Commentary

Annual Report to the Nation on the Status of Cancer, 1975-2010, Featuring Prevalence of Comorbidity and Impact on Survival Among Persons With Lung, Colorectal, Breast, or Prostate Cancer

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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 updates on cancer incidence and death rates and trends in these outcomes for the United States. This year's report includes the prevalence of comorbidity at the time of first cancer diagnosis among patients with lung, colorectal, breast, or prostate cancer and survival among cancer patients based on comorbidity level. **METHODS:** Data on cancer incidence were obtained from the NCI, the CDC, and the NAACCR; and data on mortality were obtained from the CDC. Long-term (1975/1992-2010) and short-term (2001-2010) trends in age-adjusted incidence and death rates for all cancers combined and for the leading cancers among men and women were examined by joinpoint analysis. Through linkage with Medicare claims, the prevalence of comorbidity among cancer patients who were diagnosed between 1992 through 2005 residing in 11 Surveillance, Epidemiology, and End Results (SEER) areas were estimated and compared with the prevalence in a 5% random sample of cancer-free Medicare beneficiaries. Among cancer patients, survival and the probabilities of dying of their cancer and of other causes by comorbidity level, age, and stage were calculated. **RESULTS:** Death rates continued to decline for all cancers combined for men and women of all major racial and ethnic groups and for most major cancer sites; rates for both sexes combined decreased by 1.5% per year from 2001 through 2010. Overall incidence rates decreased in men and stabilized in women. The prevalence of comorbidity was similar among cancer-free Medicare beneficiaries (31.8%), breast cancer patients (32.2%), and prostate cancer patients (30.5%); highest among lung cancer patients (52.9%); and intermediate among colorectal cancer patients (40.7%). Among all cancer patients and especially for patients diagnosed with local and regional disease, age and comorbidity level were important influences on the probability of dying of other causes and, consequently, on overall survival. For patients diagnosed with distant disease, the probability of dying of cancer was much higher than the probability of dying of other causes, and age and comorbidity had a smaller effect on overall survival. **CONCLUSIONS:** Cancer death rates in the United States continue to decline. Estimates of survival that include the probability of dying of cancer and other causes stratified by comorbidity level, age, and stage can provide important information to facilitate treatment decisions. ***Cancer*** **2013;000:000-000.** *© 2013 American Cancer Society.*

KEYWORDS: comorbidity, multiple chronic conditions, multiple health conditions, incidence, mortality, survival, trends, Surveillance, Epidemiology, and End Results (SEER)-Medicare, National Program of Cancer Registries (NPCR), North American Association of Central Cancer Registries (NAACCR).

INTRODUCTION

The Annual Report to the Nation is a collaborative effort among 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) to provide updated cancer incidence and mortality data for the United States. The first report,

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published in 1998, documented the first sustained decline in cancer death rates since the 1930s.[1] Subsequent reports have featured in-depth analyses of selected special topics.[2-15] This current report provides updated cancer rates and trends for all cancers combined, childhood cancers, and the 15 most prevalent cancers for each of the major racial and ethnic groups by sex. In addition, this report describes the prevalence and impact of comorbidities on crude probabilities of dying from cancer or other causes for patients diagnosed with 1 of the 4 major cancer sites in men and women aged ≥66 years. The data source for the comorbidity analysis is the linked Surveillance, Epidemiology, and End Results (SEER)-Medicare database, the most comprehensive source of population-based information with cancer treatment and outcomes data in the United States.[16]

Comorbidities are coexisting noncancer medical conditions that are distinct from the principal cancer diagnosis.[17] Prior studies have demonstrated that the number and severity of comorbidities at the time of cancer diagnosis strongly influence the probability of dying from noncancer causes and also may influence cancer-specific survival.[18-21] Population-based measures of cancer survival have typically focused on relative survival,[22] which is the ratio of observed survival to expected survival for a given cohort, accounting for age, sex, race, and year of diagnosis based on US life tables. However, overall and stage-specific estimates of relative survival for cancer patients may be unrepresentative if their health status differs from that of the general population.[23] One strategy to have potentially more accurate estimates is using the SEER-Medicare linked data to provide tailored survival estimates based on both cancer stage at diagnosis and comorbidity levels. This is particularly pertinent for older patients, who often have multiple or serious comorbidities, and for persons diagnosed with cancers such as low-grade prostate cancer, who have a relatively good prognosis in the absence of treatment.[21,24] These estimates[25] may be useful for cancer treatment planning, which often requires balancing treatment toxicity and complications with the expected benefit of potential healthy life years gained.[26] In addition to providing contemporary cancer rates and trends, this report highlights the considerable prevalence of comorbidities and their impact on overall health and quality of life[27] among cancer patients aged ≥65 years, in whom 53% of all new cancer cases occur.[28]

MATERIALS AND METHODS

Cancers and Cancer Deaths

Population-based data on newly diagnosed invasive cancers were obtained from registries that participate in the NCI's SEER Program and/or the CDC's National Program of Cancer Registries (NPCR) and submit their data to NAACCR. Site and histology were coded according to the International Classification of Diseases for Oncology (ICD-O) edition in use at the time of diagnosis and were converted to the third edition coding[29] and categorized according to SEER anatomic site groups.[30] Incidence rates were calculated for all cancer sites combined, for childhood cancers (ages 0-14 years and 0-19 years), and for the 15 most prevalent cancers among men and women for each of the major racial and ethnic groups (white, black, Asian-Pacific Islander [API], American Indian/Alaska Native [AI/AN], and Hispanic). Hispanic ethnicity includes individuals from all races identified as Hispanic. Rates for AI/ANs were based on cases and deaths occurring in counties covered by the Indian Health Service Contract Health Service Delivery Areas (CHSDA); these areas have better race/ethnicity ascertainment, leading to more accurate rates for this population.[10,31]

Incidence data were not available uniformly for every calendar year, geographic area, and racial and ethnic group in the United States. Long-term (1992-2010) incidence trends for all racial and ethnic groups combined were based on SEER 13 registries, which cover approximately 13% of the US population.[32,33] Five-year (2006-2010) average annual age-adjusted incidence rates and short-term (2001-2010) incidence trends for each of the 5 major racial and ethnic groups and all races combined were calculated using combined data from NPCR and the SEER registries (November 2012 submissions) and were provided by NAACCR (December 2012 submission). US population coverage was 90.1% and 85.4% for the rates and trends, respectively.

Cause of death was based on death certificate information reported to state vital statistics offices and compiled into a national file for the entire United States by the CDC National Center for Health Statistics' National Vital Statistics System.[34] The underlying causes of death were selected according to the International Classification of Disease (ICD) codes and selection rules in use at the time of death (ICD-8 through ICD-10) and categorized according to SEER anatomic site groups to maximize comparability between ICD and ICD-O versions.[30,35-37] Death rates were calculated for all cancer sites combined, for childhood cancers (ages 0-14 years and 0-19 years), and for the 15 most prevalent cancers among men and women for each of the major racial and ethnic groups. We examined long-term (1975-2010) mortality trends for all racial and ethnic groups combined and 5-year (2006-2010) average annual age-adjusted death rates and short-term

(2001-2010) mortality trends for each of the 5 major racial and ethnic groups.

Population Estimates

A modified version of the annual time series of July 1 county population estimates by age, sex, race, and ethnicity produced by the US Census Bureau[38] was used. These population estimates incorporated both the 2000 and 2010 Census results. Other modifications incorporated bridged, single-race estimates that were derived from multiple race categories in the 2000 Census.[39] For most states, population estimates as of July 1 were used to calculate annual incidence and death rates, because it is presumed that these estimates reflect the average population of a defined geographic area for a calendar year. Certain county estimates were adjusted to account for populations along the Gulf coasts of Louisiana, Alabama, Mississippi, and Texas that were displaced during 2005 by Hurricanes Katrina and Rita.[38] Additional information was used to more accurately estimate the native Hawaiian population[40] and to derive population estimates for newly created counties. These modified county-level population estimates were summed to the state and national levels and were used as denominators in the rate calculations.

Comorbidity Among Older Cancer Patients and the Medicare Population

The comorbidity analyses included a cohort of cancer patients diagnosed between 1992 and 2005 who resided in 11 SEER areas and whose data have been linked to Medicare claims data and a 5% random sample of cancer-free Medicare beneficiaries.[41] More information is available on the linked SEER-Medicare database and the 5% cancer-free sample.[16] Medicare claims were available in the same format for cancer patients and individuals without cancer (cancer-free patients). Comorbidities were identified from Medicare Part A hospitalization claims and Part B physician/supplier and outpatient facility claims. The analysis excluded individuals who were enrolled in health maintenance organizations (HMOs), individuals not enrolled continuously in both Parts A and B of Medicare between 1992 and 2005, and patients whose cancer was diagnosed by death certificate or autopsy only. HMO enrollment in the Medicare population is about 25%.[41] The analysis also included only individuals aged $\geq$66 years to ensure that comorbidities in the year before cancer diagnosis could be identified in Medicare claims.

Sixteen comorbid conditions identified by Charlson et al[42,43] from medical records comprised the comorbidity measure used in this analysis. Charlson's original algorithm was adapted for use with ICD-9 codes from administrative databases[43] and in SEER-Medicare studies of cancer patients.[44,45] The 16 conditions are: acute myocardial infarction, acquired immunodeficiency syndrome (AIDS), cerebrovascular disease, chronic renal failure, cirrhosis/chronic hepatitis, congestive heart failure, chronic obstructive pulmonary disease (COPD), dementia, diabetes, diabetes with sequelae, history of myocardial infarction, liver disease, paralysis, rheumatologic disease, ulcer disease and vascular disease. In the current analyses, diabetes (ICD-9: 250.0x-250.3x, 250.7x) and diabetes with sequelae (ICD-9: 250.4x-250.6x, 250.8x-250.9x) were grouped together. Although the Charlson index typically includes solid tumors and lymphoma/leukemia, these conditions were not included in our analysis because of our focus on noncancer comorbidity. The presence or absence of the 16 comorbid conditions was determined using the clinical modification of ICD-9 codes (ICD-9-CM) and Current Procedural Terminology codes recorded in Medicare claims data according to an algorithm developed by Klabunde et al[44-46] and used by Mariotto et al[23] to estimate comorbid condition weights. Consistent with prior work,[44,45] a rule-out algorithm was used so that only conditions appearing on more than 1 physician claim were included, thereby ensuring that diagnoses recorded only in Part B claims were not transient episodes.

Patients with female breast, prostate, lung, or colorectal cancer were selected from the SEER-Medicare database. These 4 cancer sites were chosen because they are the most common cancers (about half of all new cancer cases and all cancer deaths) in the US and because it has been demonstrated that both the prevalence of comorbidities and the probability of dying from other causes vary by these cancer types.[20] For each cancer patient, the presence or absence of the 16 comorbidities was identified in the year before their first cancer diagnosis, excluding the month of diagnosis. The month of cancer diagnosis was excluded to minimize the misclassification of complications potentially related to cancer diagnosis or its treatment as comorbid conditions.

Noncancer controls were randomly selected from the 5% random sample of cancer-free Medicare recipients in the SEER areas for each calendar year and were frequency matched to cancer cases by sex and age.[47] Comorbid conditions were identified in the year before the birthday of the matched calendar year.

Statistical Methods

Incidence and mortality rates and trends

Age-adjusted rates were expressed per 100,000 persons based on the 2000 US standard population and were

generated using SEER*Stat software, version 8.0.4.[48] Corresponding 95% confidence intervals were calculated as modified gamma intervals.[49] Rates were not reported if there were fewer than 10 cases.

Trends in age-adjusted cancer incidence and death rates were estimated using joinpoint regression, which involves fitting a series of joined straight lines on a logarithmic scale to the trends in the annual age-adjusted rates.[50,51] A maximum of 3 joinpoints was allowed in models for the period 1992 through 2010, up to 5 joinpoints were allowed in models for the period 1975 through 2010, and up to 2 joinpoints were allowed in models for the period 2001 through 2010. The resulting trends were described by the slope of the line segment or the annual percent change (APC). The average APC (AAPC) was estimated as a weighted geometric average of the APCs, with the weights equal to the length of each line segment during the prespecified, fixed interval.[52] Long-term incidence trends were calculated using both observed and delay-adjusted SEER 13 data, and descriptions of these trends were based on the delay-adjusted data. Delay adjustment[53] is a statistical method that corrects for the unreported (delayed) or updated cases and mostly affects cancers diagnosed in recent years and in nonhospital settings, eg, melanoma of the skin or leukemia. The *t* test was used to test whether the APC was statistically different from zero, and the *Z* test was used to test whether the AAPC was statistically different from zero. All statistical tests were 2-sided. In describing trends, the terms *increase* or *decrease* were used when the slope (APC or AAPC) of the trend was statistically significant (2-sided $P < .05$). For nonstatistically significant trends, terms such as *stable*, *nonsignificant increase*, and *nonsignificant decrease* were used.

Comorbidity scores and levels of severity

For each individual in the study cohort, a comorbidity score was calculated by multiplying previously estimated condition weights by comorbid condition indicators and summing over the 16 conditions. The weights represented the effect of comorbid conditions on survival for other causes of death and were estimated by fitting a Cox proportional hazards model to noncancer survival time, controlling for age, sex, and race.[23] Because individuals may have more than 1 comorbid condition, interactions among the most prevalent conditions (ie, diabetes, COPD, and congestive heart failure) were included in the model. Comorbidity was grouped into 3 levels based on comorbidity scores and clinical judgment.[20] Specifically, having no comorbidity (none) refers to a zero comorbidity score and no identified comorbid conditions. The low and moderate groups with comorbidity scores from zero to 0.66 were combined because of small sample sizes in the low group. Low comorbidity refers to conditions that usually do not require adjusting cancer treatment, such as ulcer or rheumatologic disease. Moderate comorbidity refers to conditions that may sometimes require modifying cancer treatment, including vascular disease, diabetes, paralysis, and AIDS. Severe comorbidity refers to a comorbidity score >0.66 or severe illnesses that frequently lead to organ failure or systemic dysfunction and usually require adjusting cancer treatment, such as COPD, liver dysfunction, chronic renal failure, dementia, and congestive heart failure. Most individuals with more than 1 comorbid condition fell into the severe comorbidity group.

Survival measures and analyses

To provide the most recent survival estimates, the survival analysis was restricted to patients who were diagnosed with cancer between 1999 and 2005. Survival measures by comorbidity level, taking into account competing risks of death, were calculated as the crude probabilities of death from cancer, death from other causes, and survival.[18,54] Two competing endpoints/outcomes were considered: death from a specific first diagnosis of cancer and death from other (noncancer) causes. These events were considered to be mutually exclusive, and the occurrence of 1 precluded the occurrence of the other, ie, the probability of death was partitioned into the 2 causes. Survival was calculated as 1 minus the probabilities of dying from cancer and dying from other causes and is exactly the same as all-cause survival. We used the SEER cause-specific death classification variable,[19,55] which classifies cancer deaths more accurately than cause of death reported from death certificates. In addition to cause of death, this variable incorporates the sequence of tumor occurrence, the site of original diagnosis, and comorbidities. The probabilities of dying from cancer, dying from other causes, and surviving 5 years from diagnosis were calculated by cancer site, sex, age group (66-74 years, 75-84 years, or $\geq$85 years), stage at cancer diagnosis (localized, regional, or distant), and comorbidity level using SEER*Stat software.[48] Stage was based on SEER summary stage for the year 2000.[56,57]

RESULTS

Long-Term (1992-2010) Cancer Incidence Trends for All Racial and Ethnic Groups Combined

Trend analysis based on SEER 13 data indicated that overall delay-adjusted and age-adjusted cancer incidence

rates for all persons combined decreased by 0.4% per year from 2001 through 2010, continuing a trend from 1998 (Table 1). The majority of this decrease occurred among men, for whom a 0.6% annual decrease was documented during the past decade. In contrast, the cancer incidence rate among women remained stable. For children, rates increased by 0.8% per year during the past decade both for children ages 0 through 14 years and for those ages 0 through 19 years, continuing a trend dating to 1992.

Among men, delay-adjusted and age-adjusted incidence rates from 2001 through 2010 decreased for 6 of the 17 most common cancer sites: prostate, lung and bronchus (lung), colon and rectum (colorectum/colorectal), stomach, brain and other nervous system (brain), and larynx. Rates increased for 8 other cancer sites: melanoma of the skin (melanoma), non-Hodgkin lymphoma (NHL), kidney and renal pelvis (kidney), leukemia, pancreas, liver and intrahepatic bile duct (liver), myeloma, and thyroid. Colorectal cancer had the largest percentage decrease, and thyroid cancer had the largest increase. The trends were similar for the 18 most common sites among women, with 6 sites decreasing and 8 sites increasing. The decreasing sites were colon and rectum, ovary, urinary bladder (bladder), cervix uteri (cervix), oral cavity and pharynx (oral), and stomach; and the increasing sites were corpus and uterus not otherwise specified (uterus), thyroid, melanoma, kidney, pancreas, leukemia, myeloma, and liver. As with men, the largest increase was for thyroid cancer; and the largest decrease was for cervical cancer. Rates for women were stable for all other sites, including breast cancer.

Long-Term (1975-2010) Cancer Mortality Trends for All Racial and Ethnic Groups Combined

Following many years of sustained increase in cancer mortality, rates began to stabilize and then decline among both men and women in the early 1990s (Table 2) and among children since the 1970s. From 2001 through 2010, the average annual decline was slightly larger for men (1.8% per year) compared with women (1.4% per year). Death rates declined for 11 of the 17 most common cancers in men (lung, prostate, colon and rectum, leukemia, NHL, esophagus, kidney, stomach, myeloma, oral, larynx) and for 15 of the 18 most common cancers in women (lung, breast, colon and rectum, ovary, leukemia, NHL, brain, myeloma, kidney, stomach, cervix, bladder, esophagus, oral, gallbladder) from 2001 through 2010. During this same period, pancreas and liver cancer death rates increased among men and women; melanoma and cancer of soft tissue, including heart (primarily sarcomas), increased in men; and cancer of the uterus increased in women. Long-term trends have varied, such as more recent declines that followed persistent increases (eg, cancer of the lung, kidney, prostate, female breast, brain, and myeloma) or declining trends with an intermittent period of an increase (eg, ovarian cancer). Several of the long-term mortality trends have stabilized after a decline, such as bladder cancer in men, or have shifted from decreasing mortality to an increase, as observed for cancer of the uterus.

Cancer Incidence Rates (2006-2010) and Short-Term (2001-2010) Trends by Race and Ethnicity

Five-year (2006-2010) average annual age-adjusted incidence rates and short-term (2001-2010) trends were based on combined data from SEER and NPCR registries submitted to the NAACCR (Table 3); these data were not adjusted for delayed reporting. For all cancer sites combined and for all racial and ethnic groups, cancer incidence rates during 2006 through 2010 were higher in men (532.7 per 100,000 men) versus women (412.6 per 100,000 women). Black men had the highest overall cancer incidence rate (593.9 per 100,000 men) of any racial or ethnic group. Prostate and breast cancers were the most common cancers in each racial and ethnic group among men and women, respectively. Incident lung and colorectal cancers ranked second and third, respectively, among men and women in all racial and ethnic groups except for Hispanic men, Hispanic women, and API women, for whom the rates of colorectal cancer were higher than the rates of lung cancer. Beyond these common cancers, cancer rankings varied by race and ethnicity.

Cancer incidence rates decreased from 2001 through 2010 in men of every racial and ethnic group, although the decrease was not significant for AI/AN men. Cancer incidence rates decreased in white and Hispanic women but were stable among women of other racial and ethnic groups. For children ages 0 through 19 years, cancer incidence rates increased in blacks, decreased in AI/ANs, and were stable for all other racial and ethnic groups. In men, incidence rates of the most common cancers (prostate, lung, and colon and rectum) decreased from 2001 to 2010, although the decreases in lung and colorectal cancers were not significant for AI/AN men. In women, breast cancer incidence rates increased among black women but were stable for all other racial and ethnic groups. Lung and colorectal cancer incidence rates decreased among women of all racial and ethnic groups combined, although lung cancer incidence rates were stable in black, API, and AI/AN women. Melanoma

TABLE 1. Surveillance, Epidemiology, and End Results (SEER) Cancer Incidence Rate Trends With Joinpoint Analyses From 1992 to 2010 for the Most Common Cancers, by Sex, for All Racial and Ethnic Groups Combined[a]

	Joinpoint Analyses (1992-2010)[b]									
	Trend 1		Trend 2		Trend 3		Trend 4		AAPC[c]	
Sex/Cancer Site or Type	Years	APC[d]	Years	APC[d]	Years	APC[d]	Years	APC[d]	2001-2010	2006-2010
All sites[e]										
Both sexes	1992-1994	−3.1	1994-1999	0.3	1999-2010	−0.6[f]			−0.6[g]	−0.6[g]
(Delay-adjusted)	1992-1994	−3.2[f]	1994-1998	0.4	1998-2010	−0.4[f]			−0.4[g]	−0.4[g]
Males	1992-1994	−5.8[f]	1994-2007	−0.5[f]	2007-2010	−2.2[f]			−1.1[g]	−1.8[g]
(Delay-adjusted)	1992-1994	−5.6[f]	1994-2010	−0.6[f]					−0.6[g]	−0.6[g]
Females	1992-1998	0.7[f]	1998-2010	−0.3[f]					−0.3[g]	−0.3[g]
(Delay-adjusted)	1992-1994	−0.4	1994-1998	1.2	1998-2003	−0.8[f]	2003-2010	0.1	−0.1	0.1
Children (ages 0-14 years)	1992-2010	0.8[f]							0.8[g]	0.8[g]
(Delay-adjusted)	1992-2010	0.8[f]							0.8[g]	0.8[g]
Children (ages 0-19 years)	1992-2010	0.7[f]							0.7[g]	0.7[g]
(Delay-adjusted)	1992-2010	0.8[f]							0.8[g]	0.8[g]
Top 17 cancers for males[h]										
Prostate	1992-1995	−11.2[f]	1995-2000	2.2	2000-2010	−2.2[f]			−2.2[g]	−2.2[g]
(Delay-adjusted)	1992-1995	−11.2[f]	1995-2000	2.2	2000-2010	−2.0[f]			−2.0[g]	−2.0[g]
Lung and bronchus	1992-2010	−2.0[f]							−2.0[g]	−2.0[g]
(Delay-adjusted)	1992-2010	−1.9[f]							−1.9[g]	−1.9[g]
Colon and rectum	1992-1995	−2.6[f]	1995-1998	1.4	1998-2008	−2.5[f]	2008-2010	−4.7[f]	−3.0[g]	−3.6[g]
(Delay-adjusted)	1992-1995	−2.6[f]	1995-1998	1.4	1998-2008	−2.5[f]	2008-2010	−4.2[f]	−2.9[g]	−3.3[g]
Urinary bladder	1992-2010	−0.1							−0.1	−0.1
(Delay-adjusted)	1992-2010	0.0							0.0	0.0
Melanoma of the skin	1992-2010	2.4[f]							2.4[g]	2.4[g]
(Delay-adjusted)	1992-2010	2.4[f]							2.4[g]	2.4[g]
Non-Hodgkin lymphoma	1992-1995	2.8	1995-1998	−2.1	1998-2010	0.5[f]			0.5[g]	0.5[g]
(Delay-adjusted)	1992-1995	2.8	1995-1998	−2.2	1998-2010	0.7[f]			0.7[g]	0.7[g]
Kidney and renal pelvis	1992-2004	1.9[f]	2004-2008	4.5[f]	2008-2010	−2.8			1.9[g]	0.8
(Delay-adjusted)	1992-2004	1.9[f]	2004-2008	4.7[f]	2008-2010	−2.0			2.2[g]	1.3
Oral cavity and pharynx	1992-2003	−1.5[f]	2003-2010	0.5					0.0	0.5
(Delay-adjusted)	1992-2003	−1.5[f]	2003-2010	0.7					0.2	0.7
Leukemia	1992-2010	−0.1							−0.1	−0.1
(Delay-adjusted)	1992-2010	0.4[f]							0.4[g]	0.4[g]
Pancreas	1992-2003	0.0	2003-2007	2.5[f]	2007-2010	−1.2			0.7	−0.3
(Delay-adjusted)	1992-2001	0.0	2001-2010	1.3[f]					1.3[g]	1.3[g]
Liver and intrahepatic bile duct	1992-2010	3.5[f]							3.5[g]	3.5[g]
(Delay-adjusted)	1992-2010	3.7[f]							3.7[g]	3.7[g]
Stomach	1992-2010	−1.7[f]							−1.7[g]	−1.7[g]
(Delay-adjusted)	1992-2010	−1.7[f]							−1.7[g]	−1.7[g]
Esophagus	1992-2010	−0.1							−0.1	−0.1
(Delay-adjusted)	1992-2010	0.0							0.0	0.0
Brain and other nervous system	1992-2010	−0.3[f]							−0.3[g]	−0.3[g]
(Delay-adjusted)	1992-2010	−0.3[f]							−0.3[g]	−0.3[g]
Myeloma	1992-2010	0.5[f]							0.5[g]	0.5[g]
(Delay-adjusted)	1992-2006	0.4	2006-2010	3.5[f]					1.8[g]	3.5[g]
Larynx	1992-2003	−3.2[f]	2003-2010	−1.6[f]					−1.9[g]	−1.6[g]
(Delay-adjusted)	1992-2003	−3.2[f]	2003-2010	−1.5[f]					−1.8[g]	−1.5[g]
Thyroid	1992-1996	−1.0	1996-2010	5.4[f]					5.4[g]	5.4[g]
(Delay-adjusted)	1992-1996	−0.9	1996-2010	5.4[f]					5.4[g]	5.4[g]
Top 18 cancers for females[h]										
Breast	1992-1999	1.3[f]	1999-2004	−2.2[f]	2004-2010	0.1			−0.7	0.1
(Delay-adjusted)	1992-1999	1.3[f]	1999-2004	−2.2[f]	2004-2010	0.2			−0.6	0.2
Lung and bronchus	1992-2007	0.0	2007-2010	−2.6[f]					−0.9[g]	−1.9[g]
(Delay-adjusted)	1992-1998	0.8[f]	1998-2001	−1.3	2001-2005	0.7	2005-2010	−1.2[f]	−0.4	−1.2[g]
Colon and rectum	1992-1995	−1.8[f]	1995-1998	1.8	1998-2008	−2.0[f]	2008-2010	−4.7[f]	−2.6[g]	−3.3[g]
(Delay-adjusted)	1992-1995	−1.8[f]	1995-1998	1.8	1998-2008	−1.9[f]	2008-2010	−4.1[f]	−2.4[g]	−3.0[g]
Corpus and uterus, NOS	1992-2006	−0.2	2006-2010	2.8[f]					1.1[g]	2.8[g]
(Delay-adjusted)	1992-2006	−0.2	2006-2010	2.9[f]					1.2[g]	2.9[g]
Thyroid	1992-1998	3.9[f]	1998-2010	6.5[f]					6.5[g]	6.5[g]
(Delay-adjusted)	1992-1998	3.9[f]	1998-2010	6.5[f]					6.5[g]	6.5[g]
Non-Hodgkin lymphoma	1992-2003	1.3[f]	2003-2010	−0.2					0.1	−0.2
(Delay-adjusted)	1992-2003	1.3[f]	2003-2010	0.0					0.3	0.0

TABLE 1. *Continued*

Sex/Cancer Site or Type	Joinpoint Analyses (1992-2010)[b] Trend 1 Years	Trend 1 APC[d]	Trend 2 Years	Trend 2 APC[d]	Trend 3 Years	Trend 3 APC[d]	Trend 4 Years	Trend 4 APC[d]	AAPC[c] 2001-2010	AAPC[c] 2006-2010
Melanoma of the skin	1992-1997	4.0[f]	1997-2010	1.6[f]					1.6[g]	1.6[g]
(Delay-adjusted)	1992-1997	3.9[f]	1997-2010	1.7[f]					1.7[g]	1.7[g]
Ovary[e]	1992-2010	−1.0[f]							−1.0[g]	−1.0[g]
(Delay-adjusted)	1992-2010	−0.9[f]							−0.9[g]	−0.9[g]
Kidney and renal pelvis	1992-1999	1.4[f]	1999-2008	3.4[f]	2008-2010	−4.7			1.5[g]	−0.7
(Delay-adjusted)	1992-2000	1.6[f]	2000-2008	3.6[f]	2008-2010	−4.0			1.9[g]	−0.2
Pancreas	1992-1999	−0.2	1999-2010	1.1[f]					1.1[g]	1.1[g]
(Delay-adjusted)	1992-2000	−0.1	2000-2010	1.4[f]					1.4[g]	1.4[g]
Leukemia	1992-2010	0.1							0.1	0.1
(Delay-adjusted)	1992-2010	0.6[f]							0.6[g]	0.6[g]
Urinary bladder	1992-2004	−0.2	2004-2010	−1.3[f]					−0.9[g]	−1.3[g]
(Delay-adjusted)	1992-2010	−0.4[f]							−0.4[g]	−0.4[g]
Cervix uteri	1992-2010	−2.5[f]							−2.5[g]	−2.5[g]
(Delay-adjusted)	1992-2010	−2.5[f]							−2.5[g]	−2.5[g]
Oral cavity and pharynx	1992-2010	−0.9[f]							−0.9[g]	−0.9[g]
(Delay-adjusted)	1992-2010	−0.9[f]							−0.9[g]	−0.9[g]
Brain and other nervous system	1992-2010	−0.1							−0.1	−0.1
(Delay-adjusted)	1992-2010	0.0							0.0	0.0
Myeloma	1992-2010	0.1							0.1	0.1
(Delay-adjusted)	1992-2010	0.5[f]							0.5[g]	0.5[g]
Stomach	1992-2010	−0.8[f]							−0.8[g]	−0.8[g]
(Delay-adjusted)	1992-2010	−0.7[f]							−0.7[g]	−0.7[g]
Liver and intrahepatic bile duct	1992-2010	2.8[f]							2.8[g]	2.8[g]
(Delay-adjusted)	1992-2010	2.9[f]							2.9[g]	2.9[g]

Abbreviations: AAPC, average annual percent change; APC, annual percent change; NOS, not otherwise specified.

[a] Source: Surveillance, Epidemiology, and End Results (SEER) 13 areas covering about 13% of the US population (Connecticut, Hawaii, Iowa, Utah, and New Mexico, the Alaska Native Tumor Registry, rural Georgia, and the metropolitan areas of Los Angeles, Greater San Francisco Bay Area, Detroit, Atlanta, and Seattle-Puget Sound).

[b] Joinpoint analyses with up to 3 joinpoints yielding up to 4 trend segments (Trends 1-4) were based on rates per 100,000 persons and were age-adjusted to the 2000 US standard population (19 age groups: ages <1 year, 1-4 years, 5-9 years, …, 80-84 years, ≥85 years; US Bureau of the Census. *Current Population Reports, p25-1130*. Washington, DC: US Government Printing Office; 2000). For joinpoint analysis, the Joinpoint Regression Program was used (version 4.0.3, April 2013; Surveillance Research Program, National Cancer Institute, Bethesda, Md).

[c] The AAPC is a weighted average of the APCs that is calculated by joinpoint regression.

[d] The APC is based on rates that were age-adjusted to the 2000 US standard population (19 age groups; Census publication p25-1130).

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

[f] The APC is statistically significantly different from zero (2-sided *t* test; $P < .05$).

[g] The AAPC is statistically significantly different from zero (2-sided *Z* test; $P < .05$).

[h] Cancers are listed in descending rank order of sex-specific, age-adjusted incidence rates for 2006 through 2010 for all racial and ethnic groups combined (using data from the National Program of Cancer Registries [NPCR] and SEER Program areas reported by the North American Association of Central Cancer Registries [NAACCR] as meeting high-quality incidence data standards for 2006-2010). More than 15 cancers may appear under men and women to include the top 15 cancers in each racial and ethnic group.

incidence rates increased only in white men and women. Liver cancer incidence rates increased among men and women in every racial and ethnic group except API men and women and AI/AN women. Incidence rates of myeloma increased in API men, whereas they decreased in AI/AN men and white and Hispanic women, and they were stable in all other groups.

Current Cancer Death Rates (2006-2010) and Short-Term (2001-2010) Trends by Race and Ethnicity

For all cancer sites combined and for all racial and ethnic groups, cancer death rates for 2006 through 2010 were higher among men (215.3 deaths per 100,000 men) (Table 4) than among women (149.7 deaths per 100,000 women). Black men had the highest cancer death rate (276.6 deaths per 100,000 men) of any racial or ethnic group. Lung, prostate, and colorectal cancers were the 3 leading causes of cancer death among men in every racial and ethnic group except API men, for whom liver cancer ranked second. For most women, the leading causes of cancer death were lung, breast, and colorectal cancers. However, among Hispanic women, breast cancer was the leading cause of cancer death.

Declines in cancer death rates from 2001 through 2010 were noted for men, women, and children in all

TABLE 2. US Cancer Death Rate Trends With Joinpoint Analyses From 1975 to 2010 for the Most Common Cancers, by Sex, for All Racial and Ethnic Groups Combined[a]

Sex/Cancer Site or Type	Joinpoint Analyses (1975-2010)[b]													
	Trend 1		Trend 2		Trend 3		Trend 4		Trend 5		Trend 6		AAPC[c]	
	Years	APC[d]	Years	APC[d]	Years	APC[d]	Years	APC[d]	Years	APC[d]	Years	APC[d]	2001-2010	2006-2010
All sites														
Both sexes	1975-1984	0.5[e]	1984-1991	0.3[e]	1991-1994	−0.5	1994-1998	−1.3[e]	1998-2001	−0.8	2001-2010	−1.5[e]	−1.5[f]	−1.5[f]
Males	1975-1979	1.0[e]	1979-1990	0.3[e]	1990-1993	−0.5	1993-2001	−1.5[e]	2001-2010	−1.8[e]			−1.8[f]	−1.8[f]
Females	1975-1990	0.6[e]	1990-1994	−0.2	1994-2002	−0.8[e]	2002-2010	−1.4[e]					−1.4[f]	−1.4[f]
Children (ages 0-14 years)	1975-1998	−2.9[e]	1998-2003	0.2	2003-2010	−2.4[e]							−1.9[f]	−2.4[f]
Children (ages 0-19 years)	1975-1998	−2.7[e]	1998-2002	0.3	2002-2010	−2.4[e]							−2.1[f]	−2.4[f]
Top 17 cancers for males[g]														
Lung and bronchus	1975-1978	2.5[e]	1978-1984	1.2[e]	1984-1990	0.4[e]	1990-1993	−1.1	1993-2005	−1.9[e]	2005-2010	−2.9[e]	−2.5[f]	−2.9[f]
Prostate	1975-1987	0.9[e]	1987-1991	3.1[e]	1991-1994	−0.8	1994-2004	−3.8[e]	2004-2010	−3.1[e]			−3.3[f]	−3.1[f]
Colon and rectum	1975-1978	0.8	1978-1985	−0.4[e]	1985-1990	−1.4[e]	1990-2002	−2.0[e]	2002-2005	−4.0[e]	2005-2010	−2.5[e]	−2.9[f]	−2.5[f]
Pancreas	1975-1986	−0.8[e]	1986-2001	−0.3[e]	2001-2010	0.5[e]							0.5[f]	0.5[f]
Leukemia	1975-1980	0.5	1980-1987	−0.7[e]	1987-1995	0.1	1995-2010	−0.9[e]					−0.9[f]	−0.9[f]
Liver and intrahepatic bile duct	1975-1985	1.5[e]	1985-1996	3.8[e]	1996-1999	0.5	1999-2010	2.5[e]					2.5[f]	2.5[f]
Non-Hodgkin lymphoma	1975-1996	2.5[e]	1996-2010	−2.6[e]									−2.6[f]	−2.6[f]
Urinary bladder	1975-1983	−1.4[e]	1983-1987	−2.8[e]	1987-1993	0.2	1993-1997	−1.1	1997-2010	0.1			0.1	0.1
Esophagus	1975-1985	0.7[e]	1985-1994	1.2[e]	1994-2005	0.4[e]	2005-2010	−1.1[e]					−0.4[f]	−1.1[f]
Kidney and renal pelvis	1975-1991	1.1[e]	1991-2001	−0.1	2001-2010	−0.9[e]							−0.9[f]	−0.9[f]
Brain and other nervous system	1975-1977	4.4	1977-1982	−0.4	1982-1991	1.3[e]	1991-2007	−1.0[e]	2007-2010	0.7			−0.4	0.3
Stomach	1975-1987	−2.4[e]	1987-1990	−0.3	1990-2010	−3.4[e]							−3.4[f]	−3.4[f]
Myeloma	1975-1994	1.5[e]	1994-2010	−1.1[e]									−1.1[f]	−1.1[f]
Melanoma of the skin	1975-1989	2.2[e]	1989-2010	0.3[e]									0.3[f]	0.3[f]
Oral cavity and pharynx	1975-1993	−1.9[e]	1993-2000	−3.0[e]	2000-2010	−1.2[e]							−1.2[f]	−1.2[f]
Larynx	1975-1994	−0.8[e]	1994-2010	−2.5[e]									−2.5[f]	−2.5[f]
Soft tissue including heart	1975-1980	7.6[e]	1980-1997	1.2[e]	1997-2002	−3.6[e]	2002-2010	1.4[e]					0.8[f]	1.4[f]
Top 18 cancers for females[g]														
Lung and bronchus	1975-1982	6.0[e]	1982-1990	4.2[e]	1990-1995	1.7[e]	1995-2004	0.3[e]	2004-2010	−1.4[e]			−0.8[f]	−1.4[f]
Breast	1975-1990	0.4[e]	1990-1995	−1.8[e]	1995-1998	−3.2[e]	1998-2010	−1.9[e]					−1.9[f]	−1.9[f]
Colon and rectum	1975-1984	−1.0[e]	1984-2001	−1.8[e]	2001-2010	−2.9[e]							−2.9[f]	−2.9[f]
Pancreas	1975-1984	0.8[e]	1984-2002	0.1	2002-2010	0.5[f]							0.4[f]	0.5[f]
Ovary	1975-1982	−1.2[e]	1982-1992	0.3[e]	1992-1998	−1.2[e]	1998-2002	1.0	2002-2010	−1.9[e]			−1.6[f]	−1.9[f]
Leukemia	1975-1980	0.8	1980-2000	−0.4[e]	2000-2010	−1.3[e]							−1.3[f]	−1.3[f]
Non-Hodgkin lymphoma	1975-1994	2.2[e]	1994-1997	0.9	1997-2010	−3.2[e]							−3.2[f]	−3.2[f]
Corpus and uterus, NOS	1975-1989	−1.6[e]	1989-1997	−0.7[e]	1997-2010	0.4[e]							0.4[f]	0.4[f]
Brain and other nervous system	1975-1992	0.9[e]	1992-2010	−0.9[e]									−0.9[f]	−0.9[f]
Liver and intrahepatic bile duct	1975-1987	0.8[e]	1987-1995	3.8[e]	1995-2000	0.3	2000-2010	1.6[e]					1.6[f]	1.6[f]
Myeloma	1975-1993	1.5[e]	1993-2001	−0.4	2001-2010	−2.3[e]							−2.3[f]	−2.3[f]
Kidney and renal pelvis	1975-1994	1.1[e]	1994-2010	−0.9[e]									−0.9[f]	−0.9[f]
Stomach	1975-1987	−2.8[e]	1987-1990	−0.4	1990-2010	−2.7[e]							−2.7[f]	−2.7[f]
Cervix uteri	1975-1982	−4.3[e]	1982-1996	−1.6[e]	1996-2003	−3.7[e]	2003-2010	−1.1[e]					−1.7[f]	−1.1[f]
Urinary bladder	1975-1986	−1.7[e]	1986-2010	−0.4[e]									−0.4[f]	−0.4[f]

racial and ethnic groups, although the decline was not statistically significant in API and AI/AN children (Table 4). Death rates declined for the most common cancers (lung, prostate, and colorectal) among men of all racial and ethnic groups during 2001 through 2010, although the declines were not statistically significant for AI/AN men. Death rates declined for the most common cancers (lung, breast, and colorectal) among women of most racial and ethnic groups, except for API women (in whom lung cancer rates were stable) and AI/AN women (whose rates remained stable for all 3 cancer sites). Death rates for liver cancer increased among white, Hispanic, and black men and among white and Hispanic women during 2001 through 2010. Pancreatic cancer death rates increased among white men and women. In addition, death rates for melanoma and soft tissue cancer increased among white men, kidney cancer increased among API men, leukemia increased among AI/AN men, and cancer of the uterus increased among black and API women.

Comorbidity Prevalence Among Older Cancer Patients and the Medicare Population

Table 5 provides data on the prevalence of selected comorbid conditions among cancer patients for each of the 4 most common cancer sites, for all cancers combined, and for the noncancer control cohort of Medicare beneficiaries. The prevalence of comorbidity was similar among cancer-free Medicare beneficiaries (31.8%), breast cancer patients (32.2%), and prostate cancer patients (30.5%); highest among lung cancer patients (52.9%); and intermediate among colorectal cancer patients (40.7%). The most common conditions among cancer patients were diabetes (16.0%), COPD (15.5%), congestive heart failure (9.7%), and cerebrovascular disease (6.0%). Patients with female breast and prostate cancer and the cohort of cancer-free patients were more likely than patients with colorectal or lung cancer to have no comorbidity. Patients with lung cancer had the highest prevalence of comorbidities, and the most prevalent comorbidity was COPD (33.6%). The prevalence of congestive heart failure was high among patients with lung cancer (12.4%) and patients with colorectal cancer (11.6%) relative to the cancer-free cohort (6.9%). The prevalence of diabetes was high among patients with colorectal cancer (17.2%). Demographic characteristics for the cancer patients and the cancer-free cohort are provided in Table 6.

Survival Measures Considering Competing Risks of Death by Comorbidity Level

Figures 1 through 4 present the probability of dying from cancer, dying from causes other than cancer, and survival

TABLE 2. *Continued*

Joinpoint Analyses (1975-2010)[b]

Sex/Cancer Site or Type	Trend 1		Trend 2		Trend 3		Trend 4		Trend 5		Trend 6		AAPC[c]	
	Years	APC[d]	Years	APC[d]	Years	APC[d]	Years	APC[d]	Years	APC[d]	Years	APC[d]	2001-2010	2006-2010
Esophagus	1975-2000	0.1	2000-2010	−1.5[e]									−1.5[f]	−1.5[f]
Oral cavity and pharynx	1975-1990	−0.9[e]	1990-2005	−2.4[e]	2005-2010	−0.9							−1.6[f]	−0.9
Gallbladder	1975-2002	−2.7[e]	2002-2010	−1.2[e]									−1.3[f]	−1.2[f]

Abbreviations: AAPC, average annual percent change; APC, annual percent change; NOS, not otherwise specified.

[a] Source: National Center for Health Statistics public-use data file for the total US, 1975 through 2010.

[b] Joinpoint analyses with up to 5 joinpoints yielding up to 6 trend segments (Trends 1-6) were based on rates per 100,000 persons and were age-adjusted to the 2000 US standard population (19 age groups: ages <1 year, 1-4 years, 5-9 years, . . ., 80-84 years, ≥85 years; US Bureau of the Census. *Current Population Reports, p25-1130*. Washington, DC: US Government Printing Office; 2000). For joinpoint analysis, the Joinpoint Regression Program was used (version 4.0.3, April 2013; Surveillance Research Program, National Cancer Institute, Bethesda, Md).

[c] The AAPC is a weighted average of the APCs calculated by joinpoint regression.

[d] The APC is based on rates that were age-adjusted to the 2000 US standard population (19 age groups: ages <1 year, 1-4 years, 5-9 years, . . ., 80-84 years, and ≥85 years; Census publication p25-1130).

[e] The APC is statistically significantly different from zero (2-sided *t* test; $P < .05$).

[f] The AAPC is statistically significantly different from zero (2-sided *Z* test; $P < .05$).

[g] Cancers are listed in descending rank order of sex-specific, age-adjusted incidence rates for 2006 through 2010 for all racial and ethnic groups combined. More than 15 cancers may appear under men and women to include the top 15 cancers in each racial and ethnic group.

TABLE 3. Incidence Rates From 2006 to 2010 and Fixed-Interval Trends From 2001 to 2010 for the Top 15 Cancers by Sex, Race, and Ethnicity, for Areas in the United States With High-Quality Incidence Data[a]

Sex/Cancer Site or Type	All Races/Ethnicities				White[b]			Black[b]			API[b]			AI/AN (CHSDA)[b]			Hispanic[b]			Non-Hispanic[b]		
	Rank	Rate[c]	2001-2010 AAPC[d]	2006-2010 AAPC[d]	Rank	Rate[c]	2001-2010 AAPC[d]	Rank	Rate[c]	2001-2010 AAPC[d]	Rank	Rate[c]	2001-2010 AAPC[d]	Rank	Rate[c]	2001-2010 AAPC[d]	Rank	Rate[c]	2001-2010 AAPC[d]	Rank	Rate[c]	2001-2010 AAPC[d]
All sites[e]																						
Both sexes		462.6	−1.1[f]	−1.6[f]		463.2	−1.2[f]		471.7	−0.9[f]		293.5	−0.8[f]		393.8	−0.5		361.7	−1.4[f]		473.4	−1.0[f]
Males		532.7	−1.6[f]	−2.5[f]		526.3	−1.7[f]		593.9	−1.8[f]		319.3	−1.7[f]		435.1	−0.8		419.2	−2.0[f]		544.4	−1.6[f]
Females		412.6	−0.3[f]	−0.3[f]		418.6	−0.4[f]		390.6	−0.1		278.4	0.0		367.2	−0.2		325.1	−0.8[f]		422.3	−0.2
Children (ages 0-14 years)		15.9	0.5[f]	0.5[f]		16.5	0.4		12.2	1.1[f]		12.5	−0.2		11.1	−2.7		15.7	0.2		15.9	0.6[f]
Children (ages 0-19 years)		17.2	0.3	0.3		18.1	0.3		12.8	1.0[f]		13.2	0.2		12.3	−2.5[f]		16.7	0.2		17.4	0.4[f]
Males[g]																						
Prostate	1	146.6	−3.6[f]	−5.2[f]	1	136.6	−4.0[f]	1	220.0	−2.6[f]	1	75.0	−3.9[f]	1	104.1	−2.3[f]	1	124.2	−3.1[f]	1	148.9	−3.5[f]
Lung and bronchus	2	80.0	−2.4[f]	−3.2[f]	2	79.6	−2.3[f]	2	94.7	−2.7[f]	2	48.8	−1.5[f]	2	70.2	−1.4	3	45.9	−2.7[f]	2	83.1	−2.2[f]
Colon and rectum	3	51.7	−3.8[f]	−4.5[f]	3	50.5	−4.0[f]	3	62.5	−2.0[f]	3	40.8	−2.8[f]	3	51.7	−1.4	2	47.3	−2.9[f]	3	52.2	−3.8[f]
Urinary bladder	4	36.9	−0.9[f]	−1.7[f]	4	39.0	−1.0[f]	5	19.0	0.0	6	15.5	−0.7	5	18.3	0.1	4	20.8	−1.7[f]	4	38.2	−0.8[f]
Melanoma of the skin	5	24.7	1.6[f]	1.6[f]	5	27.5	1.6[f]	25	1.1	−0.4	20	1.5	−1.8	13	7.1	1.0	17	4.7	−1.7	5	26.9	1.8[f]
Non-Hodgkin lymphoma	6	23.3	−0.1	−0.8	6	23.9	−0.2	6	16.8	−0.2	7	15.0	−0.4	7	16.5	−0.7	6	20.1	−0.3	6	23.6	0.0
Kidney and renal pelvis	7	21.4	1.3[f]	−0.2	7	21.5	1.4[f]	4	23.0	2.1[f]	9	10.6	3.1[f]	4	30.6	5.1[f]	5	20.5	1.2[f]	7	21.5	1.5[f]
Oral cavity and pharynx	8	16.5	0.2	0.2	9	16.8	0.5[f]	9	15.2	−3.0[f]	8	10.7	0.1	8	14.0	2.1	11	10.6	−1.4[f]	8	17.3	0.4
Leukemia	9	16.4	−0.8[f]	−0.8[f]	8	16.9	−0.9[f]	12	12.4	−0.8[f]	11	8.9	−0.7	10	11.7	−1.7	9	12.8	−0.7	9	16.6	−0.8[f]
Pancreas	10	13.7	0.7[f]	0.7[f]	10	13.6	0.7[f]	7	16.7	0.8[f]	10	9.7	0.1	11	10.8	0.4	10	12.0	0.2	10	13.9	0.8[f]
Liver and intrahepatic bile duct	11	10.8	3.9[f]	3.9[f]	11	9.6	4.1[f]	10	14.9	4.3[f]	4	21.3	−0.9	6	17.8	4.4[f]	7	18.8	3.0[f]	11	10.1	3.8[f]
Stomach	12	9.4	−1.7[f]	−1.7[f]	13	8.4	−1.8[f]	8	15.7	−1.8[f]	5	15.6	−3.3[f]	9	13.1	−4.8[f]	8	13.9	−2.0[f]	12	9.0	−1.8[f]
Esophagus	13	8.5	−1.0[f]	−2.3[f]	12	8.6	−0.5	14	8.7	−5.0[f]	15	3.9	−0.9	12	7.2	−2.2	15	5.4	−1.6[f]	13	8.7	−0.8
Brain and other nervous system	14	7.8	−0.6[f]	−1.2[f]	14	8.4	−0.4[f]	15	4.6	−0.5	13	4.3	−0.9	16	5.3	−0.9	13	6.0	−1.2[f]	14	8.1	−0.3
Myeloma	15	7.4	0.1	0.1	15	6.8	−0.2	11	13.9	0.2	14	4.3	1.9[f]	15	6.0	−4.9[f]	12	7.0	−0.5	15	7.4	0.1
Larynx	16	6.6	−2.4[f]	−2.4[f]	17	6.4	−2.5[f]	13	9.9	−3.3[f]	18	2.3	−1.9	14	6.2	−0.3	14	5.6	−3.0[f]	16	6.8	−2.3[f]
Thyroid	17	6.3	6.3[f]	6.3[f]	16	6.7	6.4[f]	18	3.3	5.4[f]	12	5.5	5.2[f]	20	3.3	3.8	16	4.7	4.8[f]	17	6.6	6.5[f]
Females[g]																						
Breast	1	122.2	−1.0	0.0	1	123.5	−1.1	1	118.4	0.5[f]	1	84.7	0.4	1	90.3	−0.5	1	91.1	−0.6	1	125.6	−0.9
Lung and bronchus	2	55.1	−0.7[f]	−1.8[f]	2	56.8	−0.6[f]	2	50.4	−0.1	3	28.0	0.0	2	52.1	−0.3	3	26.6	−1.0[f]	2	57.7	−0.5[f]
Colon and rectum	3	39.1	−3.2[f]	−4.0[f]	3	38.0	−3.3[f]	3	46.7	−2.9[f]	2	31.0	−2.2[f]	3	42.7	−1.3[f]	2	32.6	−2.8[f]	3	39.7	−3.1[f]
Corpus and uterus, NOS	4	24.6	0.4	1.1[f]	4	25.0	0.3	4	23.0	2.0[f]	5	16.9	2.3[f]	4	22.4	1.8	4	20.1	1.0[f]	4	25.0	0.4
Thyroid	5	18.5	6.4[f]	5.1[f]	5	19.6	6.4[f]	8	11.2	6.1[f]	4	18.5	6.0[f]	7	11.6	3.3[f]	5	17.4	6.0[f]	5	18.9	6.4[f]
Non-Hodgkin lymphoma	6	16.3	−0.2	−0.9[f]	7	16.8	−0.3	7	11.7	0.1	6	10.4	−0.7	6	14.2	−1.0	6	15.2	−0.2	7	16.4	−0.2
Melanoma of the skin	7	15.6	1.4[f]	1.4[f]	6	18.0	1.6[f]	27	1.0	−1.0	22	1.1	−2.2	14	5.5	0.1	18	4.0	−1.5	6	17.3	1.8[f]
Ovary	8	12.3	−2.2[f]	−2.9[f]	8	12.8	−2.3[f]	11	9.4	−1.5[f]	8	9.0	−1.6[f]	8	11.6	−2.0	9	10.9	−2.1[f]	8	12.4	−2.2[f]
Kidney and renal pelvis	9	11.2	1.6[f]	−0.1	9	11.3	1.9[f]	6	12.2	3.0[f]	13	5.1	2.0	5	17.5	2.1	7	11.5	1.5[f]	9	11.2	1.7[f]
Pancreas	10	10.7	0.7[f]	0.1	10	10.4	0.7[f]	5	13.9	0.4	9	8.3	0.8	9	10.0	−0.5	10	10.2	0.2	10	10.8	0.8[f]
Leukemia	11	10.0	−0.5[f]	−0.5[f]	11	10.3	−0.5[f]	13	7.8	−0.9[f]	12	6.0	0.7	12	8.0	−0.1	11	8.8	−0.5	11	10.0	−0.5[f]

TABLE 3. *Continued*

Sex/Cancer Site or Type	All Races/Ethnicities				White[b]			Black[b]			API[b]			AI/AN (CHSDA)[b]			Hispanic[b]			Non-Hispanic[b]		
	Rank	Rate[c]	2001-2010 AAPC[d]	2006-2010 AAPC[d]	Rank	Rate[c]	2001-2010 AAPC[d]	Rank	Rate[c]	2001-2010 AAPC[d]	Rank	Rate[c]	2001-2010 AAPC[d]	Rank	Rate[c]	2001-2010 AAPC[d]	Rank	Rate[c]	2001-2010 AAPC[d]	Rank	Rate[c]	2001-2010 AAPC[d]
Urinary bladder	12	9.1	−1.2[f]	−1.2[f]	12	9.6	−1.3[f]	14	6.6	−0.9	15	3.8	−1.0	17	4.7	−1.6	14	5.2	−2.4[f]	12	9.5	−0.9
Cervix uteri	13	8.0	−1.9[f]	−1.2[f]	13	7.7	−1.5[f]	9	10.3	−2.9[f]	11	6.7	−3.5[f]	10	9.7	0.4	8	10.9	−4.2[f]	13	7.6	−1.6[f]
Oral cavity and pharynx	14	6.2	0.0	0.0	14	6.3	0.3	15	5.2	−1.4[f]	14	4.8	−1.7[f]	15	5.0	−4.1	17	4.2	0.2	14	6.5	0.1
Brain and other nervous system	15	5.7	−0.5	−1.6[f]	15	6.1	−0.5	17	3.6	−0.4	16	3.0	−0.8	18	4.2	−0.7	16	4.7	−1.2[f]	15	5.8	−0.3
Myeloma	16	4.8	0.0	0.0	16	4.2	−0.4[f]	10	10.2	0.5	17	2.9	0.1	16	4.9	−4.2	15	4.9	−1.5[f]	16	4.8	0.1
Stomach	17	4.7	−1.1[f]	−1.1[f]	17	4.0	−1.4[f]	12	8.1	−1.5[f]	7	9.0	−2.8[f]	13	6.9	−2.6	12	8.2	−2.1[f]	17	4.3	−1.3[f]
Liver and intrahepatic bile duct	18	3.7	3.4[f]	3.4[f]	18	3.3	3.5[f]	16	4.4	3.5[f]	10	8.0	−0.6	11	8.0	2.5	13	6.9	2.1[f]	18	3.4	3.3[f]

Abbreviations: AAPC, average annual percent change; AI/AN, American Indian/Alaska Native; APC, annual percent change; API, Asian/Pacific Islander; CHSDA, Indian Health Service Contract Health Services Delivery Area; NAACCR, North American Association of Central Cancer Registries; NOS, not otherwise specified; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results.

[a] Source: NPCR and SEER areas reported by NAACCR as meeting high-quality incidence data standards for the specified time periods.

[b] White, black, API, and AI/AN (CHSDA 2012 counties) include Hispanic and non-Hispanic; the race and ethnicity categories are not mutually exclusive. AI/AN (CHSDA 2012) statistics exclude data from Kansas.

[c] Rates are per 100,000 persons and were age-adjusted to the 2000 US standard population (19 age groups: ages <1 year, 1-4 years, 5-9 years, …, 80-84 years, ≥85 years; US Bureau of the Census. *Current Population Reports, p25-1130*. Washington, DC: US Government Printing Office; 2000).

[d] The AAPC is a weighted average of the APCs that is calculated by joinpoint regression over the period from 2001 to 2010 unless otherwise noted. Joinpoint analyses with up to 2 joinpoints yielding up to 3 trend segments were based on rates per 100,000 persons and were age-adjusted to the 2000 US standard population (19 age groups; Census publication p25-1130). For joinpoint analysis, the Joinpoint Regression Program was used (version 4.0.3, April 2013; Surveillance Research Program, National Cancer Institute, Bethesda, Md).

[e] For all sites, myelodysplastic syndromes are included for the rate calculations but not for the APC calculations; they are excluded from cancer-specific analysis. Ovary excludes borderline tumors.

[f] The AAPC is statistically significantly different from zero (2-sided Z test; $P < .05$).

[g] Cancers are listed in descending rank order according to sex-specific, age-adjusted rates for 2006 through 2010 for all racial and ethnic groups combined. More than 15 cancers may appear under men and women to include the top 15 cancers in each racial and ethnic group (**2006-2010 rates for all races/ethnicities, white, black, AI/AN, API, Hispanic, and non-Hispanic [46 states]:** Alabama, Alaska, Arizona, California, Colorado, Connecticut, Delaware, District of Columbia, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Washington, West Virginia, Wisconsin, Wyoming; **2001-2010 AAPCs for all races/ethnicities, white, black, AI/AN, API, Hispanic, and non-Hispanic [42 states]:** Alabama, Alaska, Arizona, California, Colorado, Connecticut, Delaware, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Texas, Utah, Vermont, Washington, West Virginia, Wisconsin, Wyoming.

TABLE 4. US Cancer Death Rates From 2006 to 2010 and Fixed-Interval Trends From 2001 to 2010 for the Top Cancers by Sex, Race, and Ethnicity[a]

Sex/Cancer Site or Type[d]	All Races/Ethnicities				White[b]			Black[b]			API[b]			AI/AN (CHSDA Counties)[b]			Hispanic[b,c]			Non-Hispanic[b,c]		
	Rank	Rate[e]	2001-2010 AAPC[e]	2006-2010 AAPC[e]	Rank	Rate[e]	2001-2010 AAPC[e]	Rank	Rate[e]	2001-2010 AAPC[e]	Rank	Rate[e]	2001-2010 AAPC[e]	Rank	Rate[e]	2001-2010 AAPC[e]	Rank	Rate[e]	2001-2010 AAPC[e]	Rank	Rate[e]	2001-2010 AAPC[e]
All sites																						
Both sexes		176.4	−1.5[f]	−1.5[f]		175.8	−1.4[f]		210.3	−2.1[f]		108.8	−1.2[f]		160.4	−0.7[f]		121.9	−1.4[f]		180.7	−1.5[f]
Men		215.3	−1.8[f]	−1.8[f]		213.1	−1.7[f]		276.6	−2.6[f]		132.4	−1.3[f]		191.0	−0.4		152.2	−1.6[f]		219.9	−1.7[f]
Women		149.7	−1.4[f]	−1.4[f]		149.8	−1.3[f]		171.2	−1.7[f]		92.1	−1.0[f]		139.0	−1.1[f]		101.3	−1.2[f]		153.7	−1.3[f]
Children (ages 0-14 years)		2.2	−2.0[f]	−2.0[f]		2.3	−1.9[f]		2.1	−2.3[f]		1.9	−0.8		1.6	—[g]		2.3	−2.3[f]		2.2	−2.0[f]
Children (ages 0-19 years)		2.4	−2.2[f]	−2.2[f]		2.5	−2.2[f]		2.3	−2.3[f]		2.1	−0.5		1.8	−3.0		2.5	−2.5[f]		2.4	−2.2[f]
Top 17 cancers for men[d]																						
Lung and bronchus	1	63.5	−2.5[f]	−2.8[f]	1	63.2	−2.4[f]	1	78.5	−3.3[f]	1	35.5	−1.6[f]	1	49.6	−0.5	1	31.3	−2.8[f]	1	66.0	−2.3[f]
Prostate	2	23.0	−3.4[f]	−3.4[f]	2	21.2	−3.3[f]	2	50.9	−3.8[f]	4	10.1	−2.3[f]	2	20.7	−1.4	2	19.2	−3.0[f]	2	23.2	−3.3[f]
Colon and rectum	3	19.6	−3.0[f]	−3.0[f]	3	19.1	−3.1[f]	3	28.7	−2.4[f]	3	13.1	−2.3[f]	3	18.7	−1.5	3	16.1	−1.4[f]	3	20.0	−3.0[f]
Pancreas	4	12.5	0.4[f]	0.4[f]	4	12.5	0.5[f]	4	15.3	0.0	6	8.3	0.5	5	10.1	5.7[f]	5	9.6	0.5	4	12.8	0.5[f]
Leukemia	5	9.5	−1.0[f]	−1.0[f]	5	9.8	−0.9[f]	7	8.2	−1.3[f]	8	5.0	−0.2	8	7.0	3.7[f]	8	6.1	−1.1[f]	5	9.7	−0.9[f]
Liver and intrahepatic bile duct	6	8.3	2.5[f]	2.5[f]	9	7.6	2.6[f]	5	11.8	3.0[f]	2	14.4	−0.5	4	13.2	3.3	4	12.3	1.9[f]	7	8.0	2.5[f]
Non-Hodgkin lymphoma	7	8.2	−2.6[f]	−2.6[f]	6	8.5	−2.6[f]	10	5.9	−2.0[f]	7	5.2	−2.0[f]	10	5.4	−1.8	7	6.5	−1.4[f]	6	8.3	−2.6[f]
Urinary bladder	8	7.7	0.1	0.1	7	8.1	0.2	12	5.5	0.0	12	2.8	−1.0	11	4.1	—[g]	11	4.0	−1.1	8	8.0	0.3[f]
Esophagus	9	7.6	−0.5[f]	−0.5[f]	8	7.8	0.1	9	7.7	−4.6[f]	9	3.1	−1.1	9	6.1	−2.4	10	4.3	−0.3	9	7.9	−0.4[f]
Kidney and renal pelvis	10	5.8	−1.0[f]	−1.0[f]	10	5.9	−0.9[f]	11	5.7	−1.3[f]	11	3.0	3.3[f]	6	9.5	0.1	9	5.1	−1.5	10	5.8	−0.9[f]
Brain and other nervous system	11	5.2	−0.5	0.5	11	5.6	−0.4	15	3.0	−0.8	13	2.3	−1.5	14	2.8	1.0	13	3.3	−0.1	11	5.4	−0.5
Stomach	12	4.9	−3.2[f]	−3.2[f]	13	4.2	−3.4[f]	6	9.8	−3.1[f]	5	8.7	−3.1[f]	7	8.1	−5.7[f]	6	7.6	−2.9[f]	12	4.6	−3.4[f]
Myeloma	13	4.3	−1.4[f]	−1.4[f]	14	4.0	−1.5[f]	8	7.9	−1.3[f]	14	2.3	3.2[f]	12	3.6	−3.6[f]	12	3.5	−1.9	14	4.3	−1.3[f]
Melanoma of the skin	14	4.1	0.9[f]	0.9[f]	12	4.6	1.0[f]	22	0.5	1.9	20	0.4	—[g]	16	1.7	—[g]	17	1.1	2.2	13	4.4	1.0[f]
Oral cavity and pharynx	15	3.8	−1.3[f]	−1.3[f]	15	3.6	−0.8[f]	13	5.2	−3.7[f]	10	3.0	−2.6[f]	13	3.4	−3.4	14	2.5	−1.9[f]	15	3.9	−1.1[f]
Larynx	16	2.0	−2.7[f]	−2.7[f]	16	1.9	−2.4[f]	14	3.9	−4.0[f]	16	0.8	−2.6	15	2.1	—[g]	15	1.7	−2.7[f]	16	2.1	−2.6[f]
Soft tissue, including heart	17	1.5	1.0[f]	1.0[f]	18	1.5	1.2[f]	16	1.4	−0.8	15	0.9	1.2	17	1.3	—[g]	16	1.1	1.4	18	1.5	1.0[f]
Top 18 cancers for women[d]																						
Lung and bronchus	1	39.2	−0.9[f]	−1.5[f]	1	40.4	−0.9[f]	1	37.2	−1.0[f]	1	18.4	−0.5	1	33.1	−0.8	2	14.1	−1.1[f]	1	41.3	−0.8[f]
Breast	2	22.6	−2.0[f]	−2.0[f]	2	22.1	−2.0[f]	2	30.8	−1.6[f]	2	11.5	−1.7[f]	2	15.5	1.3	1	14.8	−1.5[f]	2	23.3	−1.8[f]
Colon and rectum	3	13.9	−3.0[f]	−3.0[f]	3	13.4	−3.0[f]	3	19.0	−3.3[f]	3	9.7	−1.6[f]	3	15.4	0.4	3	10.2	−2.1[f]	3	14.1	−2.9[f]
Pancreas	4	9.6	0.4[f]	0.4[f]	4	9.4	0.6[f]	4	12.5	−0.4	4	7.1	0.5	4	8.6	0.5	4	7.8	0.1	4	9.7	0.5[f]
Ovary	5	8.1	−1.8[f]	−1.8[f]	5	8.4	−1.8[f]	6	6.7	−1.2	7	4.8	−0.6	5	7.1	−2.3	5	5.8	−1.2[f]	5	8.3	−1.8[f]
Leukemia	6	5.3	−1.3[f]	−1.0[f]	6	5.5	−1.2[f]	8	4.8	−1.9[f]	9	3.1	0.7	11	3.3	−3.4	9	4.0	−0.6	6	5.4	−1.3[f]

TABLE 4. *Continued*

Sex/Cancer Site or Type[d]	All Races/Ethnicities				White[b]			Black[b]			API[b]			AI/AN (CHSDA Counties)[b]			Hispanic[b,c]			Non-Hispanic[b,c]		
	Rank	Rate[e]	2001-2010 AAPC[e]	2006-2010 AAPC[e]	Rank	Rate[e]	2001-2010 AAPC[e]	Rank	Rate[e]	2001-2010 AAPC[e]	Rank	Rate[e]	2001-2010 AAPC[e]	Rank	Rate[e]	2001-2010 AAPC[e]	Rank	Rate[e]	2001-2010 AAPC[e]	Rank	Rate[e]	2001-2010 AAPC[e]
Non-Hodgkin lymphoma	7	5.1	−3.1[f]	−2.8[f]	7	5.3	−3.1[f]	12	3.6	−3.0[f]	8	3.4	−2.0[f]	8	4.3	−3.8	7	4.4	−1.5[f]	7	5.2	−3.1[f]
Corpus and uterus, NOS	8	4.3	0.5	0.5	8	4.0	0.4	5	7.4	0.7[f]	10	2.6	2.3[f]	12	3.2	—[g]	10	3.3	0.6	8	4.3	0.5[f]
Brain and other nervous system	9	3.5	−0.5[f]	−0.5[f]	9	3.8	−0.4	16	2.1	−0.2	12	1.6	3.8	14	2.3	—[g]	12	2.4	−0.4	9	3.6	−0.4
Liver and intrahepatic bile duct	10	3.4	2.0[f]	2.2[f]	10	3.2	1.9[f]	11	4.1	0.8	5	6.0	−1.5	6	6.1	−1.1	6	5.4	0.9[f]	10	3.2	1.6[f]
Myeloma	11	2.7	−2.3[f]	−2.3[f]	12	2.5	−2.3[f]	7	5.4	−2.2[f]	13	1.3	−2.5	13	2.4	−6.2	13	2.3	−2.3[f]	11	2.7	−2.2[f]
Kidney and renal pelvis	12	2.6	−1.3[f]	−1.3[f]	11	2.6	−1.0[f]	14	2.6	−1.1[f]	14	1.2	−0.3	7	4.4	−0.7	14	2.3	−0.4	12	2.6	−1.3[f]
Stomach	13	2.5	−2.7[f]	−2.7[f]	14	2.2	−2.7[f]	9	4.7	−3.5[f]	6	5.1	−3.7[f]	9	3.8	−6.0[f]	8	4.4	−2.6[f]	13	2.4	−3.0[f]
Cervix uteri	14	2.4	−1.8[f]	−1.8[f]	15	2.2	−1.3	10	4.2	−2.4[f]	11	1.9	−4.6[f]	10	3.5	−0.4	11	2.9	−2.9[f]	14	2.3	−1.8[f]
Urinary bladder	15	2.2	−0.6[f]	−0.6[f]	13	2.2	−0.4	13	2.6	−1.9[f]	16	0.9	−1.1	18	1.2	—[g]	16	1.3	−1.9	15	2.3	−0.5
Esophagus	17	1.6	−1.5[f]	−1.5[f]	17	1.6	−0.9[f]	15	2.1	−5.2[f]	18	0.8	0.1	16	1.6	—[g]	18	0.8	−2.6[f]	17	1.7	−1.4[f]
Oral cavity and pharynx	18	1.4	−1.5[f]	−1.5[f]	18	1.4	−1.3[f]	17	1.4	−3.2[f]	15	1.2	−2.4	17	1.5	—[g]	19	0.8	−1.6	18	1.4	−1.4[f]
Gallbladder	20	0.8	−1.4[f]	−1.4[f]	20	0.7	−1.6[f]	19	1.0	−0.8	20	0.8	−0.3	15	2.0	−5.2	15	1.3	−1.6	20	0.7	−1.5[f]

Abbreviations: AAPC, average annual percent change; AI/AN, American Indian/Alaska Native; API, Asian/Pacific Islander; CHSDA, Indian Health Service Contract Health Services Delivery Area; NOS, not otherwise specified.

[a] Source: National Center for Health Statistics public-use data file for the total US, 1975-2010.

[b] White, black, API, and AI/AN (CHSDA counties) populations include Hispanic and non-Hispanic; the race and ethnicity categories are not mutually exclusive.

[c] Data for Hispanic and non-Hispanic exclude the District of Columbia, Minnesota, New Hampshire, North Dakota, and South Carolina.

[d] Cancers are listed in descending rank order of sex-specific, age-adjusted incidence rates for 2006 to 2010 for all racial and ethnic groups combined. More than 15 cancers may appear under men and women to include the top 15 cancers in each racial and ethnic group.

Rates are per 100,000 persons and are age-adjusted to the 2000 US standard population (19 age groups: ages <1 year, 1-4 years, 5-9 years, ..., 80-84 years, ≥85 years; US Bureau of the Census. *Current Population Reports, p25-1130*. Washington, DC: US Government Printing Office; 2000).

[e] The AAPC is a weighted average of the annual percent change and is calculated by joinpoint analyses with up to 2 joinpoints yielding up to 3 trend segments based on rates per 100,000 persons and age-adjusted to the 2000 US standard population (19 age groups: ages <1 year, 1-4 years, 5-9 years, ..., 80-84 years, ≥85 years; Census publication p25-1130). For joinpoint analysis, the Joinpoint Regression Program was used (version 4.0.3, April 2013; Surveillance Research Program, National Cancer Institute, Bethesda, Md).

[f] The AAPC is statistically significantly different from zero (2-sided *Z* test; $P < .05$).

[g] The statistic could not be calculated. The AAPC is based on <10 cases for at least 1 year within the time interval.

TABLE 5. The Prevalence of Selected Comorbidities for Cancer Patients, Aged 66 Years or Older, Diagnosed Between 1992 and 2005 With the Four Most Common Cancers, for All Cancers Combined and for Individuals Without Cancer[a]

	All Cancers (N = 1,056,534)		Breast, Female (N = 123,680)		Colorectum (N = 137,536)		Lung (N = 166,053)		Prostate (N = 213,311)		Individuals Without Cancer (N = 100,000)[b]	
Comorbidity	N	%	N	%	N	%	N	%	N	%	N	%
Diabetes, and sequelae	168,639	16.0	17,909	14.5	23,685	17.2	24,418	14.7	28,005	13.1	13,928	13.9
Chronic obstructive pulmonary disease	163,938	15.5	11,802	9.5	17,744	12.9	55,724	33.6	20,801	9.8	8,980	9.0
Congestive heart failure	102,049	9.7	8,576	6.9	15,908	11.6	20,502	12.4	12,065	5.7	6,864	6.9
Cerebrovascular disease	63,149	6.0	5,718	4.6	8,942	6.5	11,932	7.2	9,403	4.4	5,392	5.4
Peripheral vascular disease	45,436	4.3	3,306	2.7	5,767	4.2	11,350	6.8	6,229	2.9	3,440	3.4
Chronic renal failure	21,807	2.1	1,455	1.2	2,725	2.0	3,592	2.2	3,350	1.6	1,612	1.6
Rheumatologic disease	21,302	2.0	2,687	2.2	2,464	1.8	4,270	2.6	2,382	1.1	1,685	1.7
History myocardial infarction	21,347	2.0	1,286	1.0	2,856	2.1	4,382	2.6	3,777	1.8	1,641	1.6
Ulcer disease	19,489	1.8	1,245	1.0	2,911	2.1	3,246	2.0	2,428	1.1	1,223	1.2
Dementia	15,839	1.5	1,731	1.4	2,804	2.0	2,429	1.5	1,619	0.8	1,784	1.8
Acute myocardial infarction	13,898	1.3	931	0.8	2,280	1.7	2,628	1.6	2,248	1.1	1,088	1.1
Paralysis	7,764	0.7	638	0.5	1,176	0.9	1,325	0.8	1,052	0.5	674	0.7
Cirrhosis/chronic hepatitis	6,208	0.6	365	0.3	513	0.4	799	0.5	442	0.2	239	0.2
Liver disease moderate/severe	2,109	0.2	99	0.1	167	0.1	206	0.1	128	0.06	88	0.1
Acquired immunodeficiency syndrome	270	0.03	8	0.01	18	0.01	56	0.03	50	0.02	21	0.02
No comorbidity	631,457	59.8	83,791	67.8	81,559	59.3	78,301	47.1	148,170	69.5	68,231	68.2
Only 1 condition	266,928	25.2	27,766	22.4	34,579	25.1	50,931	30.7	45,627	21.4	20,930	20.9
≥2 conditions	158,149	15.0	12,123	9.8	21,398	15.6	36,821	22.2	19,514	9.1	10,839	10.9

Abbreviations: N, number of cases.

[a] Source: National Cancer Institute Surveillance, Epidemiology, and End Results (SEER)-Medicare linked database (Connecticut, Hawaii, Iowa, Utah, and New Mexico, and the metropolitan areas of Los Angeles, Greater San Francisco Bay Area, Detroit, Atlanta, and Seattle-Puget Sound) and a 5% random sample of cancer-free Medicare beneficiaries.

[b] A random sample of 100,000 individuals (controls) was chosen by frequency matching to the all sites combined cancer cohort by calendar year, age, and sex. Controls can be sampled only once in a calendar year but can be sampled repeatedly across multiple years.

in the 5 years after diagnosis for each of the 4 major cancer sites stratified by stage and within each stage by age and comorbidity level. The cancer survival data are based on the survival experience of patients who were diagnosed with cancer from 1999 through 2005 and, thus, reflect the probability of survival given the treatment patterns prevalent at the time and not the probability of survival in the absence of treatment or survival given a particular treatment. Among women diagnosed with breast cancer at a localized stage, the probability of dying from cancer was much lower than the probability of dying from noncancer causes, and both age and comorbidity level were predictive of overall survival (Fig. 1). For women diagnosed with breast cancer at regional stage, comorbidity and age were associated with overall survival. However, among women diagnosed with breast cancer at distant stage, approximately 69% or more died from cancer 5 years after diagnosis in all age and comorbidity strata. Among men diagnosed with prostate cancer, probabilities of dying from cancer and noncancer and survival by stage, age, and comorbidity level were generally similar to those of patients with breast cancer. Between 2% and 14% of men diagnosed with prostate cancer at a localized stage died from their cancer in all age and comorbidity strata (Fig. 2). Among men diagnosed with prostate cancer at regional stage, especially those ages 75 to 84 years, the probability of both cancer and noncancer death increased with comorbidity level. Men diagnosed with prostate cancer at distant stage had a high (>54%) probability of cancer death regardless of age or comorbidity level.

TABLE 6. Demographic Characteristics for Cancer Patients Aged 66 Years or Older Diagnosed Between 1992 and 2005 With the Four Most Common Cancers, for All Cancers Combined and for Individuals Without Cancer[a]

	All Cancers (N = 1,056,534)		Breast, Female (N = 123,680)		Colorectum (N = 137,536)		Lung (N = 166,053)		Prostate (N = 213,311)		Individuals Without Cancer (N = 100,000)[b]	
Characteristic	N	%	N	%	N	%	N	%	N	%	N	%
Age, years												
66-74	479,409	45.4	56,110	45.4	51,349	37.3	80,304	48.4	116,236	54.5	45,382	45.4
75-84	436,637	41.3	50,785	41.1	60,075	43.7	69,483	41.8	81,033	38.0	41,323	41.3
≥85	140,488	13.3	16,785	13.6	26,112	19.0	16,266	9.8	16,042	7.5	13,295	13.3
Sex												
Women	490,430	46.4	123,680	100.0	74,873	54.4	77,249	46.5			46,414	46.4
Men	566,104	53.6			62,663	45.6	88,804	53.5	213,311	100.0	53,586	53.6
Race												
White	928,230	87.9	111,449	90.1	120,220	87.4	145,548	87.7	182,425	85.5	87,551	87.6
Black	77,066	7.3	7,698	6.2	10,138	7.4	12,433	7.5	20,788	9.8	6,770	6.8
Other	47,629	4.5	4,219	3.4	6,687	4.9	7,353	4.4	9,657	4.5	5,437	5.4
Unknown	3,609	0.3	314	0.3	491	0.4	719	0.4	441	0.2	242	0.2

Abbreviations: N, number of cases.
[a] Source: National Cancer Institute Surveillance, Epidemiology, and End Results (SEER)-Medicare linked database (Connecticut, Hawaii, Iowa, Utah, and New Mexico, and the metropolitan areas of Los Angeles, Greater San Francisco Bay Area, Detroit, Atlanta, and Seattle-Puget Sound) and a 5% random sample of cancer-free Medicare beneficiaries.
[b] A random sample of 100,000 individuals (controls) was chosen by frequency matching to the all sites combined cancer cohort by calendar year, age, and sex. Controls can be sampled only once in a calendar year but can be sampled repeatedly across multiple years.

Among women (Fig. 3A) and men (Fig. 3B) diagnosed with colorectal cancer, approximately 7% to 26% of those diagnosed at localized disease stage died from their cancer in all age and comorbidity strata compared with 25% to 44% of those diagnosed with regional stage disease and, generally, >80% of those with distant stage disease. Overall survival and the probability of noncancer death were strongly related to comorbidity level and age among men and women diagnosed with colorectal cancer at local or regional stage (Fig. 3A,B). The influence of comorbidities on the probability of both cancer and noncancer death was smaller for lung cancer than for other cancers because of the relatively poor prognosis even among individuals diagnosed at local stage (Fig. 4A,B). For older patients diagnosed with colorectal or lung cancer at regional or distant stage, the probability of dying from cancer for individuals with severe comorbidity was smaller than for those with less severe comorbidity. This demonstrates the role of comorbidity in reducing the risk of dying from cancer (ie, competing risk).

DISCUSSION

Overall cancer death rates continue to decrease in the United States. Death rates declined for the most common sites, including female breast, prostate, lung, and colorectal cancers among both men and women and in most racial and ethnic groups. Declines in death rates for these cancers were not statistically significant among AI/AN men or women or for lung cancer among API women. However, death rates increased for cancers of the liver and pancreas among men and women; for melanoma and cancer of soft tissue, including heart (primarily sarcomas), among men; and for cancer of the uterus among women. The overall decreases in cancer death rates indicate progress in cancer control and reflect a combination of primary prevention by reductions of important risk factors as well as improved early detection and treatment.[2-15]

Temporal trends in incidence rates require a more complex interpretation. In addition to the factors that influence both incidence and mortality trends, such as changes in exposure to environmental and endogenous risk factors, disease classification, data collection systems, and variability in population estimates (ie, denominators for rates), incidence trends also are affected by changes in diagnostic practices. Overall incidence trends during 2001 through 2010 decreased for lung, colorectal, and prostate cancer but stabilized for breast cancer among women. The decrease in lung cancer incidence rates reflects long-term reduction in smoking prevalence,[11] whereas the decrease in colorectal cancer incidence rates may largely reflect increased use of screening that allows the detection and removal of adenomatous polyps.[12] The decrease in prostate cancer incidence rates likely reflects declines in prostate-specific antigen testing.[58] In 2008,

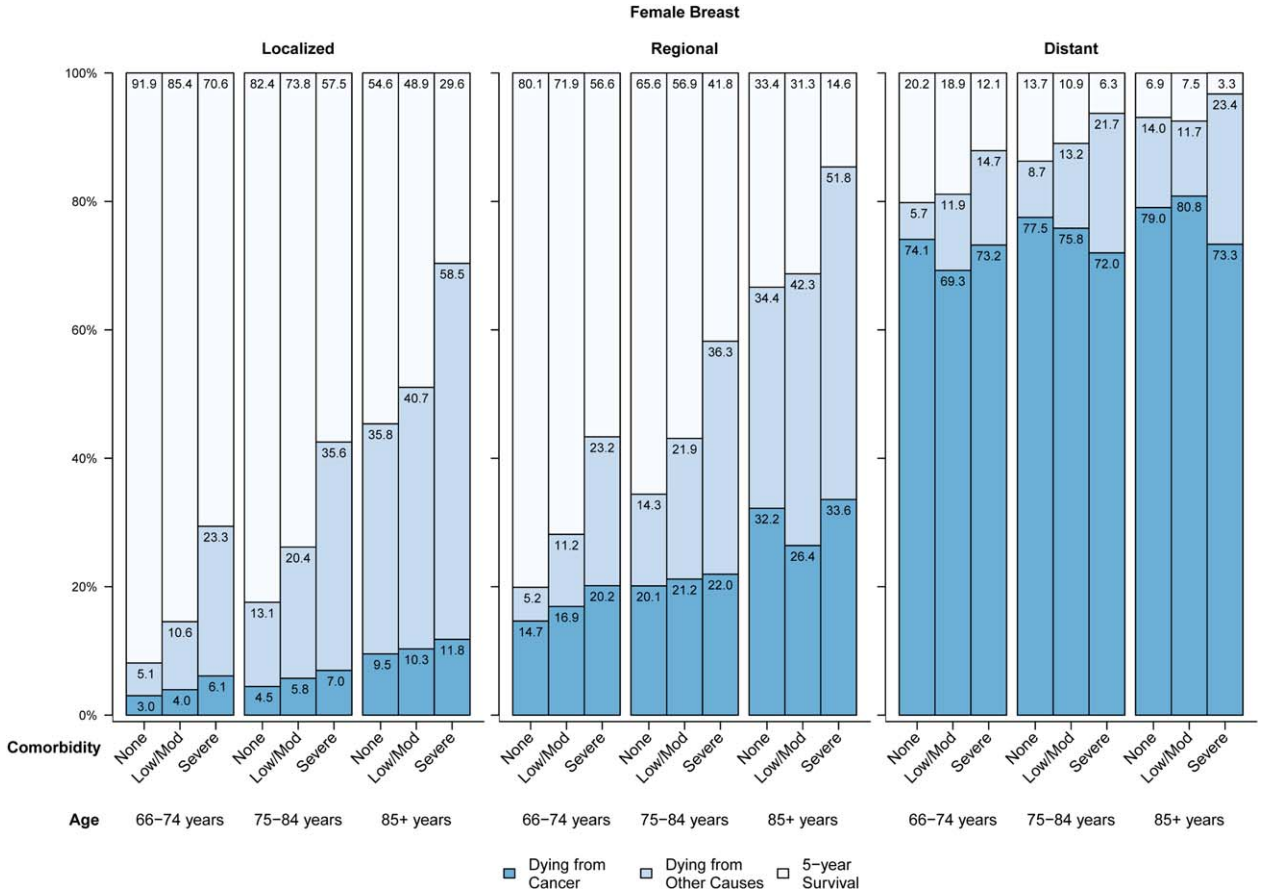

Figure 1. Probabilities of dying from cancer, dying from other causes, and survival are stratified by stage, comorbidity status, and age among women who were diagnosed with breast cancer between 1999 and 2005. Mod indicates moderate. Source: National Cancer Institute Surveillance, Epidemiology, and End Results (SEER)-Medicare linked database (Connecticut, Hawaii, Iowa, Utah, and New Mexico and the metropolitan areas of Los Angeles, Greater San Francisco Bay Area, Detroit, Atlanta, and Seattle-Puget Sound).

the US Preventive Services Task Force recommended against prostate cancer screening for men aged ≥75 years.[59] This change resulted in declines in both prostate-specific antigen testing[58] and prostate cancer incidence rates among older men (aged ≥75 years), especially early stage prostate cancer, which is most likely to be detected by screening.[60] Indeed, from 2009 through 2010, we observed that incidence rates of localized prostate cancer decreased, whereas incidence rates of regional prostate cancer stabilized, and rates of distant prostate cancer increased (Table 7). Although breast cancer incidence rates were stable during 2001 through 2010, they sharply decreased between 2002 and 2003 (most likely because of reductions in the use of postmenopausal hormone-replacement therapy) after previously increasing for many decades, in part because of early detection through mammography and changes in reproductive factors, hormone-replacement therapy, and obesity.[61-65]

External factors in data collection or reporting also may have contributed to the decline in cancer incidence rates, such as implementation of the Collaborative Staging algorithm (CSv2) for cases diagnosed in 2010, which may have resulted in longer reporting delays.[66] However, a review of the delay-adjustment factors used in recent years suggests that reporting delay in the SEER Program has actually been diminishing.[67]

This Annual Report highlights the prevalence of comorbidity and its impact on survival among persons diagnosed with lung, colorectal, breast, or prostate cancer. Data on individual comorbid conditions were combined into comorbidity indices or scores, which are frequently used for research purposes to increase analytic efficiency with fewer variables. The comorbidity score was calculated by summarizing multiple chronic conditions into a single measure that reflects the burden of these conditions on health outcomes, such as survival, which was presented

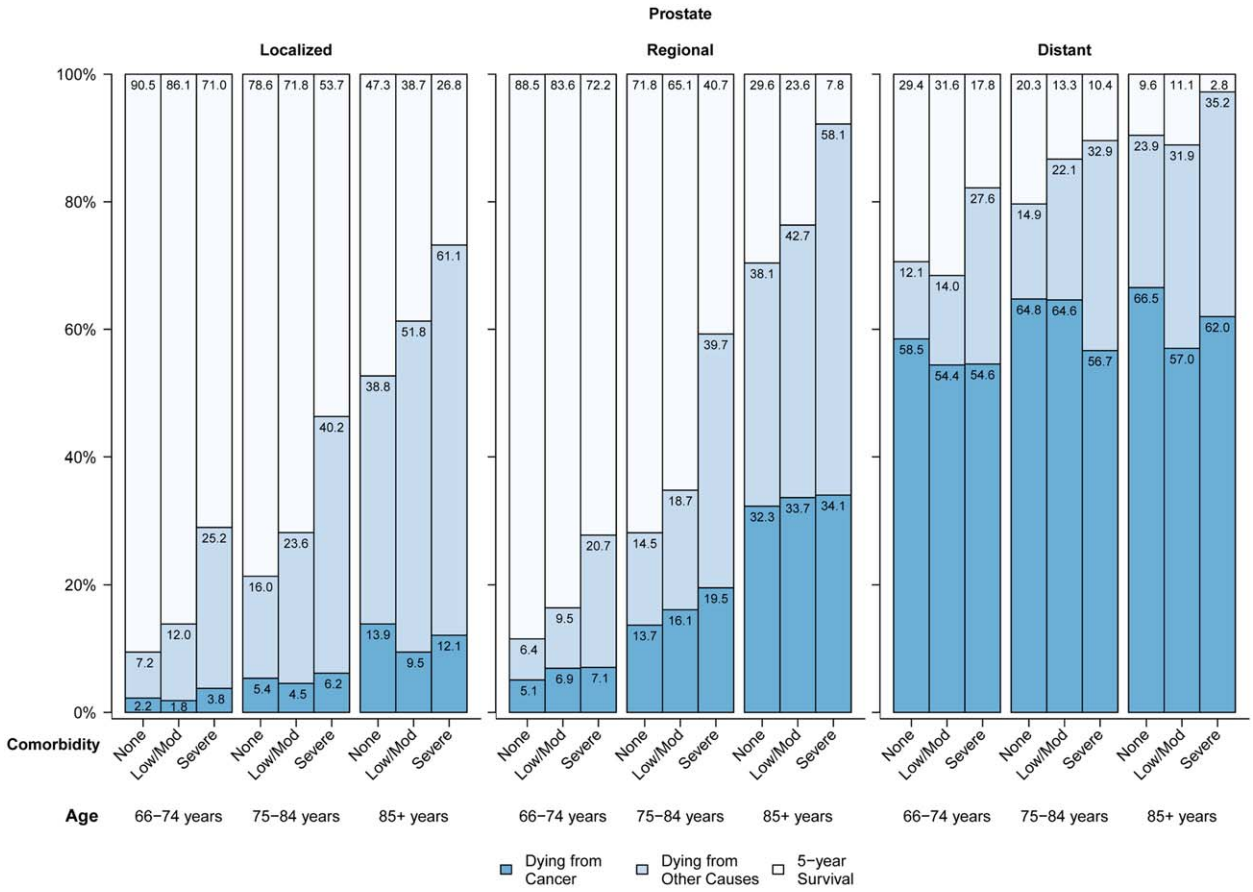

Figure 2. Probabilities of dying from cancer, dying from other causes, and survival are stratified by stage, comorbidity status, and age among men who were diagnosed with prostate cancer between 1999 and 2005. Mod indicates moderate. Source: National Cancer Institute Surveillance, Epidemiology, and End Results (SEER)-Medicare linked database (Connecticut, Hawaii, Iowa, Utah, and New Mexico and the metropolitan areas of Los Angeles, Greater San Francisco Bay Area, Detroit, Atlanta, and Seattle-Puget Sound).

in this report. During the past 20 years, many comorbidity measures have been developed, and several reviews of these measures have been published.[68,69] The index (score) used in this report[23] is an extension of that developed by Klabunde et al[44] and used claims from SEER-Medicare patients who were diagnosed with cancer in 1992 through 2005. This score was based on the original Charlson prognostic index to predict 1-year mortality using hospital data and was modified for use with ICD-9-CM diagnostic and procedure codes from both inpatient hospitalization claims (Medicare Part A) and physician and outpatient administrative claims (Medicare Part B), and it also was modified to exclude cancer as a comorbidity. The index (score) is a weighted average of the 16 comorbid conditions with the weights estimated from the models of 5-year survival.

Because of the importance of comorbidity in the care of cancer patients, prognostic and survival tools that incorporate comorbidity measures may be useful in aiding clinical decisions.[70] New tools are being developed to improve survival estimates by taking comorbidity into account.[20,21,23] However, it is important that clinicians and patients who use these tools understand that the probabilities of cancer and noncancer death in observational registry data are based on outcomes of cancer patients who were treated during the years studied (1999 through 2005 for our study) and do not reflect the probability of death from the cancer if left untreated or the effect of the most current treatments. The usefulness of comorbidity-adjusted survival data for clinical decision making would be improved if analyses could be stratified by treatment and other prognostic markers, as in a recent analysis of prostate cancer mortality using SEER-Medicare data.[71]

Furthermore, it is becoming increasingly important to understand the major health problems in the United

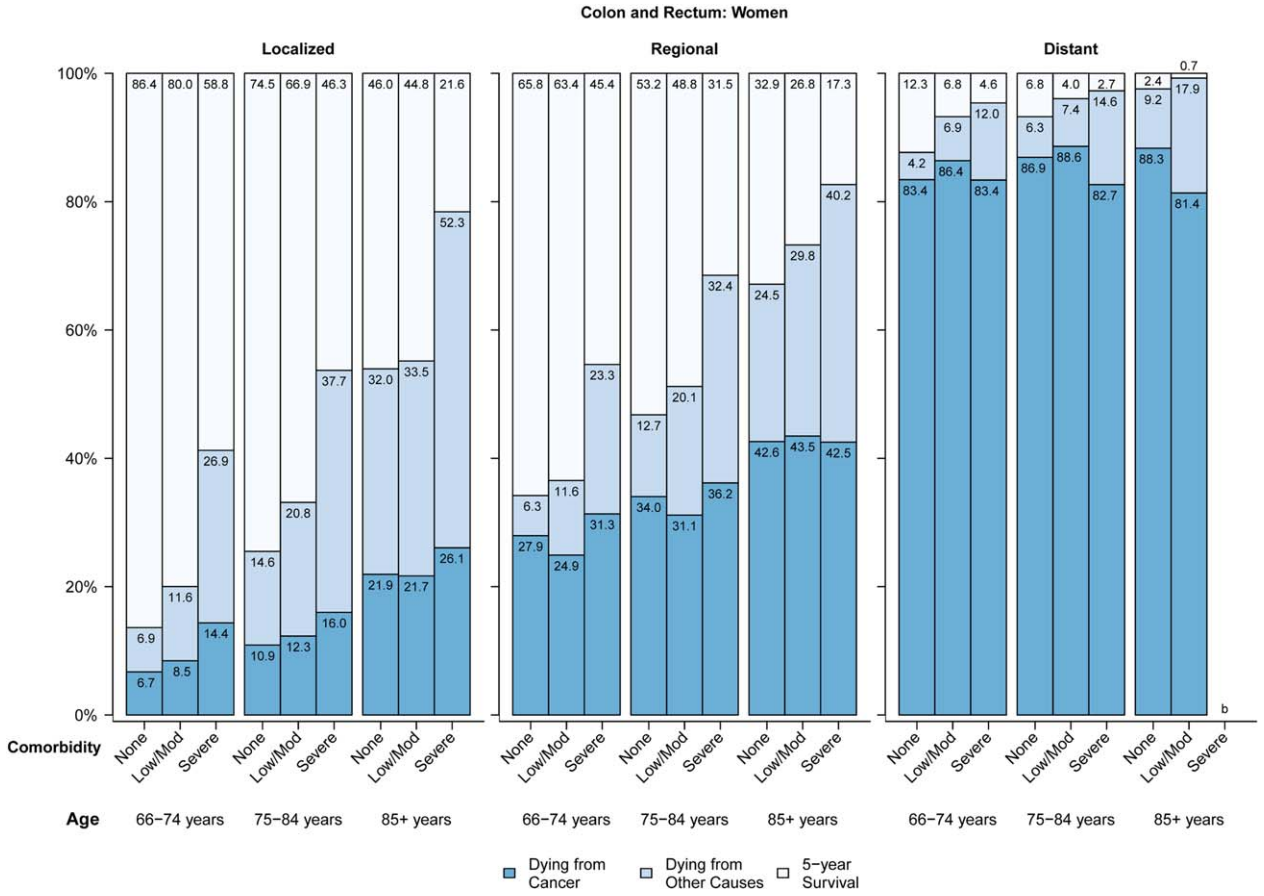

Figure 3. (A) Probabilities of dying from cancer, dying from other causes, and survival are stratified by stage, comorbidity status, and age among women who were diagnosed with colorectal cancer between 1999 and 2005. For the empty column marked "b," the statistic could not be calculated. Mod indicates moderate. (B) Probabilities of dying from cancer, dying from other causes, and survival are stratified by stage, comorbidity status, and age among men who were diagnosed with colorectal cancer between 1999 and 2005. Source: National Cancer Institute Surveillance, Epidemiology, and End Results (SEER)-Medicare linked database (Connecticut, Hawaii, Iowa, Utah, and New Mexico and the metropolitan areas of Los Angeles, Greater San Francisco Bay Area, Detroit, Atlanta, and Seattle-Puget Sound).

States and how they are changing.[26,72] Measures of the US burden of disease, including cancer, rely on important data systems and surveys produced by local, state, and federal agencies. Measures of comorbidity contribute to our understanding of cancer, other diseases, and their relations. Improving health outcomes and care in all individuals with comorbidities[72] will require response from the public and private health sectors, communities, individuals, and researchers.[73-78] Some research has used comorbidity as a surrogate measure of risk and disability[79,80] and for global estimates of disability-adjusted life years.[81] Although cancer registries do not routinely collect data on comorbidities, registry data may be supplemented with data on comorbid conditions from several sources. SEER Patterns of Care Studies[82] review medical records to obtain more detailed data on treatment and comorbid conditions for a sample of individuals with selected cancers.[83] The CDC has funded 10 NPCR registries to collect detailed treatment data as well as information on comorbidities directly from medical records and through data linkages to enhance data collection capabilities for comparative effectiveness research.[84,85] The National Cancer Database, a hospital-based registry system, requires hospitals to code diagnoses listed on the face sheet of the inpatient hospital record.[86] Registry data can also be linked with Medicaid records to obtain data on comorbid conditions.[87] One of the most widely used data sources for research on cancer treatment and outcomes is the SEER-Medicare database used in this report, in which detailed information on cancer treatment, as well as comorbidity, can be derived from claims records of Medicare enrollees.[44,45] Each data source and study has advantages and limitations of size, generalizability, scope, and content.

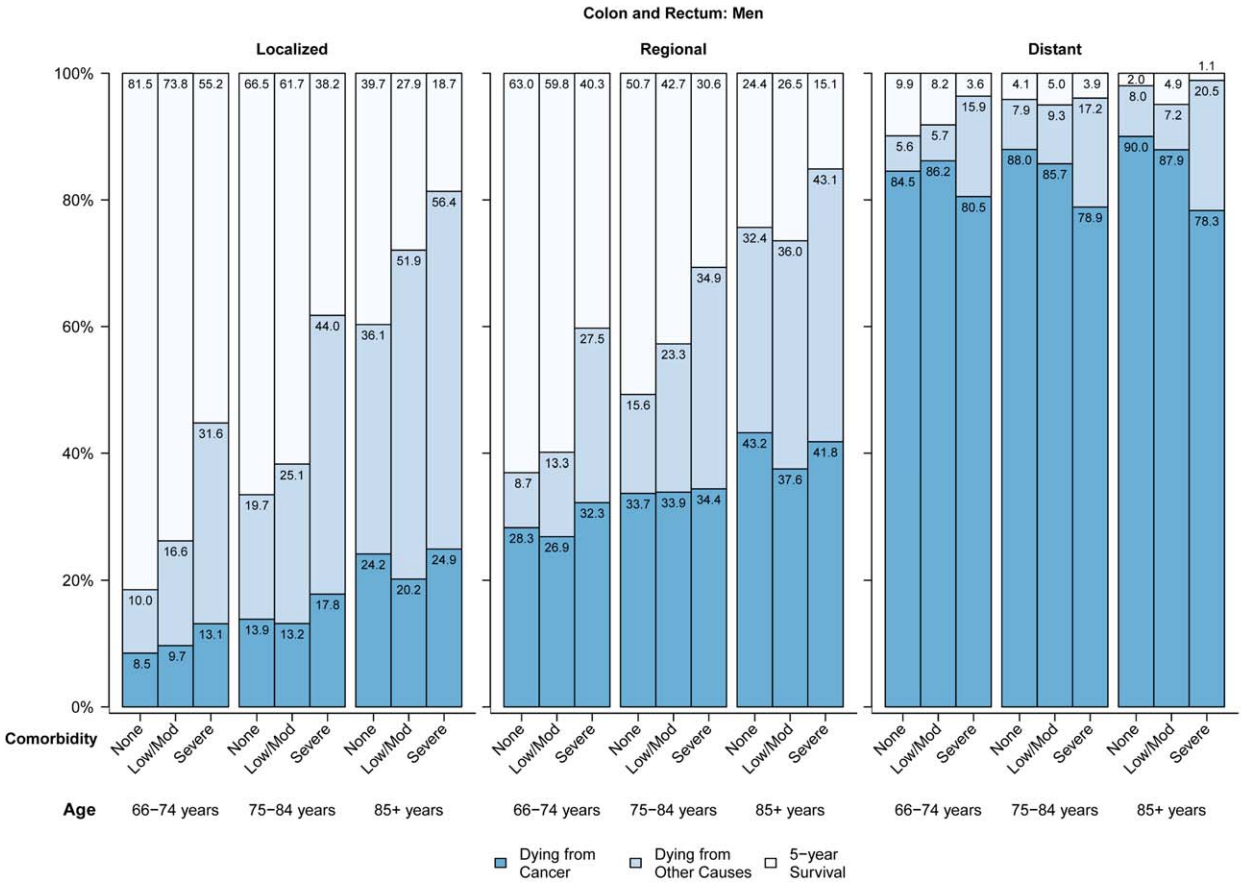

Figure 3. (Continued)

Limitations

High-quality cancer surveillance data in the United States are available and include mortality for the entire population and incidence for 90% of the population (2006 through 2010). However, certain limitations in data sources, data collection, and analyses may have influenced the findings of this report. First, differences between the numerator (incidence data) and denominator (Census population data) can occur in the designation of characteristics such as age, race, ethnicity, and place of residence, and these differences change over time. In general, data quality has improved over time (eg, decreases in unknown stage and shorter reporting delays). Also, with the incorporation of the 2010 census in this report, the populations for the intercensal years are more accurate than in prior reports, in which these data were estimated based only on the 2000 census. We examined the possibility that the incorporation of information from the 2010 census in developing the population estimates influenced the changes in rates[88] but observed that the population estimates used in the previous Annual Report to calculate rates through 2009 were very similar to those used in this report.[89]

Dynamic trends in racial and ethnic self-identification (in particular, Hispanics and APIs as "some other race") and changes in methodology for allocating "some other race" (resulting in more Hispanic AI/ANs) present difficulties for maintaining health statistics over a long time series and make 2010 data less directly comparable to earlier years. Cancer statistics have generally used the 1977 federal definitions of race and ethnicity, whereby all persons belong to 1 of 4 races (white, black, API, and AI/AN) and are either of Hispanic or non-Hispanic ethnicity. The 2010 census revealed that Americans are self-identifying in ways that deviate considerably from these standards.[90-95] Whereas the official 2010 population estimate reflected an increase of less than 1% over the 2009 estimate, it contained 19% more AI/ANs, 9% more APIs, and 31% more individuals of multiple race. In addition, in the last 2 censuses, a sizable fraction of all Hispanics self-identified as "some other race." In 2000, the Census Bureau reassigned nearly all of these as white; however, in

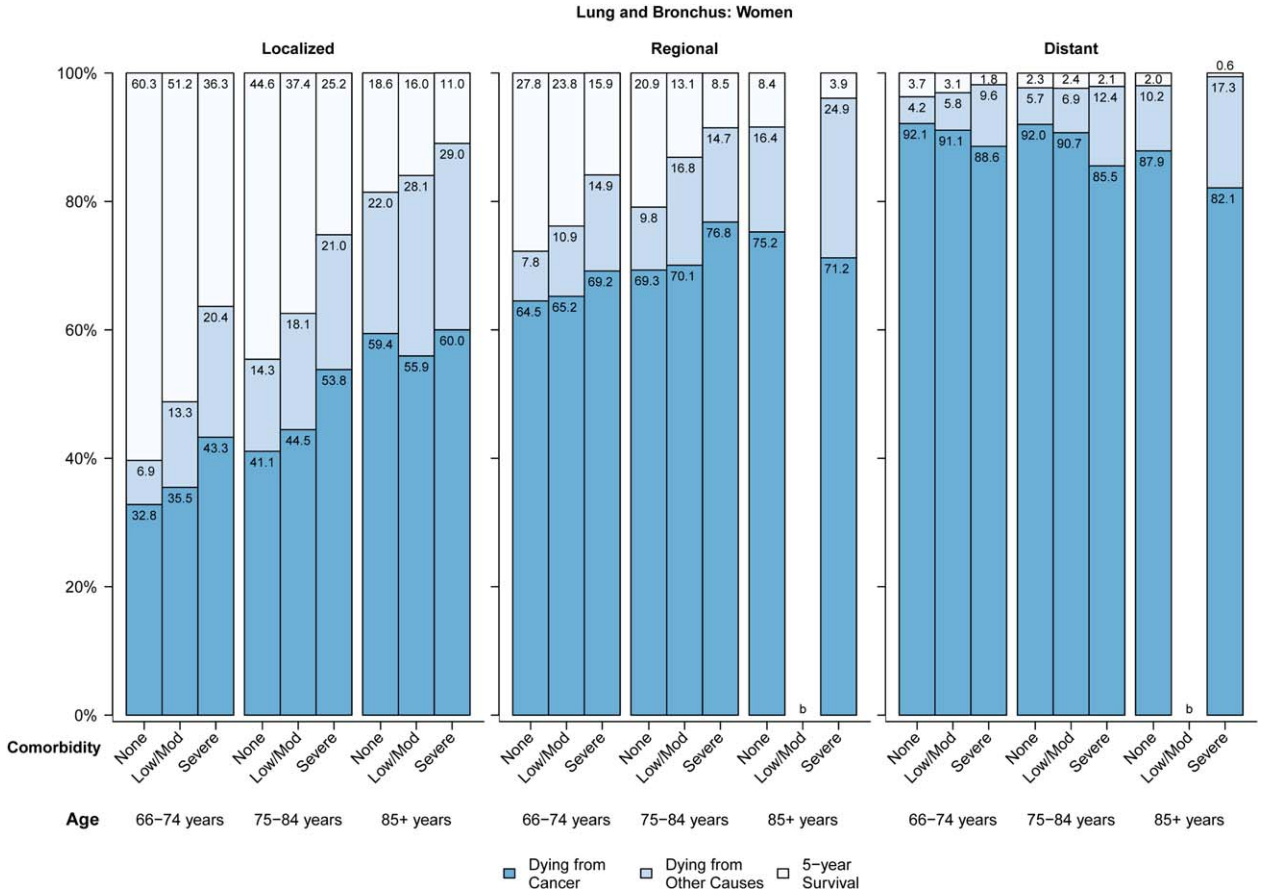

Figure 4. (A) Probabilities of dying from cancer, dying from other causes and, survival are stratified by stage and comorbidity status among women who were diagnosed with lung and bronchus cancer between 1999 and 2005. Mod indicates moderate. (B) Probabilities of dying from cancer, dying from other causes, and survival are stratified by stage and comorbidity status among men who were diagnosed with lung and bronchus cancer between 1999 and 2005. In A and B, for each empty column marked "b," the statistic could not be calculated. Source: National Cancer Institute Surveillance, Epidemiology, and End Results (SEER)-Medicare linked database (Connecticut, Hawaii, Iowa, Utah, and New Mexico and the metropolitan areas of Los Angeles, Greater San Francisco Bay Area, Detroit, Atlanta, and Seattle-Puget Sound).

2010, many were reassigned to other racial categories, particularly AI/ANs and APIs.[39] The unanticipated spike in the AI/AN and, to a lesser extent, API populations in 2010 means that the cancer rates in these groups are lower relative to whites and blacks than they were previously. Rather than representing a meaningful difference, it is more likely that this is a reflection of differences in data collection between the censuses, changes in methodology and data inputs for postcensal population estimates, revised intercensal population estimates, and racial/ethnic data recorded in medical settings.

Second, as noted in previous Annual Reports to the Nation,[1-15] the broad racial and ethnic group categories used in our analyses may mask variations in the cancer burden by country of origin or by other unique characteristics of high-risk or low-risk populations. Also, as noted above, cancer rates for racial and ethnic groups may be affected by difficulties in ascertaining race and ethnicity information from medical records, death certificates, and census reports.[96]

Third, analyses of trends should be carefully interpreted for several additional reasons. Changes in incidence may result from changes in the prevalence of risk factors, the introduction or increased use of screening or diagnostic techniques, or a combination of these factors. The AAPC was used as a summary measure to average trends over a 5-year or 10-year period using joinpoint regression. Joinpoint models identify recent changes in the magnitude and direction of trends but may give an impression of a continuous increase or decrease over time when trends actually may be more variable. Furthermore, delayed case reporting may affect incidence trends if the most recent joinpoint

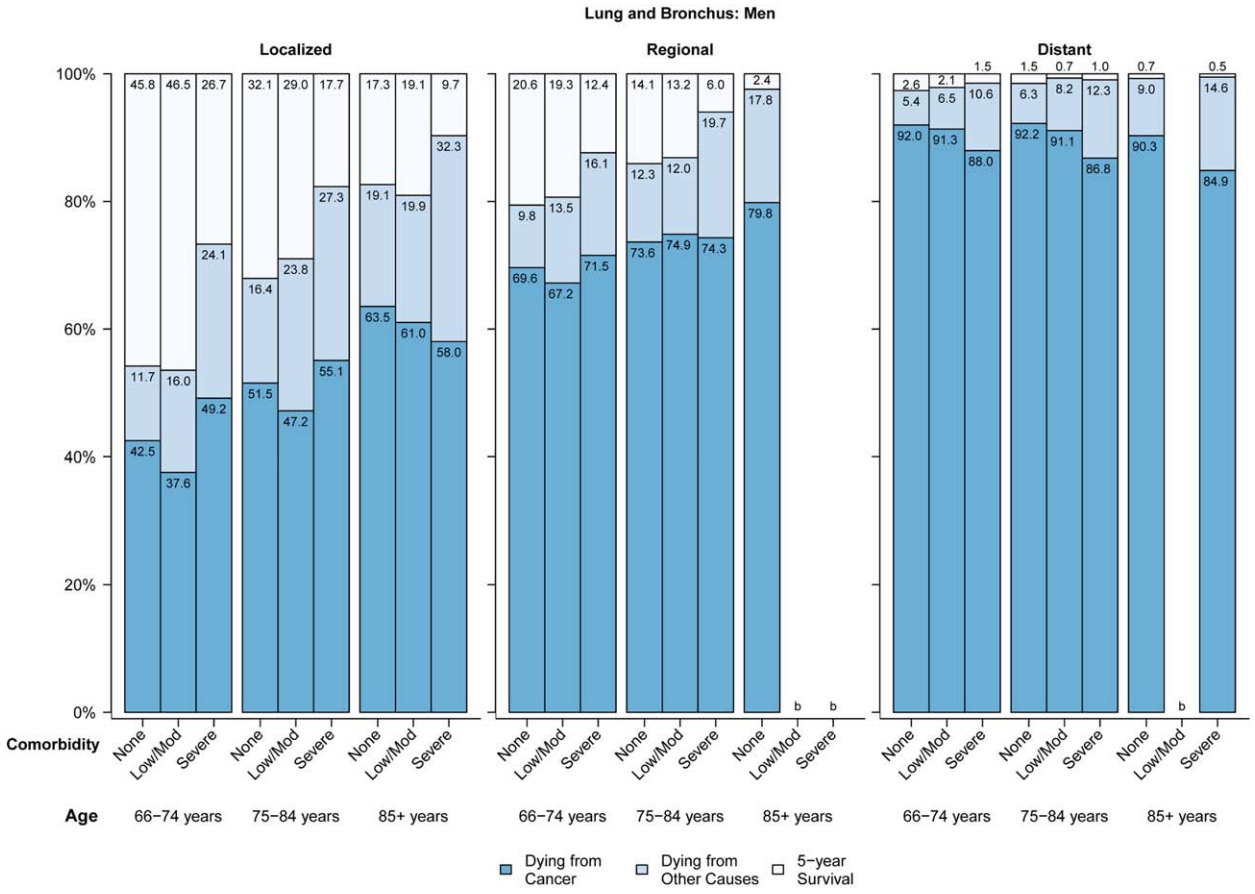

Figure 4. (Continued)

segments overestimate recent declines or underestimate recent increases. Methods to adjust for delayed reporting[53] were used in our analysis only in the analysis of SEER 13 data. The largest effects of adjusting for delayed reporting are observed in cancers diagnosed in nonhospital settings, such as melanoma and leukemia; however, SEER reporting delays have decreased over time. This report presents trends based both on data from the SEER 13 registries and on combined data from NAACCR, which include SEER and NPCR registries. Both data sets have strengths and limitations and provide valuable insight into cancer trends in the United States. Longer term trends can be examined using data from the SEER 13 registries, that have also been delay-adjusted. However, combined data from the SEER and NPCR registries cover nearly the entire US population and may better capture geographic and population differences in risk factors and incidence rates, although estimates for the most recent diagnosis years are attenuated without adjustments for reporting delays.

A 2007 policy change regarding the transfer of Veterans Health Administration (VA) cases to state cancer registries led to incomplete reporting of VA hospital cases. Because VA hospitals provide a critical source of data for cancers diagnosed among veterans who are eligible to receive care from these facilities, cancer incidence rates for men were underestimated. However, clarification of the policy and subsequent reporting of these cases has indicated that under-reporting from VA facilities diminished over time.

The SEER-Medicare linked database is a unique resource used extensively in health services research to study cancer screening, treatment, outcomes, and costs. The comparison of the older adult population in SEER areas with the US total indicates that, in the SEER areas, there are lower percentages of white persons and individuals living in poverty and higher percentages of urban-dwellers than in the total US population.[41] Older persons in the SEER regions also have higher rates of HMO enrollment (about 25%) and lower rates of cancer mortality. Medicare claims are created for payment purposes, not research, and the absence of information about reasons and outcomes for a test or procedure can make it

TABLE 7. Cancer Incidence Rates for Prostate and Female Breast Cancer by Stage for 2009 and 2010[a]

Stage	Rate[b] 2009	Rate[b] 2010	Rate Change, %
Prostate			
All	62.0	57.7	−6.9
Local	48.5	44.5	−8.3
Regional	6.1	6.1	−0.7
Distant	2.4	2.4	2.5
Unknown	4.9	4.7	−5.5
Female breast			
All	122.0	118.1	−3.2
Local	75.0	72.8	−3.0
Regional	36.2	34.8	−3.8
Distant	6.5	6.6	2.3
Unknown	4.3	3.9	−10.9

[a] Data are from National Program of Cancer Registries (NPCR) and Surveillance, Epidemiology, and End Results (SEER) areas reported by the North American Association of Central Cancer Registries (NAACCR) as meeting high-quality incidence data standards for the specified time periods. Rates are based on data from all states (excluding Minnesota), and the District of Columbia and Puerto Rico.

[b] Rates are per 100,000 persons and were age-adjusted to the 2000 US standard population (19 age groups: ages <1 year, 1-4 years, 5-9 years,. . ., 80-84 years, ≥85 years; US Bureau of the Census. *Current Population Reports, p25-1130*. Washington, DC: US Government Printing Office; 2000.

difficult to distinguish whether secondary diagnoses are complications or comorbidities.

Future Directions

This report brings attention to the prevalence (>30%) of comorbidities (multiple chronic diseases) among individuals aged ≥65 years, which increases with age and can be substantial for some cohorts of cancer patients.[20,97] Cancer patients with comorbidities have the additional challenge of coordinating both their cancer-related care and noncancer-related care.[98,99] Even in the absence of comorbidities, the challenge of coordinating multidisciplinary cancer treatment and survivorship care is formidable.[100-102] Studies using SEER-Medicare data have indicated that cancer survivors are less likely than age-matched controls to receive recommended clinical preventive services or appropriate treatment for acute and chronic conditions.[103-105]

The number of individuals diagnosed with cancer and living after a cancer diagnosis (cancer survivors)[106] will continue to rise in the coming decades due to population aging and expansion[107] as well as increasing success in treatment, even if incidence rates remain stable or decline. The ability of the US health care system to respond to the growing population of older adults, cancer survivors, and patients with multiple comorbidities is uncertain.[108] A national response by the public and private sectors has been initiated to improve the overall health status of individuals with multiple chronic conditions by fostering change within the health care system, providing information for health professionals and patients, and facilitating research to improve oversight and care.[72] Public health actions to reduce disability and improve functioning and the quality of life of persons with chronic disease include an increased application of effective tobacco-control measures and fostering behavioral changes, such as a healthy diet and sufficient physical activity, that contribute to healthier aging.[78,108,109] Health system interventions that address the increasing need for health care in our aging population include the development of better systems for the coordination of care.[100] Research initiatives to improve the coordination of care and increase the receipt of recommended preventive and treatment services are ongoing[110,111] and include increasing use of electronic medical records, reminder systems, patient navigation programs, and monitoring of quality measures by payers and consumer advocates.[112] Finally, a greater focus on risk factor prevention,[109] coordination of care,[100] chronic disease management,[78] and multilevel interventions[113] may lessen the future burden of such conditions.

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CONFLICT OF INTEREST DISCLOSURES

The authors made no disclosures.

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