interpretations of the findings in this report. First, routinely collected statistics regarding cancer occurrence, as provided in this analysis, are commonly reported according to the major racial and ethnic populations—whites, blacks, APIs, AI/ANs, and Hispanics/Latinos. Such broad racial and ethnic groupings may mask wide variations in the cancer burden by country of origin, for example,

among APIs (China, Japan, Philippines, Vietnam, etc.)[126,127] and Hispanics/Latinos (Spain, Cuba, Puerto Rico, Mexico, etc.)[128,129] and by cultural characteristics that define other high-risk populations such as white residents in Appalachia,[130] recent immigrants, blacks in the rural South, and over 560 American Indian tribes recognized by individual states and the federal government.[112,131–133] Cancer rates for populations other than whites and blacks may be limited by problems in ascertaining race/ethnicity information from basic records (medical records, death certificates, and census reports).[134,135] Furthermore, the assessment of long-term cancer trends is limited to white and black populations because annual population counts for other racial and ethnic populations are not available prior to 1990.

Second, the survival data and most of the incidence data presented in this report are taken from the SEER registries. The SEER registries were selected to be a reasonably representative subset of the U.S. population, with a higher representation of racial and ethnic minorities. Therefore, cancer statistics generated from SEER areas may differ in some respects from cancer statistics throughout the country because SEER areas tend to have more foreign-born individuals and be more urban populations compared with non-SEER areas.[136]

Third, we used two different statistical methods to describe cancer trends. A single linear model was used to describe short-term trends (1992–2001) in cancer incidence and death rates by race and ethnicity. In contrast, long-term patterns (1975–2001) for all races and ethnicities combined were characterized using the joinpoint method. Analyses of data by these two approaches may in some circumstances lead to different results. For example, the prostate cancer incidence rate decreased by 2.5% per year from 1992–2001, whereas in the joinpoint model it increased by 1.4% per year from 1995–2001, after an 11.4% per year decrease from 1992–1995. The joinpoint model is a more flexible and accurate approach to identify the years in which significant changes in trends occurred, but cannot always be employed for analyses of trends by race and ethnicity because of the limited time period with available data.

Future Directions

The long-term goals of basic and clinical research, cancer surveillance, and cancer control are activities to eliminate suffering and death from cancer. This will come about by striving to prevent the onset as well as the progression of cancer; identifying cancers at the earliest stage of disease; eliminating cancer through targeted treatments; and controlling cancers that cannot be eliminated so they become manageable, chronic diseases.

Considerable reduction in the suffering and death from cancer in the U.S. could be achieved by reaching all segments of the population with high-quality prevention, early detection, and treatment services.[137] Disparities in access to and quality of care have been documented throughout the cancer spectrum. For example, the uninsured and those with only Medicare or Medicaid may lack access to effective smoking cessation therapies.[137] Individuals with low incomes, those without health insurance, and those who immigrated to the U.S. within the last 10 years have a lower prevalence of mammography and colorectal and Papanicolaou smear testing than other population groups.[30] Geographic variations also exist in the utilization of recommended screening tests[6] and in the stage of disease at diagnosis for cancers that are detectable by screening (Table 7). In response to the documentation of healthcare disparities for racial and ethnic minorities and other medically underserved groups, federal programs targeted at reducing disparities have been created and strengthened. For example, the Quality of Cancer Care Committee (QCCC), organized by NCI in 2000, has sponsored several interagency projects to examine how the best available scientific evidence concerning intervention effectiveness can inform federal-level decision making regarding cancer care. In one QCCC project, three federal agencies (the NCI, the CDC, and the Health Resources and Services Administration) are collaborating with the nonprofit Institute for Healthcare Improvement to enhance screening and follow-up care for patients with breast, cervical, and colorectal cancers in community health centers for the medically underserved.[139] The National Breast and Cervical Cancer Early Detection Program created by the CDC in 1991 has provided over 4 million screening examinations to underserved women. However, estimates are that this program reaches only 12–15% of eligible women nationally.[140] In 2000, the NIH established the National Center on Minority Health and Health Disparities to lead and coordinate NIH efforts to improve the health of minority and medically underserved people. In 2001, the Center to Reduce Cancer Health Disparities was created within the NCI to stimulate research to address cancer health disparities.

There also has been growing recognition of gaps in the delivery of high-quality cancer care in recent years.[31] In 1999, the National Cancer Policy Board issued a comprehensive report on the state of the cancer care system, which concluded that some individuals with cancer do not receive care known to be effective for their condition.[138] Recommendations in-

cluded the development and use of evidence-based guidelines for all aspects of cancer care; the development of a core set of quality measures that can be used to measure and monitor the quality of care; the enhancement of services for the uninsured and underinsured to ensure entry to, and equitable treatment within, the cancer care system; and research to understand why specific segments of the population do not receive appropriate care. Partnerships to nurture an integrated approach to fighting cancer and to ensure that research discoveries are translated into clinical and public health interventions that can be delivered to all who need them have been embraced by many private and public institutions, several of which have made commitments to programs and activities that are building blocks for this effort.[139] For example, the NAACCR is actively involved in extending its standardization activities beyond the cancer registry community to foster and contribute to a national health information structure.

In addition to the better application of existing knowledge, leaders in the scientific community forecast an era of unprecedented progress in cancer research through applying knowledge of the molecular and cellular mechanisms that underlie the initiation and progression of cancer. Areas of particular interest, highlighted in the NCI's research priorities, include seven strategic priority areas: molecular epidemiology; integrated cancer biology; the strategic development of cancer interventions; prevention, early detection, and prediction; an integrated clinical trials system; overcoming health disparities; and bioinformatics.[141] The development of imatinib mesylate for the treatment of CML is an example of a treatment breakthrough resulting from understanding the molecular abnormality involved in a particular type of cancer.[100] In addition to treatment advances, a better understanding of the basis of cancer has led to more effective prevention strategies, the development of improved tests for early detection, more precise diagnostic methods, and more powerful treatment approaches. Transdisciplinary research efforts have the potential to enhance our understanding of the interaction of genetic and environmental risk factors for tobacco addiction and obesity, leading to the improved prevention and treatment of the major cancer risk factors in the U.S. population. However, for research advances to impact cancer incidence and death rates, the translation of research discoveries to the widespread and equitable delivery of preventive and clinical services must be expedited.

In the 21st century, cancer surveillance will play a critical role in monitoring the nation's progress against cancer. The Annual Report to the Nation is just one facet of ongoing collaborations among the ACS, the CDC's NPCR and NCHS, the NCI's SEER Program, and the NAACCR. Through collaborative and coordinated initiatives and programs, these organizations are working to improve the comprehensiveness and quality of data used to focus cancer control efforts and track progress against cancer. In the future, the integrated and efficient exchange of standardized information among clinical, administrative, and public health data systems will enable better assessments of these successes in all populations and in all areas of the U.S.

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