Lesson/Week 10

Ecology of Non-communicable Diseases

- ✓Disease Ecology: Cardiovascular Diseases
- ✓Disease Ecology: Cancer
- ✓Other Non-Communicable Diseases
- ✓Mental Health
- ✓Unintentional Injuries

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- ✓Population Ageing

Cardiovascular Diseases

✓Cardiovascular diseases are the world's largest killers, claiming **17.1 million** lives a year.

✓Tobacco use, an unhealthy diet, physical inactivity and harmful use of alcohol increase the risk of heart attacks and strokes

✓Heart attacks and strokes are major–but preventable–killers worldwide.

✓Over **80%** of cardiovascular disease deaths take place in **low-and middle-income countries** and occur almost equally in men and women.

✓Cardiovascular risk of women is particularly high after menopause.

✓Tobacco use, an unhealthy diet, and physical inactivity increase the risk of heart attacks and strokes. www.who.int

Heart Talk

✓The human heart is only the size of a fist, but it is the strongest muscle in the human body.
✓The heart starts to beat in the uterus long before birth, usually by 21 to 28 days after conception.
✓The average heart beats about 100 000 times daily or about two and a half billion times over a 70 year lifetime. With every heartbeat, the heart pumps blood around the body.
✓It beats approximately 70 times a minute, although this rate can double during exercise or at times of extreme emotion.
✓Blood is pumped out from the left chambers of the heart. It is transported through **arteries** of ever-decreasing size, finally reaching the capillaries in all the tissues, such as the skin and other body organs.
✓Having delivered its oxygen and nutrients and having collected waste products, blood is brought back to the right chambers of the heart through a system of ever-enlarging **veins**.

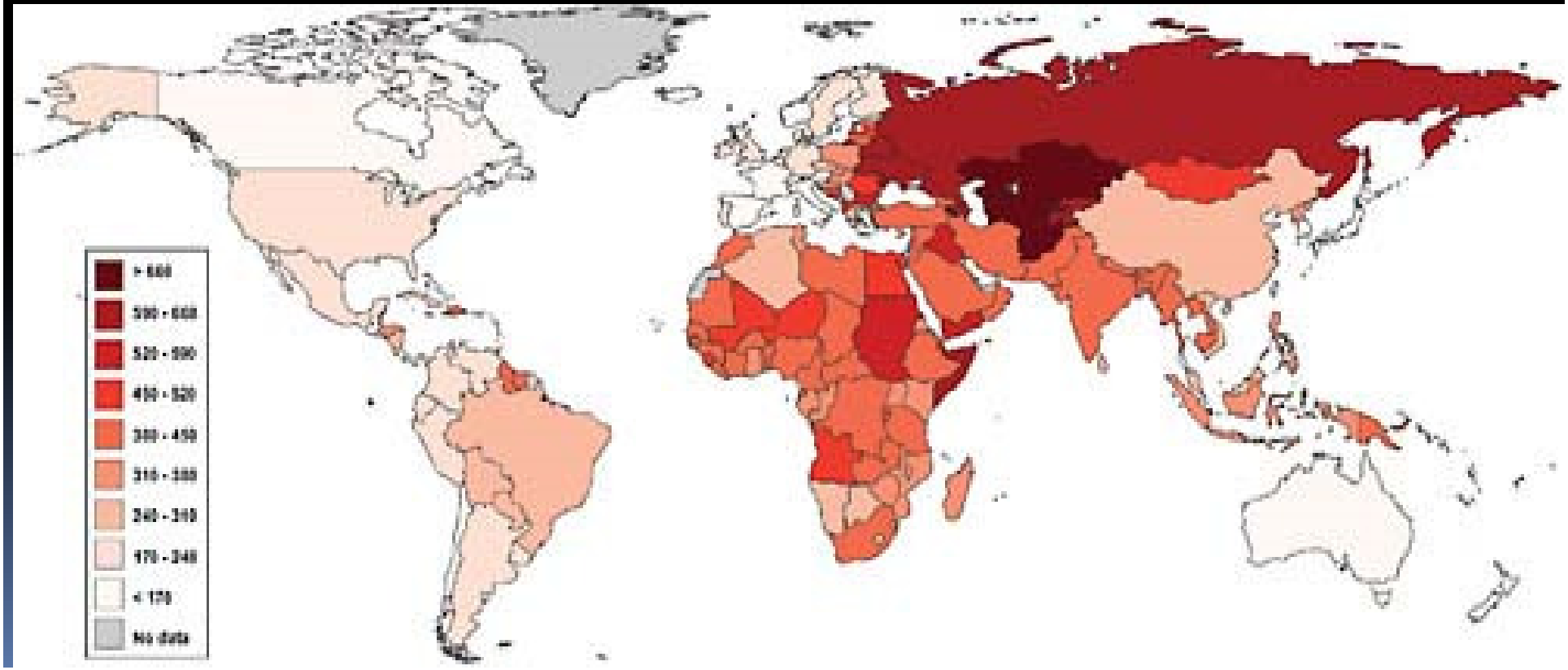
What are cardiovascular diseases?

Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels and include:

- ✓**coronary heart disease (CHD)** – disease of the blood vessels supplying the heart muscle
- ✓**cerebrovascular disease** - disease of the blood vessels supplying the brain
- ✓**peripheral arterial disease** – disease of blood vessels supplying the arms and legs
- ✓**rheumatic heart disease** – damage to the heart muscle and heart valves from rheumatic fever, caused by streptococcal bacteria
- ✓**congenital heart disease** - malformations of heart structure existing at birth
- ✓**deep vein thrombosis and pulmonary embolism** – blood clots in the leg veins, which can dislodge and move to the heart and lungs.

Global burden

"Age-standardized mortality rates for CVD are in excess of 500 per 100,000 in Russia and Egypt; between 400 and 450 for South Africa, India and Saudi Arabia; and around 300 for Brazil and China. This is in contrast to rates of between 100 and 200 per 100,000 for Australia, Japan, France, and the United States. Overall, age-adjusted CVD death rates are today higher in major low and middle income countries than in developed countries." http://books.nap.edu



CHD Trends

In general, three trending patterns of CHD mortality can be observed:

1): a rise-and-fall pattern where mortality rates increased, peaked, and then fell significantly

"High income Anglo-Celtic, Nordic, and Northwestern Continental European countries as well as in the United States and Australia. In these countries, CHD mortality rates peaked in the 1960s or early 1970s and have since fallen precipitously, by an average of about 50 percent"

2): a rising pattern, where rates have steadily increased indicating an ongoing epidemic

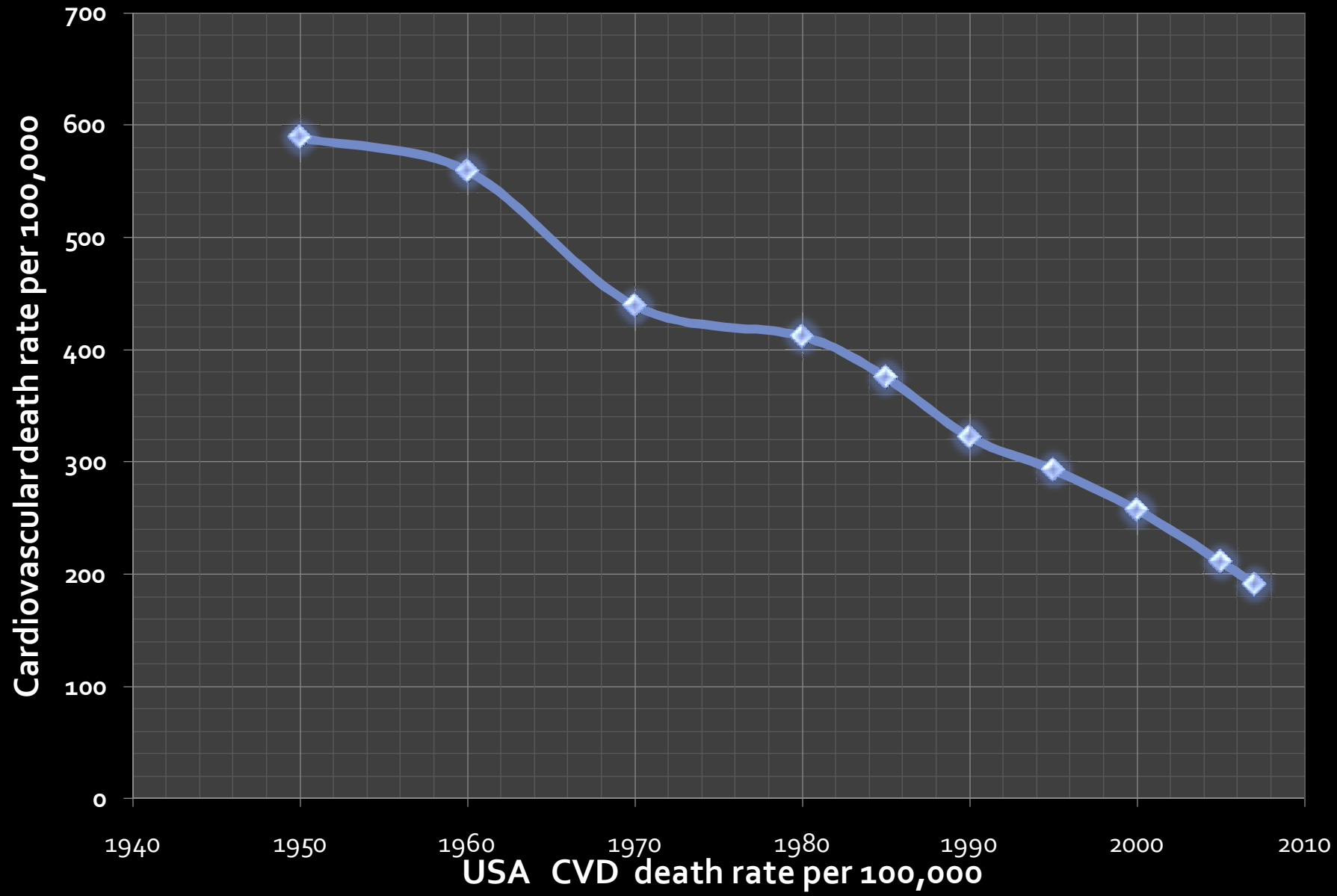
"Eastern European and former Soviet countries, where mortality rates have continued to increase at an alarming pace and where the highest mortality rates ever recorded are currently being observed."

3): and a flat pattern, where CHD mortality rates have remained relatively low and stable.

Mortality rates in Japan and several European Mediterranean countries have remained relatively low, following the flat pattern.

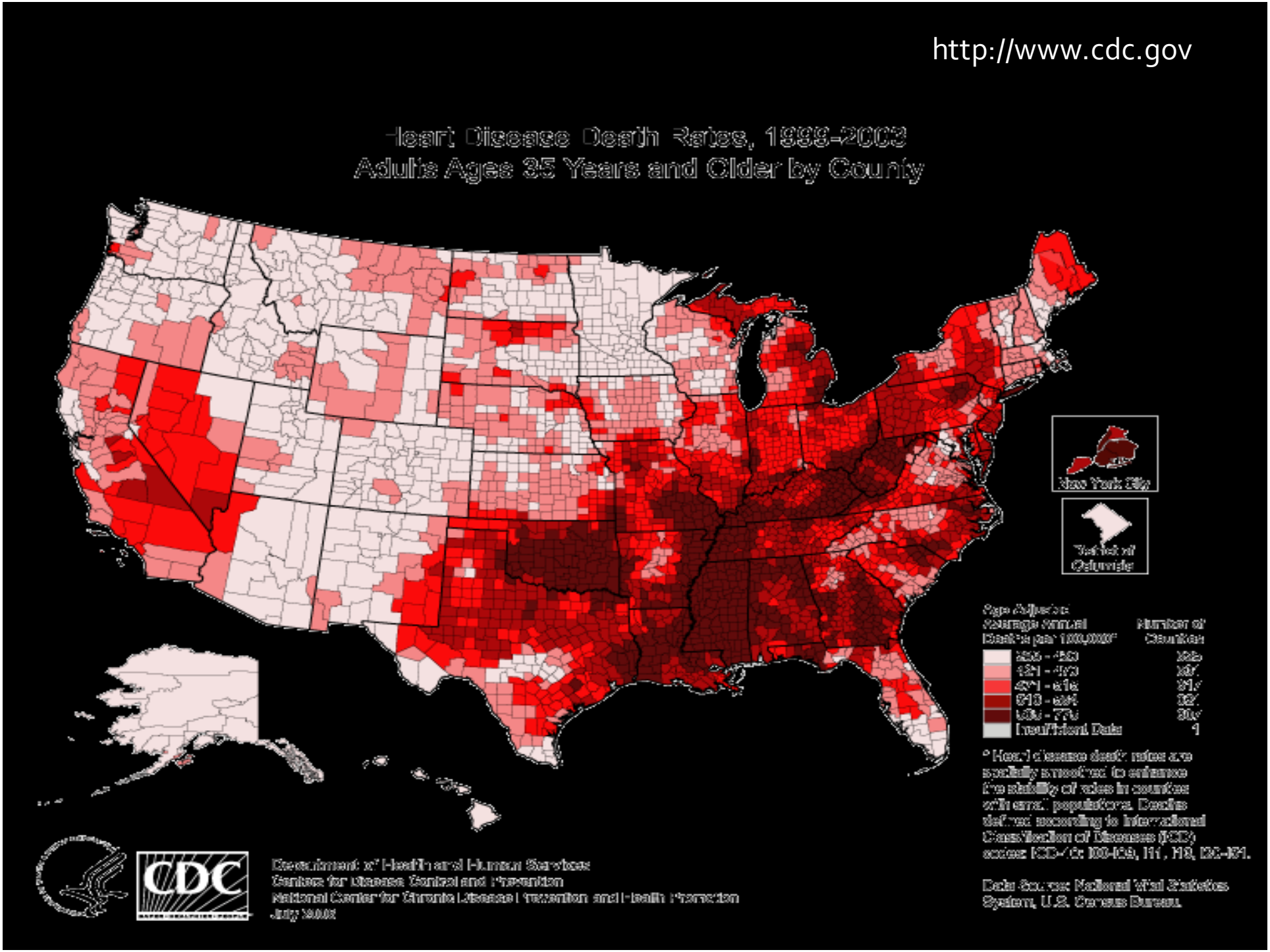
http://books.nap.edu

USA



Source: based on data from National Center for Health Statistics

http://www.cdc.gov



Disease Ecology: Cancer

Key facts

- Cancer is a leading cause of death worldwide and accounted for **7.6 million deaths** (around 13% of all deaths) in 2008. [1]
- Tobacco use is a major risk factor for cancer. Harmful alcohol use, poor diet and physical inactivity are other main risk factors.
- Certain infections cause up to 20% of cancer deaths in low- and middle-income countries and 9% of cancer deaths in high-income countries.
- More than 30% of cancer deaths can be prevented.
- Cancer arises from a change in one single cell. The change may be started by external agents and inherited genetic factors.
- Deaths from cancer worldwide are projected to continue to rise to over 11 million in 2030.

- "Cancer is a generic term for a large group of diseases that can affect any part of the body. Other terms used are malignant tumours and neoplasms. One defining feature of cancer is the rapid creation of abnormal cells that grow beyond their usual boundaries, and which can then invade adjoining parts of the body and spread to other organs. This process is referred to as metastasis. Metastases are the major cause of death from cancer." www.WHO.int

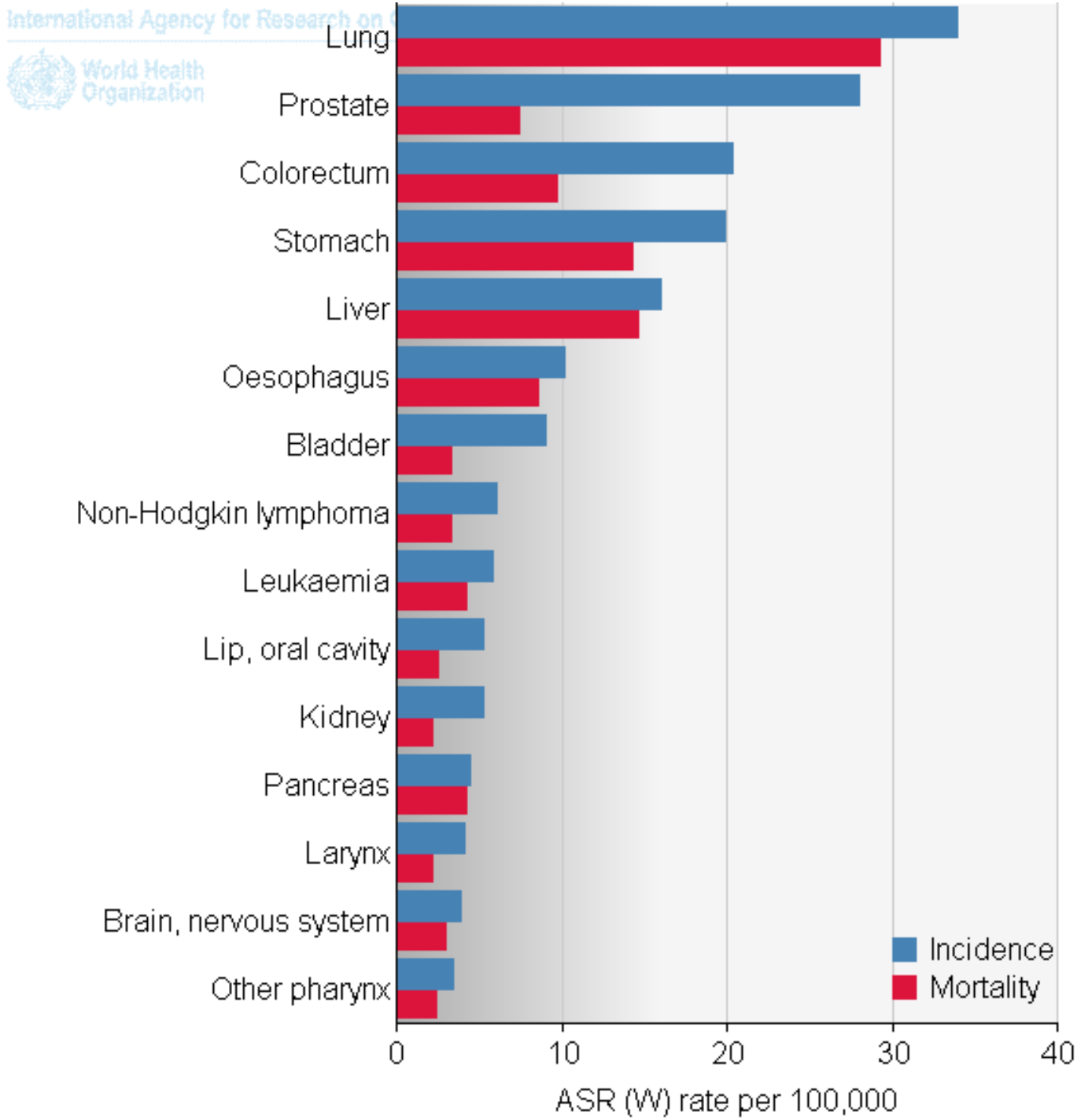
The scope of the problem

Cancer deaths by site

- lung (1.4 million deaths)
- stomach (740 000 deaths)
- liver (700 000 deaths)
- colorectal (610 000 deaths)
- breast (460 000 deaths).

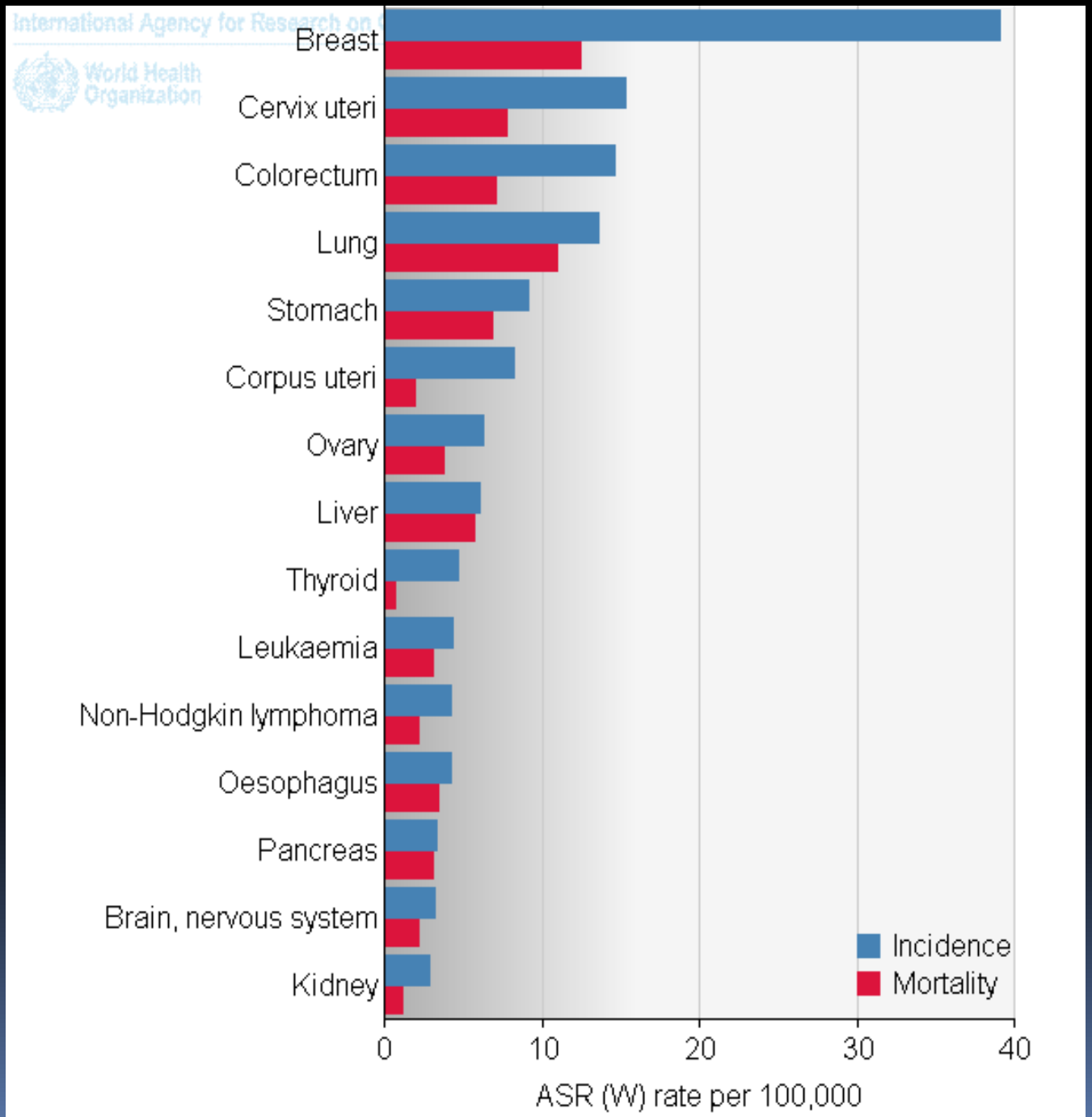
✓More than 70% of all cancer deaths occurred in low- and middle-income countries.

✓Tobacco use, alcohol use, unhealthy diet, and chronic infections from hepatitis B (HBV), hepatitis C virus (HCV) and some types of Human Papilloma Virus (HPV) are leading risk factors for cancer in low- and middle-income countries. Cervical cancer, which is caused by HPV, is a leading cause of cancer death among women in low-income countries.



Most frequent cancers: men 2008

http://globocan.iarc.fr/factsheets



Most frequent cancers: women 2008

http://globocan.iarc.fr/factsheets

USA : positive trends

✓ **Cancer d**eath rates for the four most common cancers (prostate, breast, lung, and colorectal), as well as for all cancers combined, continue to decline.

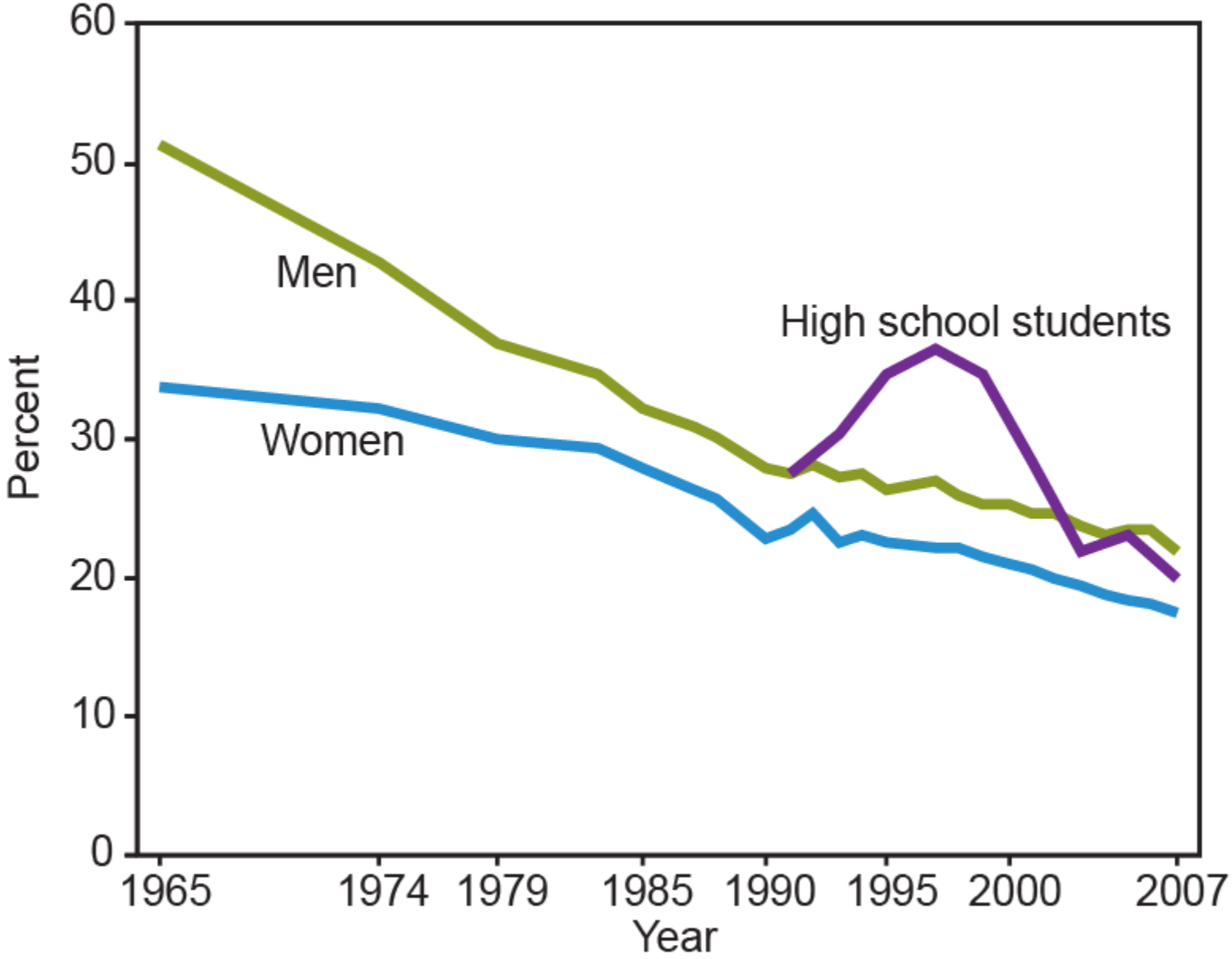
✓The rate of cancer incidence has declined since the early 2000s.

✓Length of cancer survival has increased for all cancers combined. For all sites, the percent of cases surviving five years from diagnosis in 2001 (most recent year with five-year follow-up) was 68.3% (the "Healthy People 2010" objective for five year survival envisaged an improvement to 70%)

✓Adult cigarette smoking prevalence has been slowly declining since 1991, while smoking prevalence among adolescents has declined since the late 1990s. Despite these declines, one in five adults and adolescents is a smoker.

✓Substantial decreases in secondhand smoke exposure have been realized since the beginning of the 1990's for all subgroups and across a variety of measures. This includes biological measures, as well as work place policies, rules about smoking in the home and, more recently through state and local smoke-free indoor air legislation.

Cigarette smoking



SOURCE: CDC/NCHS, *Health, United States, 2009*, Figure 6. Data from the National Health Interview Survey and the Youth Risk Behavior Survey.

USA : negative trends

✓Incidence rates of some cancers are rising including melanoma of the skin, non-Hodgkin lymphoma, childhood cancer, cancers of the kidney and renal pelvis, leukemia, thyroid, pancreas, liver and intrahepatic bile duct, testis, and esophagus.

✓Lung cancer incidence rates in women continue to rise, but not as rapidly as before.

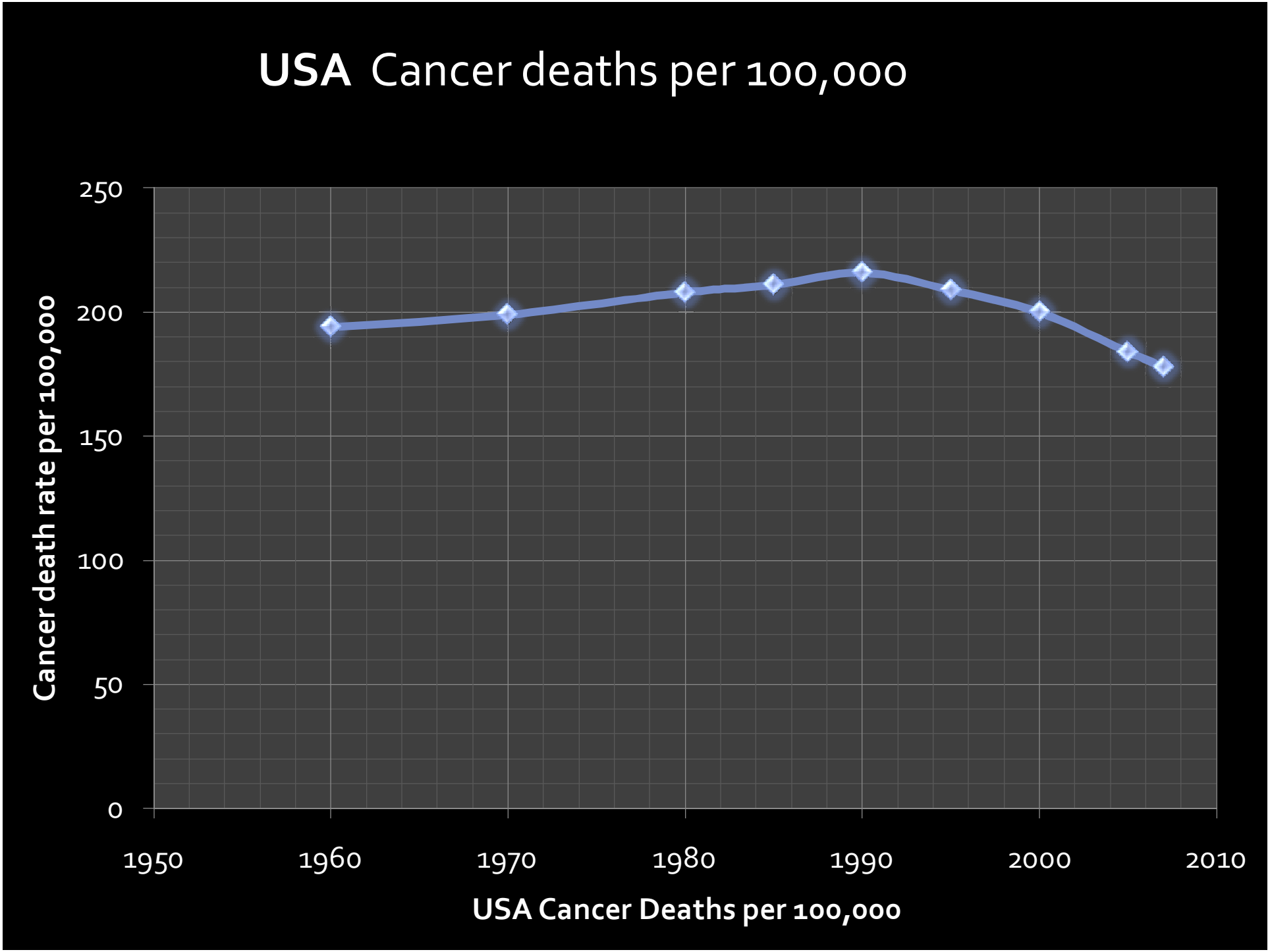
✓Death rates for cancer of the pancreas, esophagus, thyroid, and liver are increasing.

✓While more than 40 percent of smokers attempt to quit smoking each year, successful quitting rates have been low and are not improving for most of the population.

✓While progress has been made in all segments of the population, subgroups including children living in homes with smokers, young adults, subgroups of nonsmoking workers (for example, blue collar occupations and hospitality industry), and non-Hispanic Blacks have higher rates of exposure to secondhand smoke.

✓More people are overweight and obese, and leisure time physical activity is not increasing.

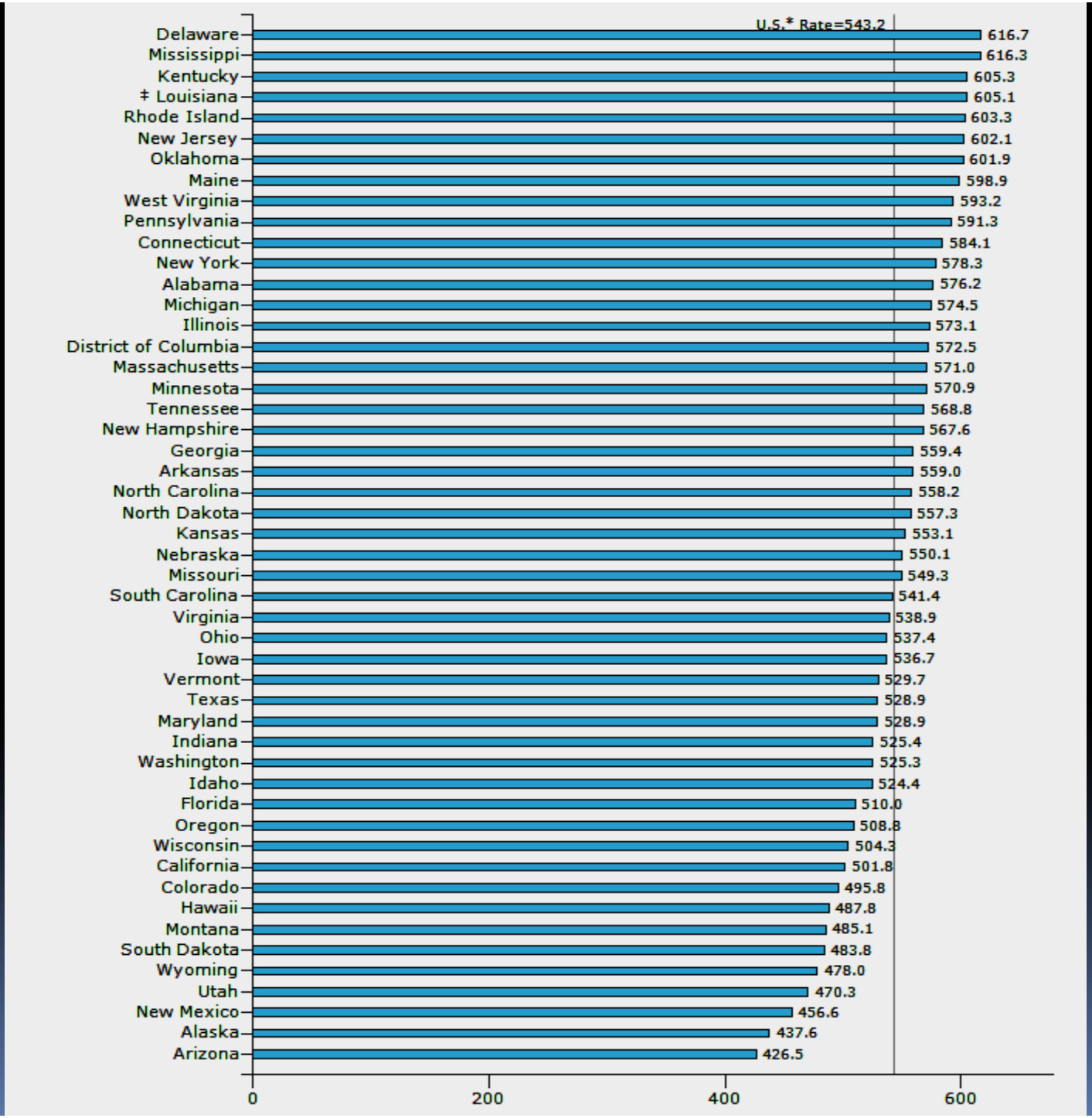
✓Alcohol consumption has risen slightly since the mid 1990s. Fruit and vegetable intake is not increasing. Red meat and fat consumption are not decreasing.


USA Cancer deaths per 100,000
250
200
150
100
50
0
Cancer death rate per 100,000
1950
1960
1970
1980
1990
2000
2010
USA Cancer Deaths per 100,000

Zoom to 100% for better viewing

Male Incidence Rate Per 100,000 2007

http://apps.nccd.cdc.gov



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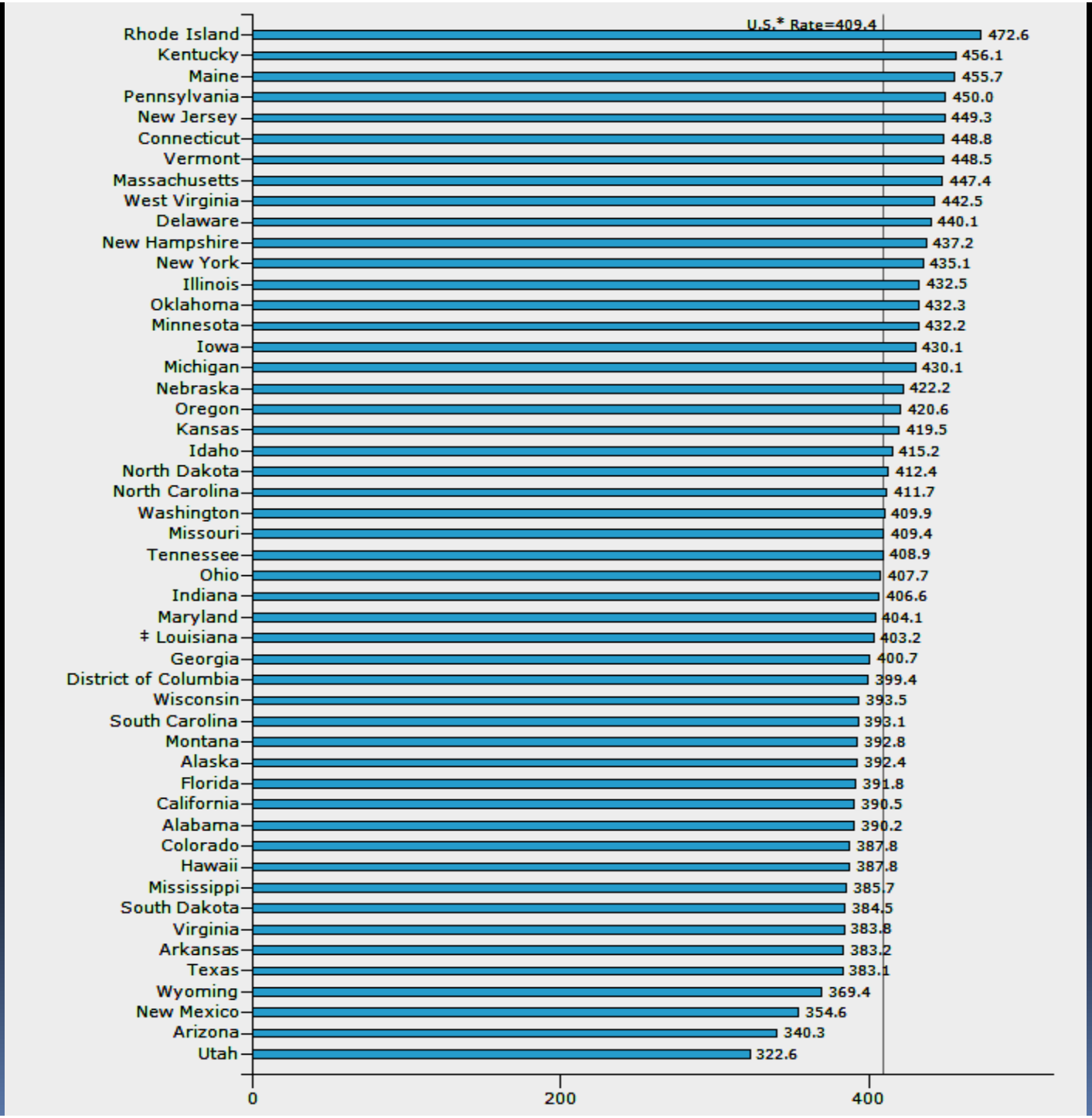
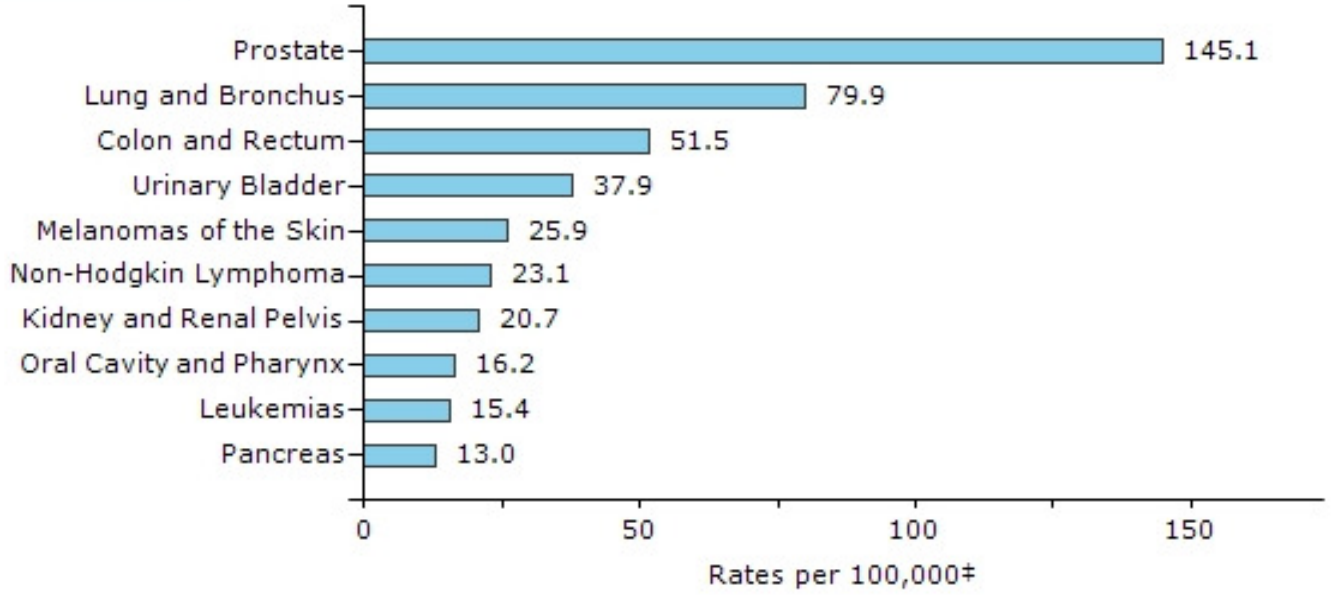
Female Incidence Rate Per 100,000 2007

http://apps.nccd.cdc.gov



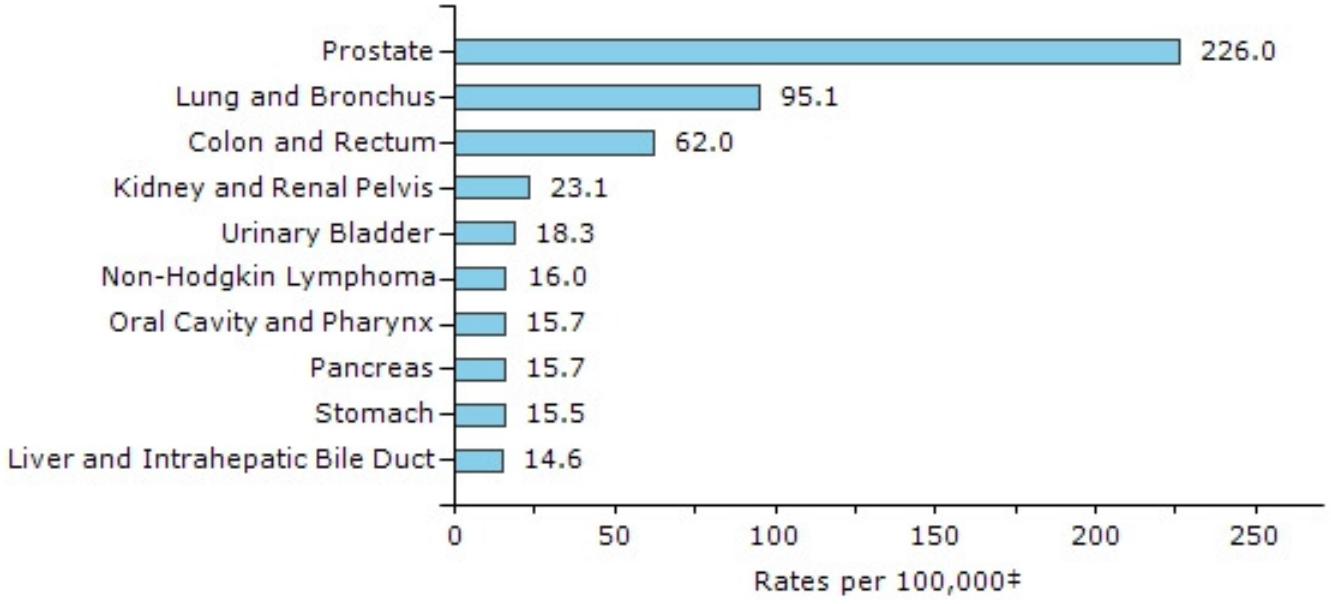
USA 2007

Top 10 Cancer Sites: 2007, Male, United States—White



USA 2007

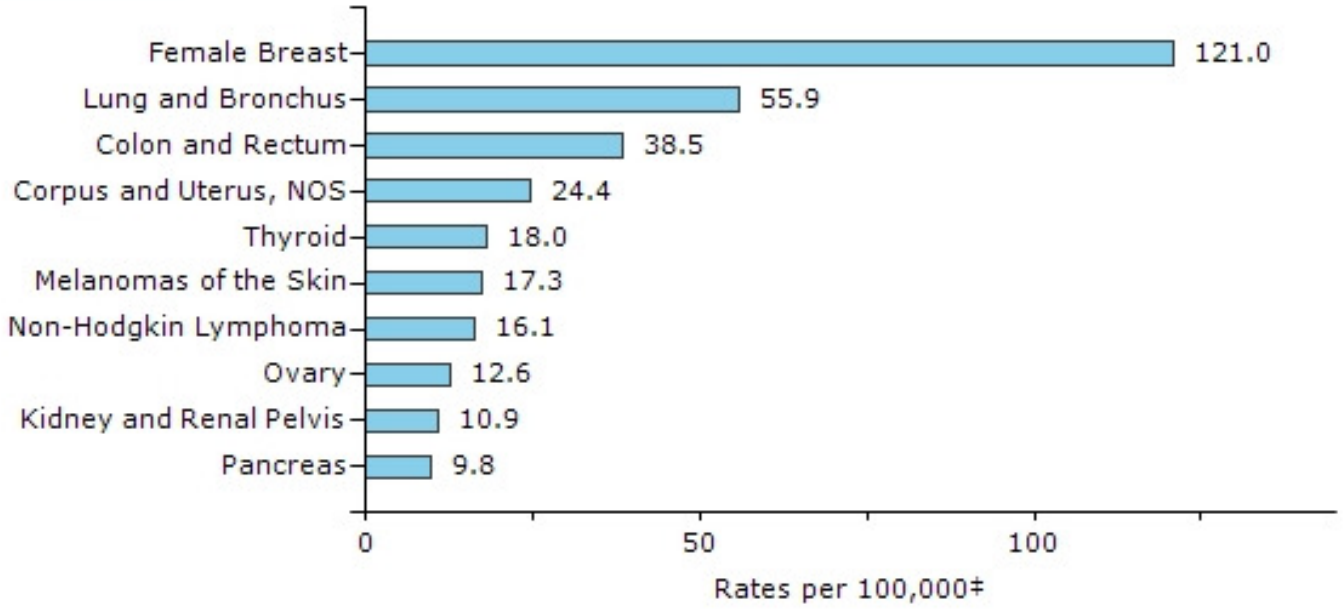
Top 10 Cancer Sites: 2007, Male, United States—Black



http://apps.nccd.cdc.gov

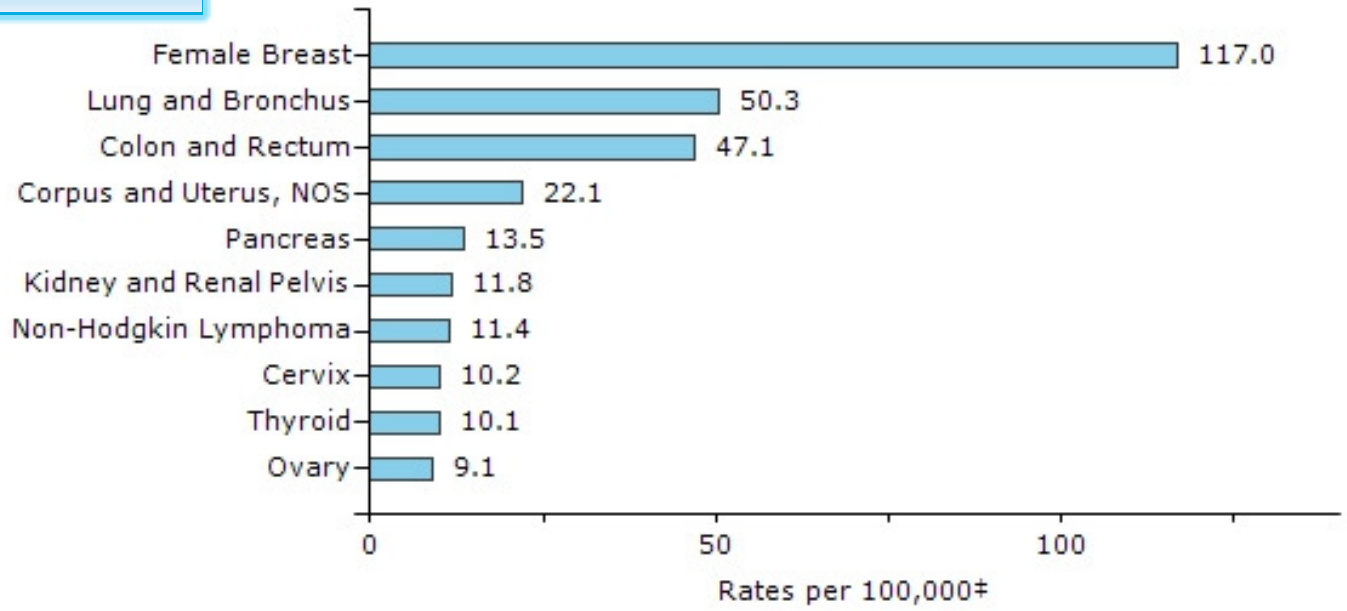
USA 2007

Top 10 Cancer Sites: 2007, Female, United States—White



USA 2007

Top 10 Cancer Sites: 2007, Female, United States—Black



Other non- infectious:

Diabetes

Global dist. Map http://geocommons.com/maps/9512

Key facts: Global

✓More than 285 million people worldwide have diabetes (430 million in 2030).
✓In 2010, an estimated 3.9 million people died from consequences of high blood sugar.
✓More than 80% of diabetes deaths occur in low- and middle-income countries.
✓WHO projects that diabetes deaths will double between 2005 and 2030. www.who.int

Top 10 countries: number of persons with diabetes (millions) 2010

1. China 92.4*
2. India 50.7
3. USA 25.6
4. Russian Fed 9.6
5. Brazil 7.6
6. Germany 7.5
7. Pakistan 7.2
8. Japan 7.1
9. Indonesia 7.0
10. Mexico 6.8

*61 percent of them do not know they have the disease

http://www.worlddiabetesfoundation.org

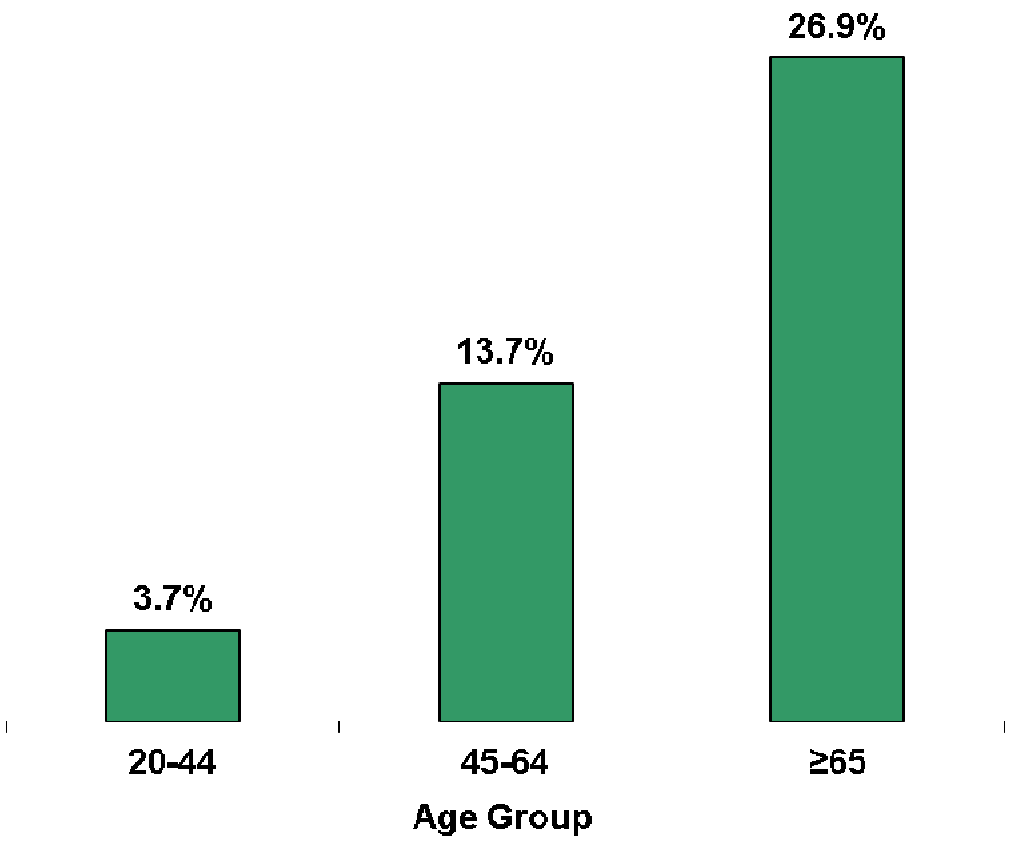
United States, 2010 SUMMARY

✓**Age 20 years or older:** 25.6 million, or 11.3% of all people in this age group, have diabetes.
✓**Age 65 years or older:** 10.9 million, or 26.9% of all people in this age group, have diabetes.

✓**Men:** 13.0 million, or 11.8% of all men aged 20 years or older, have diabetes.
✓**Women:** 12.6 million, or 10.8% of all women aged 20 years or older, have diabetes.
✓**Non-Hispanic whites:** 15.7 million, or 10.2% of all non-Hispanic whites aged 20 years or older, have diabetes.
✓**Non-Hispanic blacks:** 4.9 million, or 18.7% of all non-Hispanic blacks aged 20 years or older, have diabetes.

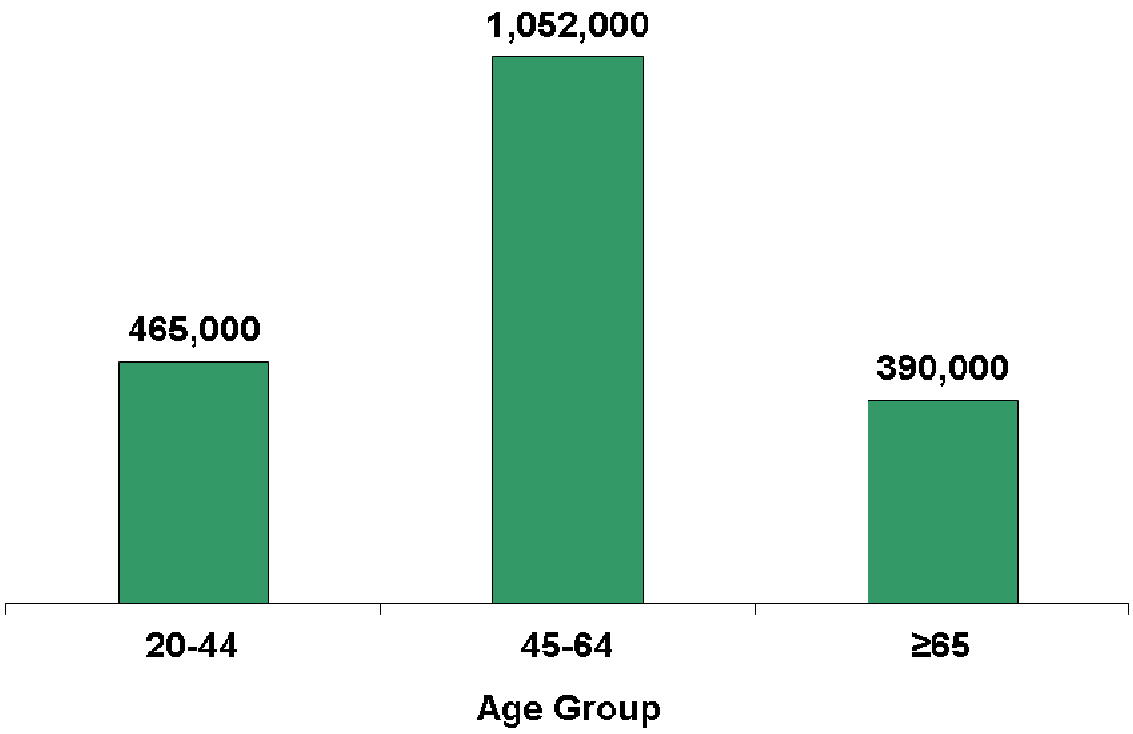
Source: 2005–2008 National Health and Nutrition Examination Survey

Estimated percentage of people aged 20 years or older with diagnosed and undiagnosed diabetes, by age group, United States, 2005–2008

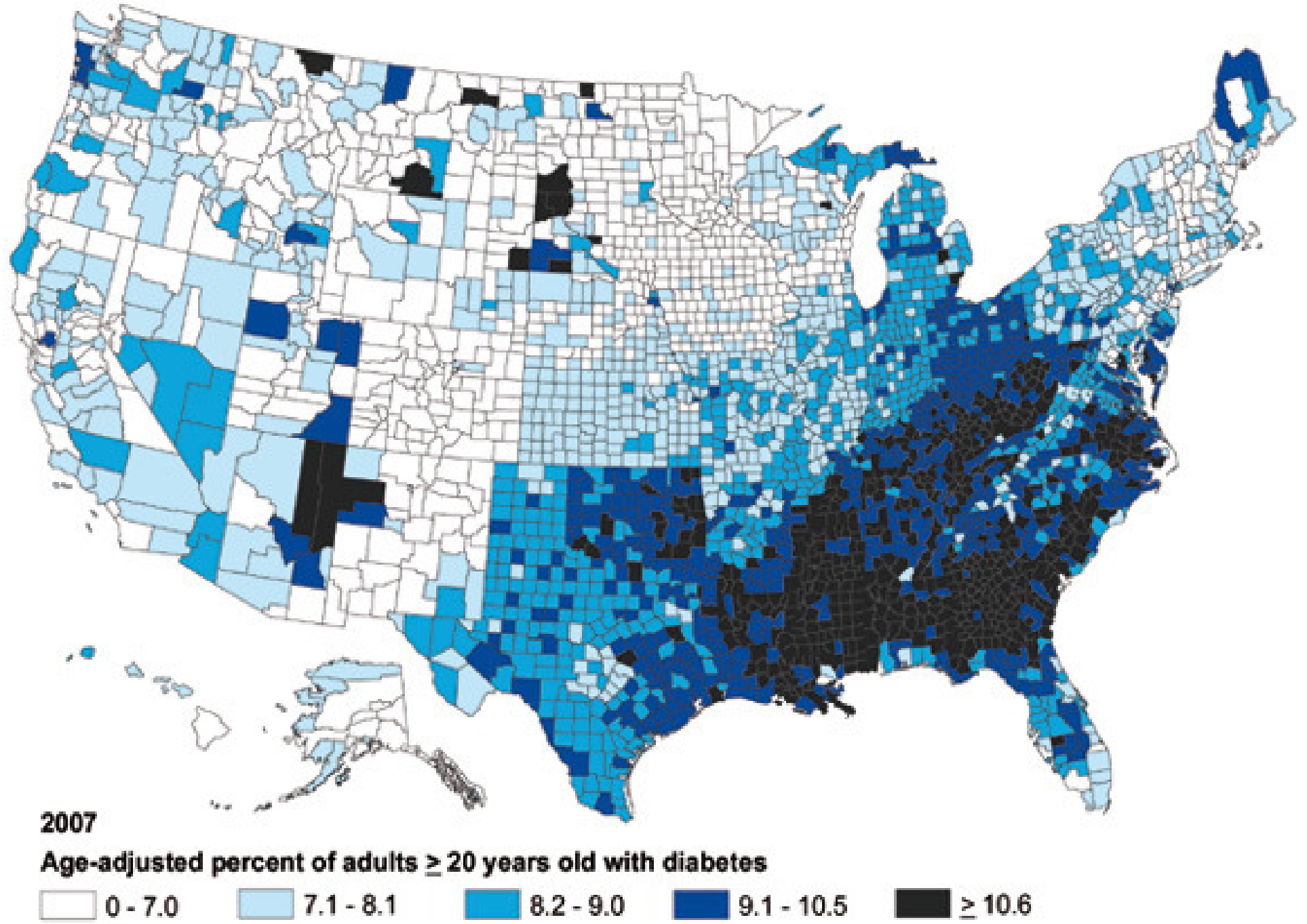


Source: 2005–2008 National Health and Nutrition Examination Survey.

Estimated number of new cases of diagnosed diabetes among people aged 20 years or older, by age group, United States, 2010



Source: 2007–2009 National Health Interview Survey estimates projected to the year 2010.


2007
Age-adjusted percent of adults ≥ 20 years old with diabetes
0 - 7.0
7.1 - 8.1
8.2 - 9.0
9.1 - 10.5
≥ 10.6

Major risk factors: I. Obesity

Prevalence estimates of adult obesity, 2010 by Country. Percent of adult population with body mass index (bmi) of 30 or higher, ranked from highest to lowest % of the adult female population.

SOURCE: International Obesity Taskforce, International Association for the Study of Obesity

Rank	Country	Male	Female
1	Papua New Guinea	74.8	79.5
2	Tonga	46.6	70.3
3	Samoa	32.9	63
4	Nauru	55.7	60.5
5	Nicaragua		48
6	Cook Islands	40.6	
7	Egypt		46.6
8	Niue	15	46
9	Qatar	34.6	45.3
10	French Polynesia	36.3	44.3
11	Saudi Arabia	26.4	44
12	Palestine	23.9	42.5
13	Lebanon	36.3	38.3
14	Dominican Republic		38
15	Panama	27.9	36.1
16	Paraguay	22.9	35.7
17	Albania (urban)	22.8	35.6
18	USA	32.2	35.5
19	Mexico	24.2	34.5
20	Seychelles	14.7	34.2

Ethiopia = 0.7

$$BMI_{\text{lbs per sq. in.}} = (weight_{\text{lbs}} \times 703) \div height_{\text{in.}}^{2}$$

BMI	Weight Status
Below 18.5	Underweight
18.5 -24.9	Normal
25 - 29.9	Overweight
30 & Above	Obese

USA

Animated map: **http://www.cdc.gov/obesity/data/trends.html**

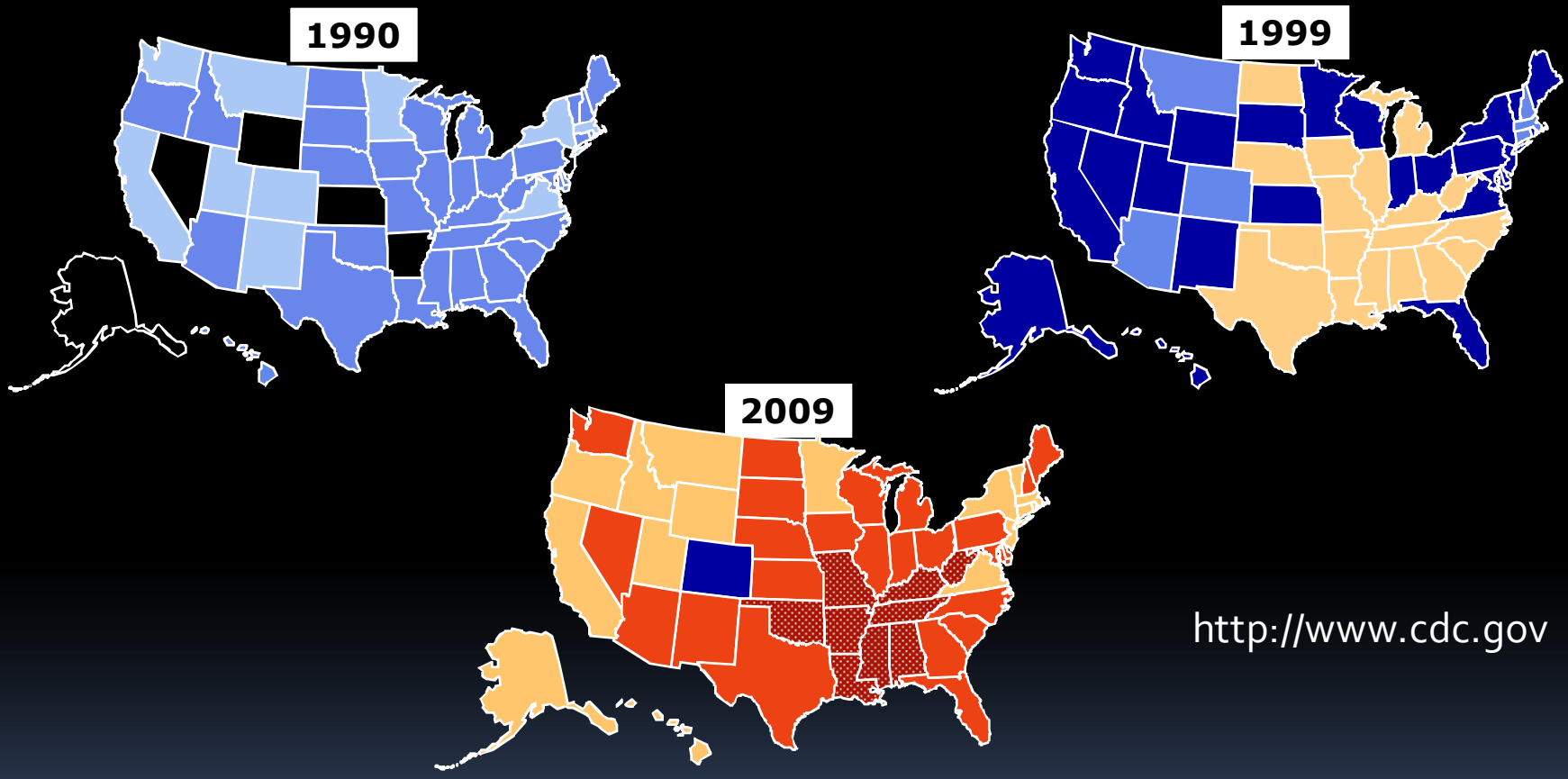
✓Obesity is defined as a body mass index (BMI) of 30 or greater. BMI is calculated from a person's weight and height and provides a reasonable indicator of body fatness and weight categories that may lead to health problems. Obesity is a major risk factor for cardiovascular disease, certain types of cancer, and type 2 diabetes.

✓During the past 20 years there has been a dramatic increase in obesity in the United States. In 2009, only Colorado and the District of Columbia had a prevalence of obesity less than 20%.

✓Thirty-three states had a prevalence equal to or greater than 25%; nine of these states (Alabama, Arkansas, Kentucky, Louisiana, Mississippi, Missouri, Oklahoma, Tennessee, and West Virginia) had a prevalence of obesity equal to or greater than 30%http://www.cdc.gov/obesity/data/trends.html.

BRFSS, 1990, 1999, 2009

(*BMI ≥30, or about 30 lbs. overweight for 5’4” person)



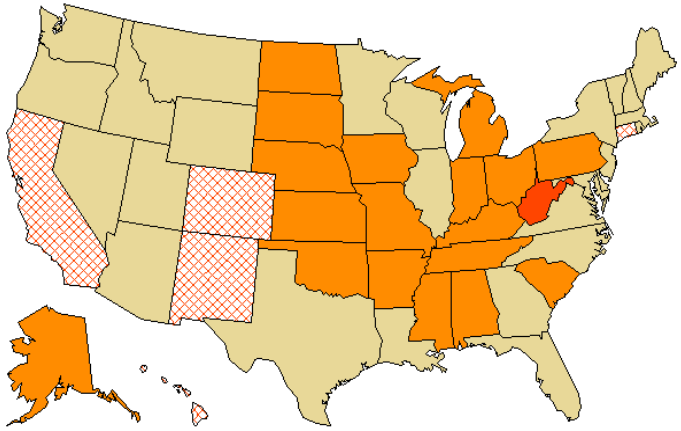
http://www.cdc.gov

2009 State Obesity Rates

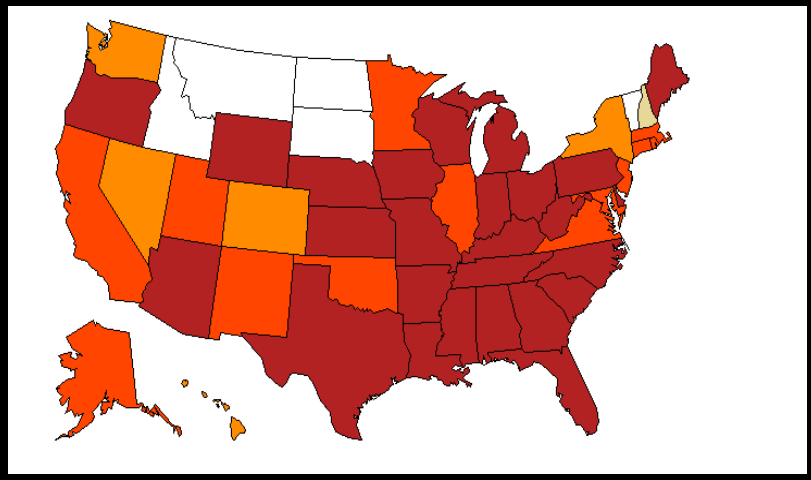
State	%	State	%	State	%	State	%
Alabama	31.0	Illinois	26.5	Montana	23.2	Rhode Island	24.6
Alaska	24.8	Indiana	29.5	Nebraska	27.2	South Carolina	29.4
Arizona	25.5	Iowa	27.9	Nevada	25.8	South Dakota	29.6
Arkansas	30.5	Kansas	28.1	New Hampshire	25.7	Tennessee	32.3
California	24.8	Kentucky	31.5	New Jersey	23.3	Texas	28.7
Colorado	18.6	Louisiana	33.0	New Mexico	25.1	Utah	23.5
Connecticut	20.6	Maine	25.8	New York	24.2	Vermont	22.8
Delaware	27.0	Maryland	26.2	North Carolina	29.3	Virginia	25.0
Washington DC	19.7	Massachusetts	21.4	North Dakota	27.9	Washington	26.4
Florida	25.2	Michigan	29.6	Ohio	28.8	West Virginia	31.1
Georgia	27.2	Minnesota	24.6	Oklahoma	31.4	Wisconsin	28.7
Hawaii	22.3	Mississippi	34.4	Oregon	23.0	Wyoming	24.6
Idaho	24.5	Missouri	30.0	Pennsylvania	27.4		

State-specific Prevalence of Obesity* Among U.S. Adults, by Race/Ethnicity, 2006-2008

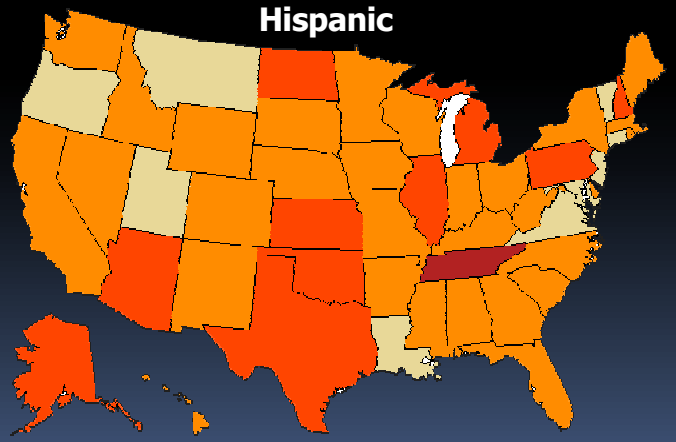
White non-Hispanic



Black non-Hispanic

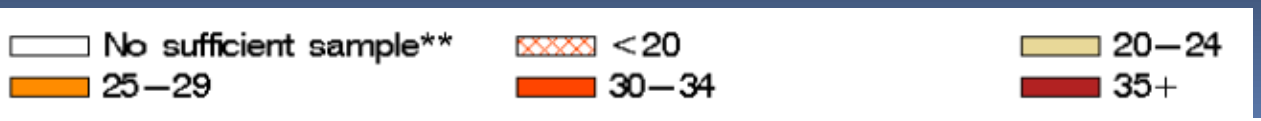


Hispanic



http://www.cdc.gov

(*BMI ≥30)



✓"Non-Hispanic blacks (35.7%) had 51% greater prevalence of obesity, and Hispanics (28.7%) had 21% greater prevalence, when compared with non-Hispanic whites (23.7%).

✓This pattern was consistent across most U.S. states.

✓However, state prevalences varied substantially, ranging from 23.0% (New Hampshire) to 45.1% (Maine) for non-Hispanic blacks, from 21.0% (Maryland) to 36.7% (Tennessee) for Hispanics, and from 9.0% (District of Columbia [DC]) to 30.2% (West Virginia) for non-Hispanic whites.

✓Greater prevalences of obesity for blacks and whites were found in the South and Midwest than in the West and Northeast.

✓Hispanics in the Northeast had lower obesity prevalence than Hispanics in the Midwest, South or West."

www.cdc.gov

USA Physical inactivity (2008)

States with at least a quarter of the population inactive

State	% inactive
Puerto Rico	47.4
Virgin Islands	33.5
Mississippi	32.4
Oklahoma	31
West Virginia	30.5
Kentucky	30.1
Louisiana	29.8
Alabama	29.3
Arkansas	29.2
Texas	28.8
Illinois	28
Nevada	27.6
Indiana	27.4
Tennessee	27.3

State	% inactive
Missouri	27.2
South Carolina	26.9
New Jersey	26.8
South Dakota	26.5
New York	26.1
Guam	25.9
Ohio	25.6
Florida	25.4
Kansas	25.4
North Dakota	25.4
Alaska	25.1
Michigan	25.1
Pennsylvania	25.1

www.cdc.gov

Mental Health

"Mental health is fundamental to health. This is reflected by the definition of health in the WHO Constitution as 'a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity'. Research conducted in recent years has brought to our attention that mental health inherently affects physical health and physical health affects mental health. The two are inseparable in terms of achieving a more complete state of wellness."

http://www.who.int/mental_health

✓Mental, neurological, and **substance abuse** (MNS) disorders are prevalent in all regions of the world and are major contributors to morbidity and premature mortality.

✓Worldwide, community-based epidemiological studies have estimated that lifetime prevalence rates of mental disorders in adults are 12.2–48.6%, and 12-month prevalence rates are 8.4–29.1%.

✓14% of the global burden of disease, measured in disability-adjusted life years (DALYs), can be attributed to MNS disorders.

✓About 30% of the total burden of oncommunicable diseases is due to these disorders.

✓Almost three quarters of the global burden of neuropsychiatric disorders is in countries with low and lower middle incomes.

✓The **stigma** and violations of human rights directed towards people with these disorders compounds the problem, increasing their vulnerability; accelerating and reinforcing their decline into poverty; and hindering care and rehabilitation.

✓Restoration of mental health is not only essential for individual well-being, but is also necessary for economic growth and reduction of poverty in societies and countries.

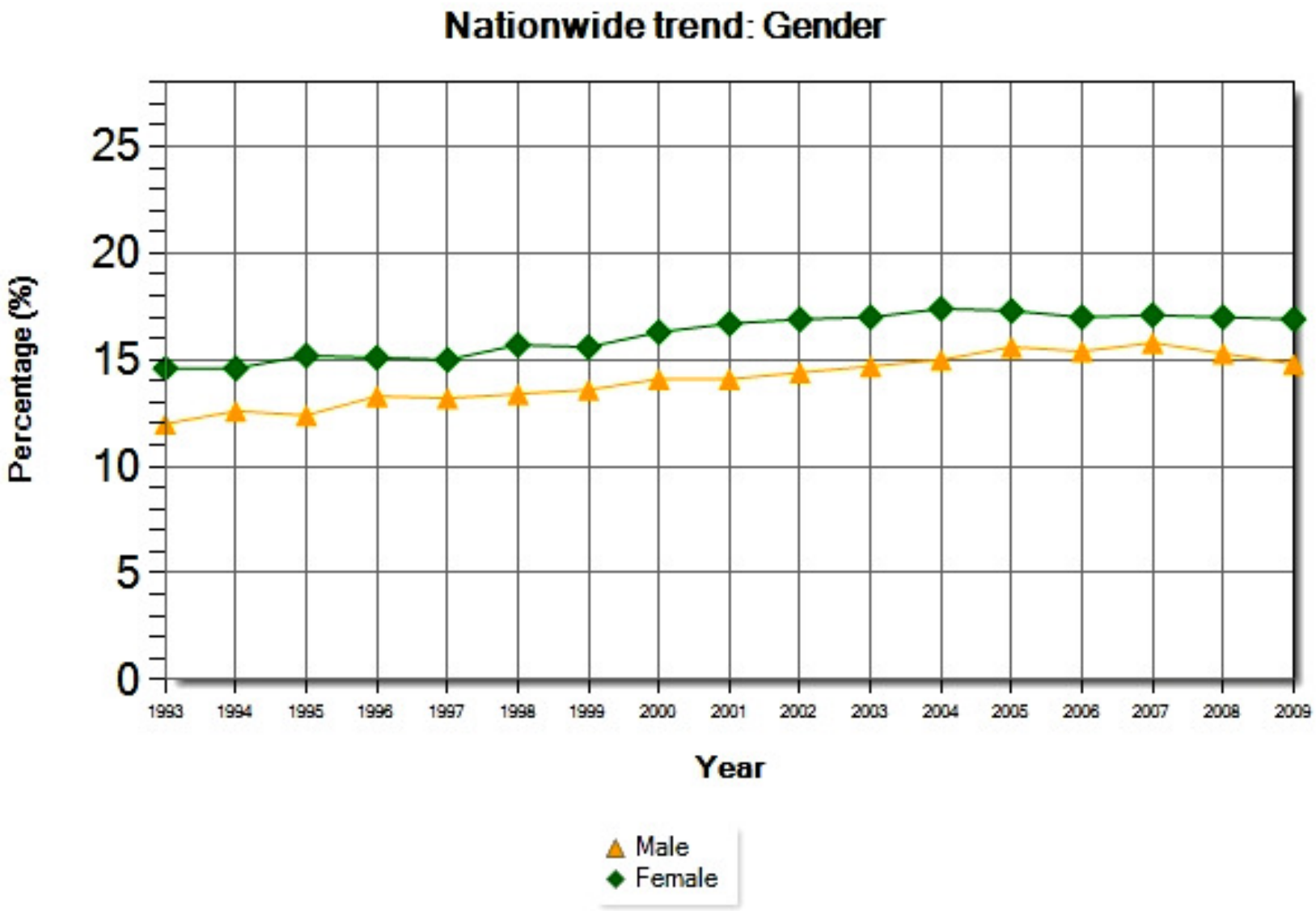
✓Mental health and health security interact closely.

✓Conditions of **conflict** create many challenges for mental health.

✓Despite the prevalence and burden of MNS disorders, a large proportion of people with such problems do not receive **treatment** or care.
✓A large multicountry survey supported by WHO showed that 35–50% of serious cases in developed countries and 76–85% in less-developed countries had received no treatment in the previous 12 months.
✓A review of the world literature found treatment gaps to be 32% for schizophrenia, 56% for depression, and as much as 78% for alcohol use disorders.
✓Of the countries that have a designated mental health budget, 21% spend less than 1% of their total health budgets on mental health.

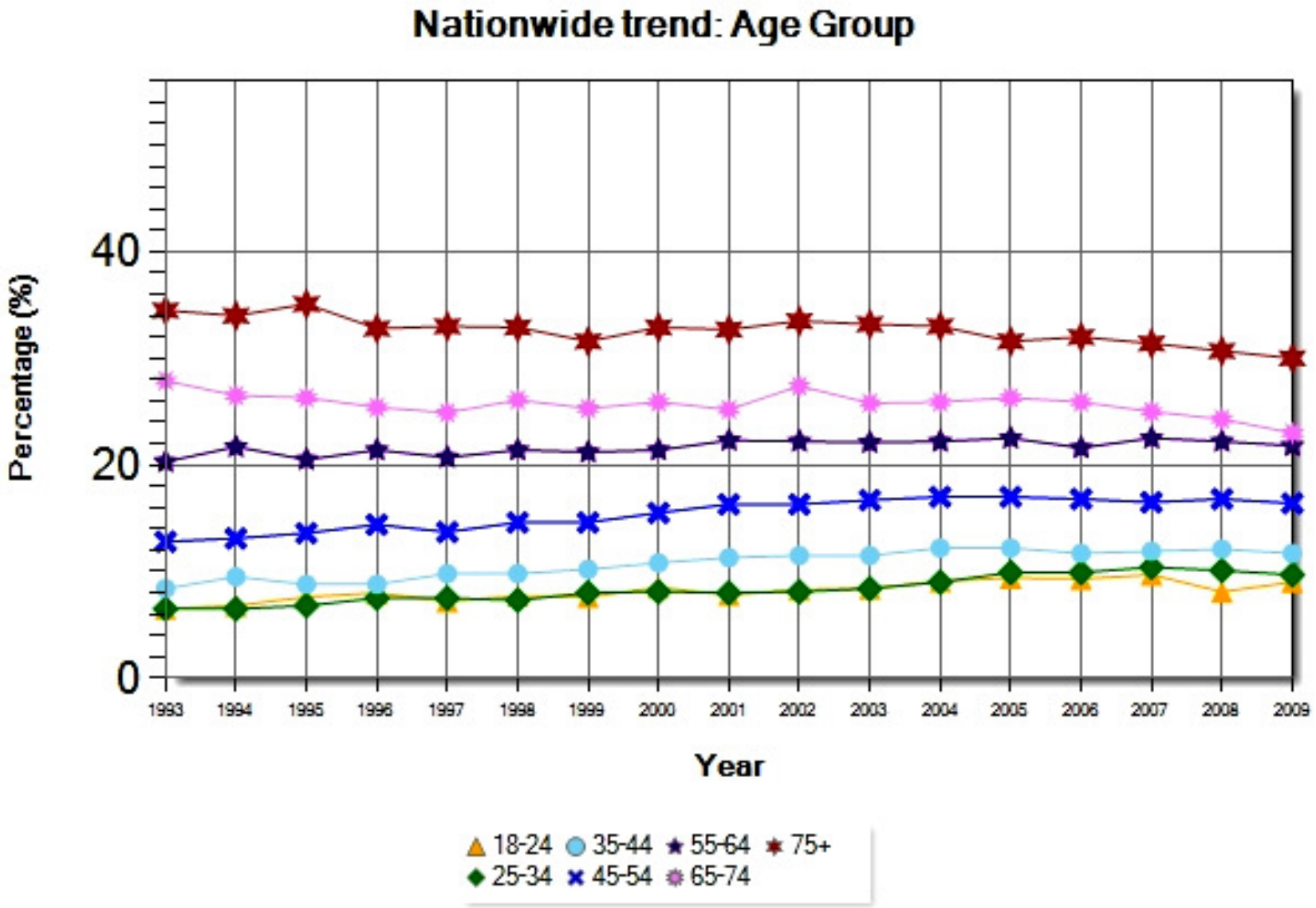
USA 2007

Percentage with fair or poor self-rated health



USA 2007

Percentage with fair or poor self-rated health



USA 2007

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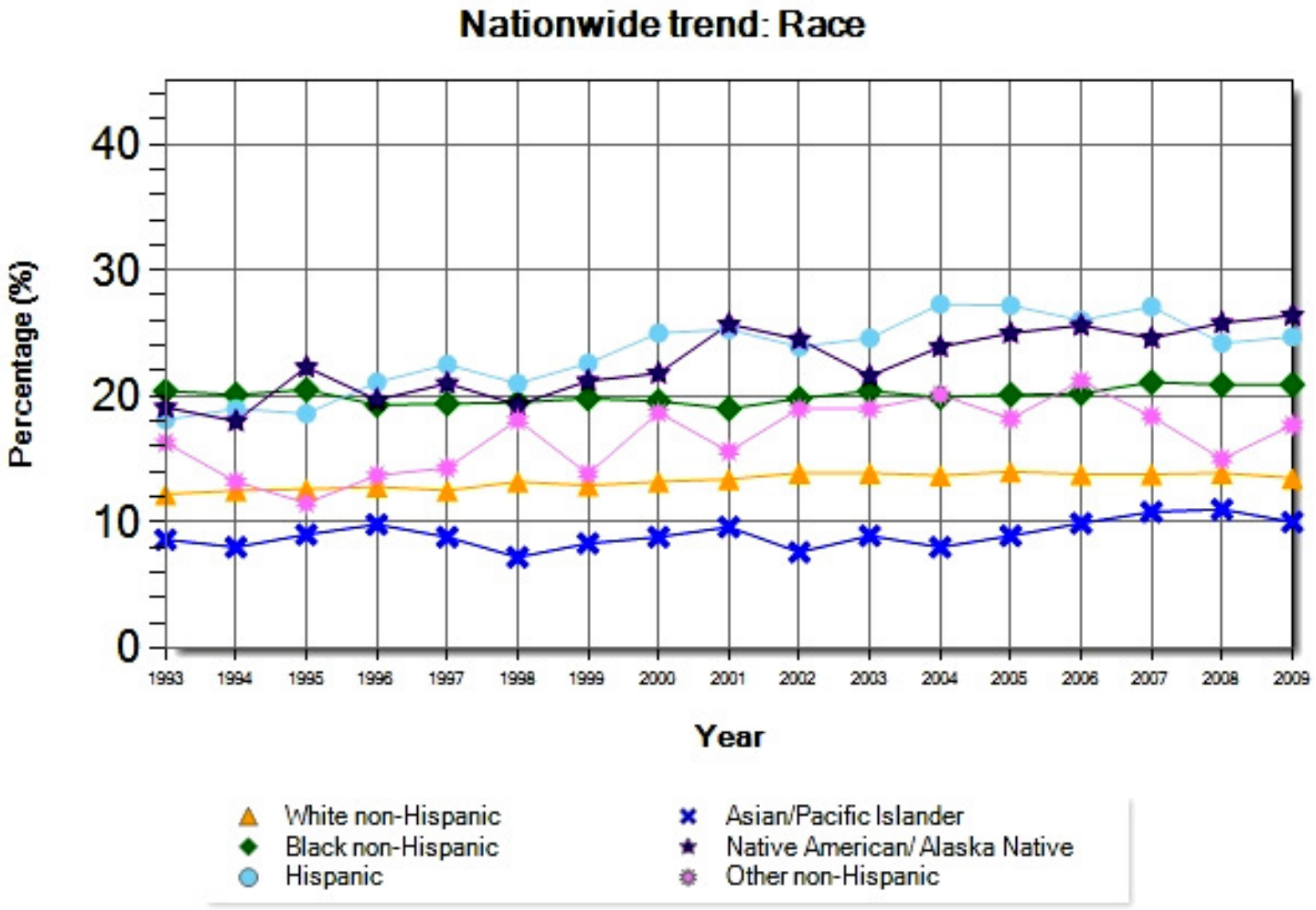

USA 2007

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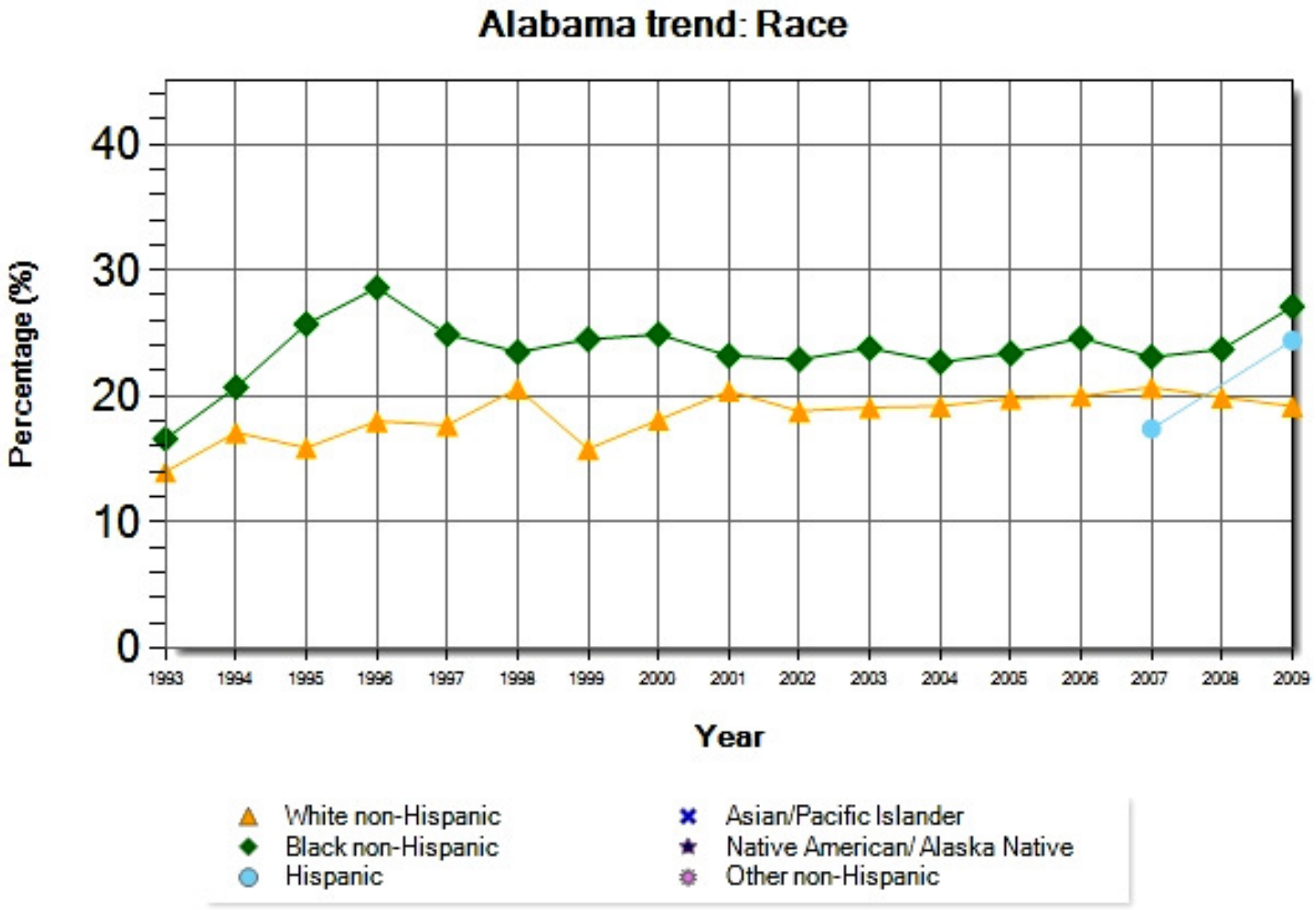
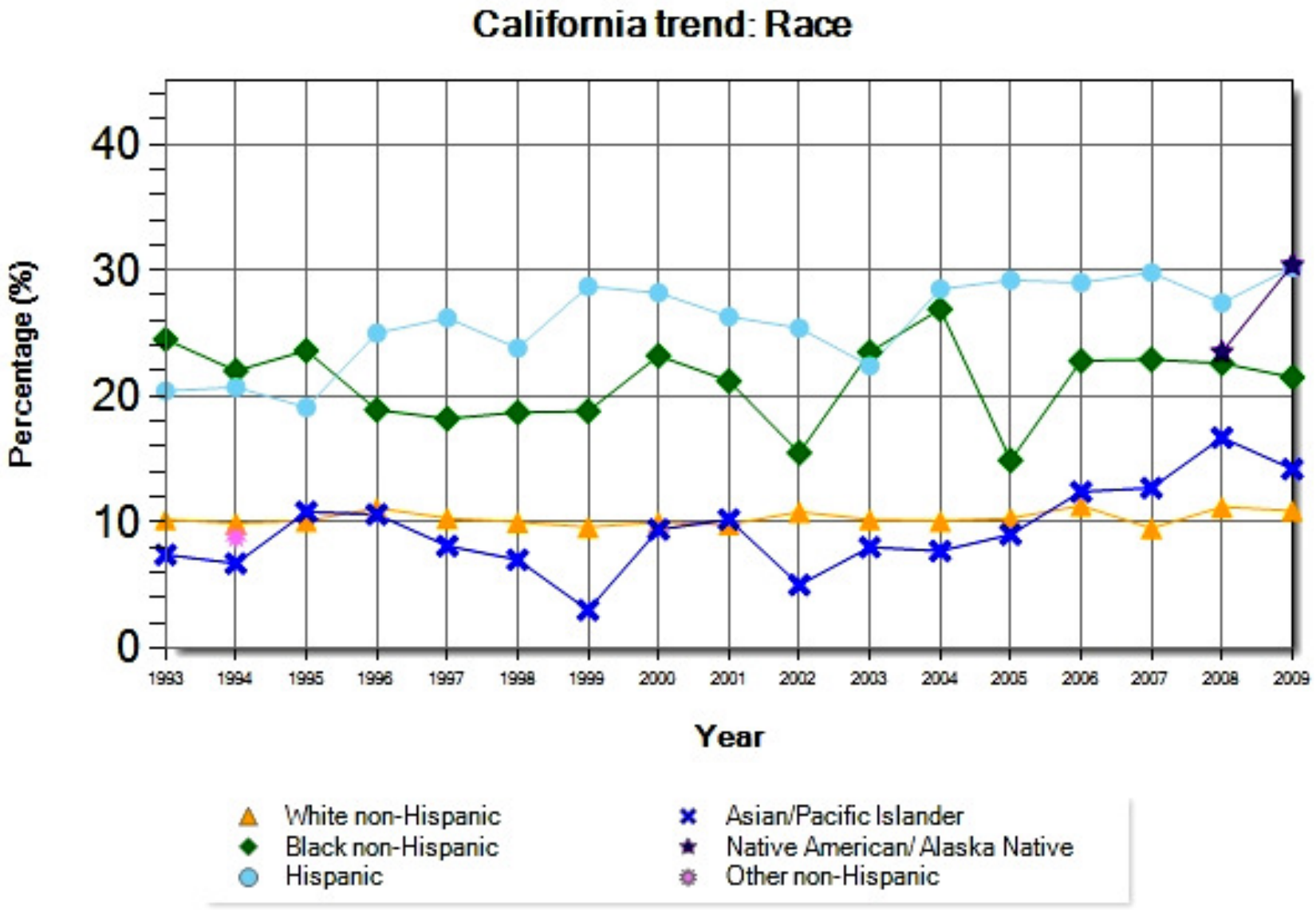


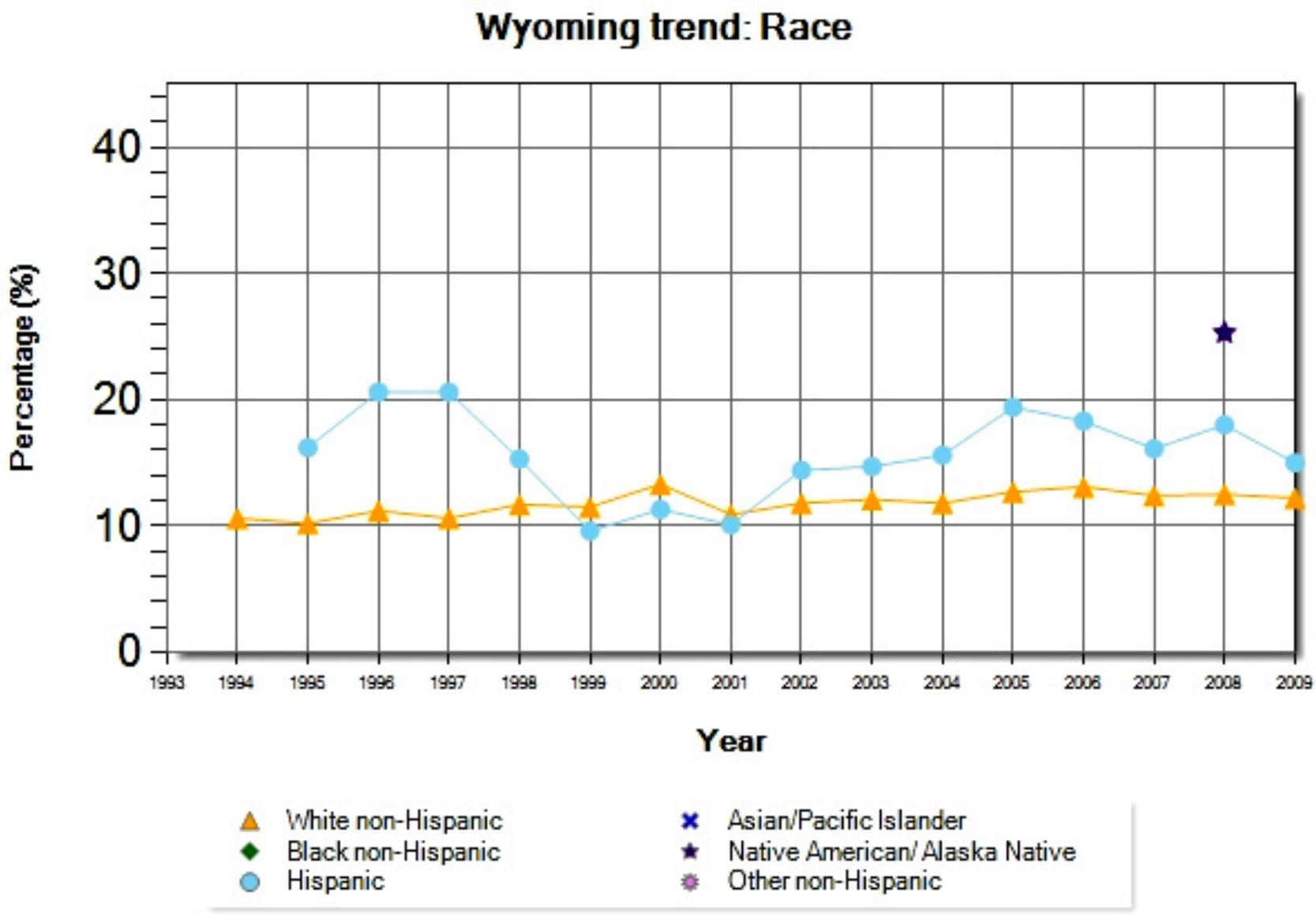
USA 2007

Percentage with fair or poor self-rated health



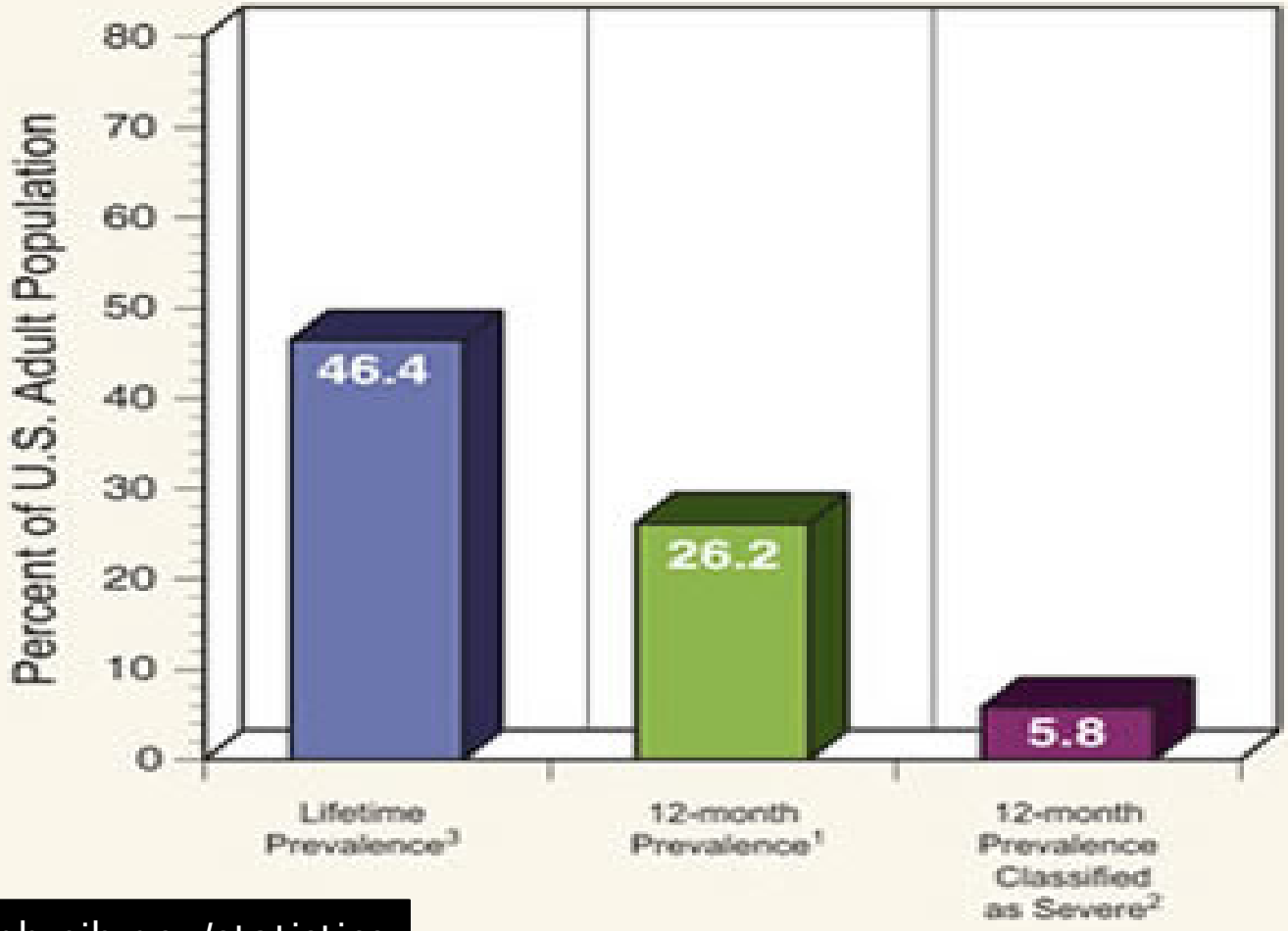
USA 2007

Percentage with fair or poor self-rated health



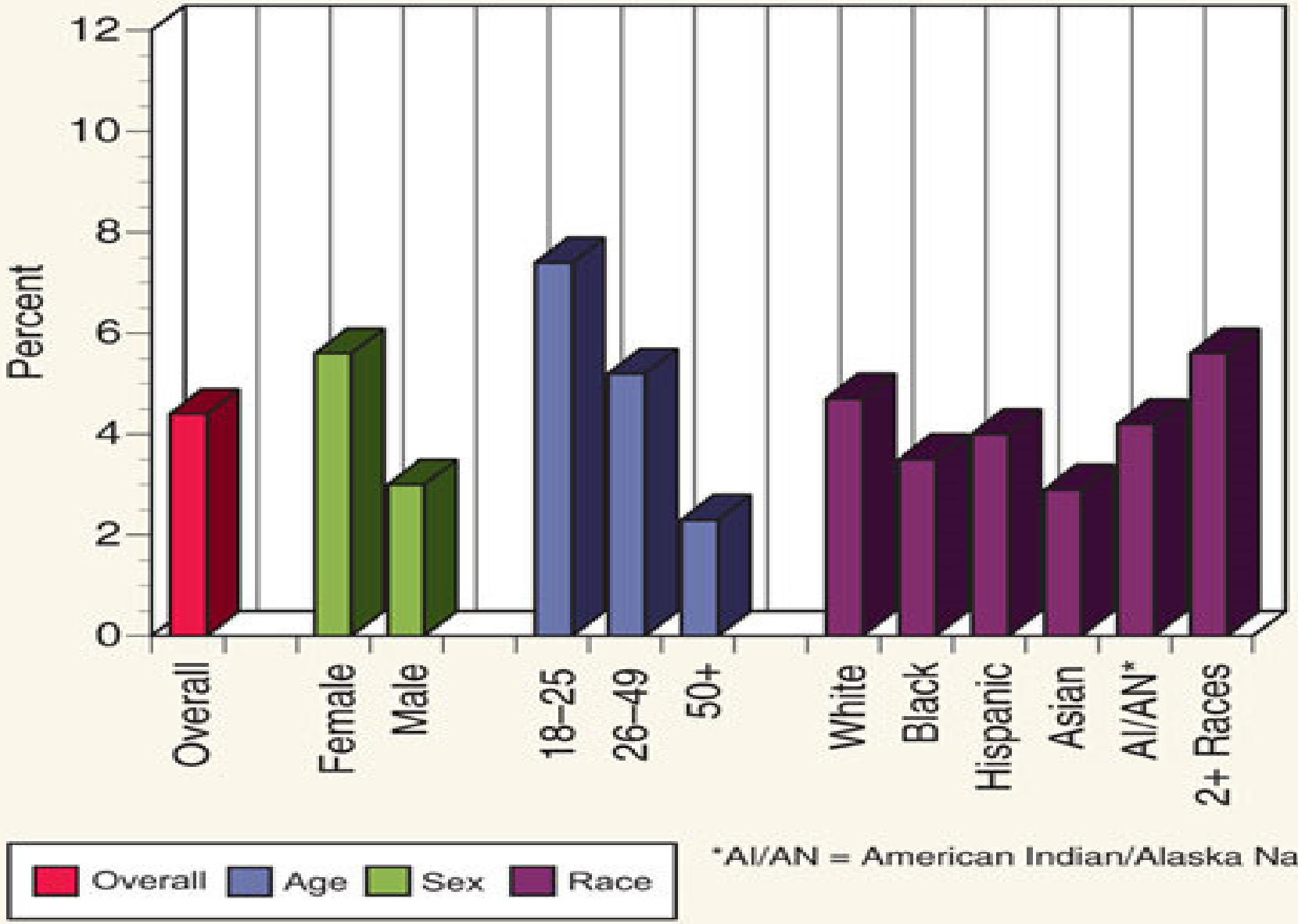
Mental illness Prevalence

- **12-month Prevalence:** 26.2% of U.S. adult population[1]
- **Severe:** 22.3% of these cases (e.g., 5.8% U.S. adult population) are classified as "severe"[2]



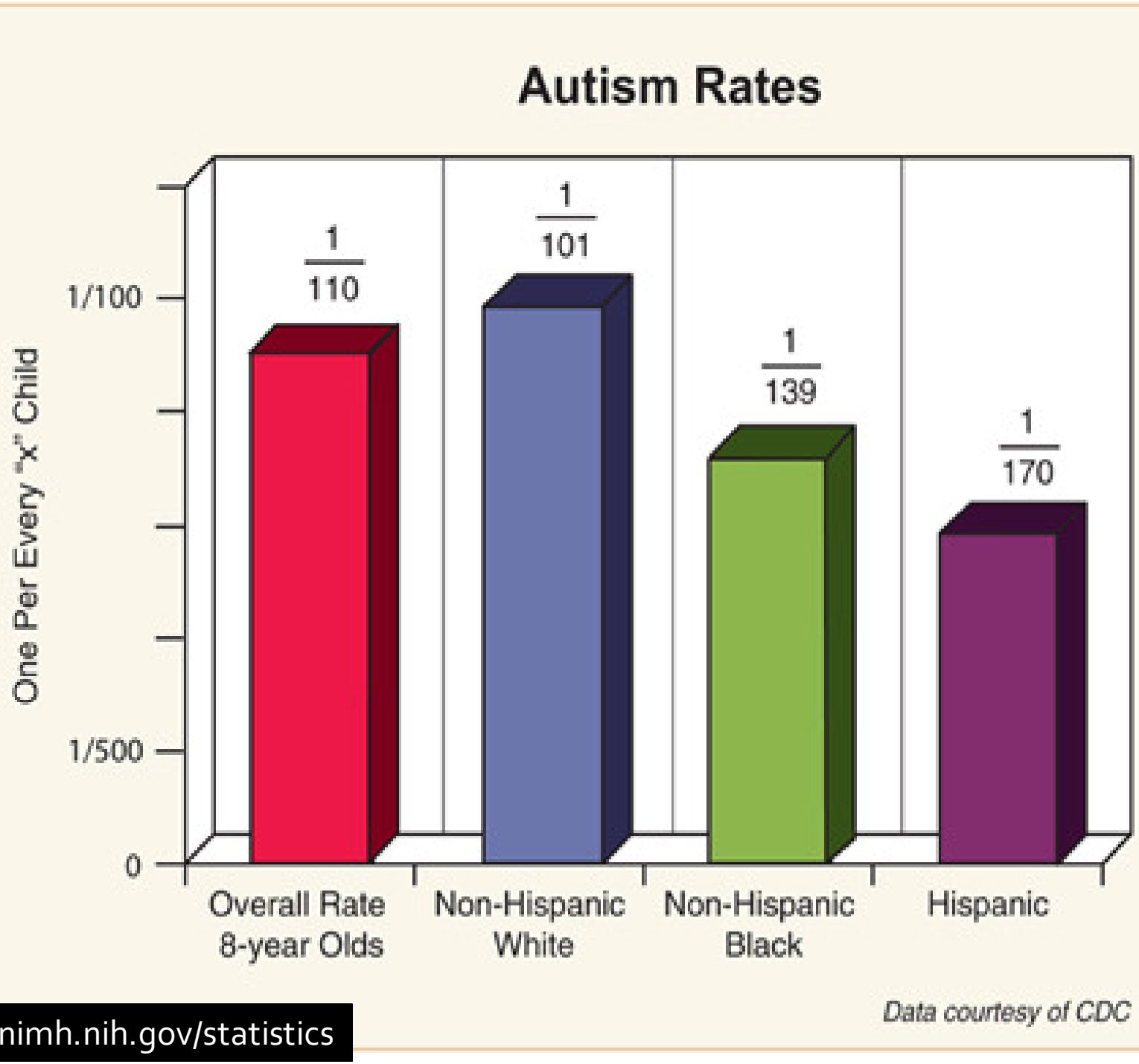
www.nimh.nih.gov/statistics

Prevalence of Serious Mental Illness Among U.S. Adults by Sex, Age, and Race in 2008



*AI/AN = American Indian/Alaska Native

Data courtesy of SAMHSA

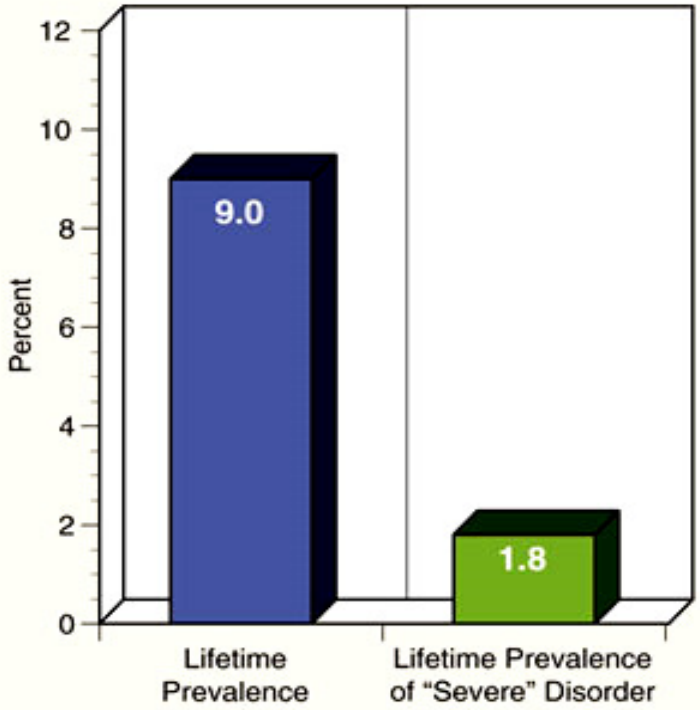


www.nimh.nih.gov/statistics

Attention Deficit Hyperactivity Disorder

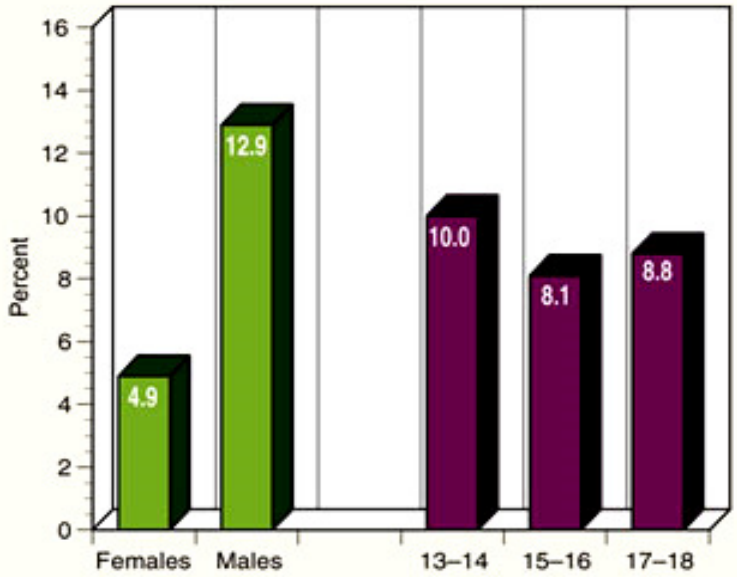
Lifetime Prevalence of 13 to 18 year olds

- **Lifetime Prevalence:** 9.0% of 13 to 18 year olds
- **Lifetime Prevalence of "Severe" Disorder:** 1.8% of 13 to 18 year olds have a "severe" disorder



Demographics (for lifetime prevalence)

- **Sex and Age**



- **Race:** Not Reported

Merikangas KR, He J, Burstein M, Swanson SA, Avenevoli S, Cui L, Benjet C, Georgiades K, Swendsen J. Lifetime prevalence of mental disorders in U.S. adolescents: Results from the National Comorbidity Study-Adolescent Supplement (NCS-A). *J Am Acad Child Adolesc Psychiatry.* 2010 Oct;49(10):980-989.

www.nimh.nih.gov/statistics

Unintentional Injuries

"Injuries, unintentional or intentional, constitute a major public health problem, killing more than 5 million people worldwide each year and causing many more cases of disability. People from all economic groups suffer fatal injuries, but death rates due to injury tend to be higher in those in the lower income groups. The poor are also less likely to make a full recovery following an injury."

"Historically, the injury problem has been neglected, largely because injuries were viewed as accidents or random events. Today, however, injuries are known to be preventable. The use of seat belts, car seats for children, designated drivers, fencing around water areas, flame-resistant clothing and smoke detectors, together with early childhood education and family counselling to prevent violence have all proved to be effective measures for preventing injuries."
www.who.int/violence_injury_prevention

Unintentional Injuries USA DEATHS http://www.cdc.gov/injury/wisqars/index.html

Rank /Age →	<1	1-4	5-9	10-14	15-24	25-34	35-44	45-54
1	Congenital Anomalies 5,785	Unintentional Injury 1,588	Unintentional Injury 965	Unintentional Injury 1,229	Unintentional Injury 15,897	Unintentional Injury 14,977	Unintentional Injury 16,931	Malignant Neoplasms 50,167
2	Short Gestation 4,857	Congenital Anomalies 546	Malignant Neoplasms 480	Malignant Neoplasms 479	Homicide 5,551	Suicide 5,278	Malignant Neoplasms 13,288	Heart Disease 37,434
3	SIDS 2,453	Homicide 398	Congenital Anomalies 196	Homicide 213	Suicide 4,140	Homicide 4,758	Heart Disease 11,839	Unintentional Injury 20,315
4	Maternal Pregnancy Comp. 1,769	Malignant Neoplasms 364	Homicide 133	Suicide 180	Malignant Neoplasms 1,653	Malignant Neoplasms 3,463	Suicide 6,722	Liver Disease 8,212
5	Unintentional Injury 1,285	Heart Disease 173	Heart Disease 110	Congenital Anomalies 178	Heart Disease 1,084	Heart Disease 3,223	HIV 3,572	Suicide 7,778
6	Placenta Cord Membranes 1,135	Influenza & Pneumonia 109	Chronic Low. Respiratory Disease 54	Heart Disease 131	Congenital Anomalies 402	HIV 1,091	Homicide 3,052	Cerebro-vascular 6,385

Population Aging

Impact on health and the health care system

Key Facts about Aging:

✓The world's population is growing—and aging.

✓Very low birth rates in developed countries, coupled with birth rate declines in most developing countries, are projected to increase the population ages 65 and over to the point in 2050 when it will be 2.5 times that of the population ages 0-4.

✓This is an exact reversal of the situation in 1950.

www.PRB.Org

www.PRB.Org

YOUNGEST	% AGES <15
Niger	50.1
Uganda	48.7
Burkina Faso	46.4
Congo, Dem. Rep.	46.4
Zambia	46.2
Malawi	45.9
Afghanistan	45.9
Chad	45.6
Somalia	44.9
Tanzania	44.7

USA	29

www.PRB.Org

OLDEST	% AGES 65+
Japan	22.6
Germany	20.5
Italy	20.4
Sweden	18.3
Greece	18.3
Portugal	17.9
Bulgaria	17.6
Austria	17.6
Latvia	17.4
Belgium	17.4

USA	**13**

Facts…..contd

www.PRB.Org

✓In 1950, there were 335 million children in the 0-4 age group and just 131 million people ages 65+.

✓According to United Nations Population Division estimates for mid-2010, there were 642 million persons ages 0-4 and 523 million ages 65+.

✓That is, of course, quite a change. The UN also projects that, for the first time in history, the 0-4 age group will decline between 2015 and 2020, having peaked at around 650 million.

✓The 65+ population is projected to exceed the 0-4 population during that same five-year period, rising from 601 million in 2015 to 714 million in 2020, although precisely when that happens will depend on how fast birth rates in developing countries decline. See animation

http://www.prb.org/Articles/2011/agingpopulationclocks.aspx

USA Implications for Health Care

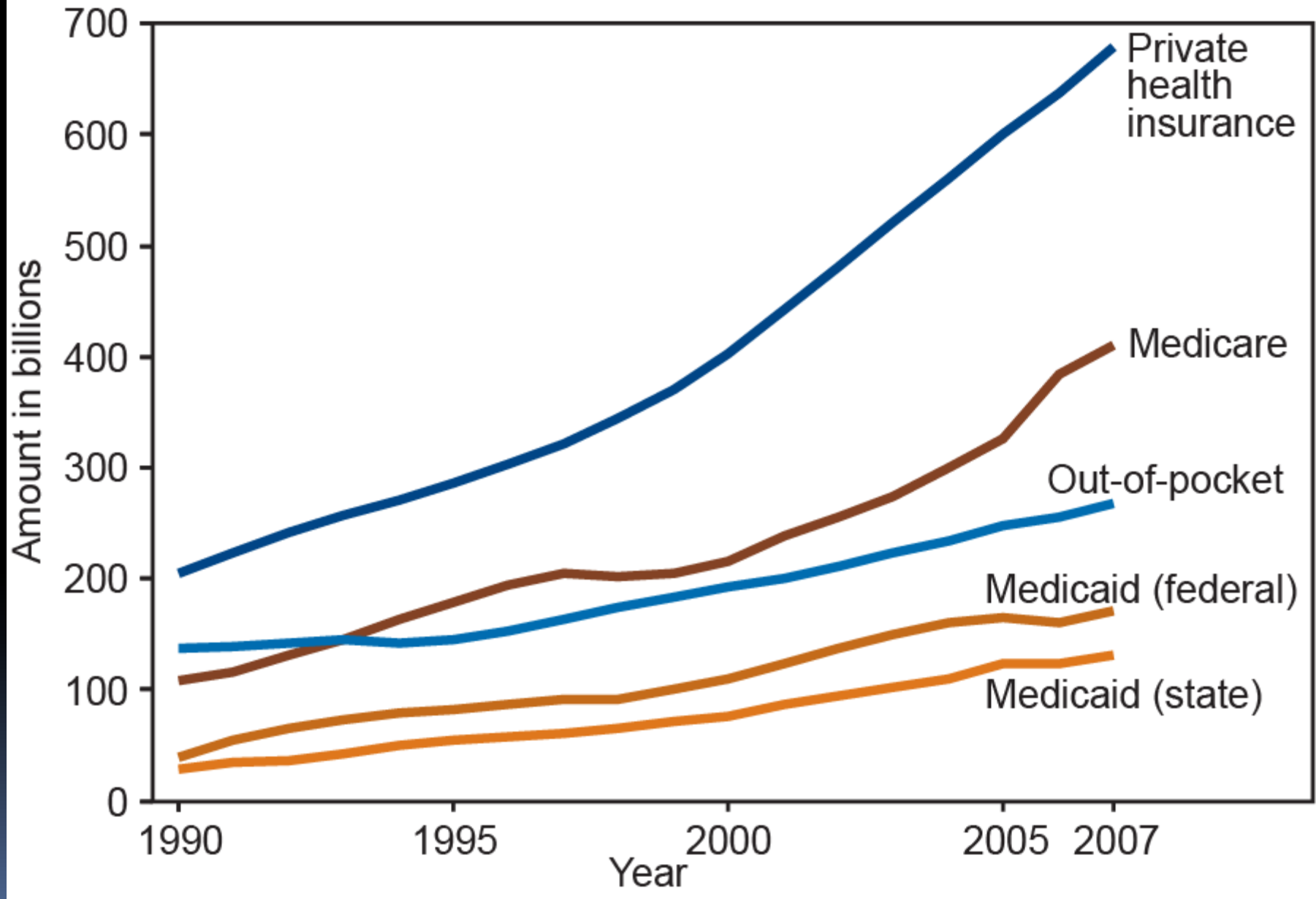
✓The growing number of older adults increases demands on the public health system and on medical and social services.

✓Chronic diseases, which affect older adults disproportionately, contribute to disability, diminish quality of life, and increased health- and long-term--care costs.

✓Increased life expectancy reflects, in part, the success of public health interventions , but public health programs must now respond to the challenges created by this achievement, including the growing burden of chronic illnesses, injuries, and disabilities and increasing concerns about future caregiving and health-care costs.

http://www.cdc.gov

Growth in personal health care expenditures



SOURCE: CDC/NCHS, *Health, United States, 2009*, Figure 22. Data from the Centers for Medicare & Medicaid Services.

Example hip and knee replacement

US dept. of health and human services