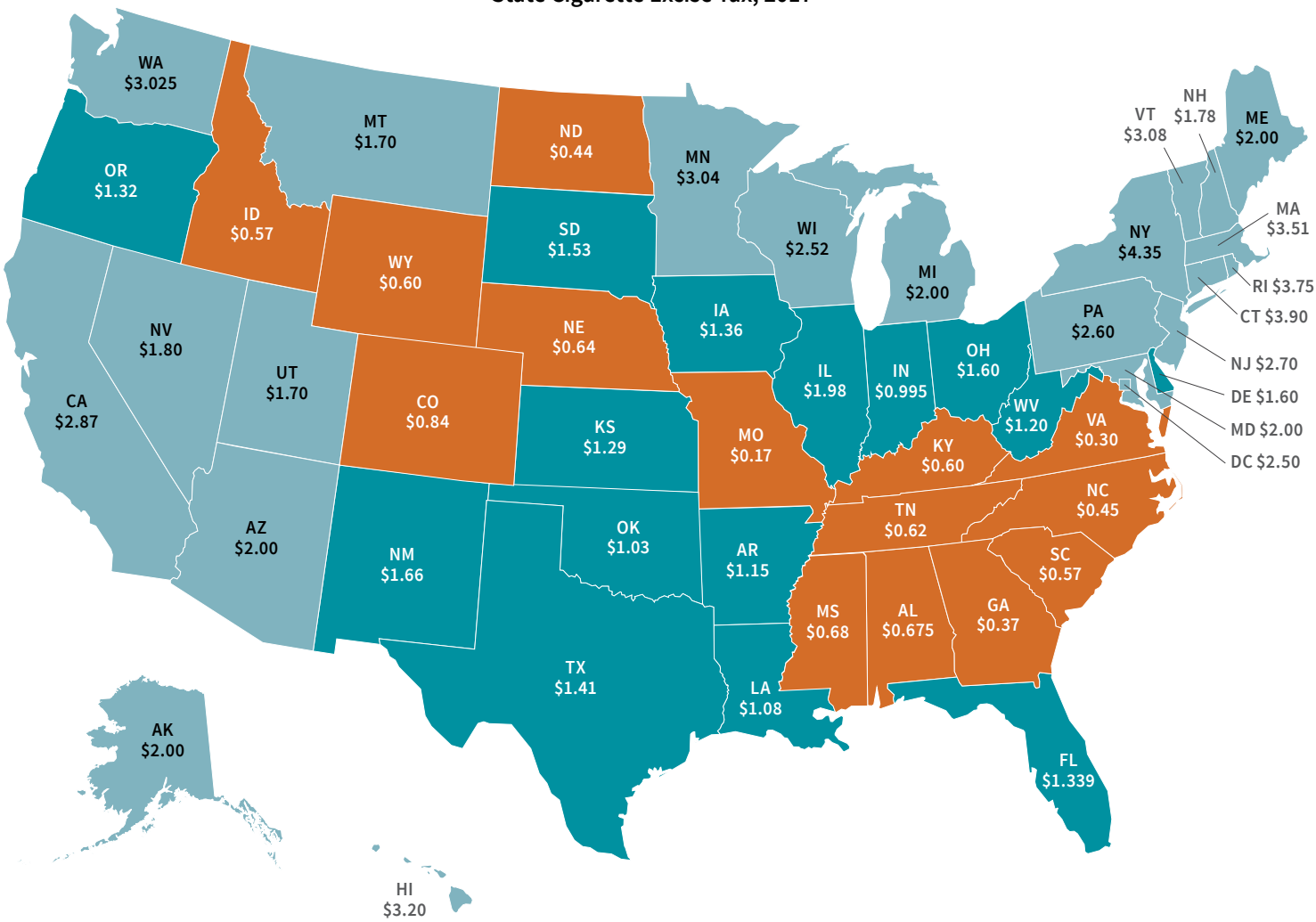
Cancer Prevention & Early Detection
Facts & Figures 2017-2018

State Cigarette Excise Tax, 2017*



*Taxes in effect or increases passed, reported as of April 1, 2017.

Source: American Cancer Society Cancer Action Network, 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.

Suggested citation: American Cancer Society. *Cancer Prevention & Early Detection Facts & Figures 2017-2018*. Atlanta: American Cancer Society; 2017.

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

Preface

Prevention and early detection are central to our mission of helping save lives, celebrate lives, and lead the fight for a world without cancer. Much of the suffering and death from cancer could be prevented by more systematic efforts to reduce tobacco use and obesity, improve diet, and increase physical activity and the use of established screening tests.[1] In 2017 about 190,500 cancer deaths in the US will be caused by cigarette smoking alone.[2] An estimated 20% of all cancers diagnosed in the US are caused by a combination of excess body weight, physical inactivity, excess alcohol consumption, and poor nutrition, and thus could also be prevented.[3] Cancer screening tests can also prevent thousands of additional cancer deaths through identification and removal of premalignant abnormalities (colorectal and cervical) and detection of cancers at an early stage when treatment is more effective.

However, the use of potentially lifesaving prevention and early detection measures is suboptimal and profoundly influenced by individual behaviors, as well as social, economic, and public policy factors. Since 1992, the American Cancer Society has published *Cancer Prevention & Early Detection Facts & Figures* (CPED) as a resource to strengthen cancer prevention and early detection efforts at the local, state, and national levels. CPED complements the American Cancer Society's flagship publication, *Cancer Facts & Figures*, by disseminating information related to cancer control. Visit cancer.org/research/cancer-facts-statistics.html to access our collection of educational publications, past and present.

References

1. World Cancer Research Fund and American Institute for Cancer Research. Policy and Action for Cancer Prevention. Washington DC, 2009.

2. American Cancer Society. *Cancer Facts & Figures 2017.* Atlanta: American Cancer Society; 2017.

3. World Cancer Research Fund and American Institute for Cancer Research. Continuous Update Project Available from URL: http://www.wcrf.org/int/research-we-fund/continuous-update-project-cup.

Highlights, CPED 2017-2018

Tobacco Use

- In 2015, 15% of adults were current cigarette smokers. Smoking prevalence varied widely by state, ranging from 9% in Utah to 26% in Kentucky.
- Current cigarette smoking among high school students declined from 29% in 1999 to 9% in 2015. By state, smoking prevalence among high school students in 2015 ranged from 5% in Rhode Island to 19% in West Virginia.
- Use of electronic cigarettes (e-cigarettes) has increased rapidly, especially among youth. Among high school students, the prevalence of current e-cigarette use increased from <2% in 2011 to 16% in 2015. Among adults, 4% were current e-cigarette users in 2015, with differences by sex, age, and race/ethnicity.
- Raising cigarette prices by increasing excise taxes reduces tobacco consumption. The federal excise tax is $1.01 per pack. As of April 1, 2017, the average state cigarette excise tax was $1.69 per pack, ranging from 17 cents in Missouri to $4.35 in New York.
- Since 2002, there have been more former smokers than current smokers in the US. In 2015, there were approximately 52.8 million former and 36.5 million current cigarette smokers.

Overweight and Obesity, Physical Activity, and Nutrition

- Based on 2013-2014 physical examination data, approximately seven out of 10 adults were overweight or obese; 38% were obese (men: 35%, women: 40%). The prevalence of obesity among women continues to rise, while it appears to have stabilized among men in recent years.
- The prevalence of obesity tripled between 1976 and 2002 among adolescents (ages 12-19 years) and increased across all race/ethnicities and genders.
- In 2015, the prevalence of adults who were overweight or obese ranged from 54% in the District of Columbia to 71% in West Virginia.
- In 2015, about 50% of adults reported meeting recommended levels of aerobic physical activity. An estimated 27% of high school students met recommended levels of physical activity.
- In 2015, only 29% of adults reported eating two or more servings of fruit and 16% reported eating three or more servings of vegetables per day. About one in three (32%) high school students consumed fruit two or more times per day and 15% consumed vegetables three or more times per day.
- About 28% of adults reported excessive alcohol consumption, according to 2011-2014 data.

Ultraviolet Radiation and Skin Cancer

- In 2015, approximately 4% of adults reported using an indoor tanning device in the past year; use was higher among women (6%) than men (2%) and those living in the Midwest (6%) compared to other regions.
- The use of indoor tanning devices among female high school students appears to have declined in recent years from 25% in 2009 to 11% in 2015. However, only 13 states and the District of Columbia have a law prohibiting indoor tanning for minors without exemptions as of January 1, 2017.

Infectious Agents

- HPV vaccination among adolescents lags behind other recommended vaccines, though rates have increased in recent years. In 2015, 63% of girls and 50% of boys received at least one dose of the HPV vaccination, and about 52% and 39%, respectively, completed two or more doses.

Cancer Screening

- In 2015, 50% of women 40 years of age and older reported having a mammogram within the past year, and 64% reported having one within the past two years. The lowest prevalence of mammography use in the past two years occurred among uninsured women (31%).
- In 2015, 81% of women 21-65 years of age had received a Pap test in the past three years, with lowest use among women who are uninsured (61%) and recent immigrants (68%).
- In 2015, 63% of adults 50 years of age and older reported having either an FOBT/FIT within the past year or sigmoidoscopy within the past five years or colonoscopy within the past 10 years. Prevalence was lowest among uninsured individuals (25%) and recent immigrants (34%).

Tobacco

Smoking remains the world's most preventable cause of death. The first US Surgeon General's report on smoking and health in 1964 helped determine that cigarette smoking caused lung cancer.[1] Since then other tobacco products, including cigars, cigarillos, roll-your-own products, and smokeless tobacco, have been causally linked to cancer as well.[2] Substantial gains in tobacco control have been made since the Surgeon General's report, yet there have been 21 million deaths in the US due to tobacco since 1964. Each year, smoking results in an estimated 480,000 premature deaths, about one-third of which are due to cancer.[2, 3] The economic cost of tobacco is also substantial; in 2012, smoking accounted for $176 billion in health care-related expenditures in the US.[2]

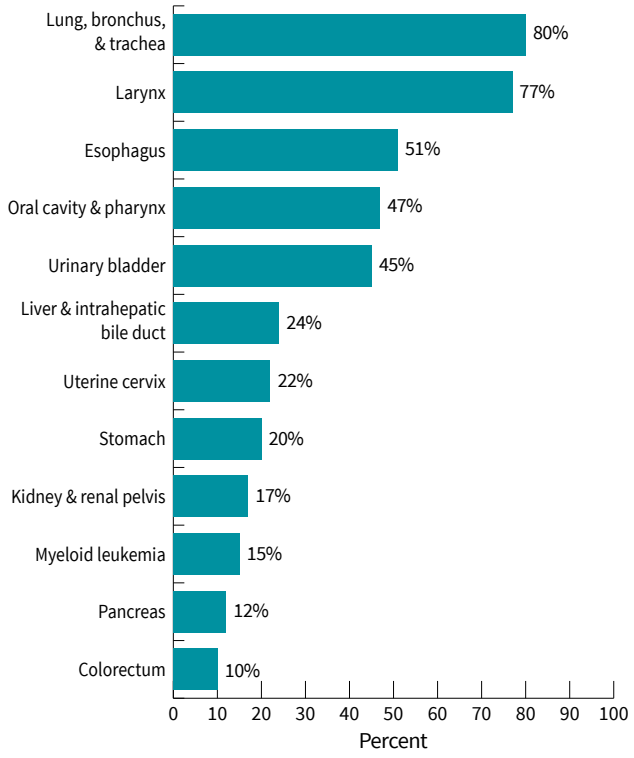
Adult Tobacco Use

Cigarette smoking increases the risk of cancers of the oral cavity and pharynx, larynx, lung, esophagus, pancreas, uterine cervix, kidney, bladder, stomach, colorectum, and liver, as well as acute myeloid leukemia.[2] In addition, the International Agency for Research on Cancer has concluded that there is some evidence that tobacco smoking causes female breast cancer, and the Surgeon General's Report concluded that smoking increases the risk of advanced-stage prostate cancer.[2, 4] The proportion of deaths attributable to smoking varies across cancer sites (Figure 1A).[5] According to American Cancer Society epidemiologists, about three in 10 cancer deaths in the US are attributable to smoking nationally, though in many Southern states, smoking causes as much as 40% of all cancer deaths in men.[6, 7] In the US, tobacco-related cancer incidence and mortality decreased from 2004-2013, though declines were not uniform across states nor population subgroups.[8]

Cigarettes

- According to the 2015 National Health Interview Survey (NHIS), an estimated 15.3% of adults (men: 16.8%, women: 13.8%) smoked cigarettes (Table 1A, page 4), compared to 17.0% in 2014 and 24.6% in 1997.[9]
- Among adults, the proportion of daily smokers decreased from nearly 17% in 2005 to about 11% in 2015.[10]
- In 2015, smoking prevalence was two to four times higher among adults without a high school diploma than among those with a college degree (Table 1A, page 4).
- Smoking prevalence has declined across racial/ethnic groups (Figure 1B, page 5), though substantial disparities remain. In 2015, smoking prevalence was lowest among Asians (7.1%) and highest among American Indians/Alaska Natives (24.2%) (Table 1A, page 4).
- In 2015, smoking prevalence was lower among those who self-identified as straight (15.1%) than among people who self-identified as gay or lesbian (17.8%) or bisexual (23.2%) (Table 1A, page 4).

Figure 1A. Proportion of Cancer Deaths Attributable to Cigarette Smoking, Adults 35 Years and Older, US, 2011



Adapted From: Siegel RL, et al.[5]

Table 1A. Current Cigarette Smoking* (%), Adults 18 Years and Older, US, 2015

	Men	Women	Overall
Overall	**16.8**	**13.8**	**15.3**
Age (years)			
18-24	15.0	11.0	13.0
25-44	19.6	15.8	17.7
45-64	17.9	16.1	17.0
65+	9.7	7.4	8.4
Race/Ethnicity			
White	17.9	16.9	17.4
Black	20.6	13.5	16.7
Hispanic	12.8	7.2	10.0
American Indian/Alaska Native	25.3	23.2	24.2
Asian	11.8	3.3	7.1
Education (25 years and older)			
No HS diploma	28.7	22.6	25.6
GED	37.4	30.4	34.1
HS diploma	22.2	19.9	21.0
Some college/Assoc. degree	18.7	17.2	17.9
Undergraduate degree	8.1	6.6	7.3
Graduate degree	4.0	3.4	3.7
Sexual Orientation			
Gay or lesbian	19.6	15.7	17.8
Straight	16.7	13.6	15.1
Bisexual	26.8	20.9	23.2
Immigration Status			
Born in US	18.1	16.1	17.1
Born in US territory	22.7	9.7	15.3
In US fewer than 10 yrs	11.3	3.2	6.9
In US 10+ years	11.0	5.0	7.9
Health insurance coverage (18-64 years)			
Uninsured	28.8	25.3	27.4
Insured	16.2	13.8	15.0
Region			
Northeast	15.0	12.5	13.7
Midwest	19.8	18.5	19.2
South	17.3	14.0	15.5
West	14.6	10.2	12.4

HS-high school. GED-General Educational Development high school equivalency. *Ever smoked 100 cigarettes in lifetime and smoking every day or some days at time of survey. Note: Estimates are age adjusted to the 2000 US standard population.

Source: National Health Interview Survey, 2015.

- According to the 2015 Behavioral Risk Factor Surveillance System (BRFSS) data, Kentucky had the highest smoking prevalence (26.0%), almost three times higher than Utah (9.1%) (Table 1B, page 6).

Cigars

In contrast to cigarettes, cigars are wrapped in leaf tobacco or other materials containing tobacco. Regular cigar smoking causes many of the same diseases as cigarette smoking, including cancers of the lung, oral cavity, larynx, and esophagus.[11-13]

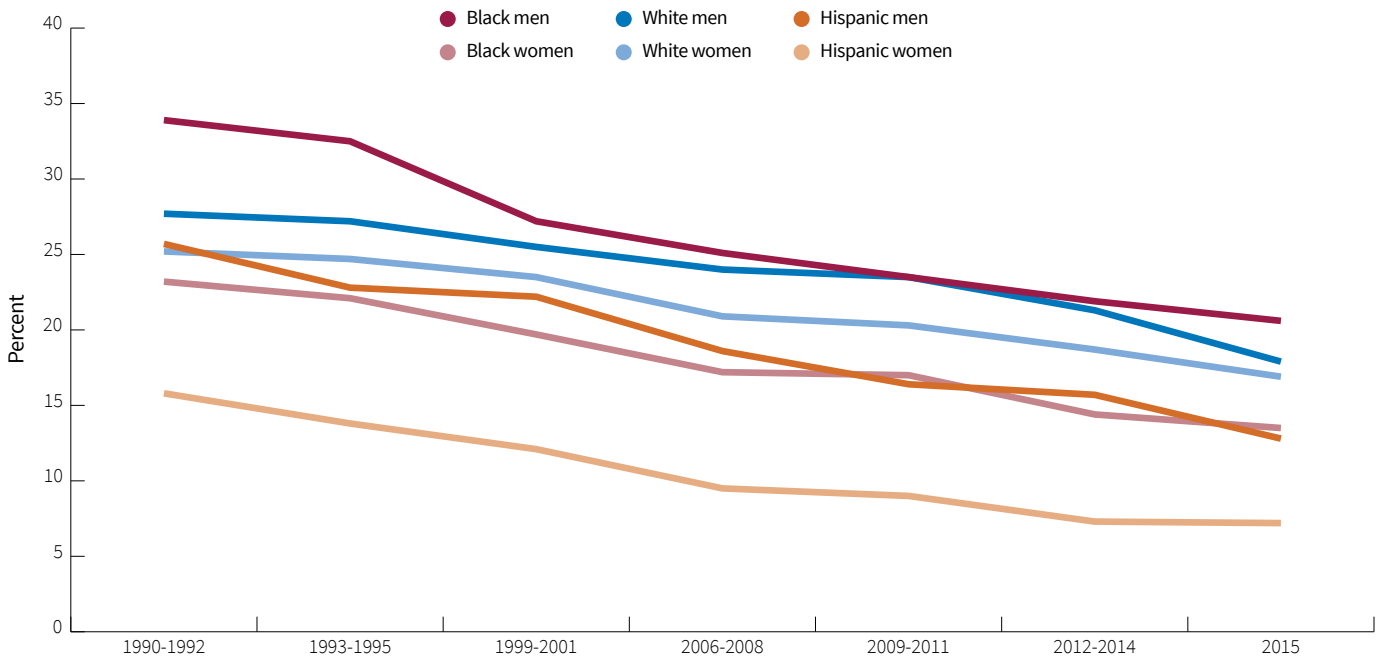
- While cigarette use has been declining over the past several decades, cigar consumption increased by over 90% between 2000 and 2015.[14, 15]
- Based on the 2015 NHIS data, 3.5% of adults (5.9% of men and 1.1% of women) were current cigar smokers.[16]
- In 2015, cigar smoking was more common in non-Hispanic blacks (4.8%) than non-Hispanic whites (3.9%), Hispanics (1.8%), and Asians (0.9%).[16]

Other Combustible Tobacco Products

In addition to cigarettes and cigars, tobacco is used in other combustible forms such as pipes, roll-your-own products, and waterpipes (also known as hookah or shisha). Waterpipes heat tobacco (that is often flavored) in a basin filled with liquid, and users inhale the smoke that is produced through a pipe, often in group settings (e.g., hookah bars). Waterpipe smoking is common in some parts of the world, especially the Eastern Mediterranean region, and is becoming more popular in the US, particularly among younger adults.[17, 18] Users often believe that waterpipe is less harmful than cigarettes; however, waterpipe smoking increases the risk of lung, gastric, and esophageal cancers, as well as other respiratory illnesses.[17, 19-21]

- According to the 2013-14 National Adult Tobacco Survey (NATS) data, 0.6% of adults were reportedly current smokers (every day or some days) of waterpipes.[22]
- In 2013-14, the prevalence of waterpipe smoking decreased with increasing age (ages 18-24 years: 3.2%, ages 45-64 years: 0.1%).[22]
- According to 2013-14 NATS data, 0.3% of adults currently (every or some days) smoked regular pipes.[22]

Figure 1B. Current Cigarette Smoking* Trends, Adults 18 Years and Older by Race/Ethnicity, US, 1990-2015



*Ever smoked 100 cigarettes in lifetime and smoking every day or some days at time of survey. Note: Estimates are age adjusted to the 2000 US standard population.
Source: 1990-2014: National Center for Health Statistics.[9] 2015: National Health Interview Survey, 2015.

Smokeless Tobacco

Smokeless tobacco products, including chewing tobacco and snuff, are not safe substitutes for combustible tobacco products because they increase the risk of oral, esophageal, and pancreatic cancer, as well as noncancerous oral conditions.[23, 24] Nonetheless, the tobacco industry continues to market smokeless tobacco products as supplemental sources of nicotine in smoke-free settings.[25, 26] In addition, cigarette companies are continually developing new products, many of which may have specific appeal to youth.

- According to 2015 NHIS data, an estimated 0.2% of women and 4.5% of men were current users of smokeless (snuff and chewing) tobacco.[16]
- Smokeless tobacco use, in 2015, was most common among white males (6.8%) and among males ages 18-24 years (5.9%) and 25-44 years (5.4%).[16]
- According to the 2015 BRFSS data, smokeless tobacco use (chewing tobacco, snuff, or snus) was lowest in California (1.6%) and highest in West Virginia (9.3%) (Table 1B, page 6).

Electronic Cigarettes

Electronic nicotine delivery systems (ENDS) are battery-operated devices that allow the user to inhale an aerosol produced from cartridges or tanks filled with a liquid typically containing nicotine, propylene glycol and/or vegetable glycerin, other chemicals, and frequently flavoring.[27, 28] The term e-cigarettes will be used hereafter to refer to any ENDS, including those not designed to mimic cigarettes.

E-cigarettes are promoted by their manufacturers as an alternative to conventional cigarettes and as a way to bypass smoke-free laws. There is limited evidence that e-cigarettes and similar products help smokers quit, although current research findings are contradictory and to-date no e-cigarette has been approved by the US Food and Drug Administration (FDA) as a cessation aid.[29, 30] While there are indications that the levels of toxins and other carcinogens are generally lower in current generation e-cigarettes than combustible tobacco products, there are a number of potential health hazards associated with e-cigarette use.[31, 32] These include hazards associated with

Table 1B. Current Tobacco Use (%), Adults 18 Years and Older by State, 2015

State	Cigarette smoking*						Smokeless tobacco use¶
	18 and older	Rank† (1=high)	Men 18 and older	Women 18 and older	Low education‡	High education§	
United States (median)	**17.5**		**19.3**	**15.8**	**28.9**	**7.0**	**4.0**
Range	*9.1-26.0*		*11.2-27.8*	*7.0-25.7*	*14.2-46.7*	*2.8-12.2*	*1.6-9.3*
Alabama	21.4	10	23.8	19.2	33.0	8.7	6.0
Alaska	19.1	16	19.6	18.6	44.4	4.8	6.4
Arizona	14.0	45	16.2	12.0	19.3	6.0	2.7
Arkansas	24.9	3	27.8	22.1	43.1	8.6	6.2
California	11.7	50	15.2	8.3	14.2	5.8	1.6
Colorado	15.7	37	17.1	14.2	27.5	6.7	4.1
Connecticut	13.5	49	16.3	10.9	25.8	6.1	1.7
Delaware	17.4	27	20.9	14.2	24.3	7.2	2.7
District of Columbia	16.0	33	15.8	16.1	27.7	7.7	#
Florida	15.8	36	17.4	14.3	23.3	6.8	2.6
Georgia	17.7	24	20.0	15.5	28.0	7.8	4.3
Hawaii	14.1	44	17.3	10.8	25.3	4.7	2.3
Idaho	13.8	47	14.7	13.0	28.9	4.8	5.3
Illinois	15.1	41	17.6	12.8	22.9	6.3	3.1
Indiana	20.6	12	21.9	19.3	33.6	6.4	4.4
Iowa	18.1	22	19.5	16.7	28.3	6.4	4.5
Kansas	17.7	23	19.3	16.1	29.9	7.2	5.6
Kentucky	26.0	1	26.4	25.5	46.7	10.6	7.3
Louisiana	21.9	8	24.7	19.3	39.7	7.5	5.7
Maine	19.5	15	21.0	18.1	40.4	6.4	3.0
Maryland	15.1	42	16.9	13.4	28.0	6.0	2.6
Massachusetts	14.0	46	16.4	11.9	25.6	5.5	2.6
Michigan	20.7	11	22.4	19.1	44.1	7.3	3.4
Minnesota	16.2	32	17.6	14.8	34.7	7.0	4.0
Mississippi	22.6	4	27.0	18.4	35.0	11.4	7.6
Missouri	22.3	5	23.6	21.0	44.3	8.7	5.5
Montana	18.9	19	19.3	18.5	37.8	5.6	8.3
Nebraska	17.1	30	18.4	15.8	24.4	7.8	5.5
Nevada	17.6	25	20.5	14.6	19.6	8.6	2.7
New Hampshire	15.9	35	16.5	15.4	33.1	5.8	2.1
New Jersey	13.5	48	15.7	11.5	15.0	7.4	1.8
New Mexico	17.5	26	19.1	16.0	24.5	9.8	4.0
New York	15.2	39	17.7	12.9	22.0	7.0	2.4
North Carolina	19.0	18	21.9	16.3	26.8	6.1	4.9
North Dakota	18.7	20	21.9	15.4	28.4	8.0	7.6
Ohio	21.6	9	23.1	20.2	42.9	8.0	4.4
Oklahoma	22.2	6	24.0	20.4	36.8	9.2	6.6
Oregon	17.1	29	18.0	16.3	32.1	7.0	3.8
Pennsylvania	18.1	21	19.8	16.6	31.8	7.1	4.0
Rhode Island	15.5	38	18.5	12.8	26.0	7.1	2.1
South Carolina	19.7	14	23.4	16.2	33.1	6.9	4.2
South Dakota	20.1	13	19.6	20.6	36.3	6.4	6.4
Tennessee	21.9	7	22.8	21.1	35.1	8.4	6.3
Texas	15.2	40	18.2	12.4	20.6	6.7	4.0
Utah	9.1	51	11.2	7.0	19.6	2.8	2.8
Vermont	16.0	34	18.0	14.0	32.1	6.5	3.7
Virginia	16.5	31	18.8	14.4	32.0	7.5	4.3
Washington	15.0	43	16.6	13.4	27.7	5.3	3.4
West Virginia	25.7	2	25.8	25.7	37.0	12.2	9.3
Wisconsin	17.3	28	19.8	14.9	26.2	6.8	3.8
Wyoming	19.1	17	20.6	17.5	30.6	7.1	9.2

*Smoked 100 cigarettes in their entire lifetime and are current smokers (regular and irregular). †Based on overall prevalence for 18 and older. ‡Adults 25 years and older with less than a high school education. §Adults 25 years and older with at least a college degree. ¶Reported currently using chewing tobacco, snuff, or snus every day or some days. #Estimate not presented due to instability.

Source: Behavioral Risk Factor Surveillance System, 2015.

nicotine use, along with potential cardiovascular and lung effects.[33] Further, ingesting large quantities of e-cigarette liquids is dangerous. Given the newness of these products, additional health risks associated with e-cigarettes may be discovered in the future.

- Based on 2015 NHIS data, 3.6% of adults were current e-cigarette users, with differences by sex (men: 4.4%, women: 2.8%), age (18-24 years: 5.2%, 65+ years: 1.1%), and race/ethnicity (white: 4.5%, Asian: 2.2%, black: 2.1%, Hispanic: 1.7%).[16]
- In 2014, an estimated 16% of current conventional cigarette smokers were concurrent users of e-cigarettes.[34]

Youth Tobacco Use

Tobacco use during adolescence can induce nicotine dependence potentially leading to smoking-related diseases. A majority (almost 90%) of adults who smoke regularly began smoking before the age of 18.[35] Adolescents are more sensitive to nicotine than adults, and there is also evidence that nicotine adversely affects adolescent brain development.[36, 37] Further, adolescents appear to be more easily addicted to nicotine and the likelihood of developing smoking-related cancers increases with the duration of smoking, such that those who start at younger ages and continue to smoke are at highest risk for tobacco-related illness and death.[35]

Cigarettes

- According to the 2015 National Youth Tobacco Survey (NYTS), current cigarette use (smoked cigarettes on one or more of the 30 days preceding the survey) among high school students decreased from 28.5% in 1999[38] to 9.3% in 2015 (Table 1C).
- Based on the 2015 Youth Risk Behavior Survey (YRBS), Rhode Island had the lowest (4.8%) and West Virginia had the highest (18.8%) smoking prevalence among high school students (Table 1D, page 8).
- Frequent cigarette smoking (smoked cigarettes on 20 or more of the 30 days preceding the survey) among high school students ranged from 1.5% in California and Rhode Island to 7.4% in West Virginia, based on 2015 YRBS data[39] (Table 1D, page 8).

Table 1C. Current Tobacco Use* (%), High School Students, US, 2015

	Cigarettes	Cigars	SLT	Waterpipe	E-cigs
Overall	**9.3**	**8.6**	**6.0**	**7.2**	**16.0**
Gender					
Boys	10.7	11.5	10.0	7.4	19.0
Girls	7.7	5.6	1.8	6.9	12.8
Race/Ethnicity					
White	10.2	8.4	7.8	6.9	17.2
Black	5.7	12.8	1.9	6.4	8.9
Hispanic	9.0	7.3	4.8	8.7	16.4

SLT – smokless tobacco. *One or more days out of the 30 days preceding the survey.

Source: Singh T, et al.[40]

- Current cigarette smoking among youth varies by race/ethnicity. Based on data from the Monitoring the Future survey, the prevalence among 12th-graders has been lowest among blacks and highest among whites since the early 1980s (Figure 1C, page 9).

Other Tobacco Products

Use of tobacco products other than cigarettes, such as waterpipes, has increased dramatically among youth. Cigar, waterpipe, and smokeless tobacco are available in flavors that are especially appealing to this population.[40]

- According to 2015 NYTS data, 8.6% of high school students reported current use of cigars and 6.0% reported current use of smokeless tobacco (Table 1C).
- High school girls (5.6%) had lower cigar use than boys (11.5%). Girls (1.8%) also had lower smokeless tobacco prevalence than boys (10.0%) (Table 1C).
- Use of waterpipes among high school students nearly doubled from 2011 (4.1%) to 2015 (7.2%).[40]

Electronic Cigarettes

The use of e-cigarettes in youth has increased drastically in the past several years, surpassing conventional cigarette use among high school students in 2014.[41] This rapid uptake prompted a 2016 Surgeon General's Report on E-Cigarette Use among Youth and Young Adults.[37] In addition to the direct hazards of e-cigarettes, including nicotine addiction and its adverse impact on fetal and adolescent brain development, there is also concern that

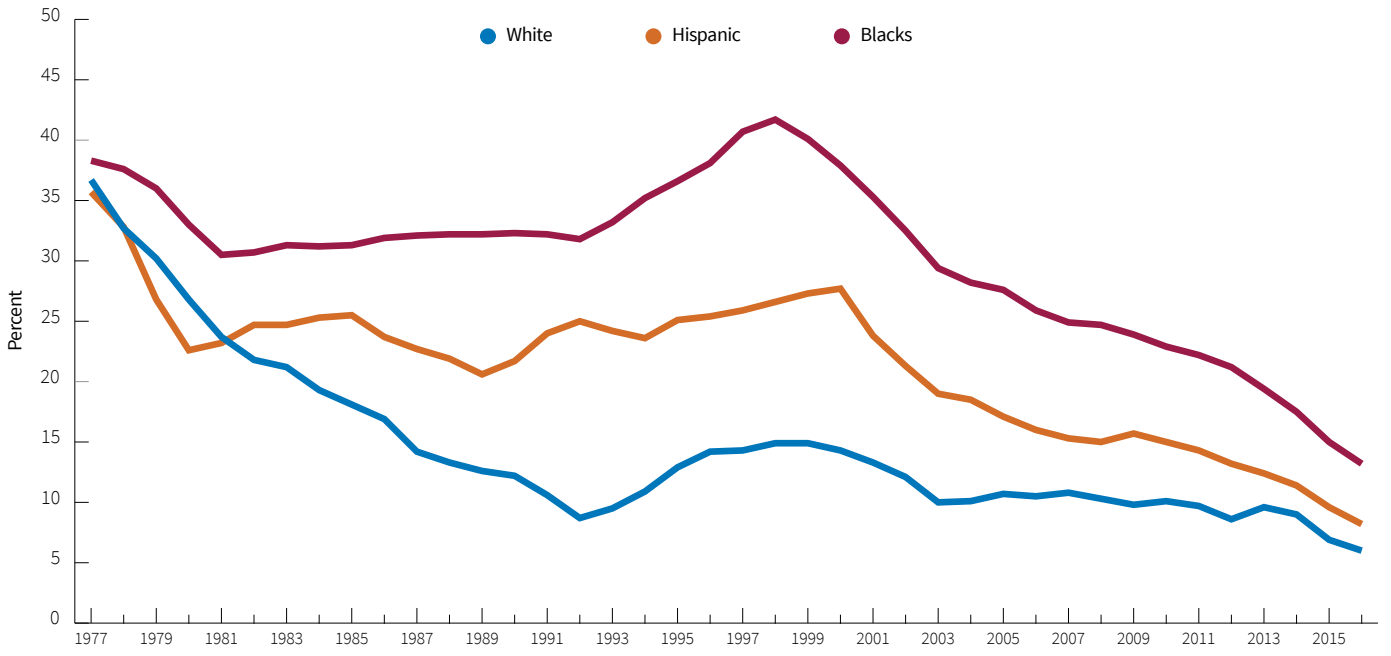
Table 1D. Tobacco Use (%), High School Students by State, 2015

	Current cigarette smoking*	Rank† (1=high)	Frequent cigarette smoking‡	Current cigar smoking*	Current smokeless tobacco use*	Current use of e-cigs*
National Range	*4.8-18.8*		*1.5-7.4*	*6.8-16.5*	*3.0-13.4*	*13.4-31.2*
Alabama	14.0	6	4.2	13.4	12.5	24.5
Alaska	11.1	17	3.7	7.1	11.7	17.7
Arizona	10.1	21	2.3	10.1	6.2	27.5
Arkansas	15.7	3	6.1	14.2	10.6	26.4
California	7.7	34	1.5	6.8	3.0	21.4
Colorado§	–	–	–	–	–	–
Connecticut	10.3	20	1.7	–	–	–
Delaware	9.9	25	4.0	10.9	4.5	23.5
District of Columbia¶	–	–	–	11.5	–	13.4
Florida	9.9	25	3.2	–	–	–
Georgia§	–	–	–	–	–	–
Hawaii	9.7	27	1.9			25.1
Idaho	9.7	27	2.7	8.2	8.3	24.8
Illinois	10.1	21	2.6	9.4	5.6	26.6
Indiana	11.2	15	3.4	11.4	9.4	23.9
Iowa§	–	–	–	–	–	–
Kansas§	–	–	–	–	–	–
Kentucky	16.9	2	5.7	14.0	12.6	23.4
Louisiana§	–	–	–	–	–	–
Maine	11.2	15	4.6	8.8	5.1	16.8
Maryland	8.7	32	2.4	10.3	5.8	20.0
Massachusetts	7.7	34	2.3	10.4	5.5	23.7
Michigan	10.0	24	3.0	9.2	6.2	23.0
Minnesota§	–	–	–	–	–	–
Mississippi	15.2	5	4.8	16.5	11.6	22.9
Missouri	11.0	18	4.2	12.1	10.0	22.0
Montana	13.1	8	3.6	12.6	12.3	29.5
Nebraska	13.3	7	3.7	8.1	9.3	22.3
Nevada	7.5	36	2.0	7.1	5.1	25.6
New Hampshire	9.3	30	3.7	11.0	6.0	25.0
New Jersey§	–	–	–	–	–	–
New Mexico	11.4	14	2.7	10.5	8.7	24.0
New York	8.8	31	2.9	10.2	6.7	21.7
North Carolina	13.1	8	3.8	–	8.6	29.6
North Dakota	11.7	12	4.3	9.2	10.6	22.3
Ohio§	–	–	–	–	–	–
Oklahoma	13.1	8	3.2	9.4	9.0	23.8
Oregon§	–	–	–	–	–	–
Pennsylvania	12.9	11	4.7	12.5	9.5	24.1
Rhode Island	4.8	37	1.5	8.4	5.3	19.3
South Carolina	9.6	29	2.8	11.2	7.2	19.7
South Dakota	10.1	21	4.7	9.6	11.7	17.3
Tennessee	11.5	13	3.9	11.0	11.0	21.7
Texas§	–	–	–	–	–	–
Utah§	–	–	–	–	–	–
Vermont	10.8	19	3.9	10.4	6.9	15.3
Virginia	8.2	33	2.2	7.4	5.5	16.8
Washington§	–	–	–	–	–	–
West Virginia	18.8	1	7.4	13.9	13.4	31.2
Wisconsin§	–	–	–	–	–	–
Wyoming	15.7	3	5.0	12.6	11.6	29.6

*Smoked or used product on one or more of the 30 days preceding the survey. †Based on % current cigarette smoking. ‡Smoked cigarettes on 20 or more of the 30 days preceding the survey. §No data available for 2015 survey cycle. See Survey Sources (p. 69) for more information. ¶Data not available for all tobacco-related questions.

Source: Kann L, et al.[39]

Figure 1C. Current Cigarette Smoking* (%) Trends, 12th-graders by Race/Ethnicity, US, 1977-2016†



*Used cigarettes in the past 30 days. †Percentages are two-year averages.
Source: Monitoring the Future Survey.

e-cigarettes may act as a gateway to combustible tobacco use. Current evidence regarding this causal association is mixed, and research is underway to help clarify this issue. Further research is also needed to identify the constituents of e-cigarettes, given the growing number of products that are becoming available. For example, recent study results suggest that a substantial amount of youth – between one- and two-thirds[42, 43] – use non-nicotine e-cigarettes. This indicates that e-cigarettes may not be the most common form of nicotine or tobacco product used by youth.

- According to NYTS data, the prevalence of current e-cigarette use among high school students increased from 1.5% in 2011[40] to 16.0% in 2015 (boys: 19.0%, girls: 12.8%) (Table 1C, page 7).
- The growing prevalence of e-cigarette use is likely due in large part to increased awareness and advertising of e-cigarettes.[44, 45]
- In 2015, the prevalence of e-cigarette use was lower among blacks (8.9%) compared to whites (17.2%) and Hispanics (16.4%) (Table 1C, page 7).
- In 2015, based on YRBS data, 13.4% of high school students in the District of Columbia reported current use of e-cigarettes compared to 31.2% of high school students in West Virginia (Table 1D).

Tobacco Cessation

Much of the risk of disease and premature death from smoking could be prevented by smoking cessation. Tobacco dependence is a chronic condition; effective treatment is available that can double or triple the chances of long-term abstinence. According to the latest US Public Health Service (USPHS) and US Preventive Services Task Force guidelines, these treatments include nicotine replacement therapy (NRT) products, other prescription medications (e.g., buproprion and varenicline), and counseling (individual, group, or telephone).[46, 47]

Following are a few examples of tobacco cessation programs and initiatives. Help is available for those who want to quit.

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

The Great American Smokeout®

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

Smokefree.gov

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

Specifically for youth:
teen.smokefree.gov (or text QUIT to iQUIT [47848])

youthtobaccocessation.org/index.html

cdc.gov/tobacco/quit_smoking/cessation/youth_tobacco_cessation

fda.gov/TobaccoProducts/PublicHealthEducation/PublicEducationCampaigns/default.htm

Combinations of one or more types of these medications and counseling may be more effective. One strategy to facilitate cessation is to integrate cessation services into comprehensive tobacco control programs. Examples include physician outreach and education, quit-smoking clinics, tobacco quitlines, text messaging systems, mobile phone applications, and free distribution of NRT. Nationally, the use of recommended cessation services remains low, especially among racial and ethnic minorities as well as individuals with lower socioeconomic status.[48]

Adult Tobacco Cessation

Smokers who quit can expect to live as many as 10 years longer than those who continue to smoke.[2, 49] One study showed that those who quit smoking at age 60, 50, 40, or 30 gained about three, six, nine, or 10 years of life expectancy, respectively.[49] Results of a recent nationwide study indicate that adult cessation rates have significantly increased since 1990.[50] In addition, smokers who are diagnosed with cancer are more likely to quit than smokers who are not diagnosed, and cancer survivors who quit smoking have better health outcomes than those who do not.[2, 51] However, an American Cancer Society study estimated that approximately nine years after diagnosis, 9% of cancer survivors reported current smoking.[52]

- Since 2002, there have been more former smokers than current smokers in the US. According to the 2015 NHIS, approximately 59% (52.8 million) of the 89.3 million Americans who have ever smoked 100 cigarettes in their lifetime are former smokers.[16]
- Of the 36.5 million US adults who currently smoke, 18.0 million (49.2%) reported having attempted to quit for at least one day in the past year.[16]

Youth Tobacco Cessation

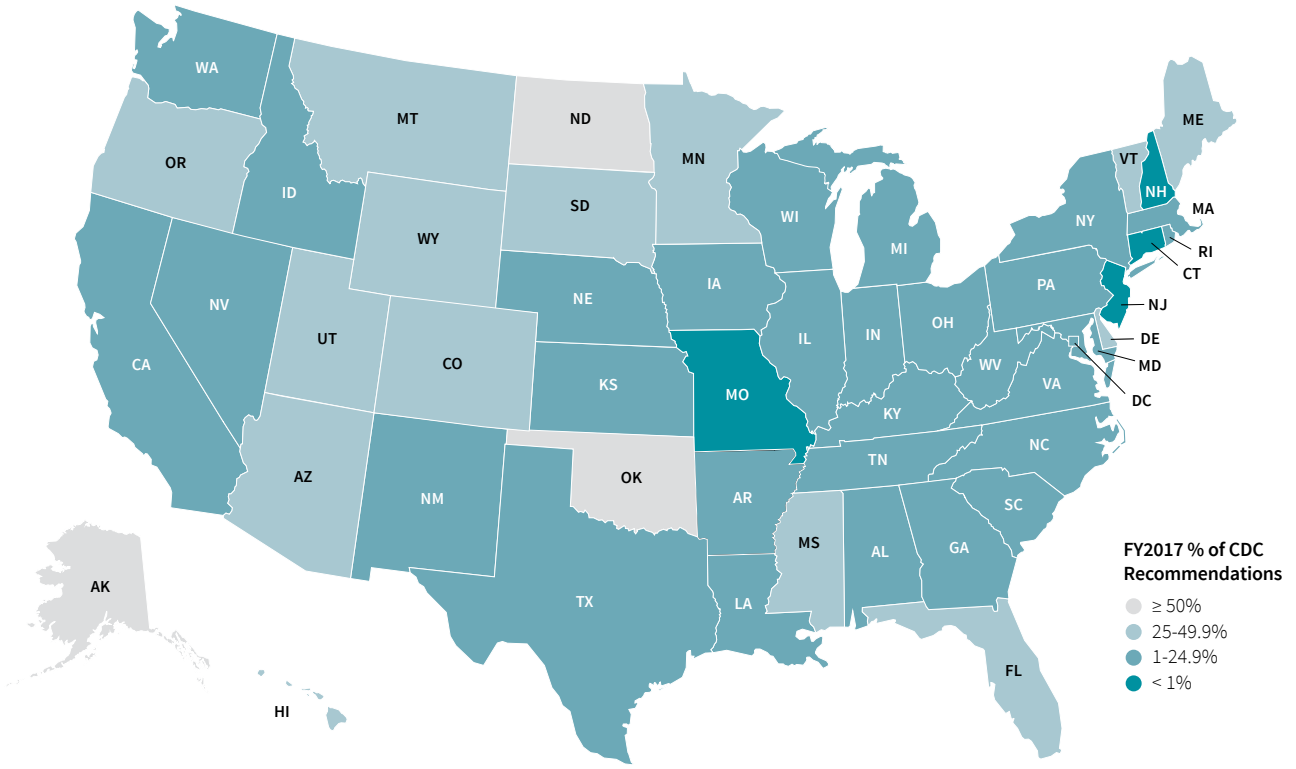
The opportunity to prevent diseases caused by smoking is greatest when smokers quit early. Adolescents often underestimate the strength and rapidity of tobacco dependence and generally overestimate their ability to quit smoking.[53] The USPHS recommends tobacco cessation counseling for adolescent smokers. Although nicotine replacement medications appear to be safe in adolescents, there is little evidence to date that these medications are effective in promoting long-term abstinence among adolescent smokers, and as a result they are not yet recommended as a component of adolescent tobacco use interventions.[47]

- According to 2015 YRBS data, 45.4% of high school student smokers made a recent attempt to quit smoking cigarettes (boys: 39.7%, girls: 52.8%).[39]
- In 2015, 35.2% of high school smokers in California made a recent quit attempt compared to 59.5% in Alaska.[39]

Comprehensive Tobacco Control Programs

Tobacco control strategies have been outlined by both the World Health Organization (WHO) (global) and the Centers for Disease Control and Prevention (CDC) (federal and state). This section highlights the CDC's comprehensive tobacco control program since the US has not yet ratified the international tobacco control treaty,

Figure 1D. State Funding for Tobacco Control, Fiscal Year 2017



FY- Fiscal Year. Note: Annual funding amounts only include state funds.
Source: Tobacco Free Kids, et al.[57]

the WHO's Framework Convention on Tobacco Control. The CDC's comprehensive tobacco control program aims to prevent initiation among youth and young adults, promote quitting among youth and adults, eliminate exposure to secondhand smoke (SHS), and identify and eliminate tobacco-related disparities.[54]

Evidence for these recommendations stems, in part, from states that have documented the benefits of implementing comprehensive tobacco control programs.[55] For example, California's longstanding comprehensive tobacco control program is associated with a marked drop in adolescent smoking initiation, as well as an earlier and faster decrease in lung cancer mortality rates compared to other states.[56] Unfortunately, even with the evidence for the success of these programs, tobacco use prevention spending is still far below CDC-recommended funding levels (Figure 1D).[54, 57]

Initiatives in Tobacco Control

There are several tobacco control initiatives at the federal, state, and local level, which are discussed by topic area below.

Federal regulation of tobacco products: The Family Smoking Prevention and Tobacco Control Act of 2009 granted the FDA the authority to regulate the manufacturing, marketing, and selling of tobacco products for the first time[58] (see Federal Policies note, page 68). In August 2016, the FDA's regulatory efforts expanded and now include waterpipes, e-cigarettes, dissolvables, smokeless tobacco, cigarettes, all cigars, and roll-your own and pipe tobacco, as well as future products that meet the statutory definition of a tobacco product.[59] Federal regulations prohibit: fruit and candy flavorings in cigarettes; misleading descriptors such as light, low, and mild; unsubstantiated health claims;

tobacco brand-name sponsorships of sports and entertainment events; free tobacco and non-tobacco item giveaways; and sale of cigarettes in packs of less than 20. New, larger, more graphic warning labels are required on cigarettes; and stores are required to place tobacco products behind counters. In addition, the law requires premarket review of new products and grants authority to remove harmful ingredients. The law also preserves state and local authority to further restrict tobacco industry marketing and promotions.[58] However, tobacco companies have challenged the graphic warning label requirements in the legal system resulting in delayed implementation. The American Cancer Society and the American Cancer Society Cancer Action Network℠ (ACS CAN), with other tobacco control collaborators, have filed a lawsuit against the FDA to force the implementation of this provision.

Cessation assistance: As of December 2016, provisions in the Patient Protection and Affordable Care Act (ACA) require coverage for cessation counseling and medications for people in most marketplace plans and those who are insured with Medicare at no cost to the individual (see Federal Policies note, page 68). In addition, pregnant women and people covered with Medicaid in states that have expanded coverage have access to no-cost tobacco cessation services. For people who were eligible for Medicaid prior to the ACA, individual states determine cessation treatment coverage, though there is a federal dollars matching program to incentivize its use.[60] As of January 1, 2017 only six states offered comprehensive coverage of cessation treatments, including all types of medications and counseling for all adults in their Medicaid program.[61] Additionally, while insurers can issue a surcharge for tobacco users, it may be lifted for some tobacco users who utilize cessation services. See the sidebar on page 10 for examples of cessation services.

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.[47, 62]

Tobacco taxes: Taxation is also an important component of tobacco control. There is very strong evidence that the price of cigarettes is inversely and predictably related to consumption; nationwide, a 10% increase in price reduces overall cigarette consumption by 3% to 5% and youth prevalence by 6% to 7%.55 Tax increases are particularly effective for low-socioeconomic status and/or young smokers who are more price sensitive than other smokers.63, 64 In addition, such increases can also form an important revenue source for government-funded health care or tobacco control programs. Unfortunately, loopholes in tax regulations and tobacco industry tactics can negate the benefits of cigarette excise tax increases.

The last increase in the federal cigarette excise tax occurred in 2009, raising the tax on cigarettes from $0.39 to $1.01 per pack.[57] Taxes on tobacco products other than cigarettes vary by product type[65] and continue to lag behind, providing a less expensive alternative for tobacco users. Cigarette affordability, which incorporates the price of cigarettes along with an individual's ability to pay for them, varies widely across the US.[66] The recommended method of taxation is as a percentage of price supplemented with a minimum tax to ensure that prices are not too low even if the product is heavily discounted. Furthermore, the WHO recommends that excise taxes account for at least 70% of the final consumer price, [67] a mark that no state has yet reached.

- As of April 1, 2017, the average state cigarette excise tax rate is $1.69, ranging from 17 cents per pack in Missouri to $4.35 per pack in New York (Cover, Table 1E).
- E-cigarettes are not taxed at the federal level. As of April 1, 2017, seven states (California, Kansas, Louisiana, Minnesota, North Carolina, Pennsylvania, West Virginia) and the District of Columbia have an e-cigarette excise tax.[69]

Reduce exposure to secondhand smoke: Exposure to secondhand smoke (SHS) causes 5% of lung cancer deaths annually[2] and increases the risk of other lung diseases, cancers, coronary artery disease, and heart attacks.[70-72] Comprehensive smoke-free laws are effective in reducing SHS exposure, modifying smoking behavior, and reducing the risk of smoking-related disease.[72, 73]

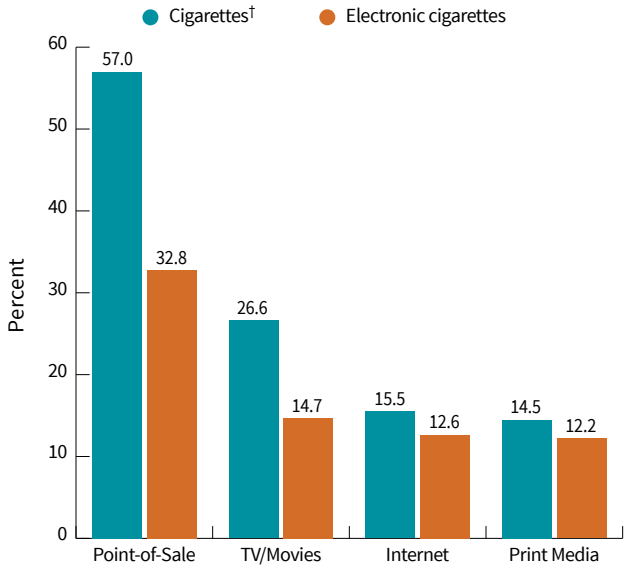
Table 1E. Comprehensive Tobacco Control Measures by State, 2017

	Cigarette tax per pack ($)*	100% smoke-free laws in workplaces, restaurants, bars, and/or state-run gambling establishments†	Tobacco control spending‡ ($ millions)	Tobacco control spending % of tobacco revenue§
United States (average)	**$1.69**		**$9.6**	**2.7%**
Range	*0.17-4.35*		*0.0-75.7*	*0.0-14.8%*
Alabama	$0.675		$1.5	0.5%
Alaska	$2.00		$9.5	9.7%
Arizona	$2.00	W, R, B, C	$18.4	4.2%
Arkansas	$1.15		$9.0	3.2%
California	$2.87	W, R, B, C	$75.7	4.1%
Colorado	$0.84	R, B, C	$23.2	7.8%
Connecticut	$3.90	R, B, C	$0.0	0.0%
Delaware	$1.60	W, R, B, C	$6.4	4.6%
District of Columbia	$2.50	W, R, B	$1.0	1.4%
Florida	$1.339	W, R, C	$67.8	4.3%
Georgia	$0.37		$1.8	0.5%
Hawaii	$3.20	W, R, B	$5.3	3.0%
Idaho	$0.57	R	$2.9	3.7%
Illinois	$1.98	W, R, B, C	$9.1	0.8%
Indiana	$0.995	W, R	$5.9	1.0%
Iowa	$1.36	W, R, B	$5.2	1.7%
Kansas	$1.29	W, R, B	$0.8	0.4%
Kentucky	$0.60		$2.4	0.7%
Louisiana	$1.08	W, R	$7.0	1.5%
Maine	$2.00	W, R, B, C¶	$7.8	4.0%
Maryland	$2.00	W, R, B, C	$10.6	1.9%
Massachusetts	$3.51	W, R, B, C	$3.9	0.4%
Michigan	$2.00	W, R, B	$1.6	0.1%
Minnesota	$3.04	W, R, B, C	$22.0	3.0%
Mississippi	$0.68		$10.7	4.3%
Missouri	$0.17		$0.1	0.0%
Montana	$1.70	W, R, B, C	$6.4	5.4%
Nebraska	$0.64	W, R, B, C	$2.6	2.5%
Nevada	$1.80	W, R	$1.0	0.5%
New Hampshire	$1.78	R, B	$0.1	0.0%
New Jersey	$2.70	W, R, B	$0.0	0.0%
New Mexico	$1.66	R, B	$5.7	4.2%
New York	$4.35	W, R, B, C	$39.3	2.0%
North Carolina	$0.45	R, B	$1.1	0.3%
North Dakota	$0.44	W, R, B, C	$9.9	14.8%
Ohio	$1.60	W, R, B, C	$13.5	1.0%
Oklahoma	$1.03		$23.5	5.9%
Oregon	$1.32	W, R, B, C	$9.8	2.8%
Pennsylvania	$2.60	W	$13.9	0.8%
Rhode Island	$3.75	W, R, B	$0.4	0.2%
South Carolina	$0.57		$5.0	2.1%
South Dakota	$1.53	W, R, B, C	$4.5	5.1%
Tennessee	$0.62		$1.1	0.3%
Texas	$1.41		$10.2	0.5%
Utah	$1.70	W, R, B	$7.5	5.0%
Vermont	$3.08	W, R, B, C	$3.4	2.9%
Virginia	$0.30		$8.2	2.7%
Washington	$3.025	W, R, B, C	$2.3	0.4%
West Virginia	$1.20		$3.0	1.2%
Wisconsin	$2.52	W, R, B, C	$5.3	0.7%
Wyoming	$0.60		$4.2	9.20%

W – workplaces, R – restaurants, B – bars, C – state-run gambling establishments. *State excise taxes in effect as of April 1, 2017. †Smoke-free laws passed or implemented, reported as of January 2, 2017. ‡Includes only state funds for fiscal year 2017. §Tobacco revenue is the projected collections from tobacco taxes and payments to states from the Master Settlement Agreement with the tobacco companies. ¶Pertains to state-run gambling establishments that opened in July 2003 or later.

Sources: Tobacco Free Kids, et al.[57] American Nonsmokers Rights Foundation.[68]

Figure 1E. Exposure to Tobacco Product Marketing* (%), Middle and High School Students, US, 2015



*Respondents who reported "Most of the time" or "Always". †Includes cigarettes and other tobacco products, except electronic cigarettes.

Source: National Youth Tobacco Survey, 2015.

Nationally, exposure to SHS among nonsmokers, as measured by detectable levels of cotinine (a metabolite of nicotine), declined from 84% in 1988-1994[74] to 25% in 2011-2012.[75] This decline likely reflects widespread implementation of smoke-free laws and reductions in smoking prevalence, though certain groups, such as those with lower socioeconomic status, have considerably higher SHS exposure.[75]

- Almost 60% of the US population is covered by a comprehensive law that prohibits smoking in all non-hospitality workplaces (such as offices, factories, and warehouses), restaurants, and bars.[68]
- Eighteen states have statewide smoke-free laws that prohibit smoking in non-hospitality workplaces, restaurants, bars, and state-run gambling establishments (Table 1E, page 13).
- There are over 860 municipalities in the US with 100% smoke-free laws in non-hospitality workplaces, restaurants, and bars (as of January 2017).[68]
- There are over 1,700 colleges and universities with 100% smoke-free campuses. Of these colleges, more than 1,300 also prohibit e-cigarette use.[68]

Age restrictions: Federal law prohibits the sale of all tobacco products, including e-cigarettes to persons under the age of 18. In addition, Hawaii, California, and more than 200 localities have passed legislation to increase the minimum age of sale for tobacco products to 21.[76, 77]

Countering Tobacco Industry Marketing

Exposure to tobacco industry marketing (advertising and promotions) significantly increases the likelihood that adolescents will use tobacco and increases per-capita cigarette consumption in adults and youth.[78] Since 1998, tobacco companies increased their cigarette advertising and promotional expenditures from $6.7 billion per year to a peak of $15.1 billion in 2003.[79]

Tobacco industry marketing is targeted toward youth in a variety of ways. As some avenues of tobacco marketing, such as sports and sporting events,[80] become more restrictive, the industry is moving toward different avenues.[81]

- Based on NYTS 2015 data, 12.2% of middle and high school students were exposed to e-cigarette marketing in print media compared to 32.8% who were exposed at points-of-sale (Figure 1E).
- In 2015, 14.5% of students were exposed to marketing for cigarettes and other tobacco products (excluding e-cigarettes) in print media while 57.0% reported seeing marketing at points-of-sale (Figure 1E).

Funding for Tobacco Control

Research indicates that increased state spending on tobacco control is associated with lower youth and adult smoking prevalence and subsequently reduces smoking-attributable deaths.[82, 83] Unfortunately, for fiscal year 2017, the funding level for state tobacco prevention programs was less than 10% of the recommended level for 23 states and less than 50% of the recommended level for all states except Alaska, North Dakota, and Oklahoma.[57]

The American Cancer Society Intramural Research and Cancer Control departments are working to provide insights into how market forces and government policies

affect tobacco use and consequent health outcomes. In addition, ACS CAN works to ensure the passage of numerous local-, state-, and federal-level tobacco control policies with the common goal of reducing the burden of tobacco use and related diseases in the US.

References

1. US Department of Health and Human Services. Smoking and Health Report of the Advisory Committee to the Surgeon General of the Public Health Service. Washington, DC: Public Health Service, 1964.

2. US Department of Health and Human Services. *The Health Consequences of Smoking-50 Years of Progress. A Report from the Surgeon General*. Atlanta, GA; USA: Department of Health and Human Services. Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 2014.

3. Centers for Disease Control and Prevention. Smoking-attributable mortality, years of potential life lost, and productivity losses – United States, 2000-2004. *MMWR Morb Mortal Wkly Rep*. 2008;57: 1226-1228.

4. Secretan B, Straif K, Baan R, et al. A review of human carcinogens – Part E: tobacco, areca nut, alcohol, coal smoke, and salted fish. *Lancet Oncol*. 2009 10: 1033-1034.

5. Siegel RL, Jacobs EJ, Newton CC, et al. Deaths Due to Cigarette Smoking for 12 Smoking-Related Cancers in the United States. *JAMA Intern Med*. 2015;175: 1574-1576.

6. Jacobs EJ, Newton CC, Carter BD, et al. What proportion of cancer deaths in the contemporary United States is attributable to cigarette smoking? *Ann Epidemiol*. 2015;25: 179-182 e171.

7. Lortet-Tieulent J, Goding Sauer A, Siegel RL, et al. State-Level Cancer Mortality Attributable to Cigarette Smoking in the United States. *JAMA Intern Med*. 2016.

8. Henley SJ, Thomas CC, Sharapova SR, et al. Vital Signs: Disparities in Tobacco-Related Cancer Incidence and Mortality – United States, 2004-2013. *MMWR Morb Mortal Wkly Rep*. 2016;65: 1212-1218.

9. National Center for Health Statistics. *Health, United States, 2015: With Special Feature on Racial and Ethnic Disparities*. Hyattsville, MD, 2016.

10. Jamal A, King BA, Neff LJ, Whitmill J, Babb SD, Graffunder CM. Current Cigarette Smoking Among Adults – United States, 2005-2015. *MMWR Morb Mortal Wkly Rep*. 2016;65: 1205-1211.

11. Baker F, Ainsworth SR, Dye JT, et al. Health risks associated with cigar smoking. *JAMA*. 2000;284: 735-740.

12. Shanks TG, Burns DM. *Disease consequences of cigar smoking. National Cancer Institute, Smoking and Tobacco Control, Monograph 9: Cigars – Health Effects and Trends*. Washington, DC: National Institutes of Health, 1998.

13. Shapiro JA, Jacobs EJ, Thun MJ. Cigar smoking in men and risk of death from tobacco-related cancers. *J Natl Cancer Inst*. 2000;92: 333-337.

14. Campaign for Tobacco Free Kids. The Rise of Cigars and Cigar-Smoking Harms. Available from URL: https://www.tobaccofreekids.org/research/factsheets/pdf/0333.pdf. Accessed September 26, 2016.

15. Wang TW, Kenemer B, Tynan MA, Singh T, King B. Consumption of Combustible and Smokeless Tobacco – United States, 2000-2015. *MMWR Morb Mortal Wkly Rep*. 2016;65: 1357-1363.

16. National Center for Health Statistics. National Health Interview Survey, 2015. Public-use data file and documentation. Available from URL: http://www.cdc.gov/nchs/nhis/quest_data_related_1997_forward.htm. Accessed July 16, 2016.

17. Cobb C, Ward KD, Maziak W, Shihadeh AL, Eissenberg T. Waterpipe tobacco smoking: an emerging health crisis in the United States. *Am J Health Behav*. 2010;34: 275-285.

18. Eissenberg T, Ward KD, Smith-Simone S, Maziak W. Waterpipe tobacco smoking on a U.S. College campus: prevalence and correlates. *J Adolesc Health*. 2008;42: 526-529.

19. Akl EA, Gaddam S, Gunukula SK, Honeine R, Jaoude PA, Irani J. The effects of waterpipe tobacco smoking on health outcomes: a systematic review. *Int J Epidemiol*. 2010;39: 834-857.

20. Raad D, Gaddam S, Schunemann HJ, et al. Effects of water-pipe smoking on lung function: a systematic review and meta-analysis. *Chest*. 2011;139: 764-774.

21. El-Zaatari ZM, Chami HA, Zaatari GS. Health effects associated with waterpipe smoking. *Tob Control*. 2015;24 Suppl 1: i31-i43.

22. Hu SS, Neff L, Agaku IT, et al. Tobacco Product Use Among Adults – United States, 2013-2014. *MMWR Morb Mortal Wkly Rep*. 2016;65: 685-691.

23. Siddiqi K, Shah S, Abbas SM, et al. Global burden of disease due to smokeless tobacco consumption in adults: analysis of data from 113 countries. *BMC medicine*. 2015;13: 194.

24. Boffetta P, Hecht S, Gray N, Gupta P, Straif K. Smokeless tobacco and cancer. *Lancet Oncol*. 2008;9: 667-675.

25. Maxwell JC. *The Maxwell Report: The Smokeless Tobacco Industry in 2011*. Richmond (VA): John C. Maxwell J, 2012.

26. Campaign for Tobacco-Free Kids. Smokeless Tobacco in the United States. Available from URL: http://tobaccofreekids.org/research/factsheets/pdf/0231.pdf. Accessed September 26, 2016.

27. Cheng T. Chemical evaluation of electronic cigarettes. *Tob Control*. 2014;May: Suppl 2:ii11-17.

28. US Food and Drug Administration. Vaporizers, E-Cigarettes, and Other Electronic Nicotine Delivery Systems (ENDS). Available from URL: http://www.fda.gov/TobaccoProducts/Labeling/ProductsIngredientsComponents/ucm456610.htm. Accessed September 26, 2016.

29. Malas M, van der Tempel J, Schwartz R, et al. Electronic Cigarettes for Smoking Cessation: A Systematic Review. *Nicotine Tob Res*. 2016;18: 1926-1936.

30. Hartmann-Boyce J, McRobbie H, Bullen C, Begh R, Stead LF, Hajek P. Electronic cigarettes for smoking cessation. *Cochrane Database Syst Rev*. 2016;9: CD010216.

31. Hajek P, Etter JF, Benowitz N, Eissenberg T, McRobbie H. Electronic cigarettes: review of use, content, safety, effects on smokers and potential for harm and benefit. *Addiction*. 2014;109: 1801-1810.

32. Goniewicz ML, Knysak J, Gawron M, et al. Levels of selected carcinogens and toxicants in vapour from electronic cigarettes. *Tob Control*. 2014;23: 133-139.

33. Benowitz N. Nicotine Toxicity. In: Ferrence R, Slade J, Room R, Pope M, editors. *Nicotine and Public Health*. Washington DC: American Public Health Association, 2000.

34. Schoenborn CA, Gindi RM. Electronic Cigarette Use Among Adults: United States, 2014. NCHS Data Brief. 2015;217.

35. US Department of Health and Human Services. *Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General*. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease and Prevention and Health Promotion, Office of Smoking and Health, 2012.

36. Goriounova NA, Mansvelder HD. Nicotine exposure during adolescence alters the rules for prefrontal cortical synaptic plasticity during adulthood. *Front Synaptic Neurosci*. 2012;4: 3.

37. US Department of Health and Human Services. *E-Cigarette Use Among Youth and Young Adults*. Rockville, MD: US Department of Health and Human Services, Office of the Surgeon General, 2016.

38. Centers for Disease Control and Prevention. Youth Tobacco Surveillance United States, 1998-1999. *MMWR Surveill Summ*. 2000;49.

39. Kann L, McManus T, Harris WA, et al. Youth Risk Behavior Surveillance – United States, 2015. *MMWR Surveill Summ*. 2016;65: 1-174.

40. Singh T, Arrazola RA, Corey CG, et al. Tobacco Use Among Middle and High School Students – United States, 2011-2015. *MMWR Morb Mortal Wkly Rep*. 2016;65: 361-367.

41. Arrazola RA, Singh T, Corey CG, et al. Tobacco use among middle and high school students – United States, 2011-2014. *MMWR Morb Mortal Wkly Rep*. 2015;64: 381-385.

42. Singh T, Kennedy S, Marynak K, Persoskie A, Melstrom P, King BA. Characteristics of Electronic Cigarette Use Among Middle and High School Students – United States, 2015. *MMWR Morb Mortal Wkly Rep*. 2016;65: 1425-1429.

43. Miech R, Patrick ME, O'Malley PM, Johnston LD. What are kids vaping? Results from a national survey of US adolescents. *Tob Control*. 2016;2016 Aug 25.

44. Duke JC, Lee YO, Kim AE, et al. Exposure to electronic cigarette television advertisements among youth and young adults. *Pediatrics*. 2014;134: e29-36.

45. Singh T, Agaku IT, Arrazola RA, et al. Exposure to Advertisements and Electronic Cigarette Use Among US Middle and High School Students. *Pediatrics*. 2016;137: e20154155.

46. Siu AL. Behavioral and Pharmacotherapy Interventions for Tobacco Smoking Cessation in Adults, Including Pregnant Women: U.S. Preventive Services Task Force Recommendation Statement. *Ann Intern Med*. 2015;163: 622-634.

47. Clinical Practice Guideline Treating Tobacco Use and Dependence 2008 Update Panel, Liaisons, and Staff. A clinical practice guideline for treating tobacco use and dependence: 2008 update. A U.S. Public Health Service report. *Am J Prev Med*. 2008;35: 158-176.

48. Babb S, Malarcher A, Schauer G, Asman K, Jamal A. Quitting Smoking Among Adults – United States, 2000-2015. *MMWR Morb Mortal Wkly Rep*. 2017;65: 1457-1464.

49. Doll R, Peto R, Boreham J, Sutherland I. Mortality in relation to smoking: 50 years' observation on male British doctors. *BMJ*. 2004;328: 1519-1527.

50. Mendez D, Tam J, Giovino GA, Tsodikov A, Warner KE. Has Smoking Cessation Increased? An Examination of the US Adult Smoking Cessation Rate 1990-2014. *Nicotine Tob Res*. 2016: 1-7.

51. Westmaas JL, Newton CC, Stevens VL, Flanders WD, Gapstur SM, Jacobs EJ. Does a Recent Cancer Diagnosis Predict Smoking Cessation? An Analysis From a Large Prospective US Cohort. *J Clin Oncol*. 2015: 1647-1652.

52. Westmaas JL, Alcaraz KI, Berg CJ, Stein KD. Prevalence and Correlates of Smoking and Cessation-Related Behavior among Survivors of Ten Cancers: Findings from a Nationwide Survey Nine Years after Diagnosis. *Cancer Epidemiol Biomarkers Prev*. 2014;23: 1783-1792.

53. Johnston LD, O'Malley PM, Bachman JG, Schulenberg JE. *Monitoring the Future national survey results on drug use, 1975-2012. Volume I: Secondary school students*. Ann Arbor, MI: University of Michigan, 2013.

54. Centers for Disease Control and Prevention. *Best Practices for Comprehensive Tobacco Control Programs-2014*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014.

55. US Department of Health and Human Services. *Reducing Tobacco Use: A Report of the Surgeon General*. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2000.

56. Messer K, Pierce JP, Zhu SH, et al. The California Tobacco Control Program's effect on adult smokers: (1) Smoking cessation. *Tob Control*. 2007;16: 85-90.

57. Truth Initiative, Campaign for Tobacco-Free Kids, American Heart Association/American Stroke Association, et al. *Broken Promises to Our Children: A State-by-State Look at the 1998 State Tobacco Settlement 18 Years Later*., 2016.

58. US Food and Drug Administration. Tobacco Control Act. Available from URL: http://www.fda.gov/TobaccoProducts/GuidanceComplianceRegulatoryInformation/ucm246129.htm. Accessed September 26, 2016.

59. US Food and Drug Administration. FDA's New Regulations for E-Cigarettes, Cigars, and All Other Tobacco Products. Available from URL: http://www.fda.gov/TobaccoProducts/Labeling/RulesRegulationsGuidance/ucm394909.htm. Accessed September 23, 2016.

60. American Lung Association. Tobacco Cessation Treatment: What is Covered? : American Lung Association 2012.

61. American Cancer Society Cancer Action Network. How Do You Measure Up? A Progress Report on State Legislative Activity to Reduce Cancer Incidence and Mortality, 2016. Updates provided by the American Cancer Society Cancer Action Network.

62. McAfee TA, Bush T, Deprey TM, et al. Nicotine patches and uninsured quitline callers. A randomized trial of two versus eight weeks. *Am J Prev Med*. 2008;35: 103-110.

63. Institute of Medicine. *Ending the Tobacco Problem: A Blueprint for the Nation*. Washington, D.C., 2007.

64. Chaloupka FJ, Straif K, Leon ME, International Agency for Research on Cancer Working Group. Effectiveness of tax and price policies in tobacco control. *Tob Control*. 2011;20: 235-238.

65. O'Connor RJ. Non-cigarette tobacco products: what have we learnt and where are we headed? *Tob Control*. 2012;21: 181-190.

66. Bandi P, Blecher E, Cokkinides V, Ross H, Jemal A. Cigarette affordability in the United States. *Nicotine Tob Res*. 2013;15: 1484-1491.

67. World Health Organization Tobacco Free Initiative. Raise taxes on tobacco. Available from URL: http://www.who.int/tobacco/mpower/raise_taxes/en/index3.html. Accessed September 26, 2016.

68. American Nonsmokers' Rights Foundation. Overview List – How many Smokefree Laws? Available from URL: http://www.no-smoke.org/pdf/mediaordlist.pdf. Accessed February 2, 2017.

69. Campaign For Tobacco-Free Kids. State Excise Tax Rates for Non-Cigarette Tobacco Products. Available from URL: https://www.tobaccofreekids.org/research/factsheets/pdf/0169.pdf. Accessed September 26, 2016.

70. International Agency for Research on Cancer. *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Volume 83: Tobacco smoke and Involuntary Smoking*. Lyon, France: IARC, 2004.

71. US Department of Health and Human Services. *The Health Consequences of Involuntary Exposure to Tobacco Smoke. A Report from the Surgeon General*. Washington, DC: US Department of Health and Human Services, Centers for Disease Control and Prevention and Health Promotion, Office of Smoking and Health, 2006.

72. Institute of Medicine. *Secondhand Smoke Exposure and Cardiovascular Effects: Making Sense of the Evidence*. Washington, DC: IOM, 2009.

73. International Agency for Research on Cancer. *IARC Handbooks of Cancer Prevention. Volume 13: Evaluating the Effectiveness of Smoke-free Policies*. Lyon, France: IARC Press, 2009.

74. Centers for Disease Control and Prevention. Disparities in secondhand smoke exposure – United States, 1988-1994 and 1999-2004. *MMWR Morb Mortal Wkly Rep*. 2008;57: 744-747

75. Homa DM, Neff LJ, King BA, et al. Vital signs: disparities in nonsmokers' exposure to secondhand smoke – United States, 1999-2012. *MMWR Morb Mortal Wkly Rep*. 2015;64: 103-108.

76. National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. State Tobacco Activities Tracking and Evaluation (STATE) System. Available from URL: https://www.cdc.gov/statesystem/. Accessed September 23, 2016.

77. Tobacco Free Kids. States and Localities that Have Raised the Minimum Legal Sale Age for Tobacco Products to 21. Available from URL: http://www.tobaccofreekids.org/content/what_we_do/state_local_issues/sales_21/states_localities_MLSA_21.pdf.

78. National Cancer Institute. *The Role of the Media in Promoting and Reducing Tobacco Use. Tobacco Control Monograph No. 19*. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute, 2008.

79. Federal Trade Commission. Federal Trade Commission Cigarette Report. Available from URL: https://www.ftc.gov/system/files/documents/reports/federal-trade-commission-cigarette-report-2014-federal-trade-commission-smokeless-tobacco-report/ftc_cigarette_report_2014.pdf. Accessed 12/12/2016.

80. Agaku IT, Odani S, Sturgis S, Harless C, Glover-Kudon R. Tobacco Advertising and Promotional Expenditures in Sports and Sporting Events – United States, 1992-2013. *MMWR Morb Mortal Wkly Rep*. 2016;65: 821-825.

81. Henriksen L, Schleicher NC, Feighery EC, Fortmann SP. A longitudinal study of exposure to retail cigarette advertising and smoking initiation. *Pediatrics*. 2010;126: 232-238.

82. Farrelly MC, Pechacek TF, Thomas KY, Nelson D. The impact of tobacco control programs on adult smoking. *Am J Public Health*. 2008;98: 304-309.

83. Tauras J, Chaloupka F, Farrelly M, et al. State tobacco control spending and youth smoking. *Am J Public Health*. 2005;95: 338-344.

Overweight and Obesity, Physical Activity, and Nutrition

The World Cancer Research Fund estimates that about 20% of all cancers in the US can be attributed to a combination of overweight and obesity, poor nutrition, excess alcohol consumption, and insufficient physical activity. These health behaviors are modifiable risk factors, and if changed, can reduce cancer risk.[1] Thus, for the 85% of US adults who do not smoke cigarettes, the most important ways to reduce cancer risk are: maintaining a healthy body weight, engaging in regular physical activity, adhering to a healthful diet, and avoiding or limiting alcohol consumption. Adults who most closely follow lifestyle cancer prevention recommendations for nutrition and physical activity are less likely to be diagnosed with and die from cancer.[2] The American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention provide recommendations regarding individual behaviors related to weight control, physical activity, diet, and alcohol consumption.[3] These guidelines, scheduled to be updated in 2018, also include recommendations for community action because the physical and social environment has a substantial influence on individual food and activity behaviors. See sidebar, page 18.

Overweight and Obesity

Weight recommendations are often determined by a measure known as body mass index (BMI) (see sidebar on page 19). The World Health Organization (WHO) has defined the ranges for BMI categories as follows: healthy weight 18.5 to 24.9 kg/m^2, overweight 25.0 to 29.9 kg/m^2, and obese 30.0 kg/m^2 or higher for adults. For children, overweight and obesity are also determined by BMI but rely on percentile rankings and growth charts for children age 2 years and older.[4]

The best way to achieve and maintain a healthy body weight is to balance energy intake (calories from food and beverages) with energy expenditure (physical activity).[5] Limiting consumption of foods and beverages

American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention[3]

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, no matter what the level of activity, 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 drink 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.

high in calories, fat, and added sugars and replacing them with vegetables and fruits, whole grains, healthy protein sources, and lower-calorie beverages may help reduce caloric intake.[6] Eating smaller portions, limiting unhealthy between-meal snacks, keeping track of food intake, and engaging in physical activity have been shown to be effective weight management strategies.[3]

Unhealthy dietary habits, physical inactivity, and excessive weight gain that begin during childhood often continue into adulthood and subsequently increase the risk of developing diabetes, cardiovascular disease, cancer, hypertension, and osteoporosis later in life. About seven out of 10 children who are overweight by adolescence will remain overweight as adults.[7, 8] Therefore, a focus on promoting healthy habits and preventing overweight and obesity in children and adolescents is important because these habits will set the foundation for their lifestyle and risk of disease as adults.[9, 10]

Body Weight and Cancer Risk

A recent review found sufficient evidence to conclude that being overweight or obese increases the risk of developing 13 cancers: uterine corpus, esophagus (adenocarcinoma), liver, stomach (gastric cardia), kidney (renal cell), brain (meningioma), multiple myeloma, pancreas, colorectum,

Table 2A. Excess Body Weight (%), Youth and Adults, US, 2013-2014

	Overweight or Obese*			Obese†		
	Males	Females	Overall	Males	Females	Overall
Young Children (2-5 years)	25.6	25.2	25.4	8.8	10.0	9.4
Older Children (6-11 years)	34.2	32.3	33.3	18.8	15.9	17.4
Adolescents (12-19 years)	36.8	37.5	37.2	19.8	21.4	20.6
Adults (≥20 years)	73.7	66.9	70.2	35.0	40.4	37.7

*For youth: BMI at or above 85th percentile of 2000 CDC growth chart. For adults: BMI ≥25.0 kg/m^2. †For youth: BMI at or above 95th percentile of 2000 CDC growth chart. For adults: BMI ≥30.0 kg/m^2. Note: Estimates for adults are age adjusted to 2000 US standard population.

Source: Overweight or obese: National Health and Nutrition Examination Surveys, 2013-2014. Adult obesity: Flegal KM, et al.[20] Childhood obesity: Ogden CL, et al.[25]

gallbladder, ovary, breast (postmenopausal), and thyroid.[11] Additionally, limited evidence suggests that excess body fatness is associated with an increased risk of non-Hodgkin lymphoma (diffuse large B-cell lymphoma), male breast cancer, and fatal prostate cancer. The link between body weight and cancer risk is not completely understood. While it has been hypothesized that it stems from multiple effects on fat and sugar metabolism, immune function, and levels of hormones (including insulin and estradiol)[3, 12] other hypotheses have also been proposed.[13] Some studies have shown that intentional weight loss is associated with decreased cancer risk among women, but the evidence is less clear for men.[14] There is also mounting evidence suggesting that obesity increases the risk of cancer recurrence and second primary tumors, and decreases survival for several cancers.[15-18]

Overweight and Obesity Prevalence and Trends

Adults

- Based on data from the National Health and Nutrition Examination Survey (NHANES), among adults, the prevalence of obesity (BMI ≥30.0 kg/m^2) more than doubled between 1976-1980 (15.0%)[19] and 2013-2014 (37.7%) (Table 2A). The prevalence of obesity among women continues to rise, while it appears to have stabilized among men in recent years.[20]

Defining Body Mass Index

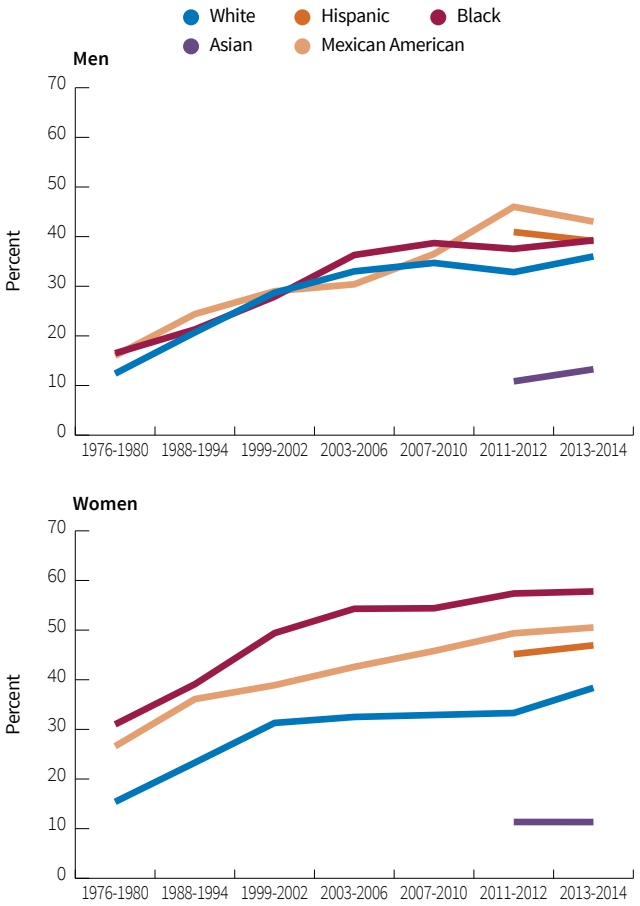
For adults, this sidebar relates body mass index (BMI) to pounds and inches. For example, a 5-foot-4-inch-tall woman is considered overweight if she weighs between 145 and 173 pounds; she is considered obese if she weighs 174 pounds or more. A 5-foot-10-inch-tall man is considered overweight if he weighs between 174 and 208 pounds and obese if he weighs 209 pounds or more.

	Body Weight (pounds)		
Height (feet, inches)	**Overweight***	**Obese†**	**Extremely Obese‡**
6'4"	205	246	328
6'3"	200	240	319
6'2"	194	233	311
6'1"	189	227	302
6'0"	184	221	294
5'11"	179	215	286
5'10"	174	209	278
5'9"	169	203	270
5'8"	164	197	262
5'7"	159	191	255
5'6"	155	186	247
5'5"	150	180	240
5'4"	145	174	232
5'3"	141	169	225
5'2"	136	164	218
5'1"	132	158	211
5'0"	128	153	204
4'11"	124	148	198
4'10"	119	143	191

*BMI of 25-29.9 kg/m^2. †BMI of 30 kg/m^2 or greater. ‡BMI of 40 kg/m^2 or greater. Note: 1kg = 2.2 pound; 1 inch = 0.0254 meters. See Special Notes (p. 68) for more information.

- In 2013-2014, 70.2% of adults (20 years of age and older) were overweight or obese (BMI ≥25.0 kg/m^2); 66.9% of women and 73.7% of men (Table 2A).
- Nationally, the prevalence of obesity was notably higher among Hispanic (46.9%) and black (57.8%) women compared to white (38.4%) women, but such wide differences are not observed among men (Figure 2A, page 20).

Figure 2A. Obesity* Trends, Adults 20-74 Years, by Gender and Race/Ethnicity†, US, 1976-2014



*Body mass index of 30.0 kg/m^2 or greater. †Persons of Mexican origin may be of any race. Estimates for whites, blacks, and Asians are among non-Hispanics.
Note: Estimates are age adjusted to the 2000 US standard population.

Source: 1976-2010: National Center for Health Statistics.[21] 2011-2014: National Health and Nutrition Examination Surveys.

- By state, according to 2015 Behavioral Risk Factor Surveillance System (BRFSS) data, the prevalence of adults who were overweight or obese ranged from 54.4% in the District of Columbia to 71.1% in West Virginia (Table 2B).
- From 2014 to 2015, the prevalence of obesity decreased in Minnesota, Montana, New York, and Ohio and increased in Kansas and Kentucky.[22, 23]
- Based on NHANES data, the prevalence of extreme obesity (BMI ≥40 kg/m^2) among adults more than doubled from 1988-1994 (2.9%) to 2011-2014 (6.9%).[24]

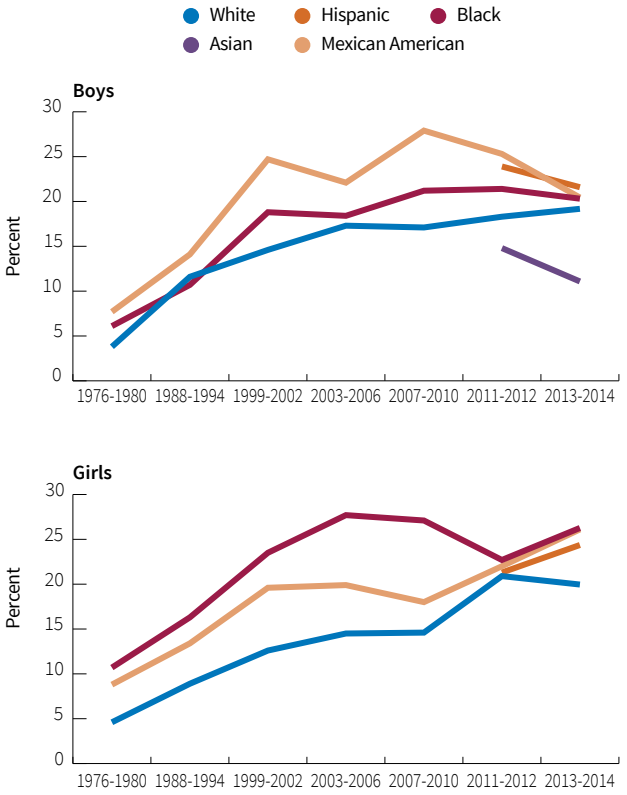
Table 2B. Overweight and Obesity (%), Adults 18 Years and Older by State, 2015

	Overweight or obese (25.0 kg/m^2 or greater)	Overweight (25.0-29.9 kg/m^2)	Obese (30.0 kg/m^2 or greater)	Rank* (1=high)
United States (median)	**65.5**	**35.5**	**29.8**	
Range	*54.4-71.1*	*32.2-38.0*	*20.2-36.2*	
Alabama	68.7	33.0	35.6	2
Alaska	67.2	37.4	29.8	26
Arizona	65.3	36.9	28.4	34
Arkansas	69.5	35.0	34.5	6
California	60.4	36.2	24.2	47
Colorado	56.6	36.4	20.2	51
Connecticut	61.6	36.4	25.3	42
Delaware	66.8	37.2	29.7	28
District of Columbia	54.4	32.2	22.1	50
Florida	64.1	37.3	26.8	35
Georgia	65.5	34.8	30.7	19
Hawaii	57.0	34.3	22.7	49
Idaho	65.2	36.6	28.6	33
Illinois	66.2	35.4	30.8	18
Indiana	66.5	35.2	31.3	15
Iowa	66.7	34.5	32.1	12
Kansas	68.0	33.8	34.2	7
Kentucky	67.2	32.6	34.6	5
Louisiana	69.2	33.0	36.2	1
Maine	66.5	36.5	30.0	24
Maryland	65.0	36.1	28.9	31
Massachusetts	59.7	35.4	24.3	46
Michigan	66.2	35.1	31.2	16
Minnesota	62.9	36.7	26.1	39
Mississippi	70.1	34.5	35.6	3
Missouri	66.3	33.9	32.4	11
Montana	61.0	37.4	23.6	48
Nebraska	67.0	35.6	31.4	14
Nevada	64.7	38.0	26.7	36
New Hampshire	63.6	37.3	26.3	38
New Jersey	63.4	37.8	25.6	41
New Mexico	64.5	35.7	28.8	32
New York	59.5	34.5	25.0	44
North Carolina	65.8	35.8	30.1	22
North Dakota	67.0	36.0	31.0	17
Ohio	66.5	36.7	29.8	27
Oklahoma	68.9	35.1	33.9	8
Oregon	64.5	34.5	30.1	23
Pennsylvania	66.2	36.2	30.0	25
Rhode Island	62.7	36.7	26.0	40
South Carolina	66.2	34.5	31.7	13
South Dakota	64.5	34.1	30.4	21
Tennessee	68.7	34.9	33.8	9
Texas	68.7	36.3	32.4	10
Utah	59.7	35.2	24.5	45
Vermont	59.9	34.7	25.1	43
Virginia	64.1	34.9	29.2	29
Washington	62.5	36.1	26.4	37
West Virginia	71.1	35.5	35.6	4
Wisconsin	66.0	35.3	30.7	19
Wyoming	65.4	36.4	29.0	30

*Based on % obese (30kg/m^2 or greater).

Source: Behavioral Risk Factor Surveillance System, 2015.

Figure 2B. Obesity* Trends, Adolescents 12-19 Years, by Gender and Race/Ethnicity†, US, 1976-2014



*Body mass index (BMI) at or above the sex- and age-specific 95th percentile BMI cutoff points from the 2000 CDC Growth Charts. †Persons of Mexican origin may be of any race. Estimates for whites, blacks, and Asians are among non-Hispanics. Note: Rates are not age adjusted. 2013-14 estimate for white girls has a relative standard error >30%. Estimates not shown for Asian girls due to instability.

Source: 1976-2010: National Center for Health Statistics.[21] 2011-2012: Ogden, CL, et al.[26] 2013-2014: National Health and Nutrition Examination Survey 2013-2014.

Children and Adolescents

- According to 2013-2014 NHANES data, obesity prevalence in children and adolescents (ages 2-19 years) was 17.2%.[25]
- Between 1976 and 2002, there were rapid increases in obesity prevalence among adolescents (ages 12-19 years). During that time, prevalence tripled (5.0% to 16.0%) and increased across all race/ethnicities and genders.[21]
- Obesity prevalence among adolescents (ages 12-19 years) has recently plateaued among black boys and white girls, but increased in Hispanic girls and decreased in Hispanic boys (Figure 2B).

Table 2C. Overweight and Obesity (%), High School Students by State, 2015

	Overweight*	Obese†	Rank‡ (1=high)
United States	**16.0**	**13.9**	
Range	*13.3-18.2*	*10.3-18.9*	
Alabama	17.5	16.1	9
Alaska	16.7	14.0	15
Arizona	14.7	10.9	37
Arkansas	18.0	18.0	4
California	16.5	13.9	18
Colorado§	–	–	–
Connecticut	14.3	12.3	28
Delaware	15.8	15.8	10
District of Columbia	17.9	15.1	12
Florida	14.5	12.3	28
Georgia§	–	–	–
Hawaii	15.3	12.9	25
Idaho	15.3	11.1	34
Illinois	15.4	12.6	26
Indiana	17.3	13.6	19
Iowa§	–	–	–
Kansas§	–	–	–
Kentucky	17.0	18.5	3
Louisiana§	–	–	–
Maine	14.9	13.3	20
Maryland	14.9	11.5	33
Massachusetts	15.3	11.0	35
Michigan	16.0	14.3	14
Minnesota§	–	–	–
Mississippi	17.1	18.9	1
Missouri	13.3	13.1	21
Montana	15.0	10.3	38
Nebraska	16.9	13.0	23
Nevada	15.0	12.2	30
New Hampshire	14.5	12.2	30
New Jersey§	–	–	–
New Mexico	16.2	15.6	11
New York	13.9	13.1	21
North Carolina	15.9	16.4	7
North Dakota	14.7	14.0	15
Ohio§	–	–	–
Oklahoma	15.3	17.3	6
Oregon§	–	–	–
Pennsylvania	15.8	14.0	15
Rhode Island	14.7	12.0	32
South Carolina	18.2	16.3	8
South Dakota	14.5	14.7	13
Tennessee	17.1	18.6	2
Texas§	–	–	–
Utah§	–	–	–
Vermont	14.0	12.4	27
Virginia	15.1	13.0	24
Washington§	–	–	–
West Virginia	17.0	17.9	5
Wisconsin§	–	–	–
Wyoming	14.6	11.0	35

*BMI at or above 85th percentile but below 95th percentile of 2000 CDC growth chart. †BMI at or above 95th percentile of 2000 CDC growth chart. ‡Based on % obese. §Data not available. See Survey Sources (p. 69) for more information.

Source: Kann L, et al. [27]

- In 2013-2014, obesity prevalence increased with age, from 9.4% in young children (ages 2-5 years) to 17.5% in older children (ages 6-11 years) and 20.5% in adolescents (ages 12-19 years) (Table 2A, page 19).
- According to the Youth Risk Behavior Survey (YRBS), the percentage of US high school students who were obese in 2015 ranged from 10.3% in Montana to 18.9% in Mississippi (Table 2C, page 21). Results of a recent study suggest that adolescent obesity exceeded 20% in many counties located in the Deep South and Southern Appalachian regions.[28]

Physical Activity

The American Cancer Society recommends that adults get 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 (see sidebar, below).

Benefits of Physical Activity

Physical activity acts in a variety of ways to reduce the risk of 13 types of cancer, including colorectal, lung, liver, kidney, and esophageal (adenocarcinoma).[29] The benefits of physical activity are even observed among people who are overweight, obese, and have a history of smoking.[29] Being active is thought to reduce cancer risk largely by improving energy metabolism and reducing circulating concentrations of estrogen, insulin, and insulin-like growth factors. In addition, regular physical activity helps maintain a healthy body weight by balancing caloric intake with energy expenditure. The health benefits of a physically active lifestyle also include reducing the risk of mortality and other chronic diseases, such as heart disease, type 2 diabetes, osteoporosis, and hypertension.[3, 30, 31] Increased levels of physical activity can help offset the increased risk of death associated with sedentary behavior, which has become increasingly common in the workplace.[32, 33] Physical activity also improves the quality of life of cancer patients and has been associated with reduced cancer recurrence and overall mortality.

Types of Physical Activity and Recommendations

Adults: Physical activity during an adult's daily routine consists primarily of light-intensity activity with occasional bouts of higher-intensity activity, which are not as common. Leisure-time physical activity or active transportation (e.g., bike riding, brisk walking) generally require higher levels of expenditure and are usually regarded as moderate- or vigorous-intensity physical activity. Moderate- to vigorous-intensity activities cause a noticeable increase in heart rate, breathing depth and frequency, and sweating (see sidebar, below, for examples).

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)

Step It Up!

"Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities"[37] aims to promote walking and walkability throughout the nation by:

- Making walking a national priority
- Designing communities that make it safe and easy to walk for all people
- Promoting programs and policies to support walking where people live, learn, work, and play
- Providing information to encourage walking and enhance walkability
- Filling knowledge gaps related to walking and walkability

Walking is accessible and an important form of physical activity as it necessitates use of large skeletal muscles and confers health benefits with few adverse effects.[34] Additionally, walking has been associated with a reduced risk of colorectal cancer and postmenopausal breast cancer.[35, 36] Given its accessibility and growing recognition of benefits, walking and walkable communities were the focus of a 2015 Surgeon General's Call to Action (see sidebar, above).[37]

Although the optimal intensity, duration, and frequency of physical activity needed to reduce cancer risk is not fully known, studies suggest that higher amounts of physical activity (e.g., 300 minutes or more of moderate-intensity activity per week or 150 minutes or more of vigorous-intensity activity per week) likely provide even greater reductions in cancer risk than lower physical activity levels.[3] Other studies have shown that being active at high levels helps to prevent weight gain and obesity, helping to reduce the risk of developing obesity-related cancers.[3, 38]

For people who are largely inactive or just beginning a physical activity program, engaging in any level of intentional physical activity is likely to be beneficial. A gradual increase in the amount of physical activity performed will provide substantial cardiovascular benefits. Most children and young adults can safely engage in moderate physical activity without consulting a physician. However, men older than 40, women older than 50, and people with chronic illnesses and/or established cardiovascular risk factors should consult their physician before beginning a physical activity program.

While it is important to engage in intentional physical activity, individuals should also recognize the importance of decreasing sedentary behaviors (e.g., limit time spent sitting) and replacing them with light to moderate activity (such as incidental walking and "moving about"). There is accumulating evidence that sedentary behavior, independent of levels of physical activity, increases the likelihood of becoming obese and developing type 2 diabetes, cardiovascular disease, and various types of cancers, and increases overall mortality.[33, 39, 40] Therefore, breaking up sitting time is likely to be beneficial.

Children and Adolescents: Physical activity plays an important role in the health and well-being of children and adolescents. Therefore, children and adolescents should be encouraged to be physically active at moderate- to vigorous-intensity activities for at least 60 minutes daily.[3, 41] The availability of routine, high-quality physical education programs is a critically important way of increasing physical activity among youth. Daily physical education and other opportunities for physical activity should be provided for children at school, and sedentary activities (e.g., watching television, playing video games) should be minimized.[42-44]

Physical Activity Prevalence and Trends

Adults

- According to National Health Interview Survey (NHIS) data from 2015, about one-half (49.8%) of adults reported meeting recommended levels of aerobic activity (engaging in at least 150 minutes of moderate or 75 minutes of vigorous aerobic activity per week) (men: 53.0%, women: 46.9%) (Table 2D, page 24).
- In 2015, meeting recommendations for aerobic activity was more common among those with higher than lower levels of educational attainment (Table 2D, page 24).

Table 2D. Physical Activity (%), Adults 18 Years and Older, US, 2015

	No leisure-time physical activity	Met rec. levels of aerobic activity*	Met rec. levels of aerobic & muscle-strengthening activity†
Overall	**30.3**	**49.8**	**21.6**
Gender			
Males	28.9	53.0	25.3
Females	31.6	46.9	18.0
Age (years)			
18-24	24.9	59.0	29.8
25-44	24.6	55.5	25.2
45-64	32.3	46.3	18.3
65+	44.3	35.6	12.2
Race/Ethnicity			
White	26.9	53.0	23.4
Black	38.0	42.7	20.1
Hispanic	38.8	43.3	16.8
American Indian/ Alaska Native	33.7	41.8	19.4
Asian	25.4	52.0	19.4
Sexual Orientation			
Gay/lesbian	29.7	52.8	29.9
Straight	30.3	49.8	21.6
Bisexual	30.4	47.2	22.9
Education (≥25 years)			
Some high school or less	50.7	29.8	7.9
High school diploma or GED	40.5	38.7	13.1
Some college/Assoc. degree	30.8	47.0	19.0
College graduate	17.3	63.1	30.5
Insurance Status (18 to 64 years)			
Uninsured	38.7	43.6	16.8
Insured	25.8	53.9	24.3
Immigration Status			
Born in US	28.9	51.3	23.0
Born in US territory	44.5	40.0	17.7
In US fewer than 10 yrs	32.8	44.9	13.7
In US 10+ years	35.8	44.2	16.5
Region			
Northeast	31.4	49.8	22.1
Midwest	29.7	48.3	21.0
South	33.4	48.1	20.7
West	24.9	54.2	23.2

GED – General Educational Development high school equivalency. *Includes 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity activity each week. †Includes 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity aerobic activity each week and moderate- or high-intensity muscle strengthening activity at least two days each week. Note: Estimates are age adjusted to the 2000 US standard population.

Source: National Health Interview Survey, 2015.

- Based on 2015 BRFSS data, Mississippi (38.0%) had the lowest proportion of adults who reported meeting recommended levels of aerobic activity, while Colorado (60.6%) had the highest (Table 2E).
- Most states in which a relatively high proportion of adults reported no leisure-time physical activity also had a relatively high prevalence of obesity, according to 2015 BRFSS data (Figure 2C, page 26).
- The proportion of adults who reported meeting both aerobic and muscle-strengthening activity levels has increased since 1998 but has not changed in recent years (Figure 2D, page 27).
- A greater proportion of adults age 65 years and older reported meeting both aerobic and muscle-strengthening activity levels in 2013-2015 compared to 2000-2002.[45]

Children and Adolescents

- According to the 2015 YRBS, 27.1% of US high school students met recommended levels of physical activity, and 57.6% played on at least one school or community sports team (Table 2F, page 28).
- The proportion of high school students meeting recommended physical activity levels in 2015 ranged from 16.0% in the District of Columbia to 32.2% in Oklahoma (Table 2F, page 28).
- In 2015, 24.7% of US high school students reported watching three or more hours of television per day, and 41.7% played video games or used a computer for something other than school work for three or more hours a day (Table 2F, page 28).

Nutrition

The scientific study of nutrition and cancer is challenging, because eating patterns are complex and difficult to assess.[46] Continued development of methods to measure usual diet in population studies remains a research priority for the American Cancer Society and other research organizations. Adhering to a diet that contains a variety of fruits and vegetables, whole grains, and fish or poultry and fewer red and/or processed meats is associated with reduced cancer risk. Unfortunately, the

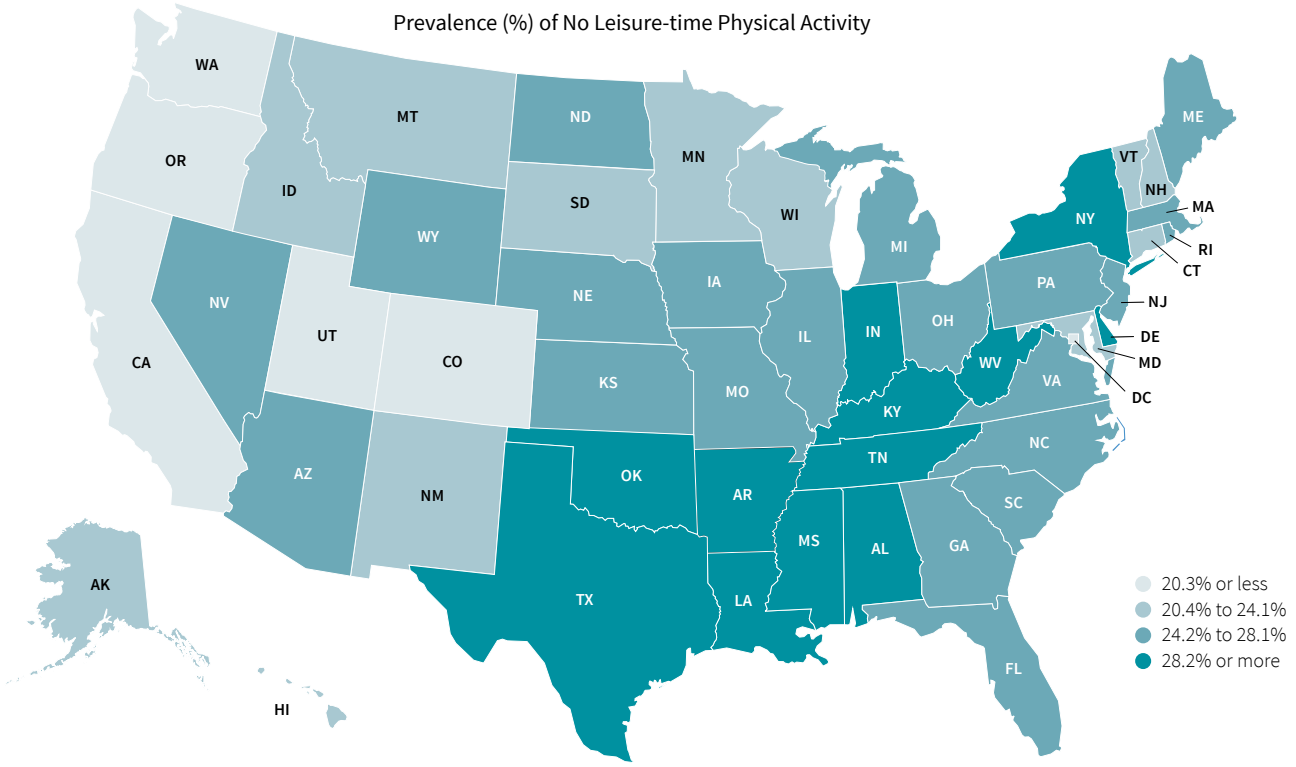
Table 2E. Factors Related to Physical Activity and Nutrition (%), Adults 18 Years and Older by State, 2011-2015

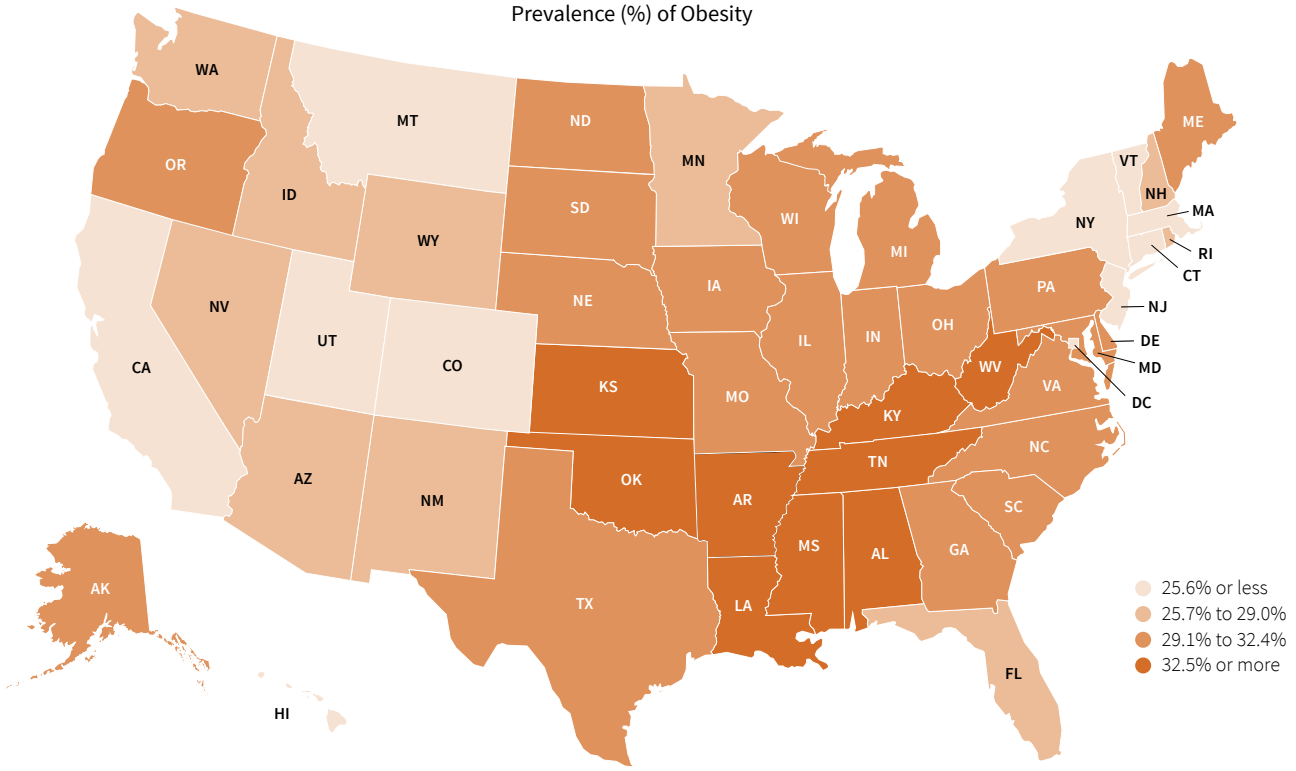
	2015				2011-14
	Met recommended levels of aerobic activity†	Met recommended levels of aerobic & muscle-strengthening activity‡	Consumed two or more fruit servings a day	Consumed three or more vegetable servings a day§	Alcohol consumption: excessive drinking¶
United States (median)*	**51.3**	**20.3**	**28.9**	**16.0**	**28.1**
Range	*38.0-60.6*	*13.8-26.2*	*17.0-35.1*	*9.8-23.0*	*18.3-40.9*
Alabama	44.6	16.7	19.0	10.5	25.5
Alaska	58.3	24.3	30.8	21.8	30.1
Arizona	53.8	21.8	29.6	18.9	29.9
Arkansas	45.1	15.6	22.8	13.8	23.8
California	57.3	22.9	32.6	19.7	26.4
Colorado	60.6	26.2	33.3	20.1	28.7
Connecticut	54.5	21.3	32.3	17.7	31.2
Delaware	48.5	20.3	28.7	15.8	29.0
District of Columbia	57.9	23.7	34.5	23.0	40.9
Florida	51.6	21.8	31.3	18.8	25.8
Georgia	48.0	18.7	25.6	16.1	24.1
Hawaii	56.6	23.6	28.9	21.2	28.8
Idaho	55.3	21.3	30.2	18.6	26.0
Illinois	49.8	21.3	33.7	17.4	32.0
Indiana	44.1	15.6	27.8	15.8	27.1
Iowa	48.8	19.4	27.7	12.2	32.5
Kansas	50.0	19.3	24.3	14.2	28.1
Kentucky	45.2	18.0	19.1	11.1	24.7
Louisiana	46.2	18.7	23.5	13.3	30.6
Maine	53.9	18.9	35.1	19.1	27.1
Maryland	52.9	22.9	31.9	16.8	27.4
Massachusetts	51.8	21.3	31.9	19.0	32.1
Michigan	52.1	19.5	29.5	14.0	30.0
Minnesota	54.9	21.8	29.1	14.4	32.3
Mississippi	38.0	15.3	19.7	11.4	22.3
Missouri	50.5	19.1	25.2	14.2	29.2
Montana	58.2	24.5	24.9	15.2	31.1
Nebraska	51.3	21.8	29.2	14.4	30.3
Nevada	54.5	24.9	26.6	17.5	30.7
New Hampshire	57.6	23.1	34.9	19.2	31.3
New Jersey	48.9	20.8	29.2	15.2	27.9
New Mexico	56.1	23.6	27.1	19.7	28.1
New York	47.1	20.1	32.5	17.8	29.7
North Carolina	48.1	18.9	25.0	15.3	23.9
North Dakota	47.0	17.7	29.2	14.2	35.6
Ohio	50.2	19.7	25.8	13.3	30.3
Oklahoma	46.6	16.9	18.6	11.0	28.9
Oregon	60.4	22.6	32.7	21.9	26.6
Pennsylvania	49.8	19.6	28.8	13.9	30.2
Rhode Island	50.4	20.0	30.6	16.4	35.3
South Carolina	50.5	19.7	23.4	13.2	27.8
South Dakota	53.6	19.3	22.5	10.9	33.1
Tennessee	45.4	17.8	25.1	16.4	21.0
Texas	44.3	18.8	27.8	19.3	28.4
Utah	55.3	24.8	29.6	17.2	18.3
Vermont	58.9	22.7	32.3	20.1	28.9
Virginia	51.0	22.1	26.7	14.4	27.0
Washington	58.4	22.7	30.1	19.3	26.2
West Virginia	48.0	13.8	17.0	9.8	21.4
Wisconsin	56.8	20.1	32.0	14.6	37.1
Wyoming	54.4	23.4	27.4	16.0	29.4

*For alcohol consumption, national mean is presented. †Includes 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity activity each week. ‡Includes 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity aerobic activity each week and moderate- or high-intensity muscle strengthening activity at least two days each week. §Vegetables excludes fried potatoes. ¶During the past 30 days – men: >2 drinks per day on average or ≥5 drinks on a single occasion; women: >1 drink per day on average or ≥4 drinks on a single occasion. Note: Estimates for alcohol consumption are age adjusted to the 2000 US standard population.

Sources: Alcohol consumption (2011-2014): National Survey on Drug Use and Health.[68] All other estimates (2015): Behavioral Risk Factor Surveillance System, 2015.

Figure 2C. No Leisure-time Physical Activity and Obesity (%)*, Adults 18 Years and Older by State, 2015

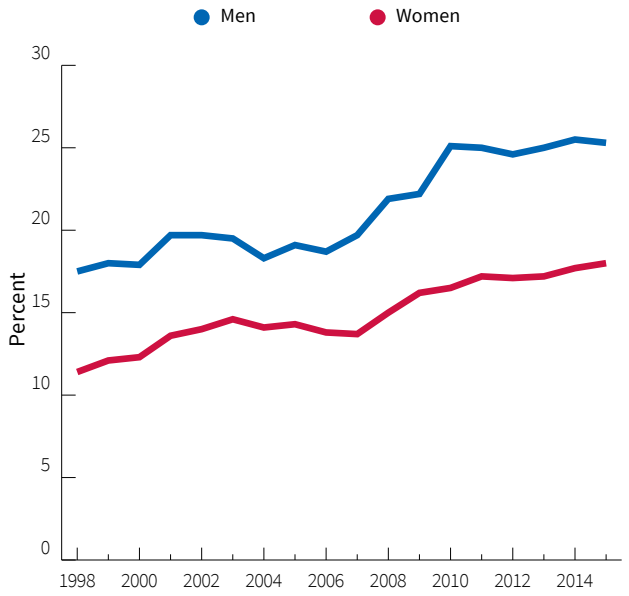




*No leisure-time physical activity reported for the 30 days preceding the survey. Obesity: ≥30.0 kg/m^2

Source: Behavioral Risk Factor Surveillance System, 2015.

Figure 2D. Physical Activity* (%) Trends by Gender, Adults 18 Years and Older, US, 1998-2015



*Met both aerobic and muscle-strengthening federal 2008 Physical Activity Guidelines for Americans. Note: Estimates are age adjusted to the 2000 US standard population.

Source: 1998-2014: National Center for Health Statistics.[24] 2015: National Health Interview Survey, 2015.

majority of Americans do not follow these recommendations and would need to substantially reduce added sugar, trans and saturated fats, refined grain, and sodium intake, as well as increase consumption of fruits, vegetables, whole grains, and low-fat dairy products to meet the *2015-2020 Dietary Guidelines for Americans*.[5]

However, there is some evidence that Americans are improving their diets.[44] Based on national data among adults, from 1999-2000 compared to 2011-2012, there was an increase in consumption of whole grains, nuts, seeds, and legumes, as well as whole fruit.[47] There was also a decline in sugar-sweetened beverage consumption, primarily driven by a decrease in soda intake, although consumption of sports and energy drinks increased.[47] Among high school students, the proportion who reported drinking soda daily decreased from 33.8% in 2007 to 20.4% in 2015.[48, 49] See the sidebar on page 29 for more detailed information about the American Cancer Society's nutritional guidelines for cancer prevention.

Portion Size

A large proportion of the American diet is comprised of foods high in fat, refined carbohydrates, and added sugar.[50] These foods and beverages add little nutritional value to the diet and may contribute to weight gain and altered distribution of body fat, insulin resistance, and increased concentrations of factors that promote cancer.[51] Consuming a varied diet that emphasizes foods from plants may help to displace these calorie-dense foods. Limiting portion sizes, especially of calorie-dense foods and beverages, will also reduce total caloric intake and help maintain a healthy weight.

Processed Meats and Red Meats

The International Agency for Research on Cancer (IARC) recently classified processed meat (e.g., lunch meats, bacon, hot dogs) as a human carcinogen and red meat (e.g., beef, lamb, pork) as a probable carcinogen based on the evidence of their association with increased colorectal cancer risk.[52] 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.[53-55] 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.[56] In addition, fatty meats and fried meat are major sources of total fat, saturated fat, and cholesterol in the American diet. To limit consumption of processed meats and red meats, persons may choose smaller portions (e.g., served as a side dish rather than the focus of a meal) or choose fish or poultry instead. Legumes, which are rich in nutrients that may protect against cancer, can serve as a healthier source of protein than red meats.

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 (such as broccoli, green beans, and lettuce) and fruits is associated with lower risk of mouth, pharynx, larynx, esophageal and stomach

Table 2F. Factors Related to Physical Activity and Nutrition (%), High School Students by State, 2015

	Played video or computer games or used a computer* three or more hours/day†	Watched three or more hours/day of TV†	Played on one or more sports teams‡	Met recommended levels of physical activity§	Consumed fruit or 100% fruit juice two or more times/day¶	Consumed vegetables three or more times/day#
United States	**41.7**	**24.7**	**57.6**	**27.1**	**31.5**	**14.8**
Range	*30.1-45.6*	*18.9-33.4*	*48.6-64.3*	*16.0-32.2*	*21.0-34.3*	*9.1-18.1*
Alabama	38.2	30.8	52.1	25.4	23.4	10.2
Alaska	34.3	22.2	62.7	20.9	28.6	14.2
Arizona	40.5	24.7	49.2	26.0	30.1	14.7
Arkansas	41.2	31.0	51.7	28.6	26.3	13.4
California	42.1	23.1	56.0	25.3	33.3	15.9
Colorado**	–	–	–	–	–	–
Connecticut	37.8	21.9	–	25.3	30.5	12.8
Delaware	35.6	27.9	54.7	24.7	31.0	–
District of Columbia	38.1	32.2	–	16.0	28.0	12.1
Florida	42.2	28.2	49.0	24.1	33.2	15.5
Georgia**	–	–	–	–	–	–
Hawaii	40.6	21.8	52.2	20.3	23.2	–
Idaho	33.7	19.7	58.1	29.6	25.6	11.3
Illinois	36.9	21.8	57.3	26.8	30.9	12.7
Indiana	38.4	22.3	60.4	25.3	25.5	9.8
Iowa**	–	–	–	–	–	–
Kansas**	–	–	–	–	–	–
Kentucky	40.1	25.5	50.8	20.2	21.0	11.1
Louisiana**	–	–	–	–	–	–
Maine	38.3	23.1	–	21.6	30.1	–
Maryland	38.3	26.7	–	19.5	28.8	13.4
Massachusetts	43.2	–	60.6	24.1	31.4	12.0
Michigan	40.6	21.7	–	24.6	27.5	9.8
Minnesota**	–	–	–	–	–	–
Mississippi	34.1	33.4	48.7	21.2	25.2	12.4
Missouri	37.4	21.2	56.3	26.0	24.1	10.5
Montana	34.2	21.9	62.4	28.7	27.5	13.3
Nebraska	31.5	20.1	64.3	29.7	26.8	13.2
Nevada	36.7	22.1	54.3	28.6	29.3	13.8
New Hampshire	38.9	19.1	–	22.3	–	–
New Jersey**	–	–	–	–	–	–
New Mexico	38.9	24.7	–	30.9	27.5	16.4
New York	37.2	24.2	–	23.3	30.5	–
North Carolina	42.3	30.5	–	24.3	27.3	12.5
North Dakota	38.6	18.9	–	25.4	27.6	11.1
Ohio**	–	–	–	–	–	–
Oklahoma	45.6	28.9	54.8	32.2	28.2	12.1
Oregon**	–	–	–	–	–	–
Pennsylvania	43.0	27.8	61.6	24.8	28.6	10.7
Rhode Island	40.0	22.2		20.3	29.6	12.0
South Carolina	39.5	28.4	48.6	23.6	23.9	9.1
South Dakota	37.8	21.5		28.1	24.0	11.9
Tennessee	43.4	29.2	50.2	25.9	23.1	9.7
Texas**	–	–	–	–	–	–
Utah**	–	–	–	–	–	–
Vermont††	–	–	–	23.1	34.3	18.1
Virginia	41.9	23.9	55.8	25.1	29.8	13.8
Washington**	–	–	–	–	–	–
West Virginia	43.4	26.8	51.7	25.8	27.9	12.9
Wisconsin**	–	–	–	–	–	–
Wyoming	30.1	21.0	62.0	27.1	26.7	13.9

*For something that was not school work. †On an average school day. ‡During 12 months preceding survey. §Physical activity that increased heart rate and made breathing difficult some of the time for a total of at least 60 minutes/day on all 7 days preceding the survey. ¶During 7 days preceding survey. #Vegetables exclude fried potatoes. **No data available for 2015 survey cycle. ††Data not available for all questions related to nutrition and physical activity.

Source: Kann L, et al. [27]

cancers.[57] Evidence also suggests that consuming non-starchy vegetables lowers the risk of hard-to-treat estrogen-receptor negative breast tumors.[58] 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.[6] For these reasons, consumption of low-calorie, whole vegetables and fruits is encouraged by a number of health organizations, including the American Cancer Society.[3, 5, 31] However, the consumption of these foods remains lower than recommended[6] due to a number of factors, including preparation time, taste preferences, and cost compared to less healthy options.[59] Consumers are encouraged to fill half of their plate with vegetables and fruits for meals and snacks.

Prevalence of Vegetable and Fruit Consumption

Adults

- According to 2015 BRFSS data, 28.9% of adults reported eating two or more servings of fruits daily, ranging from 17.0% in West Virginia to 35.1% in Maine (Table 2E, page 25).
- In 2015, only 16.0% of adults consumed three or more servings of vegetables per day, ranging from 9.8% in West Virginia to 23.0% in the District of Columbia (Table 2E, page 25).

Adolescents

- Based on the 2015 YRBS, 31.5% of high school students consumed 100% fruit juice or fruit two or more times a day, ranging from 21.0% in Kentucky to 34.3% in Vermont (Table 2F).
- In 2015, only 14.8% of high school students reported consuming vegetables three or more times per day, ranging from 9.1% in South Carolina to 18.1% in Vermont (Table 2F).

Whole Grains

Grains such as wheat, rice, oats, and barley, and the foods made from them, are an important part of a healthful diet. Whole-grain foods (made from the entire grain seed) are relatively low in caloric density and higher in fiber,

Consume a healthy diet, with an emphasis on plant sources[3]

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.

vitamins, and minerals compared to refined flour products.[5] Although evidence of the association between whole-grain foods and different types of cancer is limited, studies support a role for high intake of whole-grain foods and a diet high in fiber in reducing the risk of colorectal cancer.[1] Furthermore, epidemiological evidence shows that overall healthier diet patterns, including more whole grains (and fewer refined grains), fruits, vegetables, fish, poultry, and healthy oils, are associated with a lower risk of death, including death from cardiovascular disease and cancer.[60]

Limiting Alcohol Consumption

Alcoholic beverage consumption is an established risk factor for cancers of the mouth, pharynx, larynx, esophagus, liver, colorectum, and female breast, and there is some evidence of an association with pancreatic cancer.[3, 61-63] When combined with tobacco use, alcohol consumption increases the risk of cancers of the mouth, larynx, and esophagus far more than the independent effect of either drinking or smoking alone.[61] Studies have shown that consumption of even a few alcoholic beverages per week increases risk of breast cancer.[64] Therefore, limiting or avoiding alcohol consumption is one of the few widely recognized ways that people may reduce their risk of breast and other cancers.

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.[3, 5] The recommended limit is lower for women because of their smaller body size and slower metabolism of alcohol. Complicating the recommendation for alcohol and cancer risk reduction is the evidence that a low to moderate intake of alcoholic beverages has been associated with decreased risk of coronary heart disease.[65] There is no compelling reason for non-drinkers to start consuming alcohol to reduce their risk for heart disease because cardiovascular risk can be reduced by adopting healthy behaviors.[66] Some groups of people should not drink alcoholic beverages at all, including children and adolescents, and individuals of any age who cannot restrict their drinking to moderate levels or who have a family history of alcoholism. Further, alcohol consumption has an economic impact; in 2010, excessive drinking cost the US almost $250 billion, 40% of which was paid by the government.[67]

Prevalence and Trends of Alcohol Consumption

- In 2011-2014, according to data from the National Survey on Drug Use and Health, 28.1% of adults (men: 33.4%, women: 23.2%) reportedly drank excessively (during the past 30 days – men: >2 drinks per day on average or ≥5 drinks on a single occasion; women: >1 drink per day on average or ≥4 drinks on a single occasion) (Table 2E, page 25).[68]
- By state, excessive drinking ranged from 18.3% in Utah to 40.9% in the District of Columbia (Table 2E, page 25).
- Historically, excessive drinking has been more common among whites and Hispanics than blacks and Asians.[68]

Community Action

The dramatic rise in obesity levels in the US in the past several decades has serious implications for public health and the economy. Treating obesity-related illness in the US costs $190.2 billion annually,[69] and about 11% of annual health care costs are associated with inadequate levels of physical activity.[70] Individuals who are physically active incur fewer health care costs.[71]

Policies and programs that support healthy behaviors throughout a person's life cycle are needed to address the prevailing socioenvironmental factors contributing to increased obesity.[3, 31] 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 likely contributed to the obesity epidemic include increased reliance on automobiles, sedentary work, meals eaten away from home, availability of cheap but energy-dense processed foods, consumption of larger portion sizes, and consumption of sugar-sweetened beverages.[3, 6, 59]

Educating the public about healthy behaviors as well as creating environments that make it easier for people to make healthy choices, as outlined by the American Cancer Society's guidelines, is critical if widespread changes are to be seen at a population level.[3, 72] Schools and child care facilities, workplaces, and health care facilities are important settings for the implementation of policies and programs. The appeal of setting-based approaches includes the ability to implement effective strategies to target populations (e.g., students, employees, or patients) and also to influence social norms so behaviors transfer outside the setting through linkage with community-based prevention programs.[31]

Community 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 necessary changes that support healthy eating and active living. The Centers for Disease Control and Prevention (CDC), the National Academy of Medicine, the WHO, and others have outlined a variety of evidenced-based approaches for schools, worksites, and communities to halt and ultimately reverse obesity trends.[22, 61, 73, 74]

- States and school districts can require that students receive recommended amounts and improve the quality of physical education and implement evidence-based nutrition standards for school meals and snacks. [75]
- Employers can implement worksite health promotion programs[76] but should not tie health insurance premiums to health behaviors or health status.
- At the state and local levels, policy changes can help to improve physical activity environment, increase the availability and affordability of fresh vegetables and fruits in poor neighborhoods, and create safe spaces that promote physical activity for transportation and recreation[7] (see sidebar, above, for example).
- 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.[22, 78-80]

Local Tax on Sugar-sweetened Beverages

March 2015 marked the first time that any US jurisdiction instituted an excise tax on sugar-sweetened beverages; a $0.01 per ounce tax was implemented in Berkeley, California. Results of a recent evaluation in low-income neighborhoods show a 21% decrease in sugar-sweetened beverage consumption in Berkeley compared to a 4% increase in the study's comparison locales.[77] Furthermore, there was a greater increase in water consumption in Berkeley versus the study's comparison neighborhoods. As of December 2016, sugar-sweetened beverage excise taxes of at least $0.01 per ounce had been passed in six additional local jurisdictions.

National Policy Actions

Significant progress has been made at the federal level in recent years in passing and implementing laws that make it easier for individuals to improve nutrition and increase physical activity (see Federal Policies note, page 68). Federal government experts recommend a healthy eating plan across the lifespan in the *2015-2020 Dietary Guidelines for Americans* and highlight the importance of physical activity in their Physical Activity Guidelines for Americans.[5] These recommendations are generally similar to the American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention.[3]

Other examples of federal initiatives include:

- The Healthy Hunger-Free Kids Act (see Federal Policies note, page 68) reauthorized federal child nutrition programs, including several provisions focused on improving school nutrition and reducing obesity.[81]
- The Prevention and Public Health Fund, a source of annual funding for prevention and public health initiatives was created through the Patient Protection and Affordable Care Act (ACA).
- The Every Student Succeeds Act (see Federal Policies note, page 68) is a reauthorization bill that includes health and physical education as part of a "well-rounded education."

- In May 2016, the FDA published the final rule to modify the Nutrition Facts label.[82] Scheduled to go into effect in July 2018, for most major manufacturers, the changes include updating serving-size quantities, increasing font size for calories, and specifying the amount and percent daily value of added sugar. (See Federal Policies note, page 68.)

The American Cancer Society and ACS CAN's Initiatives Addressing Obesity/Overweight through the Promotion of Physical Activity and Nutrition

- To reduce the risk of cancer and other chronic diseases, the American Cancer Society works to promote weight control, increase physical activity, improve diet, and help facilitate changes in schools, worksites, and communities – all of which make it easier for people to make healthier choices.[3]
- The American Cancer Society Cancer Action Network (ACS CAN) and other organizations advocate at the federal, state, and local levels for policy changes that make it easier for youth and adults to lead a healthy lifestyle, reducing their long-term cancer risk as outlined in the community action section.
- ACS CAN also advocates for increased funding for nutrition and physical activity research and programs and works to ensure that federal dietary and physical activity guidelines reflect the current science and will help to reduce cancer risk.
- The American Cancer Society and ACS CAN are working collaboratively to build capacity of local communities to identify and address barriers to healthy eating and active living, and to engage collaborators in addressing strategies to reduce identified barriers to make it easier for community members to eat better and live a more physically active lifestyle.
- Working with community-based health system collaborators, the American Cancer Society developed tools to assist primary care systems and health plans in addressing nutrition and physical activity.

References

1. World Cancer Research Fund and American Institute for Cancer Research. Continuous Update Project Available from URL: http://www.wcrf.org/int/research-we-fund/continuous-update-project-cup.

2. Kohler LN, Garcia DO, Harris RB, Oren E, Roe DJ, Jacobs ET. Adherence to Diet and Physical Activity Cancer Prevention Guidelines and Cancer Outcomes: A Systematic Review. *Cancer Epidemiol Biomarkers Prev*. 2016;25: 1018-1028.

3. Kushi LH, Doyle C, McCullough M, et al. American Cancer Society Guidelines on Nutrition and Physical Activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. *CA Cancer J Clin*. 2012;62(1): 30-67.

4. Centers for Disease Control and Prevention. About BMI for Children and Teens. Available from URL: http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html. Accessed September 30, 2016.

5. US Department of Health and Human Services and US Department of Agriculture. 2015-2020 Dietary Guidelines for Americans, 2015.

6. Krebs-Smith SM, Guenther PM, Subar AF, Kirkpatrick SI, Dodd KW. Americans do not meet federal dietary recommendations. *J Nutr*. 2010;140: 1832-1838.

7. US Department of Health and Human Services. *The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity*. Washington, DC: US Department of Health and Human Services, 2001.

8. Patton GC, Coffey C, Carlin JB, et al. Overweight and obesity between adolescence and young adulthood: a 10-year prospective cohort study. *J Adolesc Health*. 2011;48: 275-280.

9. Institute of Medicine and National Research Council. *Local Government Actions to Prevent Childhood Obesity*. Washington, DC: The National Academies Press, 2009.

10. White House Task Force on Childhood Obesity Report to the President. Solving the problem of childhood obesity within a generation, 2010.

11. Lauby-Secretan B, Scoccianti C, Loomis D, Grosse Y, Bianchini F, Straif K. Body Fatness and Cancer – Viewpoint of the IARC Working Group. *N Engl J Med*. 2016;375: 794-798.

12. Iyengar NM, Hudis CA, Dannenberg AJ. Obesity and cancer: local and systemic mechanisms. *Annu Rev Med*. 2015;66: 297-309.

13. Roberts DL, Dive C, Renehan AG. Biological mechanisms linking obesity and cancer risk: new perspectives. *Annu Rev Med*. 2010;61: 301-316.

14. Birks S, Peeters A, Backholer K, O'Brien P, Brown W. A systematic review of the impact of weight loss on cancer incidence and mortality. *Obes Rev*. 2012;13: 868-891.

15. Campbell PT, Newton CC, Dehal AN, Jacobs EJ, Patel AV, Gapstur SM. Impact of body mass index on survival after colorectal cancer diagnosis: the Cancer Prevention Study-II Nutrition Cohort. *J Clin Oncol*. 2012;30: 42-52.

16. Cao Y, Ma J. Body mass index, prostate cancer-specific mortality, and biochemical recurrence: a systematic review and meta-analysis. *Cancer Prev Res*. 2011;4: 486-501.

17. Chan DS, Vieira AR, Aune D, et al. Body mass index and survival in women with breast cancer-systematic literature review and meta-analysis of 82 follow-up studies. *Annals of Oncology*. 2014;25: 1901-1914.

18. Li CI, Daling JR, Porter PL, Tang MT, Malone KE. Relationship between potentially modifiable lifestyle factors and risk of second primary contralateral breast cancer among women diagnosed with estrogen receptor-positive invasive breast cancer. *J Clin Oncol*. 2009;27: 5312-5318.

19. Fryar CD, Carroll MD, Ogden CL. Prevalence of Overweight, Obesity, and Extreme Obesity Among Adults: United States, 1960-1962 through 2011-2012. National Center for Health Statistics. September 2014. Available from URL: http://www.cdc.gov/nchs/data/hestat/obesity_adult_11_12/obesity_adult_11_12.pdf.

20. Flegal KM, Kruszon-Moran D, Carroll MD, Fryar CD, Ogden CL. Trends in Obesity Among Adults in the United States, 2005 to 2014. *JAMA*. 2016;315: 2284-2291.

21. National Center for Health Statistics. *Health, United States, 2013: With a Special Feature on Prescription Drugs*. Hyattsville, MD, 2014.

22. Trust for America's Health, Robert Wood Johnson Foundation. The State of Obesity: Better Policies for a Healthier America 2016, 2016.

23. Center for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Survey Data, 2015. Available from URL: http://www.cdc.gov/brfss/data_documentation/index.htm. Accessed September 13, 2016.

24. National Center for Health Statistics. *Health, United States, 2015: With Special Feature on Racial and Ethnic Disparities*. Hyattsville, MD, 2016.

25. Ogden CL, Carroll MD, Lawman HG, et al. Trends in Obesity Prevalence Among Children and Adolescents in the United States, 1988-1994 Through 2013-2014. *JAMA*. 2016;315: 2292-2299.

26. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011-2012. *JAMA*. 2014;311: 806-814.

27. Kann L, McManus T, Harris WA, et al. Youth Risk Behavior Surveillance – United States, 2015. *MMWR Surveill Summ*. 2016;65: 1-174.

28. Kramer MR, Raskind IG, Van Dyke ME, Matthews SA, Cook-Smith JN. Geography of Adolescent Obesity in the U.S., 2007-2011. Am J Prev Med. 2016;51: 898-909.

29. Moore SC, Lee IM, Weiderpass E, et al. Association of Leisure-Time Physical Activity With Risk of 26 Types of Cancer in 1.44 Million Adults. *JAMA Intern Med*. 2016: doi 10.

30. Samitz G, Egger M, Zwahlen M. Domains of physical activity and all-cause mortality: systematic review and dose-response meta-analysis of cohort studies. *Int J Epidemiol*. 2011;40: 1382-1400.

31. Kumanyika SK, Obarzanek E, Stettler N, et al. Population-based prevention of obesity: the need for comprehensive promotion of healthful eating, physical activity, and energy balance: a scientific statement from American Heart Association Council on Epidemiology and Prevention, Interdisciplinary Committee for Prevention (formerly the expert panel on population and prevention science). *Circulation*. 2008;118: 428-464.

32. Ekelund U, Steene-Johannessen J, Brown WJ, et al. Does physical activity attenuate, or even eliminate, the detrimental association of sitting time with mortality? A harmonised meta-analysis of data from more than 1 million men and women. *Lancet*. 2016;388: 1302-1310.

33. Biswas A, Oh PI, Faulkner GE, et al. Sedentary time and its association with risk for disease incidence, mortality, and hospitalization in adults: a systematic review and meta-analysis. *Ann Intern Med*. 2015;162: 123-132.

34. Ogilvie D, Foster CE, Rothnie H, et al. Interventions to promote walking: systematic review. *BMJ*. 2007;334 1204.

35. Hildebrand JS, Gapstur SM, Campbell PT, Gaudet MM, Patel AV. Recreational physical activity and leisure-time sitting in relation to postmenopausal breast cancer risk. *Cancer Epidemiol Biomarkers Prev*. 2013;22: 1906-1912.

36. Chao A, Connell CJ, Jacobs EJ, et al. Amount, type, and timing of recreational physical activity in relation to colon and rectal cancer in older adults: the Cancer Prevention Study II Nutrition Cohort. *Cancer Epidemiol Biomarkers Prev*. 2004;13: 2187-2195.

37. US Department of Health and Human Services. *Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities*. Washington, DC, 2015.

38. International Agency for Research on Cancer. *IARC Handbooks of Cancer Prevention. Volume 6: Weight Control and Physical Activity*. Lyon, France: IARC Press, 2002.

39. Schmid D, Leitzmann MF. Television viewing and time spent sedentary in relation to cancer risk: a meta-analysis. *J Natl Cancer Inst*. 2014;106(7). pii: dju098.

40. Patel AV, Hildebrand JS, Campbell PT, et al. Leisure-Time Spent Sitting and Site-Specific Cancer Incidence in a Large U.S. Cohort. *Cancer Epidemiol Biomarkers Prev*. 2015;24: 1350-1359.

41. US Department of Health and Human Services. *2008 Physical Activity Guidelines for Americans*. Washington, DC US Department of Health and Human Services, 2008.

42. American Academy of Pediatrics Council on Communications and Media. Media and Young Minds. *Pediatrics*. 2016;138: e201162591.

43. Strong W, Malina R, Blimkie C, et al. Evidence based physical activity for school-age youth. *J Pediatr*. 2005;146: 732-737.

44. Community Preventive Services Task Force. Obesity Prevention and Control: Behavioral Interventions that Aim to Reduce Recreational Sedentary Screen Time Among Children. Available from URL: http://www.thecommunityguide.org/obesity/behavioral.html. Accessed October 27, 2016.

45. Centers for Disease Control and Prevention. QuickStats: Percentage of Adults Aged >=65 Years Meeting 2008 Federal Guidelines for Leisure-Time Aerobic and Muscle-Strengthening Activities, by Age and Type of Activity – United States, 2000-2002 and 2013-2015. *MMWR Morb Mortal Wkly Rep*. 2016;65: 1019.

46. Mayne ST, Playdon MC, Rock CL. Diet, nutrition, and cancer: past, present and future. *Nat Rev Clin Oncol*. 2016;13: 504-515.

47. Rehm CD, Penalvo JL, Afshin A, Mozaffarian D. Dietary Intake Among US Adults, 1999-2012. *JAMA*. 2016;315: 2542-2553.

48. Miller G, Merlo C, Demissie Z, Sliwa S, Park S. Trends in Beverage Consumption Among High School Students – United States, 2007-2015. *MMWR Morb Mortal Wkly Rep*. 2017;66: 112-116.

49. Centers for Disease Control and Prevention. 1991-2015 High School Youth Risk Behavior Survey Data. Available from URL: http://nccd.cdc.gov/youthonline/App/Default.aspx. Accessed October 14, 2016.

50. Marriott BP, Olsho L, Hadden L, Connor P. Intake of added sugars and selected nutrients in the United States, National Health and Nutrition Examination Survey (NHANES) 2003-2006. *Crit Rev Food Sci Nutr*. 2010;50: 228-258.

51. Malik VS, Pan A, Willett WC, Hu FB. Sugar-sweetened beverages and weight gain in children and adults: a systematic review and meta-analysis. *Am J Clin Nutr*. 2013;98: 1084-1102.

52. Bouvard V, Loomis D, Guyton KZ, et al. Carcinogenicity of consumption of red and processed meat. *Lancet Oncol*. 2015;16: 1599-1600.

53. Sinha R, Cross AJ, Graubard BI, Leitzmann MF, Schatzkin A. Meat intake and mortality: a prospective study of over half a million people. *Arch Intern Med*. 2009;169: 562-571.

54. Joosen AM, Kuhnle GG, Aspinall SM, et al. Effect of processed and red meat on endogenous nitrosation and DNA damage. *Carcinogenesis*. 2009;30: 1402-1407.

55. Cross AJ, Pollock JR, Bingham SA. Haem, not protein or inorganic iron, is responsible for endogenous intestinal N-nitrosation arising from red meat. *Cancer Res*. 2003;63: 2358-2360.

56. Sinha R, Rothman N, Salmon CP, et al. Heterocyclic amine content in beef cooked by different methods to varying degrees of doneness and gravy made from meat drippings. *Food and chemical toxicology*. 1998;36: 279-287.

57. World Cancer Research Fund and American Institute for Cancer Research. *Diet and Cancer Report*. Washington DC: Research Fund and American Institute for Cancer Research, 2007.

58. Jung S, Spiegelman D, Baglietto L, et al. Fruit and vegetable intake and risk of breast cancer by hormone receptor status. *J Natl Cancer Inst*. 2013;105: 219-236.

59. Darmon N, Drewnowski A. Does social class predict diet quality? *Am J Clin Nutr*. 2008;87.

60. Reedy J, Krebs-Smith SM, Miller PE, et al. Higher diet quality is associated with decreased risk of all-cause, cardiovascular disease, and cancer mortality among older adults. *J Nutr*. 2014;144: 881-889.

61. World Cancer Research Fund and American Institute for Cancer Research. *Food, Nutrition, Physical Activity and the Prevention of Cancer: A Global Perspective*. Washington, DC., 2007.

62. International Agency for Research on Cancer. *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Volume 83: Alcohol Drinking*. Lyon, France: IARC Press, 1988.

63. Secretan B, Straif K, Baan R, et al. A review of human carcinogens – Part E: tobacco, areca nut, alcohol, coal smoke, and salted fish. *Lancet Oncol*. 2009 10: 1033-1034.

64. Mostofsky E, Mukamal KJ, Giovannucci EL, Stampfer MJ, Rimm EB. Key Findings on Alcohol Consumption and a Variety of Health Outcomes From the Nurses' Health Study. *Am J Public Health*. 2016;106: 1586-1591.

65. Waxman A, World Health Assembly. WHO global strategy on diet, physical activity and health. *Food Nutr Bull*. 2004;25: 292-302.

66. Estruch R, Ros E, Salas-Salvado J, et al. Primary prevention of cardiovascular disease with a Mediterranean diet. *N Engl J Med*. 2013;368: 1279-1290.

67. Sacks JJ, Gonzales KR, Bouchery EE, Tomedi LE, Brewer RD. 2010 National and State Costs of Excessive Alcohol Consumption. *Am J Prev Med*. 2015;49: e73-79.

68. Healthy People 2020. Substance Abuse Objectives. Available from URL: https://www.healthypeople.gov/2020/topics-objectives/topic/substance-abuse/objectives. Accessed September 16, 2016.

69. Institute of Medicine of the National Academies. *Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation*. Washington DC: Institute of Medicine of the National Academies, 2012.

70. Carlson SA, Fulton JE, Pratt M, Yang Z, Adams EK. Inadequate physical activity and health care expenditures in the United States. *Prog Cardiovasc Dis*. 2015;57: 315-323.

71. Valero-Elizondo J, Salami JA, Osondu CU, et al. Economic Impact of Moderate-Vigorous Physical Activity Among Those With and Without Established Cardiovascular Disease: 2012 Medical Expenditure Panel Survey. *J Am Heart Assoc*. 2016;5(9). pii: e003614.

72. Khan LK, Sobush K, Keener D, et al. Recommended community strategies and measurements to prevent obesity in the United States. *MMWR Recomm Rep*. 2009 58(RR-7): 1-26.

73. Division of Nutrition PAO, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention. Overweight & Obesity: Prevention Strategies & Goals. Available from URL: https://www.cdc.gov/obesity/resources/strategies-guidelines.html. Accessed December 10, 2016.

74. National Academy of Medicine. *Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation*. Washington, DC: The National Academies Press, 2012.

75. American Cancer Society Cancer Action Network. How Do You Measure Up? A Progress Report on State Legislative Activity to Reduce Cancer Incidence and Mortality, 2016.

76. Pronk N. Best Practice Design Principles of Worksite Health and Wellness Programs. *ACSM's Health & Fitness Journal*. 2014;18.

77. Falbe J, Thompson HR, Becker CM, Rojas N, McCulloch CE, Madsen KA. Impact of the Berkeley Excise Tax on Sugar-Sweetened Beverage Consumption. *Am J Public Health*. 2016;106: 1865-1871.

78. LeFevre ML. Counseling to promote healthy diet and physical activity in adults with cardiovascular risk factors: U.S. Preventive services task force recommendation statement. *Ann Intern Med*. 2014;161(8): 587-593.

79. US Preventive Services Task Force. Screening for obesity in children and adolescents: US Preventive Services Task Force recommendation statement. *Pediatrics*. 2010;125: 361-367.

80. Moyer VA. Screening for and management of obesity in adults: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med*. 2012;157: 373-378.

81. US Department of Agriculture. USDA Unveils Historic Improvements to Meals Served in America's Schools. Available from URL: http://www.fns.usda.gov/pressrelease/002312. Accessed September 19, 2014.

82. US Food and Drug Administration. Changes to the Nutrition Facts Label. Available from URL: http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm385663.htm. Accessed September 19, 2016.

Ultraviolet Radiation and Skin Cancer

Most cases of melanoma, the deadliest form of skin cancer, are caused by exposure to excessive ultraviolet radiation (UVR) from sunlight or tanning devices.[1, 2] Stratospheric ozone depletion has exacerbated these health effects by allowing more UVR to reach the Earth's surface.[3] The three main types of skin cancer are melanoma, basal cell, and squamous cell carcinoma. Basal cell and squamous cell carcinomas, also referred to as keratinocyte carcinoma (KC),[4] are the most frequently diagnosed and are highly curable forms of skin cancer.[5] The most recent study of KC occurrence estimated that in 2012, 5.4 million cases were diagnosed among 3.3 million people (many people are diagnosed with more than one KC).[6] Invasive melanoma represents only about 1% of all skin cancer cases, but accounts for the majority of skin cancer deaths. The American Cancer Society estimates that 87,110 new cases of invasive melanoma will be diagnosed and 9,730 deaths will occur in 2017.[7] The incidence of melanoma in the US has been increasing for at least 30 years.[8, 9] A recent study estimated that 230,000 melanoma cases could be averted from 2020 to 2030 if a nationwide comprehensive skin cancer prevention program were implemented.[10] There are also substantial economic costs of skin cancer; treatment is estimated to cost $8.1 billion annually, $3.3 billion of which is ascribed to melanoma treatment alone.[11]

Solar Ultraviolet Exposure

Everyone is exposed to naturally occurring solar UVR, which is an invisible kind of radiation that can penetrate, change, and damage skin cells. UVR is also a source of vitamin D. Vitamin D is important for bone health and 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.[12] The amount of sunlight exposure it takes to make enough vitamin D depends on many environmental factors (i.e., latitude, season, etc.) as well as on an individual's skin type. Research is underway to improve the understanding of vitamin D levels and their effects on health, including their potential protective association with some cancers.[12, 13]

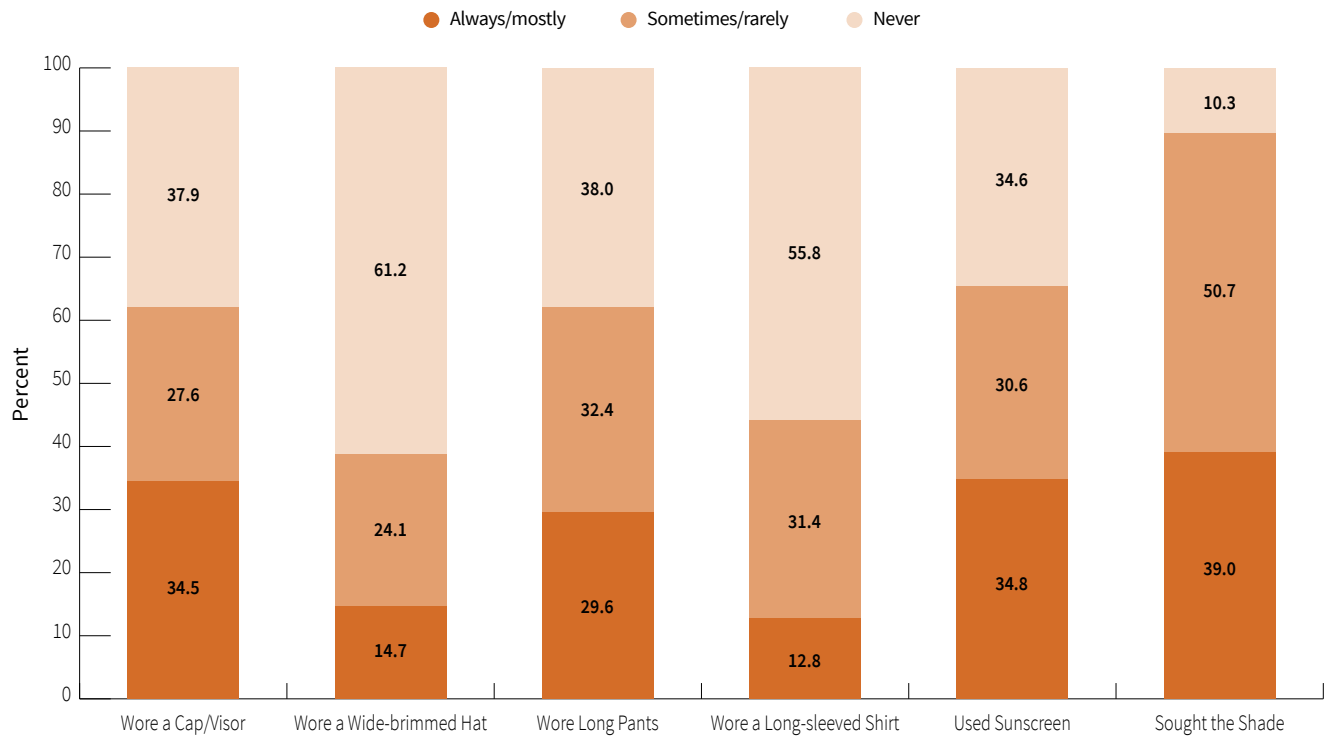
The extent of one's exposure to sunlight is determined by individual behaviors, such as recreational exposure (e.g., sunbathing, physical activity), protective behavior (e.g., sunscreen use, clothing choices), and occupational exposures. Environmental factors such as time of day, season, geographic location, altitude, and other weather conditions also affect solar radiation exposure. The Environmental Protection Agency (EPA) has developed the UV Index, taking into account these environmental factors to help inform the public about UVR risk on a daily basis.[14] The UV Index scale ranges from 0, representing the lowest risk, to 11, representing the highest risk.

Exposure to UVR, the sensitivity of a person's skin to UVR, and the duration and intensity of exposure are important risk factors for skin cancers (see sidebar, below). In addition, the damaging effects of UVR are cumulative over a lifetime.[8, 23] Some studies indicate that excessive sun exposure during childhood poses an especially high risk for melanoma and other skin cancers later in life, while

Risk factors for skin cancer[2, 15-22]

- Exposure to UV rays, including the use of indoor tanning devices
- History of excessive sun exposure, including sunburns
- Fair skin, freckling, light hair
- Presence of moles (more than 50, in particular)
- Personal or family history of skin cancer, especially melanoma
- Older age
- Weakened immune system, including from certain diseases or medical treatments
- Exposure to high amounts of certain chemicals, including arsenic
- Rare inherited conditions
- Long-term skin conditions and certain treatments for some medical conditions
- Smoking (squamous cell carcinoma only)

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



*Among those who reportedly went outside on warm, sunny days for more than one hour. Note: Estimates are age adjusted to the 2000 US standard population.
Source: National Health Interview Survey, 2015.

others have found excessive sun exposure to be harmful regardless of the age when it occurred.[24-26] The immediate adverse effects of excessive UVR exposure from all sources include sunburn, eye damage, and suppression of the immune system, while long-term effects include premature aging of the skin, solar keratosis, wrinkles, and skin cancer.[27] The visible evidence of susceptibility to skin cancer (skin type and precancerous lesions) and of sun-induced skin damage (sunburn and solar keratosis) and the ability of an individual to modify sun exposure provide the basis for implementation of programs for the primary prevention of skin cancer.

UVR Exposure Behaviors

UVR damage of unprotected 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.[28, 29] In addition, users of sunscreen (particularly those at high risk for skin cancer) should learn about proper selection of sunscreen and its application and reapplication instructions. Visit cancer.org/healthy/be-safe-in-sun/ for additional information on ways you can protect yourself from UVR.

Current Patterns in Skin Protection

- Many adults and adolescents in the US do not regularly protect themselves when outdoors on sunny days.[30] Based on 2015 National Health Interview Survey (NHIS) data, only 12.8% of adults reported wearing a long-sleeved shirt and only 14.7% reported wearing a wide-brimmed hat always or most of the time when outside on a warm, sunny day for more than an hour (Figure 3A).
- Among US high school students surveyed in 2015, 55.8% (girls: 59.8%, boys: 52.0%) reported having had a sunburn in the past year (Table 3A); this was the only sun-related practice assessed at the time in this population.

Table 3A. Sunburns and Use of an Indoor Tanning Device (%), High School Students, US, 2015

	Boys	Girls	Overall
Sunburn*			
Overall	52.0	59.8	55.8
Race/Ethnicity			
White	67.6	77.7	72.5
Black	13.4	16.2	15.0
Hispanic	38.0	43.8	40.8
American Indian/Alaska Native	†	†	44.6
Asian	29.4	26.4	28.1
Indoor tanning device*			
Overall	4.0	10.6	7.3
Race/Ethnicity			
White	3.7	15.2	9.4
Black	5.3	2.1	3.7
Hispanic	3.7	5.8	4.7
American Indian/Alaska Native	†	†	6.1
Asian	4.3	1.8	3.2

*At least once in the past 12 months. †Estimate not provided due to instability.
Source: High School Youth Risk Behavior Survey, 2015.[31]

Artificial UVR Exposure (Indoor Tanning)

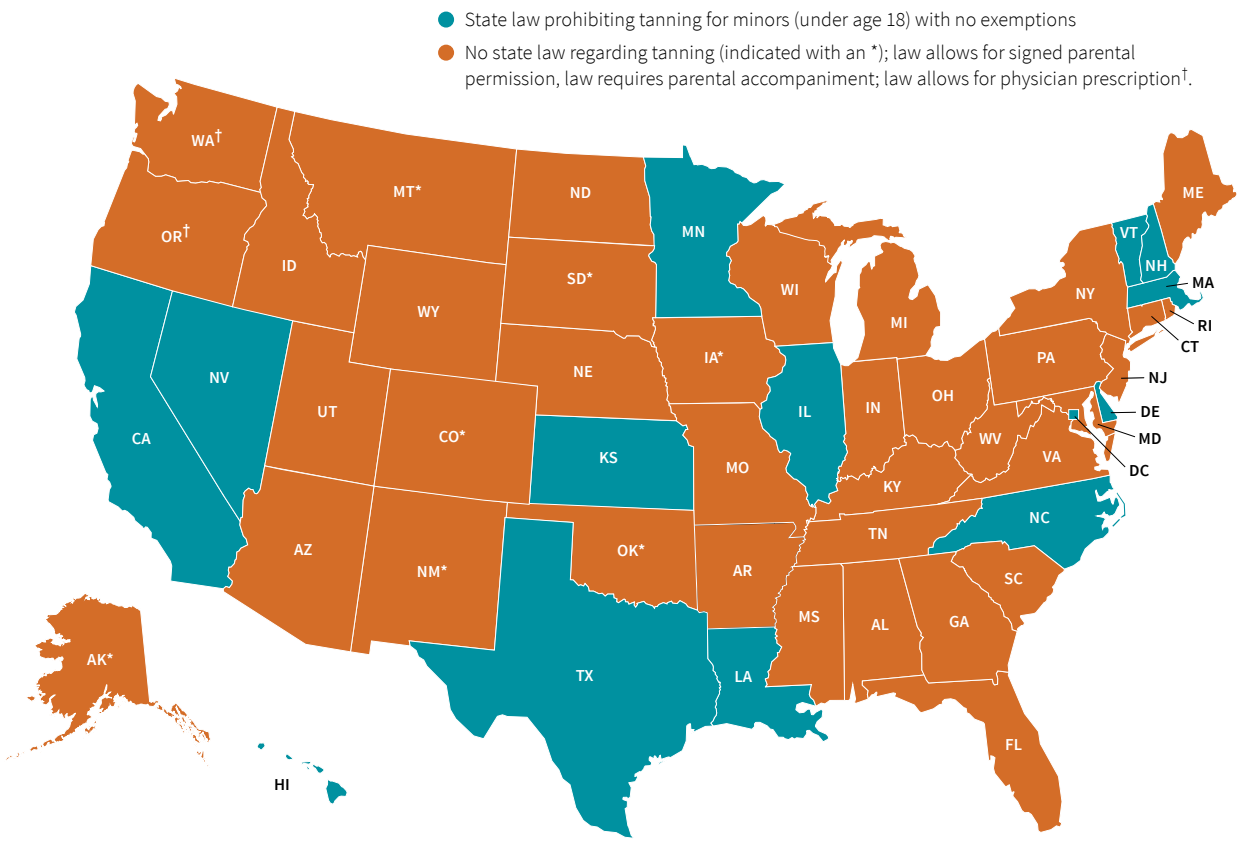
Indoor tanning devices emit artificial UVR.[32] These devices are promoted by the indoor tanning industry and often used for cosmetic purposes.[29, 32] The International Agency for Research on Cancer lists UV-emitting indoor tanning devices as carcinogenic to humans.[33] The risk of melanoma is about 60% higher for people who began using indoor tanning devices before the age of 35, and risk increases with the number of total hours, sessions, or years that indoor tanning devices are used.[29, 34] A recent meta-analysis estimated that annually in the US, more than 410,000 cases of KC and more than 6,000 cases of melanoma can be attributed to indoor tanning.[35]

Indoor tanning use is especially common among older female teens.[31] As a result, indoor tanning use laws have been passed that include parental consent and signed statements from customers, signage, and/or age restrictions.[26] However, these regulations, as well as the compliance with and enforcement of these laws, vary by state and municipality.[36-38] At the federal level, the US Food and Drug Administration (FDA) has proposed a rule to prohibit indoor tanning in tanning facilities among adolescents under the age of 18. If this rule were passed, a Centers for Disease Control and Prevention (CDC) study estimated 62,000 melanoma cases would be averted and $343 million in treatment costs would be saved over the lifetime of 61 milllion youth.[39] This rule would also require adults to acknowledge that they are aware of the health risks of indoor tanning devices.[40] Another proposed FDA rule would improve device warning labels, and enhance eye wear and technical sunlamp requirements.[40]

Patterns of Indoor Tanning in the US

- According to NHIS data, the prevalence of using an indoor tanning device among adults in the past year declined from 5.5% in 2010 [41] to 3.6% in 2015.[42]
- In 2015, indoor tanning use in the past year was higher among women (5.6%) than men (1.6%) and among those living in the Midwest (5.5%) compared to those in other regions.[42]
- The use of indoor tanning devices among female high school students appears to have declined dramatically in recent years. Based on the 2015 Youth Risk Behavior Survey (YRBS), 10.6% of high school girls reported recent use of an indoor tanning device (Table 3A) compared to 25.4% in 2009.[43, 44]
- Use of indoor tanning devices among high school boys is less common (4.0%) than girls (Table 3A), and the prevalence appears to have been relatively stable since 2009.[43]
- During 2009-2011, indoor tanning use was higher among high school students living in states without indoor tanning laws (30.1%) than in states with any form of indoor tanning laws (21.2%).[45]
- As of January 1, 2017 only 13 states and the District of Columbia have a law prohibiting tanning for minors without exemptions; 37 states fail to fully protect minors under the age of 18 from the harms caused by indoor tanning devices (Figure 3B, page 38).

Figure 3B. State Indoor Tanning Restrictions for Minors, 2017



Note: As of January 1, 2017. †There is no medical indication for the use of a tanning device in the diagnosis or treatment of a disease.
Source: American Cancer Society Cancer Action Network, Health Policy Tracking Services & Individual state bill tracking services.

Prevention Strategies in Skin Cancer

As a result of the growing public health burden of UVR and skin cancer, the Surgeon General released a Call to Action to Prevent Skin Cancer in 2014 to strengthen preventive strategies to reduce skin cancer incidence and mortality.[46] 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.

Several strategies have been identified to help reach these goals. For example, communities can help increase shade in outdoor recreational settings by planting trees or building structures to provide shade to frequently used areas. Skin cancer prevention can be included in school curricula from an early age. Implementing specific policies, such as sun safety in the workplace, can also help reduce skin cancer by limiting or reducing UVR exposure while on the job. Further, strongly enforcing existing laws that prohibit indoor tanning among minors would help reduce the harms associated with indoor tanning.[46]

To promote individual sun protection behaviors, the American Cancer Society supports the annual Don't Fry Day campaign (see sidebar), as well as the Slip! Slop! Slap!® and Wrap! awareness campaign, which highlights the following ways that individuals can protect themselves from harmful UV rays: slip on a shirt, slop on sunscreen, slap on a hat, and wrap on sunglasses to protect eyes and surrounding sensitive skin.[47]

In addition, as part of the National Council for Skin Cancer Prevention, the American Cancer Society supports the Indoor Tan-Free Skin Smart Campus Initiative to help promote skin cancer prevention on university and college campuses (see sidebar). The SunWise Program for schools and community groups (e.g., camps, scouts, museums) is an example of a cost-effective, school-based education program established by the EPA and now supported by the National Environmental Education Foundation.[48] Through this program, free resources are available to educators to teach young school children about sun safety, UVR exposure, and stratospheric ozone. Visit neefusa.org/sunwise for more information. In addition, the CDC has several fact sheets available on the topic of skin cancer prevention;[49] information and materials are available at rtips.cancer.gov/rtips/index.do for other sun safe intervention programs.

As noted in the Surgeon General's Call to Action to Prevent Skin Cancer goals, health care professionals play an important role in educating their patients on the importance of skin cancer prevention.[46] Since 2012, the US Preventive Services Task Force (USPSTF) has recommended that physicians counsel fair-skinned adolescents and young adults (ages 10-24 years) about sun protection.[50] Physician communication to practice sun safety is associated with increased use of sun protective behaviors among adolescents.[51] Only about one-half of US adolescents and their parents reported being told by a physician to practice sun protection.[51] Other strategies such as interactive web-based interventions, may have the potential to improve sun protection behaviors.[52]

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. There is evidence that appearance-based interventions may lead to behavior change in certain groups (e.g., college-age women), although more research is needed.[32, 53, 54]

Skin Cancer Prevention Initiatives

Don't Fry Day

Since 2008, the American Cancer Society has collaborated with the National Council on Skin Cancer Prevention (NCSCP) to coordinate prevention activities and improve national media relation efforts that promote and raise public health awareness about the importance of skin cancer prevention. 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. 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 the NCSCP website at skincancerprevention.org for more information about Don't Fry Day and to access these materials.

Indoor Tan-Free Skin Smart Campus Initiative

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.[46] The initiative awards US universities and colleges that promote skin cancer prevention policies and education on campus. Visit skincancerprevention.org to learn more and find out how university and college campuses can earn the Indoor Tan-Free Skin Smart Campus Award.

Early Detection of Skin Cancer

Early detection of skin cancer may include an inspection by a clinician and/or self-examination.[26] A recent USPSTF report concluded that there is insufficient evidence to recommend for or against visual skin examination by a clinician for people at average risk of skin cancer.[55]

ABCDE Rule: Warning Signs of Melanoma[56]

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.

However, there remains considerable controversy as to whether routine skin examinations by a primary care provider would improve outcomes and survival for those who develop skin cancer.[26] The American Academy of Dermatology (AAD) indicates that individuals with red or blond hair, blue or green eyes, or fair skin (in particular, fair skin with freckles or burns easily) are at higher risk for skin cancer than others and should undergo periodic screening by a trained health care provider.[56] The proportion of adults who reported having had a total body skin examination by a clinician at least once in their lifetime increased from 14.5% in 2000 to 22.0% in 2015,[42] with a greater proportion among adults with higher-risk profiles.[57]

Self-skin examinations may be beneficial by identifying melanoma at early, more treatable stages, and are supported by the AAD. Any new suspicious growths or anything changing, itching, or bleeding on the skin should be evaluated promptly by a physician. Additionally, the ABCDE rule can serve as a helpful guide for the warning signs of the most common types of melanoma (see sidebar, above).

Visit cancer.org/cancer/skin-cancer/prevention-and-early-detection for guidance on how to perform a skin self-exam.

References

1. International Agency for Research on Cancer, *World Health Organization. Solar and Ultraviolet Radiation. Vol 55*. Geneva, Switzerland: International Agency for Research on Cancer, 2002.

2. Armstrong BK, Kricker A. The epidemiology of UV induced skin cancer. *J Photochem Photobiol B*. 2001;63: 8-18.

3. United Nations Environment Programme. *Environmental Effects of Ozone Depletion and Its Interactions With Climate Change: 2006 Assessment*. Nairobi, Kenya: United Nations Environmental Programme, 2006.

4. Karimkhani C, Boyers LN, Dellavalle RP, Weinstock MA. It's time for "keratinocyte carcinoma" to replace the term "nonmelanoma skin cancer". *J Am Acad Dermatol*. 2015;72: 186-187.

5. Rogers HW, Weinstock MA, Harris AR, et al. Incidence estimate of nonmelanoma skin cancer in the United States, 2006. *Arch Dermatol*. 2010;146: 283-287.

6. Rogers HW, Weinstock MA, Feldman SR, Coldiron BM. Incidence Estimate of Nonmelanoma Skin Cancer (Keratinocyte Carcinomas) in the U.S. Population, 2012. *JAMA Dermatol*. 2015;151: 1081-1086.

7. Siegel RL, Miller KD, Jemal A. Cancer Statistics 2017. *CA Cancer J Clin*. 2017;1: 7-30.

8. Jemal A, Saraiya M, Patel P, et al. Recent trends in cutaneous melanoma incidence and death rates in the United States, 1992-2006. *J Am Acad Dermatol*. 2011;65: S17-25 e11-13.

9. Wong JR, Harris JK, Rodriguez-Galindo C, Johnson KJ. Incidence of childhood and adolescent melanoma in the United States: 1973-2009. *Pediatrics*. 2013;131: 846-854.

10. Guy GP, Jr., Thomas CC, Thompson T, Watson M, Massetti GM, Richardson LC. Vital signs: melanoma incidence and mortality trends and projections – United States, 1982-2030. *MMWR Morb Mortal Wkly Rep*. 2015;64: 591-596.

11. Guy GP, Jr. Machlin SR, Ekwueme DU, Yabroff RK. Prevalence and Costs of Skin Cancer Treatment in the U.S., 2002-2006 and 2007-2011. *Am J Prev Med*. 2015;48(2): 183-187.

12. Brannon PM, Yetley EA, Bailey RL, Picciano MF. Overview of the conference "Vitamin D and Health in the 21st Century: an Update". *Am J Clin Nutr*. 2008;88(suppl): 483S-490S.

13. Institute of Medicine. Dietary Reference Intakes for Calcium and Vitamin D, Food and Nutrition Board. Available from URL: https://www.nationalacademies.org/hmd/~/media/Files/Report%20Files/2010/Dietary-Reference-Intakes-for-Calcium-and-Vitamin-D/Vitamin%20D%20and%20Calcium%202010%20Report%20Brief.pdf. Accessed November, 2010.

14. Environmental Protection Agency. UV Index. Available from URL: http://www2.epa.gov/sunwise/uv-index-scale. Accessed August 28, 2014.

15. Gandini S, Sera F, Cattaruzza MS, et al. Meta-analysis of risk factors for cutaneous melanoma: I. Common and atypical naevi. *Eur J Cancer*. 2005;41: 28-44.

16. Belloni-Fortina A, Piaserico S, Tonin E, Alaibac M. Melanoma and immunosuppression. *Dermatology*. 2009;218: 88; author reply 89.

17. Diepgen TL, Mahler V. The epidemiology of skin cancer. *Br J Dermatol*. 2002;146 Suppl 61: 1-6.

18. Tucker MA, Halpern A, Holly EA, et al. Clinically recognized dysplastic nevi. A central risk factor for cutaneous melanoma. *JAMA*. 1997;277: 1439-1444.

19. Hemminki K, Chen B. Familial risks for eye melanoma and retinoblastoma: results from the Swedish Family-Cancer Database. *Melanoma Res*. 2006;16: 191-195.

20. Hsueh YM, Chiou HY, Huang YL, et al. Serum beta-carotene level, arsenic methylation capability, and incidence of skin cancer. *Cancer Epidemiol Biomarkers Prev.* 1997;6: 589-596.

21. De Hertog SA, Wensveen CA, Bastiaens MT, et al. Relation between smoking and skin cancer. *J Clin Oncol.* 2001;19: 231-238.

22. Stern RS, Laird N. The carcinogenic risk of treatments for severe psoriasis. Photochemotherapy Follow-up Study. *Cancer.* 1994;73: 2759-2764.

23. Vainio H, Miller AB, Bianchini F. An international evaluation of the cancer-preventive potential of sunscreens. *Int J Cancer.* 2000;88: 838-842.

24. Gandini S, Sera F, Cattaruzza MS, et al. Meta-analysis of risk factors for cutaneous melanoma: II. Sun exposure. *Eur J Cancer.* 2005;41: 45-60.

25. Dennis LK, Vanbeek MJ, Freeman LE, Smith BJ, Dawson DV, Coughlin JA. Sunburns and risk of cutaneous melanoma: does age matter? A comprehensive meta-analysis. *Ann Epidemiol.* 2008;18: 614-627.

26. Tripp MK, Watson M, Balk SJ, Swetter SM, Gershenwald JE. State of the science on prevention and screening to reduce melanoma incidence and mortality: The time is now. *CA Cancer J Clin.* 2016.

27. Vainio H, Wilbourn J. Identification of carcinogens within the IARC monograph program. *Scand J Work Environ Health.* 1992;18 64-73.

28. Lin JS, Eder M, Weinmann S. Behavioral counseling to prevent skin cancer: a systematic review for the U.S. Preventive Services Task Force. *Ann Intern Med.* 2011;154: 190-201.

29. Boniol M, Autier P, Boyle P, Gandini S. Cutaneous melanoma attributable to sunbed use: systematic review and meta-analysis. *BMJ.* 2012 345: e4757.

30. Buller DB, Cokkinides V, Hall IH, Hartman AM, Saraiya M, et al. Prevalence of Sunburn, Sun Protection, and Indoor Tanning Behaviors Among Americans: Review from National Surveys and Case Studies of Three States. *J Am Acad Dermatol.* 2011;65 (5S1): S114–S123.

31. Centers for Disease Control and Prevention. 2015 High School Youth Risk Behavior Survey Data. Available from URL: http://nccd.cdc.gov/youthonline/App/Default.aspx. Accessed October 14, 2016.

32. Lim HW, James WD, Rigel DS, Maloney ME, Spencer JM, Bhushan R. Adverse effects of ultraviolet radiation from the use of indoor tanning equipment: time to ban the tan. *J Am Acad Dermatol.* 2011;64: 893-902.

33. International Agency for Research on Cancer. The association of use of sunbeds with cutaneous malignant melanoma and other skin cancers: A systematic review. *Int J Cancer.* 2007;120: 1116-1122.

34. Lazovich D, Vogel RI, Berwick M, Weinstock MA, Anderson KE, Warshaw EM. Indoor tanning and risk of melanoma: a case-control study in a highly exposed population. *Cancer Epidemiol Biomarkers Prev.* 2010;19: 1557-1568.

35. Wehner MR, Chren MM, Nameth D, et al. International prevalence of indoor tanning: a systematic review and meta-analysis. *JAMA Dermatol.* 2014;150: 390-400.

36. Pichon LC, Mayer JA, Hoerster KD, et al. Youth access to artificial UV radiation exposure: practices of 3647 US indoor tanning facilities. *Arch Dermatol.* 2009;145: 997-1002.

37. Watson M, Holman DM, Fox KA, et al. Preventing skin cancer through reduction of indoor tanning: current evidence. *Am J Prev Med.* 2013;44: 682-689.

38. Bulger AL, Mayer JE, Gershenwald JE, Guild SR, Gottlieb MA, Geller AC. Enforcement Provisions of Indoor Tanning Bans for Minors: An Analysis of the First 6 US States. *Am J Public Health.* 2015;105: e10-e12.

39. Guy GP, Jr., Zhang Y, Ekwueme DU, Rim SH, Watson M. The potential impact of reducing indoor tanning on melanoma prevention and treatment costs in the United States: An economic analysis. *J Am Acad Dermatol.* 2016.

40. US Food and Drug Administration. FDA proposes tanning bed age restrictions and other important safety measures, 2015.

41. Guy GP, Jr., Berkowitz Z, Holman DM, Hartman AM. Recent Changes in the Prevalence of and Factors Associated With Frequency of Indoor Tanning Among US Adults. *JAMA Dermatol.* 2015;151: 1256-1259.

42. National Center for Health Statistics. National Health Interview Survey, 2015. Public-use data file and documentation. Available from URL: http://www.cdc.gov/nchs/nhis/quest_data_related_1997_forward.htm. Accessed July 16, 2016.

43. Guy GP, Jr., Berkowitz Z, Everett Jones S, Holman DM, Garnett E, Watson M. Trends in indoor tanning among US high school students, 2009-2013. *JAMA Dermatol.* 2015;151: 448-450.

44. Kann L, McManus T, Harris WA, et al. Youth Risk Behavior Surveillance – United States, 2015. *MMWR Surveill Summ.* 2016;65: 1-174.

45. Guy GP, Jr., Berkowitz Z, Jones SE, et al. State indoor tanning laws and adolescent indoor tanning. *Am J Public Health.* 2014;104: e69-74.

46. US Department of Health and Human Services. *The Surgeon General's Call to Action To Prevent Skin Cancer.* Washington, DC: U.S. Dept of Health and Human Services, Office of the Surgeon General, 2014.

47. American Cancer Society. Be Safe in the Sun. Available from URL: http://www.cancer.org/healthy/besafeinthesun/index. Accessed October 10, 2016.

48. National Environmental Education Foundation. SunWise. Available from URL: https://www.neefusa.org/sunwise. Accessed October 13, 2016.

49. Division of Cancer Prevention and Control, Centers for Disease Control and Prevention. Skin Cancer Prevention Fact Sheets. Available from URL: http://www.cdc.gov/cancer/skin/basic_info/fact_sheets.htm. Accessed December 11, 2016, 2016.

50. Moyer VA, Force USPST. Behavioral counseling to prevent skin cancer: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med.* 2012;157: 59-65.

51. Bandi P, Cokkinides VE, Weinstock MA, Ward EM. Physician sun protection counseling: prevalence, correlates, and association with sun protection practices among US adolescents and their parents, 2004. *Prev Med.* 2010;51: 172-177.

52. Heckman CJ, Darlow SD, Ritterband LM, Handorf EA, Manne SL. Efficacy of an Intervention to Alter Skin Cancer Risk Behaviors in Young Adults. *Am J Prev Med.* 2016;51: 1-11.

53. Cokkinides V, Weinstock M, Glanz K, Albano J, Ward E, Thun M. Trends in sunburns, sun protection practices, and attitudes toward sun exposure protection and tanning among US adolescents, 1998-2004. *Pediatrics.* 2006;118: 853-864.

54. Hillhouse J, Turrisi R, Stapleton J, Robinson J. Effect of seasonal affective disorder and pathological tanning motives on efficacy of an appearance-focused intervention to prevent skin cancer. *Arch Dermatol.* 2010;146: 485-491.

55. Bibbins-Domingo K, Grossman DC, Curry SJ, et al. Screening for Skin Cancer: US Preventive Services Task Force Recommendation Statement. *JAMA.* 2016;316: 429-435.

56. American Academy of Dermatology. Melanoma. Available from URL: https://www.aad.org/media/stats/conditions/melanoma-faqs. Accessed December 11, 2016.

57. Lakhani NA, Saraiya M, Thompson TD, King SC, Guy GP, Jr. Total body skin examination for skin cancer screening among U.S. adults from 2000 to 2010. *Prev Med.* 2014;61: 75-80.

Infectious Agents

There are several agents known to cause cancer, such as human papillomavirus, *Helicobacter pylori*, hepatitis B virus, and hepatitis C virus.[1] In North America, about 4% of all cancers in 2012 were attributable to infectious agents.[1] Fortunately, there are opportunities to prevent and treat many of these infections, thereby averting cancer occurrence and death.

Human Papillomavirus

Persistent infection with human papillomavirus (HPV) can cause six types of cancer, in addition to genital warts. Although most HPV infections are cleared by the body and do not cause cancer, virtually all cervical cancers are caused by persistent HPV infections. Further, persistent infection with HPV causes 90% of anal cancers, about 70% of oropharyngeal cancers, and 60-70% of vaginal, vulvar, and penile cancers.[2] Cervical cancer is the most common HPV-related cancer in women, and oropharyngeal cancer the most common in men.[3] Incidence rates for several HPV-related cancers, including oropharyngeal, anal, and vulvar cancers, have increased in recent years; however, cervical cancer incidence rates have continued to decline because of widespread screening that can prevent this cancer.[4] Infection with HPV is very common in the US, with approximately 14 million people becoming newly infected annually. The Centers for Disease Control and Prevention (CDC) estimates that most Americans will acquire HPV at some point in their lives.[5] The virus is spread primarily through intimate skin-to-skin contact and is usually asymptomatic.

HPV Prevention and Control

There are more than 100 types of HPV, only about 13 of which cause cancer.[6] Three vaccines have been approved by the US Food and Drug Administration (FDA) for the prevention of HPV. The 9-valent vaccine is the only one currently offered in the US. It protects against 9 HPV types and has the potential to avert nearly 90% of HPV cancers.[7] Results from many large studies indicate that vaccines are effective at reducing infection from HPV and are safe to use.[8-10] In the US, more than 80 million doses of the vaccine have been given. Reactions that people have had after the HPV vaccines have been mostly mild and similar to those from other vaccines. For the vaccine to be most effective, vaccination should be completed at the recommended age of 11-12 years as a higher immune response is produced in younger adolescents than older adolescents.

The American Cancer Society's current HPV vaccination guidelines, published in July 2016, recommend routine vaccination of both girls and boys beginning at 11-12 years of age, possibly as early as age 9.[11] An updated version of these guidelines was published in early 2017, following the FDA approval of a new dosing schedule for younger adolescents (see sidebar, below). The updated American Cancer Society guidelines state that for persons initiating vaccination before their 15th birthday, the recommended immunization schedule consists of two doses.[12] For those initiating the HPV vaccine on or after their 15th birthday, a three-dose HPV series is recommended, in accordance with the Advisory Committee on Immunization Practices (ACIP).[13] The American Cancer Society's guidelines also indicate that

American Cancer Society Recommendations for HPV Vaccine Use[11, 12]

- Routine HPV vaccination for girls and boys should be started at age 11 or 12. The vaccination series can be started as early as age 9.
- HPV vaccination is also recommended for females 13 to 26 years old and for males 13 to 21 years old who have not started the vaccines, or who have started but not completed the series. Males 22 to 26 years old 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 22 to 26 years old 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.

persons should be informed that vaccination at older ages is less effective in lowering cancer risk.

The promise of preventing multiple types of cancers will be fully realized only if the HPV vaccine is adequately utilized by adolescents.[14, 15] There are several potential barriers to HPV vaccination, including lack of effective provider recommendation and lack of HPV vaccination awareness. There are also missed opportunities within the health care system for children to be vaccinated.[16] Fortunately, there are several proven strategies to improve coverage, which include provider education and awareness, educating parents or guardians, and increasing access to vaccination in medical settings. Reminder-recall systems, and removal of administrative and financial barriers to vaccination have been shown to improve vaccination uptake.[14] In the US, HPV vaccine costs approximately $130 per dose, excluding the cost of administering the injections and any physician's charge. The Affordable Care Act (ACA) requires all new private insurance plans to cover HPV vaccination without cost sharing for eligible children, adolescents, and adults (see Federal Policies note, page 68).[17] The federal Vaccines for Children (VFC) program covers vaccine costs for children and teens who meet certain eligibility requirements (i.e., do not have insurance and for some children and teens who are underinsured or eligible for Medicaid, or of American Indian/Alaska Native descent).[18]

The American Cancer Society Cancer Action Network (ACS CAN) supports and advocates for the widespread availability and use of the vaccine consistent with published guidelines and the ACA's cost-removal provision. Lawmakers in at least 41 states and the District of Columbia have introduced legislation to require, fund, or educate the public about the HPV vaccine; to date, at least 25 states have enacted such legislation.[19]

In 2014, the American Cancer Society and the CDC established the National HPV Vaccination Roundtable (see sidebar, above).[20] Additionally, the CDC provided the American Cancer Society with funding to develop the HPV VACs (Vaccinate Adolescents against Cancers) Project, which focuses on expanding current cancer prevention and early detection interventions in federally qualified health care centers to increase HPV vaccination.

The National HPV Vaccination Roundtable[20]

The National HPV Vaccination Roundtable is a national coalition of organizations working together 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:

- Increasing 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 of age
- Decreasing missed opportunities for administration of the HPV vaccine
- Increasing HPV vaccination rates over time at national and state levels, 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 cancer.org/healthy/informationforhealthcareprofessionals/nationalhpvvaccinationroundtable for more information.

Furthermore, the American Cancer Society is collaborating with state health departments and other state-based entities to facilitate changes in the health system that increase the availability and utilization of the HPV vaccine. The CDC established the Vaccines for Preteens and Teens communication campaign to educate parents and clinicians about immunizations recommended for adolescents.[21] Although knowledge of HPV and the HPV vaccine is increasing, programs such as these could help fill remaining knowledge gaps.[22]

Of note, because it does not protect against established infections or all HPV types, HPV vaccination supplements rather than replaces cervical cancer screening. Therefore, women in the appropriate age groups should continue to receive regular cervical cancer screening (see page 64).

Table 4A. Vaccination Coverage (%), Adolescents 13 to 17 Years by Race/Ethnicity and Poverty Status, US, 2015

	Human Papillomavirus						Hepatitis B
	Girls			Boys			Overall
	≥ 1 dose	≥ 2 doses	≥ 3 doses	≥ 1 dose	≥ 2 doses	≥ 3 doses	≥ 3 doses
Overall	**62.8**	**52.2**	**41.9**	**49.8**	**39.0**	**28.1**	**91.1**
Age							
13	56.4	42.6	29.5	48.7	36.7	24.9	91.0
14	61.2	49.0	37.3	47.0	38.5	27.7	91.8
15	92.7	53.1	44.1	51.4	40.4	28.6	91.7
16	63.0	54.2	44.2	51.5	38.6	30.6	89.7
17	70.6	61.7	54.4	50.4	40.9	28.8	91.4
Race/Ethnicity							
White	59.2	49.4	39.6	43.8	34.9	25.2	92.5
Black	66.9	51.9	40.8	54.0	37.1	26.0	92.5
Hispanic	68.4	57.8	46.2	58.9	47.8	35.0	87.4
American Indian/Alaska Native	70.5	55.4	38.7	58.5	48.6	34.6	93.1
Asian	63.8	58.1	53.5	49.6	39.8	30.7	89.2
Poverty Status*							
Below poverty level	70.0	56.6	44.4	61.1	46.7	31.0	90.3
At or above poverty level	60.4	50.5	41.3	46.0	36.3	27.4	91.1

*Based on total family income in relation to the federal poverty level.
Source: Reagan-Steiner S, et al.[23]

HPV Vaccination Prevalence and Trends in the US

- The uptake of HPV vaccination is increasing, though utilization still lags behind other recommended vaccines, such a tetanus, diphtheria, and acellular pertussis.[23]
- According to the 2015 National Immunization Survey-Teen (NIS-Teen), 62.8% of girls and 49.8% of boys ages 13 to 17, initiated HPV vaccination (at least one dose) (Table 4A).
- In 2015, initiation of HPV vaccination for adolescent girls ranged from 47.7% in Wyoming to 87.9% in Rhode Island. For adolescent boys, initiation ranged from 34.8% in Kentucky to 80.6% in Rhode Island (Table 4B).
- In 2015, 52.2% of adolescent girls and 39.0% of adolescent boys received at least two doses of the vaccine (Table 4A).
- Only 41.9% of adolescent girls received at least three doses of the vaccine, ranging from 38.7% among American Indians/Alaska Natives to 53.5% among Asians, in 2015 (Table 4A). This proportion is up from the 6% of girls who received the three-dose series in 2007, the first year the vaccine was recommended for this group.[24]
- In 2015, among adolescent boys, only 28.1% received at least three doses of the vaccine, ranging from 25.2% among whites to 35.0% among Hispanics (Table 4A). This represents a substantial increase from the <2% of boys who received three doses in 2011, the first year it was recommended for them.[24]
- In 2014, among adult women and men ages 19-26 years, 40.2% and 8.2%, respectively, reported ever having received at least one dose of HPV vaccine.[25]

Helicobacter Pylori

Chronic infection with *Helicobacter pylori (H. pylori)*, a bacterium that grows in and causes damage to the stomach lining, may eventually lead to stomach cancer and gastric lymphoma.[26,27] Approximately one-half of the world's population is infected with *H. pylori*, and most will remain unaware of their infection because they do not experience symptoms or develop stomach cancer.[28]

Table 4B. Vaccination Coverage (%), Adolescents 13 to 17 Years by State, 2015

	Human Papillomavirus						Hepatitis B
	Girls			Boys			Overall
	≥ 1 dose	≥ 2 doses	≥ 3 doses	≥ 1 dose	≥ 2 doses	≥ 3 doses	≥ 3 doses
United States	**62.8**	**52.2**	**41.9**	**49.8**	**39.0**	**28.1**	**91.1**
Range	*47.7-87.9*	*35.9-77.9*	*24.4-68.0*	*34.8-80.6*	*25.2-66.6*	*16.0-58.1*	*83.1-97.8*
Alabama	57.7	50.4	40.8	39.4	30.3	22.6	94.1
Alaska	57.0	46.3	36.9	41.6	30.3	18.8	90.1
Arizona	68.3	56.1	44.2	51.3	40.6	27.0	83.5
Arkansas	63.5	49.4	34.0	44.2	28.9	16.4	91.2
California	66.7	59.7	48.4	58.5	41.8	29.5	84.9
Colorado	65.3	57.7	46.0	63.2	52.7	37.1	93.2
Connecticut	70.9	64.3	55.2	65.3	58.2	42.0	97.3
Delaware	67.6	60.9	52.8	62.9	53.2	43.0	94.4
District of Columbia	76.5	67.5	58.8	73.0	57.6	40.9	89.3
Florida	62.5	44.6	36.8	45.3	33.2	19.8	95.4
Georgia	54.4	38.7	32.3	51.0	42.5	27.5	97.2
Hawaii	71.3	64.1	52.4	62.5	50.2	36.2	93.0
Idaho	57.3	43.5	30.3	44.2	36.4	26.4	83.1
Illinois	62.0	52.0	40.2	44.3	34.3	26.8	93.1
Indiana	53.7	43.1	30.9	43.2	34.3	27.5	91.4
Iowa	66.7	62.3	49.8	48.0	37.0	23.9	93.4
Kansas	50.9	43.6	31.7	36.0	26.3	18.5	86.8
Kentucky	57.4	42.7	36.2	34.8	25.2	17.1	92.8
Louisiana	60.3	53.3	39.3	49.5	39.1	30.5	95.5
Maine	66.0	53.9	44.1	65.8	58.7	46.7	94.6
Maryland	66.0	61.7	43.7	55.0	46.6	31.3	90.6
Massachusetts	73.5	63.0	52.8	63.0	50.9	35.2	95.4
Michigan	67.6	56.9	47.2	52.3	40.2	28.6	94.8
Minnesota	65.5	51.3	44.5	57.1	36.2	22.4	93.2
Mississippi	52.4	37.2	24.4	38.9	29.6	21.4	92.1
Missouri	59.3	43.4	31.5	44.7	33.7	25.1	89.5
Montana	55.0	41.8	34.8	46.0	33.3	21.7	88.2
Nebraska	67.3	55.5	48.2	54.3	46.9	32.2	92.5
Nevada	72.0	57.6	42.5	44.5	31.9	23.7	92.1
New Hampshire	74.2	59.7	51.4	69.8	55.1	47.1	97.8
New Jersey	69.0	56.3	45.0	50.9	41.4	30.9	96.0
New Mexico	66.7	55.6	40.6	54.3	49.9	40.3	88.3
New York	62.3	56.4	47.3	60.3	49.4	38.1	95.8
North Carolina	65.7	53.5	37.8	48.0	40.3	29.8	93.3
North Dakota	70.5	60.9	47.1	62.3	53.1	38.4	91.7
Ohio	61.0	47.8	37.8	43.7	32.0	21.0	92.0
Oklahoma	58.1	43.4	32.2	52.9	40.1	35.7	95.3
Oregon	70.0	55.4	48.9	58.6	48.2	35.7	91.6
Pennsylvania	62.2	56.4	47.8	55.9	48.2	38.3	93.3
Rhode Island	87.9	77.9	68.0	80.6	66.6	58.1	95.1
South Carolina	53.7	43.3	34.3	35.1	26.4	21.0	91.8
South Dakota	53.2	42.3	32.4	39.2	28.6	22.0	90.1
Tennessee	59.7	46.7	38.9	38.2	26.0	16.0	94.1
Texas	60.1	50.4	40.9	41.4	32.9	24.0	85.3
Utah	47.8	35.9	24.6	40.9	33.7	19.9	86.2
Vermont	68.7	59.1	54.4	66.1	56.9	41.1	96.1
Virginia	61.2	43.9	38.5	40.1	32.0	25.7	89.2
Washington	65.8	55.8	45.1	46.8	41.2	28.0	85.0
West Virginia	62.0	49.7	39.2	45.3	36.6	27.1	86.5
Wisconsin	60.5	53.2	47.3	46.4	42.1	33.5	93.2
Wyoming	47.7	37.6	26.5	37.1	30.8	18.8	92.8

Source: Reagan-Steiner S, et al.[23]

H. pylori transmission is thought to occur 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 *H. pylori* treatment options that are relatively inexpensive and effectively eliminate the bacteria.[29] There is evidence that gastric cancer incidence and mortality rates may be reduced among people with *H. pylori* infection who were treated with antibiotics compared to those who were not.[30] In 2014, the International Agency for Research on Cancer recommended that countries with high gastric cancer incidence (including China, Japan, Chile, Argentina, and several central Asian countries) should incorporate *H. pylori* screening and treatment into their cancer control programs.[31] In the US, there is no recommendation to screen asymptomatic people for *H. pylori* because of the low gastric cancer incidence.

H. Pylori in the US

- *H. pylori* infection is two to three times higher among Mexican Americans and non-Hispanic blacks, compared to non-Hispanic whites.[32]
- *H. pylori* prevalence is higher among those who recently immigrated to the US.[33]
- *H. pylori* prevalence is five to nine times higher in adults over the age of 50 compared to adults in their 20s.[32]

Hepatitis B Virus

Chronic infection with hepatitis B virus (HBV) can cause cirrhosis and liver cancer.[34] In developing countries, HBV accounts for nearly six out of 10 liver cancers compared to less than one out of 10 in the US.[35] HBV is also increasingly recognized as a risk factor for non-Hodgkin lymphoma.[36] 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 sex with multiple partners).[37, 38] Although mother-to-child transmission and infection in the health care setting due to needle sticks is possible, these are less common transmission routes in the US.[39]

Most (95%) newly infected adults will clear the virus within six months of infection, whereas the majority of infected infants will become chronically infected.[39] Although HBV infection is usually asymptomatic, one-third to one-half of adults experience symptoms, including jaundice, within the first several months.[39]

Vaccination against HBV has been the primary prevention strategy in reducing prevalence of the virus. In 1991, the CDC first outlined a nationwide strategy aimed at reducing HBV including a three-dose HBV vaccination series for youth.[38, 40] In 2014, the US Preventive Services Task Force (USPSTF) updated their HBV screening guidelines, concluding that people at high risk should be tested for HBV.[37] There are several drugs that are effective at treating HBV and if infection progresses to liver disease, liver transplantation is also a treatment option.

HBV Prevalence and Trends 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.[41, 42]
- According to 2007-2012 National Health and Nutrition Examination Survey (NHANES) data, 3.1% of Asians and 0.6% of blacks had chronic HBV infection compared to an estimated <0.1% of whites and Mexican Americans.[41]
- In general, HBV infection prevalence was higher in foreign-born Americans,[41, 42] particularly among those born in Asia.[43]
- According to the 2015 NIS-Teen, 91.1% of adolescents (ages 13 to 17) received at least three HBV vaccine doses; vaccination was lowest among Hispanics (87.4%) and highest among American Indians/Alaska Natives (93.1%) (Table 4A, page 44).
- The lowest prevalence of adolescent HBV vaccination coverage in 2015 was reported in Idaho (83.1%), and the highest was in New Hampshire (97.8%) (Table 4B, page 45).

Hepatitis C Virus

Chronic infection with hepatitis C virus (HCV) can also cause cirrhosis and liver cancer[39] and has been shown to increase the risk of non-Hodgkin lymphoma.[44] Liver cancer incidence and mortality rates have increased rapidly in the US for several decades as has HCV-related mortality.[45] Six out of 10 liver cancer cases diagnosed after 2000 are attributable to HCV.[35] The rise in HCV-associated deaths is thought to reflect the HCV epidemic that began in the late 1960s primarily through injection drug use.[46] Transmission may occur through needle stick injuries in health care settings, mother-to-child transmission during birth, and sexual contact with an infected partner (though this is rare). Most people with HCV will become chronically infected and are unaware of their infection until liver disease develops.

In contrast to HBV infection, there is no vaccine to protect against HCV infection, which often becomes chronic regardless of age at 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 USPSTF updated their guidelines recommending one-time screening among men and women born between 1945 and 1965 because people born during this time period represent the vast majority of the HCV infections in the US, and HCV-associated death rates are highest among this birth cohort.[47] However, according to nationwide data from 2015, approximately 14% of adults in this birth cohort have ever been tested.[48] Those who test positive for HCV are advised to begin antiviral treatment in order to reduce health effects related to HCV infection, including liver cancer.[47]

HCV Prevalence and Trends in the US

- In the US, approximately 3.5 million persons are living with HCV infection.[49]
- HCV infection is more common among men, non-Hispanic blacks, and those with lower socioeconomic status.[50]
- HCV infection prevalence is particularly high in certain sub-groups, including the homeless (22.2-52.5%), the incarcerated (23.1-41.2%), and veterans (5.4-10.7%).[51]

Human Immunodeficiency Virus

There are several acquired immunodeficiency syndrome (AIDS)-defining cancers. The term AIDS-defining means that if people who are human immunodeficiency virus (HIV) infected develop one of these cancers, HIV has progressed to AIDS.[52] HIV is a virus that 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 AIDS develops. The weakened immune system of people with HIV/AIDS increases their risk of several cancers, including Kaposi sarcoma, non-Hodgkin lymphoma, and cervical cancer.[53, 54] People infected with HIV are at an increased risk for other cancer-causing infectious agents, such as Kaposi sarcoma herpes virus (KSHV), HCV, HBV, and HPV, in part due to shared routes of transmission and as a result have higher incidence of cancers associated with these infectious agents.[55] People infected with HIV also have higher rates of lung cancers, which is thought to be related to higher smoking rates as well as immunosuppression in this population.[54, 56]

HIV is primarily transmitted through sexual intercourse and injection drug use, though other infection routes are possible. There are several primary prevention strategies for HIV, such as safe sex practices and using sterile needles. There is no vaccine against HIV, but prophylaxis is available for men at risk for the disease. Treatment is available for men with HIV, which has been shown to reduce cancer risk.[57] Visit cdc.gov/hiv for more information about HIV.

HIV Prevalence and Trends in the US

- In the US, there are approximately 1.2 million adults and adolescents living with HIV, many of whom were unaware of their infection.[58, 59]
- The majority of people living with HIV are men and men who have sex with men.[60]

- Since the mid-1990s, the prevalence of HIV infection has increased due to improvements in survival among those with HIV while incidence has remained stable.[60] Improvements in survival have also resulted in increased cumulative incidence and burden of cancer among persons living with HIV.[61, 62]
- The prevalence of persons diagnosed with HIV is seven times higher in blacks and two times higher in Hispanics compared to whites.[60]
- HIV prevalence is higher in urban areas, as well as in the Northeast states; however, the rate of newly acquired HIV is highest in Southern states, especially among men who have sex with men.[63, 64]

Epstein-Barr Virus

Epstein-Barr virus (EBV) causes Burkitt lymphoma, Hodgkin lymphoma, some types of nasopharyngeal carcinoma, and non-Hodgkin lymphoma, including diffuse large B cell lymphoma in immunocompromised people.[65] The vast majority of people with EBV do not develop cancer. However, people who are infected with HIV and immunosuppressed transplant recipients are at an increased risk of EBV-related non-Hodgkin and Hodgkin lymphoma.[55, 66]

Burkitt lymphoma, a type of non-Hodgkin lymphoma, is rare in the US and Europe, but is the most common cancer among children in sub-Saharan Africa. Approximately 50% of Hodgkin lymphoma cancers[1] are related to EBV, though the mechanism through which the virus might be associated with Hodgkin lymphoma is unclear and may be influenced by genetic factors.[67, 68]

EBV is very common, infecting more than 90% of the world's adult population. EBV is transmitted through body fluids, primarily saliva. People with EBV may develop mononucleosis or experience flu-like symptoms followed by a period of dormancy. Currently, there are no primary prevention strategies for EBV and no treatments to eradicate the virus.[69]

References

1. Plummer M, de Martel C, Vignat J, Ferlay J, Bray F, Franceschi S. Global burden of cancers attributable to infections in 2012: a synthetic analysis. *Lancet Glob Health*. 2016;4: e609-616.

2. Saraiya M, Unger ER, Thompson TD, et al. US assessment of HPV types in cancers: implications for current and 9-valent HPV vaccines. *J Natl Cancer Inst*. 2015;107: djv086.

3. Viens LJ, Henley SJ, Watson M, et al. Human Papillomavirus-Associated Cancers – United States, 2008-2012. *MMWR Morb Mortal Wkly Rep*. 2016;65: 661-666.

4. Jemal A, Simard EP, Dorell C, et al. Annual Report to the Nation on the Status of Cancer, 1975-2009, featuring the burden and trends in human papillomavirus(HPV)-associated cancers and HPV vaccination coverage levels. *J Natl Cancer Inst*. 2013;105: 175-201.

5. Centers for Disease Control and Prevention. HPV Vaccination Information for Clinicians. Available from URL: https://www.cdc.gov/hpv/hcp/need-to-know.pdf. Accessed: February 22,2017

6. Centers for Disease Control and Prevention. *Epidemiology and Prevention of Vaccine-Preventable Diseases. 13th ed*. Washington DC: Public Health Foundation, 2015.

7. Serrano B, de Sanjose S, Tous S, et al. Human papillomavirus genotype attribution for HPVs 6, 11, 16, 18, 31, 33, 45, 52 and 58 in female anogenital lesions. *Eur J Cancer*. 2015;51: 1732-1741.

8. Markowitz LE, Liu G, Hariri S, Steinau M, Dunne EF, Unger ER. Prevalence of HPV After Introduction of the Vaccination Program in the United States. *Pediatrics*. 2016;137: e20151968.

9. Hariri S, Bennett NM, Niccolai LM, et al. Reduction in HPV 16/18-associated high grade cervical lesions following HPV vaccine introduction in the United States – 2008-2012. *Vaccine*. 2015;33: 1608-1613.

10. Joura EA, Giuliano AR, Iversen OE, et al. A 9-valent HPV vaccine against infection and intraepithelial neoplasia in women. *N Engl J Med*. 2015;372: 711-723.

11. Saslow D, Andrews KS, Manassaram-Baptiste D, et al. Human papillomavirus vaccination guideline update: American Cancer Society guideline endorsement. *CA Cancer J Clin*. 2016;66: 375-385.

12. Smith RA, Andrews K, Brooks D, Fedewa SA, Manassaram-Baptiste D, Saslow D, Brawley OW, Wender RC. Cancer Screening in the United States, 2017: A review of current American Cancer Society guidelines and current issues in cancer screening. *CA Cancer J Clin*. 2017; doi: 10.3322/caac.21392.

13. Centers for Disease Control and Prevention. CDC recommends only two HPV shots for younger adolescents, 2016.

14. Kessels SJ, Marshall HS, Watson M, Braunack-Mayer AJ, et al. Factors associated with HPV vaccine uptake in teenage girls: a systematic review. *Vaccine*. 2012 30(24): 3546-3556.

15. Etter DJ, Zimet GD, Rickert VI. Human papillomavirus vaccine in adolescent women: a 2012 update. *Curr Opin Obstet Gynecol*. 2012 24(5): 305-310.

16. Holman DM, Benard V, Roland KB, Watson M, Liddon N, Stokley S. Barriers to human papillomavirus vaccination among US adolescents: a systematic review of the literature. *JAMA Pediatr*. 2014;168: 76-82.

17. Koh HK, Sebelius KG. Promoting prevention through the Affordable Care Act. *N Engl J Med*. 2010;363: 1296-1299.

18. Centers for Disease Control and Prevention. Vaccines for Children Program (VFC). Available from URL: http://www.cdc.gov/vaccines/programs/vfc/providers/eligibility.html. Accessed September 22, 2014.

19. National Conference of State Legislatures. HPV Vaccine: State Legislation and Statutes. Available from URL: http://www.ncsl.org/research/health/hpv-vaccine-state-legislation-and-statutes.aspx. Accessed October 19, 2016.

20. American Cancer Society. The National HPV Vaccination Roundtable. Available from URL: http://www.cancer.org/healthy/informationforhealthcareprofessionals/nationalhpvvaccinationroundtable/. Accessed October 20, 2016.

21. Centers for Disease Control and Prevention. Preteen and Teen Vaccines. Available from URL: http://www.cdc.gov/vaccines/who/teens/for-hcp.html. Accessed October 19, 2016.

22. Blake KD, Ottenbacher AJ, Finney Rutten LJ, et al. Predictors of Human Papillomavirus Awareness and Knowledge in 2013: Gaps and Opportunities for Targeted Communication Strategies. *Am J Prev Med*. 2015;48: 402-410.

23. Reagan-Steiner S, Yankey D, Jeyarajah J, et al. National, Regional, State, and Selected Local Area Vaccination Coverage Among Adolescents Aged 13-17 Years – United States, 2015. *MMWR Morb Mortal Wkly Rep*. 2016;65: 850-858.

24. Stokley S, Jeyarajah J, Yankey D, et al. Human papillomavirus vaccination coverage among adolescents, 2007-2013, and postlicensure vaccine safety monitoring, 2006-2014 – United States. *MMWR Morb Mortal Wkly Rep*. 2014;63: 620-624.

25. Williams WW, Lu PJ, O'Halloran A, et al. Surveillance of Vaccination Coverage Among Adult Populations – United States, 2014. *MMWR Surveill Summ*. 2016;65: 1-36.

26. Wroblewski LE, Peek RM, Jr., Wilson KT. Helicobacter pylori and gastric cancer: factors that modulate disease risk. *Clin Microbiol Rev*. 2010;23: 713-739.

27. Plummer M, Franceschi S, Vignat J, Forman D, de Martel C. Global burden of gastric cancer attributable to pylori. *Int J Cancer*. 2015;136: 487-490.

28. Brown LM. Helicobacter pylori: epidemiology and routes of transmission. *Epidemiol Rev*. 2000;22: 283-297.

29. Suerbaum S, Michetti P. Helicobacter pylori infection. *N Engl J Med*. 2002;347: 1175-1186.

30. Ford AC, Forman D, Hunt RH, Yuan Y, Moayyedi P. Helicobacter pylori eradication therapy to prevent gastric cancer in healthy asymptomatic infected individuals: systematic review and meta-analysis of randomised controlled trials. *BMJ*. 2014;348: g3174.

31. International Agency for Research on Cancer. *Heliobacter pylori Eradication as a Strategy for Preventing Gastric Cancer IARC Workgroup Report*. Lyon, France: IARC, 2013.

32. Grad YH, Lipsitch M, Aiello AE. Secular trends in Helicobacter pylori seroprevalence in adults in the United States: evidence for sustained race/ethnic disparities. *Am J Epidemiol*. 2012;175: 54-59.

33. Siao D, Somsouk M. Helicobacter pylori: evidence-based review with a focus on immigrant populations. *J Gen Intern Med*. 2014;29: 520-528.

34. International Agency for Research on Cancer. *IARC Monographs on the Evaluation of Carciongenic Risks to Humans: Biological Agents*. Lyon, France: International Agency for Cancer Research, 2012.

35. de Martel C, Maucort-Boulch D, Plummer M, Franceschi S. World-wide relative contribution of hepatitis B and C viruses in hepatocellular carcinoma. *Hepatology*. 2015;62: 1190-1200.

36. Engels EA, Cho ER, Jee SH. Hepatitis B virus infection and risk of non-Hodgkin lymphoma in South Korea: a cohort study. *Lancet Oncol*. 2010;11: 827-834.

37. LeFevre ML, US Preventive Services Task Force. Screening for hepatitis B virus infection in nonpregnant adolescents and adults: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med*. 2014;161: 58-66.

38. Mast EE, Weinbaum CM, Fiore AE, et al. A comprehensive immunization strategy to eliminate transmission of hepatitis B virus infection in the United States: recommendations of the Advisory Committee on Immunization Practices (ACIP) Part II: immunization of adults. *MMWR Recomm Rep*. 2006;55: 1-33.

39. Centers for Disease Control and Prevention. *Viral Hepatitis Surveillance – United States, 2014*. Atlanta, GA: Centers for Disease Control and Prevention, 2014.

40. American Academy of Pediatrics. ACIP updates recommendations on HPV, HepB, MenB vaccines. Available from URL: http://www.aappublications.org/news/2016/10/20/ACIP102016. Accessed October 21, 2016.

41. Roberts H, Kruszon-Moran D, Ly KN, et al. Prevalence of chronic hepatitis B virus (HBV) infection in U.S. households: National Health and Nutrition Examination Survey (NHANES), 1988-2012. *Hepatology*. 2016;63: 388-397.

42. Kowdley KV, Wang CC, Welch S, Roberts H, Brosgart CL. Prevalence of chronic hepatitis B among foreign-born persons living in the United States by country of origin. *Hepatology*. 2012;56: 422-433.

43. Vijayadeva V, Spradling PR, Moorman AC, et al. Hepatitis B virus infection testing and prevalence among Asian and Pacific Islanders. *Am J Manag Care*. 2014;20: e98-e104.

44. de Sanjose S, Benavente Y, Vajdic CM, et al. Hepatitis C and non-Hodgkin lymphoma among 4784 cases and 6269 controls from the International Lymphoma Epidemiology Consortium. *Clin Gastroenterol Hepatol*. 2008;6: 451-458.

45. Ly KN, Xing J, Klevens RM, Jiles RB, Ward JW, Holmberg SD. The increasing burden of mortality from viral hepatitis in the United States between 1999 and 2007. *Ann Intern Med*. 2012;156: 271-278.

46. Armstrong GL, Wasley A, Simard EP, McQuillan GM, Kuhnert WL, Alter MJ. The prevalence of hepatitis C virus infection in the United States, 1999 through 2002. *Ann Intern Med*. 2006;144: 705-714.

47. Moyer VA, US Preventive Services Task Force. Screening for hepatitis C virus infection in adults: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med*. 2013;159: 349-357.

48. Jemal A, Fedewa SA. Recent Hepatitis C Virus Testing Patterns Among Baby Boomers. *Am J Prev Med*. 2017; doi: 10.1016/j.amepre.2017.01.033.

49. Edlin BR, Eckhardt BJ, Shu MA, Holmberg SD, Swan T. Toward a more accurate estimate of the prevalence of hepatitis C in the United States. *Hepatology*. 2015;62: 1353-1363.

50. Denniston MM, Jiles RB, Drobeniuc J, et al. Chronic hepatitis C virus infection in the United States, National Health and Nutrition Examination Survey 2003 to 2010. *Ann Intern Med*. 2014;160: 293-300.

51. Chak E, Talal AH, Sherman KE, Schiff ER, Saab S. Hepatitis C virus infection in USA: an estimate of true prevalence. *Liver Int*. 2011;31: 1090-1101.

52. Castro KG, Ward JW, Slutsker L, et al. 1993 revised classification system for HIV infection and expanded surveillance case definition for AIDS among adolescents and adults. *MMWR Recomm Rep*. 1992;41: 1-19.

53. Engels EA, Biggar RJ, Hall HI, et al. Cancer risk in people infected with human immunodeficiency virus in the United States. *Int J Cancer*. 2008;123: 187-194.

54. Simard EP, Pfeiffer RM, Engels EA. Spectrum of cancer risk late after AIDS onset in the United States. *Arch Intern Med*. 2010;170: 1337-1345.

55. Shiels MS, Cole SR, Kirk GD, Poole C. A meta-analysis of the incidence of non-AIDS cancers in HIV-infected individuals. *J Acquir Immune Defic Syndr*. 2009;52: 611-622.

56. Engels EA. Non-AIDS-defining malignancies in HIV-infected persons: etiologic puzzles, epidemiologic perils, prevention opportunities. *AIDS*. 2009;23: 875-885.

57. Samji H, Cescon A, Hogg RS, et al. Closing the gap: increases in life expectancy among treated HIV-positive individuals in the United States and Canada. *PLoS One*. 2013;8: e81355.

58. Hall HI, An Q, Tang T, et al. Prevalence of Diagnosed and Undiagnosed HIV Infection – United States, 2008-2012. *MMWR Morb Mortal Wkly Rep*. 2015;64: 657-662.

59. Centers for Disease Control and Prevention. *Monitoring Selected National HIV Prevention and Care Objectives by Using HIV Surveillance Data-United States and 6 Dependent Areas-2013*. Surveillance Supplemental Report. Atlanta, GA: Centers for Disease Control and Prevention, 2015.

60. Centers for Disease Control and Prevention. *HIV Surveillance Report, 2015*. Atlanta, GA: Center for Disease Control and Prevention, 2016.

61. Silverberg MJ, Lau B, Achenbach CJ, et al. Cumulative Incidence of Cancer Among Persons With HIV in North America: A Cohort Study. *Ann Intern Med*. 2015;163: 507-518.

62. Shiels MS, Pfeiffer RM, Gail MH, et al. Cancer burden in the HIV-infected population in the United States. *J Natl Cancer Inst*. 2011;103: 753-762.

63. Rosenberg ES, Grey JA, Sanchez TH, Sullivan PS. Rates of Prevalent HIV Infection, Prevalent Diagnoses, and New Diagnoses Among Men Who Have Sex With Men in US States, Metropolitan Statistical Areas, and Counties, 2012-2013. *JMIR Public Health Surveill*. 2016;2: e22.

64. Centers for Disease Control and Prevention. HIV and AIDS in the United States by Geographic Distribution. Available from URL: http://www.cdc.gov/hiv/statistics/overview/geographicdistribution.html. Accessed October 21, 2016.

65. International Agency for Research on Cancer. IARC Monograph on Biological Agents: A Review of Human Carcinogens, 2012.

66. Clarke CA, Morton LM, Lynch C, et al. Risk of lymphoma subtypes after solid organ transplantation in the United States. *Br J Cancer*. 2013;109: 280-288.

67. Jarrett AF, Armstrong AA, Alexander E. Epidemiology of EBV and Hodgkin's lymphoma. *Ann Oncol*. 1996;7 Suppl 4: 5-10.

68. Flavell KJ, Murray PG. Hodgkin's disease and the Epstein-Barr virus. *Mol Pathol*. 2000;53: 262-269.

69. Cohen JI, Mocarski ES, Raab-Traub N, Corey L, Nabel GJ. The need and challenges for development of an Epstein-Barr virus vaccine. *Vaccine*. 2013;31 Suppl 2: B194-196.

Environmental Cancer Risks

Carcinogens are substances and exposures that can lead to cancer; they can be synthetic or naturally occurring in our air, food, water, and soil. Some carcinogen-containing exposures, such as exposure to tobacco smoke, have been detailed in other sections of this publication. This section describes some of the other carcinogens found in the environment as occupational or chemical exposures. For example, radon is a naturally occurring carcinogen present in soil and rock that has been linked to lung cancer. Occupational radon exposure can occur in underground mines, and substantial exposure may occur in poorly ventilated basements of homes in regions where radon soil emissions are high. In addition to radon, other examples of carcinogens include lead, asbestos, radiation, and benzene.

Lower-income workers and communities are disproportionately affected by exposure to environmental carcinogens, contributing to disparities in the cancer burden across the US population. There has been significant progress in what is known about the relationship between environmental exposures and cancer, though information gaps exist. For example, we know that exposures to environmental carcinogens are potentially modifiable, though it is unknown how environmental exposures can precisely impact human reproduction and development in ways that eventually lead to cancer, or how interactions between pollutant exposures and lifestyle factors impact an individual's overall cancer risk.

Evaluation and Identification of Carcinogens

The US National Toxicology Program (NTP) and World Health Organization's International Agency for Research on Cancer (IARC) are the primary agencies for evaluation and classification of substances regarding their potential as carcinogens. These agencies establish if a substance is likely to be a carcinogen but do not assign quantitative risk values. The NTP is responsible for producing the *Report on Carcinogens*, an informational scientific and public health document that identifies agents, substances, mixtures, or exposure circumstances that may increase the risk of developing cancer. The 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] Visit ntp.niehs.nih.gov/pubhealth/roc/index-1.html to review the full report. The IARC regularly convenes scientific consensus groups to review research to classify whether there is evidence (sufficient, limited, or inadequate) to conclude that a substance is a carcinogen. In total, there are currently 119 agents classified by the IARC as Group 1 (i.e., carcinogenic to humans) and 81 agents classified as Group 2A (i.e., probably carcinogenic to humans).[2] Visit monographs.iarc.fr/ENG/Classification/ for more information.

Notably while these listed substances are classified as carcinogens, not every exposure in an individual will inevitably lead to cancer. There are many factors that influence an individual's risk of getting cancer, such as the duration and intensity of exposures and individual susceptibility. Although the risk of cancer for any individual exposed to a specific carcinogen is typically small, if exposure is widespread, the impact on the population can be large. Thus, identifying such hazards and preventing exposure is important to reduce preventable cancers and associated deaths. The American Cancer Society does not systematically review and evaluate carcinogens, but does provide the public information on selected carcinogens on our cancer.org website. In addition, the American Cancer Society funds and manages the Cancer Prevention Studies, which are long-term epidemiological studies that examine the association between many exposures, including some environmental factors and cancer risk.[3-5] More information on the American Cancer Society's role in reducing cancer risks can be found in the article by Fontham et al. in *CA: A Cancer Journal for Clinicians*.[6]

Carcinogens are usually identified on the basis of epidemiological studies, testing in animals, or studies in cell culture. Studying the effect of potential carcinogens in humans is difficult due to uncertainties in exposure assessment and the challenge of long-term follow-up of study participants. However, studies of occupational groups have played an important role in understanding the association between chemical carcinogens, as well as radiation and cancer, because exposures are often higher among workers who can also be followed for longer periods of time. Information has also come from studies of people exposed to carcinogens during medical treatments (e.g., radiation and estrogen) and from studies conducted among individuals who experienced high levels of short-term exposure to a chemical or physical agent (e.g., survivors of the atomic bomb explosions or industrial accidents).

Managing Cancer Risk

The relatively small risks associated with low-level exposure to carcinogens in air, food, or water are difficult to detect in epidemiological studies and expensive to observe in animal studies. Scientific and regulatory bodies worldwide instead expose animals, typically mice and rats, to high levels of suspected carcinogens and extrapolate these study findings to estimate risks to humans at low environmental concentrations or to establish not-to-exceed levels. Exposures below regulatory threshold concentrations are not completely "safe" but are established to balance cancer risks with the technical ability to keep carcinogen exposures low. For example, even though much public concern about the influence of synthetic pesticides and industrial chemicals has focused on cancer, pollution may adversely affect the health of humans and ecosystems in many other ways. Further, not all exposures carry the same level of cancer risk, hence the need to be strategic in focusing environmental exposure reduction (e.g., risk management) efforts.

References

1. National Toxicology Program. *Report on Carcinogens, Fourteenth Edition*. Research Triangle Park, NC: US Department of Health and Human Services, Public Health Service, 2016.

2. International Agency for Research on Cancer. IARC MONOGRAPHS, VOLUMES 1–117. Available from URL: http://monographs.iarc.fr/ENG/Classification/index.php.

3. Turner MC, Cohen A, Jerrett M, et al. Interactions between cigarette smoking and fine particulate matter in the Risk of Lung Cancer Mortality in Cancer Prevention Study II. *Am J Epidemiol*. 2014;180: 1145-1149.

4. Diver WR, Teras LR, Gaudet MM, Gapstur SM. Exposure to environmental tobacco smoke and risk of non-Hodgkin lymphoma in nonsmoking men and women. *Am J Epidemiol*. 2014;179: 987-995.

5. Teras LR, Diver WR, Turner MC, et al. Residential radon exposure and risk of incident hematologic malignancies in the Cancer Prevention Study-II Nutrition Cohort. *Environ Res*. 2016;148: 46-54.

6. Fontham ET, Thun MJ, Ward E, et al. American Cancer Society perspectives on environmental factors and cancer. *CA Cancer J Clin*. 2009;59: 343-351.

Cancer Screening

Early detection of cancer through screening reduces mortality from cancers of the colon and rectum, breast, uterine cervix, and lung. Screening refers to testing individuals who are asymptomatic for a particular disease (i.e., they have no symptoms that indicate the presence of disease). In addition to detecting cancer early, screening for colorectal and cervical cancers can prevent these cancers by identifying precancerous lesions that can be removed.[1] Following the American Cancer Society's cancer screening guidelines, summarized on page 64, is an important complement to healthy behaviors that reduce the risk of developing and dying from cancer.

Breast Cancer Screening

Among women in the US, an estimated 252,710 cases of invasive breast cancer will be diagnosed in 2017, and 40,610 deaths will occur.[2] Approximately six out of every 10 cases are diagnosed at the localized stage; the five-year survival rate for these cases is 99%.[3] Overall, female breast cancer death rates have been declining since 1989 in the US, in part, due to early detection by mammography screening and treatment.[2]

The American Cancer Society has guidelines for the early detection of breast cancer for women with average- and high-risk profiles. The primary exam for average-risk women is mammography. There are three main types of mammography: film, digital (2D mammography), and digital breast tomosynthesis (3D mammography). Film mammography has largely been replaced by digital mammography, which appears to be even more accurate for women under the age of 50 and those with dense breast tissue (a mammographic indicator of the amount of a breast's glandular and connective tissue relative to its fatty tissue).[4-6] Early detection of breast cancer by mammography also leads to a greater range of and less invasive treatment options. 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%.[7] While these studies establish the efficacy of mammography screening, more recent results from studies of modern, organized mammography programs in Europe and Canada indicate that risk of breast cancer mortality among women exposed to screening was reduced by more than 40%.[8-10] More recently, 3-D mammography (tomosynthesis) has been approved by the Food and Drug Administration to provide high-resolution x-rays along with 2-D mammography.[11] The benefits of 3-D mammography are still being assessed, though early investigations indicate that it may be more sensitive than 2-D mammography alone.[12]

For women at average risk of breast cancer, recently updated American Cancer Society screening guidelines recommend that those 40 to 44 years of age have the option to begin annual mammography; those 45 to 54 years of age should undergo annual mammography; and those 55 years of age and older may transition to biennial mammography or continue annual mammography. Women should continue screening as long as their overall health is good and they have a life expectancy of 10 years

or more (see page 64).[13] It is especially important that women are regularly screened to increase the chance that a breast cancer is detected early before it has spread.

Women should be informed of the benefits of mammography as well its limitations. Mammography will not detect all breast cancers; some breast cancers detected with mammography still have poor prognosis; and a small percentage of breast neoplasms detected by screening, particularly ductal carcinoma in situ, may not progress, and thus may be treated unnecessarily. Further, women should be informed about the 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. Among the one in 10 women who have an abnormal mammogram, 5% will have cancer.[14]

Study results suggest that some women are not receiving appropriate and timely follow-up of abnormal results, when indicated.[15-17] These indicators of inadequate screening and lack of follow-up, which may be more common in black women, are associated with more advanced tumor size and stage at diagnosis.[18, 19] Additionally, some women, such as average-risk women under the age of 40 and elderly women with limited life expectancy, receive screening even though it is not recommended.[20-22]

For some women who are at high risk for breast cancer, the American Cancer Society recommends annual screening using magnetic resonance imaging (MRI) in addition to mammograms beginning at age 30. The high-risk status of these women (lifetime risk approximately 20%-25% or greater) is mainly based on family history and includes 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).[23] Interventions offered to these women include chemoprevention, genetic counseling, and among women with certain genetic mutations, surgical options.[24] 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. However, at the time these recommendations were published, there was not enough evidence to recommend supplemental MRI screening for women with significant mammographic breast density.[23] In 2016, the American Cancer Society began updating the breast cancer screening guidelines for women at increased and high risk.

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

	Within the past year	Within the past two years
Overall	**50.2**	**64.3**
Age (years)		
40-44	37.6	49.1
45-54	53.5	69.3
55+	53.1	67.6
Race/Ethnicity		
White	50.3	64.8
Black	55.4	68.8
Hispanic	45.7	60.8
American Indian/ Alaska Native	46.1	60.1
Asian	47.1	59.4
Sexual Orientation		
Gay/lesbian	62.0	78.2
Straight	50.1	64.3
Bisexual	*	*
Education		
Some high school or less	38.9	50.8
High school diploma or GED	45.0	58.0
Some college/ Assoc. degree	51.2	65.9
College graduate	57.9	73.2
Insurance Status (40 to 64 years)		
Uninsured	20.9	30.7
Insured	52.5	67.8
Immigration Status		
Born in US	51.1	65.5
Born in US territory	47.4	58.9
In US fewer than 10 years	33.3	46.2
In US 10+ years	46.8	60.1
Region		
Northeast	53.7	67.2
Midwest	50.6	63.3
South	50.1	64.6
West	47.0	62.7

GED – General Educational Development high school equivalency. *Estimate not provided due to instability. Note: Estimates are age adjusted to the 2000 US standard population.

Source: National Health Interview Survey, 2015.

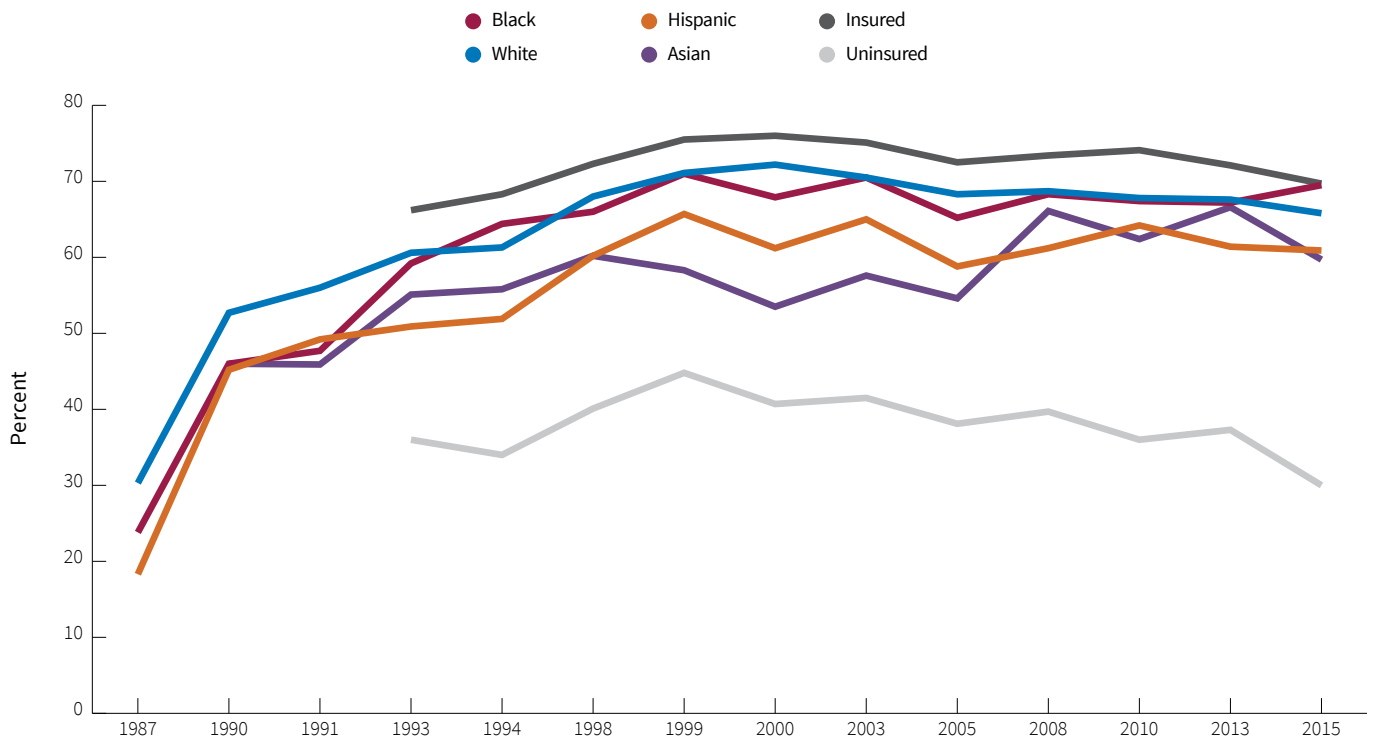
Table 6B. Mammography (%), Women 40 Years and Older by State, 2014

	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)	**56.2**	**52.1**	**72.8**	**76.3**	**42.7**
Range	*44.7-67.8*	*37.5-65.5*	*62.2-82.0*	*68.7-83.4*	*29.3-67.6*
Alabama	56.8	51.0	72.7	76.3	39.3
Alaska	44.7	38.5	62.8	68.9	40.4
Arizona	53.9	46.6	70.7	75.4	50.7
Arkansas	49.4	44.8	64.6	69.0	29.3
California	59.6	56.9	77.0	79.4	56.3
Colorado	50.6	45.6	68.6	73.0	43.6
Connecticut	63.5	63.5	79.8	80.9	54.1
Delaware	62.8	58.2	79.5	82.7	67.6
District of Columbia	53.1	47.6	75.0	80.1	*
Florida	57.6	51.1	74.5	77.7	46.4
Georgia	59.8	55.1	75.3	78.8	52.0
Hawaii	65.2	62.9	78.9	80.6	51.7
Idaho	46.9	37.5	62.2	68.7	33.5
Illinois	55.1	51.4	73.6	76.3	45.8
Indiana	51.7	47.3	67.4	70.8	35.4
Iowa	61.6	57.8	76.0	78.7	37.4
Kansas	55.7	49.4	71.1	75.6	38.9
Kentucky	60.5	56.9	74.6	77.7	37.5
Louisiana	57.9	52.2	75.0	78.3	53.3
Maine	62.5	56.4	78.2	81.6	43.1
Maryland	62.7	59.1	79.5	81.8	60.3
Massachusetts	67.8	65.5	82.0	83.4	58.9
Michigan	57.6	52.0	75.9	79.0	43.7
Minnesota	60.9	55.7	76.5	79.5	55.9
Mississippi	53.4	49.4	67.6	70.8	42.4
Missouri	54.6	52.3	68.2	70.3	33.6
Montana	50.1	41.6	68.7	72.9	41.3
Nebraska	53.4	49.7	70.4	72.3	29.7
Nevada	52.1	52.1	69.7	71.3	43.7
New Hampshire	61.7	61.4	79.3	80.6	50.8
New Jersey	58.8	55.7	74.5	76.6	50.7
New Mexico	49.2	41.9	66.0	70.3	38.3
New York	60.4	58.1	74.9	74.9	53.1
North Carolina	62.5	57.7	76.7	79.7	46.5
North Dakota	56.1	53.9	72.5	74.3	43.0
Ohio	55.7	52.8	72.2	74.2	34.9
Oklahoma	51.2	46.3	65.5	68.7	36.9
Oregon	54.2	47.3	70.4	76.2	36.0
Pennsylvania	57.1	53.2	72.8	75.6	37.1
Rhode Island	64.9	62.2	80.6	82.9	47.3
South Carolina	54.4	46.2	71.9	76.3	36.0
South Dakota	61.1	60.1	74.7	75.4	48.4
Tennessee	55.7	49.6	72.6	76.5	36.9
Texas	54.4	51.0	71.0	74.8	50.7
Utah	49.2	43.1	66.0	72.2	33.5
Vermont	56.4	52.6	74.0	77.4	37.2
Virginia	59.5	55.1	75.1	78.4	50.7
Washington	53.1	49.4	71.0	74.9	31.8
West Virginia	56.2	49.9	71.9	75.6	30.9
Wisconsin	58.8	56.7	74.4	76.8	32.0
Wyoming	46.7	40.0	65.4	69.8	40.4

*Estimate not presented due to instability.

Source: Behavioral Risk Factor Surveillance System, 2014.

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



*Among women 40-64 years of age. Note: Estimates for whites and blacks are among non-Hispanics. Estimates for Asians may be Hispanic or non-Hispanic.
Source: 1987-2013: National Center for Health Statistics.[25] 2015: National Health Interview Survey, 2015.

Mammography Screening in the US

- Among women 40 years of age and older, according to 2015 National Health Interview Survey (NHIS) data, 50.2% reported having had a mammogram within the past year; 64.3% reported having had one within the past two years (Table 6A, page 53).
- In 2015, about one-half of women ages 40-44 years received a mammogram in the past two years and over two-thirds of women 45 years of age and older received a mammogram in the past two years (Table 6A, page 53).
- In 2015, the prevalence of mammography in the past two years was similar among Hispanic, American Indian/Alaskan Native, and Asian women (59.4%-60.8%) but was higher among black (68.8%) and white (64.8%) women (Table 6A, page 53).
- In 2015, the lowest prevalence of mammography use in the past two years was reported among uninsured women (30.7%), followed by recent immigrants (46.2%) (Table 6A, page 53).
- The percentage of women 40 years of age and older who reported having a mammogram within the past two years increased from 29% in 1987 to 70% in 2000 and has since gradually declined.[26] While mammography prevalence has improved over time in all racial and ethnic groups, uptake has been persistently low among uninsured women (Figure 6A).

State-level Mammography Screening

- By state, based on 2014 Behavioral Risk Factor Surveillance System (BRFSS) data, the percentage of women 40 years of age and older who reported having a mammogram in the past year ranged from 44.7% in Alaska to 67.8% in Massachusetts (Table 6B).

- In 2014, among women ages 40-64 without health insurance, 29.3% of those in Arkansas reported having a mammogram in the past two years compared to 67.6% in Delaware (Table 6B, page 54).

For more information, visit cancer.org/research/cancer-facts-statistics for the current edition of *Breast Cancer Facts & Figures*.

Cervical Cancer Screening

In the US about 12,820 cases of invasive cervical cancer will be diagnosed in 2017, and an estimated 4,210 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.[27] For women in whom precancerous lesions are detected, the likelihood of survival is nearly 100% with appropriate evaluation, treatment, and follow-up. However, 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.[28]

In 2012, the American Cancer Society, along with collaborators, released updated cervical cancer screening guidelines[29] (see page 64). In brief, Pap testing is recommended every three years for women ages 21-29 years; the preferred method of screening for women ages 30-65 years is human papillomavirus (HPV) testing with Pap testing every five years, though Pap testing without HPV testing every three years is acceptable for women in this age group. After the age of 65, most women with a recent Pap test should discontinue screening.[29] When updating the cervical cancer screening guideline, the American Cancer Society will thoroughly evaluate all available screening strategies including primary HPV testing.

In addition to screening, there is potential to further reduce the occurrence of cervical cancer with the HPV vaccine (see Infectious Agents chapter beginning on page 42). Of note, because it does not protect against established infections or all HPV types, HPV vaccination supplements rather than replaces cervical cancer screening.

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

	Pap test within the past three years
Overall	**81.4**
Age (years)	
21-29	76.7
30-39	87.9
40-49	81.1
50-65	81.5
Race/Ethnicity	
White	83.1
Black	84.7
Hispanic	77.4
American Indian/Alaska Native	70.9
Asian	73.3
Education (25 to 65 years)	
Some high school or less	69.9
High school diploma or GED	75.1
Some college/Assoc. degree	83.9
College graduate	88.6
Sexual Orientation	
Gay/lesbian	73.6
Straight	81.8
Bisexual	79.8
Insurance Status (21 to 64 years)	
Uninsured	60.8
Insured	84.4
Immigration Status	
Born in US	83.3
Born in US territory	74.3
In US fewer than 10 years	68.2
In US 10+ years	76.0
Region	
Northeast	84.7
Midwest	80.3
South	80.8
West	80.8

GED – General Educational Development high school equivalency. Note: Estimates are age adjusted to the 2000 US standard population and are among women with intact uteri.

Source: National Health Interview Survey, 2015.

Pap Test Screening in the US

- Based on 2015 NHIS data, 81.4% of women 21 to 65 years of age reported having had a Pap test within the past three years (Table 6C).
- The prevalence of Pap test use in 2015 was similar among white (83.1%) and black (84.7%) women but lower among Hispanic (77.4%), Asian (73.3%), and American Indian/Alaska Native women (70.9%) (Table 6C).

Table 6D. Pap Test (%), Women 21 to 65 Years by State, 2014

	Within the past three years	
	Overall	No health insurance (21 to 64 years)
United States (median)	**82.6**	**67.3**
Range	*76.2-88.0*	*55.2-81.3*
Alabama	83.2	65.7
Alaska	78.7	61.2
Arizona	79.8	67.9
Arkansas	78.1	64.0
California	83.1	76.6
Colorado	84.7	67.8
Connecticut	87.4	77.1
Delaware	86.5	81.3
District of Columbia	85.1	*
Florida	79.5	62.5
Georgia	84.7	74.9
Hawaii	78.1	60.8
Idaho	76.2	70.9
Illinois	81.4	78.1
Indiana	78.0	62.4
Iowa	84.5	75.0
Kansas	81.8	68.0
Kentucky	81.3	67.6
Louisiana	84.0	69.4
Maine	85.1	73.5
Maryland	86.7	76.0
Massachusetts	88.0	76.5
Michigan	83.5	58.7
Minnesota	86.1	65.0
Mississippi	83.5	72.4
Missouri	80.7	57.2
Montana	81.3	70.9
Nebraska	81.7	65.0
Nevada	78.1	66.0
New Hampshire	85.3	62.9
New Jersey	83.8	68.0
New Mexico	79.0	65.1
New York	82.6	63.4
North Carolina	85.8	72.7
North Dakota	81.6	60.5
Ohio	81.5	55.2
Oklahoma	77.2	63.6
Oregon	82.9	80.9
Pennsylvania	80.7	61.2
Rhode Island	85.9	70.2
South Carolina	82.5	65.6
South Dakota	84.7	64.9
Tennessee	85.5	68.9
Texas	77.7	67.0
Utah	77.2	60.8
Vermont	85.8	61.1
Virginia	85.2	68.8
Washington	81.0	61.7
West Virginia	80.3	70.4
Wisconsin	86.7	68.9
Wyoming	81.4	64.8

*Estimate not provided due to instability. Note: Estimates among women with intact uteri.

Source: Behavioral Risk Factor Surveillance System, 2014.

- In 2015, the prevalence of recent Pap test use was lowest among uninsured women (60.8%) and recent immigrants (68.2%) (Table 6C).
- According to 2015 data, about one-third (32.4%) of women ages 30-64 years reported having had a HPV test with a Pap test within the past five years; this proportion was higher among women in their 30s (43.1%) compared to women 40 years of age and older (22.3%-31.6%).[30]

State-level Pap Test Screening

- By state, based on 2014 BRFSS data, uptake of recent Pap testing among women 21 to 65 years of age ranged from 76.2% in Idaho to 88.0% in Massachusetts (Table 6D).
- In 2014, among women with no health insurance, screening ranged from 55.2% in Ohio to 81.3% in Delaware (Table 6D).

Colorectal Cancer Screening

An estimated 95,520 cases of colon cancer and 39,910 cases of rectal cancer will be diagnosed in the US in 2017.[2] Colorectal cancer (CRC) is the second-leading cause of cancer death when men and women are combined, with 50,260 deaths estimated to occur in 2017. The acceleration in the decline in CRC incidence rates during the past decade is thought to primarily reflect the increased uptake of screening. Still, only 39% of cases are diagnosed at the localized stage, for which the five-year survival rate is 90%.[2]

Promoting CRC screening is a major priority for the American Cancer Society because screening can reduce CRC death rates both by preventing the disease through the detection and removal of adenomatous polyps and other precursor lesions and by detecting invasive colorectal cancer at earlier, more treatable stages. The most recent American Cancer Society guidelines were released in 2008 and recommend that CRC screening begin at age 50 for people at average risk, but earlier for most people at increased risk because of family history or certain medical conditions. However, these guidelines were under review as of the writing of this report, so

please refer to cancer.org for the most current information regarding screening recommendations.

There are several recommended methods for screening persons at average risk, including both visual exams, which directly examine the bowel, and stool-based tests (see page 64). The recommended stool-based tests include the fecal immunochemical test (FIT), the guaiac-based fecal occult blood test (gFOBT), and the multi-target stool DNA (sDNA) test, which combines a FIT test with an sDNA test. Visual examinations include colonoscopy, computed tomography (CT) colonography, flexible sigmoidoscopy, and double-contrast barium enema.[32] All tests have the ability to reduce CRC death rates when performed at the appropriate intervals and with recommended follow-up; and offering patients different test options substantially increases adherence to screening recommendations.[32-34] However, a positive stool test, flexible sigmoidoscopy, and CT colonography must be followed by a colonoscopy for a complete diagnostic evaluation.[32]

Colorectal Cancer Screening in the US

- According to 2015 NHIS data, among adults 50 years of age and older, 62.6% reported having either an FOBT/FIT within the past year or a sigmoidoscopy within the past five years or a colonoscopy within the past 10 years (Table 6E).
- Although endoscopic screening, primarily colonoscopy, was much more common in 2015 (60.3%) than FOBT/FIT (7.2%) (Table 6E), stool-based tests are important screening options.
- In 2015, the proportion of adults who had a stool test or an endoscopy within the recommended timeframe was higher among those 65 years of age and older (68.3%) compared to those ages 50-64 years (57.8%) (Table 6E).
- CRC screening prevalence in 2015 was highest among whites (65.4%), followed by blacks (61.8%), American Indian/Alaska Natives (54.3%), Hispanics (49.9%), and Asians (49.4%) (Table 6E).
- CRC screening prevalence in 2015 was lowest among the uninsured (25.1%) and recent immigrants (33.7%) (Table 6E).

Table 6E. Colorectal Cancer Screening (%), Adults 50 Years and Older, US, 2015

	Stool test*	Endoscopy†	Combined Stool/ Endoscopy‡
Overall	**7.2**	**60.3**	**62.6**
Gender			
Males	7.6	60.9	63.2
Females	6.8	59.9	62.2
Age (years)			
50-64	6.0	55.3	57.8
65+	8.6	66.1	68.3
Race/Ethnicity			
White	6.9	63.3	65.4
Black	8.0	59.3	61.8
Hispanic	7.3	47.6	49.9
American Indian/ Alaska Native	§	49.6	54.3
Asian	9.2	44.8	49.4
Education			
Some high school or less	6.3	45.3	47.4
High school diploma or GED	7.1	56.4	58.6
Some college/Assoc. degree	7.2	61.6	64.3
College graduate	7.7	68.9	71.3
Sexual Orientation			
Gay/lesbian	§	68.0	71.8
Straight	7.2	60.3	62.7
Bisexual	§	52.0	53.2
Insurance Status (50 to 64 years)			
Uninsured	4.0	24.0	25.1
Insured	6.2	56.8	59.6
Immigration Status			
Born in US	7.1	62.4	64.7
Born in US territory	§	62.5	63.4
In US fewer than 10 years	§	25.6	33.7
In US 10+ years	8.0	48.8	51.8
Region			
Northeast	5.0	64.5	65.5
Midwest	4.5	62.6	64.0
South	6.7	59.3	61.0
West	12.6	55.8	61.3

GED – General Educational Development high school equivalency. *Fecal occult blood test (FOBT) or fecal immunochemical test (FIT) within the past year. †A sigmoidoscopy within the past five years or a colonoscopy within the past 10 years. ‡Either an FOBT or FIT within the past year, sigmoidoscopy within the past five years, or a colonoscopy within the past 10 years. §Estimate not provided due to instability. Note: Estimates are age adjusted to the 2000 US standard population.

Source: National Health Interview Survey, 2015.

- Regardless of race/ethnicity, the prevalence of CRC screening is much lower among people without health insurance (14.2-30.4%) compared to people with insurance (48.8-61.9%) (Figure 6B, page 60).

Table 6F. Colorectal Cancer Screening (%), Adults 50 Years and Older by State, 2014

	Stool Testing*	Endoscopy†	Combined Stool Testing/Endoscopy‡			
	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)	**8.2**	**63.9**	**67.6**	**60.8**	**76.1**	**28.7**
Range	*3.0-20.4*	*56.1-73.4*	*58.0-76.0*	*51.3-73.4*	*68.5-81.8*	*19.6-52.7*
Alabama	7.7	63.6	65.9	58.0	76.9	19.7
Alaska	4.6	59.1	61.2	56.6	71.6	28.4
Arizona	10.7	61.9	65.6	57.1	75.9	27.1
Arkansas	7.2	59.5	62.1	55.3	70.5	23.4
California	20.4	61.0	68.6	60.7	80.1	26.7
Colorado	8.8	64.0	67.7	61.4	78.0	26.2
Connecticut	9.4	71.5	73.8	70.0	79.1	37.2
Delaware	5.9	71.9	73.2	67.0	81.7	49.0
District of Columbia	10.1	65.7	69.5	63.6	78.2	§
Florida	13.9	65.6	69.2	57.9	81.8	25.6
Georgia	10.7	65.1	67.6	60.8	78.2	26.8
Hawaii	17.4	60.2	69.3	65.5	74.1	37.9
Idaho	5.9	60.6	62.5	53.9	74.0	19.6
Illinois	6.7	60.3	62.5	57.2	70.3	27.9
Indiana	8.2	60.0	62.5	56.5	71.2	29.4
Iowa	7.0	66.0	68.2	63.2	74.8	26.9
Kansas	8.2	62.9	65.9	59.9	74.1	29.0
Kentucky	10.0	65.6	68.1	62.7	75.6	33.0
Louisiana	10.0	62.1	65.8	58.2	76.8	32.5
Maine	6.8	73.1	75.2	71.0	80.8	44.9
Maryland	11.5	69.3	72.1	65.9	81.5	44.1
Massachusetts	9.5	72.7	76.0	73.4	79.9	52.7
Michigan	9.0	69.9	72.1	66.0	80.8	35.1
Minnesota	5.8	69.4	71.7	67.6	78.0	41.6
Mississippi	11.5	58.8	62.0	54.6	72.4	28.5
Missouri	6.8	61.1	63.5	56.8	72.7	23.1
Montana	6.6	60.3	63.4	56.4	72.8	27.9
Nebraska	7.6	62.3	65.0	60.1	71.8	24.5
Nevada	12.1	56.4	61.6	51.6	75.6	22.5
New Hampshire	6.0	72.6	74.2	69.4	81.7	38.7
New Jersey	7.9	63.9	66.4	59.9	76.0	35.5
New Mexico	8.5	58.6	62.5	57.0	69.9	33.0
New York	8.8	66.7	69.4	64.0	77.0	36.8
North Carolina	11.4	68.5	71.8	66.6	78.8	33.4
North Dakota	6.9	60.7	63.6	56.8	73.1	20.9
Ohio	8.2	62.8	66.2	59.8	75.0	26.3
Oklahoma	8.6	56.3	59.4	51.5	70.3	20.0
Oregon	10.9	63.9	68.3	60.8	78.4	38.3
Pennsylvania	7.6	64.9	67.4	62.8	73.6	32.4
Rhode Island	8.7	73.4	75.5	71.6	80.9	47.9
South Carolina	7.9	66.5	69.0	61.4	78.8	25.4
South Dakota	7.7	64.6	67.5	62.2	74.7	33.5
Tennessee	9.2	63.5	66.6	59.1	76.6	20.6
Texas	8.5	59.3	62.7	55.8	73.4	23.0
Utah	3.0	70.0	70.7	65.5	78.5	24.6
Vermont	6.6	68.5	71.0	67.2	76.5	32.8
Virginia	7.7	67.8	70.0	65.9	76.1	38.0
Washington	10.9	65.8	70.1	65.5	76.9	24.7
West Virginia	10.7	61.7	65.4	59.3	73.1	34.2
Wisconsin	6.8	71.9	73.8	68.9	80.6	41.2
Wyoming	4.8	56.1	58.0	51.3	68.5	20.1

*Fecal occult blood test (FOBT) or fecal immunochemical test (FIT) within the past year. †Sigmoidoscopy within the past five years or colonoscopy within the past 10 years. ‡Either FOBT or FIT within the past year or sigmoidoscopy within the past five years or colonoscopy within the past 10 years. §Estimate not provided due to instability.

Source: Behavioral Risk Factor Surveillance System, 2014.

The 80% by 2018 Initiative[35]

The National Colorectal Cancer Roundtable (NCCRT) is a coalition of public, private, and nonprofit organizations and experts dedicated to reducing CRC incidence and mortality in the US. In 2014, the NCCRT launched the 80% by 2018 effort, a major initiative in which over 1,200 organizations have committed to working toward the shared goal that 80% of US adults age 50 years and older are up-to-date with CRC screening by 2018. If this goal is reached, an estimated 277,000 CRC cases and 203,000 CRC deaths will be averted by 2030.[36] To reach this goal, an estimated 24.4 million individuals ages 50-75 years need to be screened nationwide.[37] The four key components of the 80% by 2018 effort are:

- Moving consumers to action
- Working with multiple components in the health care arena, including community health centers, hospitals and health systems, providers, and payers
- Increasing access and removing barriers to screening
- Evaluating progress and maintaining momentum

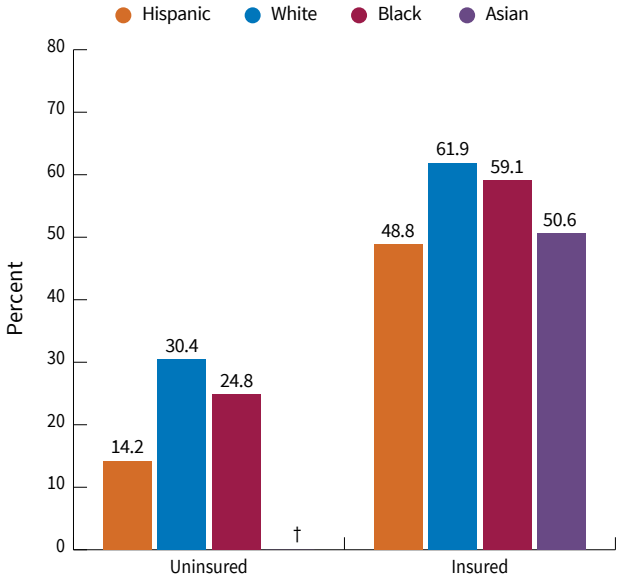
Through these four components, members of the NCCRT and other collaborators of the 80% by 2018 effort are working to increase screening rates, reduce disparities in screening utilization and access to care, and make CRC screening the next great public health success story. Visit nccrt.org/80by2018 for more information.

NATIONAL Colorectal Cancer ROUNDTABLE

State-level Colorectal Cancer Screening

- Based on 2014 BRFSS data, the percentage of adults 50 years of age and older who had a stool test in the past year, a sigmoidoscopy in the past five years, or a colonoscopy in the past 10 years ranged from 58.0% in Wyoming to 76.0% in Massachusetts (Table 6F, page 59).
- Stool testing use ranged from 3.0% in Utah to 20.4% in California in 2014. CRC screening with endoscopy ranged from 56.1% in Wyoming to 73.4% in Rhode Island (Table 6F, page 59).
- In 2014, among adults ages 50-64 without insurance, only 19.6% of those in Idaho reported CRC screening compared to 52.7% in Massachusetts (Table 6F, page 59).

Figure 6B. Colorectal Cancer Screening* (%), Adults 50 to 64 Years by Race/Ethnicity and Insurance Status, US, 2015



*Either a fecal occult blood test or fecal immunochemical test within the past year, sigmoidoscopy within the past five years, or a colonoscopy within the past 10 years. †Estimate not presented due to instability. Note: Estimates are age adjusted to the 2000 US standard population.

Source: National Health Interview Survey, 2015.

For more information, visit cancer.org/research/cancer-facts-statistics for the current edition of *Colorectal Cancer Facts & Figures.*

Endometrial Cancer Screening

In the US, approximately 61,380 cases of cancer of the uterine corpus (body of the uterus) will be diagnosed and 10,920 uterine cancer deaths will occur in 2017. There are notable racial/ethnic disparities in stage at diagnosis and survival where black women are more likely to be diagnosed at a later stage and have poorer survival.[2] Cancer of the uterine corpus is often referred to as endometrial cancer because 92% of cases occur in the endometrium. 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 should be instructed to report them promptly to their physician. Women at high risk for

endometrial cancer (i.e., known Lynch syndrome genetic mutation carrier status or substantial likelihood of carrying the genetic mutation) should consider beginning annual endometrial cancer screening at age 35 after being informed of the benefits, harms, and limitations associated with the test. Endometrial biopsy is the standard test used for evaluation of endometrial tissue.[1]

Lung Cancer Screening

Among men and women in the US, an estimated 222,500 new cases of lung cancer will be diagnosed in 2017. Lung cancer is the leading cause of cancer death for both men and women; about 155,870 deaths are expected in 2017. The overall five-year relative survival rate for lung cancer is low – 17% for men and 24% for women as a result of the large proportion of cases diagnosed with advanced-stage disease.[2] The lung cancer death rate has declined by 43% since 1990 in men and by 17% since 2002 in women due to reductions in smoking.[2]

Until recently, studies evaluating the efficacy of early detection tests for lung cancer (e.g., chest x-ray) did not find a reduced risk of lung cancer death with screening.[38] However, after eight years of follow-up, a randomized clinical trial in the US showed about 20% fewer lung cancer deaths 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.[39] Based on these results and other evidence, the American Cancer Society issued guidelines for lung cancer screening in 2013 (see page 64); other public health organizations have issued recommendations as well.[40-42]

The American Cancer Society recommends that clinicians with access to high-volume, high-quality lung cancer screening and treatment centers should initiate a discussion about lung cancer screening with apparently healthy patients ages 55-74 years who have at least a 30 pack-year smoking history and who currently smoke or have quit within the past 15 years.[42] Patients should be informed of the potential benefits, limitations, and harms associated with LDCT screening for lung cancer before any decision is made to initiate screening. For current smokers, the discussions should also include information about the health risks associated with continuing to smoke. Providing current smokers with smoking cessation counseling, medications approved for cessation, and information on their continued risk of lung cancer remains a priority for health care providers. Screening should not be viewed as an alternative to smoking cessation as smoking cessation is an important component in lung cancer prevention.[43]

Current evidence suggests that screening for lung cancer is most beneficial among people at highest risk for developing lung cancer. At this time, it is unclear whether the benefits of lung cancer screening for adults with lighter smoking history outweigh the harms.[44] 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 an excuse to continue smoking.

- A recent American Cancer Society study found 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.[45]
- In 2015, there were an estimated 6.8 million current and former smokers eligible for screening; only 262,700 received it.[45]

Prostate Cancer Screening

In 2017, an estimated 161,360 new cases of prostate cancer will be diagnosed in the US; approximately 26,730 men will die of the disease.[2] Among men in the US, cancer of the prostate is the most common type of cancer (other than skin cancer) and the third-leading cause of cancer death. Almost eight in 10 cases are diagnosed at a localized stage. The five-year survival rate for localized disease is near 100%, but it drops to 31% for distant stage.[2] Mortality trends for prostate cancer have been declining, which is thought to be, 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).[46] However, results of two

large clinical trials designed to determine the efficacy of PSA testing were not in agreement. Results from a European trial showed a lower risk of death from prostate cancer among men invited to receive PSA screening, while a US trial did not.[47, 48] One recent reassessment of the US trial indicates that based on uptake of PSA in the control group, the benefit of screening may actually be greater than originally reported.[49] Additional studies are underway, and all results will be considered when the screening guidelines are updated. When the American Cancer Society last updated the prostate cancer screening guidelines (2010), most experts agreed that the evidence was insufficient to recommend for or against routine testing for early prostate cancer detection given concerns about frequent overdiagnosis (diagnosis of cancer that would not have caused harm) and substantial risk for serious side effects from prostate cancer treatment.[50] Since the American Cancer Society released its guidelines, the US Preventive Services Task Force (USPSTF) no longer recommends routine PSA-testing for asymptomatic men, leading to a decline in both PSA testing as well as prostate cancer incidence from 2008 to 2013 according to a recent American Cancer Society study.[51]

However, the American Cancer Society does recommend that asymptomatic men who have at least a 10-year life expectancy have an opportunity to make an informed decision with their health care provider about whether to be screened for prostate cancer. The decision should be made only after receiving information about the uncertainties, risks, and potential benefits associated with PSA screening.[50] Men at average risk should receive this information beginning at age 50; men at higher risk should receive this information at age 40 or 45 depending on individual risk profile. Asymptomatic men who have less than a 10-year life expectancy should not be offered prostate cancer screening (see page 64).

Studies have shown that informed and shared decision-making 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.[52, 53] In an effort to address these shortcomings, the 2010 American Cancer Society screening guideline provided detailed recommendations to clinicians.[50] An update of the American Cancer Society's prostate cancer screening guideline is planned for 2017.

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

	Within the past year
Overall	**34.4**
Age (years)	
50-64	28.7
65+	41.1
Race/Ethnicity	
White	37.1
Black	30.7
Hispanic	25.5
American Indian/Alaska Native	*
Asian	17.4
Education	
Some high school or less	20.1
High school diploma or GED	30.4
Some college/Assoc. degree	34.6
College graduate	44.0
Sexual Orientation	
Gay/lesbian	44.2
Straight	34.4
Bisexual	*
Insurance Status	
Uninsured	10.2
Insured	29.8
Immigration Status	
Born in US	35.9
Born in US territory	26.9
In US fewer than 10 years	*
In US 10+ years	26.7
Region	
Northeast	34.7
Midwest	34.1
South	38.7
West	27.4

GED – General Educational Development high school equivalency.
*Estimate not provided due to instability. Note: Estimates are age adjusted to the 2000 US standard population and are among men who have not been diagnosed with prostate cancer.

Source: National Health Interview Survey, 2015.

Prostate Cancer Testing in the US

- According to 2015 NHIS data, the prevalence of PSA testing within the past year was 34.4% in men 50 years of age and older (Table 6G).
- In 2015, those who had no health insurance, Asian men, and those with less than a high school education were the least likely to have had a recent PSA test (Table 6G).

Cancer Screening Obstacles and Opportunities to Improve Cancer Screening 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). As part of the goal to lower cancer incidence and mortality overall and among medically underserved populations, ACS CAN is working to ensure that preventive services, including evidence-based cancer screening, remain covered by insurance without any cost sharing (see Federal Policies note, page 68). Studies have shown that those who lack health insurance are more likely to be diagnosed at an advanced stage of cancer, when survival rates are much lower and treatment is more expensive and extensive.[54]

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 intervention strategies targeted at each of these can improve cancer screening rates.[55, 56] 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.[55, 57] Multiple interventions directed toward patients, physicians, and health care systems may provide the best approaches to improving rates of cancer screening.[56] Though there is substantial evidence supporting the use of these strategies, utilization is suboptimal.[58]

Breast and Cervical Cancer Screening Program

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 timely, high-quality screening exams for breast and cervical cancers; case management; patient navigation; and diagnostic and follow-up services.[59] Since 1991, the NBCCEDP has served more than 4.9 million women, provided more than 12 million screening examinations, and diagnosed more than 70,990 breast cancers; 175,680 precancerous cervical lesions; and 3,840 cases of invasive cervical cancers.[59] Among women with abnormal screening results, 90% receive complete diagnostic evaluation.[60]

In order to locate vulnerable populations, outreach is needed and can be costly, but imperative in reducing disparities.[61] About 11% of women are eligible for NBCCEDP cervical cancer screening, of which about 7% are served by the program. About 10% of women are eligible for NBCCEDP breast cancer screening, of which about 11% are served.[59] ACS CAN strongly advocates for protecting and increasing funding for the NBCCEDP.[62]

Colorectal Cancer Screening Programs and Initiatives

The American Cancer Society, along with the CDC, and many other organizations form the National Colorectal Cancer Roundtable (NCCRT), launched the 80% by 2018 effort in 2014 (see sidebar, page 60).[35] The NCCRT produces evidence-based tool kits and other materials to improve cancer screening rates. Visit nccrt.org/tools for a full listing of resources.

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.[63] In September 2015, the CRCCP announced that 24 state health departments, six universities, and one American Indian tribe had been awarded $22.8 million to increase colorectal screening.[63] Results of a recent study showed an increase in the use of evidence-based CRC screening interventions among previous program grantees.[64] The CDC has also funded a Screen for Life media campaign aimed at increasing knowledge and awareness of CRC screening benefits.[65]

The Patient Protection and Affordable Care Act

The Patient Protection and Affordable Care Act (ACA), aims to improve health delivery systems, prevention efforts, and access to care. More than 20 million uninsured adults gained health insurance coverage as a result of the ACA;[66] however, 12-13% of adults under 65

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 undergo regular screening mammography starting at age 45. Women ages 45 to 54 should be screened annually. Women should have the opportunity to begin annual screening between the ages of 40 and 44.
	Women, ages 55+		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 50+	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.
		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.
		Double-contrast barium enema, **OR**	Every 5 years
		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.

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.

years of age remained uninsured.[67] Provisions of the ACA have helped reduce or eliminate out-of-pocket costs for breast, cervical, colorectal, and lung cancer screenings for those Medicare or privately insured[68-70] (see Federal Policies note, page 68). Researchers have documented increases in CRC screening in the period following implementation of the ACA, particularly among the economically disadvantaged.[71] 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 it was deemed "diagnostic" rather than a "screening" colonoscopy by Centers for Medicare and Medicaid Services. As of December 2016, legislation was pending before Congress to ensure that Medicare beneficiaries are not assessed cost sharing in connection with a colonoscopy screening regardless of whether a polyp is removed.[72]

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

References

1. Smith RA, Andrews K, Brooks D, Fedewa SA, Manassaram-Baptiste D, Saslow D, Brawley OW, Wender RC. Cancer Screening in the United States, 2017: A review of current American Cancer Society guidelines and current issues in cancer screening. *CA Cancer J Clin*. 2017; doi: 10.3322/caac.21392.

2. Siegel RL, Miller KD, Jemal A. Cancer Statistics 2017. *CA Cancer J Clin*. 2017; 1: 7-30.

3. Howlader N NA, Krapcho M, et al. SEER Cancer Statistics Review, 1975-2013. http://seer.cancer.gov/csr/1975_2013/, based on November 2015 SEER data submission, posted to the SEER web site, April 2016. Bethesda, MD: National Cancer Institute, 2016.

4. Pisano ED, Hendrick RE, Yaffe MJ, et al. Diagnostic accuracy of digital versus film mammography: exploratory analysis of selected population subgroups in DMIST. *Radiology*. 2008;246: 376-383.

5. Kerlikowske K, Hubbard RA, Miglioretti DL, et al. Comparative effectiveness of digital versus film-screen mammography in community practice in the United States: a cohort study. *Ann Intern Med*. 2011;155: 493-502.

6. Souza FH, Wendland EM, Rosa MI, Polanczyk CA. Is full-field digital mammography more accurate than screen-film mammography in overall population screening? A systematic review and meta-analysis. *Breast*. 2013;22: 217-224.

7. Marmot MG, Altman DG, Cameron DA, Dewar JA, Thompson SG, Wilcox M. The benefits and harms of breast cancer screening: an independent review. *Br J Cancer*. 2013;108: 2205-2240.

8. Coldman A, Phillips N, Wilson C, et al. Pan-Canadian study of mammography screening and mortality from breast cancer. *J Natl Cancer Inst*. 2014;106(11). pii: dju261.

9. Hofvind S, Ursin G, Tretli S, Sebuodegard S, Moller B. Breast cancer mortality in participants of the Norwegian Breast Cancer Screening Program. *Cancer*. 2013;119: 3106-3112.

10. Paci E, Group EW. Summary of the evidence of breast cancer service screening outcomes in Europe and first estimate of the benefit and harm balance sheet. *J Med Screen*. 2012;19 Suppl 1: 5-13.

11. US Food and Drug Administration. FDA approves first 3-D mammography imaging system, 2011.

12. Friedewald SM, Rafferty EA, Rose SL, et al. Breast cancer screening using tomosynthesis in combination with digital mammography. *JAMA*. 2014;311: 2499-2507.

13. Oeffinger KC, Fontham ET, Etzioni R, et al. Breast Cancer Screening for Women at Average Risk: 2015 Guideline Update From the American Cancer Society. *JAMA*. 2015;314: 1599-1614.

14. Rosenberg RD, Yankaskas BC, Abraham LA, et al. Performance benchmarks for screening mammography. *Radiology*. 2006;241: 55-66.

15. Zapka J, Taplin SH, Price RA, Cranos C, Yabroff R. Factors in Quality Care – The Case of follow-up to abnormal cancer screening tests – problems in the steps and interfaces of care. *J Natl Cancer Inst Monogr*. 2010;40: 58-71.

16. Hahn KME, Bondy ML, Selvan M, Lund MJ, Liff JM, et al. Factors Associated with Advanced Disease Stage at Diagnosis in a Population-based Study of Patients with Newly Diagnosed Breast Cancer. *Am J Epidemiol*. 2007;166: 1035-1044.

17. Taplin S, Ichikawa L, Yood M, et al. Reason for late-stage breast cancer: absence of screening or detection, or breakdown in follow-up? *J Natl Cancer Inst*. Oct 20;. 2004;96: 1518-1527.

18. McCarthy AM, Kim JJ, Beaber EF, et al. Follow-Up of Abnormal Breast and Colorectal Cancer Screening by Race/Ethnicity. *Am J Prev Med*. 2016;51: 507-512.

19. Mandelblatt J, van Ravesteyn N, Schechter C, et al. Which strategies reduce breast cancer mortality most? Collaborative modeling of optimal screening, treatment, and obesity prevention. *Cancer*. 2013;119: 2541-2548.

20. Yankaskas BC, Haneuse S, Kapp JM, et al. Performance of first mammography examination in women younger than 40 years. *J Natl Cancer Inst*. 2010;102: 692-701.

21. Tan A, Kuo YF, Goodwin JS. Potential overuse of screening mammography and its association with access to primary care. *Med Care*. 2014;52: 490-495.

22. Kapp JM, Yankaskas BC, LeFevre ML. Are mammography recommendations in women younger than 40 related to increased risk? *Breast Cancer Res Treat*. 2010;119: 485-490.

23. Saslow D, Boetes C, Burke W, et al. American Cancer Society Guidelines for Breast Screening with MRI as an Adjunct to Mammography. *CA Cancer J Clin*. 2007;57: 75–89.

24. Mahoney MC, Bevers T, Linos E, Willett WC. Opportunities and Strategies for Breast Cancer Prevention Through Risk Reduction. *CA Cancer J Clin*. 2008;58: 347-371.

25. National Center for Health Statistics, *Health in the United States, 2015: With a Special Feature on Racial and Ethnic Disparities*. Hyattsville, MD. 2016.

26. Breen N, Gentleman JF, Schiller JS. Update on mammography trends: comparisons of rates in 2000, 2005, and 2008. *Cancer*. 2011;117: 2209-2218.

27. Schiffman MH, Castle PE, Jeronimo J, Rodriguez AC, Wacholder S. Human Papilloma Virus and cervical cancer. *Lancet*. 2007;370 (9590): 890-907.

28. Kirschner B, Poll S, Rygaard C, Wahlin A, Junge J. Screening history in women with cervical cancer in a Danish population-based screening program. *Gynecol Oncol*. 2011;120: 68-72.

29. Saslow D, Solomon D, Lawson HW, et al. American Cancer Society, American Society for Colposcopy and Cervical Pathology, and American Society for Clinical Pathology screening guidelines for the prevention and early detection of cervical cancer. *CA Cancer J Clin*. 2012;62: 147-172.

30. National Center for Health Statistics. National Health Interview Survey, 2015. Public-use data file and documentation. Available from URL: http://www.cdc.gov/nchs/nhis/quest_data_related_1997_forward.htm. Accessed July 16, 2016.

31. Edwards BK, Ward E, Kohler BA, et al. Annual Report to the Nation on the Status of Cancer, 1975-2006, Featuring Colorectal Trends and Impact of Interventions (Risk Factors, Screening, and Treatment) to reduce future rates. *Cancer*. 2009;116: 544-573.

32. Levin B, Lieberman DA, McFarland B, et al. Screening and surveillance for the early detection of colorectal cancer and adenomatous polyps, 2008: a joint guideline from the American Cancer Society, the US Multi-Society Task Force on Colorectal Cancer, and the American College of Radiology. *CA Cancer J Clin*. 2008;58: 130-160.

33. Pignone M, Rich M, Teutsch S, Berg AO, Lohr KN. Screening for colorectal cancer in adults at average risk: a summary of the evidence for the US Preventive Services Task Force. *Ann Intern Med*. 2002;137: 132-141.

34. Gupta S, Halm EA, Rockey DC, et al. Comparative effectiveness of fecal immunochemical test outreach, colonoscopy outreach, and usual care for boosting colorectal cancer screening among the underserved: a randomized clinical trial. *JAMA Intern Med*. 2013;173: 1725-1732.

35. National Colorectal Cancer Roundtable. Tools & Resources – 80% by 2018. Available from URL: http://nccrt.org/tools/80-percent-by-2018/. Accessed October 5, 2016.

36. Meester RG, Doubeni CA, Zauber AG, et al. Public health impact of achieving 80% colorectal cancer screening rates in the United States by 2018. *Cancer*. 2015;121: 2281-2285.

37. Fedewa SA, Ma J, Sauer AG, et al. How many individuals will need to be screened to increase colorectal cancer screening prevalence to 80% by 2018? *Cancer*. 2015;121: 4258-4265.

38. Oken MM, Hocking WG, Kvale PA, et al. Screening by chest radiograph and lung cancer mortality: the Prostate, Lung, Colorectal, and Ovarian (PLCO) randomized trial. *JAMA*. 2011;306: 1865-1873.

39. National Lung Screening Trial Research Team, Aberle DR, Berg CD, et al. The National Lung Screening Trial: overview and study design. *Radiology*. 2011;258: 243-253.

40. Moyer VA, on behalf of the U.S. Preventive Services Task Force. Screening for lung cancer: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med*. 2014;160: 330-338.

41. Jaklitsch MT, Jacobson FL, Austin JH, et al. The American Association for Thoracic Surgery guidelines for lung cancer screening using low-dose computed tomography scans for lung cancer survivors and other high-risk groups. *J Thorac Cardiovasc Surg*. 2012;144: 33-38.

42. Wender R, Fontham ET, Barrera E, Jr., et al. American Cancer Society lung cancer screening guidelines. *CA Cancer J Clin*. 2013;63: 107-117.

43. Kanodra NM, Silvestri GA, Tanner NT. Screening and early detection efforts in lung cancer. *Cancer*. 2015;121: 1347-1356.

44. Bach PB, Mirkin JN, Oliver TK, et al. Benefits and harms of CT screening for lung cancer: a systematic review. *JAMA*. 2012;307: 2418-2429.

45. Jemal A, Fedewa SA. Lung Cancer Screening With Low-Dose Computed Tomography in the United States – 2010 to 2015. *JAMA Oncology*. 2017; doi:10.1001/jamaoncol.2016.6416.

46. Etzioni R, Gulati R, Tsodikov A, et al. The prostate cancer conundrum revisited: treatment changes and prostate cancer mortality declines. *Cancer*. 2012;118: 5955-5963.

47. Schröder FH, Hugosson J, Roobol MJ, et al. Screening and prostate-cancer mortality in a randomized European study. *N Engl J Med*. 2009 360: 1320-1328.

48. Andriole GL, Crawford ED, Grubb RL 3rd, et al. Mortality results from a randomized prostate-cancer screening trial. *N Engl J Med*. 2009 360: 1310-1319.

49. Shoag JE, Mittal S, Hu JC. Reevaluating PSA Testing Rates in the PLCO Trial. *N Engl J Med*. 2016;374: 1795-1796.

50. Wolf A, Wender RC, Etzioni RB, et al. American Cancer Society Guideline for the Early Detection of Prostate Cancer: Update 2010. *CA Cancer J Clin*. 2010;60: 70-98.

51. Jemal A, Fedewa SA, Ma J, et al. Prostate Cancer Incidence and PSA Testing Patterns in Relation to USPSTF Screening Recommendations. *JAMA*. 2015;314: 2054-2061.

52. Hoffman RM, Couper MP, Zikmund-Fisher BJ, et al. Prostate cancer screening decisions: results from the National Survey of Medical Decisions (DECISIONS study). *Arch Intern Med*. 2009;169: 1611–1618.

53. Han PK, Kobrin S, Breen N, et al. National evidence on the use of shared decision making in prostate-specific antigen screening. *Ann Fam Med*. 2013;11: 306-314.

54. Halpern MT, Bian J, Ward E, Schrag NM, Chen AY. Insurance status and stage of cancer at diagnosis among women with breast cancer. *Cancer*. 2007;110: 403-411.

55. Curry SJ, Byers T, Hewitt M. *Fulfilling the Potential of Cancer Prevention and Early Detection*. Washington, DC: The National Academies Press, 2003.

56. Task Force on Community Preventive Services. Recommendations for client and provider-directed interventions to increase breast, cervical and colorectal cancer screening. *Am J Prev Med*. 2008;35(1S): S21-S25.

57. Fenton JJ, Cai Y, Weiss NS, et al. Delivery of cancer screening: how important is the preventive health examination? *Arch Intern Med*. 2007;167: 580-585.

58. Yabroff KR, Zapka J, Klabunde CN, et al. Systems strategies to support cancer screening in U.S. primary care practice. *Cancer Epidemiol Biomarkers Prev*. 2011;20: 2471-2479.

59. Centers for Disease Control and Prevention. National Breast and Cervical Cancer Early Detection Program (NBCCEDP). Available from URL: http://www.cdc.gov/cancer/nbccedp/. Accessed November 19, 2014.

60. Miller JW, Hanson V, Johnson GD, Royalty JE, Richardson LC. From cancer screening to treatment: Service delivery and referral in the National Breast and Cervical Cancer Early Detection Program. *Cancer*. 2014;120 Suppl 16: 2549-2556.

61. Miller JW, Plescia M, Ekwueme DU. Public health national approach to reducing breast and cervical cancer disparities. *Cancer*. 2014;120 Suppl 16: 2537-2539.

62. American Cancer Society Cancer Action Network. How Do You Measure Up? A Progress Report on State Legislative Activity to Reduce Cancer Incidence and Mortality, 2016.

63. Centers for Disease Control and Prevention. CDC awards $22,800,000 to increase colorectal cancer screening, 2015.

64. Maxwell AE, Hannon PA, Escoffery C, et al. Promotion and provision of colorectal cancer screening: a comparison of colorectal cancer control program grantees and nongrantees, 2011-2012. *Prev Chronic Dis*. 2014;11: E170.

65. Centers for Disease Control and Prevention. Screen for Life: National Colorectal Cancer Action Campaign. Available from URL: http://www.cdc.gov/cancer/colorectal/sfl/. Accessed October 1, 2014.

66. Uberoi N FK, Gee E. Health Insurance Coverage and the Affordable Care Act, 2010-2016: US Department of Health and Human Services, Office of the Assistant Secretary for Planning and Evaluation, 2016:14.

67. Collins SR, Gunja M, Doty MM, Beutel S. Americans' Experience with ACA Marketplace and Medicaid Coverage: Access to Care and Satisfaction. Findings from the Commonwealth Fund Affordable Care Act Tracking Survey, February-April 2016: The Commonwealth Fund, 2016.

68. US Department of Health and Human Services. Preventive Services Covered Under the Affordable Care Act. Available from URL: http://www.hhs.gov/healthcare/facts/factsheets/2010/07/preventive-services-list.html. Accessed September 9, 2014.

69. Koh HK, Sebelius KG. Promoting prevention through the Affordable Care Act. *N Engl J Med*. 2010;363: 1296-1299.

70. Centers for Medicare and Medicaid Services. Proposed Decision Memo for Screening for Lung Cancer with Low Dose Computed Tomography (LDCT). Available from URL: http://www.cms.gov/medicare-coverage-database/details/nca-proposed-decision-memo.aspx?NCAId=274. Accessed November 30, 2014.

71. Fedewa SA, Goodman M, Flanders WD, et al. Elimination of cost-sharing and receipt of screening for colorectal and breast cancer. *Cancer*. 2015;121: 3272-3280.

72. Pollitz K, Lucia K, Keith K, et al. Coverage of colonoscopies under the affordable care act's prevention benefit. Available from URL: http://nccrt.org/wp-content/uploads/NCCRT.pdf. Accessed: February 20, 2017.

Special Notes

Federal Policies

The references to the Patient Protection and Affordable Care Act (ACA) provisions and other federal laws and guidance reflect current law as of December 2016. The references in this publication do not take into account potential changes to the ACA or other federal laws and guidance subsequently considered by Congress and the administration.

Body Mass Index

The body mass index (BMI) table presented on page 19 is based on the BMI calculator available through the National Heart, Lung, and Blood Institute of the National Institutes of Health (http://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmicalc.htm). The values presented in the table are rounded down. For example, for a 5-foot-4-inch-tall individual, the obesity weight presented in the table is 174, even though a 5-foot-4-inch-tall individual who weighs 174.0 pounds has a BMI of 29.9 (overweight, but not obese). A 5-foot-4-inch-tall individual who weighs 174.6 pounds has a BMI of 30.0 (obese). For children, BMI is based on growth charts. 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) BMI for 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. According to the CDC, obesity in children is defined as a BMI at or above the sex- and age-specific 95th percentile BMI cutoff points, and overweight is defined as between the 85th to less than the 95th percentile.

Sample Surveys

Population-based surveys are conducted by selecting a sample of people to estimate the prevalence in a population using 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 regard to phone-based surveys such as the BRFSS, the participants are those from households with either a landline telephone or cell phone. Second, both in-person and telephone 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 once reached). Third, survey measures in general are based on self-reported data, which may be subject to bias.

Population: A group of people defined by the survey

Population-based surveys: A survey conducted to estimate the prevalence of a disease, risk factor, or other characteristic in an entire population of a city, state, or nation

Prevalence: The percentage of people exhibiting the behavior out of the total number in the defined population

Sample: A smaller group of people chosen from the population defined by the survey. The sample is chosen based on the age, race, ethnic, and gender demographics of a given city, state, or nation. At times, population-based surveys will oversample a particular age, race, ethnic, or gender group. This oversampling provides enough responses to make valid estimates for a particular population of interest.

Weighted data: Data that are representative of an entire city, state, or nation. Once the sample of the population has completed the survey, statistical analyses are conducted to extrapolate the surveyed group's responses to the entire population (city, state, or nation).

Other Statistical Terms

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. The distance between the prevalence estimate to the minimum or maximum of its 95% confidence interval.

Survey Sources

The statistics reported in this publication are compiled from several different publicly available surveys, with varying designs, to provide prevalence estimates of health-related behaviors and practices for a state or nationwide. A brief description of each survey follows:

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. It is designed to provide state prevalence estimates on behavioral risk factors such as cigarette smoking, physical activity, and cancer screening. Data are gathered through monthly computer-assisted telephone interviews with adults 18 years of age 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 2014 and 2015 data results within this publication are not directly comparable to BRFSS data prior to 2011. 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, 2014 and 2015.

National Adult Tobacco Survey (NATS): The CDC and the Chronic Disease Prevention and Health Promotion Program initiated this annual survey in 2009. It is designed to provide estimates of tobacco use prevalence and other factors supporting the use and avoidance of tobacco among adults, and is representative at both the national and state levels. Adults 18 years of age and older who live in households in the US are interviewed over the telephone (landline or cellular).

NATS website: cdc.gov/tobacco/data_statistics/surveys/nats/

National Health and Nutrition Examination Survey (NHANES): The CDC's NHANES is a national survey that assesses the health and nutritional status of adults and children in the US. Three cycles of the 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.

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

Complete citation: National Center for Health Statistics. National Health and Nutrition Examination Survey, 2013-2014. Public-use data file and documentation. http://wwwn.cdc.gov/nchs/nhanes/search/nhanes13_14.aspx. 2015.

National Health Interview Survey (NHIS): The CDC's NHIS has monitored the health of the nation since 1957. The survey is designed to provide national prevalence estimates on personal, socioeconomic, demographic, and health characteristics (such as cigarette smoking and physical activity) of US adults. Data are gathered through a computer-assisted personal interview of adults 18 years of age and older living in households in the US.

Beginning in 2013, the NHIS included questions regarding sexual orientation. The data presented within this publication regarding sexual orientation are reflective of the following response options provided on the NHIS: Gay – "gay" for men and "lesbian or gay" for women; Straight – "straight, that is, not gay" for men and "straight, that is not lesbian or gay" for women. For NHIS data represented herein, estimates for white, black, American Indian/Alaska Native, and Asian are among non-Hispanics unless otherwise noted. The Asian subgroup 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. Screening estimates do not distinguish between examinations for screening and diagnosis.

Regional data presented within this publication are defined as follows:

Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont

Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin

South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia

West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming

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

Complete citation: National Center for Health Statistics. National Health Interview Survey, 2015. Public-use data file and documentation. http://www.cdc.gov/nchs/nhis.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. Data are provided by both surveyed households and immunization providers. 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.

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

Monitoring the Future Survey (MTFS): This survey is sponsored by grants from the National Institute on Drug Abuse and has been conducted by the University of Michigan since 1975. The annual survey is conducted among 8th-, 10th- and 12th-graders and contains questions related to behaviors and attitudes towards alcohol, drugs, and tobacco.

MTFS website: http://www.monitoringthefuture.org/

National Youth Tobacco Survey (NYTS): This national survey was first conducted in the fall of 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.

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

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 on health risk behaviors among public and private high school students. 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. State data that do not meet the weighting requirements are not publicly available and are not presented within this publication. Additionally, participation in YRBSS is a voluntary collaboration between a state's departments of health and education; not all states participate in each YRBSS survey.

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

List of Tables and Figures

Tables

Figures

Acknowledgments

The production of this report would not have been possible without the efforts of:
Kim Andrews; Tracie Bertaut, APR; Otis Brawley, MD; Durado Brooks, MD, MPH; Zach Cahn, PhD; Cathy Callaway; Michelle DelFavero, MOT, MPH; Carol DeSantis, MPH; Ryan Diver, MSPH; Mary Doroshenk, MA; Colleen Doyle, MS, RD; Jeffrey Drope, PhD; Eric Engels, MD, MPH; Marcie Fisher-Borne, PhD, MSW, MPH; Silvia Franceschi, MD, MSc; Susan Gapstur, PhD, MPH; Farhad Islami Gomeshtapeh, MD, PhD; Eric Jacobs, PhD; Betsy Janes; Ahmedin Jemal, DVM, PhD; Rabia Khan, MPH; Debbie Kirkland, BA; Len Lichtenfeld, MD, MACP; Melissa Maitin-Shepard, MPP; Lauri Markowitz, MD; Marji McCullough, ScD, RD; Catherine McMahon, MPH; Alpa Patel, PhD; Anthony Piercy; Kenneth Portier, PhD, MS; Debbie Saslow, PhD; Kerem Shuval, PhD; Rebecca Siegel, MPH; Scott Simpson; Robert Smith, PhD; Citseko Staples; Michal Stoklosa, MA; Margaret Tucker, MD; Dana Wagner; Meg Watson, MPH; Lee Westmaas, PhD.

Cancer Prevention & Early Detection Facts & Figures is a biannual publication of the American Cancer Society, Atlanta, Georgia. Updated tables and figures are available online at cancer.org/research/cancerfactsstatistics/index in years for which a complete edition is not produced.

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

The American Cancer Society's mission is to save lives, celebrate lives, and lead the fight for a world without cancer.

American Cancer Society®

cancer.org | 1.800.227.2345
1.866.228.4327 TTY