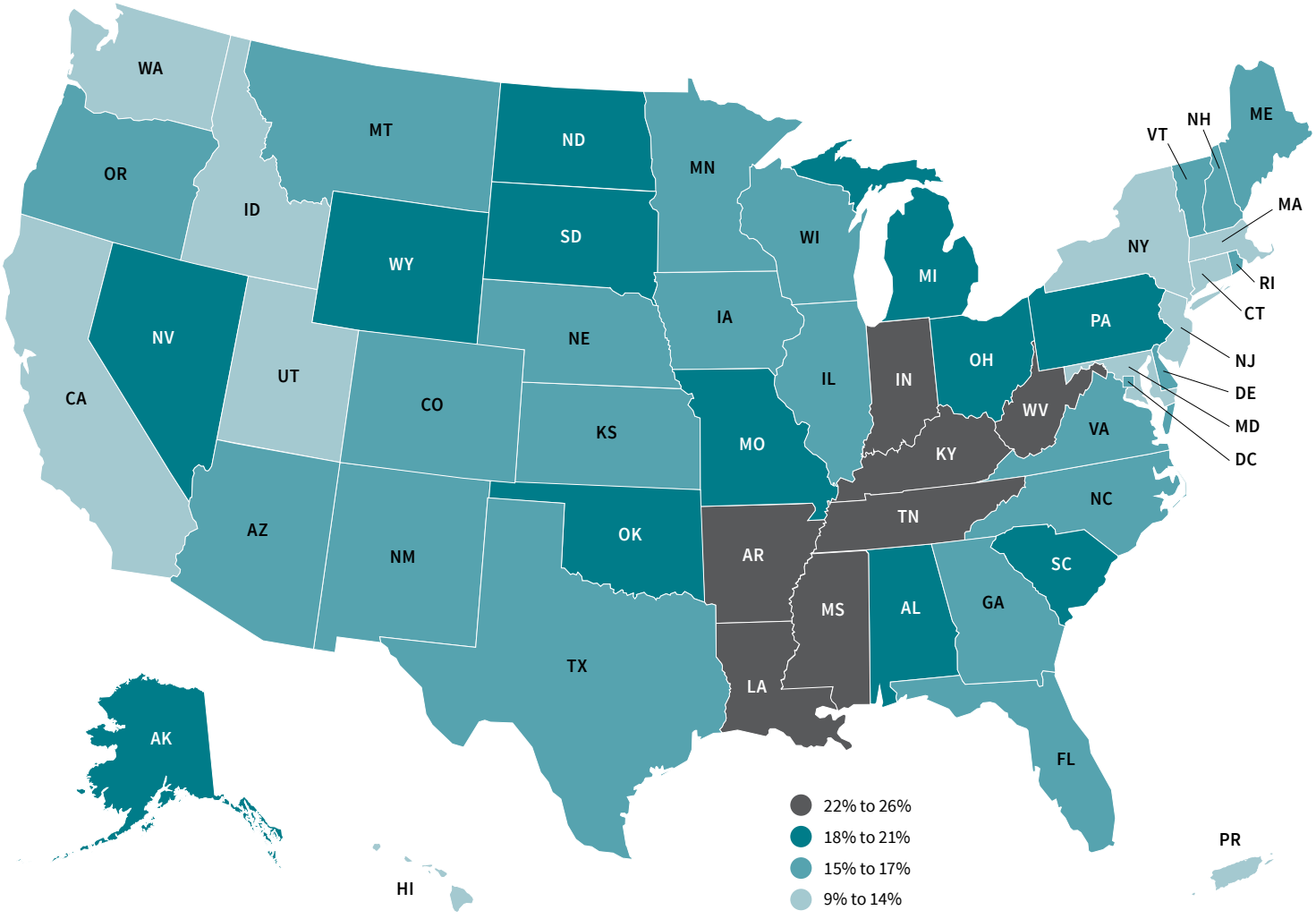
American Cancer Society®

Cancer Prevention & Early Detection
Facts & Figures 2019-2020

Current* Cigarette Smoking (%), Adults 18 Years and Older by State, 2017



*Smoked 100 cigarettes in lifetime and are current smokers (regular and irregular).
Source: Behavioral Risk Factor Surveillance System, 2017.

Contents

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

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Global Headquarters: American Cancer Society Inc.
250 Williams Street, NW, Atlanta, GA 30303-1002
404-320-3333

Introduction

Cancer prevention and early detection are central to the American Cancer Society's mission to save lives, celebrate lives, and lead the fight for a world without cancer. Over the past several years, cancer incidence has decreased among men while remaining stable among women; cancer mortality has declined in recent decades.[1] Additional cancer morbidity and mortality could be prevented by implementing evidence-based interventions to reduce cancer risk factors and increase cancer screening uptake.[2] An estimated 42% of cancer cases and 45% of cancer deaths in the US are attributed to potentially modifiable risk factors.[3] Furthermore, cancer screening tests can prevent thousands of additional cancer cases and deaths.

References

1. Siegel RL, Miller KD, Jemal A. Cancer Statistics, 2019. *CA Cancer J Clin*. 2019;69: 7-34.

2. Siegel RL, Jemal A, Wender RC, Gansler T, Ma J, Brawley OW. An assessment of progress in cancer control. *CA Cancer J Clin*. 2018.

3. Islami F, Goding Sauer A, Miller KD, 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.

Highlights, CPED 2019-2020

Tobacco

- In 1965, 42% of adults were current cigarette smokers, decreasing to 14% in 2017. Prevalence varied widely by state, ranging from 9% in Utah to 26% in West Virginia.
- Current cigarette smoking among high school students declined from 29% in 1999 to 8% in 2018 and ranged from 4% in Utah and Puerto Rico to 14% in Arkansas, Kentucky, and West Viriginia in 2017.
- Unchanged since 2009, the federal excise tax is $1.01 per pack. As of December 21, 2018, the average state cigarette excise tax was $1.79 per pack, ranging from 17 cents in Missouri to $4.50 in the District of Columbia and $5.10 in Puerto Rico.
- Among high school students, current e-cigarette use increased from about 2% in 2011 to 21% in 2018.

Excess Body Weight, Alcohol, Diet, and Physical Activity

- Among adults, the prevalence of overweight has remained relatively stable since the early 1960s, but obesity has markedly increased. In 2015-2016, approximately 7 in 10 adults were overweight or obese; about 4 in 10 were obese.
- From 1971 to 2002, the prevalence of obesity among youth ages 2-19 years tripled from 5% to 15%, increasing to 19% in 2015-2016. Among youth, the prevalence of obesity was higher in older (ages 12-19 years: 21%) than younger (ages 2-5 years: 14%) children in 2015-2016.
- In 2017, approximately 6% of adults reported drinking heavily (>14 drinks per week for males or >7 drinks per week for females).
- In 2017, an estimated 54% of adults and only 26% of high school students reported meeting recommended levels of physical activity.

Ultraviolet Radiation

- Despite declining use in recent years, 8% of female high school students in 2017 reported use of indoor tanning in the past year.
- As of January 1, 2019, only 17 states and the District of Columbia had a law prohibiting indoor tanning for minors without exemptions.
- In 2015, approximately 4% of adults reported using an indoor tanning device in the past year; use was highest among women, younger adults (ages 18-29 years), and those living in the Midwest.

Infectious Agents

- HPV vaccination among adolescents remains low. In 2017, 42% of girls and 31% of boys received two doses before their 13th birthday.
- In 2017, 53% of girls and 44% of boys ages 13-17 years were up-to-date.

Cancer Screening

- In 2015, 50% of women ages 40 years and older reported having a mammogram within the past year, and 64% reported having one within the past two years. Mammography use in the past two years was lowest among the uninsured (31%).
- Among women ages 21-65 years, 83% were up-to-date with cervical cancer screening in 2015; uptake was lowest among the uninsured (64%) and recent immigrants (70%).
- In 2015, 63% of adults ages 50 years and older were up-to-date for colorectal cancer screening. Prevalence was less than or equal to 50% among Hispanics, Asians, people with less than a high school diploma, recent immigrants, and the uninsured.
- In 2015, only 4% of eligible former and current smokers reported having a low-dose computed tomography screening for lung cancer in the past year.

Tobacco

The first US Surgeon General's Report on Smoking and Health in 1964 concluded that cigarette smoking caused lung cancer.[1] Since then, other tobacco products, including cigars, cigarillos, waterpipes, and smokeless tobacco, have been causally linked to cancer as well.[2] About 30% of all cancer deaths in the US[3,4] and as much as 40% in men in some Southern states, are still caused by smoking.[5] Despite decades of declining smoking prevalence, the burden of smoking-related cancers remains high because the risk of cancer exists even after exposure has ceased. Additionally, smoking prevalence remains high in many segments of the population (e.g., those with low socioeconomic status and/or mental illness).[6] Tobacco use remains the most preventable cause of death in the US.

Cigarette Smoking

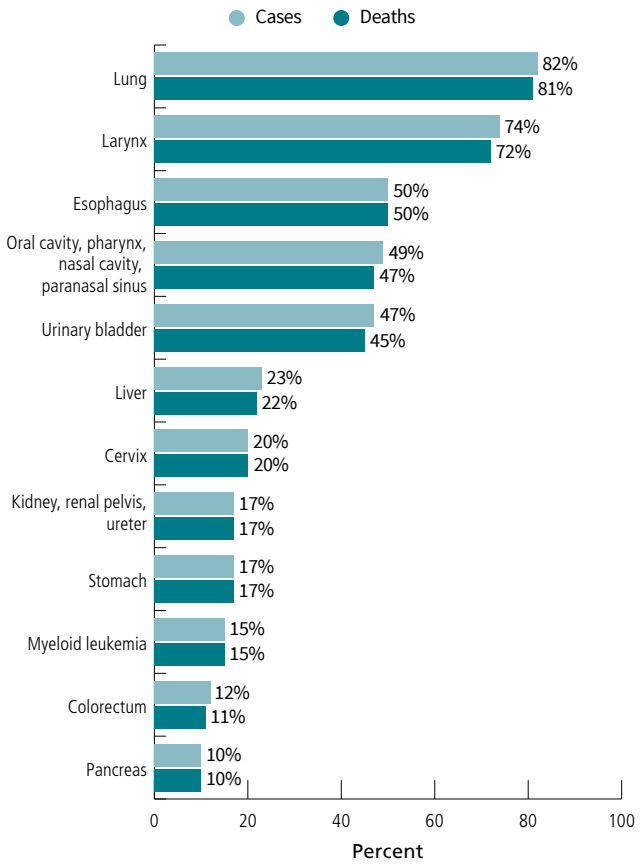
Cigarette smoking increases the risk of several cancers, including those of the oral cavity and pharynx, larynx, lung, esophagus, pancreas, uterine cervix, kidney, bladder, stomach, colorectum, liver; and acute myeloid leukemia.[2] Evidence suggests that smoking may also increase the risk of fatal prostate cancer and a rare type of ovarian cancer.[2,7] The proportion of cases and deaths attributable to smoking varies across cancer sites (Figure 1A).[4] Health consequences increase with both duration and intensity of smoking.

Tobacco use in youth is an important public health issue because almost 90% of adults who smoke regularly began smoking before the age of 18; adolescents appear to be more easily addicted to nicotine.[8]

Adult Cigarette Smoking

- The prevalence of current smoking among adults decreased from 42% in 1965 to 25% in 1997.[9] In 2017, an estimated 14% (more than 34 million adults) were current smokers (Table 1A).
- Smoking prevalence has declined across races/ethnicities and in men and women, though substantial disparities remain (Figure 1B). In 2017, smoking prevalence was lowest among Asians (7%) and highest among American Indians/Alaska Natives (25%), with the largest gender gap in blacks and Asians (Table 1A).
- Smoking prevalence in 2017 was lowest among those with a graduate degree (4%) and highest among adults with a GED (36%) (Table 1A).
- In 2017, smoking prevalence was lower among those who self-identified as straight (14%) than among people who self-identified as gay or lesbian (18%) or bisexual (22%) (Table 1A).
- By state, smoking prevalence was lowest in Utah (9%) and highest in West Virginia (26%) (Cover, Table 1B).

Figure 1A. Proportion of Cancer Cases and Deaths Attributable to Cigarette Smoking, Adults 30 Years and Older, US, 2014



Source: Islami F et al, 2018.[4]

Table 1A. Current Cigarette Smoking* (%), Adults 18 Years and Older, US, 2017

	Males	Females	Overall
Overall	**16**	**12**	**14**
Age (years)			
18-24	12	9	10
25-44	19	13	16
45-64	17	16	16
65+	9	8	8
Race/Ethnicity			
White	17	15	16
Black	19	12	15
Hispanic	13	7	10
American Indian/Alaska Native	27	21	25
Asian	11	4	7
Sexual orientation			
Gay or lesbian	20	17	18
Straight	16	12	14
Bisexual	23	22	22
Education (25 years and older)			
No HS diploma	30	20	25
GED	38	33	36
HS diploma	22	17	20
Some college	18	17	17
Undergraduate degree	8	6	7
Graduate degree	5	3	4
Insurance status (18 to 64 years)			
Uninsured	29	20	25
Insured	16	12	14
Immigration status			
Born in US	17	14	16
Born in US territory	–	–	9
In US fewer than 10 yrs	12	–	7
In US 10+ years	12	4	8

HS-high school. GED-General Educational Development high school equivalency.
*Ever smoked 100 cigarettes in lifetime and now smoke every day or some days.

Source: National Health Interview Survey, 2017.

Youth Cigarette Smoking

- Current cigarette smoking among high school students decreased from 29% in 1999[10] to 8% in 2018 (Table 1C).
- Cigarette smoking among youth has declined across races/ethnicities (Figure 1C). Current smoking prevalence in 2014-2017 among American Indian/Alaska Native and Native Hawaiian/Other Pacific Islander high school students was higher than that of whites, blacks, and Hispanics.[11]
- In 2017, high school students in Utah and Puerto Rico (4%) had the lowest prevalence of cigarette smoking while students in Arkansas, Kentucky, and West Virginia (14%) had the highest (Table 1D).
- Frequent cigarette smoking (smoking on 20 or more of the past 30 days) among high school students ranged from <1% in California to 6% in West Virginia.[12]

Other Combustible Tobacco Products

In addition to cigarettes, tobacco is used in other combustible forms such as cigars, pipes, waterpipes (also known as hookahs or shishas), and roll-your-own products. In contrast to cigarettes, cigars are wrapped in leaf tobacco or other materials containing tobacco. Cigar smokers have an increased risk of cancers of the lung, oral cavity, larynx, and esophagus.[13-15] Cigars, including little cigars (similar to cigarettes in size and shape), are often taxed at a lower rate than cigarettes, leading some smokers to switch from cigarettes to small cigars.[16] Additionally, cigars are often sold as singles and many include flavorings;[8] both traits are particularly appealing to youth. Waterpipes heat tobacco (often flavored), and smoke is passed through water before being inhaled. Waterpipes are often used in social settings (e.g., hookah bars). Although many users perceive waterpipe smoking to be less harmful than cigarettes, it is known to increase the risk of lung, oral, and esophageal cancers, as well as other respiratory illnesses.[17-19]

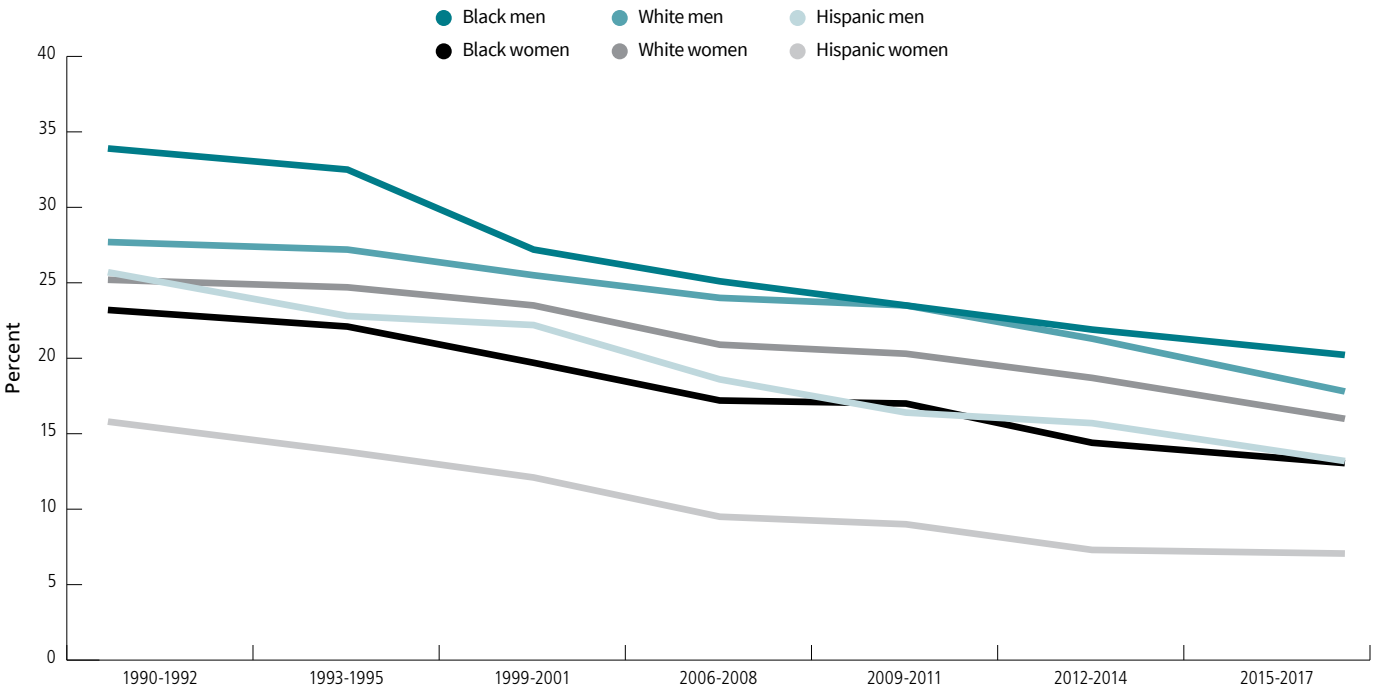
Adult Other Combustible Tobacco Use

- In 2017, 4% of adults (men: 7%, women: 1%) were current cigar smokers.[20]
- Cigar smoking was more common in blacks (6%) and American Indians/Alaska Natives (5%) than whites (4%) and Hispanics (2%).[20]

Youth Other Combustible Tobacco Use

- In 2018, 8% of high school students reported current use of cigars; use was similar across races/ethnicities but higher among boys (9%) than girls (6%) (Table 1C).

Figure 1B. Current Cigarette Smoking* Trends (%), Adults 18 Years and Older by Sex and Race/Ethnicity, US, 1990-2017



*Ever smoked 100 cigarettes in lifetime and now smoke every day or some days.

Source: 1990-2014: National Center for Health Statistics, 2018.[9] 2015-2017: National Health Interview Surveys, 2015-2017.

- Cigar smoking among high school students was lowest in Utah (3%) and highest in Arkansas (14%) (Table 1D).
- Use of waterpipes among high school students declined from 9% in 2014[21] to 4% in 2018 (Table 1C).

E-cigarettes (Vaping Devices)

A new category of devices emerged in the mid-to-late 2000s that aerosolizes a liquid nicotine solution, commonly referred to by researchers as electronic nicotine delivery systems (ENDS) and known colloquially as "e-cigarettes" or "vaporizers." JUUL brand has recently become the largest-selling e-cigarette product in traditional retail outlets.[22] E-cigarettes are battery-powered devices that allow the user to inhale an aerosol produced from cartridges or tanks filled with a liquid typically containing nicotine, propylene glycol (PG) and/or vegetable glycerin (VG), and flavoring.[23, 24] They are promoted as high-tech alternatives to traditional cigarettes, a way to bypass some smoke-free laws, and as a cessation aid.[25] E-cigarette use has risen rapidly in the US, particularly among youth and since 2014 has been the most commonly used tobacco product in this age group.

While evidence suggests that current-generation e-cigarettes are likely less harmful than conventional cigarettes, risks associated with long-term use are not clear.[26, 27] Metals and other hazardous chemicals can seep into the inhaled aerosol through contact with heating coils or wicks, and some commonly used flavoring components (e.g., diacetyl) are hazardous to the lungs. When present, concentrations of these hazardous chemicals are typically far below those of tobacco smoke, but they have been observed at sufficient levels to warrant health concerns. Moreover, little is known about the long-term effects of inhaling PG/VG or nicotine-absent tobacco. E-cigarettes are addictive and may lead to the use of combustible tobacco products among some individuals who would otherwise have been nonsmokers. Research indicates adolescent and young adults who use e-cigarettes may be two to four times more likely than nonusers to begin using combustible tobacco products.[28-30]

Table 1B. Current Tobacco Use (%), Adults 18 Years and Older by State, 2017

State	Cigarettes*						E-cigarettes¶ 18 years and older	Smokeless tobacco# 18 years and older
	Overall 18 years and older	Rank† (1=high)	Males 18 years and older	Females 18 years and older	Low education‡ 25 years and older	High education§ 25 years and older		
United States (median)	**17**		**18**	**15**	**31**	**7**	**5**	**4**
Range	*9-26*		*11-27*	*7-27*	*16-44*	*3-11*	*2-7*	*1-9*
Alabama	21	8	23	19	36	7	5	6
Alaska	21	8	24	17	44	8	3	7
Arizona	16	28	18	13	24	7	5	3
Arkansas	22	5	23	22	35	7	6	7
California	11	50	15	8	16	5	3	2
Colorado	15	36	17	13	25	6	5	4
Connecticut	13	47	14	11	23	4	3	2
Delaware	17	20	18	16	26	7	5	3
District of Columbia	15	36	17	12	34	7	2	1
Florida	16	28	19	14	29	6	4	3
Georgia	17	20	21	14	31	7	4	4
Hawaii	13	47	16	9	21	6	5	3
Idaho	14	42	16	13	29	5	5	5
Illinois	15	36	17	14	23	7	4	3
Indiana	22	5	23	20	38	8	6	5
Iowa	17	20	18	16	33	8	4	5
Kansas	17	20	18	16	35	7	5	6
Kentucky	25	2	27	22	44	9	6	8
Louisiana	23	3	25	21	38	8	4	6
Maine	17	20	20	14	36	6	4	3
Maryland	14	42	16	12	23	5	3	2
Massachusetts	14	42	15	13	31	6	3	2
Michigan	19	13	22	17	39	7	5	4
Minnesota	15	36	16	13	27	6	4	5
Mississippi	22	5	22	22	36	10	5	7
Missouri	21	8	22	20	42	8	5	6
Montana	17	20	17	17	38	9	4	8
Nebraska	15	36	16	14	24	6	4	5
Nevada	18	18	19	16	28	9	5	4
New Hampshire	16	28	17	15	41	6	5	2
New Jersey	14	42	16	12	22	7	4	2
New Mexico	17	20	21	15	25	8	5	4
New York	14	42	18	11	21	7	4	3
North Carolina	17	20	19	15	26	5	5	4
North Dakota	18	18	19	17	36	8	4	6
Ohio	21	8	22	20	43	7	5	5
Oklahoma	20	12	21	19	33	8	7	7
Oregon	16	28	18	14	35	7	4	3
Pennsylvania	19	13	21	17	32	8	5	4
Rhode Island	15	36	17	13	29	5	5	2
South Carolina	19	13	22	16	37	7	4	4
South Dakota	19	13	22	16	34	7	4	6
Tennessee	23	3	24	21	43	7	6	6
Texas	16	28	18	14	21	6	5	4
Utah	9	51	11	7	22	3	5	3
Vermont	16	28	17	15	29	5	3	3
Virginia	16	28	18	14	31	6	5	4
Washington	13	47	15	12	25	5	4	3
West Virginia	26	1	25	27	40	11	6	9
Wisconsin	16	28	17	15	30	6	4	4
Wyoming	19	13	19	18	33	6	6	9
Puerto Rico	11	–	17	6	11	8	1	1

*Smoked 100 cigarettes in lifetime and are current smokers (regular and irregular). †Based on overall % for 18 years and older. ‡Less than a high school education. §At least a college degree. ¶Some days or every day. #Use of chewing tobacco, snuff, or snus every day or some days. Note: Puerto Rico not included in range or median.

Source: Behavioral Risk Factor Surveillance System, 2017.

Table 1C. Current* Tobacco Use (%), High School Students, US, 2018

	Cigarettes	Cigars	Waterpipes	E-cigarettes	Smokeless tobacco†
Overall	**8**	**8**	**4**	**21**	**6**
Sex					
Males	9	9	4	23	8
Females	7	6	4	19	3
Race/Ethnicity					
White	10	8	3	27	8
Black	3	9	4	8	2
Hispanic	7	7	6	15	4

*In the past 30 days. †Includes chewing tobacco/snuff/dip, snus, and dissolvable tobacco.

Source: Gentzke et al, 2019.[31]

Adult E-Cigarette Use

- About 3% of adults were current e-cigarette users in 2017, 51% of whom were also current conventional cigarette smokers.[20]
- E-cigarette use was higher among whites (4%) than blacks, Hispanics, and Asians (1-2%).[20]
- By state, e-cigarette use in 2017 ranged from 2% in the District of Columbia to 7% in Oklahoma (Table 1B).

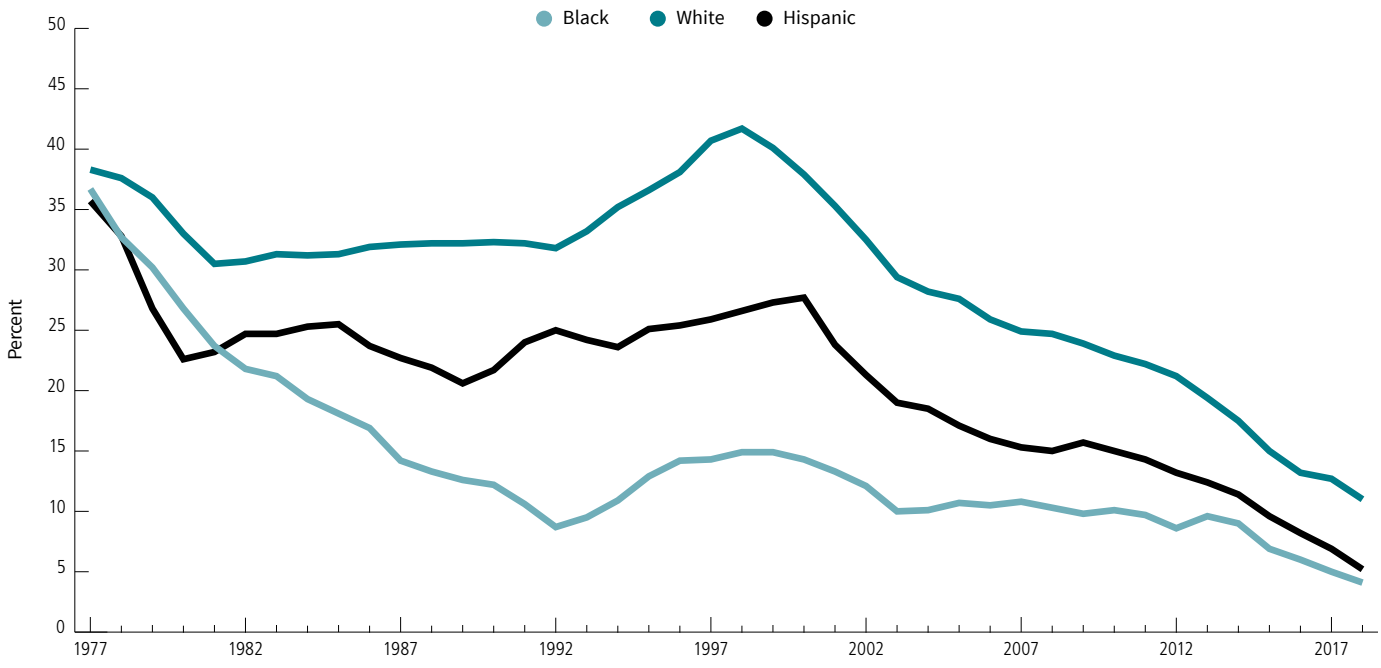
Youth E-Cigarette Use

- Among high school students, current e-cigarette use increased from 2% in 2011 to 21% in 2018.[31]
- E-cigarette use among high schoolers in 2018 was lowest among blacks (8%) and highest among whites (27%) (Table 1C).
- By state, in 2017, e-cigarette use among high school students ranged from 8% in Utah to 26% in Colorado and Hawaii (Table 1D).

Smokeless Tobacco Products

Smokeless tobacco includes products such as chewing tobacco, moist snuff, snus (a "spitless," moist powder tobacco, often in a pouch), and a variety of other tobacco-

Figure 1C. Current* Cigarette Smoking (%) Trends, 12th-graders by Race/Ethnicity, US, 1977-2018†



*In the past 30 days. †Percentages are two-year averages.

Source: Johnston et al, 2019.[63]

containing products that are not smoked. These products can cause oral, esophageal, and pancreatic cancer, as well as precancerous lesions of the mouth.[7] Switching from smoking to using smokeless tobacco products has been shown to result in a higher risk of tobacco-related death than complete tobacco cessation.[32] The tobacco industry often markets smokeless tobacco as a cigarette alternative in smoke-free settings and has developed new smokeless products, many of which have specific appeal to youth.

Adult Smokeless Tobacco Use

- The prevalence of smokeless tobacco use among adults has remained stable since 2003;[33] in 2017, about 4% of men and <1% of women were current smokeless tobacco users.[20]
- By state, smokeless tobacco use in 2017 was lowest in the District of Columbia and Puerto Rico (1%) and highest in West Virginia and Wyoming (9%) (Table 1B).

Youth Smokeless Tobacco Use

- Among high school students, in 2018, 8% of boys and 3% of girls were current smokeless tobacco users (Table 1C).
- Use was higher among whites (8%) than Hispanics (4%) and blacks (2%) (Table 1C).
- In 2017, current use of smokeless tobacco among high school students ranged from 3% in California, Nevada, Utah, and Puerto Rico to 13% in Arkansas (Table 1D).

Secondhand Smoke

About 3% of lung cancer cases in the US are attributable to secondhand smoke (SHS) exposure, and in 2014, an estimated 5,840 nonsmoking adults in the US were diagnosed with lung cancer as a result of breathing SHS.[4] Comprehensive smoke-free laws (e.g., laws that prohibit smoking in public places and create smoke-free environments) are effective in reducing SHS exposure, modifying smoking behavior, and reducing the risk of smoking-related disease.[34]

Table 1D. Current* Tobacco Use (%), High School Students by State, 2017

	Cigarettes	Rank† (1=high)	Cigars	E-cigarettes‡	Smokeless tobacco§
National Range	*4-14*		*3-14*	*8-26*	*3-13*
Alabama	–	–	–	–	–
Alaska	11	9	7	16	9
Arizona	7	26	6	16	5
Arkansas	14	1	14	14	13
California	5	38	–	17	3
Colorado	7	26	–	26	–
Connecticut	8	20	–	–	–
Delaware	6	33	7	14	4
District of Columbia	–	–	11	11	–
Florida	6	33	–	–	–
Georgia	–	–	–	–	–
Hawaii	8	20	–	26	–
Idaho	9	14	6	14	5
Illinois	8	20	8	13	6
Indiana	–	–	–	–	–
Iowa	10	12	7	9	6
Kansas	7	26	8	11	5
Kentucky	14	1	11	14	11
Louisiana	12	6	11	12	11
Maine	9	14	8	16	5
Maryland	8	20	9	13	6
Massachusetts	6	33	7	20	5
Michigan	11	9	9	15	6
Minnesota	–	–	–	–	–
Mississippi	–	–	–	–	–
Missouri	9	14	9	11	6
Montana	12	6	13	23	10
Nebraska	7	26	7	9	5
Nevada	7	26	6	16	3
New Hampshire	8	20	10	24	–
New Jersey	–	–	–	–	–
New Mexico	11	9	10	25	8
New York	6	33	8	15	5
North Carolina	12	6	–	22	–
North Dakota	13	4	8	21	8
Ohio	–	–	–	–	–
Oklahoma	13	4	8	16	9
Oregon	–	–	–	–	–
Pennsylvania	9	14	8	11	6
Rhode Island	6	33	7	20	5
South Carolina	10	12	11	12	8
South Dakota	–	–	–	–	–
Tennessee	9	14	10	12	7
Texas	7	26	7	10	5
Utah	4	39	3	8	3
Vermont	9	14	9	12	5
Virginia	7	26	6	12	4
Washington	–	–	–	–	–
West Virginia	14	1	11	14	12
Wisconsin	8	20	8	12	6
Wyoming	–	–	–	–	–
Puerto Rico	4	–	8	5	3

*≥1 of the 30 days preceding the survey. †Based on % current cigarette smoking. ‡E-cigarettes, e-cigars, e-pipes, vape pipes, vaping pens, e-hookahs, and hookah pens. §Chewing tobacco, snuff, dip, snus, or dissolvable tobacco products. Note: Puerto Rico not included in range. See Survey Sources (page 59) for more information regarding unavailable data.

Source: Kann L et al, 2018.[12]

Secondhand Smoke Exposure and Policies

Nationally, SHS exposure among nonsmokers declined from 88% in 1988-1991 to 25% in 2013-2014.[35] Certain groups, such as those with lower socioeconomic status, have considerably higher SHS exposure.[6, 35]

- Almost 60% of the US population is covered by comprehensive laws that prohibit smoking in all non-hospitality workplaces (such as offices, factories, and warehouses), restaurants, and bars.[36]
- As of January 2019, 25 states, the District of Columbia, Puerto Rico, and the US Virgin Islands had 100% smoke-free laws in non-hospitality workplaces, restaurants, and bars (Table 1E).
- Additionally, in 2017, the US Housing and Urban Development Department's smoke-free public housing rule went into effect.[37]
- Over 2,300 college/university campuses are 100% smoke-free.[36]

Tobacco Cessation

Smoking cessation reduces the risk of developing cancer.[2] Smokers who quit, regardless of age, increase their longevity, and those who quit by age 30 live an average of 10 years longer than if they had continued to smoke.[2, 38] Smoking cessation also improves outcomes for cancer survivors.[2]

Nicotine replacement therapy (NRT), prescription medications (e.g., buproprion and varenicline), and counseling (individual, group, or telephone) improve the chances of long-term cessation.[39] Combinations of one or more types of these cessation aids may be more effective than the use of one treatment alone. Most people begin smoking during their youth, underestimate the strength and rapidity of tobacco dependence, and overestimate their ability to quit.[40] The US Public Health Service recommends tobacco cessation counseling for adolescent smokers. Although NRTs appear to be safe in adolescents, there is little evidence to date that these medications are effective in promoting long-term abstinence, and as a result they are not yet recommended as a component of adolescent tobacco use interventions.[39] In addition to smokefree.gov, the sidebar above provides examples of cessation programs and initiatives.

Examples of Tobacco Cessation Programs and Initiatives

Quit for Life® Program
cancer.org/healthy/stay-away-from-tobacco/smoke-free-communities/create-smoke-free-workplace/quit-for-life
1-800-227-2345

Great American Smokeout®
cancer.org/healthy/stay-away-from-tobacco/great-american-smokeout
1-800-227-2345

Tips From Former Smokers
cdc.gov/tobacco/campaign/tips/
1-800-QUIT-NOW

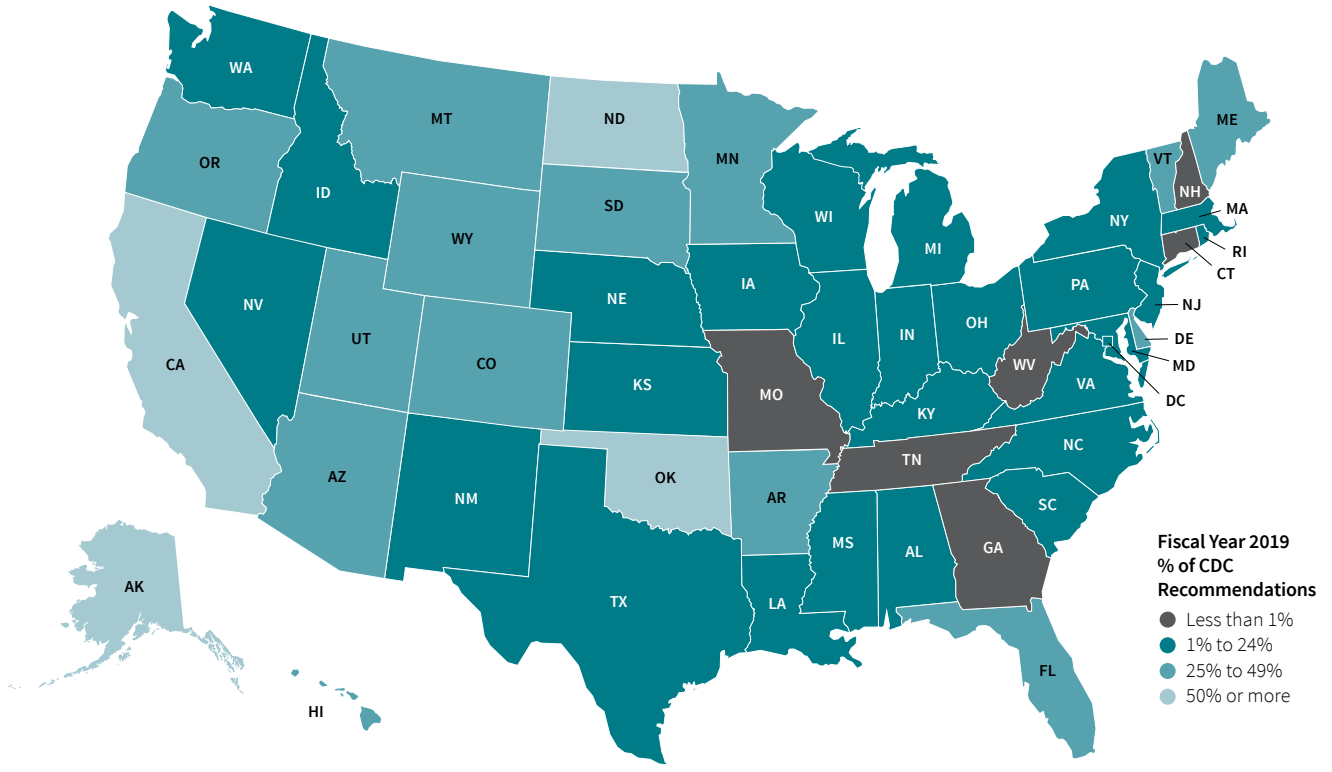
Adult Tobacco Cessation

- In 2005 and as recently as 2015, only about one-third of people who tried to quit smoking used cessation aids. Use was especially low among racial/ethnic minorities and individuals with lower socioeconomic status.[41]
- In 2017, 62% (55.2 million) of the 89.5 million adults who ever smoked at least 100 cigarettes were former smokers.[20]
- Nearly one-half of current smokers in 2017 attempted to quit for at least one day in the past year.[20]

Youth Tobacco Cessation

- Among high school tobacco product users, in 2017, about 41% tried to quit using all tobacco products in the previous year (boys: 37%, girls: 48%).[12]
- In 2017, only 33% of high school smokers in Vermont made a recent quit attempt compared to 51% in Louisiana.[12]

Figure 1D. State Funding for Tobacco Control, Fiscal Year 2019



CDC-Centers for Disease Control and Prevention. Note: Annual funding amounts only include state funds. Data not available for Puerto Rico.
Sources: Truth Initiative et al, 2018.[64] Centers for Disease Control and Prevention, 2014.[65]

Reducing Tobacco Use and Exposure

Numerous federal, state, and local tobacco control policies have been enacted since the 1964 Surgeon General's Report on Smoking and Health, including increased cigarette taxes; improved cessation treatment; enforced worksite, bar, and restaurant restrictions; improved health warnings; and restricted advertising. Such initiatives helped reduce smoking and avert almost 2 million smoking-related deaths through 2014.[42] Research indicates that increased state spending on tobacco control is associated with lower youth and adult smoking prevalence.[43, 44] Unfortunately, for fiscal year 2019, the funding level for state tobacco prevention programs was less than 1% of the recommended level for six states (Connecticut, Georgia, Missouri, New Hampshire, Tennessee, and West Virginia) and less than 50% of the recommended level for all states except Alaska, California, North Dakota, and Oklahoma (Figure 1D).

In addition to the information that follows, visit fightcancer.org to review the most recent edition of *How Do You Measure Up?* – a state-by-state assessment of cancer care and control efforts. Visit tobaccoatlas.org for a comprehensive presentation of tobacco-related problems and solutions.

Regulation of Tobacco Products

The Family Smoking Prevention and Tobacco Control Act of 2009 granted the Food and Drug Administration (FDA) authority to regulate the manufacturing, marketing, and selling of tobacco products.[45] Key provisions of the act include requiring the FDA to review new products before they can go on the market and standards to make tobacco products less toxic, less addictive, and less appealing. Specific requirements under the act include the prohibition of fruit and candy cigarette flavorings and misleading descriptors (e.g., light, low, mild) on

tobacco product labels. Evidence suggests that the prohibition of flavored cigarettes was associated with a reduction in overall tobacco use among youth, although there was an increase in use of tobacco products not included in the prohibition of flavors (e.g., menthol cigarettes, cigars, and pipes).[46]

In 2016, the FDA expanded their regulations to include additional tobacco products (e.g., waterpipes, e-cigarettes, loose tobacco, cigars), as well as future products that meet the statutory definition of a tobacco product.[47] In 2017, the FDA announced a new strategy focused on making cigarettes less addictive by reducing nicotine levels. While a rule has not yet been proposed, evidence suggests that a reduction in nicotine could result in a significant decrease in tobacco-related death because smokers would be more likely to quit and nonsmokers would be less likely to initiate or re-initiate.[48] Additionally, the American Cancer Society Cancer Action Network℠ (ACS CAN), the American Cancer Society's nonprofit, nonpartisan advocacy affiliate, and its partners won a lawsuit in 2018 requiring the FDA to develop larger, graphic warning labels for cigarettes as required by law.

Tobacco Taxes

The affordability of a tobacco product, which incorporates price as well as an individual's income and ability to purchase the product, varies widely across the US.[49] There is very strong evidence that the price of cigarettes is inversely and predictably related to consumption.[50] Tax increases are particularly effective at reducing smoking rates among smokers with lower socioeconomic status and/or young smokers who are particularly price sensitive.[51, 52] Tobacco control advocates aim for taxation levels that help ensure prices are not too low even if the product is heavily discounted. Unfortunately, loopholes in tax regulations and tobacco industry tactics can negate the benefits of cigarette excise tax increases. Taxes on tobacco products other than cigarettes vary by product type[53] and continue to lag behind, often providing less expensive alternatives to conventional cigarettes.

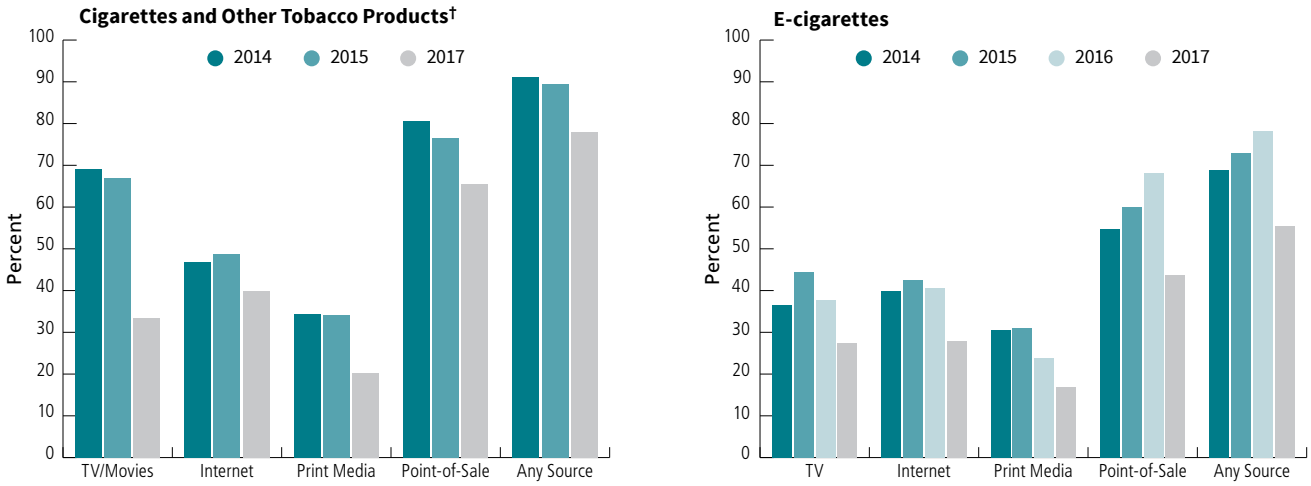
Table 1E. Comprehensive Tobacco Control Measures by State, 2018-2019

		100% smoke-free laws†			
	Cigarette tax per pack ($)*	**W**	**R**	**B**	**C**
United States (average)	**$1.79**				
Range	*0.17-4.50*				
Alabama	$0.675				
Alaska	$2.00				
Arizona	$2.00	✓	✓	✓	✓
Arkansas	$1.15				
California	$2.87	✓	✓	✓	✓
Colorado	$0.84		✓	✓	✓
Connecticut	$4.35		✓	✓	✓
Delaware	$2.10	✓	✓	✓	✓
District of Columbia	$4.50	✓	✓	✓	
Florida	$1.339	✓	✓		✓
Georgia	$0.37				
Hawaii	$3.20	✓	✓	✓	
Idaho	$0.57		✓		
Illinois	$1.98	✓	✓	✓	✓
Indiana	$0.995	✓	✓		
Iowa	$1.36	✓	✓	✓	
Kansas	$1.29	✓	✓	✓	
Kentucky	$1.10				
Louisiana	$1.08	✓	✓		
Maine	$2.00	✓	✓	✓	‡
Maryland	$2.00	✓	✓	✓	✓
Massachusetts	$3.51	✓	✓	✓	✓
Michigan	$2.00	✓	✓	✓	
Minnesota	$3.04	✓	✓	✓	✓
Mississippi	$0.68				
Missouri	$0.17				
Montana	$1.70	✓	✓	✓	✓
Nebraska	$0.64	✓	✓	✓	✓
Nevada	$1.80	✓	✓		
New Hampshire	$1.78		✓	✓	
New Jersey	$2.70	✓	✓	✓	
New Mexico	$1.66		✓	✓	
New York	$4.35	✓	✓	✓	✓
North Carolina	$0.45		✓	✓	
North Dakota	$0.44	✓	✓	✓	✓
Ohio	$1.60	✓	✓	✓	✓
Oklahoma	$2.03				
Oregon	$1.33	✓	✓	✓	✓
Pennsylvania	$2.60	✓			
Rhode Island	$4.25	✓	✓	✓	
South Carolina	$0.57				
South Dakota	$1.53	✓	✓	✓	✓
Tennessee	$0.62				
Texas	$1.41				
Utah	$1.70	✓	✓	✓	
Vermont	$3.08	✓	✓	✓	✓
Virginia	$0.30				
Washington	$3.025	✓	✓	✓	✓
West Virginia	$1.20				
Wisconsin	$2.52	✓	✓	✓	✓
Wyoming	$0.60				
Puerto Rico	$5.10	✓	✓	✓	✓

W – workplaces, R – restaurants, B – bars, C – state-run gambling establishments. *Effective as of December 21, 2018. †Passed or implemented, reported as of January 2, 2019. ‡Pertains only to those that opened in July 2003 or later.

Sources: Tax data: Campaign for Tobacco-Free Kids, 2018.[54]
Smoke-free laws: American Nonsmokers Rights Foundation, 2019.[36]

Figure 1E. Tobacco Product Marketing Exposure* Trends (%), Middle and High School Students, US, 2014-2017



*Respondents who reported "Sometimes," "Most of the time," or "Always." †Except e-cigarettes. Note: Only e-cigarette marketing questions were included in 2016. For e-cigarettes, "movies" was included with "TV" in 2014 only.

Source: National Youth Tobacco Survey, 2014-2017.

- Unchanged since 2009, the federal cigarette tax is $1.01.[2] As of December 21, 2018, the average state cigarette excise tax rate was $1.79, ranging from 17 cents per pack in Missouri to $4.50 per pack in the District of Columbia and $5.10 in Puerto Rico (Table 1E).
- E-cigarettes are not taxed at the federal level, but as of November 14, 2018, California, Delaware, the District of Columbia, Kansas, Louisiana, Minnesota, New Jersey, North Carolina, Pennsylvania, and West Virginia had an e-cigarette excise tax.[55]

Cessation Assistance

Provisions of the Affordable Care Act (ACA) require coverage for evidence-based cessation treatments for people in most private and some public health insurance plans. In addition, pregnant women and people covered by Medicaid in states that have expanded coverage have access to no-cost tobacco cessation services. Although there have been improvements in state Medicaid tobacco cessation coverage, as of June 30, 2017, only 10 states covered individual and group counseling in addition to the FDA-approved cessation medications.[56] Statewide telephone quitlines have broad accessibility and can deliver effective behavioral counseling to diverse groups of tobacco users. Integrating standard NRT into state quitline programs can further improve quit rates.[39, 57]

Age Restrictions

Federal law prohibits the sale of all tobacco products, including e-cigarettes, to persons under the age of 18. In addition, as of January 1, 2019, California, the District of Columbia, Hawaii, New Jersey, Maine, Massachusetts, and Oregon, along with many localities, had passed legislation to increase the minimum age of sale for tobacco products to 21.[58]

Countering Tobacco Industry Marketing

Exposure to tobacco industry marketing (advertising and promotions) significantly increases both the likelihood that adolescents will use tobacco and per-capita cigarette consumption in adults and youth.[59] Tobacco companies increased their cigarette advertising and promotional expenditures from $6.7 billion in 1998 to a peak of $15.1 billion in 2003; in 2016 expenditures totaled $8.7 billion.[60] Efforts such as the FDA's smoking prevention campaign, "The Real Cost," which educates at-risk teens on the harmful effects of smoking, are an attempt to counter industry marketing. "The Real Cost" has been associated with preventing approximately

350,000 youth from smoking initiation between 2014 and 2016,[61] which is associated with a savings of $31 billion in smoking-related costs.[62] Among middle and high school students, from 2014 to 2017, there were notable decreases in exposure to tobacco product marketing (Figure 1E). Despite these declines, in 2017, 78% of youth reported some exposure to marketing for cigarettes and other tobacco products, mostly through point-of-sale advertising; about 55% of youth reported exposure to e-cigarette marketing.

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Excess Body Weight, Alcohol, Diet, and Physical Activity

Aside from avoiding tobacco use, maintaining a healthy weight and limiting alcohol consumption (for those who drink) are among the most effective strategies for reducing cancer risk.[1] An estimated 18% of cancer cases and 16% of cancer deaths are attributable to the combined effects of excess body weight, alcohol consumption, physical inactivity, and consuming an unhealthy diet.[2] The American Cancer Society's 2012 nutrition and physical activity guidelines provide recommendations to help individuals adopt healthy behaviors (see sidebar, page 15). Adults who most closely follow these recommendations are 10%-20% less likely to be diagnosed with cancer and 25% less likely to die from cancer.[3] Community action strategies are also included in the guidelines because of the strong environmental influence on individual food and activity choices. An update to these guidelines is expected in 2019. Cancer survivors can also benefit from healthy eating and active living and are often eager to learn about healthy behaviors to improve outcomes and quality of life.[4]

Excess Body Weight

Body mass index (BMI) is an indirect measure of excess body weight calculated by using an individual's height and weight (see sidebar, page 16). Nationally, an estimated 5% of cancer cases in men and 11% in women are attributed to excess body weight.[2] In 2011-2015, the proportion of cancer cases attributable to excess body weight was lowest in Montana and highest in Texas among men; among women, the proportion was lowest in Hawaii and highest in the District of Columbia.[6] Excess body weight is associated with an increased risk of developing several types of cancer: uterine corpus (endometrium), esophagus (adenocarcinoma), liver, stomach (cardia), kidney (renal cell), brain (meningioma), multiple myeloma, pancreas, colorectum, gallbladder, ovary, female breast (postmenopausal), and thyroid.[7] Excess body weight may also increase the risk of non-Hodgkin lymphoma (diffuse large B-cell lymphoma), male breast cancer, and fatal prostate cancer.[7] Limited evidence suggests that excess body weight negatively impacts breast cancer survival.[8] Some studies have shown that intentional weight loss is associated with decreased cancer risk among women, but the evidence is less clear for men.[9]

Unhealthy dietary habits, physical inactivity, and excessive weight gain that begin during childhood often continue into adulthood, resulting in cumulative exposure to excess body fat and subsequent adverse health consequences.[10] Although the underlying mechanism for how excess body weight causes cancer is unclear, scientists have proposed several explanations. Excess adipose tissue is related to chronic inflammation that can lead to DNA damage and tumor growth over time. It is also related to greater estrogen production, insulin resistance that may fuel tumor progression, and adipokines (hormones that stimulate or inhibit growth).

Adult Overweight and Obesity

- The proportion of men (about 40%) and women (25%-30%) classified as overweight has remained relatively stable since the early 1960s. However, obesity prevalence has markedly increased; in 1960-1962, 11% of men and 16% of women were classified as obese, and by 2015-2016, approximately 38% of men and 41% of women were obese[11] (Figure 2A).
- In 2015-2016, 74% of men and 68% of women were overweight or obese; the prevalence of overweight was higher among men (37%) than women (27%) (Figure 2A).
- In 2015-2016, among men, obesity prevalence was lowest among Asians (10%) and notably higher among blacks (37%), whites (38%), and Hispanics (43%). Among women, it was lowest among Asians (15%), followed by whites (38%), Hispanics (51%), and blacks (55%) (Figure 2B).

American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention

Individual Choices

Achieve and maintain a healthy weight throughout life.

- Be as lean as possible throughout life without being underweight.
- Avoid excess weight gain at all ages. For those who are currently overweight or obese, losing even a small amount of weight has health benefits and is a good place to start.
- Engage in regular physical activity and limit consumption of high-calorie foods and beverages as key strategies for maintaining a healthy weight.

Adopt a physically active lifestyle.

- Adults should engage in at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity physical activity each week, or an equivalent combination, preferably spread throughout the week.
- Children and adolescents should engage in at least one hour of moderate- or vigorous-intensity physical activity each day, with vigorous-intensity activity at least three days each week.
- Limit sedentary behavior such as sitting, lying down, and watching television and other forms of screen-based entertainment.
- Doing any intentional physical activity above usual activities can have many health benefits.

Consume a healthy diet, with an emphasis on plant sources.

- Choose foods and beverages in amounts that help achieve and maintain a healthy weight.
- Limit consumption of processed meats and red meats.
- Eat at least 2½ cups of vegetables and fruits each day.
- Choose whole-grain instead of refined-grain products.

Limit alcohol consumption, if you drink at all.

- Drink no more than one alcoholic beverage per day for women or two per day for men.

Community Action

Public, private, and community organizations should work collaboratively at national, state, and local levels to implement environmental policy changes that:

- Increase access to affordable, healthy foods in communities, worksites, and schools; and decrease access to and marketing of foods and beverages of low nutritional value, particularly to youth.
- Provide safe, enjoyable, and accessible environments for physical activity in schools and worksites, and for transportation and recreation in communities.

For more information, visit:

- Guidelines for cancer prevention: cancer.org/healthy/eat-healthy-get-active/acs-guidelines-nutrition-physical-activity-cancer-prevention/guidelines.html
- Guidelines for cancer survivors:[5] cancer.org/health-care-professionals/american-cancer-society-prevention-early-detection-guidelines/nupa-guidelines-for-cancer-survivors.html

- In 2017, by state, obesity prevalence among adults ranged from 23% in Colorado and the District of Columbia to 38% in West Virginia (Table 2A).
- Obesity prevalence is higher in rural counties compared to more urban counties, with the largest disparities in the South.[12]
- About one-half of US adults report being obese at one point in their lifetime.[13] In 2013-2016, about two-thirds of obese and one-half of overweight adults tried to lose weight in the previous year; the proportion was higher for women than men.[14]

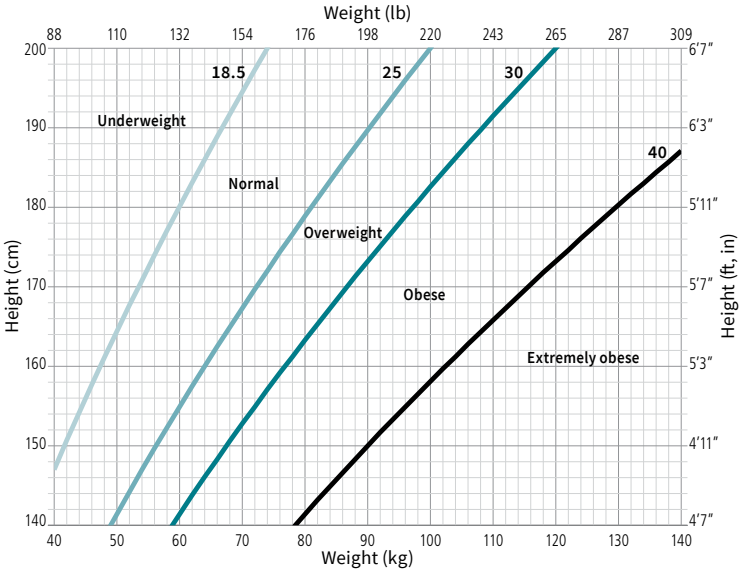
Youth Overweight and Obesity

- The prevalence of overweight among youth ages 2-19 years increased from 10% in 1971-1974 to 17% in 2015-2016.[15]
- From 1971 to 2002, the prevalence of obesity among youth ages 2-19 years tripled from 5% to 15%, increasing to 19% in 2015-2016.[15]
- By age, in 2015-2016 obesity prevalence ranged from 14% in young children (ages 2-5 years) to 21% in adolescents (ages 12-19 years) (Figure 2A).

Defining Body Mass Index

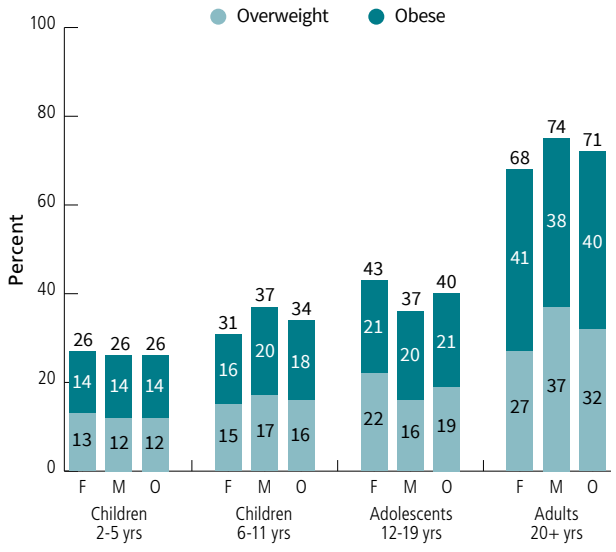
Body mass index (BMI) is defined by an individual's height and weight. For adults, a BMI of 25.0-29.9 kg/m^2 is overweight; a BMI of ≥30.0 kg/m^2 is obese. Excess body weight is defined as a BMI of ≥25.0 kg/m^2. For youth (ages 2-20 years), BMI is based on percentile rankings of the individual's height and weight on age- and sex-specific growth charts; BMIs between the 85th and 94.9th percentile are considered overweight, and BMIs at or above the 95th percentile are classified as obese. See Glossary (page 58) for more information.

BMI Categories for Adults



- Trends in obesity prevalence vary by sex and race/ethnicity[15] (Figure 2C). Among adolescent boys, prevalence has consistently been highest among Mexican Americans while among girls, prevalence has been highest among blacks. Among both boys and girls, prevalence is lowest among Asians.

Figure 2A. Excess Body Weight* (%), Youth and Adults, US, 2015-2016



F: females, M: males, O: overall. *See sidebar above.

Sources: National Health and Nutrition Examination Survey, 2015-2016. Fryar, 2018.[11] Fryar, 2018.[15]

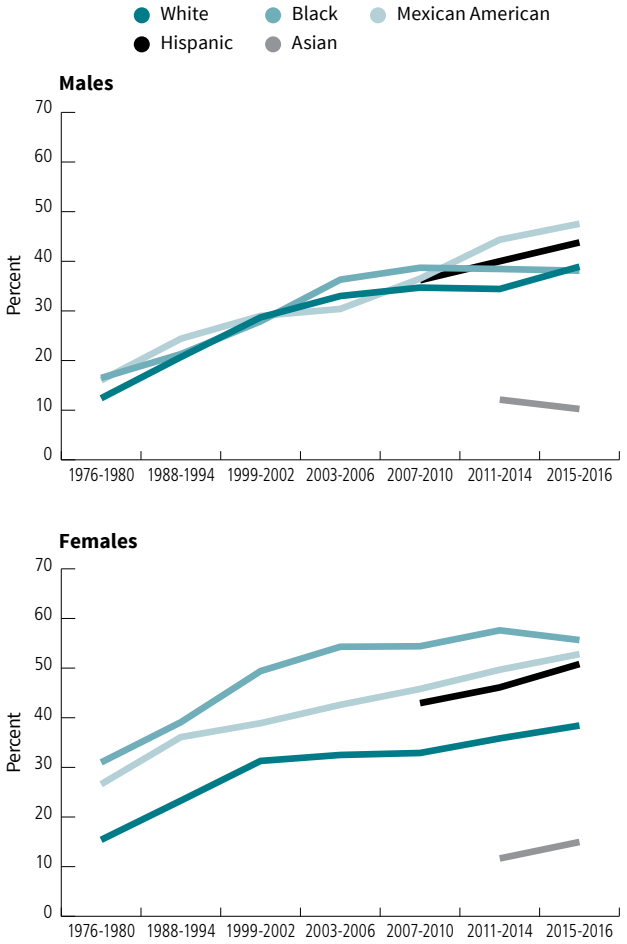
- In 2017, the prevalence of obesity among high school students ranged from 10% in Colorado and Utah to 22% in Arkansas (Table 2B). Evidence suggests that adolescent obesity exceeds 20% in many counties located in the Deep South and Southern Appalachian regions.[16]

Alcohol

An estimated 6% of cancer cases can be attributed to alcohol consumption,[2] which increases the risk for cancers of the mouth, pharynx, larynx, esophagus, liver, colorectum, and female breast.[17] Approximately three or more drinks per day may also increase the risk of stomach and pancreatic cancer.[17, 18] Cancer risk increases with alcohol volume, and even a few drinks per week may be associated with a slightly elevated risk of female breast cancer.[19] Combined with tobacco use, alcohol consumption increases the risk of cancers of the mouth, pharynx, larynx, and esophagus far more than the independent effect of either drinking or smoking alone.[20]

The American Cancer Society's 2012 nutrition and physical activity guidelines recommend that people who drink alcohol should limit their intake to no more than two drinks per day for men and one drink per day for women.[1, 21] The recommended limit is lower for women because of their smaller body size and slower metabolism of alcohol.

Figure 2B. Obesity* Trends, Adults 20-74 Years by Sex and Race/Ethnicity†, US, 1976-2016



*See sidebar, page 16. †See Survey Sources (page 59).

Source: National Center for Health Statistics, 2014.[60] National Health and Nutrition Examination Surveys, 2011-2016.

Moreover, recent results from the Global Burden of Disease indicated that the amount of alcohol consumption that minimized harm across health outcomes was zero.[22]

Alcohol Consumption

- In 2017, 67% of adults reported current alcohol consumption (12+ drinks in lifetime and ≥1 drink in past year).[23]
- About 6% of adults reported heavier drinking (men: >14 drinks/week, women: >7 drinks/week in past year) in 2017, ranging from 4% in Oklahoma, Utah, and West Virginia to 9% in the District of Columbia, Hawaii, and Maine (Table 2C).

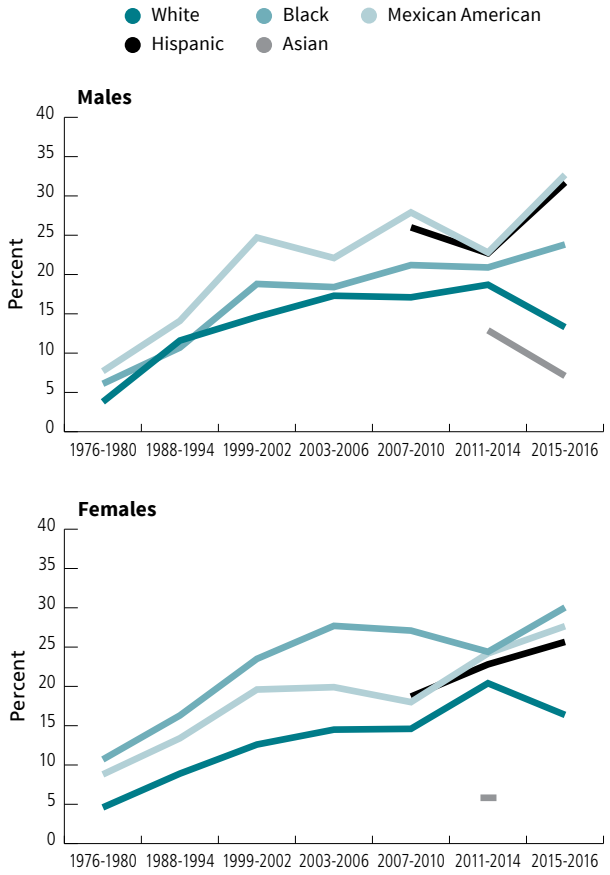
Table 2A. Overweight and Obesity* (%), Adults 18 Years and Older by State, 2017

	Overweight	Obese	Rank† (1=high)
United States (median)	**35**	**31**	
Range	*31-39*	*23-38*	
Alabama	34	36	3
Alaska	33	34	8
Arizona	35	29	30
Arkansas	35	35	7
California	36	25	46
Colorado	36	23	50
Connecticut	36	27	41
Delaware	37	32	17
District of Columbia	31	23	50
Florida	36	28	35
Georgia	34	32	17
Hawaii	35	24	49
Idaho	37	29	30
Illinois	35	31	26
Indiana	34	34	8
Iowa	34	36	3
Kansas	35	32	17
Kentucky	34	34	8
Louisiana	34	36	3
Maine	36	29	30
Maryland	35	31	26
Massachusetts	36	26	44
Michigan	35	32	17
Minnesota	37	28	35
Mississippi	33	37	2
Missouri	35	32	17
Montana	37	25	46
Nebraska	36	33	13
Nevada	39	27	41
New Hampshire	37	28	35
New Jersey	35	27	41
New Mexico	37	28	35
New York	36	26	44
North Carolina	35	32	17
North Dakota	36	33	13
Ohio	34	34	8
Oklahoma	34	36	3
Oregon	35	29	30
Pennsylvania	36	32	17
Rhode Island	35	30	28
South Carolina	34	34	8
South Dakota	36	32	17
Tennessee	35	33	13
Texas	36	33	13
Utah	35	25	46
Vermont	35	28	35
Virginia	36	30	28
Washington	35	28	35
West Virginia	34	38	1
Wisconsin	35	32	17
Wyoming	36	29	30
Puerto Rico	35	33	–

*See sidebar, page 16. †Based on % obese. Note: Puerto Rico not included in range or median.

Source: Behavioral Risk Factor Surveillance System, 2017.

Figure 2C. Obesity* Trends, Adolescents 12-19 Years, by Sex and Race/Ethnicity†, US, 1976-2016



*See sidebar, page 16. †See Survey Sources (page 59). Note: The 2015-16 estimate for Asian girls is not presented due to instability.

Source: National Center for Health Statistics, 2014.[60] National Center for Health Statistics, 2018.[50] National Health and Nutrition Examination Survey, 2015-2016.

- In 2017, the prevalence of heavier drinking ranged from 2% in Asians to 6% in whites.[23]
- About 30% of high school students in 2017 reported alcohol consumption in the past month.[24]

Diet

About 4% of cancer cases can be attributed to poor diet.[2] Unhealthy dietary patterns are associated with a higher risk of developing cancer (predominantly colon).[25] In contrast, dietary patterns with an emphasis on a variety of fruits and vegetables, whole grains, legumes, and fish or poultry and fewer red and processed meats are associated with lower cancer risk[26, 27] (see sidebar, page 20). One

Table 2B. Overweight and Obesity* (%), High School Students by State, 2017

	Overweight	Obese	Rank† (1=high)
United States	**16**	**15**	
Range	*12-18*	*10-22*	
Alabama	–	–	–
Alaska	18	14	20
Arizona	16	12	33
Arkansas	18	22	1
California	15	14	20
Colorado	12	10	39
Connecticut	16	13	27
Delaware	17	15	12
District of Columbia	18	17	6
Florida	14	11	37
Georgia	–	–	–
Hawaii	14	14	20
Idaho	15	11	37
Illinois	16	15	12
Indiana	–	–	–
Iowa	16	15	12
Kansas	15	13	27
Kentucky	16	20	3
Louisiana	18	17	6
Maine	16	14	20
Maryland	15	13	27
Massachusetts	14	12	33
Michigan	16	17	6
Minnesota	–	–	–
Mississippi	–	–	–
Missouri	16	17	6
Montana	15	12	33
Nebraska	17	15	12
Nevada	14	14	20
New Hampshire	14	13	27
New Jersey	–	–	–
New Mexico	16	15	12
New York	16	12	33
North Carolina	16	15	12
North Dakota	16	15	12
Ohio	–	–	–
Oklahoma	17	17	6
Oregon	–	–	–
Pennsylvania	16	14	20
Rhode Island	16	15	12
South Carolina	17	17	6
South Dakota	–	–	–
Tennessee	18	21	2
Texas	18	19	5
Utah	13	10	39
Vermont	14	13	27
Virginia	16	13	27
Washington	–	–	–
West Virginia	16	20	3
Wisconsin	15	14	20
Wyoming	–	–	–
Puerto Rico	13	11	–

*See sidebar, page 16. †Based on % obese. Note: Puerto Rico not included in range or national estimate. See Survey Sources (page 59) for more information regarding unavailable data.

Source: Kann L et al, 2018.[24]

review found that individuals with the healthiest diets have an 11%-24% lower risk of cancer death than those with the least healthy diet.[28] Furthermore, improving diet quality over time is associated with an overall reduced risk of death.[29]

Processed Meats and Red Meats

Processed meat (e.g., lunch meats, bacon, hot dogs) has been classified as a human carcinogen, and red meat (e.g., beef, lamb, pork) has been classified as a probable carcinogen based on the evidence of their association with increased colorectal cancer risk.[30] While specific mechanisms are unknown, substances such as nitrates or nitrites used to preserve processed meats and heme iron in red meat can contribute to the formation of nitrosamines, which are involved in carcinogenesis.[31-33] Smoking, curing, and cooking meat at high temperatures, such as pan frying or grilling, can form carcinogenic chemicals, which may also contribute to increased risk.[34] In addition, fatty meats and fried meat are major sources of total fat, saturated fat, and cholesterol in the American diet.

Vegetables and Fruits

Vegetables (including legumes) and fruits contain numerous vitamins, minerals, fiber, carotenoids, and other bioactive substances that may help prevent cancer. There is probable evidence that greater consumption of non-starchy vegetables (e.g., broccoli, green beans, and lettuce) and fruits is associated with lower risk of mouth, pharynx, larynx, esophageal, and stomach cancers.[17, 35] Evidence also suggests that higher vegetable intake may lower the risk of aggressive, hard-to-treat breast tumors.[36, 37] The potential benefits of vegetable and fruit consumption on cancer risk may also stem from their replacement of more calorie-dense foods and associated maintenance of a healthy weight.[38] For these reasons, consumption of low-calorie whole vegetables and fruits is encouraged.

Whole Grains

Whole-grain foods (made from the entire grain seed) are an important part of a healthful diet and relatively low in caloric density and high in fiber, vitamins, and minerals compared to refined flour products.[21] Although evidence

Table 2C. Alcohol, Diet, and Physical Activity (%), Adults 18 Years and Older by State, 2017

	Alcohol consumption*	Consumed ≥2 fruit servings a day	Consumed ≥3 vegetable servings a day	Met rec. levels of aerobic activity†
United States (median)	**6**	**33**	**16**	**50**
Range	*4-9*	*20-40*	*10-27*	*42-60*
Alabama	5	24	12	43
Alaska	8	33	19	58
Arizona	5	33	16	53
Arkansas	6	28	18	45
California	6	37	17	57
Colorado	7	36	19	59
Connecticut	5	38	18	52
Delaware	6	33	14	46
District of Columbia	9	35	27	49
Florida	6	34	16	50
Georgia	5	32	16	46
Hawaii	9	33	19	57
Idaho	7	35	17	55
Illinois	6	35	16	53
Indiana	6	31	16	46
Iowa	7	32	14	50
Kansas	6	31	16	49
Kentucky	6	26	13	45
Louisiana	7	29	14	45
Maine	9	38	22	53
Maryland	5	36	17	51
Massachusetts	7	36	17	51
Michigan	7	33	13	50
Minnesota	7	36	15	51
Mississippi	5	27	14	45
Missouri	6	26	12	47
Montana	8	27	13	55
Nebraska	7	33	15	49
Nevada	6	27	11	47
New Hampshire	8	39	20	54
New Jersey	5	34	14	49
New Mexico	6	32	15	54
New York	6	36	16	49
North Carolina	6	31	17	49
North Dakota	7	32	16	46
Ohio	7	30	13	48
Oklahoma	4	22	10	42
Oregon	8	37	19	57
Pennsylvania	6	34	16	53
Rhode Island	7	37	18	51
South Carolina	7	29	13	49
South Dakota	6	30	13	51
Tennessee	5	30	18	47
Texas	7	33	16	42
Utah	4	34	13	54
Vermont	8	40	21	60
Virginia	6	33	17	51
Washington	6	37	19	58
West Virginia	4	20	11	48
Wisconsin	8	36	16	57
Wyoming	8	32	15	54
Puerto Rico	5	14	3	20

*Men: >14 drinks per week, women: >7 drinks per week. †Includes 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity activity each week.
Note: Puerto Rico not included in range or median.

Source: Behavioral Risk Factor Surveillance System, 2017.

Consume a healthy diet, with an emphasis on plant sources

Choose foods and beverages in amounts that help achieve and maintain a healthy weight.

- Read food labels to become more aware of portion sizes and calories consumed. Be aware that low fat or nonfat does not necessarily mean low calorie.
- Eat smaller portions of high-calorie foods.
- Choose vegetables, whole fruit, and other low-calorie foods instead of calorie-dense foods such as French fries, potato and other chips, ice cream, doughnuts, and other sweets.
- Limit consumption of sugar-sweetened beverages such as soft drinks, sports drinks, and fruit-flavored drinks.
- When you eat away from home, be especially mindful to choose food low in calories, fat, and sugar, and avoid consuming large portion sizes.

Limit consumption of processed meats and red meats.

- Minimize consumption of processed meats such as bacon, sausage, luncheon meats, and hot dogs.
- Choose fish, poultry, or beans as alternatives to red meat (beef, pork, and lamb).
- If you eat red meat, select lean cuts and eat smaller portions.
- Prepare meat, poultry, and fish by baking, broiling, or poaching rather than by frying or charbroiling.

Eat at least 2½ cups of vegetables and fruits each day.

- Include vegetables and fruits at every meal and for snacks.
- Eat a variety of vegetables and fruits each day.
- Emphasize whole vegetables and fruits; choose 100% juice if you drink vegetable or fruit juices.
- Limit consumption of creamy sauces, dressings, and dips with vegetables and fruits.

Choose whole-grain instead of refined-grain products.

- Choose whole-grain foods such as whole-grain breads, pasta, and cereals (such as barley and oats), and brown rice instead of white rice, breads, cereals, and pasta made from refined grains.
- Limit consumption of other refined-carbohydrate foods, including pastries, candy, sugar-sweetened cereals, and other high-sugar foods.

of the association between whole-grain foods and different types of cancer is limited, studies support the role of a diet high in whole-grain foods and fiber in reducing the risk of colorectal cancer. Some evidence also shows reduced mortality with increased fiber intake after a colorectal cancer diagnosis.[39]

Adult Dietary Patterns

- Consumption of total fruit and vegetables and of processed meats has not changed since 1999; although, from 1999-2000 to 2011-2012, there was an increase in consumption of whole grains, nuts, and seeds.[40]
- Despite a decrease in sugar sweetened beverages (SSBs) consumption since 1999-2000,[40] in 2011-2014, about 50% of adults consumed at least one on a given day, and these beverages accounted for 6%-7% of daily caloric intake.[41]
- In 2017, only about 33% of adults reported eating two or more servings of fruits daily, ranging from 20% in West Virginia to 40% in Vermont (Table 2C).
- Only 16% of adults consumed three or more servings of vegetables per day in 2017, ranging from 10% in Oklahoma to 27% in the District of Columbia (Table 2C).

Youth Dietary Patterns

- Among youth ages 2-19 years, in 2011-2014, about 63% consumed at least one SSB on a given day, accounting for about 7% of daily caloric intake.[42]
- About 31% of high school students consumed 100% fruit juice or fruit two or more times a day in 2017, ranging from 20% in Oklahoma to 33% in California and Vermont (Table 2D).
- In 2017, only 14% of high school students reported consuming vegetables three or more times per day, ranging from 9% in Kansas, Kentucky, and Oklahoma to 18% in New Mexico and Vermont (Table 2D).

Physical Activity

Physical activity is defined as movement that uses skeletal muscles and more energy than what is required at rest. Its intensity is measured by the amount of energy expended; see sidebar on page 22 for examples.

Approximately 3% of cancer cases can be attributed to physical inactivity.[2] There is strong evidence that physical activity decreases the risk of colon (but not rectal), endometrial, and postmenopausal breast cancer.[17, 43] Accumulating evidence suggests that physical activity may reduce the risk of other cancers including but not limited to: esophageal, liver, and premenopausal breast cancers.[17] Additionally, mounting evidence suggests greater time spent in sedentary behavior may increase risk of colon and endometrial cancers.[44]

The benefits of physical activity are observed even among people who are overweight, obese, and have a history of smoking.[45] Additionally, cancer survivors who are physically active are less likely to have adverse effects and to die from their cancer than those who are inactive.[46] Studies have shown that being active at high levels helps to prevent weight gain and obesity, which contributes to a reduced risk of developing obesity-related cancers.[1, 43] Even low amounts of physical activity appear to reduce cancer mortality.[46, 47]

Extended leisure-time sitting has also been associated with increased risk of cancer death,[48] although 60-75 minutes per day of moderate-intensity activity may offset this excess risk.[49] The American Cancer Society recommends that adults limit sedentary behavior in addition to getting at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity exercise per week, or an equivalent combination, preferably spread throughout the week. Achieving at least double the minimum recommended amounts of exercise likely provides additional protection against cancer. Children and adolescents should be encouraged to be physically active for at least 60 minutes daily.

Table 2D. Diet and Physical Activity (%), High School Students by State, 2017

	Consumed fruit or 100% fruit juice ≥2 times/day	Consumed vegetables ≥3 times/ day	No physical activity*	Met rec. levels of physical activity†
United States	**31**	**14**	**15**	**26**
Range	*20-33*	*9-18*	*11-28*	*13-31*
Alabama	–	–	–	–
Alaska	26	13	16	18
Arizona	25	12	17	25
Arkansas	23	16	28	21
California	33	14	13	28
Colorado	–	–	13	27
Connecticut	32	13	15	22
Delaware	–	–	17	25
District of Columbia	28	13	28	13
Florida	31	15	22	23
Georgia	–	–	–	–
Hawaii	21	12	19	20
Idaho	28	13	13	24
Illinois	28	12	16	23
Indiana	–	–	–	–
Iowa	26	10	11	29
Kansas	24	9	13	27
Kentucky	21	9	19	22
Louisiana	27	14	25	21
Maine	29	–	14	20
Maryland	27	12	22	18
Massachusetts	28	12	15	23
Michigan	28	13	16	23
Minnesota	–	–	–	–
Mississippi	–	–	–	–
Missouri	23	10	17	29
Montana	25	12	11	28
Nebraska	26	12	15	27
Nevada	28	–	15	25
New Hampshire	32	–	13	23
New Jersey	–	–	–	–
New Mexico	28	18	14	31
New York	32	–	15	23
North Carolina	28	12	20	22
North Dakota	26	11	13	26
Ohio	–	–	–	–
Oklahoma	20	9	16	30
Oregon	–	–	–	–
Pennsylvania	29	12	16	25
Rhode Island	28	12	17	23
South Carolina	29	10	24	22
South Dakota	–	–	–	–
Tennessee	26	10	17	26
Texas	28	12	19	25
Utah	25	13	13	19
Vermont	33	18	13	25
Virginia	29	15	17	22
Washington	–	–	–	–
West Virginia	26	11	17	23
Wisconsin	30	14	14	25
Wyoming	–	–	–	–
Puerto Rico	23	10	30	15

*No physical activity for a total of ≥60 minutes on any day during the preceding 7 days. †Physical activity that increased heart rate and made breathing difficult for a total of ≥60 minutes/day on 7 days preceding the survey. Note: Puerto Rico not included in range or national estimate. See Survey Sources (page 59) for more information regarding unavailable data.

Source: Kann L et al, 2018.[24]

Examples of Moderate- and Vigorous-intensity Physical Activity

	Moderate-intensity Activities	Vigorous-intensity Activities
Leisure-time Physical Activity	Walking, dancing, leisurely bicycling, ice and roller skating, horseback riding, canoeing, power yoga	Jogging or running, fast bicycling, circuit weight training, aerobic dance, martial arts, jumping rope, swimming
Sports	Volleyball, golfing (without a cart), softball, baseball, badminton, doubles tennis, downhill skiing	Soccer, field or ice hockey, lacrosse, singles tennis, racquetball, basketball, cross-country skiing
Home activities	Mowing the lawn, general yard and garden maintenance	Digging, carrying, and hauling; masonry; carpentry
Occupational activity	Walking and lifting as part of the job (custodial work, farming, auto or machine repair)	Heavy manual labor (forestry, construction, fire-fighting)

Adult Physical Activity

- Historically, a higher proportion of men than women have met physical activity recommendations,[50] a trend that continued in 2017 with 59% of men meeting recommendations compared to 50% of women (overall: 54%) (Table 2E).
- In 2017, meeting recommendations for physical activity was more common among those with higher levels of educational attainment (less than high school: 33%, college graduate: 66%) (Table 2E).
- In 2017, Oklahoma and Texas (42%) had the lowest proportion of adults who reported meeting recommended levels of physical activity, while Vermont (60%) had the highest (Table 2C).
- Most states in which a relatively high proportion of adults reported no leisure-time physical activity also had a relatively high prevalence of excess body weight (Figure 2D).

Youth Physical Activity

- In 2017, about 15% of high school students reported no physical activity in the past week (Table 2D).
- About 26% of high school students reported at least 60 minutes of daily physical activity, ranging from 13% in the District of Columbia to 31% in New Mexico (Table 2D).

Type 2 Diabetes

Type 2 diabetes, a chronic condition in which the body loses its ability to respond to insulin, shares several risk factors with cancer, including excess body weight, poor diet, and physical inactivity. Mounting evidence suggests that type 2 diabetes independently increases risk for several cancers including liver, endometrium, pancreas, colorectum, kidney, bladder, breast, and perhaps ovary.[51-53] The biology underlying this association is not completely understood, but may involve abnormal glucose control and related factors, including inflammation.

- In 2015, an estimated 27 to 29 million Americans had type 2 diabetes.[54]
- In 2013-2015, the prevalence of type 2 diabetes was higher among American Indians/Alaska Natives (15%), blacks (13%), and Hispanics (12%) than among Asians (8%) and whites (7%).[54]
- About 1 in 2 Asians with diabetes is unaware of their disease compared to 1 in 4 people nationwide, partly because Asians are more likely to develop the disease at a normal body weight.[55]

Community Action

The rise of obesity in the US has serious implications for public health. Policies and programs that support healthy behaviors throughout a person's life cycle are needed to

Table 2E. Physical Activity (%), Adults 18 Years and Older, US, 2017

	No leisure-time physical activity in past week	Met rec. levels of aerobic activity*
Overall	**26**	**54**
Sex		
Males	24	59
Females	28	50
Age (years)		
18-24	22	62
25-44	21	60
45-64	27	52
65+	40	38
Race/Ethnicity		
White	22	59
Black	35	45
Hispanic	36	45
American Indian/Alaska Native	27	55
Asian	25	52
Sexual orientation		
Gay/lesbian	22	57
Straight	26	54
Bisexual	24	55
Education (25 years and older)		
Less than high school	49	33
High school diploma	37	43
Some college	26	52
College graduate	14	66
Insurance status (18 to 64 years)		
Uninsured	35	45
Insured	22	59
Immigration status		
Born in US	25	56
Born in US territory	41	37
In US fewer than 10 years	39	39
In US 10+ years	32	49

*Includes 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity activity each week.

Source: National Health Interview Survey, 2017.

address the prevailing socioenvironmental factors contributing to obesity.[1, 56] These factors include lack of access to full-service grocery stores, wide availability of unhealthy foods, relatively high costs of healthy foods compared to processed foods, and lack of access to safe places to play and exercise. Historical changes that have likely contributed to the obesity epidemic include increased reliance on automobiles, sedentary work, meals eaten away from home, availability of inexpensive energy-dense processed foods and consumption of larger portion sizes and SSBs.[1, 38, 57]

National Action Strategies

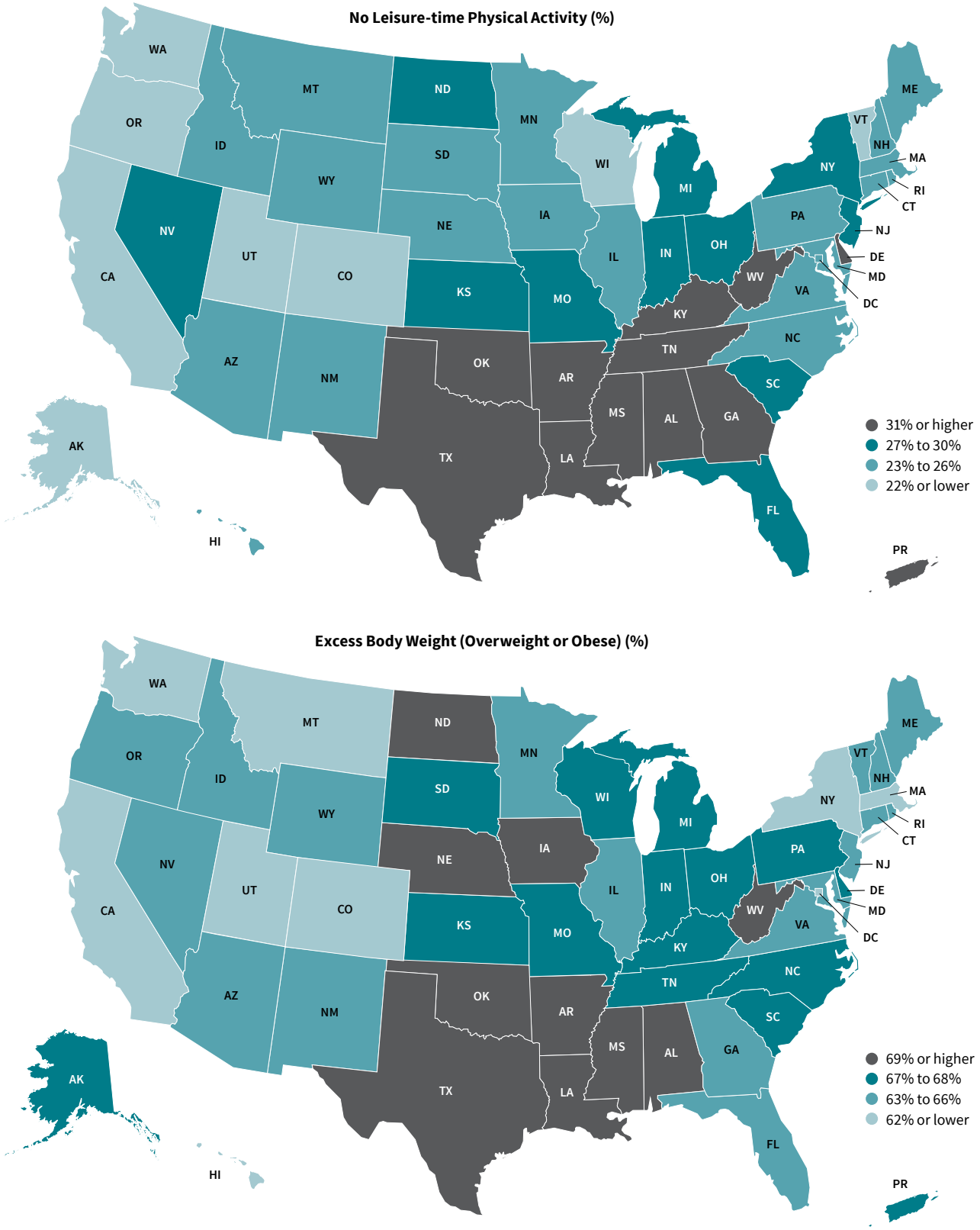
Progress has been made at the federal level on passing and implementing laws to promote healthy eating and active living. Federal government experts recommend a healthy eating plan in the 2015-2020 Dietary Guidelines for Americans and highlight the importance of physical activity in the Physical Activity Guidelines for Americans.[21, 58] These recommendations are generally similar to the American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention.[1] The Food and Drug Administration (FDA) has also finalized a rule to modify the Nutrition Facts label to more prominently present caloric and portion size information.

State and Local Action Strategies

There are multiple ways that public and private organizations at the local, state, and national levels can develop and implement policies and allocate or expand resources to facilitate changes that support healthy eating and active living.

- States and school districts can require that students receive recommended amounts of high-quality physical education and implement evidence-based nutrition standards for school meals and snacks.
- Employers can implement worksite health promotion programs but should not tie health insurance premiums to health behaviors or health status.
- At the state and local levels, policy changes can help improve the availability and affordability of fresh vegetables and fruits in poor neighborhoods, as well as create safe spaces that promote physical activity for transportation and recreation.
- Health care professionals can assess weight status and advise and assist their patients on effective weight loss and weight management programs as recommended by the US Preventive Services Task Force.[59]

Figure 2D. No Leisure-time Physical Activity* and Excess Body Weight† (%), Adults 18 Years and Older by State, 2017



*In the past 30 days. †See sidebar, page 16.

Source: Behavioral Risk Factor Surveillance System, 2017.

Initiatives of the American Cancer Society/ American Cancer Society Cancer Action Network

The American Cancer Society and the American Cancer Society Cancer Action Network℠ (ACS CAN), our nonprofit, nonpartisan advocacy affiliate, also have specific initiatives to address excess body weight and physical inactivity by promoting healthy eating and active living. Such initiatives include but are not limited to nutrition and physical activity research and working with communities to help identify and address barriers to healthy eating and active living. ACS CAN also supports well-designed taxes on SSBs as a component of multifaceted efforts to promote healthy eating and active living. Visit fightcancer.org to learn more about ACS CAN's initiatives and to view the most recent edition of *How Do You Measure Up?* – a state-by-state assessment of cancer care and control efforts.

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Ultraviolet Radiation

Most cases of melanoma are caused by exposure to excessive ultraviolet radiation (UVR) from sunlight or tanning devices.[1] Invasive melanoma represents only about 1% of all skin cancer cases but accounts for the majority of skin cancer deaths. Basal cell and squamous cell carcinomas, also referred to as keratinocyte carcinomas (KC), are the most frequently diagnosed and are highly curable forms of skin cancer.[2] The most recent study of KC occurrence estimated that in 2012, 3.3 million people were diagnosed with at least one KC.[3]

The American Cancer Society estimates that 96,480 new cases of invasive melanoma will be diagnosed and 7,230 deaths will occur in 2019.[4] Melanoma most commonly occurs in non-Hispanic whites. Incidence is increasing among adults ages 50 years and older but is stable among those under the age of 50.[4] The 5-year relative survival rate for melanoma is about 92%.

Major risk factors for melanoma include a personal or family history of melanoma and the presence of atypical, large, or numerous (more than 50) moles.[5-7] Heavy UVR exposure, from sunlight or indoor tanning devices, is a risk factor for all types of skin cancer.[8] Skin cancer risk is also increased for individuals with a weakened immune system, as well as those who are sun-sensitive (e.g., sunburn easily or have natural blond or red hair color) and those who have a history of excessive sun exposure (including sunburns) or skin cancer.[9, 10]

Solar UVR Exposure

Everyone is exposed to naturally occurring solar UVR, which is an invisible kind of radiation that can penetrate, change, and damage skin cells. The sensitivity of a person's skin to UVR and the duration and intensity of UVR exposure are important risk factors for skin cancers. The damaging effects of UVR are cumulative over a lifetime.[1] Some studies indicate that excessive sun exposure during childhood poses an especially elevated risk for melanoma and other skin cancers later in life, while others have found excessive sun exposure to be equally harmful, regardless of age.[11-13]

UVR is also a source of vitamin D, which is important for bone health. Vitamin D is naturally present in a few foods (e.g., oily fish, eggs), added to others (e.g., milk, cereal), and available as a dietary supplement.[14] Additional research is underway to improve the understanding of vitamin D levels and their effects on health, including their potential protective association with some cancers.

Artificial UVR Exposure (Indoor Tanning)

The International Agency for Research on Cancer classifies UV-emitting indoor tanning devices as carcinogenic to humans.[15] In the US, more than 410,000 cases of KC and 6,000 cases of melanoma can be attributed to indoor tanning annually.[16] The risk of melanoma is about 60% higher for people who begin using indoor tanning devices before the age of 35, and risk increases with duration and intensity of use.[17, 18]

These devices are promoted by the indoor tanning industry and often used for cosmetic purposes, especially among teenagers and young adults. Evidence suggests that age restrictions may be effective in reducing indoor tanning among high school girls.[19] Some states and localities have passed indoor tanning use laws that restrict the age at which adolescents can use tanning devices and require signage warning about health risks, but there is variation in regulation compliance, enforcement, and impact.[20] At the federal level, the Food and Drug Administration has proposed a rule to prohibit indoor tanning in tanning facilities among adolescents under the age of 18. If this rule were finalized and implemented, an estimated 62,000 melanoma cases would be averted and $343 million in treatment costs would be saved over the lifetime of 61 million youth.[21] This rule would also require all users, regardless of age, to acknowledge that they are aware of the health risks of indoor tanning devices.[22]

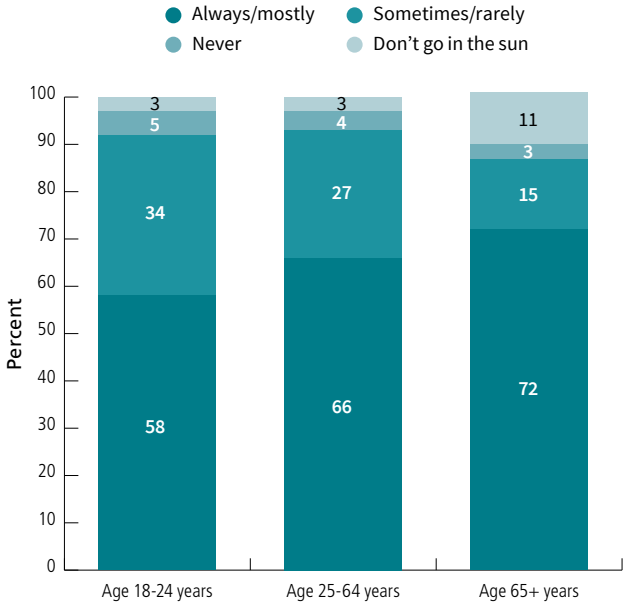
Table 3A. Sunburn and Use of an Indoor Tanning Device* (%), High School Students, US, 2017

	Males	Females	Overall
Sunburn			
Overall	**53**	**62**	**57**
Race/Ethnicity			
White	71	79	75
Black	10	16	13
Hispanic	40	50	45
American Indian/Alaska Native	–	–	–
Asian	32	39	36
Indoor tanning device			
Overall	**4**	**8**	**6**
Race/Ethnicity			
White	3	10	7
Black	7	4	6
Hispanic	3	3	3
American Indian/Alaska Native	–	–	12
Asian	3	3	3

*At least once in the past 12 months.

Source: High School Youth Risk Behavior Survey, 2017.[26]

Figure 3A. Sun Protective Behaviors* (%), Adults 18 Years and Older, US, 2015



*At least one of the following: wear wide-brimmed hat, long pants, long-sleeve shirt, sunscreen (SPF 30+); or seek the shade.

Source: National Health Interview Survey, 2015.

UVR Exposure and Protective Behaviors

UVR damage to skin can be minimized by avoiding tanning devices, timing outdoor activities when UVR is less intense, wearing protective clothing, seeking shade, and applying adequate amounts of sunscreen to exposed skin. Visit cancer.org/healthy/be-safe-in-sun/ for additional information.

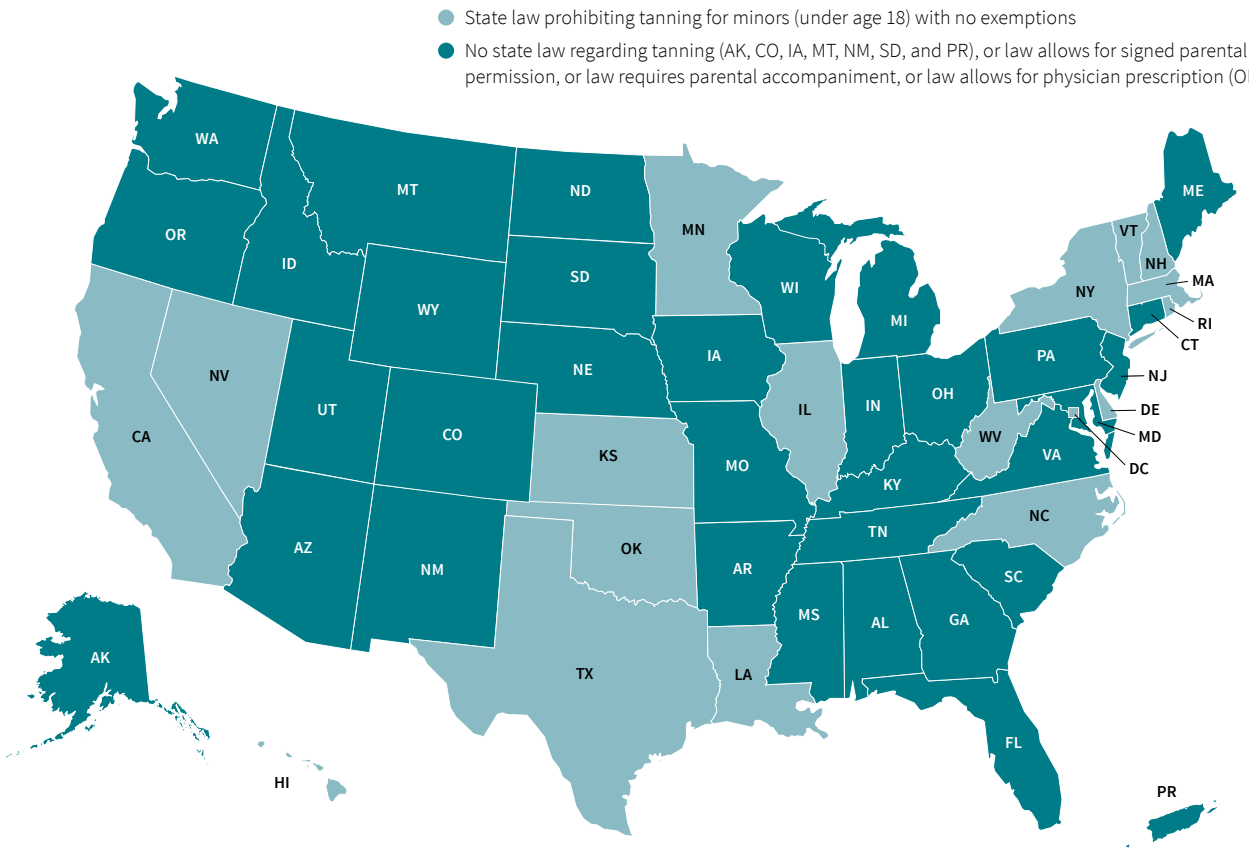
Adult UVR Exposure and Sun Protective Behaviors

- Among adults, the prevalence of using an indoor tanning device in the past year declined from 6% in 2010 to 4% in 2015.[23]
- In 2015, indoor tanning use was higher among women (6%, men: 2%), younger adults (ages 18-29 years: 6%, ages 50-64 years: 3%, ages 65+ years: <1%) and among those living in the Midwest (5%) than other regions (2-4%).[24]
- Although indoor tanning use has declined in recent years, in 2015, about 1 in 5 white women ages 18-21 years reported using an indoor tanning device in the previous year.[23]
- About one-third of adults in 2015 reported having had a sunburn in the past year; prevalence of sunburn was highest among younger adults ages 18-39 years (44%-47%) and whites (43%).[25]
- In 2015, about 40% of adults ages 18-24 years inconsistently (sometimes, rarely, or never) practiced sun protective behaviors when outside on a sunny day for more than an hour compared to 18% of those ages 65 years and older (Figure 3A).

Youth UVR Exposure and Sun Protective Behaviors

- The prevalence of indoor tanning use among high school students declined from 25% in 2009[26] to 8% in 2017 among girls and from 7% to 4% among boys (Table 3A).
- During 2009-2015, indoor tanning use was lower among high school girls residing in states with an age restriction for indoor tanning (7%) compared to those in states with parental permission (20%) or no restriction (25%).[19]

Figure 3B. State Indoor Tanning Restrictions for Minors, 2019



Note: There is no medical indication for the use of a tanning device in the diagnosis or treatment of a disease. Reported as of January 1, 2019.

Source: American Cancer Society Cancer Action Network, Inc., 2019.

- As of January 1, 2019, only 17 states and the District of Columbia had a law prohibiting tanning for minors (under the age of 18) without exemptions (Figure 3B).
- Among high school students surveyed in 2017, 57% (girls: 62%, boys: 53%) reported having had a sunburn in the past year (Table 3A).
- According to the most recent data available, in 2013, 10% of high school students reported using sunscreen (SPF 15+) always or most of the time when outside for more than one hour on a sunny day.[27]

Prevention Strategies in Skin Cancer

To address the growing public health burden of UVR and skin cancer, the US surgeon general released a Call to Action to Prevent Skin Cancer in 2014 to strengthen preventive strategies to reduce skin cancer incidence and mortality.[28] The call to action set forth five overarching goals:

- Increase opportunities for sun protection in outdoor settings.
- Provide individuals with the information they need to make informed, healthy choices about UVR exposure.
- Promote policies that advance the national goal of preventing skin cancer.
- Reduce harms from indoor tanning.
- Strengthen research, surveillance, monitoring, and evaluation related to skin cancer prevention.

Skin Cancer Prevention Initiatives

Since 2008, the American Cancer Society has collaborated with the National Council on Skin Cancer Prevention (NCSCP) to coordinate prevention activities and improve media relation efforts that promote and raise awareness about the importance of skin cancer prevention. In addition, the NCSCP has aggregated several sun safety resources targeting a variety of audiences such as health professionals, media, outdoor workers, parents, parks and recreation staff, policy makers, educators, and teenagers. Visit skincancerprevention.org to access these materials and to learn more about the initiatives listed below.

Don't Fry Day: The NCSCP and its collaborators have designated the Friday before Memorial Day as Don't Fry Day. This pre-Memorial Day awareness initiative uses key messages to ensure consistent communication about the individual steps people can take to prevent skin cancer.

Indoor Tan-Free Skin Smart Campus: The Indoor Tan-Free Skin Smart Campus initiative, sponsored by the NCSCP, was launched in 2016 in response to the 2014 US Surgeon General's Call to Action to Prevent Skin Cancer. The initiative recognizes US universities and colleges that promote skin cancer prevention policies and education on campus.

To help reach these goals, communities can increase shade in outdoor recreational settings by planting trees or building structures in frequently used areas. Additionally, skin cancer prevention can be included in school curricula, and implementing specific workplace policies can help reduce skin cancer by limiting or reducing UVR exposure while on the job. Better enforcement of existing laws that prohibit indoor tanning among minors would also help reduce use of indoor tanning.[28] One study estimated that about 230,000 melanoma cases could be averted from 2020 to 2030 if a nationwide comprehensive skin cancer prevention program were implemented.[29] To promote individual sun protective behaviors, the American Cancer Society supports several campaigns and initiatives (see sidebar above).

Health care professionals also play an important role in educating their patients on the importance of skin cancer prevention. In March 2018, the US Preventive Services Task Force (USPSTF) published updated recommendations stating that to reduce skin cancer risk, young adults, adolescents, children, and parents of young children should be counseled about minimizing UVR exposure among those ages 6 months to 24 years with fair skin types.[30] Social norms about tanned skin appearing healthy and attractive present barriers to sun protective behaviors. Therefore, another important approach to promoting individual protection against UVR exposure focuses on appearance, emphasizing the harms of sun exposure (i.e., age spots and wrinkles) to physical appearance and increasing the perceived attractiveness of untanned skin.[28, 31]

Early Detection of Skin Cancer

Early detection of skin cancer may include an inspection by a clinician and/or self-examination. The American Cancer Society does not have a guideline on the early detection of skin cancer because there is uncertainty about whether routine skin examinations reduce skin cancer mortality. In 2016, the USPSTF concluded that there was insufficient evidence to recommend for or against visual skin examination by a clinician for people at average risk and without symptoms.[32] The American Academy of Dermatology supports skin self-examinations for individuals with red or blond hair, blue or green eyes, or fair skin given their increased risk for skin cancer.[33] In 2015, about 1 in 5 adults reported having had a total body skin examination by a clinician at least once in their lifetime, with a greater proportion among adults with higher-risk profiles.[24, 34] Anyone with new, suspicious growths or anything changing, itching, or bleeding on the skin should be evaluated promptly by a physician. The ABCDE rule can serve as a helpful guide for the warning signs of the most common types of melanoma (see sidebar, page 31).

Visit cancer.org/cancer/skin-cancer/prevention-and-early-detection for guidance on how to perform a skin self-exam in addition to general information about skin cancer prevention. Visit fightcancer.org to learn more about skin cancer initiatives and to view the most recent edition of *How Do You Measure Up?* – a state-by-state assessment of cancer care and control efforts.

ABCDE Rule: Warning Signs of Melanoma

Asymmetry – One-half of the mole does not match the other half.

Border irregularity – Edges of the mole are ragged, notched, or blurred.

Color – Pigmentation of the mole is not uniform. For example, different shades of tan, brown, or black are often present; dashes of red, white, and blue can add to the spotted appearance.

Diameter – Melanomas usually are >6mm in diameter, but they can be smaller.

Evolving – A particular mole looks different than the others or is changing in size, shape, or color.

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Infectious Agents

There are several infectious agents known to cause cancer, such as the human papillomavirus, *Helicobacter pylori*, the hepatitis B virus, and the hepatitis C virus. In the US, about 3% of all cancers are attributable to infections, accounting for an estimated 51,440 cases in 2014.[1] Fortunately, there are opportunities to prevent and treat many of these infections.

Human Papillomavirus

Human papillomavirus (HPV) infection is very common, but usually is cleared by the body and does not cause cancer. However, persistent HPV infection causes almost all cervical cancers, 90% of anal cancers and 60%-70% of oropharyngeal, vaginal, vulvar, and penile cancers.[2] Cervical cancer is the most common HPV-related cancer in women, and oropharyngeal cancer is the most common in men.[3] Incidence rates for several HPV-related cancers, including oropharyngeal, anal, and vulvar, have increased in recent years; but, the overall cervical cancer incidence rate continues to decline because of widespread screening that can prevent this cancer.[3] HPV vaccination may also be contributing to the decrease in cervical cancer incidence among young women in the US.[4] The Centers for Disease Control and Prevention (CDC) estimates that 14 million Americans are newly infected annually with genital HPV.[5] The virus is spread primarily through direct sexual contact and is usually asymptomatic.

There are more than 100 types of HPV, and only about 13 of which are known to cause cancer. The HPV vaccine currently used in the US protects against 9 HPV types and has the potential to avert 90% of HPV-related cancers.[2]

The American Cancer Society's 2017 HPV vaccination guidelines recommend routine vaccination of both girls and boys beginning at age 11 or 12; the series can be started at age 9 (see sidebar, page 33).[6] For persons initiating vaccination before their 15th birthday, the recommended immunization schedule consists of two doses. For those initiating the HPV vaccine on or after their 15th birthday, a three-dose series is recommended, in accordance with the Advisory Committee on Immunization Practices (ACIP) recommendation.[7] Vaccination does not prevent established infections from progressing to precancer or cancer and does not prevent infection of all HPV types; therefore, women should receive appropriate cervical cancer screening (see page 48).

The promise of preventing multiple types of HPV-related cancers will be fully realized only if high coverage with HPV vaccine is achieved in adolescents. Recommended strategies for increasing rates of HPV vaccination in the US focus on improving provider recommendation, parental awareness, and access to vaccination in medical and non-medical settings (e.g., schools, pharmacies, health departments).[8, 9] Research has shown that there are many missed opportunities within the health care system for children to be vaccinated.[10] Proven strategies to improve vaccination coverage include reminder-recall systems and removal of administrative and financial barriers.[11] In the US, the HPV vaccine costs approximately $170-$200 per dose, excluding the cost of administering the injections and provider charges.[12] The Affordable Care Act (ACA) requires private insurance plans to cover HPV vaccination without cost sharing for eligible children, adolescents, and adults.[13] Furthermore,

American Cancer Society Recommendations for HPV Vaccine Use

- Routine HPV vaccination for girls and boys should be started at age 11 or 12. The vaccination series can be started at age 9.
- HPV vaccination is also recommended for females ages 13-26 years and for males ages 13-21 years who have not started the vaccines, or who have started but not completed the series. Males ages 22-26 years may also be vaccinated.*
- HPV vaccination is also recommended through age 26 for men who have sex with men and for people with weakened immune systems (including people with HIV infection), if they have not previously been vaccinated.

**For people ages 22-26 years who have not started the vaccines, or who have started but not completed the series, it is important to know that vaccination at older ages is less effective in lowering cancer risk.*

the federal Vaccines for Children program covers vaccine costs for children and teens who meet certain eligibility requirements (i.e., uninsured, underinsured, eligible for Medicaid, or of American Indian/Alaska Native descent).[14]

HPV Prevalence and Vaccination in the US

- In 2011-2014, an estimated 4% of adults had high-risk oral HPV and 23% had high-risk genital HPV infection. Prevalence of HPV infection was higher among men (oral: 7%, genital: 25%) than women (oral: 1%, genital: 20%).[15]
- High-risk oral HPV among adults was lower in Asians (1%) than whites (4%), blacks (4%), and Hispanics (3%). High-risk genital HPV prevalence ranged from 12% in Asians to 22% in whites and Hispanics to 34% in blacks.[15]
- The uptake of HPV vaccination is increasing among youth, though utilization still lags behind other recommended vaccines.[16]
- In 2017, 58% of girls and 51% of boys initiated (at least one dose) the HPV vaccine and 42% and 31%, respectively, received both doses before their 13th birthday (Table 4A).

The National HPV Vaccination Roundtable

The National HPV Vaccination Roundtable is a coalition of organizations working together nationwide to prevent HPV-associated cancers and precancers by increasing and sustaining HPV vaccination in the US. The HPV Roundtable strives to achieve this objective by:

- Promoting the use of evidence-based strategies to increase HPV vaccination
- Increasing the use of tools that facilitate effective provider recommendations for HPV vaccination with a focus on girls and boys ages 11-12 years
- Decreasing missed opportunities for administration of the HPV vaccine
- Increasing HPV vaccination rates over time, including rates of series completion by age 13
- Decreasing the gap between female and male HPV vaccination rates

To overcome barriers to HPV vaccination, the HPV Roundtable develops and implements projects focusing on providers, parents, systems, policies, and health disparities. Visit hpvroundtable.org for more information.

National HPV Vaccination **Roundtable**

- In 2017, 69% of girls and 63% of boys ages 13-17 years had initiated the HPV vaccine. The prevalence of up-to-date vaccination was markedly lower at 53% among girls and 44% among boys (Table 4A).
- Among girls ages 13-17 years, up-to-date HPV vaccination was lowest in whites (50%) and highest in Asians (60%). Among boys, vaccination was also lowest in whites (40%) but highest in Hispanics (55%) (Table 4A).
- Overall, up-to-date HPV vaccination ranged from 29% in Mississippi to 78% in the District of Columbia and Rhode Island (Figure 4A, Table 4B).
- In 2016, among adult women and men ages 19-26 years, 50% and 14%, respectively, reported ever having received at least one dose of HPV vaccine.[17]

Table 4A. Vaccination Coverage (%), Youth by Sex, Race/Ethnicity, and Poverty Status, US, 2017

	Before 13th birthday				13-17 years		
	HPV				HPV		Hepatitis B
	Females		Males		Females	Males	Overall
	Initiation	Up-to-Date*	Initiation	Up-to-Date*	Up-to-Date*	Up-to-Date*	≥ 3 doses
Overall	**58**	**42**	**51**	**31**	**53**	**44**	**92**
Race/Ethnicity							
White	49	35	46	30	50	40	92
Black	69	41	47	28	56	45	92
Hispanic	66	50	58	33	58	55	92
American Indian/Alaska Native	–	–	–	–	53	46	82
Asian	–	–	–	–	60	44	89
Poverty Status							
Below poverty level	72	49	56	36	58	50	90
At or above poverty level	54	40	47	29	52	42	93

*According to recommendations (see sidebar on page 33 and sources for more information).

Source: Walker TY et al, 2018.[16] TeenVaxView, 2018.[51] National Immunization Survey-Teen, 2017.

Initiative to Increase HPV Vaccination Coverage

In 2014, the American Cancer Society and the CDC established the National HPV Vaccination Roundtable to improve HPV vaccine uptake (see sidebar, page 33). Additionally, the CDC provided the American Cancer Society with funding to develop the HPV VACs (Vaccinate Adolescents against Cancers) Project, which focuses on expanding interventions in federally qualified health care centers and hospital systems to increase HPV vaccination. In addition, the American Cancer Society is collaborating with state health departments and other state-based entities to facilitate changes in the health system to increase the availability and utilization of the vaccine. The CDC established the Vaccines for Preteens and Teens communication campaign to educate parents and clinicians about immunizations recommended for adolescents,[18] and, in 2018, the American Cancer Society launched its *Mission: HPV Cancer Free* public health campaign. See cancer.org/hpv for more information.

Helicobacter Pylori

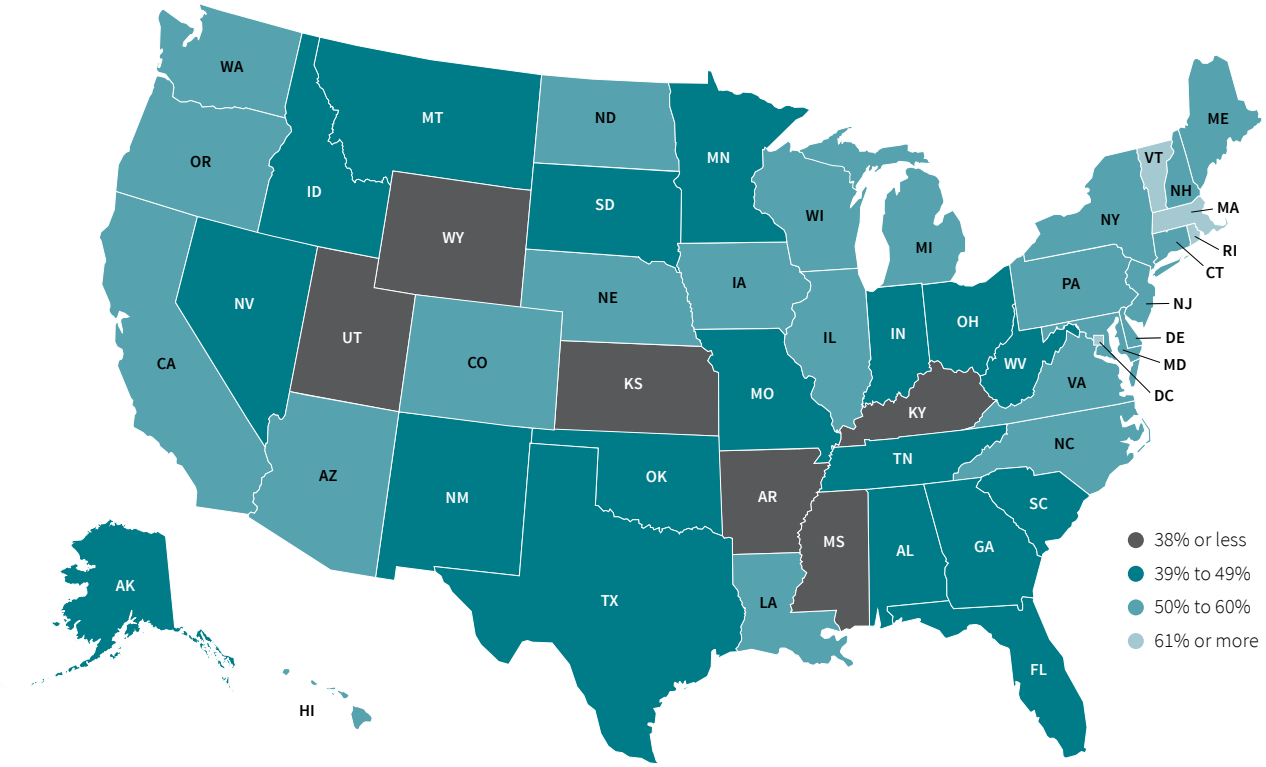
Chronic infection with *Helicobacter pylori (H. pylori)*, a bacterium that grows in and causes damage to the stomach lining, may lead to stomach cancer and gastric lymphoma.[19, 20] In the US, about 65% of non-cardia gastric cancers (cancers in the lower part of the stomach) and 31% of all stomach cancers are attributable to *H. pylori* infection.[1]

Approximately one-half of the world's population is infected with *H. pylori*, but most people are unaware because they do not experience symptoms and will not develop stomach cancer.[21] *H. pylori* is thought to be transmitted from person to person through fecal-oral and oral-oral routes and is facilitated by crowded living conditions and relatively poor sanitation. There are several treatment options that are relatively inexpensive and effectively eliminate the bacteria, such as antibiotics, which may also reduce the risk of gastric cancer.[22] It is recommended that countries with relatively high gastric cancer incidence (including China, Japan, and several South American and Central Asian countries) incorporate *H. pylori* screening and treatment into their cancer control programs.[23] However, there is no recommendation to screen asymptomatic people in the US because of the relatively low gastric cancer risk.

H. Pylori in the US

- About one-third of the US population is infected with *H. pylori*.[1, 21]

Figure 4A. Up-to-date* Human Papillomavirus Vaccination (%), Adolescents 13 to 17 Years by State, 2017



*According to recommendations (see sidebar on page 33 and sources for more information). Note: Data for Puerto Rico not available.

Source: Walker TY et al, 2018.[16] TeenVaxView, 2018.[51]

- *H. pylori* prevalence is two to three times higher among Mexican Americans and blacks, compared to whites; prevalence is also greater among those who recently immigrated to the US.[24, 25]
- *H. pylori* prevalence is five to nine times higher in adults over the age of 50 compared to adults in their 20s.[25]

Hepatitis B Virus

Chronic infection with the hepatitis B virus (HBV) can cause liver cancer and is increasingly recognized as a risk factor for non-Hodgkin lymphoma.[26, 27] In the US, about 7% of all liver cancers are attributable to HBV.[1] The virus is transmitted through blood or mucosal contact with infectious blood or body fluids (e.g., semen, saliva). Most new HBV infections occur in unvaccinated adults who practice risky behaviors (e.g., injection drug users, men who have unprotected sex with men, and adults who have numerous sex partners).[28] About 95% of newly infected adults will clear the virus within six months of infection, whereas the majority of infected infants will become chronically infected.[29]

Vaccination against HBV has been available since 1982 and is the primary prevention strategy. In 1991, the CDC outlined a nationwide strategy aimed at reducing HBV, which included a three-dose HBV vaccination series for children.[28] Most HBV vaccines are given during infancy, but the CDC also recommends that youth under the age of 19 who have not been vaccinated and unvaccinated adults who are at high risk for infection (e.g., health care workers, travelers to regions with HBV) receive the vaccine.[28] There are several drugs that effectively treat HBV; if infection progresses to liver disease, liver transplantation is also a treatment option.

Table 4B. Vaccination Coverage (%), Adolescents 13 to 17 Years by State, 2017

	Human Papillomavirus						Hepatitis B
	Females		Males		Overall		Overall
	≥ 1 dose	Up-to-Date*	≥ 1 dose	Up-to-Date*	Up-to-Date*		≥ 3 doses
United States	**69**	**53**	**63**	**44**	**49**	**Rank**	**92**
Range	50-92	34-79	44-92	23-78	29-78	(1=low)	85-96
Alabama	61	47	55	34	40	8	92
Alaska	61	46	68	40	43	14	91
Arizona	69	58	61	48	53	29	89
Arkansas	67	47	56	24	35	4	93
California	76	61	68	46	53	29	90
Colorado	74	53	70	54	54	34	89
Connecticut	75	64	67	53	58	41	95
Delaware	76	60	75	57	58	41	94
District of Columbia	92	79	92	77	78	50	87
Florida	62	45	57	39	42	13	96
Georgia	65	45	64	46	46	19	96
Hawaii	79	63	61	47	55	38	91
Idaho	68	52	57	37	44	16	90
Illinois	62	49	70	52	50	25	94
Indiana	68	48	51	34	41	11	96
Iowa	80	66	63	43	54	34	96
Kansas	55	39	50	30	34	3	90
Kentucky	55	45	44	31	38	6	93
Louisiana	74	64	65	42	53	29	95
Maine	80	62	72	57	59	45	94
Maryland	73	58	65	48	53	29	91
Massachusetts	85	67	79	64	66	49	95
Michigan	71	60	64	49	54	34	96
Minnesota	66	49	70	45	47	20	96
Mississippi	56	34	44	23	29	1	95
Missouri	63	45	53	34	40	8	88
Montana	65	50	66	48	49	23	93
Nebraska	72	61	70	55	58	41	96
Nevada	71	53	59	45	49	23	91
New Hampshire	75	63	73	57	60	47	95
New Jersey	72	54	60	46	50	25	91
New Mexico	74	55	60	42	48	22	86
New York	71	58	66	49	54	34	94
North Carolina	67	50	67	54	52	27	91
North Dakota	75	63	70	53	58	41	92
Ohio	70	55	59	39	47	20	95
Oklahoma	56	46	61	38	41	11	90
Oregon	70	55	72	54	55	38	90
Pennsylvania	69	56	66	49	53	29	95
Rhode Island	89	77	89	78	78	50	96
South Carolina	60	47	59	38	43	14	92
South Dakota	68	49	59	41	45	18	93
Tennessee	63	48	50	31	39	7	91
Texas	60	44	55	36	40	8	85
Utah	63	42	55	33	37	5	88
Vermont	84	69	74	61	65	48	92
Virginia	83	68	69	50	59	45	94
Washington	73	57	71	54	55	38	90
West Virginia	68	49	55	39	44	16	85
Wisconsin	74	56	65	49	52	27	95
Wyoming	50	34	44	28	31	2	93
Puerto Rico	–	–	–	–	–	–	–

*According to recommendations (see sidebar on page 33 and Survey Sources (page 59) for more information).

Source: Walker TY et al, 2018.[17] TeenVaxView, 2018.[51]

HBV Prevalence and Vaccination in the US

- The overall prevalence of chronic HBV infection in the US has remained unchanged since 1999 (0.3%). Approximately 850,000 to 2.2 million people are living with chronic HBV infection in the US.[30, 31]
- In 2007-2012, 3% of Asians had chronic HBV infection compared to an estimated <0.1% of whites and Mexican Americans.[30]
- HBV infection prevalence is generally higher in foreign-born Americans, particularly among those born in Asia.[30, 31] In addition, HBV vaccination coverage is lower among foreign-born adolescents than their US-born counterparts.[32]
- In 2017, 92% of adolescents (ages 13-17 years) had received at least three HBV vaccine doses; vaccination was lowest among American Indians/ Alaska Natives (82%) and highest among whites, blacks, and Hispanics (92%) (Table 4A).
- By state, adolescent HBV vaccination coverage in 2017 ranged from 85% in Texas and West Virginia to 96% in Florida, Georgia, Indiana, Iowa, Michigan, Minnesota, Nebraska, and Rhode Island (Table 4B).

Hepatitis C Virus

Chronic infection with the hepatitis C virus (HCV) can cause liver cancer, and has also been shown to increase the risk of non-Hodgkin lymphoma.[26, 33] Liver cancer incidence and mortality rates have increased rapidly in the US 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.[34, 35] Nearly one-quarter of liver cancers in the US are attributable to HCV infection.[1]

Most HCV is spread through injection drug use. Less common routes of transmission include needle stick injuries in health care settings, mother-to-child transmission during birth, and sexual contact with an infected individual. Prior to 1992, HCV was also transmitted through blood infusion and organ transplants, but since then, donated blood and tissues have been screened for the virus. Most people with HCV will become chronically infected, regardless of age at infection, and are unaware of their infection until liver disease develops.

In contrast to HBV infection, there is no vaccine to protect against HCV infection. Primary prevention strategies include both educating uninfected individuals who are at high risk for infection about exposure prevention and counseling infected individuals about how to avoid transmission to others.

In 2013, the US Preventive Services Task Force updated its HCV guidelines, recommending one-time screening among men and women born between 1945 and 1965 because people born during this time period represent the majority of HCV infections and deaths in the US.[36] Those who test positive for HCV are advised to begin antiviral treatment, which is very effective at eliminating HCV infection, but is also very expensive.[36]

HCV Prevalence and Testing in the US

- The incidence of acute HCV infection, which will become chronic in 75%-85% of those infected, was steady between 2005-2010, but tripled between 2010 and 2016 in both men and women.[29]
- In the US, approximately 3.5 million persons are living with chronic HCV infection.[37]
- In 2010, the estimated prevalence of HCV infection nationwide was about 2%, but varied across states from <1% in Illinois, North Dakota, Utah, and Wisconsin to about 3% in Oklahoma, Oregon, and the District of Columbia.[38]
- HCV infection is more common among men, blacks, and those with lower socioeconomic status.[39]
- The prevalence of HCV infection is particularly high in certain groups, including the homeless (22%-53%), the incarcerated (23%-41%), and veterans (5%-11%).[40]
- In 2015, approximately 14% of adults (men: 15%, women: 12%) born between 1945 and 1965 had ever been tested for HCV.[41] Testing was least common among people who were uninsured (11%), Hispanic (11%), and did not have a high school degree (11%).[41]

Human Immunodeficiency Virus

The human immunodeficiency virus (HIV) may be present in the body for a long period of time without resulting in symptoms; however, as HIV progresses, the immune system is weakened, and acquired immunodeficiency syndrome (AIDS) develops. HIV is primarily transmitted through sexual intercourse, especially in men who have sex with men, and injection drug use, though other infection routes are possible. There are several AIDS-defining cancers, meaning that their occurrence in an HIV-infected individual indicates that the infection has progressed to AIDS. They include Kaposi sarcoma, high-grade non-Hodgkin lymphoma (NHL), and cervical cancer.[42] HIV-infected individuals are at an increased risk of developing other cancers, often referred to as non-AIDS-defining cancers, including Hodgkin lymphoma, some head and neck cancers, anal cancer, and liver cancer. The weakened immune system, along with shared routes of transmission with other cancer-causing infectious agents (e.g., HPV, HCV), increases the risk of cancers in this population.[43] Moreover, people infected with HIV also have higher rates of lung cancer, which is thought to be related to higher smoking prevalence as well as immunosuppression.[44] Approximately 77%, 11%, 8%, 5%, and <1% of Kaposi sarcoma, anal cancer, non-Hodgkin and Hodgkin lymphomas, and cervical cancers in the US are attributed to HIV infection.[1]

There are several primary prevention strategies for HIV, such as safe sex practices and the use of sterile needles. There is no vaccine against HIV, but prophylaxis is available for those at risk for the disease. Among those infected with HIV, effective antiretroviral medications can suppress virus replication and boost the immune system, but these medication regimens must be taken throughout life. Furthermore, HIV-infected individuals are recommended to receive tailored screenings for certain cancers. Visit cdc.gov/hiv for more information.

HIV Prevalence and Trends in the US

- Overall, HIV incidence declined between 2011-2015, but has increased in some groups including those ages 25-29 years, American Indians/Alaska Natives, and Asians.[45]
- However, since the mid-1990s, the number of people living with HIV infection has increased due to improvements in survival.[45, 46] As a result, there is an increased cumulative incidence and burden of cancer among persons living with HIV.[46]
- 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.[45]
- HIV infection is seven times higher in blacks and 2.5 times higher in Hispanics compared to whites.[45]
- HIV prevalence is higher in urban than rural areas, as well as in Northeastern than other states. However, the rate of newly acquired HIV is highest in Southern states, especially among men who have sex with men.[45, 47]

Epstein-Barr Virus

The Epstein-Barr virus (EBV) causes Hodgkin lymphoma, some types of nasopharyngeal carcinoma, and non-Hodgkin lymphomas, including Burkitt lymphoma and diffuse large B cell lymphoma.[26] The vast majority of people with EBV do not develop cancer. People who are infected with HIV and immunosuppressed transplant recipients are at an increased risk of EBV-related lymphoma.[43, 48] EBV is very common, infecting more than 90% of the world's adult population. The virus is transmitted through body fluids, primarily saliva. People with EBV may develop mononucleosis or experience flu-like symptoms followed by a period of dormancy. Reactivation of EBV may be the crucial step in the link between EBV and cancer risk.[49] Currently, there are no primary prevention strategies for EBV and no treatments to eradicate the virus.[50]

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Occupational and Environmental Cancer Risk Factors

Carcinogens are substances and exposures that can lead to cancer; they can be synthetic or naturally occurring and will not cause cancer in everyone who is exposed. An individual's risk of cancer is dependent on numerous factors including the intensity and duration of exposure, other risk and biological factors.

The US National Toxicology Program (NTP) and the World Health Organization's International Agency for Research on Cancer (IARC) are the primary agencies that evaluate and classify substances. The NTP's 14th *Report on Carcinogens*, published in 2016, classifies 62 substances that are known to be, and 186 substances as reasonably anticipated to be human carcinogens.[1] The IARC's multidisciplinary scientific review groups have currently classified 120 agents as Group 1 carcinogens (i.e., carcinogenic to humans) and 82 agents as Group 2A carcinogens (i.e., probably carcinogenic to humans).[2] The American Cancer Society does not classify carcinogens but provides summary information for the public (cancer.org/cancer/cancer-causes.html), based on NTP and IARC reviews; the information is updated as needed with research published since the last reviews. The American Cancer Society also funds and manages the Cancer Prevention Studies, which are long-term epidemiological studies that examine the association between many exposures, including some occupational and environmental factors, and cancer risk.[3, 4]

Some cancer-causing exposures, such as tobacco smoke and certain infectious agents, have been detailed in other sections of this publication. This section describes environmental carcinogens found in the air, water, and soil, as well as occupational carcinogens. For more information about specific carcinogens and how they are identified, visit ntp.niehs.nih.gov/pubhealth/roc/index-1.html to see the NTP report and monographs.iarc.fr/ENG/Classification/ to review the IARC report.

Occupational Cancer Risk Factors

Many of the first substances found to be carcinogenic were discovered through observations and studies of workers or work environments. For example, a physician in the late 1700s observed higher incidence of testicular cancer among chimney sweeps and concluded that soot was associated with increased cancer risk. Since this time, additional exposures have been more formally examined through scientific studies comparing cancer occurrence among workers exposed to a potential carcinogen with that in the general population. Workers are often exposed to certain substances at higher levels and over a longer period of time than the general public, conferring greater cancer risk.

In 2017, 47 of the 120 IARC's Group 1 carcinogens were classified as occupational, meaning contact typically occurs in a workplace setting, up from 28 in 2004, a trend that has been attributed to a growing body of research on occupational agents.[5] Occupational exposures are known to cause many types of cancer, though the most common occupational-related cancers are those of the lung, skin, bone, and urinary bladder, as well as mesothelioma and leukemia.[5, 6] Examples of occupational exposures and the cancers they cause include: diesel engine exhaust among workers in the trucking, mining, and railroad industries,[7] and lung and possibly bladder cancers; coal tar products used in roofing and paving, and lung and skin cancers; leather dust exposure from the manufacturing and repair of leather footwear, and nasal cavity and paranasal sinus cancers.[5, 6] Certain working conditions may also contribute to cancer risk. Outdoor workers with prolonged exposure to ultraviolet radiation have a higher risk for melanoma. Mounting evidence suggests a positive association between long-term night-shift work and breast, gastrointestinal, and skin cancers in women, though there was not sufficient evidence to classify it as a carcinogen in humans in the most recent IARC monograph, published in 2007.[8, 9]

Some carcinogens are now more tightly regulated than in the past, leading to declines in present-day exposure. One example is asbestos, a mineral fiber that causes cancers of the lung, larynx, ovary, peritoneum, and pleura.[10] Beginning in the late 1800s, it was used in fire protection and insulation products in the US.[10, 11] Its use increased following World War II, peaked in the mid-1970s, then declined due to concerns over its harmful impacts on health and was classified as a carcinogen in 1980.[11] While asbestos is rarely produced and consumed in the US today, it may exist in buildings constructed prior to modern regulations and is still regularly produced in other countries. Notably, like many other environmental carcinogens, asbestos-related cancer can occur many decades after exposures have ceased.

Despite dozens of identified occupation-related carcinogens, there are also many substances or working conditions whose impact on cancer and other outcomes are not fully known.[12] Continued study of exposures in the midst of changing technology and standards are needed to inform workplace laws set forth by the Occupational Safety and Health Administration, the US agency primarily responsible for worker safety, as well as other federal regulatory agencies. Several large, ongoing cohort studies of workers exposed to potential and known carcinogens are being conducted by the National Cancer Institute (NCI), a government cancer research institution, and the National Institute for Occupational Safety and Health (NIOSH), the governmental institution responsible for ensuring workplace safety and health. As new substances are identified as carcinogenic, it will be important to put protections in place to maintain worker safety.

For more information regarding:

- Occupation/industry and cancer research: cdc.gov/niosh/topics/cancer/default.html
- Workplace standards and carcinogens: osha.gov/SLTC/carcinogens/index.html

Environmental Cancer Risk Factors

There are also carcinogenic substances in the air, water, and soil. The risk of cancer associated with these types of exposures in typically small, though if the exposure is widespread, the impact on a population can be considerable. Socioeconomically deprived communities are disproportionately affected by exposure to environmental carcinogens, contributing to disparities in the cancer burden across the US. This section highlights a few carcinogens that people might be exposed to

outside the workplace. Visit cancer.org for more information on these and other carcinogens.

Ionizing Radiation

Ionizing radiation is causally linked to several solid tumors and leukemia.[13] Everyone is exposed to some level of ionizing radiation, defined as a particle or electromagnetic wave strong enough to penetrate human skin and remove electrons from atoms. It is naturally present in cosmic rays and radon (discussed in further detail below) and is generated synthetically, such as in medical radiation. Additionally, atomic bombs (e.g, those dropped on Hiroshima and Nagasaki in World War II), nuclear weapons testing, and nuclear power accidents may be sources of synthetic radiation exposure in certain populations.

Background or natural radiation varies by altitude and latitude and on average, currently accounts for about half of all radiation exposure in the US. The other half comes from medical sources, up from 15% in the 1980s.[14] The increase in exposure to medical radiation is mostly attributed to the growing use of computerized tomography (CT) scans, a type of x-ray used to diagnose and screen for an array of diseases and injuries.[15] Therapeutic radiation used to treat medical conditions, such as certain nerve disorders and some cancers, may increase cancer risk, although the benefits of this treatment generally far exceed the harms. For example, breast cancer patients refusing radiation therapy have been shown to have poorer outcomes than those receiving guideline-recommended treatment.[16]

Efforts have been established to mitigate overuse of medical radiation, and various public health groups, including the American Cancer Society and the US Preventive Services Task Force, balance the benefits-to-risks when recommending the age to begin and frequency of cancer screening tests (e.g., low-dose CT scans for lung cancer screening and mammography screening for breast cancer) in adults. Youth are more sensitive to radiation than adults, and it is advised that x-rays, including CT scans, only be used when medically necessary. Medical workers (e.g., radiation technicians) should have their radiation levels regularly monitored because cancer risk increases with degree of exposure.

Radon

Radon is a form of ionizing radiation that is of particular concern because it accounts for most naturally occurring radiation exposure and is estimated to be the second-leading cause of lung cancer death in the US, accounting for about 20,000 lung cancer cases annually.[17] While radon-related lung cancers occur in both nonsmokers and smokers, approximately 85% develop in smokers due to the synergistic effect that radon and tobacco smoke have on lung cancer risk.[18]

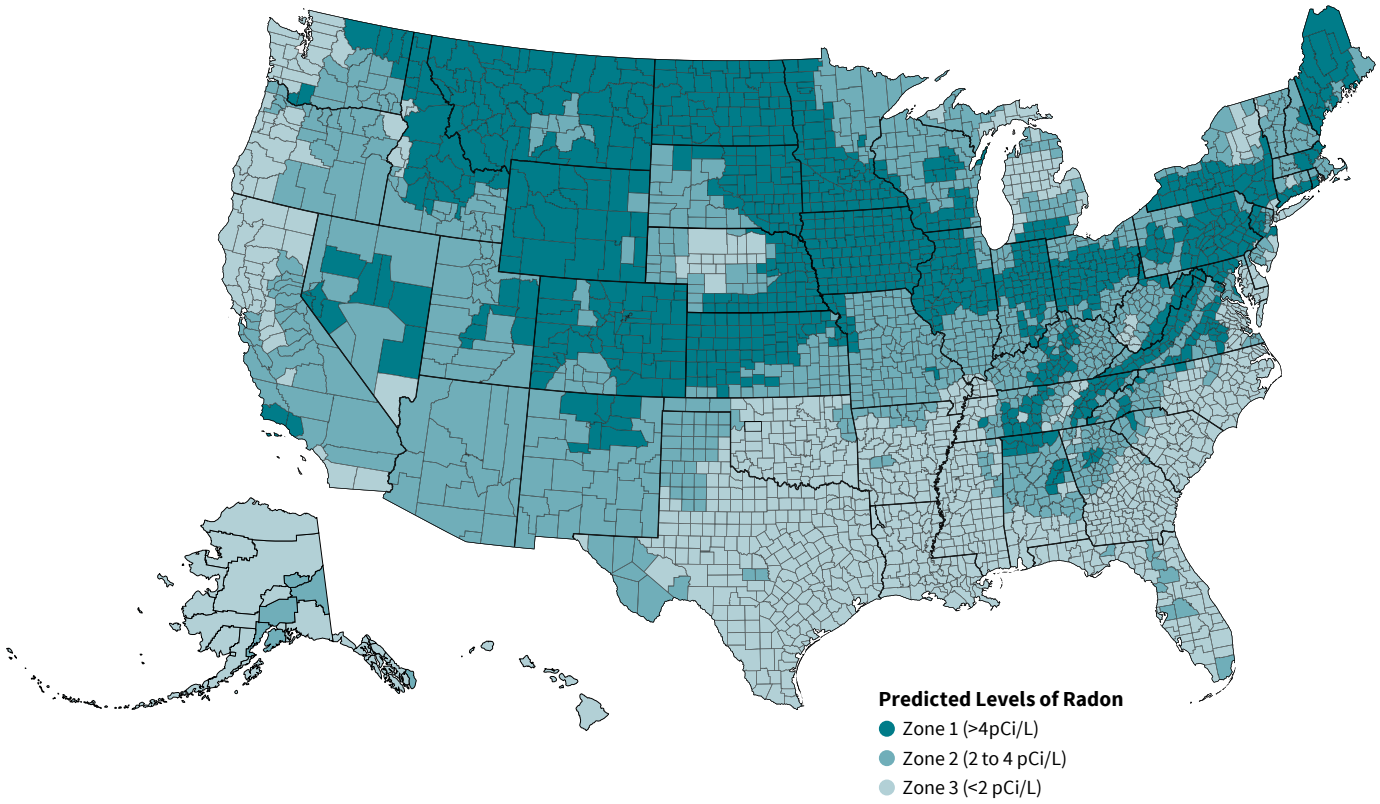
Radon is a colorless and odorless gas that occurs from the breakdown of radioactive elements, including uranium, an element in the Earth's crust. Virtually everyone is exposed to some level of radon; however, long-term and elevated exposure is of concern due to its negative impact on health. People are typically exposed to elevated levels by inhaling indoor air where radon gas has been trapped. This may occur in tightly sealed buildings or residences constructed in areas with relatively high levels of naturally occurring radon. Predicted radon levels vary widely by geographic location (Figure 5A). The Environmental Protection Agency (EPA) recommends that homeowners test for radon; for those with measured levels exceeding 4 pCi/L, remediation to reduce exposure is recommended. Visit the EPA's Consumer's Guide to Radon Reduction at epa.gov/radon/consumers-guide-radon-reduction-how-fix-your-home for more information on residential radon exposure.

Arsenic

Arsenic is classified as a carcinogen by the IARC based on its causal association with bladder, lung, and skin cancer.[19] It is a natural element found in rocks, soil, water, air, and plants and is also found in synthetic products including pressure-treated wood, cigarette smoke, and pesticides. Inorganic arsenic (unbound to carbon) is more toxic than organic arsenic (bonded to carbon) and has been the focus of most studies on cancer.

The general population is primarily exposed to arsenic by drinking water from aquifers with naturally high levels of inorganic arsenic and to a lesser extent, food, air, and tobacco smoke. The EPA regulates municipal water sources and in 2006, reduced the maximum contaminate

Figure 5A. Predicted Levels of Naturally Occurring Radon by US County



Note: Zone designation for Puerto Rico is under development.
Source: US Environmental Protection Agency.[26]

limit (MCL) for arsenic from 50 parts per billion (ppb) to 10, leading to declines in urinary arsenic levels among public water consumers.[20] However, household wells are not regulated and may contain levels above the EPA's MCL if they are drilled or dug into arsenic-containing soil/bedrock. Strong evidence linking arsenic and cancer risk are mostly from observational studies outside the US, where levels of arsenic in drinking water were greater than or equal to 100 ppb. Several regions in the US, including parts of New England, the Midwest, and the West, contain private wells with measurable or predicted levels above the EPA standard of 10 ppb, but below 100 ppb. Evidence for these low-to-moderate levels of arsenic (10-99 ppb) and cancer is mixed, with some research showing an increased risk of bladder cancer in exposed populations and others have not.[21, 22] Visit epa.gov/privatewells for more information on arsenic in private drinking water sources and ways to mitigate exposure.

Outdoor Air Pollution

In 2013, the IARC classified outdoor air pollution as a carcinogen based on evidence that it causes lung cancer and increases the risk of bladder cancer.[23] Outdoor air pollution contains a mixture of pollutants, such as particulate matter (solid particles and liquid droplets of varying sizes), sulfur dioxide, ozone, nitrogen dioxide, and many other substances. Particulate matter was separately classified as a carcinogen based on its association with lung cancer. Fine particulate matter, defined as particles <2.5 millionths of a meter across (a single human hair is about 30 times greater in width), also referred to as PM2.5, is particularly harmful to human health.

Exposure to outdoor air pollution varies by geographic location, season/temperature, and proximity to its source, which typically originates from transportation, power generation, manufacturing, and the burning of

biomass. In the US, several clean-air policies such as the EPA's Clean Air Act have improved outdoor air quality and the concentration of pollutants has declined between 1990 and 2016.[24] However, outdoor air pollution remains a concern because of the large number of people exposed to its deleterious effects, especially those with lower socioeconomic status.[25]

Visit epa.gov/outdoor-air-quality-data for more information on outdoor air quality.

Conclusions

There has been significant progress in what is known about the relationship between occupational and environmental risk factors and cancer, although there is much more to be learned. There are several agents, including several types of pesticides (e.g., glyphosate), that have been recently classified as probably or possibly carcinogenic to humans, but there was not enough evidence to definitively classify them as carcinogenic in humans in the recent IARC evaluation. In addition, important questions remain about the amount of pollutant exposure needed to cause cancer, how they can cause cancer, operate together in mixtures, and how other lifestyle factors interact with pollutants. The relationships between cancer and environmental exposures, including drinking water contaminants, electromagnetic fields, ionizing radiation, and endocrine disruptors are still being studied.

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Cancer Screening

Early detection of cancer through screening reduces mortality from cancers of the colon and rectum, breast, uterine cervix, prostate, and lung. Screening refers to testing individuals who have no symptoms for a particular disease. In addition to detecting cancer early, screening for colorectal and cervical cancers can prevent these cancers by identifying removable precancerous lesions.[1]

Breast Cancer Screening

Among women in the US in 2019, an estimated 268,600 cases of invasive breast cancer will be diagnosed, and 41,760 deaths will occur.[2] Overall, female breast cancer death rates have been declining since 1989 in the US, in large part, due to early detection by mammography screening and improvements in treatment.[2, 3]

The American Cancer Society has guidelines for the early detection of breast cancer for women with average- and high-risk profiles (see page 55 for average-risk screening gudelines). The primary screening exam for average-risk women is mammography, a low-dose x-ray image of breast tissue. Newer digital technology, in which a 2-dimensional (2D) image of breast tissue is captured electronically and viewed on a monitor with specialized equipment, has largely replaced film mammography, which uses general-purpose x-ray equipment. Digital mammography has improved sensitivity for women under age 50 and women with mammographically dense breasts (a mammographic indicator of the amount of a breast's glandular and connective tissue relative to its fatty tissue).[4] Combined analysis of the randomized controlled trials of breast cancer screening, with varying outcomes, has demonstrated an overall reduction in breast cancer deaths of about 20%.[5] While these studies establish the efficacy of mammography screening, recent results from more modern and organized mammography programs in Europe and Canada indicate that the risk of breast cancer mortality among women exposed to screening was reduced by more than 40%.[6-8] Additionally, early detection of breast cancer leads to a greater range of and less invasive treatment options.

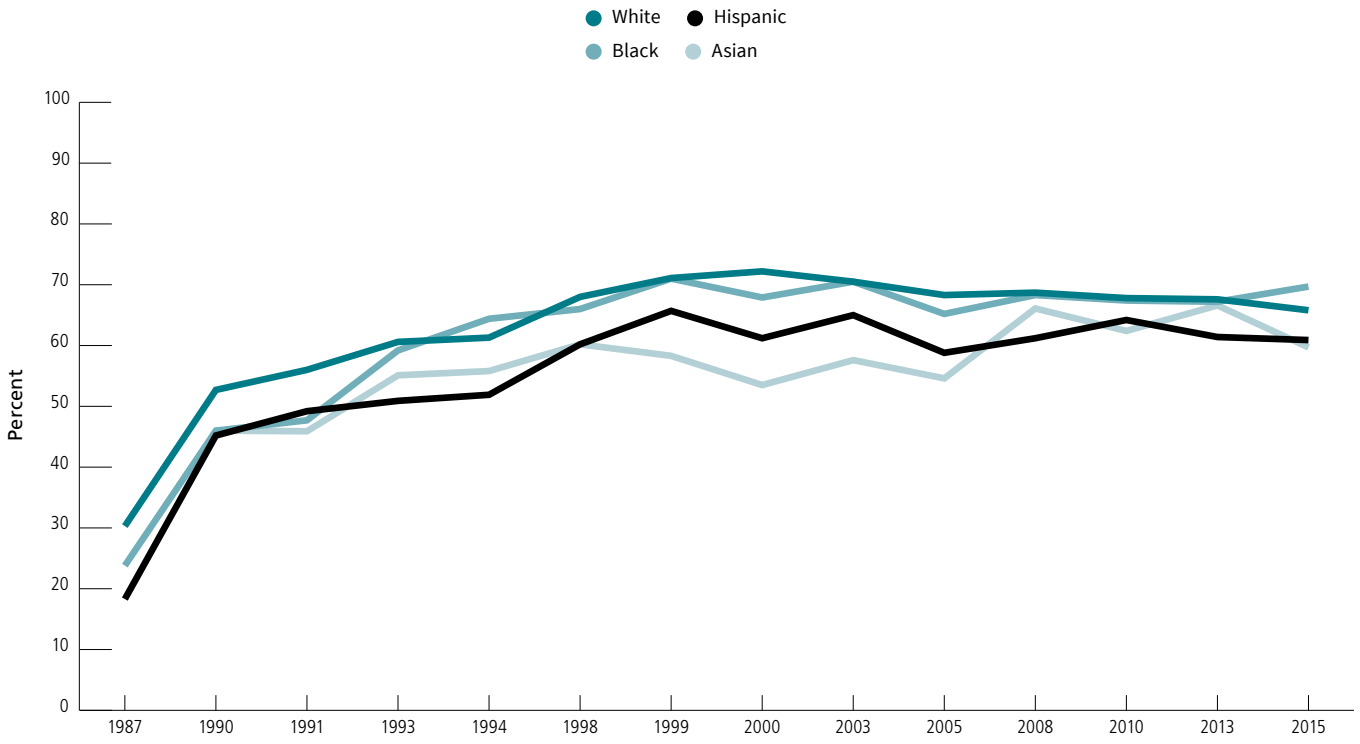
Recently, the Food and Drug Administration (FDA) has approved digital breast tomosynthesis (DBT or 3D) for breast cancer screening. 3D mammography takes multiple images, in combination with digital 2D mammography of the breast, that can be used to create a synthetic 3D image. A large randomized clinical trial was launched in 2017 to examine the benefits of 3D mammography; initial results indicate that it may be more sensitive and have lower recall rates than 2D mammography alone.[9] However, when 2D images are produced in combination with DBT images, women

Table 6A. Mammography (%), Women 40 Years and Older, US, 2015

	Within the past year	Within the past two years
Overall	**50**	**64**
Age (years)		
40-44	38	49
45-54	53	69
55+	53	68
Race/Ethnicity		
White	50	65
Black	55	69
Hispanic	46	61
American Indian/ Alaska Native	46	60
Asian	47	59
Sexual orientation		
Gay/lesbian	62	78
Straight	50	64
Bisexual	–	–
Education		
Less than high school	39	51
High school diploma	45	58
Some college	51	66
College graduate	58	73
Insurance status (40 to 64 years)		
Uninsured	21	31
Insured	52	68
Immigration status		
Born in US	51	65
Born in US territory	47	59
In US fewer than 10 years	33	46
In US 10+ years	47	60

Source: National Health Interview Survey, 2015.

Figure 6A. Trends in Mammography within the Past Two Years, Women 40 Years and Older by Race/Ethnicity, US, 1987-2015



Note: Estimates for Asians may be Hispanic or non-Hispanic.
Source: National Center for Health Statistics, 2018.[59]

receive about double the radiation dose than they would have if they received 2D mammography alone. The FDA has also approved the use of tomographic images to produce synthetic, conventional 2D images, thus reducing the radiation dose to that similar to conventional digital mammography.

Women should be informed of the limitations of mammography as well as its benefits. Mammography will not detect all breast cancers; some breast cancers detected with mammography still have poor prognosis; and a percentage of breast neoplasms detected by screening, particularly ductal carcinoma in situ, may not progress, and thus may be treated unnecessarily. There is also potential for false-positive results, which are most common when a woman has her first screening, and the possibility of undergoing a biopsy for abnormalities that are benign. About 12% of women screened with modern digital mammographies require follow-up imaging or biopsy, and for every 1,000 screening mammograms performed, about five breast cancers are detected.[10]

The American Cancer Society recommends annual screening with magnetic resonance imaging (MRI), in addition to mammograms, beginning at age 30 for women with an estimated lifetime risk of at least 20%-25% due to the presence of mutations in the breast cancer susceptibility genes *BRCA1* and *BRCA2*, a first-degree relative (parent, sibling, or child) with a *BRCA1* or *BRCA2* gene mutation, a strong family history of breast and/or ovarian cancer, or prior chest radiation therapy (e.g., for Hodgkin lymphoma).[11] Women with dense breast tissue are at a moderately increased risk for breast cancer (15%-20%), and mammography for these women is not as sensitive as it is for women without dense breasts.[12] In 2007 when these recommendations were published, there was not enough evidence to recommend supplemental MRI screening for women with significant

Table 6B. Mammography (%), Women 40 Years and Older by State, 2016

	Within the past year		Within the past two years		
	40 years and older	**40 to 54 years**	**40 years and older**	**55 years and older**	**No health insurance 40 to 64 years**
United States (median)	**56**	**52**	**72**	**75**	**44**
Range	*42-67*	*36-65*	*60-81*	*64-83*	*27-63*
Alabama	58	54	73	77	36
Alaska	45	36	63	66	41
Arizona	51	44	69	74	41
Arkansas	52	51	68	69	60
California	56	49	74	79	60
Colorado	48	43	68	72	43
Connecticut	64	62	80	81	60
Delaware	64	57	78	82	45
District of Columbia	58	52	74	79	–
Florida	60	57	77	80	52
Georgia	60	55	74	77	51
Hawaii	62	63	77	76	56
Idaho	45	38	60	65	27
Illinois	56	54	72	74	53
Indiana	50	44	67	70	39
Iowa	58	54	72	75	51
Kansas	55	48	70	75	39
Kentucky	59	56	73	76	43
Louisiana	55	50	73	76	50
Maine	58	54	76	78	57
Maryland	60	59	77	79	59
Massachusetts	66	63	81	83	63
Michigan	57	52	74	77	48
Minnesota	60	53	76	79	53
Mississippi	54	50	68	70	51
Missouri	56	50	70	74	40
Montana	50	39	67	73	44
Nebraska	53	51	67	69	40
Nevada	49	44	67	70	46
New Hampshire	60	53	77	80	41
New Jersey	60	58	75	77	55
New Mexico	42	36	64	68	28
New York	56	56	74	75	63
North Carolina	62	57	75	77	40
North Dakota	55	51	71	74	43
Ohio	59	57	74	75	42
Oklahoma	54	51	70	72	41
Oregon	50	44	67	72	35
Pennsylvania	56	52	71	73	43
Rhode Island	67	65	81	83	–
South Carolina	52	45	71	76	41
South Dakota	62	56	75	76	33
Tennessee	55	48	71	75	38
Texas	51	45	67	72	40
Utah	51	41	67	75	53
Vermont	56	49	72	75	53
Virginia	60	55	76	79	46
Washington	51	44	69	74	44
West Virginia	58	52	73	76	54
Wisconsin	61	57	75	77	–
Wyoming	43	37	61	64	37
Puerto Rico	61	58	80	82	48

Note: Puerto Rico not included in range or median.

Source: Behavioral Risk Factor Surveillance System, 2016.

mammographic breast density. The American Cancer Society breast cancer screening recommendations for women at increased and high risk are expected to be updated in 2019.

National Mammography Screening

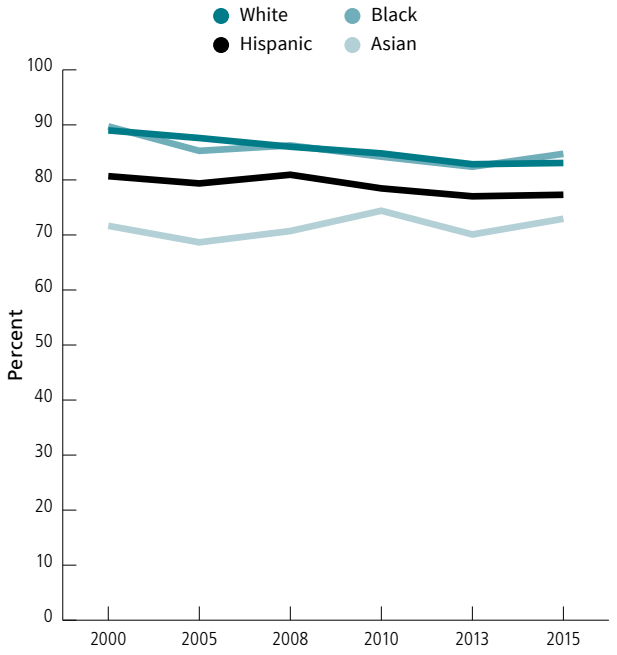
- The percentage of women ages 40 years and older who reported having a mammogram within the past two years increased from 29% in 1987 to 70% in 2000 and gradually declined to 64% between 2000-2015.[13] Trends in mammography prevalence are relatively similar across races/ethnicities (Figure 6A).
- In 2015, 50% of women ages 40 years and older reported having had a mammogram within the past year; 64% reported having had one within the past two years (Table 6A).
- About one-half of women ages 45-54 years received a mammogram in the past year; about two-thirds of women ages 55 years and older had a mammogram in the past two years (Table 6A).
- The 2015 prevalence of mammography in the past two years was lower among Hispanic, American Indian/Alaskan Native, and Asian women (59%-61%) than among white (65%) and black (69%) women 40 years of age and older (Table 6A).
- In 2015, uninsured women (31%) and recent immigrants (46%) reported the lowest prevalence of mammography use in the past two years (Table 6A).

State-level Mammography Screening

- In 2016, the prevalence of mammography in the past year among women ages 40 years and older ranged from 42% in New Mexico to 67% in Rhode Island (Table 6B).
- In 2016, among women ages 40-64 years without insurance, receipt of a mammogram in the past two years ranged from 27% in Idaho to 63% in Massachusetts and New York (Table 6B).

Visit cancer.org/research/cancer-facts-statistics for the current edition of *Breast Cancer Facts & Figures*.

Figure 6B. Trends in Pap Test* within the Past Three Years, Women 21 to 65 Years by Race/Ethnicity, US, 2000-2015



*Among women with intact uteri. Note: 2003 estimates not available.
Source: National Health Interview Surveys, 2000-2015.

Cervical Cancer Screening

In the US, about 13,170 cases of invasive cervical cancer will be diagnosed in 2019, and an estimated 4,250 deaths will occur.[2] Cervical cancer incidence and mortality rates have decreased by more than 50% over the past three decades, with most of the reduction attributed to screening with the Pap test, which can detect both cervical cancer at an early stage and precancerous lesions.[14] For women in whom precancerous lesions are detected, the likelihood of survival is nearly 100% with appropriate evaluation, treatment, and follow-up. Over one-half of cervical cancer cases are diagnosed at regional- or distant-stage disease, most occurring among women who have not had a recent Pap test.[15]

In 2012, the American Cancer Society and collaborating organizations released updated cervical cancer screening guidelines (see page 55). In 2019, the American Cancer Society began updating its cervical cancer screening guidelines and will thoroughly evaluate all available screening strategies including the use of high-risk HPV

Table 6C. Cervical Cancer Screening* (%), Women 21 to 65 Years, US, 2015

	Pap test within the past three years (21-65 yrs)	Pap test and HPV test within the past 5 yrs (30-64 yrs)	Up-to-date† (21-65 yrs)
Overall	**81**	**32**	**83**
Age (years)			
21-29	77	–	77
30-39	88	43	89
40-49	81	32	83
50-65	82	22	84
Race/Ethnicity			
White	83	34	85
Black	85	35	86
Hispanic	77	31	79
American Indian/ Alaska Native	71	27	79
Asian	73	23	75
Sexual orientation			
Gay/lesbian	74	30	77
Straight	82	32	84
Bisexual	80	29	82
Education (25 to 65 years)			
Less than high school	70	21	72
High school diploma	75	27	77
Some college	84	35	86
College graduate	89	36	90
Insurance status (21 to 64 years)			
Uninsured	61	21	64
Insured	84	34	86
Immigration status			
Born in US	83	35	85
Born in US territory	74	24	75
In US fewer than 10 years	68	23	70
In US 10+ years	76	27	78

*Among women with intact uteri. †See page 55.

Source: National Health Interview Survey, 2015.

Table 6D. Cervical Cancer Screening* (%), Women 21 to 65 Years by State, 2016

	Pap test within the past 3 years (21-65 years)	Pap test and HPV test within the past 5 years (30-65 years)	Up-to-Date† (21-65 years)	
	Overall	Overall	Overall	No health insurance (21-64 years)
United States (median)	**80**	**41**	**84**	**68**
Range	*73-85*	*31-55*	*77-88*	*57-83*
Alabama	80	36	83	67
Alaska	79	38	83	61
Arizona	–	–	–	–
Arkansas	–	–	–	–
California	82	43	85	78
Colorado	81	52	87	76
Connecticut	–	–	–	–
Delaware	79	46	82	70
District of Columbia	85	55	87	–
Florida	79	46	82	68
Georgia	80	44	83	71
Hawaii	81	37	84	61
Idaho	73	34	78	62
Illinois	84	41	86	78
Indiana	75	35	78	67
Iowa	82	36	84	83
Kansas	79	35	83	67
Kentucky	80	42	85	68
Louisiana	81	41	85	68
Maine	82	46	86	68
Maryland	–	–	–	–
Massachusetts	84	46	87	73
Michigan	81	43	85	68
Minnesota	82	41	86	66
Mississippi	83	39	88	71
Missouri	79	40	83	57
Montana	81	40	86	69
Nebraska	78	36	82	64
Nevada	75	45	80	70
New Hampshire	–	–	–	–
New Jersey	82	43	85	63
New Mexico	78	38	82	71
New York	81	45	83	72
North Carolina	84	43	88	76
North Dakota	79	34	82	68
Ohio	82	45	86	66
Oklahoma	79	32	83	69
Oregon	79	51	85	72
Pennsylvania	77	44	82	57
Rhode Island	–	–	–	–
South Carolina	79	34	83	67
South Dakota	81	37	85	60
Tennessee	80	38	84	71
Texas	75	39	78	64
Utah	76	31	80	71
Vermont	–	–	–	–
Virginia	82	44	84	65
Washington	–	–	–	–
West Virginia	80	48	85	65
Wisconsin	84	42	87	79
Wyoming	73	41	77	70
Puerto Rico	78	43	80	56

*Among women with intact uteri. †See page 55. Note: Puerto Rico not included in median or range.

Source: Behavioral Risk Factor Surveillance System, 2016.

testing without Pap testing, which the US Preventive Services Task Force (USPSTF) recently recommended as a screening option for women ages 30-65 years.[16]

In addition to screening, there is potential to further prevent cervical cancer with the HPV vaccine (see Infectious Agents section, page 32). Of note, because it does not protect against established infections or all HPV types, HPV vaccination supplements rather than replaces cervical cancer screening.

National Cervical Cancer Screening

- Between 2000-2015, cervical cancer screening prevalence in women ages 21-65 years modestly declined (Figure 6B) and in 2015, approximately 14 million women were not up-to-date with screening.[17]
- In 2015, 83% of women ages 21-65 years were up-to-date with cervical cancer screening and 81% had received a Pap test in the past three years (Table 6C).
- In 2015, about one-third (32%) of women ages 30-64 years reported having had an HPV test with a Pap test within the past five years; this proportion was higher among women in their 30s (43%) compared to women ages 40 years and older (22%-32%) (Table 6C).
- The prevalence of up-to-date cervical cancer screening in 2015 was similar among white (85%) and black (86%) women, but lower among Hispanic (79%), American Indian/Alaska Native (79%), and Asian women (75%) (Table 6C).
- The utilization of cervical cancer screening reported in 2015 was lowest among uninsured women (64%) and recent immigrants (70%) (Table 6C).

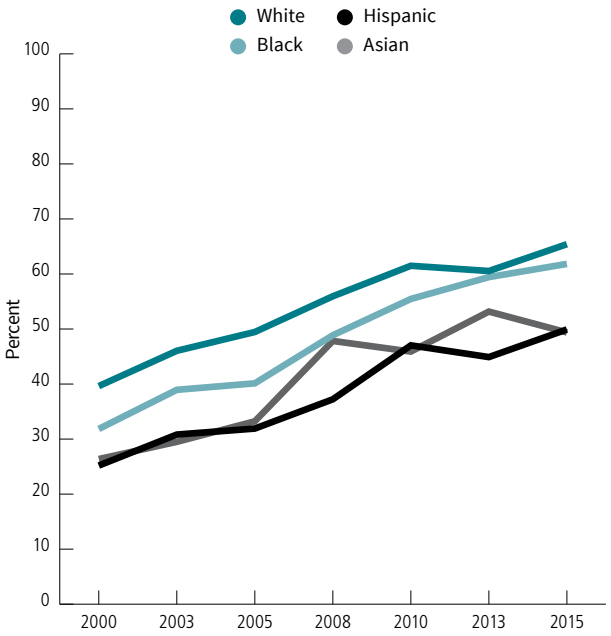
State-level Cervical Cancer Screening

- Among states with available 2016 data, up-to-date cervical cancer screening prevalence in women ages 21-65 years ranged from 77% in Wyoming to 88% in Mississippi and North Carolina (Table 6D).
- In 2016, among women with no health insurance, screening prevalence ranged from 57% in Pennsylvania and Missouri to 83% in Iowa (Table 6D).

Colorectal Cancer Screening

An estimated 101,420 cases of colon cancer and 44,180 cases of rectal cancer will be diagnosed in the US in 2019.[2] Colorectal cancer (CRC) is the second-leading cause of cancer death when men and women are combined, with 51,020 deaths estimated to occur in 2019. The accelerated decline in CRC incidence rates during the past decade is thought primarily to reflect the increased uptake of screening and removal of precancerous lesions.[2]

Figure 6C. Trends in Colorectal Cancer Screening* (%), Adults 50 Years and Older by Race/Ethnicity, US, 2000-2015



*Fecal occult blood test or fecal immunochemical test within the past year, sigmoidoscopy within the past five years, or colonoscopy within the past 10 years.

Source: National Health Interview Surveys, 2000-2015.

Colorectal cancer screening can reduce CRC death rates both by preventing the disease and by detecting invasive tumors at earlier, more treatable stages. The American Cancer Society's 2018 CRC screening guideline recommends that adults ages 45 years and older undergo regular screening with a high-sensitivity stool-based or structural examination (described below), depending on patient preference and test availability.[18] In previous guidelines, screening was recommended to begin at age 50 for those at average risk, while screening before the age of 50 was recommended only for people at higher CRC risk based on family history of CRC or polyps or hereditary syndromes that increase CRC risk (e.g., familial adenomatous polyposis or Lynch syndrome). The updated earlier age to start screening in average-risk adults is based on a growing body of evidence that CRC risk is increasing in younger generations and a judgment that the benefits of screening in this group outweigh the risks.

There are several recommended methods for screening persons at average risk (see page 55). High-sensitivity stool-based tests include the fecal immunochemical test (FIT), the guaiac-based fecal occult blood test (gFOBT), and the multi-target stool DNA (MT-sDNA) test, which combines an FIT test with an sDNA test. Structural (visual) examinations include colonoscopy, computed tomography (CT) colonography, and flexible sigmoidoscopy. All tests have the ability to reduce CRC death rates when performed at the appropriate intervals and with recommended follow-up. However, some people do not receive adequate or timely follow-up after a positive stool test, which is associated with a greater risk of advanced-stage CRC.[19, 20] Offering patients different test options substantially increases adherence to screening recommendations.[21] Visit cancer.org/colonmd to review materials from the American Cancer Society to facilitate decision making in selecting a CRC screening test at the point of care.

National Colorectal Cancer Screening

- Between 2000 and 2015, CRC screening prevalence increased in all races/ethnicities, and overall increased from 38% to 63% (Figure 6C).
- In 2015, screening was highest among whites (65%), followed by blacks (62%), American Indians/Alaska Natives (54%), Hispanics (50%), and Asians (49%) (Table 6E).
- In 2015, 60% of adults ages 50 years and older had a colonoscopy in the past 10 years, 7% had a stool test in the past year, and <3% had a sigmoidoscopy or CT colonography in the past five years (Table 6E).
- CRC screening prevalence is lowest in the uninsured (25%), recent immigrants (34%), and those without a high school diploma (47%) (Table 6E).
- The most recent screening data from the National Health Interview Survey (2015) preceded the updated American Cancer Society guideline recommending screening begin at age 45. In 2015, 54% of adults ages 45 years and older had been screened for CRC. Screening prevalence was 19% among those ages 45-49 years compared to 58% and 68% among those ages 50-64 years and ages 65 years and older, respectively (Table 6E).

Table 6E. Colorectal Cancer Screening (%), Adults 45 Years and Older, US, 2015

	Stool test*	Colonoscopy†	Up-to-date‡	
	50 years and older	50 years and older	50 years and older	45 years and older
Overall	**7**	**60**	**63**	**54**
Sex				
Males	8	60	63	54
Females	7	60	62	53
Age (years)				
50-64	6	55	58	58
65+	9	66	68	68
Race/Ethnicity				
White	7	63	65	56
Black	8	58	62	53
Hispanic	7	47	50	42
American Indian/ Alaska Native	–	49	54	46
Asian	9	44	49	42
Sexual orientation				
Gay/lesbian	–	68	72	64
Straight	7	60	63	54
Bisexual	–	52	53	52
Education				
Less than high school	6	45	47	40
High school diploma	7	56	59	50
Some college	7	61	64	55
College graduate	8	68	71	61
Insurance status (50 to 64 years)				
Uninsured	4	23	25	21
Insured	6	56	60	47
Immigration status				
Born in US	7	62	65	56
Born in US territory	–	63	63	53
In US fewer than 10 years	–	26	34	28
In US 10+ years	8	48	52	43

*Fecal occult blood test (FOBT) or fecal immunochemical test (FIT) within the past year. †Within the past 10 years. ‡FOBT or FIT within the past year, sigmoidoscopy within the past five years, or colonoscopy within the past 10 years.

Source: National Health Interview Survey, 2015.

State-level Colorectal Cancer Screening

- In 2016, the percentage of adults ages 50 years and older who were up-to-date with CRC screening ranged from 60% in New Mexico, Oklahoma, and Puerto Rico to 76% in Maine and Massachusetts (Table 6F).

Table 6F. Colorectal Cancer Screening (%), Adults 50 Years and Older by State, 2016

	Stool Test*	Colonoscopy†	Up-to-date‡			
	50 years and older	50 years and older	50 years and older	50 to 64 years	65 years and older	No health insurance 50 to 64 years
United States (median)	**8**	**64**	**69**	**63**	**76**	**34**
Range	3-23	56-73	60-76	53-73	67-85	14-57
Alabama	10	67	71	64	79	34
Alaska	7	63	65	60	74	26
Arizona	11	60	65	58	73	30
Arkansas	10	61	66	62	70	28
California	23	63	73	65	85	32
Colorado	9	63	68	63	76	27
Connecticut	9	72	75	73	78	49
Delaware	6	70	73	67	81	34
District of Columbia	14	65	70	65	78	–
Florida	16	63	69	59	79	35
Georgia	13	59	64	58	74	27
Hawaii	19	62	72	70	75	48
Idaho	6	61	64	57	72	26
Illinois	5	62	65	59	73	36
Indiana	8	61	65	60	72	31
Iowa	6	66	69	65	74	21
Kansas	7	65	68	62	76	30
Kentucky	10	67	71	65	79	42
Louisiana	9	61	65	59	74	25
Maine	7	73	76	73	79	36
Maryland	9	67	70	65	79	43
Massachusetts	9	72	76	72	81	57
Michigan	9	67	70	65	77	45
Minnesota	6	70	74	69	80	34
Mississippi	9	58	61	54	71	22
Missouri	6	63	66	59	75	24
Montana	8	58	62	56	70	33
Nebraska	7	63	66	62	71	37
Nevada	11	58	64	56	74	29
New Hampshire	7	72	75	72	80	40
New Jersey	8	63	66	60	74	39
New Mexico	7	56	60	55	67	14
New York	8	66	69	63	77	38
North Carolina	9	70	74	68	81	30
North Dakota	6	62	65	60	72	39
Ohio	8	63	67	62	73	34
Oklahoma	9	56	60	53	70	25
Oregon	13	63	71	66	77	38
Pennsylvania	7	66	69	64	76	35
Rhode Island	9	70	74	70	79	48
South Carolina	8	67	70	64	79	32
South Dakota	8	64	67	61	74	38
Tennessee	10	64	68	61	77	36
Texas	9	57	61	54	73	30
Utah	3	70	72	67	78	25
Vermont	6	70	73	69	78	40
Virginia	8	67	71	65	78	36
Washington	12	64	71	66	77	37
West Virginia	11	64	68	61	76	35
Wisconsin	7	70	74	69	81	44
Wyoming	5	59	62	55	70	31
Puerto Rico	18	52	60	49	72	25

*Fecal occult blood test (FOBT) or fecal immunochemical test (FIT) within the past year. †Within the past 10 years. ‡FOBT or FIT within the past year or sigmoidoscopy within the past five years or colonoscopy within the past 10 years. Note: Puerto Rico not included in range or median.

Source: Behavioral Risk Factor Surveillance System, 2016.

- Stool testing use ranged from 3% in Utah to 23% in California in 2016. CRC screening with colonoscopy ranged from 56% in New Mexico to 73% in Maine (Table 6F).
- In 2016, among uninsured adults ages 50-64 years, only 14% in New Mexico reported up-to-date CRC screening compared to 57% in Massachusetts (Table 6F).

Visit cancer.org/research/cancer-facts-statistics for the current edition of *Colorectal Cancer Facts & Figures*.

Lung Cancer Screening

Among men and women in the US, an estimated 228,150 new cases of lung cancer will be diagnosed in 2019. Lung cancer is the leading cause of cancer death for both men and women; about 142,670 deaths are expected in 2019.[2] The overall five-year relative survival rate for lung cancer is low – 16% for men and 22% for women as a result of the large proportion of cases diagnosed with advanced-stage disease.[2]

The American Cancer Society issued guidelines for lung cancer screening in 2013 (see page 55) after a randomized clinical trial showed that 20% fewer lung cancer deaths occurred in the group that received an invitation to annual low-dose computed tomography (LDCT) screening compared to the group invited to receive annual chest x-rays. Other public health organizations have issued recommendations as well.

Current evidence suggests that screening for lung cancer is most beneficial among people at highest risk for the disease. It is unclear whether the benefits of lung cancer screening for adults with lighter smoking history outweigh the harms, though one model-based study found that some ever smokers not meeting current screening eligibility may benefit from LDCT.[22] The risks associated with LDCT screening include cumulative radiation exposure from multiple scans and unnecessary biopsy and surgery in individuals who do not have lung cancer (false positives). Another concern is that some smokers might use LDCT imaging as a reason to continue smoking. Although based on current evidence, receipt of screening does not appear to influence smoking cessation, but a positive finding from a screening test may be related to smoking abstinence.[23]

National Lung Cancer Screening

- The proportion of eligible current and former smokers who reported LDCT screening in the past 12 months remained low and constant, from 3.3% in 2010 to 3.9% in 2015.[24]
- In 2015, of the estimated 6.8 million eligible current and former smokers, only 262,700 received screening.[24]

Prostate Cancer Screening

In 2019, an estimated 174,650 new cases of prostate cancer will be diagnosed in the US; approximately 31,620 men will die of the disease.[2] In the US, cancer of the prostate is the most common type of cancer among men (other than skin cancer) and the third-leading cause of cancer death. Mortality rates for prostate cancer have been declining, in part, due to improvements in treatment, management of recurrent disease, and early detection with the prostate-specific antigen (PSA) test (a blood test to assess the levels of a protein made by the prostate).[25]

The American Cancer Society recommends that asymptomatic men who have a life expectancy of at least 10 years have an opportunity to make an informed decision with their health care provider about whether to be screened for prostate cancer (see page 55). This guideline generally aligns with other groups' recommendations, including those from the USPSTF, which endorses shared decision making (SDM) for PSA-testing among men ages 55-69 years after a brief period (2012-2016) when they did not recommend routine screening.

Studies have shown that informed and SDM measures are inconsistently utilized in clinical practice and that when such discussions do take place, the content varies widely and frequently falls short of accepted standards.[26, 27] To help address this issue, the American Cancer Society provides clinicians with tools to facilitate SDM; visit cancer.org/health-care-professionals/prostate-md.html to access the resources.

Table 6G. Prostate Specific Antigen Test* (%), Men 50 Years and Older, US, 2015

	Within the past year
Overall	**34**
Age (years)	
50-64	29
65+	41
Race/Ethnicity	
White	37
Black	31
Hispanic	25
American Indian/Alaska Native	–
Asian	17
Sexual orientation	
Gay/lesbian	44
Straight	34
Bisexual	–
Education	
Less than high school	20
High school diploma	30
Some college	35
College graduate	44
Insurance status	
Uninsured	10
Insured	30
Immigration status	
Born in US	36
Born in US territory	27
In US fewer than 10 years	–
In US 10+ years	27

*Among men who have not been diagnosed with prostate cancer.
Source: National Health Interview Survey, 2015.

National Prostate Cancer Testing and Shared Decision Making

- Between 2005-2010, approximately 41%-44% of men ages 50 years and older received a PSA test in the past year; this proportion declined to approximately 35% in 2013 and remained stable through 2013-2015 (34%)[1] (Table 6G).
- The uninsured, Asians, and those with less than a high school education were the least likely to have had a recent PSA test (Table 6G).
- In 2015, 63% of men ages 50 years and older reported receiving at least one element of SDM.[26]
- Only 17% of men with a recent PSA test reported participating in full SDM; receipt was even lower among men without a high school diploma compared to college graduates.[26]

Endometrial Cancer Screening

Uterine corpus cancer is the fourth most common cancer among women and is often referred to as endometrial cancer because most of these cancers are located in endometrial tissue.[2] At present, there is insufficient evidence to recommend screening for endometrial cancer among women at average or increased risk. However, during menopause, women should be informed of the risks and symptoms of endometrial cancer (specifically, unexpected bleeding and spotting) and be instructed to report these symptoms promptly to their physician. Women at high risk for endometrial cancer (i.e., known or substantial likelihood of carrying the Lynch syndrome genetic mutation) should consider annual endometrial cancer testing beginning at age 35 after being informed of the benefits, harms, and limitations associated with the test.

Cancer Screening Obstacles and Opportunities to Improve Utilization

Ensuring the maintenance of access to affordable, quality health care is a top priority for the American Cancer Society and the American Cancer Society Cancer Action Network℠ (ACS CAN), our nonprofit, nonpartisan advocacy affiliate. Research on barriers related to cancer screening shows that multiple factors – public policy, organizational systems and practice settings, clinicians, and the patients themselves – influence cancer screening and that a diverse set of interventions targeted at each of these can improve cancer screening rates.[28] Studies have shown that people who have more recent routine checkups and receive a clinician's recommendation for cancer screening are more likely to be screened than those who do not receive a recommendation.[29,30] Multiple interventions directed toward patients, physicians, and health care systems may provide the best approaches to improving rates of cancer screening, though utilization of these strategies is suboptimal.[29]

American Cancer Society Recommendations for the Early Detection of Cancer in Average-risk Asymptomatic People*

Cancer Site	Population	Test or Procedure	Recommendation
Breast	Women, ages 40-54	Mammography	Women should have the opportunity to begin annual screening between the ages of 40 and 44. Women should undergo regular screening mammography starting at age 45. Women ages 45 to 54 should be screened annually.
	Women, ages 55+	Mammography	Transition to biennial screening, or have the opportunity to continue annual screening. Continue screening as long as overall health is good and life expectancy is 10+ years.
Cervix	Women, ages 21-29	Pap test	Screening should be done every 3 years with conventional or liquid-based Pap tests.
	Women, ages 30-65	Pap test & HPV DNA test	Screening should be done every 5 years with both the HPV test and the Pap test (preferred), or every 3 years with the Pap test alone (acceptable).
	Women, ages 66+	Pap test & HPV DNA test	Women ages 66+ who have had ≥3 consecutive negative Pap tests or ≥2 consecutive negative HPV and Pap tests within the past 10 years, with the most recent test occurring in the past 5 years should stop cervical cancer screening.
	Women who have had a total hysterectomy		Stop cervical cancer screening.
Colorectal†	Men and women, ages 45+	Guaiac-based fecal occult blood test (gFOBT) with at least 50% sensitivity or fecal immunochemical test (FIT) with at least 50% sensitivity, **OR**	Annual testing of spontaneously passed stool specimens. Single stool testing during a clinician office visit is not recommended, nor are "throw in the toilet bowl" tests. In comparison with guaiac-based tests for the detection of occult blood, immunochemical tests are more patient-friendly and are likely to be equal or better in sensitivity and specificity. There is no justification for repeating FOBT in response to an initial positive finding.
		Multi-target stool DNA test, **OR**	Every 3 years
		Flexible sigmoidoscopy (FSIG), **OR**	Every 5 years alone, or consideration can be given to combining FSIG performed every 5 years with a highly sensitive gFOBT or FIT performed annually
		Colonoscopy, **OR**	Every 10 years
		CT Colonography	Every 5 years
Endometrial	Women at menopause		Women should be informed about risks and symptoms of endometrial cancer and encouraged to report unexpected bleeding to a physician.
Lung	Current or former smokers ages 55-74 in good health with 30+ pack-year history	Low-dose helical CT (LDCT)	Clinicians with access to high-volume, high-quality lung cancer screening and treatment centers should initiate a discussion about annual lung cancer screening with apparently healthy patients ages 55-74 who have at least a 30 pack-year smoking history, and who currently smoke or have quit within the past 15 years. A process of informed and shared decision making with a clinician related to the potential benefits, limitations, and harms associated with screening for lung cancer with LDCT should occur before any decision is made to initiate lung cancer screening. Smoking cessation counseling remains a high priority for clinical attention in discussions with current smokers, who should be informed of their continuing risk of lung cancer. Screening should not be viewed as an alternative to smoking cessation.
Prostate	Men, ages 50+	Prostate-specific antigen test with or without digital rectal examination	Men who have at least a 10-year life expectancy should have an opportunity to make an informed decision with their health care provider about whether to be screened for prostate cancer, after receiving information about the potential benefits, risks, and uncertainties associated with prostate cancer screening. Prostate cancer screening should not occur without an informed decision-making process. African American men should have this conversation with their provider beginning at age 45.

CT-Computed tomography. *All individuals should become familiar with the potential benefits, limitations, and harms associated with cancer screening. †All positive tests (other than colonoscopy) should be followed up with colonoscopy.

Breast and Cervical Cancer Screening Programs and Initiatives

The Centers for Disease Control and Prevention's (CDC) National Breast and Cervical Cancer Early Detection Program (NBCCEDP) provides low-income, uninsured, and underinsured women with access to exams for breast and cervical cancers, as well as diagnostic and follow-up services. Since 1991, the NBCCEDP has served more than 5 million women, provided nearly 13 million screening examinations, and diagnosed more than 64,500 breast cancers and 20,800 lesions; 204,400 precancerous cervical lesions; and 4,500 cases of invasive cervical cancers.[31] Among women with abnormal screening results, 90% receive complete diagnostic evaluation.[32]

Colorectal Cancer Screening Programs and Initiatives

The American Cancer Society, along with the CDC, and many other organizations forming the National Colorectal Cancer Roundtable (NCCRT), launched an initiative in 2014 to raise CRC screening rates to 80% by 2018 (see sidebar, right).

In 2009, the CDC launched the Colorectal Cancer Control Program (CRCCP), which uses a variety of evidence-based strategies aimed at increasing CRC screening rates, especially in lower socioeconomic groups. In July 2015, the CRCCP awarded $23 million in grants to 30 state, university, and tribal grantees to increase CRC screening.[33] In the initial two years of the program, CRC screening rates have improved in partnering clinics.

Lung Cancer Screening Programs and Initiatives

In 2017, the American Cancer Society launched the National Lung Cancer Roundtable (NLCRT) to engage key organizations in the common mission of reducing incidence, morbidity, and mortality from lung cancer (see sidebar, page 57).

Healthcare Policy and Cancer Screening

The Affordable Care Act (ACA) aims to improve health delivery systems, prevention efforts, and access to care.

The National Colorectal Cancer Roundtable

The National Colorectal Cancer Roundtable (NCCRT), established in 1997 by the American Cancer Society and the CDC, is a coalition of more than 100 member organizations and individual experts dedicated to reducing CRC incidence and mortality in the US through coordinated leadership, strategic planning, and advocacy.

The ultimate goal of the NCCRT is to increase the use of recommended CRC screening tests among appropriate populations. In March 2014, the NCCRT launched the 80% by 2018 initiative, an ambitious goal to reach an 80% CRC screening rate among adults ages 50 years and older by 2018. Over 1,700 organizations – including health plans, medical professional societies, hospitals, systems, survivor groups, government agencies, and cancer coalitions – pledged to make this goal a priority. In 2019, the NCCRT's efforts to reach an 80% nationwide screening rate was renamed 80% In Every Community, with a renewed focus on addressing persistent screening rate disparities so that every community can benefit from lifesaving CRC screening. Visit nccrt.org for more information.

More than 20 million uninsured adults gained health insurance coverage as a result of the ACA;[34] however, 25 million (12%-13%) adults under the age of 65 remained uninsured as of 2017.[35] Gains in insurance coverage among low-income adults have led to improvements in earlier stage at diagnosis for several screen-detected cancers (e.g., breast and colorectal) in states that expanded Medicaid eligibility.[36] Provisions of the ACA have helped reduce or eliminate out-of-pocket costs for breast, cervical, colorectal, and lung cancer screening for those Medicare- or privately insured. Researchers have documented increases in CRC screening in the period following implementation of the ACA, particularly among the economically disadvantaged.[37]

The American Cancer Society and ACS CAN, as well as other organizations, have raised concerns about the cost imposed on Medicare beneficiaries who had a polyp removed during their screening colonoscopy. As of December 2018, legislation was pending before Congress

The National Lung Cancer Roundtable

In 2017, the American Cancer Society launched the National Lung Cancer Roundtable (NLCRT) to engage key organizations in the common mission of reducing incidence, morbidity, and mortality from lung cancer among current and former smokers through age- and risk-appropriate high-quality screening, follow-up, and treatment as well as smoking cessation. The NLCRT currently includes more than 80 member organizations across the country. Goals of the roundtable are to:

- Improve awareness in the population at risk for lung cancer
- Improve identification of adults at risk and referral for screening by providers, including risk assessment, competent conversations about lung cancer screening with eligible adults, and follow-up after screening tests
- Increase enrollment and participation in American College of Radiology-designated lung screening center program and lung cancer screening registry, and improve lung screening and diagnosis technology and interpretative skills
- Improve treatment for tobacco cessation and abstinence
- Address special topics such as treatment planning, lung cancer in women, policy issues, survivorship, stigma, and support for state-based programs

Visit nlcrt.org for more information.

to ensure that Medicare beneficiaries are not assessed cost sharing in connection with a colonoscopy screening regardless of whether a polyp is removed.

With regards to breast cancer screening, some insurance companies may not reimburse physicians for the DBT or 3D mammography. While several states have recently mandated that insurance companies cover 3D mammography, other states have not. Women should have access to 2D or 3D mammography, but with the rapid introduction of DBT, it may be the only mammography exam available.

Visit fightcancer.org for resources related to health insurance and the work of ACS CAN.

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Special Notes

Glossary

Body Mass Index (ages 2-20 years): After a BMI value is calculated for a child based on their weight and height, the BMI value is plotted on the Centers for Disease Control and Prevention's (CDC) age- and sex-specific growth charts to obtain a percentile ranking. The percentile indicates the relative position of the child's BMI value among children of the same sex and age. Visit cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html for more information.

Sample Surveys: Population-based surveys are conducted by selecting a sample of people to estimate the prevalence in a population using sample weights. The population-based survey methodology introduces sampling error to the estimated prevalence since a true prevalence is not calculated.

Data quality: The sources of data used for this report are from government-sponsored national and state systems of behavioral and health surveillance. These systems employ standardized techniques for sampling and use the latest advances in survey research methodology to survey targeted population groups on an ongoing basis.

The design and administration of these surveillance systems can provide sources of good-quality data from which to derive population estimates of specific behaviors in a targeted population. The data included in this report are subject to at least three limitations. First, with regards to phone-based surveys such as the Behavioral Risk Factor Surveillance System, the participants are from households with either a landline telephone or cell phone. Second, both in-person and phone surveys have varying proportions of individuals who do not participate for a variety of reasons (e.g., cannot be reached during the time of data collection or refused to participate). Third, most estimates presented herein are based on self-reported data, which may be subject to bias.

Age-adjusted prevalence: A statistical method used to adjust prevalence estimates to allow for valid comparisons between populations with different age compositions

Range: The lowest and highest values of a group of prevalence estimates

Median: Middle value in a range of prevalence estimates. Estimates are arranged from smallest to largest values; the median is the middle value.

Survey Sources

Behavioral Risk Factor Surveillance System (BRFSS): This survey of the US states and territories is conducted by the CDC and the National Center for Chronic Disease Prevention and Health Promotion. Since 1996, all 50 states, the District of Columbia, and Puerto Rico have participated in this annual survey. Data are gathered through monthly computer-assisted telephone interviews with adults ages 18 years and older living in households in a state or US territory. The methods are generally comparable from state to state. Due to methodological changes, BRFSS results within this publication are not directly comparable to BRFSS data prior to 2011. Estimates are not presented if statistically unstable, and screening estimates do not distinguish between examinations for screening and diagnosis.

BRFSS website: cdc.gov/brfss/

Complete citation: Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Data. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2016 and 2017.

National Health and Nutrition Examination Survey (NHANES): Three cycles of this US national survey were conducted between 1971 and 1994. Beginning in 1999, the NHANES was implemented as a continuous annual survey. Data are gathered through in-person interviews and direct physical exams in mobile examination centers.

For NHANES data presented herein, persons of Mexican origin may be of any race. Estimates for whites, blacks, and Asians are among non-Hispanics. Estimates for adults are age adjusted to the 2000 US standard population.

NHANES website: cdc.gov/nchs/nhanes.htm

Complete citation: National Center for Health Statistics. National Health and Nutrition Examination Survey, 2015-2016. Public-use data file and documentation. https://wwwn.cdc.gov/nchs/nhanes/Default.aspx. 2017.

National Health Interview Survey (NHIS): The CDC's NHIS has monitored the health of the nation since 1957 and is designed to provide national estimates. Data are gathered through a computer-assisted personal interview of adults ages 18 years and older living in households in the US.

For NHIS data presented herein, estimates for white, black, American Indian/Alaska Native, and Asian are among non-Hispanics unless otherwise noted. The Asian group does not include Native Hawaiians or other Pacific Islanders. Estimates for people born in US territories include those who have been in the US for any length of time. Unless otherwise noted, estimates for high school diploma include GED, and some college includes those with an associate's degree Screening estimates do not distinguish between examinations for screening and diagnosis. Estimates are age adjusted to the 2000

standard US population and are not presented if statistically unstable.

NHIS website: cdc.gov/nchs/nhis/index.htm

Complete citation: National Center for Health Statistics. National Health Interview Surveys, 2000-2017. Public-use data files and documentation. https://www.cdc.gov/nchs/nhis/index.htm

National Immunization Survey-Teen (NIS-Teen): This survey is sponsored and conducted by the National Center for Immunizations and Respiratory Diseases, the National Center for Health Statistics, and the CDC. It is designed to monitor national, state, and selected local area vaccination coverage among children ages 13-17 years in the US. Telephone (landline and cellular) interviews of adolescents' parents/guardians are conducted in all 50 states and the District of Columbia. Immunization data for surveyed adolescents are also collected through a mail survey of their pediatricians, family physicians, and other health care providers. Race/ethnicity is reported by parent or guardian. Estimates for white, black, American Indian/Alaska Native, and Asian are among non-Hispanics. Those identified as Hispanic might be of any race. Native Hawaiians or other Pacific Islanders and persons of multiple races were not included due to small sample sizes. Adolescents were classified as below poverty if their total family income was less than the federal poverty level. Methods for calculating HPV initiation before the age of 13 are described here: Fedewa et al, Cancer 2018. https://www.ncbi.nlm.nih.gov/m/pubmed/30257056/

NIS-Teen website: cdc.gov/vaccines/imz-managers/nis/about.html

Complete citation: U.S. Department of Health and Human Services (DHHS). National Center for Immunization and Respiratory Diseases. The 2017 National Immunization Survey - Teen. Hyattsville, MD: Centers for Disease Control and Prevention, 2018. https://www.cdc.gov/vaccines/imz-managers/nis/datasets-teen.html

National Youth Tobacco Survey (NYTS): This national survey was first conducted in fall 1999. Beginning in 2011, the CDC's Office on Smoking and Health and the US Food and Drug Administration's Center for Tobacco Products began collaborating on the NYTS. Now an annual survey, it is designed to provide national data for public and private students in grades six through 12. Data are gathered through a self-administered questionnaire completed during a required subject or class period. For NYTS data presented herein, estimates for white, black, American Indian/Alaska Native, and Asian are among non-Hispanics unless otherwise noted.

NYTS website: cdc.gov/TOBACCO/data_statistics/surveys/NYTS/

Complete citation: Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion. National Youth Tobacco Survey data. Available from: https://www.cdc.gov/tobacco/data_statistics/surveys/nyts/data/index.html

Youth Risk Behavior Surveillance System (YRBSS): This biennial survey of the CDC's National Center for Chronic Disease Prevention and Health Promotion began in 1991. It is designed to provide national, state, and local prevalence estimates. Data are gathered through a self-administered questionnaire completed during a required subject or class period. The state and local surveys are of variable data quality, and caution should be used when comparing data among them. Data from states and local areas with an overall response rate of 60% and appropriate documentation are considered weighted and are generalized to all public and private high school students in grades nine through 12 in the respective jurisdiction. Data that do not meet the weighting requirements are not publicly available. Weighted data for 2017 were not available for Alabama, Georgia, Indiana, Mississippi, New Jersey, Ohio, or South Dakota. Additionally, participation in YRBSS is a voluntary collaboration between a state's departments of health and education; Minnesota, Oregon, Washington, and Wyoming did not participate in the 2017 YRBSS survey. Participating states may not have data for all measures on a given topic.

YRBSS website: cdc.gov/HealthyYouth/yrbs/index.htm

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For more information, contact:
Stacey Fedewa, MPH, PhD; Ann Goding Sauer, MSPH

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