Review

Cancer Epidemiology, Biomarkers & Prevention

Current Prevalence of Major Cancer Risk Factors and Screening Test Use in the United States: Disparities by Education and Race/Ethnicity

Ann Goding Sauer, Rebecca L. Siegel, Ahmedin Jemal, and Stacey A. Fedewa

Abstract

Overall cancer death rates in the United States have declined since 1990. The decline could be accelerated by eliminating socioeconomic and racial disparities in major risk factors and screening utilization. We provide an updated review of the prevalence of modifiable cancer risk factors, screening, and vaccination for U.S. adults, focusing on differences by educational attainment and race/ethnicity. Individuals with lower educational attainment have higher prevalence of modifiable cancer risk factors and lower prevalence of screening versus their more educated counterparts. Smoking prevalence is 6-fold higher among males without a high school (HS) education than female college graduates. Nearly half of women without a college degree are obese versus about one third of college graduates. Over 50% of black and Hispanic women are obese compared with 38% of whites and 15% of Asians. Breast, cervical, and colorectal cancer screening utilization is 20% to 30% lower among those with <HS education compared with college graduates. Screening for breast, cervical, and colorectal cancers is also lower among Hispanics, Asians, and American Indians/Alaska Natives relative to whites and blacks. Enhanced, multilevel efforts are needed to further reduce the prevalence of modifiable risk factors and improve screening and vaccination, particularly among those with lower socioeconomic status and racial/ethnic minorities.

Introduction

In the United States, cancer death rates have steadily declined since the 1990s (1). Yet in 2019 about 607,000 cancer deaths are expected to occur (2), approximately 45% of which are caused by potentially modifiable risk factors such as cigarette smoking, excess body weight (EBW), alcohol intake, physical inactivity, and unhealthy diet (3). For example, cigarette smoking accounts for approximately 29% of all cancer deaths, but this proportion is expected to be larger among populations that continue to smoke at high rates, including those with lower educational attainment (4). Among women, EBW accounts for about 7% of all cancer deaths, but this estimate could be larger among certain racial/ethnic groups, including black and Hispanic women among whom more than 50% are obese (5, 6).

Assessing the most current prevalence of cancer risk factors, vaccination, and screening is an important component of monitoring progress and strengthening cancer control efforts. We previously provided an overview of prevalence patterns of major risk factors, cancer screening, and vaccination for both adults and youth (where applicable) in the United States (7); herein, we update with data through 2017, focusing on educational and racial/ethnic disparities.

Intramural Research Department, American Cancer Society, Atlanta, Georgia.

Note: Supplementary data for this article are available at Cancer Epidemiology, Biomarkers & Prevention Online (http://cebp.aacrjournals.org/).

Corresponding Author: Ann Goding Sauer, American Cancer Society, 250 Williams Street, Atlanta, GA 30303. Phone: 404-329-7989; Fax: 404-321-4669; E-mail: ann.godingsauer@cancer.org

doi: 10.1158/1055-9965.EPI-18-1169

Materials and Methods

Data from publicly available population-based surveys were used to estimate the prevalence of cancer risk factors and screening utilization. These surveys included the National Health Interview Survey (NHIS), Behavioral Risk Factor Surveillance System (BRFSS), National Health and Nutrition Examination Survey (NHANES), and National Immunization Survey-Teen (NIS-Teen). NHIS is an annual computer-assisted in-person household survey of noninstitutionalized adults $\geq$18 years designed to provide national estimates for health and sociodemographic factors. In 2015 and 2017, the response rates were 55.2% and 53.0%, respectively (8, 9). Data from the 2017 NHIS were used to estimate cigarette smoking, alcohol consumption, and physical inactivity prevalence as well as sociodemographic and healthcare characteristics. The most recent ultraviolet radiation (UVR) exposure and cancer screening data were ascertained in the 2015 survey. BRFSS is a computer-assisted telephone-based survey of adults $\geq$18 years designed to provide state-level estimates for health behaviors and was used to estimate fruit and vegetable intake in 2017; the median response rate for this survey was 45.8% (10). NHANES collects data through in-person interviews and physical examinations by trained personnel. The 2015–2016 NHANES data were used to estimate the prevalence of overweight and obesity among adults $\geq$20 years based on physical examination data, with a response rate of 54.8% (6). Published data on human papillomavirus (HPV) and hepatitis B virus (HBV) vaccination were obtained from the 2017 NIS-Teen (11); HPV initiation rates were computed using methods described elsewhere (12).

Educational attainment is often used as a marker of socioeconomic status (SES) in studies evaluating disparities in cancer mortality (1, 13). We similarly examined cancer risk factor and screening prevalence by self-reported educational attainment and race/ethnicity to help further guide cancer control efforts. The highest level of education was stratified into four groups: <high school (HS), high school (including graduate equivalent degree), some college (including associates degree), and bachelor's degree or higher (college). The following racial/ethnic groups were considered: Hispanics, non-Hispanic white (whites), non-Hispanic blacks (blacks), non-Hispanic Asians (Asians), non-Hispanic American Indian/Alaska Natives (AI/ANs), and non-Hispanic others, including those who identified multiple races. More detailed data on subgroups were not considered, though there is heterogeneity within racial/ethnic groups; statistics for some subgroups have been provided elsewhere (14–16). All weighted estimates were generated using SAS-callable SUDAAN release 11.0.1 and accounted for the complex survey designs. The Healthy People criteria for data suppression were followed (17).

Tobacco

According to the 2014 Surgeon General's Report, smoking increases the risk of cancers of the oral cavity and pharynx, larynx, lung, esophagus, pancreas, uterine cervix, kidney, bladder, stomach, colorectum, liver, and acute myeloid leukemia (18). Additionally, evidence suggests that tobacco smoking may increase the risk of fatal prostate cancer and a rare type of ovarian cancer (18, 19).

Cigarette smoking

In 2017, more than 34 million adults (≥18 years, overall: 14.1%, men: 16.0%, women: 12.3%) were current cigarette smokers (Table 1). Despite significant overall declines, smoking prevalence remains substantially higher among some populations (4, 20). For example, smoking prevalence ranged from 5.0% among female college graduates to 30.1% of males with <HS education (Fig. 1A). Among both men and women, smoking prevalence was lowest among Asians (10.6% and 3.6%, respectively) and highest among AI/ANs (27.3% and 21.5%, respectively; Fig. 2A).

Use of other forms of tobacco

Cigar smoking increases the risk of lung, oral cavity, larynx, and esophageal (21–23) cancers. In 2017, 6.8% of men and 1.1% of women were current cigar smokers (9). Among men, 6.5% of those with some college education were current cigar smokers compared with 7.4% of those with HS education. Among women, 1.8% of those with <HS education were cigar smokers compared with <1% of those with at least some college education. Cigar smoking was more common in blacks (5.8%) and AI/ANs (5.3%) than in whites (4.2%) and Hispanics (2.0%; ref. 9).

Tobacco used in other combustible forms such as pipes, roll-your-own products, and waterpipes increases the risk of lung, gastric, and esophageal cancers (24–26). In the United States, waterpipe smoking among college students is of particular concern as 30% to 50% have reported ever use (27–29). In 2017, 1.1% of adults were current pipe users; prevalence was lower among Hispanics (<1%) than whites (1.2%) and blacks (1.3%; ref. 9). There was little variation by education.

Smokeless tobacco products (e.g., chewing tobacco, moist snuff, snus) can increase the risk of oral, esophageal, and pancreatic cancers (19). Among adults, smokeless tobacco use has remained stable since 2003 (30). In 2017, an estimated 4.1% of men and <1% of women were current smokeless tobacco users (9). Use was most common among white males (5.9%) and males with a HS education (5.7%).

E-cigarettes are newer products promoted as an alternative to conventional cigarettes. Although evidence suggests that currently available e-cigarettes are likely less harmful than conventional cigarettes (e.g., fewer and lower concentrations of toxicants have been found in e-cigarette vapor compared with conventional cigarette smoke), long-term risks are unknown (31, 32). Additionally, adolescent and young adult

Table 1. Current cigarette smoking, adults 18 years and older, NHIS 2017

	Males Weight %	Females Weight %	Overall Weight %
Overall	16.0	12.3	14.1
Age category			
18–24	12.0	8.8	10.4
25–44	19.3	13.0	16.1
45–64	17.4	15.6	16.5
65–74	11.3	9.3	10.2
75+	5.5	5.1	5.3
Race/ethnicity			
Hispanic	12.9	6.9	9.8
White	16.9	14.8	15.8
Black	19.1	11.8	15.1
Asian	10.6	3.6	6.8
AI/AN	27.3	21.5	24.5
Other	[b]	[b]	[b]
Educational attainment (≥25 years)			
<HS	30.1	19.7	24.9
HS	24.1	18.9	21.7
Some college	18.0	16.5	17.2
College graduate	7.0	5.0	5.9
Health insurance			
Uninsured	27.9	18.2	23.0
Private	11.6	8.9	10.3
Medicaid/public	31.5	24.9	27.5
Medicare	10.2	6.9	8.3
Medicare + Medicaid	13.9	10.1	11.5
Other	22.5	16.6	19.6
Usual source of care			
Yes	14.1	11.6	12.7
No	25.7	19.5	23.2
Visited a physician in the past year			
Yes	14.4	12.1	13.2
No	19.2	13.0	16.3
Income			
Poor <100% FPL	26.8	22.6	24.2
Near poor 100%–199% FPL	25.1	16.4	20.3
Non-poor ≥200% FPL	13.1	9.4	11.3
Immigration status			
Born in the USA[a]	17.2	14.4	15.8
In the USA, fewer than 10 years	12.7	[b]	7.1
In the USA, 10+ years	11.5	4.2	7.8
Region			
Northeast	12.1	10.7	11.3
Midwest	18.2	16.0	17.1
South	18.6	13.0	15.7
West	13.2	8.8	11.1

NOTE: Estimates are age adjusted to 2000 standard U.S. population. Estimates for white, black, AI/AN, Asian, and other are among non-Hispanics. Estimate for Asian does not include Native Hawaiians or other Pacific Islanders.
Abbreviation: FPL, federal poverty level.
[a]Includes 50 states and the District of Columbia.
[b]Estimate not provided due to instability.
Source: National Health Interview Survey, 2017.

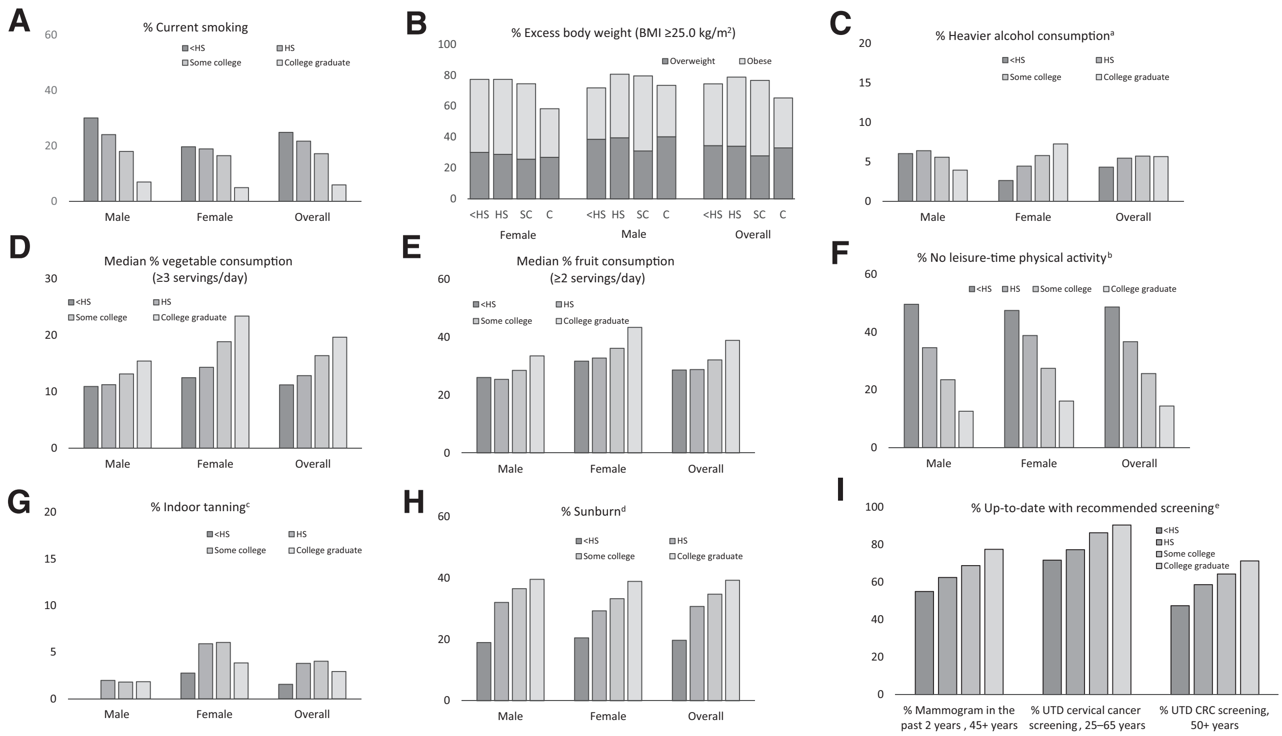

Figure 1.

A–I, Prevalence of major, modifiable cancer risk factors and screening utilization by educational attainment, U.S. adults, NHIS 2015 and 2017, NHANES 2015–16, BRFSS 2017. HS, high school; SC, some college; C, college graduate; BMI, body mass index; UTD, up-to-date; CRC, colorectal cancer. [a]12+ drinks in lifetime, and (male) >14 drinks/week in past year OR (female) >7 drinks/week in past year. [b]Within the past week. [c]Within the past year. Estimate for <HS males not presented due to instability. [d]Within the past year. [e]Cervical cancer screening estimate is among women with intact uteri. Up-to-date cervical cancer screening: Pap test in the past 3 years among women 21–65 years of age OR Pap test and human papillomavirus test within the past 5 years among women 30–65 years of age. Up-to-date colorectal cancer screening: either a fecal occult blood test or fecal immunochemical test within the past year, sigmoidoscopy within the past 5 years, or a colonoscopy within the past 10 years. Sources: National Health Interview Survey 2015 and 2017. National Health and Nutrition Examination Survey 2015–16. Behavioral Risk Factor Surveillance System 2017.

e-cigarette users may be 2 to 4 times more likely than nonusers to begin using combustible tobacco products (33–35).

The proportion of adults who reportedly ever tried e-cigarettes increased dramatically between 2010 (36) and 2017 (9). In 2017, 2.9% of adults were current e-cigarette users, with differences by education (college: 1.4%; HS: 3.9%) and race/ethnicity (Hispanic: 1.6%; white: 3.7%; ref. 9). Half (50.6%) of current e-cigarette users were also current cigarette (conventional) smokers. Conventional smokers may concurrently use e-cigarettes, for example, to reduce or stop smoking, circumvent some smoke-free policies, or comply with social norms (37–39).

Tobacco cessation

Smokers who quit can expect to live as many as 10 years longer than those who continue to smoke, with the largest benefit for those who quit earliest (18, 40). Approximately 61.7% of the 89.5 million Americans who have ever smoked 100 cigarettes in their lifetime are former smokers (9). Among current smokers, in 2017, 16.8 million (48.8%) reported attempting to quit for at least one day in the past year. By education, the proportion of current smokers who made quit attempts ranged from about 45% to 50%; the variation by race/ethnicity was wider (approximately 40% to 60%; ref. 9). Those with lower levels of educational attainment are less often successful at quitting possibly because they are less likely to both use nicotine replacement therapy (NRT) for longer periods and have smoking banned at home (41). Smoking-related morbidity can be reduced with the use of evidence-based tobacco dependence interventions (42). However, less than one third of all those who try to quit report using counseling, NRT, and/or other medication (43).

Secondhand smoke

In the United States, secondhand smoke (SHS) exposure was attributed to about 3% of lung cancer deaths in 2014 (3). Among nonsmokers, SHS exposure declined from 88% in 1988–1991 to 25% in 2013–2014 (unchanged from 2011–2012; ref. 44). However, people living below the poverty level (47.9%), blacks (50.3%), and people living in rental housing (38.6%) had considerably higher exposure (44). Almost 60% of the U.S. population is covered by comprehensive laws that prohibit smoking in all non-hospitality workplaces (such as offices, factories, and warehouses), restaurants, and bars; 25 states, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands have comprehensive, state-wide, smoke-free laws (45). However, among states without such laws, people residing in areas with lower measures of SES are less likely to be covered by local smoke-free restrictions, possibly contributing to disparities in SHS exposure (46).

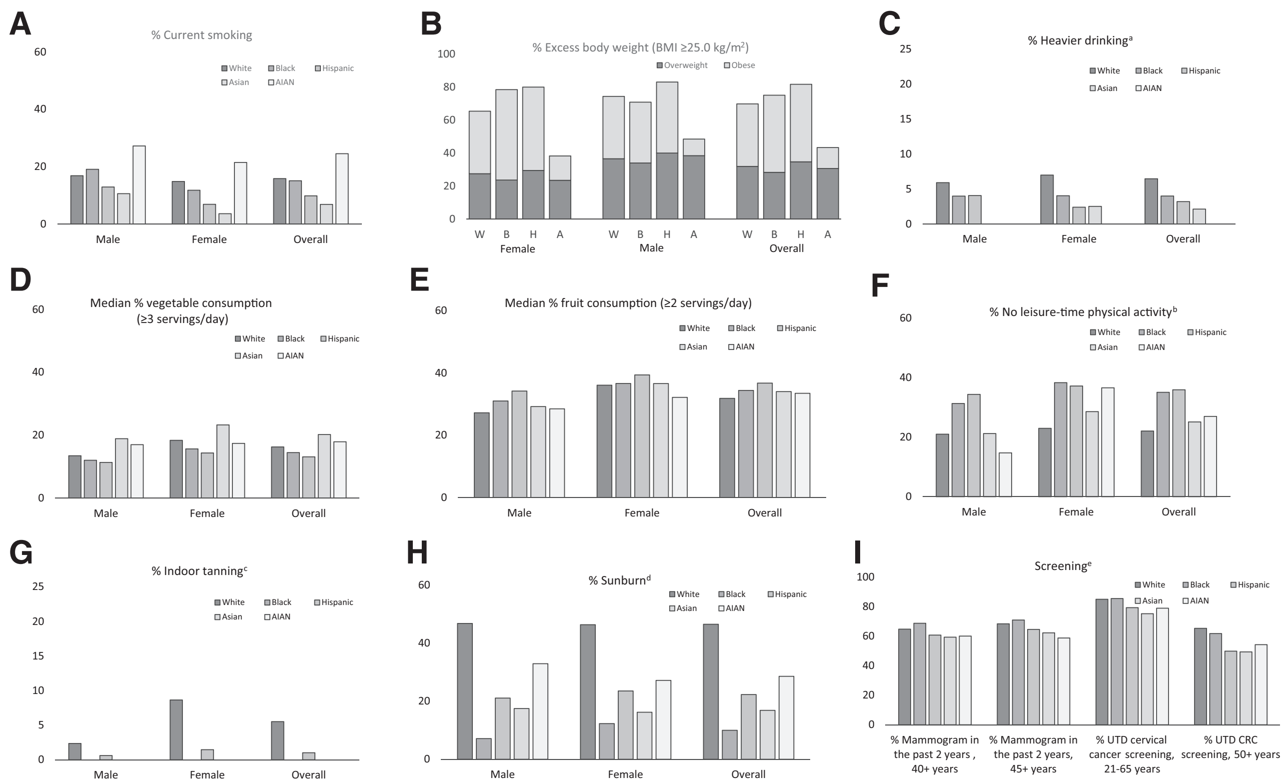

Figure 2.

A–I, Prevalence of major, modifiable cancer risk factors and screening utilization by race/ethnicity, US adults, NHIS 2015 and 2017, NHANES 2015–16, and BRFSS 2017. AIAN, American Indian/Alaska Native; W, white; B, black; H, Hispanic; A, Asian; BMI, body mass index; UTD, up-to-date; CRC, colorectal cancer. [a]Heavier alcohol consumption defined as 12+ drinks in lifetime, and (male) >14 drinks per week in past year OR (female) >7 drinks per week in past year. Estimates for Asian males and AIAN are not presented due to instability. [b]Within the past week. [c]Within the past year. Estimates for blacks, Asians, and AIANs not presented due to instability. [d]Within the past year. [e]Cervical cancer screening estimate is among women with intact uteri. Up-to-date cervical cancer screening: Pap test in the past 3 years among women 21–65 years of age OR Pap test and human papillomavirus test within the past 5 years among women 30–65 years of age. Up-to-date colorectal cancer screening: either a fecal occult blood test or fecal immunochemical test within the past year, sigmoidoscopy within the past 5 years, or a colonoscopy within the past 10 years. Note: Estimates for white, black, Asian, and AIAN are among non-Hispanics. Sources: National Health Interview Survey 2015 and 2017. National Health and Nutrition Examination Survey 2015–16. Behavioral Risk Factor Surveillance System 2017.

EBW, Alcohol, Diet, and Physical Activity

Approximately 16% of cancer deaths in the United States can be attributed to a combination of overweight and obesity, excess consumption of alcoholic beverages, poor diet, and insufficient physical activity (3). Adults who most closely follow the American Cancer Society's Guidelines on Nutrition and Physical Activity for Cancer Prevention (Supplementary Table S1; ref. 47) are less likely to be diagnosed with and die from cancer (48).

EBW

Being overweight or obese increases the risk of uterine corpus, esophageal (adenocarcinoma), liver, stomach (gastric cardia), kidney (renal cell), brain (meningioma), multiple myeloma, pancreatic, colorectum, gallbladder, ovarian, female breast (postmenopausal), and thyroid cancers (49). Excess body fatness may also be associated with an increased risk of non-Hodgkin lymphoma (diffuse large B-cell lymphoma), male breast cancer, and fatal prostate cancer (49). In 2014, about 7% of cancer deaths could be attributed to EBW (3).

The prevalence of overweight (BMI 25.0–29.9 kg/m^2) has remained relatively stable over the past several decades. In 2015–2016, 36.5% of men and 26.9% of women were overweight (5). Among both men and women, prevalence was lowest among those with some college education (Table 2; Fig. 1B). By race/ethnicity, among men, overweight prevalence ranged from 34.0% among blacks to 40.0% among Hispanics (Fig. 2B). The prevalence among women was slightly lower, ranging from about 24% of Asians and blacks to 29.4% of Hispanics.

The prevalence of obesity (BMI $\geq$ 30 kg/m^2) in adults has drastically increased over time. In 1960–1962, 10.7% of men and 15.8% of women were obese; in 2015–2016, these proportions were 37.9% and 41.1%, respectively (5), representing about 93.3 million adults (https://www.cdc.gov/obesity/data/adult.html). By education, obesity prevalence among women was far lower among college graduates (31.4%) than those with less education (47%–49%; Table 2; Fig. 1B). Among men, different patterns were observed; obesity was lower among those with <HS education and college graduates (33.2%) than those with some college education (48.5%). By race/ethnicity, over half of black (54.9%) and Hispanic (50.6%) women were classified as obese compared with 38.0% of white women (Fig. 2B). Differences in obesity rates were not as striking among men (Hispanic: 43.1%, white: 37.9%, black: 36.9%). Asian men (10.1%) and women

Table 2. EBW, alcohol consumption, and physical inactivity, NHANES 2015–16 and NHIS 2017

	Overweight (BMI 25.0–29.9 kg/m^2), ≥20 yrs, NHANES			Obese (BMI ≥30.0 kg/m^2), ≥20 yrs, NHANES			Alcohol consumption (heavier)[a], ≥18 yrs, NHIS			No physical activity, ≥18 yrs, NHIS		
	Males Wgt %	Females Wgt %	Overall Wgt %	Males Wgt %	Females Wgt %	Overall Wgt %	Males Wgt %	Females Wgt %	Overall Wgt %	Males Wgt %	Females Wgt %	Overall Wgt %
Overall	36.5	26.9	31.6	37.9	41.1	39.6	5.1	5.5	5.3	24.3	27.8	26.2
Age category												
18–24	—	—	—	—	—	—	4.0	4.3	4.2	18.4	25.0	21.7
20–24	32.8	22.6	27.8	27.9	30.7	29.3	—	—	—	—	—	—
25–44	34.6	23.2	28.7	40.9	41.6	41.2	5.4	5.9	5.7	19.5	22.5	21.0
45–64	35.3	27.1	31.2	41.9	45.6	43.8	5.6	6.0	5.8	26.7	27.3	27.0
65–74	43.7	30.4	36.4	38.8	47.7	43.7	5.3	6.1	5.7	28.5	34.8	31.9
75+	47.7	34.0	39.5	29.7	33.5	32.0	2.2	3.0	2.6	44.6	53.1	49.5
Race/ethnicity												
Hispanic	40.0	29.4	34.7	43.1	50.6	47.0	4.1	2.4	3.2	34.3	37.2	35.9
White	36.5	27.5	31.9	37.9	38.0	37.9	5.9	7.0	6.5	21.0	22.9	22.0
Black	34.0	23.6	28.3	36.9	54.9	46.8	4.0	4.0	4.0	31.3	38.3	35.0
Asian	38.4	23.5	30.7	10.1	14.8	12.7	[c]	2.5	2.1	21.2	28.6	25.1
AI/AN	—	—	—	—	—	—	[c]	[c]	[c]	14.7	36.5	27.0
Other	22.2	20.8	21.9	53.1	50.0	51.9	[c]	[c]	[c]	[c]	[c]	27.4
Educational attainment (≥25 years)												
<HS	38.6	30.1	34.5	33.2	47.2	39.9	6.0	2.6	4.3	49.7	47.5	48.7
HS	39.6	28.9	34.2	41.1	48.4	44.6	6.4	4.5	5.5	34.6	38.8	36.7
Some college	31.1	25.8	27.9	48.5	48.7	48.7	5.6	5.8	5.7	23.5	27.4	25.6
College graduate	40.2	27.0	33.0	33.2	31.4	32.2	4.0	7.3	5.7	12.6	16.1	14.4
Health insurance												
Uninsured	37.4	28.2	32.9	35.7	43.2	39.3	7.1	3.9	5.4	38.0	40.0	39.2
Private	36.4	26.9	31.6	37.9	38.8	38.4	4.8	6.1	5.5	19.6	22.1	20.9
Medicaid/public	30.5	23.9	26.3	36.0	42.8	40.3	5.0	4.2	4.5	36.3	39.9	38.7
Medicare	29.3	26.1	27.5	47.2	52.5	50.0	4.4	4.8	4.6	35.8	44.0	40.4
Medicare + Medicaid	23.2	[c]	[c]	56.7	53.6	54.8	[c]	[c]	[c]	54.5	59.0	57.5
Other	39.8	36.8	37.4	40.8	35.9	38.9	4.8	4.2	4.5	27.4	33.4	30.3
Usual source of care												
Yes	35.6	27.0	30.8	40.2	40.6	40.4	4.3	5.4	4.9	23.1	27.0	25.2
No	44.5	29.8	38.6	27.7	42.0	33.0	9.4	5.6	7.7	31.1	34.0	32.2
Visited a physician in the past year												
Yes	36.8	26.7	31.2	38.8	41.6	40.4	4.4	5.8	5.1	22.2	26.1	24.3
No	39.5	26.8	34.4	30.2	37.3	33.3	6.6	4.7	5.7	27.8	32.7	30.3
Income												
Poor <100% FPL	32.5	28.2	30.2	38.5	47.4	43.4	4.9	3.9	4.3	38.6	42.7	41.0
Near poor 100%–199% FPL	37.4	23.5	30.1	38.5	44.4	41.5	5.3	3.3	4.2	39.5	38.5	39.1
Non-poor ≥200% FPL	36.0	27.2	31.6	38.9	38.3	38.6	5.0	6.5	5.8	19.3	21.8	20.6
Immigration status												
Born in the USA[b]	34.9	26.2	30.4	40.1	43.1	41.7	5.8	6.4	6.1	22.8	26.4	24.7
In USA, fewer than 10 years	43.9	25.9	34.9	24.1	31.8	28.3	[c]	[c]	[c]	40.3	39.0	39.7
In USA, 10+ years	41.6	32.4	37.0	30.6	32.9	31.9	2.7	2.5	2.6	28.9	34.0	31.7
Region												
Northeast	—	—	—	—	—	—	3.5	5.3	4.5	24.9	28.3	26.8
Midwest	—	—	—	—	—	—	6.6	6.5	6.6	21.9	24.8	23.4
South	—	—	—	—	—	—	5.3	5.0	5.1	28.7	32.5	30.7
West	—	—	—	—	—	—	4.4	5.7	5.1	19.9	22.6	21.3

NOTE: Estimates are age-adjusted to 2000 standard US population. Estimates for white, black, AI/AN, Asian, and other are among non-Hispanics. Estimate for Asian does not include Native Hawaiians or other Pacific Islanders.

Abbreviations: AI/AN, American Indian/Alaska Native; BMI, body mass index; FPL, federal poverty level; HS, high school; wgt, weight.

[a]12+ drinks in lifetime, and (male) >14 drinks per week in past year OR (female) >7 drinks per week in the past year.

[b]Includes 50 states and the District of Columbia.

[c]Estimate not provided due to instability.

Source: National Health and Nutrition Examination Survey, 2015–16. National Health Interview Survey, 2017.

(14.8%) had lower obesity prevalence. Overall, 69.8% of whites, 75.1% of blacks, and 81.7% of Hispanics had EBW.

Alcohol

Alcohol consumption increases the risk of mouth, pharynx, larynx, esophageal, liver, colorectum, and female breast cancers (50). Consuming approximately ≥3 drinks per day may also increase the risk of stomach and pancreatic cancer (50, 51). When combined with tobacco use, alcohol consumption increases the risk of mouth, pharyngeal, laryngeal, and esophageal cancers far more than the independent effect of either drinking or smoking alone (52). In 2014, about 4% of all cancer deaths in the United States could be attributed to alcohol consumption (3). In 2017, an estimated 5.3% of adults were classified as heavier drinkers [12+ drinks in lifetime and (male) >14 drinks per week in the past year, (female) >7 drinks per week in the past year], with similar prevalence by gender (Table 2). Heavier alcohol consumption increased with higher levels of education among women

(<HS: 2.6%, college graduate: 7.3%); among men there was little variation by education (Fig. 1C). Among both men and women, the proportion of heavier drinking was higher among whites (men: 5.9%, women: 7.0%) than other race/ethnicities (Fig. 2C).

Diet

Unhealthy dietary patterns are associated with a higher risk of developing cancer (primarily colon; ref. 53), whereas adhering to a diet that contains a variety of fruits and vegetables, whole grains, and fish or poultry is associated with reduced cancer risk (54, 55). About 5% of cancer deaths in 2014 were attributed to poor diet (3). Overall, most Americans do not meet the guidelines for healthy eating (56). From 1999 to 2012, Mexican Americans and blacks as well as those with less than a college education consistently reported a less healthful diet than whites and college graduates, respectively (56).

Processed meats and red meat. The IARC has classified processed meat as a human carcinogen and unprocessed red meat as a probable carcinogen based on the evidence of their association with increased colorectal cancer risk (57). In the United States, intake of both unprocessed red meat and processed meat was stable from 1999–2000 to 2011–2012 (56). Since the mid-2000s, consumption of red meat has been similar among whites, blacks, and Hispanics (58).

Vegetables and fruits. There is probable evidence that greater consumption of non-starchy vegetables and fruits is associated with lower risk of mouth, pharyngeal, laryngeal, esophageal, and stomach cancers (50, 59). Some evidence also suggests that higher vegetable intake may lower the risk of aggressive, hard-to-treat breast tumors (60, 61).

In 2017, only about 16% of adults reported consuming $\geq$3 servings of vegetables per day (Supplementary Table S2). Variations by education were wider among women (<HS: 12.5%, college graduate: 23.4%) than men (<HS: 10.9%, college graduate: 15.4%; Fig. 1D). About one third of adults reported eating $\geq$2 servings of fruit daily, ranging from 25% to 26% among men with $\leq$HS degree to 43.4% of college-educated women (Fig. 1E). Vegetable consumption was substantially lower among Hispanics and blacks relative to whites, Asians, and AIANs for both sexes; fruit consumption was less variable (Fig. 2D and E).

Whole grains. The association between whole-grain foods and cancer has limited evidence, though higher intake of whole-grain foods and dietary fiber may reduce the risk of colorectal cancer (62). From 1999 to 2012, the average daily consumption of whole grains increased from 0.56 to 1 serving per day, yet the majority of adults do not meet recommended levels of consumption (56).

Physical Activity

An estimated 2% of cancer deaths can be attributed to physical inactivity (3). Physical activity can decrease the risk of colon (but not rectal) cancer and also probably reduce the risk of endometrial and postmenopausal breast cancer (50). Mounting evidence suggests that it may reduce the risk of other cancers, such as esophageal, liver, and premenopausal breast cancers, among others (50).

In 2017, over a quarter (26.2%) of adults reported no leisure-time physical activity (Table 2). The disparity by education was vast, ranging from nearly half (48.7%) of people with <HS education compared with 14.4% of college graduates and was similar between sexes (Fig. 1F). The racial/ethnic disparity was narrower and varied by sex. Among men, Hispanics (34.3%) and blacks (31.3%) were more likely to report no leisure-time physical activity than whites (21.0%), Asians (21.2%), and AI/ANs (14.7%; Fig. 2F). Among women, Hispanics (37.2%), blacks (38.3%), and AI/ANs (36.5%) were more likely to be inactive than Asians (28.6%) and whites (22.9%). However, individuals with lower levels of educational attainment, blacks, and Hispanics are more likely to engage in work-related physical activity (63). The proportions of adults meeting leisure-time physical activity recommendations (Supplementary Table S1) are presented in Supplementary Table S3.

Ultraviolet Radiation

Ultraviolet radiation (UVR) causes basal cell and squamous cell carcinomas, as well as melanomas, which account for only about 1% of all skin cancer cases but the majority of skin cancer deaths (64). Approximately 7,000 invasive melanoma deaths are expected to occur in 2019 (2). UV-emitting indoor tanning devices are considered carcinogenic to humans based on their association with increased risk of cutaneous and ocular melanoma (65). The risk of melanoma is about 60% higher for people who began using indoor tanning devices before age 35 and increases with the number of total hours, sessions, or years of use (66, 67). An estimated 1.5% of cancer deaths can be attributed to UVR from sun exposure and indoor tanning (3).

UVR exposure and sun protection

Among adults, indoor tanning in the past year declined from 5.5% in 2010 to 3.6% in 2015 (8, 68). In 2015, indoor tanning device use in the past year ranged from 1.6% in those with <HS education to 3.8% and 4.0% to those with HS and some college education, respectively (Supplementary Table S4; Figs. 1G and 2G).

In 2015 (most recent available data), 35.4% of adults (men: 35.5%; women: 35.4%) reported having a sunburn in the past year either through outdoor exposure or indoor tanning device use (Supplementary Table S4). Those with <HS education were less likely to report having had a sunburn (19.7%) than those with higher levels of education (31%–39%; Fig. 1H). Sunburns in both men and women were more commonly reported among whites (46.5%) than other race/ethnicities (Fig. 2H). In 2015, about two thirds of men and three fourths of women reported that they typically take $\geq$1 action to protect themselves from the sun (69).

Infectious Agents

There are several infectious agents including HPV, *Helicobacter pylori* (*H. pylori*), HBV, and hepatitis C virus (HCV) that are known to cause cancer (70). In the United States in 2014, about 3% of all cancer deaths were attributed to infectious agents (3).

Human papillomavirus

Persistent infection with HPV accounts for virtually all cervical cancers, 90% of anal cancers, about 70% of oropharyngeal cancers, and 60% to 70% of vaginal, vulvar, and penile cancers (71). Incidence rates for several HPV-related cancers, including oropharyngeal, anal, and vulvar cancers, have increased in recent years; however, cervical cancer incidence rates have declined because of widespread screening that can prevent this cancer (72). There are more than 100 types of HPV; about 13 ("high-risk" types) are known to cause cancer. The current HPV vaccine protects against 9 types and has the potential to avert about 90% of HPV-related cancers (71).

In 2011–2014, an estimated 4% of adults had high-risk oral HPV and 23% had high-risk genital HPV infection. High-risk HPV (hrHPV) infection was higher among men (oral: 7%, genital: 25%) than women (oral: 1%, genital: 20%; ref. 73). hrHPV prevalence by educational attainment has not yet been reported. By race/ethnicity, high-risk oral HPV was lower among Asians (1%) than among Hispanics, whites, and blacks (3% to 4%). High-risk genital prevalence was more variable, ranging from 12% in Asians to 34% in blacks (73).

HPV vaccination is increasing among youth (11), though in 2017 only 53.1% and 44.3% of girls and boys age 13 to 17 years, respectively, were up-to-date (UTD) with HPV vaccination, well below nationwide goals of 80% (https://www.healthypeople.gov/2020/topics-objectives/topic/immunization-and-infectious-diseases/objectives; Supplementary Table S5). Vaccination before age 13 is recommended as it is more effective at younger ages. Based on 2017 data, only 41.7% of females and 30.6% of males were UTD with HPV vaccination by their 13th birthday. Educational attainment for youth was not examined, but both girls and boys residing in households below the poverty level had higher HPV vaccination rates than those at or above poverty (11).

Among girls 13 to 17 years, UTD HPV vaccination was lowest in whites (49.7%) and highest in Asians (60.2%; https://www.cdc.gov/vaccines/imz-managers/coverage/teenvaxview/index.html). Among boys, vaccination was also lowest in whites (40.2%) but highest in Hispanics (54.6%). In 2016, among adult women and men ages 19 to 26 years, 48.5% and 13.5%, respectively, reported ever having received $\geq$1 dose of HPV vaccine (74). In contrast to adolescents, among adult women, HPV vaccination was highest among whites (52.2%) and lowest in blacks (41.5%; Supplementary Table S5).

Helicobacter pylori

Chronic infection with *H. pylori*, a bacterium that grows in and causes damage to the stomach lining, may lead to stomach cancer and gastric lymphoma (75, 76). In the United States, about 21% of stomach cancer deaths are attributable to *H. pylori* infection (3). Most people will remain unaware of their infection because they do not experience symptoms and will not develop stomach cancer (77). In the United States, *H. pylori* infection ranges from 21.2% in whites to 52.0% in blacks and 64.0% in Mexican Americans (78), with higher prevalence among those who recently immigrated to the United States (79).

HBV

Chronic infection with HBV can cause liver cancer and is increasingly recognized as a risk factor for non-Hodgkin lymphoma (80, 81). In the United States, about 7% of liver cancer deaths are attributable to HBV (3). The overall prevalence of chronic HBV in the United States has remained unchanged since 1999 (0.3%). Approximately 850,000 to 2.2 million people are living with chronic HBV infection in the United States (82, 83). Based on 2007–2012 data, <0.1% whites and Mexican Americans, 0.6% of blacks, and 3.1% of Asians had chronic HBV infection (82). In general, HBV prevalence is higher among immigrants, particularly those born in South East Asia and Sub-Saharan Africa (83–85).

Vaccination against HBV is the primary prevention strategy. In 2017, 91.9% of adolescents had received $\geq$3 HBV vaccine doses (Supplementary Table S5) ranging from 82.1% in AI/ANs to about 92% in blacks, whites, and Hispanics (11). HBV vaccination was greater among adoloscents at or above the poverty level than below poverty. Only 24.6% adults age $\geq$19 years received 3 doses of the HBV vaccine and among adults 19 to 49 years, vaccination was lower among Hispanics (22.5%) and blacks (29.4%) than whites (34.9%) and Asians (38.3%; ref. 86).

HCV

Chronic HCV infection can cause liver cancer and has been shown to increase the risk of non-Hodgkin lymphoma (80, 87). Nearly a quarter of liver cancers in the United States are attributable to HCV (3). Liver cancer incidence and mortality rates have increased rapidly in the United States for several decades, as has HCV-related mortality; these increases are thought to be, in part, due to the HCV epidemic that began in the late 1960s primarily through injection drug use (88, 89). The U.S. Preventive Services Task Force (USPSTF) recommends one-time screening for those born between 1945 and 1965 because this birth cohort represents the vast majority of the HCV infections in the United States, and HCV-associated death rates are highest in this group (90).

In the United States, approximately 3.5 million persons are living with chronic HCV infection (91). HCV infection is more common among men, blacks, and those with lower SES (92). HCV infection prevalence is particularly high in certain groups, including the homeless (22%–53%), the incarcerated (23%–41%), and veterans (5%–11%; ref. 93). In 2015, approximately 14% of adults (men: 15%, women: 12%) born between 1945 and 1965 had ever been tested for HCV (94); testing was least common among people who were uninsured, Hispanic, and those with <HS education.

Human immunodeficiency virus (HIV)

The weakened immune system of people with HIV/AIDS increases their risk of several cancers, including Kaposi sarcoma, non-Hodgkin and Hodgkin lymphomas, as well as anal and cervical cancers (80). Approximately 86%, 12%, 8%, 6%, and <1% of Kaposi sarcoma, anal cancer, non-Hodgkin and Hodgkin lymphomas, and cervical cancer deaths in the United States are attributed to HIV infection (3).

Since the mid-1990s, the prevalence of HIV infection has increased due to improvements in survival among those with HIV, which has also resulted in increased cumulative incidence and burden of cancer, including non–AIDS-related cancers, among persons living with HIV (95). In 2015, nearly 1 million adults and adolescents were estimated to be living with HIV, many of whom were unaware of their infection; the majority of people living with HIV are men and men who have sex with men (96). The prevalence of persons diagnosed with HIV is seven times higher in blacks and 2.5 times higher in Hispanics compared with whites (96).

Cancer Screening

Early detection of cancer through screening reduces mortality from cancers of the breast, uterine cervix, colon, rectum, and lung. In addition to detecting cancer early, screening for colorectal and cervical cancers can prevent these cancers by identifying precancerous lesions that can be removed (97).

Breast cancer screening

In 2019, about 42,000 breast cancer deaths were estimated to occur among U.S. women (2). In the United States, female breast cancer death rates overall have been declining since 1989, largely due to earlier detection and improvements in treatment (2).

In 1987, less than one third (29%) of women ≥40 years reported having a mammogram within the past 2 years compared with 70% in 2000 and 64% in 2015 (8, 98). In 2015, the American Cancer Society updated its recommendations stating that women ≥45 years be screened annually or biennially depending on age, including informed decision-making with their healthcare provider; women 40 to 44 years should have the opportunity to begin annual mammography (ref. 99; Supplementary Table S6). In 2015, about half (53.0%) of women ≥45 years reported having a mammogram within the past year, and two thirds (67.8%) reported having a mammogram within the past 2 years (Supplementary Table S7). The USPSTF recommends biennial mammography in women age 50 to 74 years, and in this age group, 71.5% reported receiving a mammogram in the past 2 years (100).

More than half of women ≥45 years with <HS degree (55.0%) reported having a mammogram in the past 2 years compared with 77.5% of college graduates (Fig. 1I). Less than 65% of Hispanic, AI/AN, and Asian women had a mammogram in the past 2 years compared with 68.4% of whites and 71.0% of blacks (Fig. 2I). However, overestimates of self-reported mammography are more prominent among racial/ethnic minorities, masking some disparities (101).

Cervical cancer screening

In 2019, 4,000 cervical cancer deaths were estimated to occur (2). Cervical cancer incidence and mortality rates have decreased by >50% over the past three decades, with most of the reduction attributed to Pap testing (refs. 2, 102).

Between 2000 and 2015, cervical cancer screening rates in women 21 to 65 years modestly declined (103). In 2015, 81.4% of women 21 to 65 years reported having a Pap test within the past 3 years and 83.2% reported being UTD with cervical cancer screening, which incorporates HPV cotesting (ref. 104; Supplementary Tables S6 and S7). Though cervical cancer screening rates are relatively high compared with other types of screening, an estimated 14 million women are not UTD (103). Furthermore, there is a disproportionate number of women with lower educational attainment in need of screening; only about 7 in 10 women with <HS education (71.7%) were UTD with cervical cancer screening compared with about 9 in 10 college graduates (90.5%; Fig. 1I). Less than 80% of Hispanic (79.4%), AI/AN (79.0%), and Asian women (75.3%) were UTD with cervical cancer screening compared with ≥85% of black (85.6%) and white (85.0%) women (Fig. 2I).

Colorectal cancer screening

In 2019, approximately 51,000 colon and rectal cancer deaths are estimated to occur in the United States (2). Among those ≥50 years, declines in colorectal cancer incidence since the mid-1980s and mortality since the early 1970s are attributed to increased colorectal cancer screening utilization, changing patterns in risk factors, and improved treatment (mortality; ref. 105). However, colorectal cancer incidence has been increasing among people born since 1950, prompting the American Cancer Society to recommend that screening begin at age 45 (refs. 106, 107; Supplementary Table S6).

Among those ≥50 years, UTD colorectal cancer screening has increased rapidly from <40% in 2000 (108) to nearly 60% in 2010 (97) and further increased to 62.6% in 2015 (Supplementary Table S7), primarily the result of increased utilization of colonoscopy. The 2015 screening prevalence based on the USPSTF colorectal cancer screening recommendations (ages 50–75) was similar (62.4%; ref. 100). Among those ≥45 years, colorectal cancer screening prevalence was 53.6% (8).

Endoscopic screening, primarily colonoscopy, continues to be more common (60%) than stool-based tests (7%; ref. 97). Less than half of adults with <HS education were UTD with colorectal cancer screening (47.4%) compared with 71.3% of college graduates (Fig. 1I). Only half of Hispanics (49.9%) and Asians (49.4%) were UTD with colorectal cancer screening compared with 54.3% of AI/ANs, 61.8% of blacks and 65.4% of whites (Fig. 2I).

Lung cancer screening

Among men and women in the United States, 143,000 lung cancer deaths were estimated to occur in 2019 (2). Lung cancer death rates have declined by 48% since 1990 in men and by 23% since 2002 in women due to reductions in smoking (2). In 2013, recommendations were issued for annual low-dose spiral computed tomography (LDCT) for healthy individuals 55 to 74 years (American Cancer Society; Supplementary Table S6; ref. 97; USPSTF recommendation: 55–80 years; ref. 109) who are current smokers with at least a 30 pack-year history of smoking or former smokers who quit within the past 15 years. Approximately 6.8 to 8.0 million former and current smokers were eligible for lung cancer screening in 2015, though only 3.2% of current high-risk smokers and 4.6% of former smokers had undergone LDCT for lung cancer screening within the past year (110, 111). Use of LDCT was similarly low across education levels and race/ethnicity (110). Recommendations also state that patients should be involved in shared decision-making (SDM) about the benefits, harms, and limitations of lung cancer screening, yet emerging evidence suggests that such discussions may be lacking (112).

Prostate cancer screening

In 2019, about 175,000 diagnosed cases of prostate cancer and 32,000 deaths among U.S. men are estimated to occur (2). Death rates for prostate cancer have been declining since the mid-1990s, in part, due to improvements in treatment, management of recurrent disease, and early detection with the prostate-specific antigen (PSA) test (113). The role of PSA testing in reducing mortality is debated because results of two large clinical trials designed to determine its efficacy were not in agreement. Furthermore, the harms of PSA testing (e.g., over-treatment and side effects) have shifted in recent years as more men with non-aggressive disease are receiving noninvasive treatment options (114). Since 2010, the American Cancer Society has recommended the use of SDM (discussing the advantages, disadvantages, and uncertainity) for PSA testing of men at average risk beginning at age 50, indicating that PSA testing should only occur if SDM has been conducted (Supplementary Table S6; ref. 97). In 2012, the USPSTF did not recommend routine PSA testing for asymptomatic men. However, the USPSTF's 2018 recommendation states that men between the ages of 55 and 69 years should make an individual choice on whether to have PSA testing after discussing its benefits and harms with a clinician (115). PSA testing and prostate cancer incidence rates declined following the 2012 USPSTF recommendation against routine PSA testing (116). In 2015, about a third (34.4%) of men $\geq$50 years reported having a PSA test within the past year (Supplementary Table S7). PSA testing varied widely by educational attainment (<HS: 20.1%; college: 44.0%) and race/ethnicity (Asians: 17.4%; whites: 37.1%).

The process of SDM for PSA testing is infrequently implemented (117). In 2015, only 17.4% of men with recent PSA testing reported full SDM; men with <HS, HS, and some college were 55%, 38%, and 42% less likely to receive SDM compared with college graduates. Black men receiving PSA testing were 45% more likely to report SDM than white men (118).

Discussion

This review provides a contemporary and comprehensive overview of modifiable cancer risk factors and screening in the United States where 14.1% of adults smoked, 71.2% had EBW, 5.3% were heavy alcohol drinkers, 26.2% reported no leisure-time physical activity, and 35.4% of adults reported at least one sunburn in the past year. High-risk oral (4%) and genital (23%) HPV infection was relatively common, and HPV vaccination was suboptimal. Furthermore, many adults for whom HCV testing is recommended had not received it. Cancer screening tests are underutilized, especially for colorectal cancer where less than two thirds of adults were UTD.

With a few exceptions, men and women with lower educational attainment reported both a higher prevalence of modifiable cancer risk factors and lower utilization of potentially life-saving cancer screenings. For example, smoking rates among males without a HS degree were four to six times higher than college graduates. Lack of leisure-time physical activity was three times greater among people with <HS education than college graduates. About three quarters of women without a college degree were overweight or obese compared with 60% of female college graduates. Furthermore, screening prevalence was notably lower among those with <HS education compared with college graduates; colorectal cancer screening had the largest disparity, where <50% of those <HS degree were UTD compared with >70% of college graduates.

Patterns of cancer risk factors and screening by race/ethnicity are complex and reflect cultural factors that influence behaviors as well as the heterogeneity of these broad categories (119). Compared with whites, blacks had higher obesity, physical inactivity, and HPV prevalence; adult smoking rates and reported breast, cervical, and colorectal cancer screening rates were similar, whereas HPV vaccination among youth was higher. Overall, relative to whites, Hispanics had lower smoking rates, but higher rates of EBW and some cancer-causing infectious agents (*H. pylori*), as well as substantially lower cancer screening use, yet Hispanic youth had one of the highest HPV vaccination uptake of any race/ethnicity. The prevalence of smoking and alcohol consumption was markedly lower among Asians compared with whites and consumption of fruits and vegetables was higher; however, rates of Hepatitis B were higher, and screening prevalence for breast, cervical, and colorectal cancers was considerably lower among Asians than among whites. Obesity prevalence was also lower among Asians compared with whites, but there are some limitations of using BMI as a health risk indicator. For example, Asians are more likely to develop type 2 diabetes (another cancer risk factor) at a normal body weight than the general U.S. population (https://www.cdc.gov/diabetes/library/spotlights/diabetes-asian-americans.html). Smoking prevalence among AI/ANs remains high, and cancer screening uptake was far lower than whites.

Reducing these modifiable cancer risk factors and improving cancer screening will require broad implementation of national, state, and local policies, social/community efforts, as well as individual behavioral interventions (120). Many of these strategies have been proven to be effective, but their application has been suboptimal, especially in socioeconomically deprived populations (120). For example, tobacco taxation has a considerable impact on smoking uptake, especially among those with lower SES (121, 122), but taxation in the United States is well below the World Health Organization's recommendations (123), the national tobacco tax has remained at $1.01 since 2009 (124), and state taxation varies widely, from 17 cents per pack in Missouri to $4.50 in the District of Columbia (125). Furthermore, improving the availability of affordable healthy food and beverages, especially in neighborhoods with lower SES, is one of several unmet recommendations (47). Additionally, barriers to accessing healthcare hinders a variety of preventive services, including receipt of provider recommendations for smoking cessation in current smokers, weight loss in obese adults, as well as vaccination and screening (12, 42, 126–128). The most recent policy to address barriers to healthcare is the 2010 Affordable Care Act (ACA), which has led to gains in health insurance and the use of some preventive services by expanding dependent insurance coverage, subsidizing insurance through the federal marketplace for individuals with low and medium incomes (100%–400% of the federal poverty levels), expanding Medicaid eligibility to low-income adults in some states, and removing the cost of some preventive services for privately and Medicare insured adults (129–133). However, 14 states have not expanded Medicaid eligibility, and these states have a disproportionate number of lower socioeconomic and racial/ethnic minorities (Supplementary Table S8). In 2017, almost a quarter (23.3%) of the 24.47 million adults with <HS degree were uninsured compared with <5% of college graduates (Table 3). Similarly, nearly a quarter of the 39.42 million Hispanics represented in the 2017 NHIS were uninsured,

Table 3. Sociodemographic and healthcare characteristics according to educational attainment and race/ethnicity, NHIS 2017

	Educational attainment, adults ≥25 years				Race/ethnicity, adults ≥18 years					
	<High school	High school	Some college	College	Hispanic	White	Black	Asian	AI/AN	Other
Total (weighted *n*, in millions)	24.47	51.38	61.42	78.98	39.42	159.33	30.19	14.94	2.15	0.64
Total (%)	11.3	23.8	28.4	36.5	16.0	64.6	12.2	6.1	0.9	0.3
Male	47.2	49.8	45.9	48.6	49.7	48.7	45.3	46.6	45.7	35.3
Age category										
18–24	—	—	—	—	16.7	10.4	14.5	10.8	13.2	11.1
25–44	31.0	34.0	38.9	44.3	43.8	30.3	37.4	43.0	34.8	46.1
45–64	38.4	40.1	39.2	36.7	29.1	35.4	33.1	31.0	39.9	34.5
65–74	14.3	13.5	14.3	12.8	6.7	14.1	9.0	9.5	7.2	3.6
75+	16.3	12.4	7.7	6.1	3.8	9.9	5.9	5.7	5.0	4.8
Health insurance										
Uninsured	23.3	11.5	9.7	3.7	24.2	6.3	12.0	5.9	28.1	9.9
Private	28.6	54.5	63.5	81.3	46.9	69.6	53.0	71.1	42.2	62.6
Medicaid/public	21.5	13.7	9.0	3.1	17.3	7.3	18.6	10.3	16.1	15.2
Medicare	14.7	11.9	9.8	7.7	5.3	10.4	7.5	5.9	5.0	6.5
Medicare + Medicaid	6.0	1.8	1.1	0.7	2.2	1.0	2.4	3.0	2.4	0.2
Other	5.9	6.7	7.0	3.5	4.2	5.4	6.5	3.7	6.2	5.6
Usual source of care	80.6	85.1	88.2	90.4	77.4	88.5	84.5	86.2	87.6	84.9
Visited a physician in the past year	65.4	70.7	73.2	74.3	60.6	73.9	67.3	68.7	73.3	53.2
Income										
Poor <100% FPL	30.0	12.6	8.4	3.3	18.9	7.9	22.2	10.9	29.4	12.6
Near poor 100%–199% FPL	35.2	24.0	16.6	5.7	27.3	13.3	22.2	15.0	18.7	15.9
Non-poor ≥200% FPL	34.8	63.5	75.0	91.0	53.7	78.8	55.6	74.1	51.9	71.4
Immigration status										
Born in the USA[a]	59.7	82.7	88.0	81.0	46.5	94.8	86.4	25.4	94.6	64.0
In the USA, fewer than 10 years	5.5	3.0	1.5	4.6	8.7	0.8	4.1	21.0	1.9	12.2
In the USA, 10+ years	34.8	14.3	10.6	14.4	44.9	4.4	9.5	53.7	3.5	23.9
Race/ethnicity										
Hispanic	39.1	15.7	13.9	7.9	—	—	—	—	—	—
White	39.8	64.5	68.2	73.1	—	—	—	—	—	—
Black	14.3	14.2	12.9	8.7	—	—	—	—	—	—
Asian	5.3	4.2	3.5	9.7	—	—	—	—	—	—
AI/AN	1.2	1.0	1.2	0.4	—	—	—	—	—	—
Other	0.3	0.4	0.4	0.1	—	—	—	—	—	—
Educational attainment										
<High school	—	—	—	—	27.8	7.5	15.2	9.4	15.0	12.0
High school	—	—	—	—	25.9	23.6	28.7	15.9	28.3	32.5
Some college	—	—	—	—	29.3	31.1	31.9	20.1	41.1	39.7
College graduate	—	—	—	—	17.0	37.8	24.2	54.6	15.7	15.8
Region										
Northeast	15.3	19.7	16.0	20.6	14.7	19.2	17.5	21.7	7.3	6.8
Midwest	16.7	23.0	23.6	21.1	8.9	27.4	14.9	11.1	17.2	7.2
South	42.7	36.7	35.9	34.0	36.5	32.6	60.2	26.0	35.9	20.4
West	25.3	20.7	24.5	24.4	39.9	20.7	7.4	41.2	39.5	65.7

NOTE: Estimates for white, black, AI/AN, Asian, and other are among non-Hispanics. Estimate for Asian does not include Native Hawaiians or other Pacific Islanders.
Abbreviations: AI/AN, American Indian/Alaska Native; FPL, federal poverty level.
[a]Includes 50 states and the District of Columbia.
Source: National Health Interview Survey, 2017.

28% of AI/ANs, and 12% of blacks were uninsured. Furthermore, even the insured may face logistical and financial barriers to timely care, which may be addressed with other policies and navigation efforts (134). Additionally, targeted, tailored communication may be needed to address cultural and language barriers (135, 136).

Limitations of this review include the use of national and state-based surveys with variable response rates, though analyses were weighted to mitigate nonresponse biases (137). Additionally, most estimates were based on self-reports, which may be influenced by recall and social desirability bias, although some measures are reasonably accurate according to validation studies (101, 138, 139).

This review provides a comprehensive overview of major cancer risk factors and screening utilization. Focused cancer prevention and control efforts to reduce tobacco use and EBW and increase screening and vaccination uptake are necessary to further reduce the suffering and death from cancer. Such systematic efforts should be enhanced across all populations, particularly those most at risk, including those with lower SES and racial/ethnic minorities.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

Acknowledgments

This work was supported by the American Cancer Society's Intramural Research Department. The authors are employed by the American Cancer Society as part of the Intramural Research Department, which received a grant from Merck Inc. for research outside the submitted work; however, their salaries are solely funded through American Cancer Society funds.

The costs of publication of this article were defrayed in part by the payment of page charges. This article must therefore be hereby marked *advertisement* in accordance with 18 U.S.C. Section 1734 solely to indicate this fact.

Received October 26, 2018; revised January 11, 2019; accepted February 21, 2019; published first April 3, 2019.

References

1. Siegel RL, Jemal A, Wender RC, Gansler T, Ma J, Brawley OW. An assessment of progress in cancer control. CA Cancer J Clin 2018;68: 329–39.
2. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2019. CA Cancer J Clin 2019;69:7–34.
3. Islami F, Goding Sauer A, Miller KD, Siegel RL, Fedewa SA, Jacobs EJ, et al. Proportion and number of cancer cases and deaths attributable to potentially modifiable risk factors in the United States. CA Cancer J Clin 2018; 68:31–54.
4. Drope J, Liber AC, Cahn Z, Stoklosa M, Kennedy R, Douglas CE, et al. Who's still smoking? Disparities in adult cigarette smoking prevalence in the United States. CA Cancer J Clin 2018;68:106–15.
5. Fryar CD CM, Ogden CL. Prevalence of overweight, obesity, and severe obesity among adults aged 20 and over: United States, 1960–1962 through 2015–2016. National Center for Health Statistics Health E-Stats; 2018.
6. National Center for Health Statistics. 2015–2016 National Health and Nutrition Examination Survey Data; 2017.
7. Sauer AG, Siegel RL, Jemal A, Fedewa SA. Updated review of prevalence of major risk factors and use of screening tests for cancer in the United States. Cancer Epidemiol Biomarkers Prev 2017;26:1192–208.
8. National Center for Health Statistics. 2015 National Health Interview Survey data and documentation; 2016.
9. National Center for Health Statistics. 2017 National Health Interview Survey data and documentation; 2018.
10. Centers for Disease Control and Prevention (CDC). 2017 Behavioral Risk Factor Surveillance System Survey data and documentation; 2018.
11. Walker TY, Elam-Evans LD, Yankey D, Markowitz LE, Williams CL, Mbaeyi SA, et al. National, regional, state, and selected local area vaccination coverage among adolescents aged 13–17 years—United States, 2017. MMWR Morb Mortal Wkly Rep 2018;67:909–17.
12. Fedewa SA, Preiss AJ, Fisher-Borne M, Goding Sauer A, Jemal A, Saslow D. Reaching 80% human papillomavirus vaccination prevalence by 2026: how many adolescents need to be vaccinated and what are their characteristics? Cancer 2018;124:4720–30.
13. Singh GK, Jemal A. Socioeconomic and racial/ethnic disparities in cancer mortality, incidence, and survival in the United States, 1950–2014: over six decades of changing patterns and widening inequalities. J Environ Public Health 2017;2017:2819372.
14. Miller KD, Goding Sauer A, Ortiz AP, Fedewa SA, Pinheiro PS, Tortolero-Luna G, et al. Cancer Statistics for Hispanics/Latinos, 2018. CA Cancer J Clin 2018;68:425–45.
15. DeSantis CE, Siegel RL, Sauer AG, Miller KD, Fedewa SA, Alcaraz KI, et al. Cancer statistics for African Americans, 2016: Progress and opportunities in reducing racial disparities. CA Cancer J Clin 2016; 66:290–308.
16. Torre LA, Sauer AM, Chen MS Jr, Kagawa-Singer M, Jemal A, Siegel RL. Cancer statistics for Asian Americans, Native Hawaiians, and Pacific Islanders, 2016: converging incidence in males and females. CA Cancer J Clin 2016;66:182–202.
17. Klein R, Proctor SE, Boudreault MA, Turczyn KM. Health People 2010 Criteria for Data Suppression. Hyattsville, MD: Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics; 2002.
18. US Department of Health and Human Services. The Health Consequences of Smoking-50 Years of Progress. A Report from the Surgeon General. Atlanta, GA; USA: Department of Health and Human Services. Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion; 2014.
19. Secretan B, Straif K, Baan R, Grosse Y, El Ghissassi F, Bouvard V, et al. A review of human carcinogens—Part E: tobacco, areca nut, alcohol, coal smoke, and salted fish. Lancet Oncol 2009;10:1033–4.
20. National Center for Health Statistics. Health, United States, 2017: With special feature on mortality. Hyattsville, MD: National Center for Health Statistics; 2018.
21. Baker F, Ainsworth SR, Dye JT, Crammer C, Thun MJ, Hoffmann D, et al. Health risks associated with cigar smoking. JAMA 2000;284:735–40.
22. Shanks TG, Burns DM. Disease consequences of cigar smoking. National Cancer Institute, Smoking and Tobacco Control, Monograph 9: Cigars—Health Effects and Trends. Washington, DC: National Institutes of Health; 1998.
23. Shapiro JA, Jacobs EJ, Thun MJ. Cigar smoking in men and risk of death from tobacco-related cancers. J Natl Cancer Inst 2000;92:333–7.
24. Cobb C, Ward KD, Maziak W, Shihadeh AL, Eissenberg T. Waterpipe tobacco smoking: an emerging health crisis in the United States. Am J Health Behav 2010;34:275–85.
25. Akl EA, Gaddam S, Gunukula SK, Honeine R, Jaoude PA, Irani J. The effects of waterpipe tobacco smoking on health outcomes: a systematic review. Int J Epidemiol 2010;39:834–57.
26. Raad D, Gaddam S, Schunemann HJ, Irani J, Abou Jaoude P, Honeine R, et al. Effects of water-pipe smoking on lung function: a systematic review and meta-analysis. Chest 2011;139:764–74.
27. Heinz AJ, Giedgowd GE, Crane NA, Veilleux JC, Conrad M, Braun AR, et al. A comprehensive examination of hookah smoking in college students: use patterns and contexts, social norms and attitudes, harm perception, psychological correlates and co-occurring substance use. Addict Behav 2013;38:2751–60.
28. Primack BA, Shensa A, Kim KH, Carroll MV, Hoban MT, Leino EV, et al. Waterpipe smoking among U.S. university students. Nicotine Tob Res 2013;15:29–35.
29. Sutfin EL, McCoy TP, Reboussin BA, Wagoner KG, Spangler J, Wolfson M. Prevalence and correlates of waterpipe tobacco smoking by college students in North Carolina. Drug Alcohol Depend 2011; 115:131–6.
30. Chang JT, Levy DT, Meza R. Trends and factors related to smokeless tobacco use in the United States. Nicotine Tob Res 2016;18:1740–8.
31. Dinakar C, O'Connor GT. The health effects of electronic cigarettes. N Engl J Med 2016;375:1372–81.
32. National Academy of Sciences Engineering, and Medicine. Public Health Consequences of E-Cigarettes. Washington, DC: The National Academies Press; 2018.
33. Leventhal AM, Strong DR, Kirkpatrick MG, Unger JB, Sussman S, Riggs NR, et al. Association of electronic cigarette use with initiation of combustible tobacco product smoking in early adolescence. JAMA 2015;314:700–7.
34. Soneji S, Barrington-Trimis JL, Wills TA, Leventhal AM, Unger JB, Gibson LA, et al. Association between initial use of e-cigarettes and subsequent cigarette smoking among adolescents and young adults: a systematic review and meta-analysis. JAMA Pediatr 2017;171:788–97.
35. Miech R, Patrick ME, O'Malley PM, Johnston LD. E-cigarette use as a predictor of cigarette smoking: results from a 1-year follow-up of a national sample of 12th grade students. Tob Control 2017;26: e106–e11.
36. King BA, Patel R, Nguyen KH, Dube SR. Trends in awareness and use of electronic cigarettes among US adults, 2010–2013. Nicotine Tob Res 2015;17:219–27.
37. Zhuang YL, Cummins SE, Sun JY, Zhu SH. Long-term e-cigarette use and smoking cessation: a longitudinal study with US population. Tob Control 2016;25(Suppl 1):i90–i5.
38. Robertson L, Hoek J, Blank ML, Richards R, Ling P, Popova L. Dual use of electronic nicotine delivery systems (ENDS) and smoked tobacco: a qualitative analysis. Tob Control 2019;28:13–9.
39. Maglia M CP, Di Piazza J, La Torre D, Polosa R. Dual use of electronic cigarettes and classic cigarettes: a systematic review. Addict Res Theory 2017:330–8.

40. Doll R, Peto R, Boreham J, Sutherland I. Mortality in relation to smoking: 50 years' observation on male British doctors. BMJ 2004; 328:1519–27.
41. Goding Sauer A, Fedewa SA, Kim J, Jemal A, Westmaas JL. Educational attainment & quitting smoking: a structural equation model approach. Prev Med 2018;116:32–9.
42. Fiore MC, Jaen CR, Baker TB, Bailey WC, Bennett G, Benowitz NL, et al. Treating Tobacco Use and Dependence: 2008 Update. Clinical Practice Guideline. Rockville, MD: US Department of Health and Human Services; 2008 May 2008.
43. Babb S, Malarcher A, Schauer G, Asman K, Jamal A. Quitting Smoking Among Adults - United States, 2000–2015. MMWR Morb Mortal Wkly Rep 2017;65:1457–64.
44. Tsai J, Homa DM, Gentzke AS, Mahoney M, Sharapova SR, Sosnoff CS, et al. Exposure to secondhand smoke among nonsmokers—United States, 1988–2014. MMWR Morb Mortal Wkly Rep 2018;67:1342–6.
45. American Nonsmokers' Rights Foundation. Overview list – how many smokefree laws? 2019.
46. Huang J, King BA, Babb SD, Xu X, Hallett C, Hopkins M. Sociodemographic disparities in local smoke-free law coverage in 10 states. Am J Public Health 2015;105:1806–13.
47. Kushi LH, Doyle C, McCullough M, Gansler T, Courneya K, et al. American Cancer Society Guidelines on Nutrition and Physical Activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. CA Cancer J Clin 2012;62:30–67.
48. Kabat GC, Matthews CE, Kamensky V, Hollenbeck AR, Rohan TE. Adherence to cancer prevention guidelines and cancer incidence, cancer mortality, and total mortality: a prospective cohort study. Am J Clin Nutr 2015;101:558–69.
49. Lauby-Secretan B, Scoccianti C, Loomis D, Grosse Y, Bianchini F, Straif K. Body fatness and cancer–viewpoint of the IARC Working Group. N Engl J Med 2016;375:794–8.
50. World Cancer Research Fund and American Institute for Cancer Research. Continuous Update Project. 3rd ed. London, UK: World Cancer Research Fund and American Institute for Cancer Research; 2018.
51. Bagnardi V, Rota M, Botteri E, Tramacere I, Islami F, Fedirko V, et al. Alcohol consumption and site-specific cancer risk: a comprehensive dose-response meta-analysis. Br J Cancer 2015;112:580–93.
52. International Agency for Research on Cancer. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Alcohol Consumption and Ethyl Carbamate. Lyon, France: International Agency for Research on Cancer; 2010.
53. Grosso G, Bella F, Godos J, Sciacca S, Del Rio D, Ray S, et al. Possible role of diet in cancer: systematic review and multiple meta-analyses of dietary patterns, lifestyle factors, and cancer risk. Nutr Rev 2017;75:405–19.
54. Schwingshackl L, Bogensberger B, Hoffmann G. Diet quality as assessed by the healthy eating index, alternate healthy eating index, dietary approaches to stop hypertension score, and health outcomes: an updated systematic review and meta-analysis of cohort studies. J Acad Nutr Diet 2018;118:74–100.e11.
55. Schwingshackl L, Hoffmann G. Adherence to Mediterranean diet and risk of cancer: an updated systematic review and meta-analysis of observational studies. Cancer Med 2015;4:1933–47.
56. Rehm CD, Penalvo JL, Afshin A, Mozaffarian D. Dietary Intake Among US Adults, 1999–2012. JAMA 2016;315:2542–53.
57. Bouvard V, Loomis D, Guyton KZ, Grosse Y, Ghissassi FE, Benbrahim-Tallaa L, et al. Carcinogenicity of consumption of red and processed meat. Lancet Oncol 2015;16:1599–600.
58. National Cancer Institute. Cancer Trends Progress Report: Red Meat Consumption. Bethesda, MD: NCI; February 2018.
59. World Cancer Research Fund and American Institute for Cancer Research. Diet and Cancer Report. Washington, DC: Research Fund and American Institute for Cancer Research; 2007.
60. Farvid MS, Chen WY, Rosner BA, Tamimi RM, Willett WC, Eliassen AH. Fruit and vegetable consumption and breast cancer incidence: repeated measures over 30 years of follow-up. Int J Cancer 2019;144: 1496–510.
61. Emaus MJ, Peeters PH, Bakker MF, Overvad K, Tjonneland A, Olsen A, et al. Vegetable and fruit consumption and the risk of hormone receptor-defined breast cancer in the EPIC cohort. Am J Clin Nutr 2016;103: 168–77.
62. Song M, Wu K, Meyerhardt JA, Ogino S, Wang M, Fuchs CS, et al. Fiber intake and survival after colorectal cancer diagnosis. JAMA Oncol 2018;4: 71–9.
63. Saffer H DD, Grossman M. Racial, Ethnic and Gender Differences in Physical Activity. Cambridge, MA: National Bureau of Economic Research; 2011.
64. Karimkhani C, Boyers LN, Dellavalle RP, Weinstock MA. It's time for "keratinocyte carcinoma" to replace the term "nonmelanoma skin cancer". J Am Acad Dermatol 2015;72:186–7.
65. International Agency for Research on Cancer. The association of use of sunbeds with cutaneous malignant melanoma and other skin cancers: a systematic review. Int J Cancer 2007;120:1116–22.
66. Boniol M, Autier P, Boyle P, Gandini S. Cutaneous melanoma attributable to sunbed use: systematic review and meta-analysis. BMJ 2012;345: e4757.
67. Lazovich D, Vogel RI, Berwick M, Weinstock MA, Anderson KE, Warshaw EM. Indoor tanning and risk of melanoma: a case-control study in a highly exposed population. Cancer Epidemiol Biomarkers Prev 2010;19: 1557–68.
68. Guy GP Jr, Berkowitz Z, Holman DM, Hartman AM. Recent changes in the prevalence of and factors associated with frequency of indoor tanning among US adults. JAMA Dermatol 2015;151:1256–9.
69. US Department of Health and Human Services, Centers for Disease Control and Prevention. Skin Cancer Prevention Progress Report 2018. Atlanta, GA: US Department of Health and Human Services; 2018.
70. Plummer M, de Martel C, Vignat J, Ferlay J, Bray F, Franceschi S. Global burden of cancers attributable to infections in 2012: a synthetic analysis. Lancet Glob Health 2016;4:e609–16.
71. Saraiya M, Unger ER, Thompson TD, Lynch CF, Hernandez BY, Lyu CW, et al. US assessment of HPV types in cancers: implications for current and 9-valent HPV vaccines. J Natl Cancer Inst 2015;107:djv086.
72. Van Dyne EA, Henley SJ, Saraiya M, Thomas CC, Markowitz LE, Benard VB. Trends in human papillomavirus-associated cancers: United States, 1999–2015. MMWR Morb Mortal Wkly Rep 2018;67:918–24.
73. McQuillan G, Kruszon-Moran D, Markowitz LE, Unger ER, Paulose-Ram R. Prevalence of HPV in adults aged 18–69: United States, 2011–2014. NCHS Data Brief 2017:1–8.
74. Hung MC WW, Lu PJ, Kim DK, Grohskopf LA, Pilishvili T, Skoff TH, et al. Vaccination coverage among adults in the United States, National Health Interview Survey, 2016. 2018.
75. Wroblewski LE, Peek RM Jr, Wilson KT. Helicobacter pylori and gastric cancer: factors that modulate disease risk. Clin Microbiol Rev 2010;23: 713–39.
76. Plummer M, Franceschi S, Vignat J, Forman D, de Martel C. Global burden of gastric cancer attributable to pylori. Int J Cancer 2015;136:487–90.
77. Hooi JKY, Lai WY, Ng WK, Suen MMY, Underwood FE, Tanyingoh D, et al. Global prevalence of helicobacter pylori infection: systematic review and meta-analysis. Gastroenterology 2017;153:420–9.
78. Grad YH, Lipsitch M, Aiello AE. Secular trends in Helicobacter pylori seroprevalence in adults in the United States: evidence for sustained race/ethnic disparities. Am J Epidemiol 2012;175:54–9.
79. Siao D, Somsouk M. Helicobacter pylori: evidence-based review with a focus on immigrant populations. J Gen Intern Med 2014;29:520–8.
80. International Agency for Research on Cancer. IARC Monograph on Biological Agents: A Review of Human Carcinogens. France: IARC; 2012.
81. Engels EA, Cho ER, Jee SH. Hepatitis B virus infection and risk of non-Hodgkin lymphoma in South Korea: a cohort study. Lancet Oncol 2010; 11:827–34.
82. Roberts H, Kruszon-Moran D, Ly KN, Hughes E, Iqbal K, Jiles RB, et al. Prevalence of chronic hepatitis B virus (HBV) infection in U.S. households: National Health and Nutrition Examination Survey (NHANES), 1988–2012. Hepatology 2016;63:388–97.
83. Kowdley KV, Wang CC, Welch S, Roberts H, Brosgart CL. Prevalence of chronic hepatitis B among foreign-born persons living in the United States by country of origin. Hepatology 2012;56:422–33.
84. Vijayadeva V, Spradling PR, Moorman AC, Rupp LB, Lu M, Gordon SC, et al. Hepatitis B virus infection testing and prevalence among Asian and Pacific Islanders. Am J Manag Care 2014;20:e98–e104.
85. Wasley A, Kruszon-Moran D, Kuhnert W, Simard EP, Finelli L, McQuillan G, et al. The prevalence of hepatitis B virus infection in the United States in the era of vaccination. J Infect Dis 2010;202:192–201.

86. Williams WW, Lu PJ, O'Halloran A, Kim DK, Grohskopf LA, Pilishvili T, et al. Surveillance of vaccination coverage among adult populations: United States, 2015. MMWR Surveill Summ 2017;66:1–28.
87. de Sanjose S, Benavente Y, Vajdic CM, Engels EA, Morton LM, Bracci PM, et al. Hepatitis C and non-Hodgkin lymphoma among 4784 cases and 6269 controls from the International Lymphoma Epidemiology Consortium. Clin Gastroenterol Hepatol 2008;6:451–8.
88. Ryerson AB, Eheman CR, Altekruse SF, Ward JW, Jemal A, Sherman RL, et al. Annual report to the nation on the status of cancer, 1975–2012, featuring the increasing incidence of liver cancer. Cancer 2016;122: 1312–37.
89. Ly KN, Xing J, Klevens RM, Jiles RB, Ward JW, Holmberg SD. The increasing burden of mortality from viral hepatitis in the United States between 1999 and 2007. Ann Intern Med 2012;156:271–8.
90. Moyer VA, US Preventive Services Task Force. Screening for hepatitis C virus infection in adults: U.S. Preventive Services Task Force recommendation statement. Ann Intern Med 2013;159:349–57.
91. Edlin BR, Eckhardt BJ, Shu MA, Holmberg SD, Swan T. Toward a more accurate estimate of the prevalence of hepatitis C in the United States. Hepatology 2015;62:1353–63.
92. Denniston MM, Jiles RB, Drobeniuc J, Klevens RM, Ward JW, McQuillan GM, et al. Chronic hepatitis C virus infection in the United States, National Health and Nutrition Examination Survey 2003 to 2010. Ann Intern Med 2014;160:293–300.
93. Chak E, Talal AH, Sherman KE, Schiff ER, Saab S. Hepatitis C virus infection in USA: an estimate of true prevalence. Liver Int 2011;31: 1090–101.
94. Jemal A, Fedewa SA. Recent hepatitis C virus testing patterns among baby boomers. Am J Prev Med 2017;53:e31–e33.
95. Shiels MS, Pfeiffer RM, Gail MH, Hall HI, Li J, Chaturvedi AK, et al. Cancer burden in the HIV-infected population in the United States. J Natl Cancer Inst 2011;103:753–62.
96. Center for Disease Control and Prevention. HIV Surveillance Report, 2016. Atlanta, GA: CDC; 2017.
97. Smith RA, Andrews KS, Brooks D, Fedewa SA, Manassaram-Baptiste D, Saslow D, et al. Cancer screening in the United States, 2018: a review of current American Cancer Society guidelines and current issues in cancer screening. CA Cancer J Clin 2018;68:297–316.
98. Breen N, Gentleman JF, Schiller JS. Update on mammography trends: comparisons of rates in 2000, 2005, and 2008. Cancer 2011;117: 2209–18.
99. Oeffinger KC, Fontham ET, Etzioni R, Herzig A, Michaelson JS, Shih YC, et al. Breast cancer screening for women at average risk: 2015 guideline update from the American Cancer Society. JAMA 2015;314:1599–614.
100. White A, Thompson TD, White MC, Sabatino SA, de Moor J, Doria-Rose PV, et al. Cancer screening test use: United States, 2015. MMWR Morb Mortal Wkly Rep 2017;66:201–6.
101. Rauscher GH, Johnson TP, Cho YI, Walk JA. Accuracy of self-reported cancer-screening histories: a meta-analysis. Cancer Epidemiol Biomarkers Prev 2008;17:748–57.
102. Schiffman MH, Castle PE, Jeronimo J, Rodriguez AC, Wacholder S. Human papilloma virus and cervical cancer. Lancet 2007;370:890–907.
103. Watson M, Benard V, King J, Crawford A, Saraiya M. National assessment of HPV and Pap tests: changes in cervical cancer screening, National Health Interview Survey. Prev Med 2017;100:243–7.
104. Saslow D, Solomon D, Lawson HW, Killackey M, Kulasingam SL, Cain J, et al. American Cancer Society, American Society for Colposcopy and Cervical Pathology, and American Society for Clinical Pathology screening guidelines for the prevention and early detection of cervical cancer. CA Cancer J Clin 2012;62:147–72.
105. Edwards BK, Ward E, Kohler BA, Eheman C, Zuber AG, Anderson RN, et al. Annual report to the nation on the status of cancer, 1975–2006, featuring colorectal trends and impact of interventions (risk factors, screening, and treatment) to reduce future rates. Cancer 2009;116:544–73.
106. Siegel RL, Fedewa SA, Anderson WF, Miller KD, Ma J, Rosenberg PS, et al. Colorectal cancer incidence patterns in the United States, 1974–2013. J Natl Cancer Inst 2017;109.
107. Wolf AMD, Fontham ETH, Church TR, Flowers CR, Guerra CE, LaMonte SJ, et al. Colorectal cancer screening for average-risk adults: 2018 guideline update from the American Cancer Society. CA Cancer J Clin 2018;68: 250–81.
108. Klabunde CN, Cronin KA, Breen N, Waldron WR, Ambs AH, Nadel MR. Trends in colorectal cancer test use among vulnerable populations in the United States. Cancer Epidemiol Biomarkers Prev 2011;20: 1611–21.
109. Moyer VA, US Preventive Services Task Force. Screening for lung cancer: U.S. Preventive Services Task Force recommendation statement. Ann Intern Med 2014;160:330–8.
110. Jemal A, Fedewa SA. Lung cancer screening with low-dose computed tomography in the United States-2010 to 2015. JAMA Oncol 2017;3: 1278–81.
111. Cheung LC, Katki HA, Chaturvedi AK, Jemal A, Berg CD. Preventing lung cancer mortality by computed tomography screening: the effect of risk-based versus U.S. Preventive Services Task Force Eligibility Criteria, 2005–2015. Ann Intern Med 2018;168:229–32.
112. Brenner AT, Malo TL, Margolis M, Elston Lafata J, James S, Vu MB, et al. Evaluating shared decision making for lung cancer screening. JAMA Intern Med 2018;178:1311–6.
113. Etzioni R, Gulati R, Tsodikov A, Wever EM, Penson DF, Heijnsdijk EA, et al. The prostate cancer conundrum revisited: treatment changes and prostate cancer mortality declines. Cancer 2012;118:5955–63.
114. Cooperberg MR, Carroll PR. Trends in management for patients with localized prostate cancer, 1990–2013. JAMA 2015;314:80–2.
115. U. S. Preventive Services Task Force, Grossman DC, Curry SJ, Owens DK, Bibbins-Domingo K, Caughey AB, et al. Screening for prostate cancer: US Preventive Services Task Force Recommendation Statement. JAMA 2018; 319:1901–13.
116. Jemal A, Fedewa SA, Ma J, Siegel R, Lin CC, Brawley O, et al. Prostate cancer incidence and PSA testing patterns in relation to USPSTF screening recommendations. JAMA 2015;314:2054–61.
117. Hoffman RM, Couper MP, Zikmund-Fisher BJ, Levin CA, McNaughton-Collins M, Helitzer DL, et al. Prostate cancer screening decisions: results from the National Survey of Medical Decisions (DECISIONS study). Arch Intern Med 2009;169:1611–8.
118. Fedewa SA, Gansler T, Smith R, Sauer AG, Wender R, Brawley OW, et al. Recent patterns in shared decision making for prostate-specific antigen testing in the United States. Ann Fam Med 2018; 16:139–44.
119. Brawley OW. Some thoughts on health surveillance data, race, and population categorization. CA Cancer J Clin 2016;66:179–81.
120. Colditz GA, Emmons KM. Accelerating the pace of cancer prevention—right now. Cancer Prev Res 2018;11:171–84.
121. Institute of Medicine. Ending the Tobacco Problem: A Blueprint for the Nation. Washington, DC: Institute of Medicine; 2007.
122. Chaloupka FJ, Straif K, Leon ME, International Agency for Research on Cancer Working Group. Effectiveness of tax and price policies in tobacco control. Tob Control 2011;20:235–8.
123. Orzechowski W WR. The Tax Burden on Tobacco 1970–2017. Arlington, VA: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2017.
124. Truth Initiative, Campaign for Tobacco-Free Kids, American Heart Association/American Stroke Association, American Cancer Society Cancer Action Network, American Lung Association, Americans for Nonsmokers' Rights, et al. Broken Promises to Our Children: A State-by-State Look at the 1998 State Tobacco Settlement 19 Years Later. 2017.
125. Campaign For Tobacco-Free Kids. State Cigarette Excise Tax Rates and Rankings. Washington, DC: Campaign For Tobacco-Free Kids; 2018.
126. Schueler KM, Chu PW, Smith-Bindman RD. Factors associated with mammography utilization: a systematic quantitative review of the literature. J Womens Health 2008;17:1477–98.
127. Laiyemo AO, Adebogun AO, Doubeni CA, Ricks-Santi L, McDonald-Pinkett S, Young PE, et al. Influence of provider discussion and specific recommendation on colorectal cancer screening uptake among U.S. adults. Prev Med 2014;67:1–5.
128. US Preventive Services Task Force. Behavioral weight loss interventions to prevent obesity-related morbidity and mortality in adults. JAMA 2018; 320:1163–71.
129. Mazurenko O, Balio CP, Agarwal R, Carroll AE, Menachemi N. The effects of Medicaid expansion under The ACA: a systematic review. Health Aff 2018;37:944–50.

130. Koh HK, Sebelius KG. Promoting prevention through the Affordable Care Act. N Engl J Med 2010;363:1296–9.
131. Sommers BD, Buchmueller T, Decker SL, Carey C, Kronick R. The Affordable Care Act has led to significant gains in health insurance and access to care for young adults. Health Aff 2013;32:165–74.
132. Wherry LR, Miller S. Early coverage, access, utilization, and health effects associated with the Affordable Care Act Medicaid Expansions: a quasi-experimental study. Ann Intern Med 2016;164:795–803.
133. Han X, Yabroff KR, Robbins AS, Zheng Z, Jemal A. Dependent coverage and use of preventive care under the Affordable Care Act. N Engl J Med 2014;371:2341–2.
134. Allen EM, Call KT, Beebe TJ, McAlpine DD, Johnson PJ. Barriers to care and health care utilization among the publicly insured. Med Care 2017;55:207–14.
135. Betancourt JR, Green AR, Carrillo JE, Ananeh-Firempong O 2nd. Defining cultural competence: a practical framework for addressing racial/ethnic disparities in health and health care. Public Health Rep 2003;118:293–302.
136. Genoff MC, Zaballa A, Gany F, Gonzalez J, Ramirez J, Jewell ST, et al. Navigating language barriers: a systematic review of patient navigators' impact on cancer screening for limited English proficient patients. J Gen Intern Med 2016;31:426–34.
137. Czajka JL, Beyler A. Background Paper—Declining Response Rates in Federal Surveys: Trends and Implications. Washington, DC: Mathematica Policy Research; 2016.
138. de Leeuw ED. Data Quality In Mail, Telephone, and Face to Face Surveys. Amsterdam: TT-Publications; 1992.
139. Burgess DJ, Powell AA, Griffin JM, Partin MR. Race and the validity of self-reported cancer screening behaviors: development of a conceptual model. Prev Med 2009;48:99–107.

Cancer Epidemiology, Biomarkers & Prevention

Current Prevalence of Major Cancer Risk Factors and Screening Test Use in the United States: Disparities by Education and Race/Ethnicity

Ann Goding Sauer, Rebecca L. Siegel, Ahmedin Jemal, et al.

Cancer Epidemiol Biomarkers Prev 2019;28:629-642.