

## RESULTS

As shown in tables 1 and 3 and figure 2, the leading causes of death are a mixture of natural and external causes. Heart disease and cancer are the leading causes of death for males and females, blacks and whites; but the relative order of other causes differs by race and, to a lesser extent, by sex. Clearly, heart disease and cancer exact a tremendous toll on public health, together causing over half of all deaths in the United States each year (table 3). However, homicide among black males and unintentional injuries among white and black males cause the greatest years of potential life lost before age 65 (53).

Figure 3 presents the age-specific death rates for the United States by sex and race for the causes mapped in this atlas. For most natural causes, death rates rise steadily with age, in some cases after an initial drop from higher rates in children under age 5. For external causes death rates peak in the age group 15–24 years and then either decline (homicide), level off (suicide), or rise again (unintentional injuries) in the age group 65 years and over. Greater differences in age-specific rates by sex and race are noted for the external causes of death. Exceptions to these general patterns are noted in the cause-specific discussions.

The age-adjusted rate maps (figure 1a) have been reproduced on a single page for each sex and race group (figure 4). These small maps have colors assigned according to the value of the comparative mortality ratio, that is, the proportional difference between each HSA's rate and the U.S. rate (more than

25 percent higher, 16 percent to 25 percent higher, within 15 percent of the U.S. rate, etc.). Through use of a common scale, geographic patterns of rates can be compared quickly. In addition, color coding according to the level instead of the relative ranking of the rates permits comparison of the range and variability of the rates across cause, race, and sex. Unlike the full-page maps (figure 1a), where rates are assigned to all seven color categories according to their ranks, using the absolute scaling of figure 4, all 805 rates could be coded to a single color if the range of rates is very narrow. For example, in figure 4 most HSA's have very low HIV death rates, with higher rates found in urban areas across the United States.

What follows are brief summaries about each cause of death along with comments on the geographic patterns of mortality. These notes are not intended to be comprehensive literature reviews. Information has been drawn heavily from annual statistical summaries published by NCHS, textbooks, and review articles. References are provided for additional information. Where appropriate, comments are provided on rates among Native Americans, Alaskan Natives, and Asian Americans for comparison to whites and blacks even though rates for other racial groups are not mapped in this atlas.

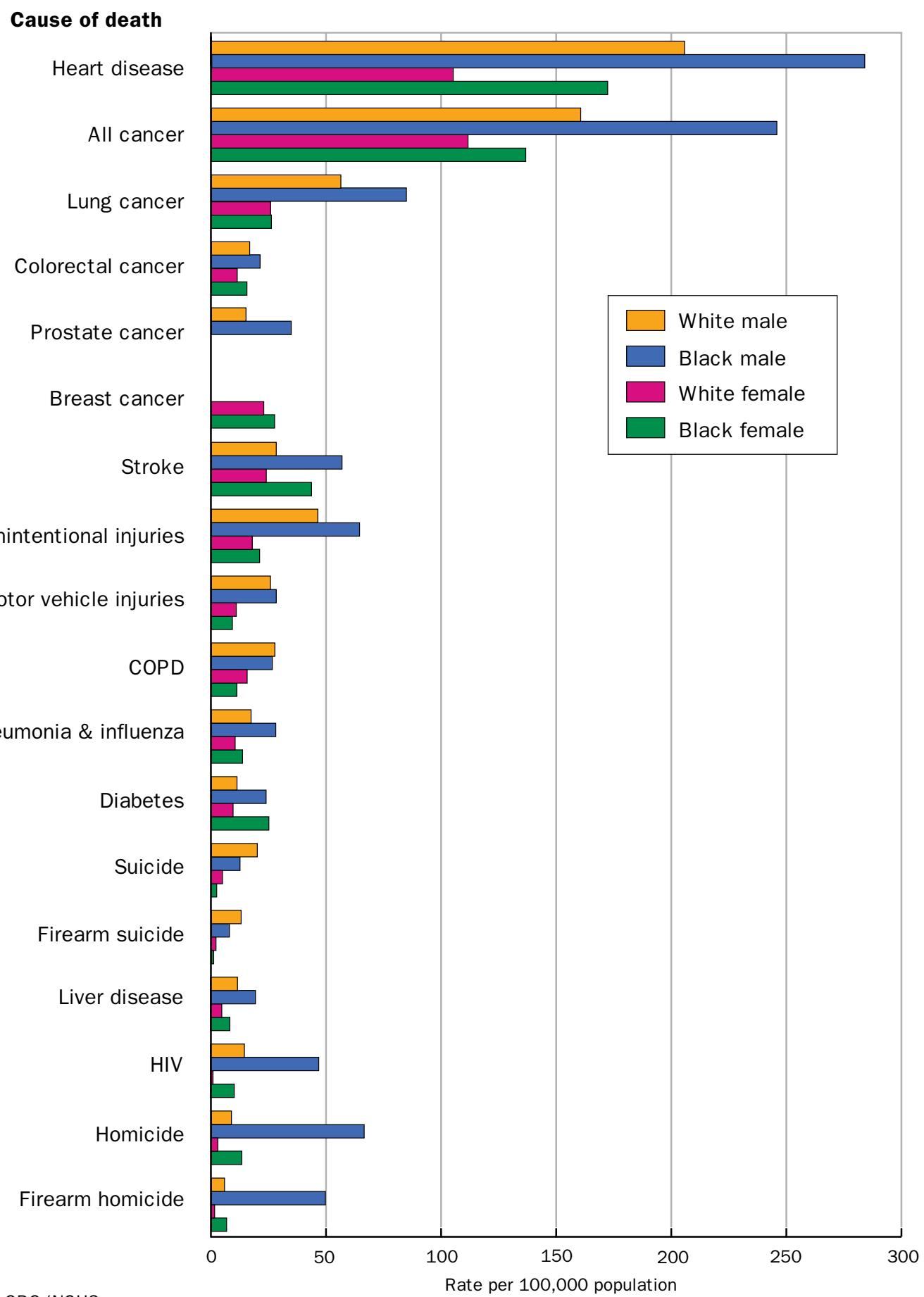
For each cause separate paragraphs include:

- General comments, including differences in national statistics over race, sex, and time;
- generally accepted risk factors; and
- geographic patterns.

**Table 3. Average annual number of deaths by cause, race, and sex during 1988–92**

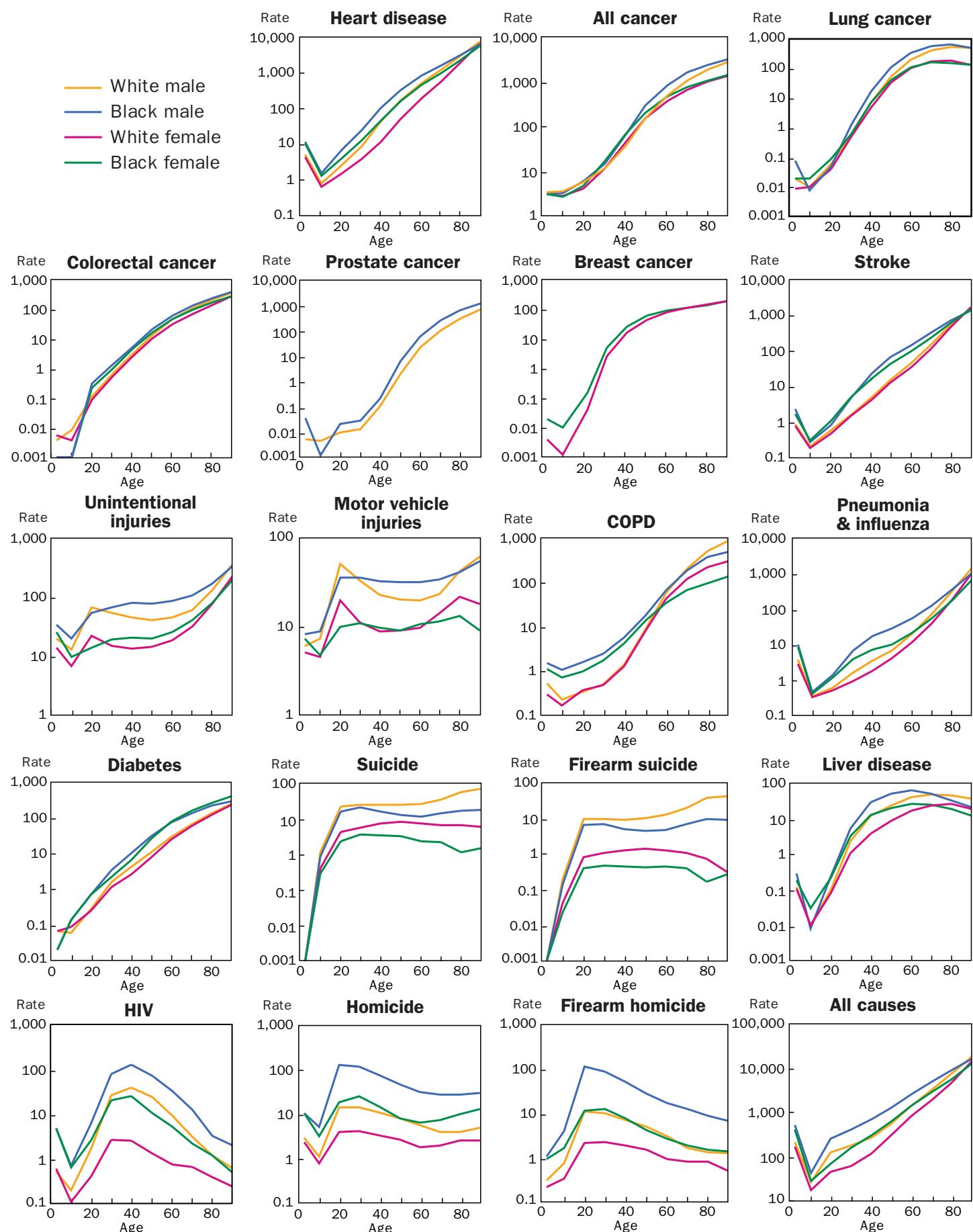
Cause of death	White male	Black male	White female	Black female	Total
Heart disease	323,842	37,866	323,103	38,825	723,636
All cancer	232,057	31,599	208,910	24,979	497,545
Lung cancer	78,790	10,455	45,023	4,474	138,742
Colorectal cancer	25,139	2,794	25,545	3,138	56,616
Prostate cancer	26,592	5,066	0	0	31,658
Breast cancer	0	0	37,928	4,623	42,551
Stroke	48,635	7,717	76,999	9,933	143,284
Unintentional injuries	51,020	8,970	25,673	3,732	89,395
Motor vehicle injuries	26,495	3,932	12,152	1,477	44,056
COPD	45,351	3,609	35,426	2,084	86,470
Pneumonia & influenza	31,554	4,025	37,430	3,329	76,338
Diabetes	16,506	3,059	21,390	4,982	45,937
Suicide	22,162	1,747	5,607	356	29,872
Firearm suicide	14,572	1,092	2,289	151	18,104
Liver disease	14,070	2,338	7,580	1,315	25,303
HIV	15,840	6,424	1,232	1,679	25,175
Homicide	8,862	9,573	3,034	2,163	23,632
Firearm homicide	5,948	7,274	1,493	1,054	15,769
All causes	955,814	145,886	909,128	121,149	2,131,977

FIGURE 2. AGE-ADJUSTED DEATH RATES BY CAUSE, RACE, AND SEX



SOURCE: CDC/NCHS

FIGURE 3. U.S. DEATH RATE PER 100,000 POPULATION BY AGE, CAUSE, RACE, AND SEX



NOTE: For plotting purposes, rates equal to 0 are shown as 0.001 per 100,000 population.

SOURCE: CDC/NCHS

FIGURE 4. COMPARISON OF HSA RATES  
WITH U.S. RATES BY CAUSE

WHITE MALE

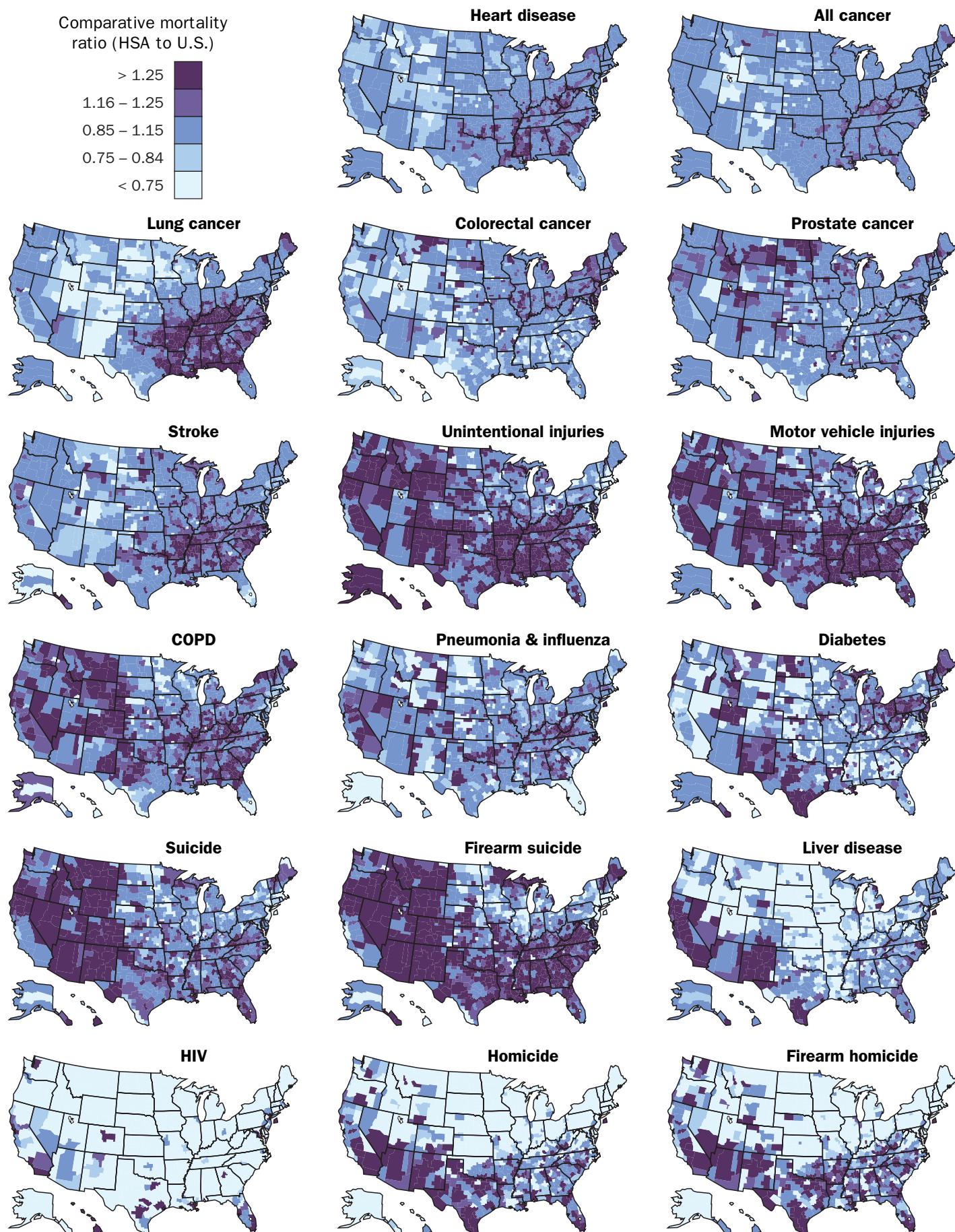


FIGURE 4. COMPARISON OF HSA RATES  
WITH U.S. RATES BY CAUSE

BLACK MALE

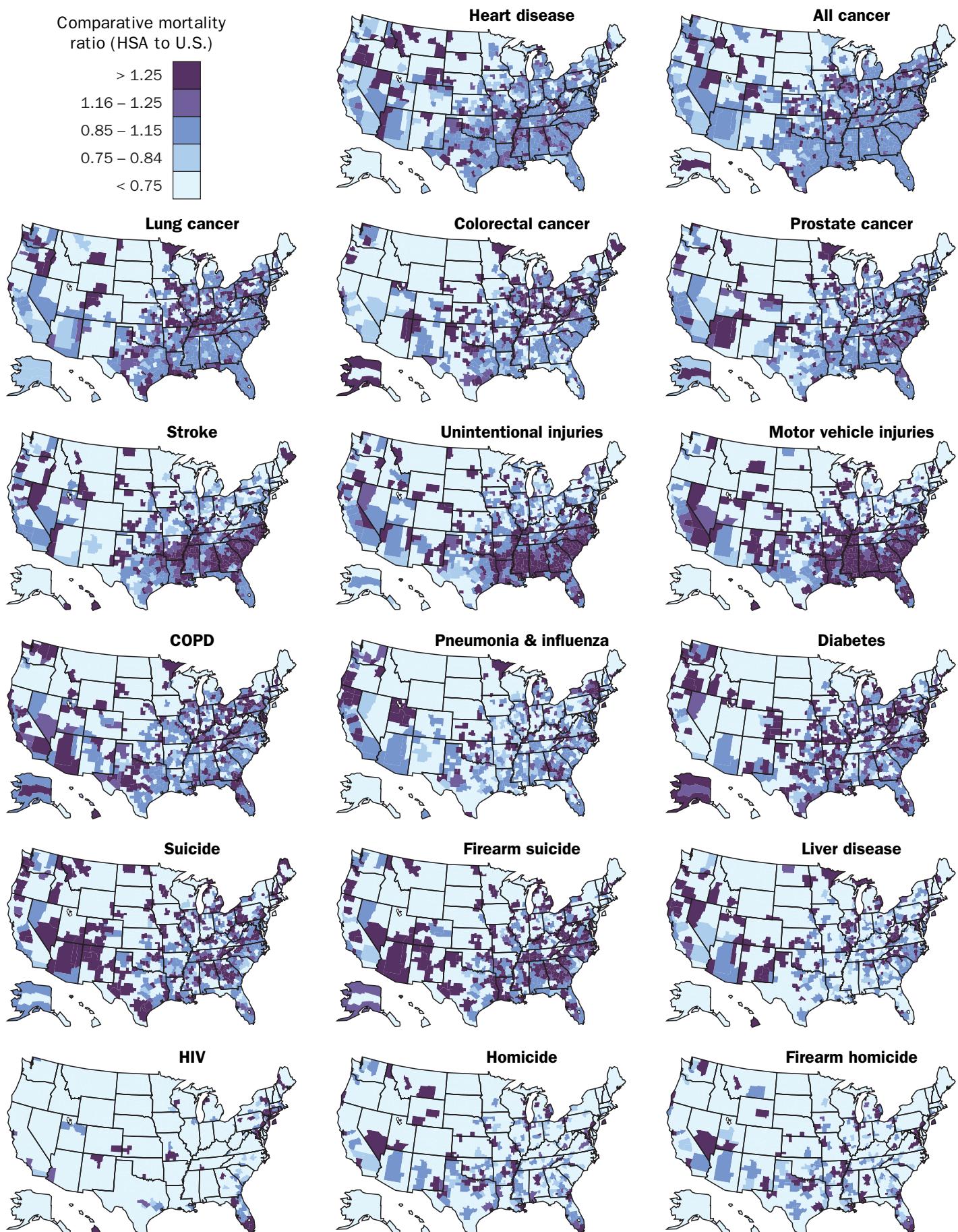


FIGURE 4. COMPARISON OF HSA RATES  
WITH U.S. RATES BY CAUSE

WHITE FEMALE

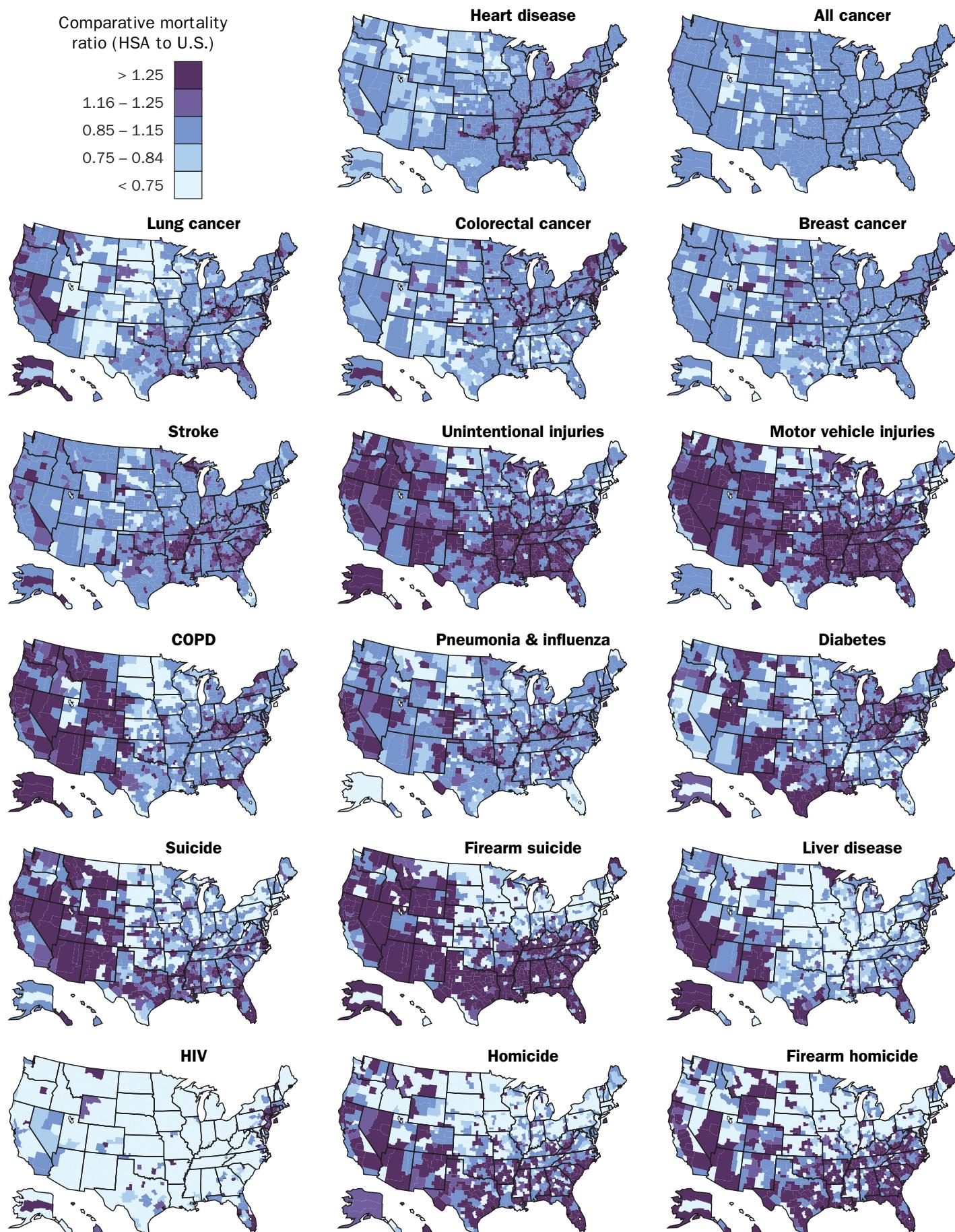
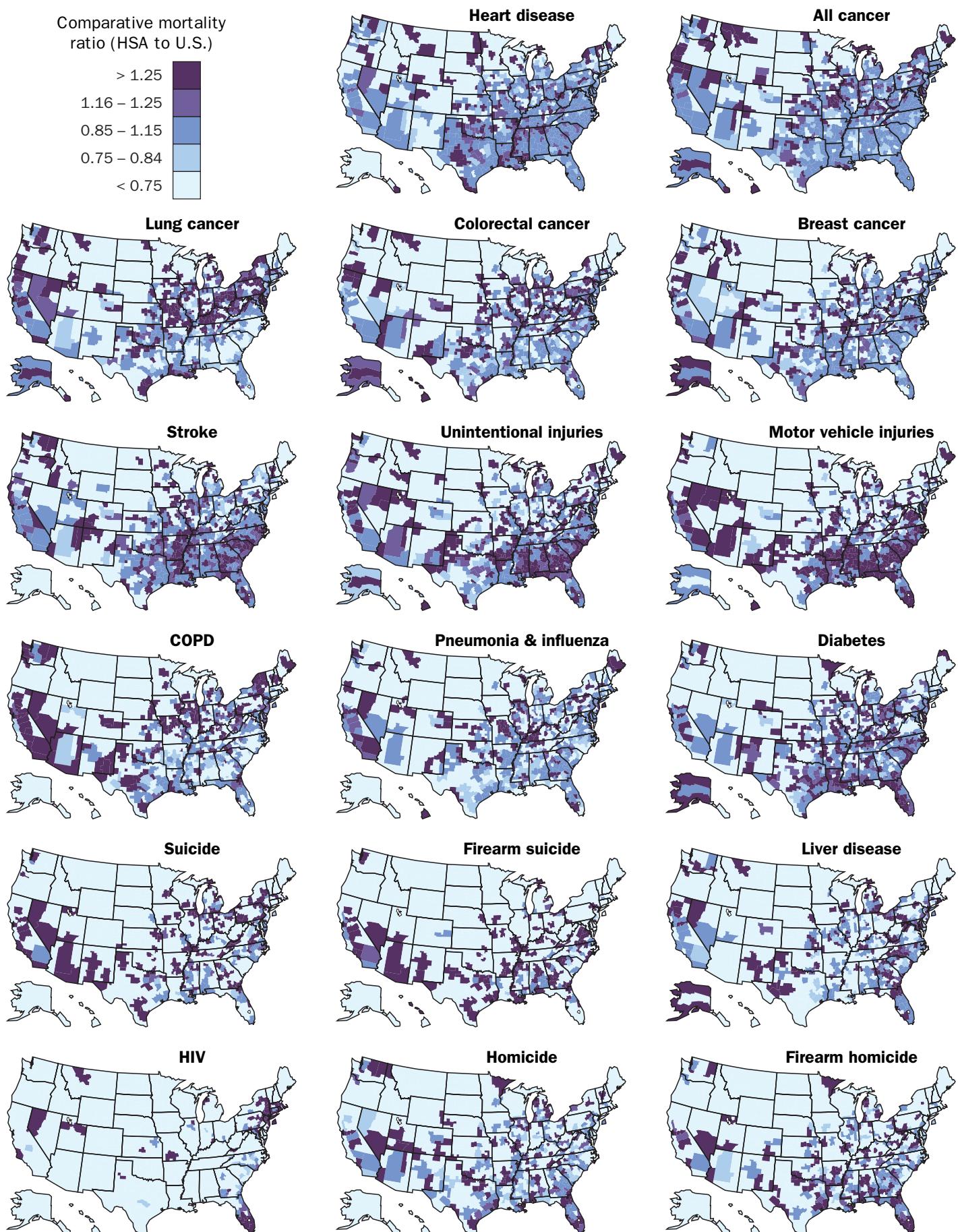


FIGURE 4. COMPARISON OF HSA RATES  
WITH U.S. RATES BY CAUSE

BLACK FEMALE



## HEART DISEASE

Although death rates have declined for over 30 years (54), heart disease remains the leading cause of death in the United States (53). Two-thirds of all deaths coded to this cause of death are specified as ischemic (or coronary) heart disease. Death rates from all diseases of the heart have been consistently higher for blacks than for whites for at least 40 years, with greater differences in recent years due to a more rapid drop in rates among whites (55). Hispanics, American Indians/Alaskan Natives, and Asians have lower rates than blacks or whites (53). Rates for women are 40 percent to 50 percent lower than the corresponding male rates in each racial or ethnic group. For men and women, regardless of race, death rates rise steadily with age, with lessening male/female and black/white differences in the older age groups.

Along with age, sex, and race, other strong predictors of heart disease risk are cigarette smoking, high blood pressure, elevated serum cholesterol, physical inactivity, family history of heart disease, obesity, and diabetes (54, 56-59). Areas of current epidemiologic research include the effects of diet (60) and exercise (61) and the possible protective effect of estrogen therapy for postmenopausal women (62). The importance of these risk factors varies by age and sex and by the particular type of heart disease (63). Reductions in hospital discharges and hospitalized case fatality rates for heart disease patients point to improvements in population risk factor levels and medical care, for example, improved treatment of heart attack patients and wide availability of coronary artery bypass surgery, as partly responsible for continued reductions in death rates (64). However, over half of ischemic heart disease deaths among white males during a recent period occurred out of hospital or in emergency rooms; variation of this proportion by urbanization level and State suggests that a lack of quick access to effective emergency medical services is also a risk factor for death out of hospital (65).

In 1970 the highest heart disease death rates were in the Middle Atlantic region, whereas all States west of the Mississippi River had low rates (7). In the northeastern regions, rates were highest in metropolitan areas, but in the southeastern regions, nonmetropolitan areas had higher rates (66). Since 1970 rates first declined more rapidly in the northeastern United States than elsewhere, particularly in metropolitan areas, thus lessening regional differences (65, 67, 68). Later, rates declined

in nonmetropolitan areas and in southeastern States (66, 67). This geographic difference in mortality time trends resulted in a shift in the areas of highest rates from northeastern to southeastern States, although rates are still declining in all regions. This southeastern cluster of relatively high rates now includes areas west of the Mississippi River, where rates had been low in the past. A recent nationwide study showed a higher prevalence of self-reported current smoking in central cities across the United States for blacks and whites, with high rates among whites also noted in nonmetropolitan States in the South and West. The prevalence of high blood pressure and low education was also high in the nonmetropolitan South (64).

## ALL CANCER

Age-adjusted death rates for all cancer sites combined have changed little in the United States since the 1970's (53), while incidence rates have increased approximately 1.3 percent per year (69). However, these summary rates mask increases for specific types of cancer and decreases among younger persons that are attributed to improved diagnostic and therapeutic procedures (70). Over the past 20 years, overall incidence has increased at least 2 percent per year for cancer of the liver and kidney, as well as for melanoma of the skin and non-Hodgkin's lymphoma, prostate and testicular cancer among men, and lung cancer among women (69). Death rates for these cancer sites have also risen over this time, except for a 6-percent per year decline in testicular cancer (69). Reductions in incidence rates of over 2 percent per year during this period were seen for cancers of the uterus and cervix and in death rates for cancers of the stomach and uterine cervix and for Hodgkin's disease (69). Female lung cancer death rates have risen so rapidly that this is now the leading site of cancer mortality among women. (However, breast cancer incidence rates are more than double those of lung cancer (69), because of the high fatality rate among lung cancer patients.) Death rates from all cancers combined; cancers of the esophagus, uterine cervix, larynx, prostate, stomach and liver; and multiple myeloma are significantly higher in blacks (71); whereas whites experience higher rates of lymphomas; leukemias; and cancers of the ovary, brain, testis, and skin (69).

The most prominent risk factor for cancer development is cigarette smoking, which has been linked not only to lung cancer, but also to cancers of the mouth, pharynx, larynx, esophagus, pancreas,

uterine cervix, kidney, and bladder (71). Alcohol consumption in combination with smoking has been implicated in the development of cancers of the oral cavity, esophagus, and larynx (72). Studies of the influence of diet on cancer development have been inconclusive, though a diet high in fat and low in fiber, fruits, or vegetables has been associated with an increased risk for a number of cancers, including breast and colorectal cancer. Certain occupational exposures have been linked to leukemia, non-Hodgkin's lymphoma, lung cancer, bladder cancer, and liver cancer, and exposures to high levels of ionizing radiation are associated with cancers of the bone marrow, breast, and thyroid (72). The role of viruses, such as HIV and papilloma viruses, in the development of certain cancers is a topic of current research (72). Recent research has identified specific genetic abnormalities that may be responsible for a predisposition to breast and colorectal tumors (73, 74).

The geographic patterns for all cancer mortality reflect the patterns of death for leading cancer sites, particularly lung cancer. The four sites included in this atlas accounted for 54 percent of all cancer deaths during 1988–92.

## LUNG CANCER

Lung cancer has been the leading cause of cancer death in men since the 1950's (71). In 1987 lung cancer became the leading cause of cancer death in women, surpassing breast cancer (69). Between 1950 and 1990, death rates increased 3.5 times among men and nearly 7 times among women (53), thus narrowing the gender gap in mortality for this tumor. During 1988–92, lung cancer death rates remained highest in black males, whose rates are 50 percent higher than white males; rates for black and white women are nearly equal.

The primary risk factor for lung cancer is cigarette smoking, an association demonstrated repeatedly in epidemiological studies (75). Risk has been shown to increase with the number of cigarettes smoked, the duration of smoking, an earlier age at onset of smoking, degree of inhalation, the tar and nicotine content, and the use of unfiltered cigarettes (75). Exposure to second-hand smoke; radon; and occupational exposures to asbestos, bis(chloromethyl) ether, polycyclic aromatic hydrocarbons, chromium, nickel, and inorganic arsenic compounds have also been shown to increase lung cancer risk (71, 75).

In the 1950's the highest lung cancer rates for white males were in northeastern urban areas and

port cities along the Atlantic and Gulf coasts (8). During the following 20 years, increasingly clustered areas of high rates appeared in the East South Central and South Atlantic-South regions, particularly along the Mississippi River (8). Case-control studies identified differences in smoking patterns and exposure to asbestos through shipyard employment as potential explanations for these geographic differences (8). From 1950 to 1970, patterns of lung cancer rates for white females were similar to earlier white male patterns, but a cluster of high rates appeared in Pacific States during the 1970's (8). During this time high rates for blacks were limited to urban centers in the Middle Atlantic and East North Central regions (9). The new maps for 1988–92 show patterns of even stronger geographic concentration among whites, with high male rates now extending along the Ohio River into the South Atlantic-North and East North Central regions. Rates for black males are highest in the South Atlantic and East South Central regions. The western cluster of high rates among white females now encompasses the entire Pacific region and portions of the Mountain regions; this western excess is most pronounced for the older ages, whereas higher rates in the East South Central, South Atlantic-South and New England regions are more notable for the younger age group.

## COLORECTAL CANCER

From 1973 to 1992, incidence and mortality rates for colorectal cancer have increased by approximately 1 percent per year among blacks, while rates among whites have declined slightly (69). Improved survival rates are attributed to earlier detection due to improvements in diagnostic tests (76). From 1980 to 1992, black males experienced the highest death rates from colorectal cancer (53), though the incidence rates for white and black males are similar (76). Women are at a slightly lower risk of developing colorectal cancer (76).

In addition to age, race and sex, family or personal history of cancer or colorectal polyps, and inflammatory bowel disease are risk factors for colorectal cancer (71). Recent advances in identifying cancer susceptibility genes suggest that 10 percent of colorectal cancer cases are due to an inherited predisposition (73, 74). A number of studies have demonstrated that a high-fat, low-fiber diet can lead to the development of colorectal cancer, which could explain the 20- to 50-percent lower risk among Mormons and Seventh-Day Adventists, groups which observe certain dietary restrictions and refrain from

using alcohol and tobacco products (77). With increasing availability of methods of screening for colorectal cancer in asymptomatic patients (71), access to and utilization of these medical procedures may play a role in mortality patterns in the future.

Since the 1950's colorectal cancer death rates have been highest for blacks and whites in the more densely populated areas of the northeastern States, although regional differences have diminished over time (8, 9). For 1988-92 age-adjusted rates remain higher in the northeast (New England, Middle Atlantic, East North Central, and South Atlantic-North regions) but the age-specific maps show relatively higher rates among younger whites in South Central and South Atlantic States, although rates in this age group vary little across the United States.

## PROSTATE CANCER

Prostate cancer death rates have increased slowly from 14.4 deaths per 100,000 population in 1980 to 16.6 deaths per 100,000 population during 1992 (53). Incidence rates have increased more rapidly, rising 50 percent over this period (71). This rapid rise in incidence is attributed to improved diagnostic techniques that may be identifying tumors that will never become life threatening (71). Black American men have the highest prostate cancer incidence, and possibly mortality, in the world (71). Their death rates are twice those of white American men (78). Prostate cancer is primarily a disease of older men, with over 80 percent of all diagnoses occurring over age 65 (71). Autopsy studies have estimated that 30 percent of men over age 50 have latent carcinoma of the prostate (79).

Very little is known about the etiology of prostate cancer, although age and race are recognized as major risk factors (71, 79). Other proposed risk factors include high circulating androgen levels (80), genetic predisposition to the disease (78), and dietary factors such as vitamin D deficiency (80) and high fat and vitamin A intake (79). Increased risk may be associated with exposure to cadmium and employment in agricultural, nitrate fertilizer, or ferrochromium industries (79). Other studies have suggested that a history of venereal disease or multiple sex partners also increases the risk of prostate cancer (78).

Scattered areas of high rates for white males have been noted previously in rural sections of the northern States (8). In the 1970's an apparent clustering of high black male death rates emerged in the Carolinas and central Florida (9). The 1988-92

maps for the older ages confirm these patterns for white and black men. Higher rates among younger men are seen along the Atlantic coast, but rates for this age group are extremely low.

## BREAST CANCER

In the United States, death rates for breast cancer have been stable for the past 50 years, even as incidence rates have increased (71). Before 1980 white women had slightly higher age-adjusted death rates than black women, but since then death rates for black women have increased 16 percent, surpassing rates for white women, which decreased 5 percent over the same period (53). Breast cancer incidence and death rates increase with age, but the rate of increase slows after menopause (81). Among premenopausal women, breast cancer incidence is higher in blacks (81).

Two well-established risk factors for breast cancer are personal history of breast, endometrial, or ovarian cancer and family history of breast cancer (82). The recent identification of genetic mutations linked to early onset breast cancer may explain at least part of this familial aggregation (73). Older age, higher socioeconomic status, and never having been married have been associated with increased risk of breast cancer (82). Other established risk factors include exposure to high doses of ionizing radiation; certain breast tissue abnormalities; and factors related to reproductive history such as early onset of first menarche, late onset of menopause, late age of first full-term pregnancy or nulliparity (83). The effects of alcohol consumption, oral contraceptive use, postmenopausal estrogen therapy, diet, and pesticide exposure are still being considered (82-84). As many as 70 percent of women diagnosed with breast cancer may not have any identifiable risk factor (83).

Between 1950 and 1980, the highest breast cancer death rates for white and black women were found in the urban areas of the New England and Middle Atlantic regions, although the north-south differences diminished over this period (8, 9). High rates for postmenopausal white females were concentrated in the urban areas of these northeastern States, but much of this excess can be explained by regional differences of recognized risk factors (85); premenopausal rates varied little by region (8). A comparison of the age-specific and age-adjusted maps for 1988-92 shows that the higher age-adjusted rates in the northeast are still predominantly due to geographic differences among older white women. The map for younger ages shows an east-to-west decline

in rates, but the range of rates is very narrow. High rates among black females appear to be scattered across the southern States for both age groups.

## STROKE

In the United States, the death rate for cerebrovascular diseases (stroke) has steadily declined since about 1900 (86). Even so, stroke remains a leading cause of death, ranking third behind heart disease and all cancer for white and black women, fourth for white men, and fifth for black men. About 75 percent of strokes are ischemic (a blockage of cerebral blood vessels) rather than hemorrhagic (a ruptured blood vessel) (54). Sharp declines in ischemic stroke death rates are responsible for the downward trend in overall rates (56), although over half of the stroke deaths during 1988–92 were not coded to a specific type. Death rates for men have been higher than those for women since the 1950's, though the gender gap narrowed in the 1980's (86). During 1988–92 the age-adjusted death rate for stroke among blacks was twice that among whites for males and females, with the greatest racial disparities seen in the younger age groups (87). Rates among non-Hispanic whites and Asians were nearly equal during 1988–92, with rates among Hispanics and American Indians/Alaskan Natives somewhat lower (53). Hospitalization rates for stroke have remained stable over the period of declining mortality, although regional differences in these rates reflect those of mortality (87), suggesting that improvements in diagnosis and in prevention and treatment of associated medical conditions may have contributed to the reduction in mortality.

Risk factors for stroke vary somewhat according to the type of stroke in question (88), but one-third of all strokes may be attributed to a medical history of hypertension, diabetes, elevated hemoglobin levels, or prior heart disease (56). Other important risk factors for ischemic stroke include age, sex, race, genetic predisposition, cigarette smoking, obesity, elevated blood cholesterol and lipids, excess alcohol consumption, use of oral contraceptives, a history of transient ischemic attacks, and physical inactivity (54, 89, 90). At one time characteristics of soil and drinking water were suspected as risk factors for stroke, but the changing geographic patterns of stroke mortality are inconsistent with these hypotheses (91). Geographic and temporal differences in stroke mortality are now thought to be real, not an artifact of certification differences (92), and due to multiple individual, rather than community, factors (91).

Over 40 years ago, a cluster of areas with high stroke mortality was identified in the South Atlantic-South region, which became known as the "Stroke Belt" (91). Over time rates have declined faster in this region than others, lessening regional differences (92). Although rates remain high along the south Atlantic coast, the "Stroke Belt" appears to be dispersing as a consequence of regional differences in time trends, with clusters of relatively high rate areas seen more to the north and west of the original cluster (7, 91, 93). For example, the maps for 1988–92 show that age-adjusted rates in the East South Central and West South Central regions are relatively high for whites and blacks. If the geographic differences noted in the smoothed maps by age group represent a cohort effect, high rates will continue to move westward. Little information is available about geographic patterns of risk factors for stroke, but a recent nationwide study showed self-reported hypertension and smoking to be high in the nonmetropolitan south (South Atlantic and South Central regions) (64). It is interesting to note some local exceptions to these regional trends, notably in retirement destinations. A study of stroke mortality by State of birth and death suggests that persons who retire to other regions retain the stroke risk of their States of origin; hence white retirees from the Middle Atlantic region may lower the total stroke death rate in Florida, compared to higher rates seen among white and black native Floridians (94).

## UNINTENTIONAL INJURIES

Death rates due to unintentional injuries have been decreasing among both sexes and all races since 1970 (53). Death rates from all unintentional injuries peak at ages 15–24 years, then rise again after age 60; in fact, unintentional injury was the leading cause of death for each age group from 1–4 years to 25–44 years in 1992 (53). For 1988–92 nearly half of these deaths were motor vehicle-related, but falls were the leading cause of unintentional injury death among older persons. Death rates among males were nearly three times those of females. Native Americans have the highest overall death rates due to unintentional injuries, and rates among blacks are somewhat higher than those among whites (53).

Age is the predominant risk factor for death due to unintentional injury. The very young, particularly males, are prone to unintentional injuries because their lack of knowledge and experience leads them to engage in high-risk behavior (95). The risk of sustaining a fatal injury increases with exposure to

potentially fatal materials, such as poisonous substances, or events, such as a dangerous work environment. The use of alcohol is a risk factor for many types of unintentional injuries such as drownings and motor vehicle crashes (96). Elevated death rates among older persons are attributed to their diminishing physical capacity, which leads to a higher frequency of accidents, a higher likelihood of sustaining an injury in the accident, and greater difficulty recovering from the injury (95).

The highest unintentional injury death rates are seen in the East South Central region for whites and the South Atlantic-South region for blacks, with scattered high-rate areas in the western States. Rates are higher in rural than in urban areas (12, 95). See cautionary note in "Amended data" section under "Causes of death."

## MOTOR VEHICLE INJURIES

Rates of death due to motor vehicle injuries have declined to 42 percent of the 1970 U.S. rate (53). This improvement has been attributed to successful public awareness and education campaigns, legal interventions, improved vehicle and equipment designs, roadways, and emergency medical and trauma care (97). Despite these improvements, motor vehicle injury remains one of the leading causes of death among young adults. Motor vehicle death rates are nearly three times higher among males than among females (53). Native Americans have death rates about twice those for whites or blacks (97).

Factors that have been associated with motor vehicle fatalities include alcohol and drug use, risk denial and aggressive behavior, young or old age, and characteristics of the vehicle and roadways (95).

Motor vehicle-related death rates have been higher in the southeastern States and in scattered western areas (12, 95, 97). Motor vehicle death rates are higher in nonmetropolitan than metropolitan areas. The age-specific maps for 1988–92 show consistently high rates in the East South Central and South Atlantic-South regions, especially among young adults, but the location of high-rate areas in the west vary by race and sex. See cautionary note in "Amended data" section under "Causes of death."

## CHRONIC OBSTRUCTIVE PULMONARY DISEASES

U.S. age-adjusted death rates for chronic obstructive pulmonary diseases (COPD) increased

from 1950 until 1988, after which rates remained relatively stable (53). Between 1980 and 1992, death rates increased among older age groups, while among the younger age cohorts death rates remained stable or declined (53). Since 1980 the largest increases in death rates for COPD have been among females (+76 percent) and among black men (+19 percent), but the highest rates are still seen among white males (53). Overall, male death rates are about twice those of females (53). This broad cause of death includes emphysema, asthma, and bronchitis, but less than 30 percent of deaths attributed to COPD during 1988–92 were coded to these specific causes.

Cigarette smoking and coal dust exposure are established risk factors for COPD (98). Other occupational dust and fume exposures, childhood lung disease, passive cigarette smoke exposure, prenatal cigarette smoke exposure (99), and low socioeconomic status as related to poor housing (98) are suggested risk factors. Familial aggregation of COPD has been noted, but it is not clear whether this is due to genetic predisposition or to shared environmental factors, such as dust or passive smoking (99).

Age-adjusted death rates are highest in the Mountain regions for whites and the South Atlantic regions for blacks. Rates are also high in other areas depending on race, sex, and age; for example, rates among older white males are high in the East South Central region, similar to patterns for lung cancer death rates. Patterns on these maps resemble those seen on earlier maps of emphysema (7), although care must be taken in drawing inferences about COPD component diseases.

## PNEUMONIA & INFLUENZA

By 1980 the combined death rate for pneumonia and influenza declined to less than half the 1950 death rate (53); since then, the rates have changed little. A higher than usual proportion of deaths due to pneumonia and influenza occurred during the initial 4 years covered by this atlas (100, 101). Though influenza infection rates are highest among children and adolescents, nearly 90 percent of the deaths occur among older persons (53, 102). Death rates from pneumonia and influenza are 69 percent higher for males than for females and 48 percent higher for blacks than for whites. Pneumonia and influenza deaths have a characteristic annual pattern of peak death rates in the winter months and low death rates in the summer months, but additional deaths may occur during an epidemic (103).

The majority of risk factors for acute pneumonia infection are related to disruptions of natural pulmonary host defense mechanisms (104). Cigarette smoke, preexisting disease, alcohol, certain medical procedures bypassing the upper airways, and some commonly prescribed drugs are examples of factors that may compromise pulmonary defense mechanisms and increase host susceptibility to pneumonia (104). Primary viral pneumonia most often occurs in pregnant women and individuals with cardiovascular disease but can also occur in healthy young adults (103). Secondary bacterial pneumonia most commonly occurs in persons over age 65 who have a chronic disease (103). Both types of pneumonia can occur as a complication of influenza. Persons at greatest risk for death due to pneumonia and influenza are infants, older persons, and those with preexisting diseases (102). Although persons with HIV infection are at higher risk of developing and dying from pneumonia, these deaths should be coded to HIV infection as underlying cause of death. It is not known to what degree this potential bias affects the maps shown in this atlas.

Rates are high in East South Central States for older whites, similar to the pattern seen for lung cancer, heart disease, and COPD. In addition, rates are high in the Pacific region for older white females and in the South Atlantic-North region for older white males. Rates for blacks and whites appear high in several Pacific and Mountain-South States, particularly for the younger age group. Previously published maps for these diseases show no elevated rates in these western regions (7), but rates of death due to HIV infection are high in several of these States.

## DIABETES

Diabetes mellitus death rates declined from 1950 through the mid-1980's, then increased slightly before leveling off by 1990 (53). For 1988–92, male and female death rates were similar, but the rates for blacks were more than twice those for whites (53). In 1992 diabetes was the seventh leading cause of death among white females, but the fourth leading cause among black, American Indian/Alaskan Native, and Hispanic women (53). The prevalence of diabetes has been estimated as two to three times greater for Mexican Americans and Puerto Ricans than for non-Hispanic whites (105). The mortality figures may underestimate the actual number of deaths due to diabetes by as much as 50 percent, because of failure to note a history of diabetes on the death

certificates of diabetics who die of stroke or heart disease (27).

The etiology of diabetes mellitus has yet to be determined (106). Genetic predisposition seems to play an important role in the development of both noninsulin-dependent and insulin-dependent diabetes mellitus (107). Recent research has suggested that the latter type may be associated with viral infections (106), exposure to certain chemicals and pharmaceutical products (106), and psychological stress (108). The primary risk factor for noninsulin-dependent diabetes seems to be obesity (107). Differences in socioeconomic factors and higher prevalence of obesity may explain part of the higher risk of diabetes among Mexican Americans compared to non-Hispanic whites (105).

Death rates among whites are highest in the Middle Atlantic and East North Central States, and in southern Texas and New Mexico, similar to patterns seen on maps for 1968–71 (7). The southwestern excess may reflect the high proportion of Mexican Americans living in this region. Rates among blacks are highest along the Gulf and south Atlantic coasts.

## SUICIDE

Since 1980 overall suicide rates have remained relatively stable, with slight increases due primarily to increasing rates among older persons (53, 109). Men are about five times more likely than women to commit suicide, and rates among whites are twice those among blacks. Native American males have the highest suicide rates of all races up to age 44, but for older ages, white males have consistently had the highest rates (53). Firearms are the most common method of suicide used by men and women, although a drug overdose is the method of choice for nearly as many women (109).

Persons with a family history of suicide, alcohol abusers, and individuals diagnosed with a psychiatric illness (for example, depression) or a personality disorder are at a higher risk of suicide (110, 111). Other possible risk factors include the level of certain neurotransmitter metabolites, previous suicide attempts, stressful life events such as divorce or widowhood (109, 110), and firearm availability. The observation of suicide clusters among young persons has suggested that exposure to a suicide may initiate suicidal behavior (110, 111).

Geographic patterns for suicide rates vary by method of suicide (95), but rates for all types of suicide combined are highest in the western States (12, 95) and in nonmetropolitan areas. See cautionary

note in "Amended data" section under "Causes of death."

## FIREARM SUICIDE

During 1988–92 firearms were associated with 65 percent of all suicides among men and 42 percent among women; although, among women under age 75, the most common method of suicide is by firearm. The trends in firearm suicide rates paralleled the overall suicide rates through the 1960's (111); but between 1968 and 1986, the firearm suicide rate increased 36 percent, while suicide rates for other methods remained stable (95). As with all suicides, rates for whites are several times those for blacks, but an even greater gender difference is seen for firearm suicide, with the highest rates among older white males. The firearm suicide rate among adolescents has doubled in the last 30 years (112), now accounting for two-thirds of all suicides among persons ages 15–34 years (113).

Risk factors are the same as for all suicides as noted in the previous section.

The highest rates of suicide by firearms are found in the Mountain regions and scattered southern States, where gun ownership has been more common (95). Among whites high rates predominate in the Mountain and West South Central regions for younger males, while the East South Central, South Atlantic, and Pacific regions have higher rates among older males and among females. In all regions of the United States, firearm suicide rates are highest in nonmetropolitan areas.

## LIVER DISEASE

After peaking in the early 1970's, chronic liver disease and cirrhosis death rates have steadily declined by about 3 percent annually through 1992 (53). During 1988–92 death rates were about twice as high for males compared to rates for females and for blacks compared to whites. Excess deaths from cirrhosis have been noted among Mexican-born Americans (114). Of all deaths in this category, 79 percent were due to cirrhosis, 10 percent to an unspecified liver disease, 6 percent to hepatitis, and 5 percent to other liver diseases.

Heavy alcohol use is considered a major risk factor for chronic liver disease (115) and is a well-established risk factor for cirrhosis (116). Younger men are more likely to consume alcohol than older men (53). However, among drinkers, younger black men and older Hispanic men are more likely to have

heavier consumption than others (53). Infection with hepatitis B or C virus is also believed to increase risk of chronic liver disease, as are certain drugs, industrial chemicals, and less common infectious agents (115). Liver cirrhosis may develop as a result of an interaction between alcohol consumption and other risk factors (117). Established risk factors for chronic hepatitis include viral infection, autoimmune disease, drug use, and certain genetically transmitted metabolic disorders (118).

Among whites rates are highest in the Mountain-South and Pacific regions; rates for the younger ages are particularly high for the Pacific region. Cirrhosis mortality among whites was high in California during 1965–71, but most rates in the Mountain-South region were not significantly high at that time (7). High rates among blacks are seen in scattered areas throughout the south and west.

## HUMAN IMMUNODEFICIENCY VIRUS INFECTION

Death rates due to HIV infection nearly doubled over the period covered by this atlas, from 6.7 percent in 1988 to 12.6 percent in 1992 (53). The highest rates occur in the 25 to 44-year age group, accounting for 73 percent of all HIV infection deaths (119). Substantially higher HIV infection and death rates occur among males and among blacks (53, 120). Black male death rates for 1988–92 were triple those of white males; more black men died in 1992 from HIV infection than from unintentional injuries or stroke (53). Since 1988 death rates among females have risen slightly faster than death rates among males, but rates among females are still much lower than rates among males.

HIV infection is primarily spread through a number of high risk sexual practices and the sharing of contaminated drug paraphernalia (121). Though anyone who practices these high risk behaviors is at risk, persons recognized to be at greatest risk for HIV infection include homosexual and bisexual men, injecting drug users, and females who have sexual contact with bisexual men or injecting drug users (120–122). Other populations at risk for HIV infection include infants born to HIV-infected mothers and hemophiliacs and others exposed to contaminated blood or blood products through transfusion or occupational activities (121).

The geographic distribution of new acquired immunodeficiency syndrome cases reported for 1993 indicates that the majority of the cases are concentrated in major metropolitan areas, particularly

in Florida, California, and the urban corridor from Washington, D.C., to Boston, Massachusetts (123). A similar, but less concentrated, pattern is seen for death rates, with few notable differences between maps for males and females or for younger and older ages despite the large differences in rates for these groups.

## HOMICIDE

Since the mid-1950's, homicide rates have generally increased (95), rising about 5 percent annually from 1987 to 1991, followed by a 4-percent decline to 1992 (53). Historically, these trends have reflected changes in firearm homicide rates, as rates for other types of homicides have remained relatively stable over time (95). One-third of all homicides occur among persons ages 15–24 years (53). Homicide is the leading cause of death among black males in this age group (53). For black males of all ages, homicide ranks third of the causes included in this atlas, ahead of unintentional injuries and stroke. Black male rates are higher than those for black females and white males and females for every age group. Mortality statistics for 1993–94 suggest that rates may have peaked in 1992 (124).

Factors that influence the risk of being a victim of homicide include age, sex, ethnicity, and socioeconomic status (125). Other factors hypothesized to be associated with homicide are firearm availability, alcohol and drug use, drug trafficking, racial discrimination, and cultural acceptance of violent behavior (126).

For all race/sex groups, the highest homicide rates are seen across the southern States; the extension of high rates into the Pacific region for

whites was less apparent in maps that combined data over racial groups (12, 95). For all ages and races, 1992 homicide rates were nearly twice as high in metropolitan regions as in nonmetropolitan regions and are particularly high for blacks in urban areas. See cautionary note in "Amended data" section under "Causes of death."

## FIREARM HOMICIDE

While the death rates from other types of homicide remained relatively stable, firearm homicide rates varied greatly from 1930 to 1986 and have consistently influenced overall homicide trends (95, 124). During 1988–92, a firearm was used in the commission of 65 to 75 percent of all homicides among males and 50 percent of all homicides among females. Firearm homicide rates have been rising most significantly among adolescents and young adults (124). From 1985 to 1990, the firearm homicide rate among black teenage males nearly tripled, while doubling among white males and black females (113). As with overall homicide rates, the rates for black males are much higher than those of any other race or sex for each age group.

The risk factors and geographic patterns for firearm homicide are similar to those of all homicides.

## ALL CAUSES

Patterns on the all causes maps are influenced by patterns of rates for the leading causes of death. The influence of heart disease and lung cancer can be seen as high rates in the East South Central region, and for women, in the Pacific region.