Healthy Hearts, Healthy Lungs: Living Longer and Living Better

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Goals

➢ Understand the Societal impact of **Air Pollution** and **Smoking**

➢ Specifically, *their* impact on **Lung Cancer**

➢ Understand the Societal impact of **Heart Disease**

➢ How to have a Healthy Heart with focus on **Nutrition** and **Exercise**

➢ Introduce **Newer Surgical Treatment options** available for Lung Disease such as **Video-Assisted Thorascopic Surgery (VATS) Lobectomy**

➢ Introduce **Surgical Treatment options** available for Heart Disease such as **Off-pump Coronary Artery Bypass Grafting (OPCABG), Robotic Surgery** and **Endoscopic Vein Harvesting (EVH)**

Air Pollution

Air Pollution

Two types dominate the problem in the US: Ozone and Particle Pollution

Ozone

- ➢ **Extremely reactive gas molecule**
- ➢ **Primary ingredient in smog air pollution**
- ➢ **Very harmful to breathe**
- ➢ **Attacks lung tissue by reacting chemically with it**

- ➢ **At risk from breathing Ozone**
    - ➢ **Children and Teens**
    - ➢ **Age 65 and older**
    - ➢ **People who work or exercise outdoors**
    - ➢ **People with existing lung disease (COPD, Asthma)**
    - ➢ **"*Responders*" who are healthy but react more strongly to ozone**
    - ➢ **Some segments of society (high unemployment, high public transit use, and African Americans) face higher risks from dying prematurely secondary to ozone pollution**

Air Pollution

- **Harm to your Health**
  - **Shortness of breath**
  - **Chest pain with inhalation**
  - **Wheezing or Coughing**
  - **Asthma**
  - **Increased susceptibility to respiratory infections and pulmonary inflammation**
  - **Increased need for people with lung disease to go to the hospital**
  - **<u>Reduced lung function</u>**
    - **Decreased lung function in college freshman who were lifelong residents of Los Angeles or San Francisco**

  - **Increased risk or heart attacks, arrhythmias, stroke, and premature death**

  - **<u>Premature death</u>**
    - ***3700 deaths / yr* with 10 parts per billion increase in ozone level**

Air Pollution

Particle Pollution

➢ EPA regulates particle pollution as $PM^{2.5}$ (fine particles) and PM^{10} (all particles 10 micrometers or less in diameter).

  ➢ **Prenatal Harm**
     ➢ Increased risk of preterm births with chronic exposure to high levels of air pollution during the last 6 weeks of pregnancy

  ➢ **Newborn Harm**
     ➢ Air pollution may increase the risk of sudden death syndrome (SIDS)
     ➢ May increase risk of babies born with low birth weight

     ➢ Prolonged exposure to Fine Particle Pollution Increases Odds of Severe Infant Bronchiolitis

     For each 10 ug/m^3 in $PM^{2.5}$, risk of bronchiolitis increased by **9%**

Air Pollution

Particle Pollution

- **Harm to Children**
    - **Long term exposure to air pollutants associated with increased risk of asthmatic bronchitis, hay fever, eczema, and allergic sensitization**
    - **Worsening of Asthma**
    - **Increased prevalence and incidence of cough and bronchitis**
    - **Increased risk of upper / lower respiratory infections**
    - **Exacerbates cystic fibrosis**
    - **Diesel school buses expose children to four times the diesel exhaust versus car**

- **Short and Long-term decreased lung function**
    - **1759 children age 10-18 in Southern California who grew up in more polluted areas had an average drop in lung function 20% below what was expected for the child's age**

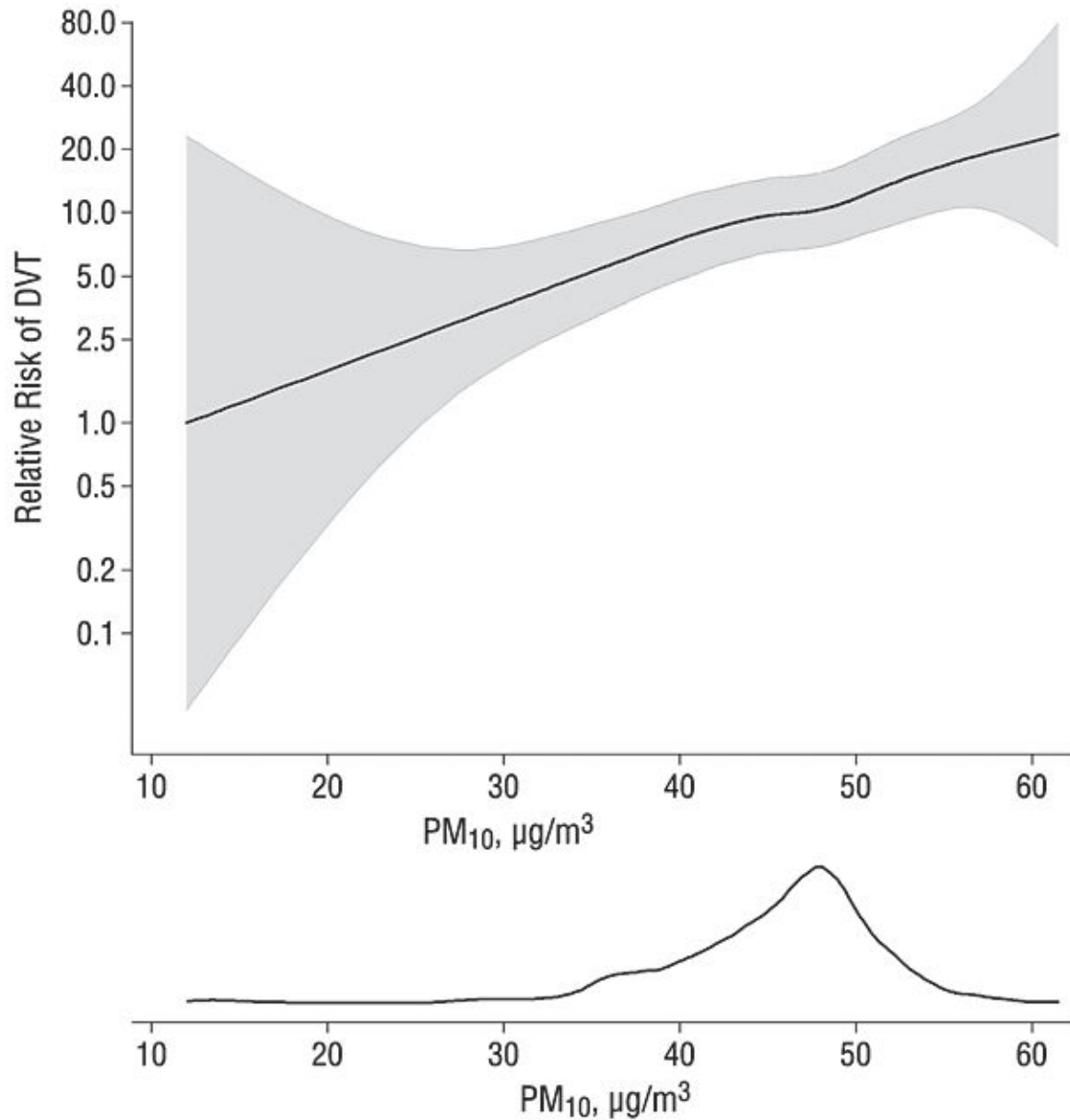# Air Pollution

Particle Pollution

- **Harm to Adults**
  - **California** Air Resources Board estimates premature deaths in California from particle pollution at **14,000 – 24,000 annually** with the possibility of as high as **41,000 annually**

  - Dutch and British studies confirm that Long-term exposure to Air Pollution is **Deadly** and **Shortens lives**

  - Long term exposure to air pollution, especially from highway traffic appears to **increase women's risk of lower lung function, COPD, and premature death from cardiopulmonary causes**

  - Pollution from heavy highway traffic contributes to **higher risks for heart attacks, allergies, premature births, and death of newborns**

  - Long-term exposure to Air Pollution **Increases risk of Developing COPD**

Air Pollution

Particle Pollution

- <u>**Harm to Adults**</u>

  - Truck drivers, dockworkers, and railroad workers face higher risk of death from lung cancer, heart disease, and COPD from breathing diesel emissions on the job.

    - 50,000 members of Teamsters Union
    - Smoking rates were similar to general population

    - 49% higher death rate from heart disease for <u>truck drivers</u>
    - 32% higher death rate from heart disease for <u>dockworkers</u>
    - 10% higher Lung cancer death rate for both truck drivers and dockworkers

Particle Pollution may **increase the risk of Blood Clots** in the Legs

Italian study of 870 patients with DVT's compared to 1210 controls

Showed that an increase of 10 ug/m³ increased the risk of blood clots in the legs by 70 percent

Air Pollution

- **Data from Women's Health Initiative**: 36 US cities / 66,000 women
- **Risk of Fatal and Nonfatal Cardiovascular Events Increases with increasing air pollution levels**
    - **For every increase of 10 ug/m³ in PM²·⁵, 76% increased risk of death from cardiovascular disease**
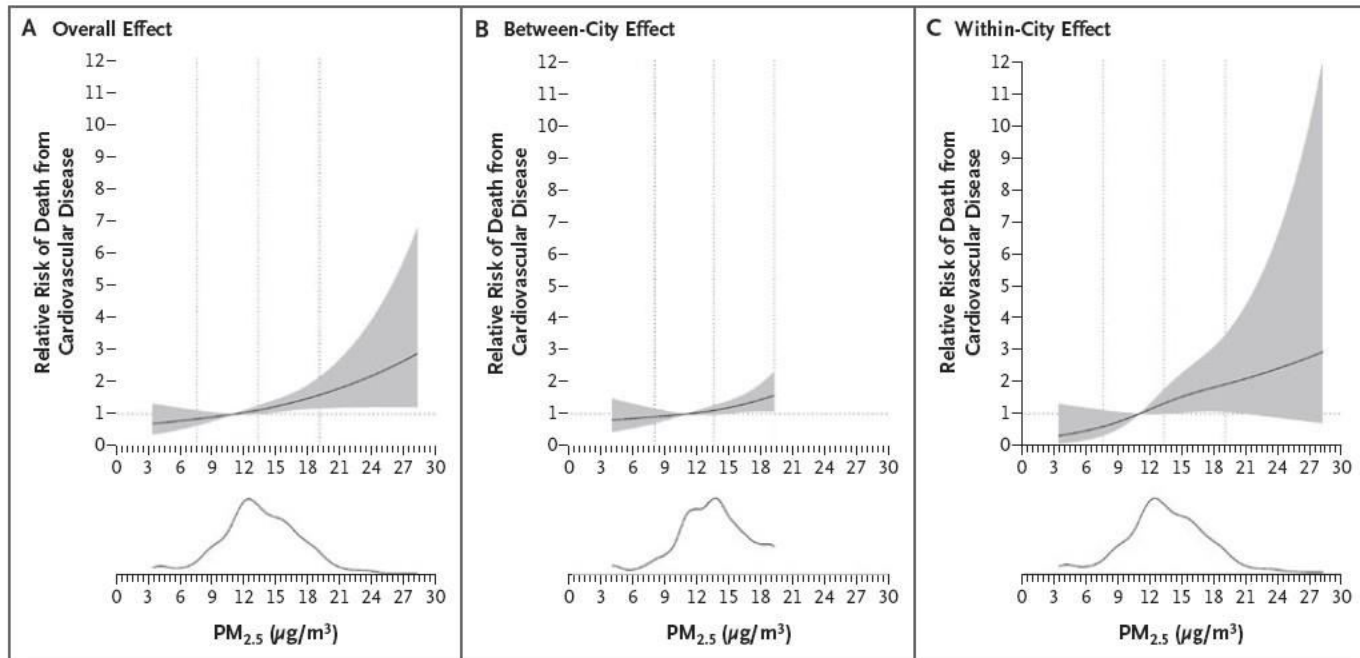

Figure 1. Level of Exposure to Fine Particulate Matter and the Risk of Death from Cardiovascular Causes in Women.

The graphs demonstrate the observed relationship between the risk of death from cardiovascular disease and the level of particulate matter of less than 2.5 μm in aerodynamic diameter (PM₂.₅), including both definite and possible deaths from coronary heart disease or cerebrovascular disease. Panel A shows the overall relationship between the PM₂.₅ level and death, Panel B the effects between metropolitan areas, and Panel C the effects within metropolitan areas, with an indicator variable used to adjust for each city. These results suggest a generally linear relationship between exposure and risk, though the 95% confidence intervals (shaded areas) are wide at the extremes of exposure. Risk is depicted in comparison with a reference value of 11 μg per cubic meter. The histogram in each panel illustrates the density of exposure distribution for air pollution. All estimates are adjusted for age, race or ethnic group, educational level, household income, smoking status, systolic blood pressure, body-mass index, and presence or absence of a history of diabetes, hypertension, or hypercholesterolemia.
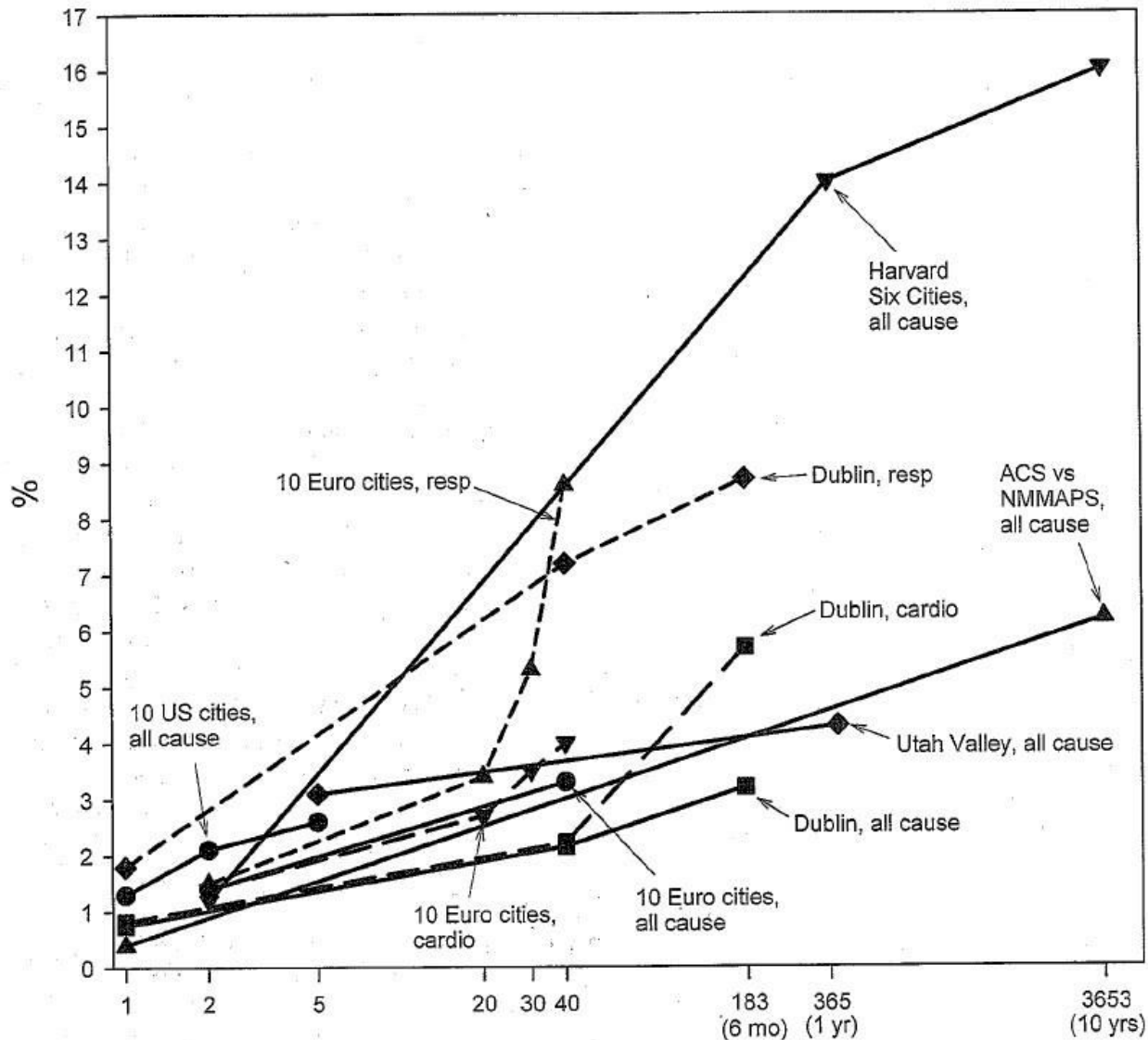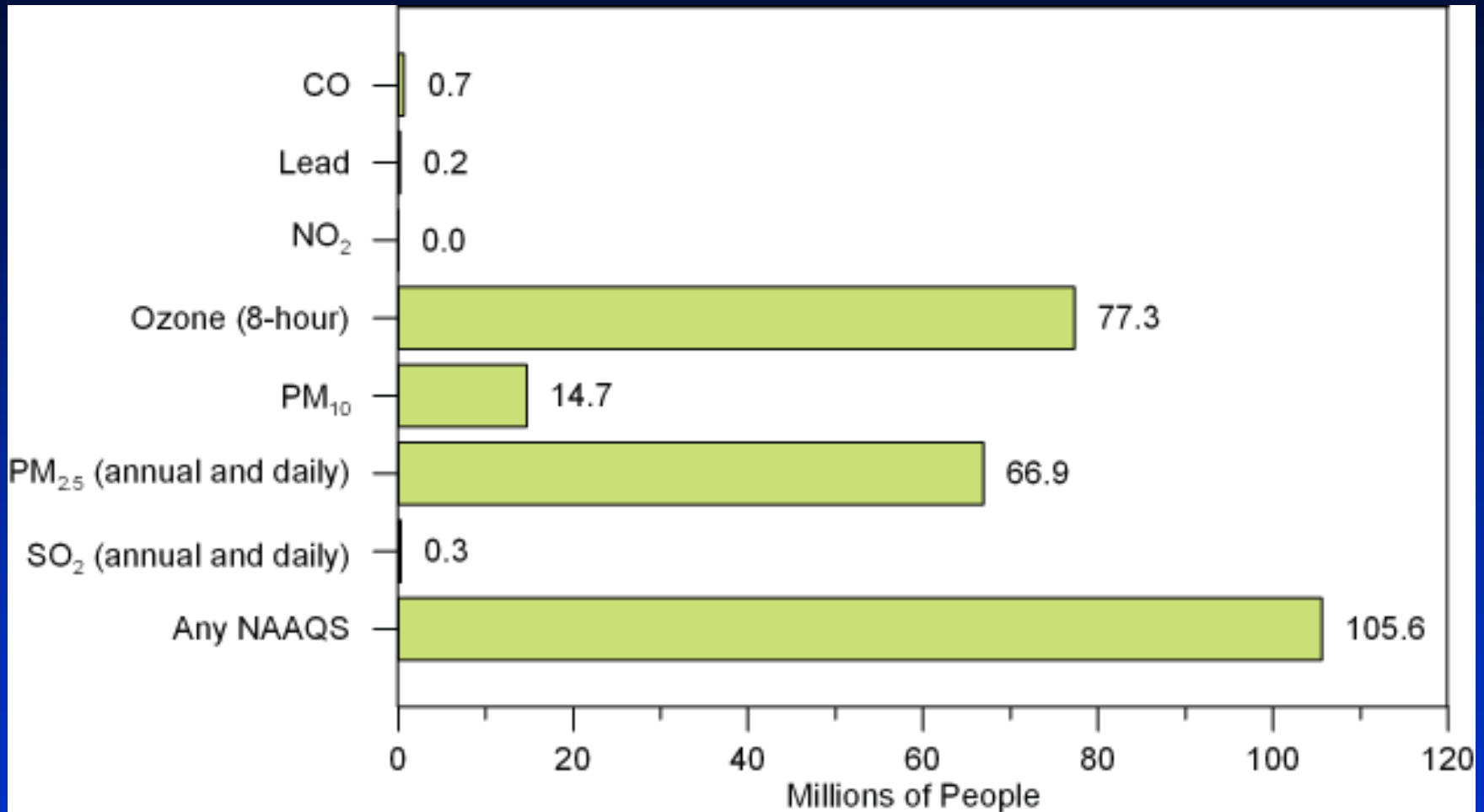
Air Pollution

FIG. 1. Comparison of percent change in risk of mortality associated with an increment of 10 $\mu g/m^3$ PM$_{2.5}$ or 20 μ/m^3 PM$_{10}$ or BS estimated for different time scales of exposure (approximate number of days, log scale).

Air Pollution

Number of people living in counties with air quality concentrations **above** the level of the primary National Ambient Air Quality Standards (NAAQS) in 2006.

What to Do about Air Pollution

Protect Yourself

➢ **Pay attention to forecasts for high air pollution days to know when to take precautions**

➢ **Avoid exercising near high-traffic areas**

➢ **Avoid exercising outdoors when pollution levels are high, or substitute an activity that requires less exertion**

➢ **Do not let anyone smoke indoors and support measures to make all places smoke-free**

➢ **Reduce the use of fireplaces and wood-burning stoves.**

Clean up Pollution

➢ **Atlanta Georgia during 1996 Olympics**

➢ **Reduced traffic during the Olympics succeeded in not just reducing congestion, but in improving the health of children with asthma**

➢ **City brought in more buses, more subway cars, and encouraged ridesharing and telecommuting during the Summer Olympic Games**

➢ **These measures created a prolonged period of low ozone pollution that resulted in significantly lower rates of childhood asthma events for children aged 1–16**

➢ **The number of asthma acute care events (e.g., treatment and hospitalization) decreased 42 percent in the Georgia Medicaid claims files**

Air Pollution

➢ **Long-term improvement in Air Quality Benefits Lung function**

➢ **Reduction in PM$^{2.5}$ concentrations Would Increase Life Expectancy**

  ➢ **Harvard Six Cities Study found that the deaths associated with exposure to fine particles occur primarily within two years of exposure, implying that reductions in air pollution levels can be expected to produce rapid improvements in public health**

➢ **Multiple studies and experts agree that reductions in air pollution levels with have an impact in the public health sector in years not decades of the reduction**

Smoking

Smoking

Smoking Facts

- **Smoking is the most important preventable cause of morbidity and premature mortality Worldwide**

- **438,000 Americans die each year from smoking related diseases**
- **Smoking is responsible for more than one in five US deaths**
- **About ½ of all regular smokers will die from the addiction**
- **Smoking costs the United States $193 billion in 2004**

- **Cigarette smoke contains over 4800 chemicals, of which 69 are known to cause cancer**

- **Smoking is directly responsible for 90% of the 161,000 Lung Cancer deaths**
- **Smoking is directly responsible for 80-90% of the 127,000 COPD deaths**
- **Smoking is major risk factor for Coronary artery disease, stroke, and lower respiratory infections**

Smoking

Smoking Facts

- Smoking reduces the normal life expectancy by an average of 13-15 years

- 8.6 million Americans have a smoking related illness

- This means that for every 1 American who dies from smoking related disease, there are 20 more people who suffer from a smoking related disease

List of diseases caused by smoking

COPD

Coronary Artery Disease

➢ **60 % Higher Risk of dying from heart attack in smokers over 65** than non smokers

Stroke

➢ **Men** over 65 who smoke are **twice as likely to die from stroke** than non smokers

➢ **Women** over 65 who smoke are **1 ½ times as likely to die from stroke** than non smokers

AAA

Acute Myeloid Leukemia

Cataracts → **2-3 times the risk higher in smokers**

Pneumonia

Periodontitis

Bladder cancer

Esophageal cancer

Laryngeal cancer

Lung cancer

Oral cancer

Throat cancer

Cervical cancer

Kidney cancer

Stomach cancer

Pancreatic cancer

Infertility

Peptic Ulcer Disease

Slow wound healing

Dementia / Alzheimer's

➢ **Smokers have far greater chance of developing dementia than nonsmokers**

Smoking

- **Worldwide**

  - **Tobacco is leading cause of preventable death worldwide**
  - **Tobacco kills more than HIV/AIDS, Tuberculosis, and Malaria**
    COMBINED

  - **Tobacco responsible for 5 million deaths each year and will increase to 8 million / year in 2030**

  - **Tobacco was responsible for 100 million deaths in the 20th Century**
  - **With current usage, tobacco could kill 1 billion people in the 21st Century**

  - **48% Men versus 10% Women smoke**

  - **China: 63% Men versus 3.8% Women → 300 million people smoke in China which is more than the entire US population**
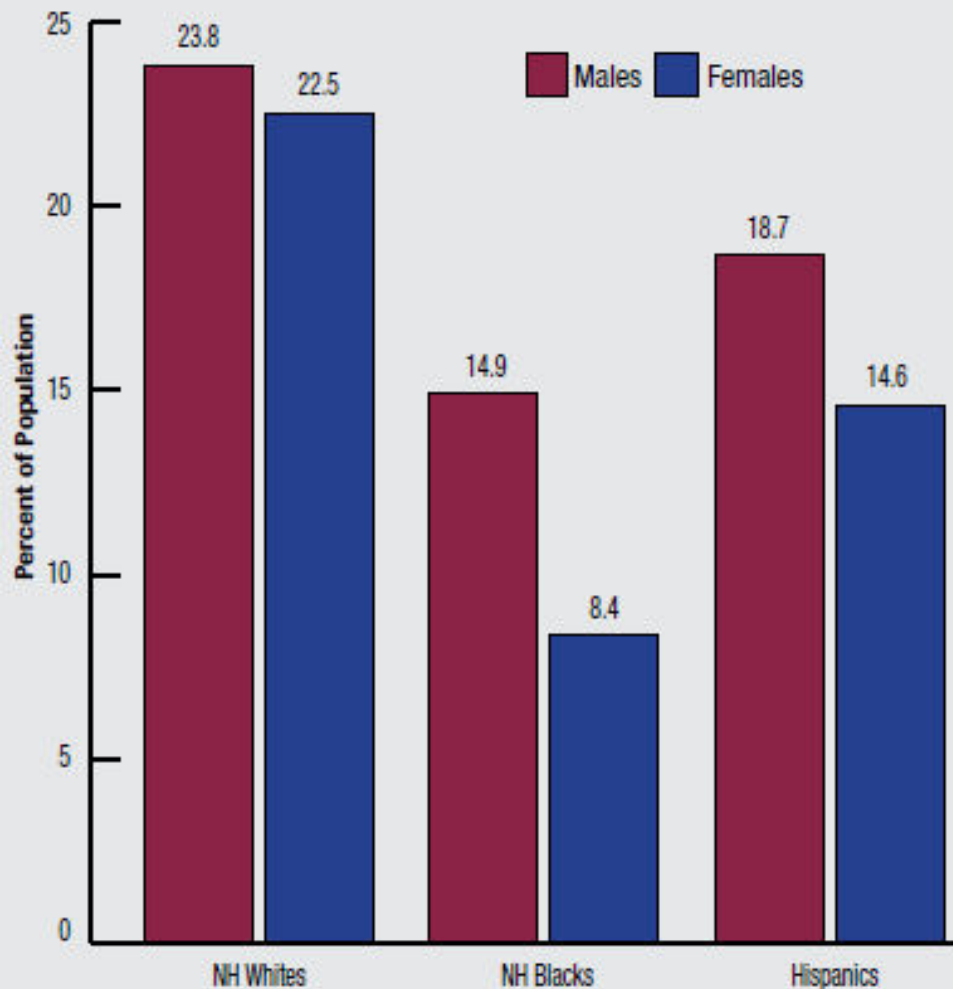
Smoking

Smoking Facts

- **45.3 million** Americans (**20.6 % of adults**) were <u>current smokers</u> in 2006
- **45.7 million** Americans were <u>former smokers</u> in 2006

- Prevalence of smoking decreased 40% between 1965 and 1990, but has been **UNCHANGED** since

Males	23.6%
Females	17.8%
American Indians/ Alaskan Natives	32.2%
Whites	21.8%
Blacks	22.6%
Hispanics	15.1%
Asians	10.3%

Prevalence of Students in Grades 9–12 Reporting Current Cigarette Use by Sex and Race/Ethnicity. YRBS: 2007

Source: MMWR Surveill Summ. 2008;57:1-131. NH indicates non-Hispanic.

2007

20% high school students were smokers

6% middle school students were smokers

Smoking

Smoking Facts

➤ <u>2005</u>: **Advertising** by the 5 major tobacco companies totaled **$13.1 billion** → **$35 million / day**

➤ **90%** of adults who smoke start by the age of 21

➤ **50%** became regular smokers by the age of 18

➤ **Average youth in the US is annually exposed to 559 tobacco ads**
  ➤ **617 tobacco ads for every adult female**
  ➤ **892 tobacco ads for every adult African American**

Smoking

- **Smoking in Pregnancy**

  - Smoking accounts for 20-30% of low birth weight
  - 14% of preterm deliveries
  - 10% of all infant deaths
  - 10.7% of women smoked during pregnancy in 2005 (down 45% from 1990)
  - Neonatal health-care costs attributed to maternal smoking is $366 million per year

- Mothers who smoke can pass nicotine to their children through breast milk

Second Hand Smoke

- Described by the EPA as a known human **Group A carcinogen**

- Contains **more than 250 toxic or cancer causing chemicals**, including formaldehyde, benzene, vinyl chloride, arsenic, ammonia, and hydrogen cyanide

- Current Surgeon General report concluded that there is **NO risk free level** of exposure to secondhand smoke

- Second hand smoke even in short exposures can cause platelets to become stickier, damage blood vessel lining, decrease coronary flow velocity, and reduce heart rate variability → all of these can increase the risk of a heart attack

- **3,400 lung cancer deaths / year**
- **46,000 heart disease deaths / year**

Second Hand Smoke

➢ **Smoking by Parents**

    ➢ **Exacerbation of asthma**
    → **400,000 – 1,000,000** asthma episodes per year

    ➢ **Increased frequency of colds and ear infection**
    → **790,000** ear infections per year

    ➢ **Increased risk of respiratory infections**
    → **150,000 - 300,000** lower respiratory infections per year

    ➢ **Increased frequency of Sudden Infant Death Syndrome**
    → **430** cases per year

    ➢ **21 million or 35% of children** live with smokers on a regular basis

What to do about Smoking

QUIT

DO NOT SMOKE

AVOID SECOND HAND SMOKE

What to do about Smoking

➢ <u>**WHO proven policies for effective tobacco control**</u>

    ➢ **Raising taxes and prices**
        ➢ **Price of cigarettes has very significant effect on youth smoking → every 10% increase in price decreased youth consumption by 7%**

    ➢ **Banning advertising, promotion and sponsorship**
    ➢ **Protecting people from secondhand smoke**
    ➢ **Warning everyone about the dangers of tobacco**
    ➢ **Offering help to people who want to quit**
    ➢ **Carefully monitoring the epidemic and prevention policies**

Smoking

Smoking Cessation

- ➤ **Quitting often requires multiple attempts**

- ➤ **Cutting down on cigarettes but not quitting DOES NOT reduce mortality risks from tobacco related illnesses**

- ➤ **Only 5% long term success with quitting "cold turkey"**

- ➤ **Counseling and medication in combination is more effective than either one alone**

- ➤ **There are 7 FDA approved medications to aid in quitting smoking**

Smoking

➤ **20 minutes after last cigarette**:

   blood pressure decreases; pulse rate drops; and body temperature increases

➤ **8 hours after quitting**:

   carbon monoxide level in blood drops to normal; oxygen level in blood increases to normal

➤ **24 hours after quitting**:

   chance of a heart attack decreases

➤ **48 hours after quitting**:

   nerve endings start regrowing; ability to smell and taste is enhanced

➤ **2 weeks to 3 months after quitting**:

   circulation improves; walking becomes easier; lung function increases

➤ **1 to 9 months after quitting**:

   coughing, sinus congestion, fatigue, shortness of breath decreases

Smoking

➤ **1 year after quitting:**
excess risk of coronary heart disease is decreased to half that of a smoker

➤ **5 to 15 years after quitting:**
stroke risk is reduced to that of people who have never smoked

➤ **10 years after quitting:**
risk of lung cancer drops to as little as one-half that of continuing smokers
risk of cancer of the mouth, throat, esophagus, bladder, kidney, and pancreas decreases
risk of ulcer decreases

➤ **15 years after quitting:**
risk of coronary heart disease is now similar to that of people who have never smoked
risk of death returns to nearly the level of people who have never smoked

Smoking

Life Expectancy Benefit

- ➤ <u>**Quit at age 35 years**</u>
- ➤ **Increase in life expectancy versus those who continue to smoke:**
- ➤ **6.9 to 8.5 years for men**
- ➤ **6.1 to 7.7 years for women**

- ➤ <u>**Quit at age 45 years**</u>
- ➤ **Increase in life expectancy versus those who continue to smoke:**
- ➤ **5.6 to 7.1 years for men**
- ➤ **5.6 to 7.2 years for women**

- ➤ <u>**Quit at age 55 years**</u>
- ➤ **Increase in life expectancy versus those who continue to smoke:**
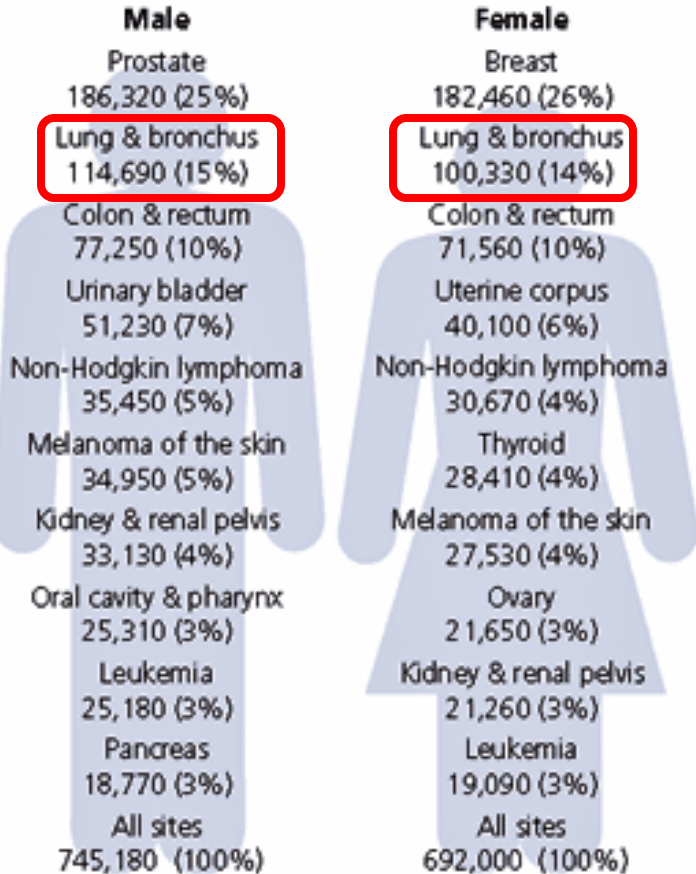- ➤ **3.4 to 4.8 years for men**
- ➤ **4.2 to 5.6 years for women**

- ➤ <u>**Quit at age 65 years**</u>
- ➤ **Increase in life expectancy versus those who continue to smoke:**
- ➤ **1.4 to 2.0 years for men**
- ➤ **2.7 to 3.7 years for women**

Lung Cancer

US Epidemiology

Leading Cancer Sites, Cases 2008

Estimated New Cases*

Male	Female
Prostate 186,320 (25%)	Breast 182,460 (26%)
Lung & bronchus 114,690 (15%)	Lung & bronchus 100,330 (14%)
Colon & rectum 77,250 (10%)	Colon & rectum 71,560 (10%)
Urinary bladder 51,230 (7%)	Uterine corpus 40,100 (6%)
Non-Hodgkin lymphoma 35,450 (5%)	Non-Hodgkin lymphoma 30,670 (4%)
Melanoma of the skin 34,950 (5%)	Thyroid 28,410 (4%)
Kidney & renal pelvis 33,130 (4%)	Melanoma of the skin 27,530 (4%)
Oral cavity & pharynx 25,310 (3%)	Ovary 21,650 (3%)
Leukemia 25,180 (3%)	Kidney & renal pelvis 21,260 (3%)
Pancreas 18,770 (3%)	Leukemia 19,090 (3%)
All sites 745,180 (100%)	All sites 692,000 (100%)

*Excludes basal and squamous cell skin cancers and in situ carcinoma except urinary bladder.

©2008, American Cancer Society, Inc., Surveillance Research

- ➢ **215,020 new cases in the US in 2008**
  - ➢ **114,690 in men**
  - ➢ **100,330 in women**
  - ➢ **Accounts for 15% of all new cancer cases**
  - ➢ **Average age at diagnosis is 71**
  - ➢ **Lifetime risk is 1 in 13 for men and 1 in 16 for women**
- ➢ **161,840 deaths in the US in 2008**
  - ➢ **90,810 men**
  - ➢ **71,030 women**
  - ➢ **Accounts for 29% of all cancer deaths**

Lung cancer is the leading cause of cancer death for both men and women

More people die of Lung cancer than of Colon, Breast, and Prostate cancers COMBINED!

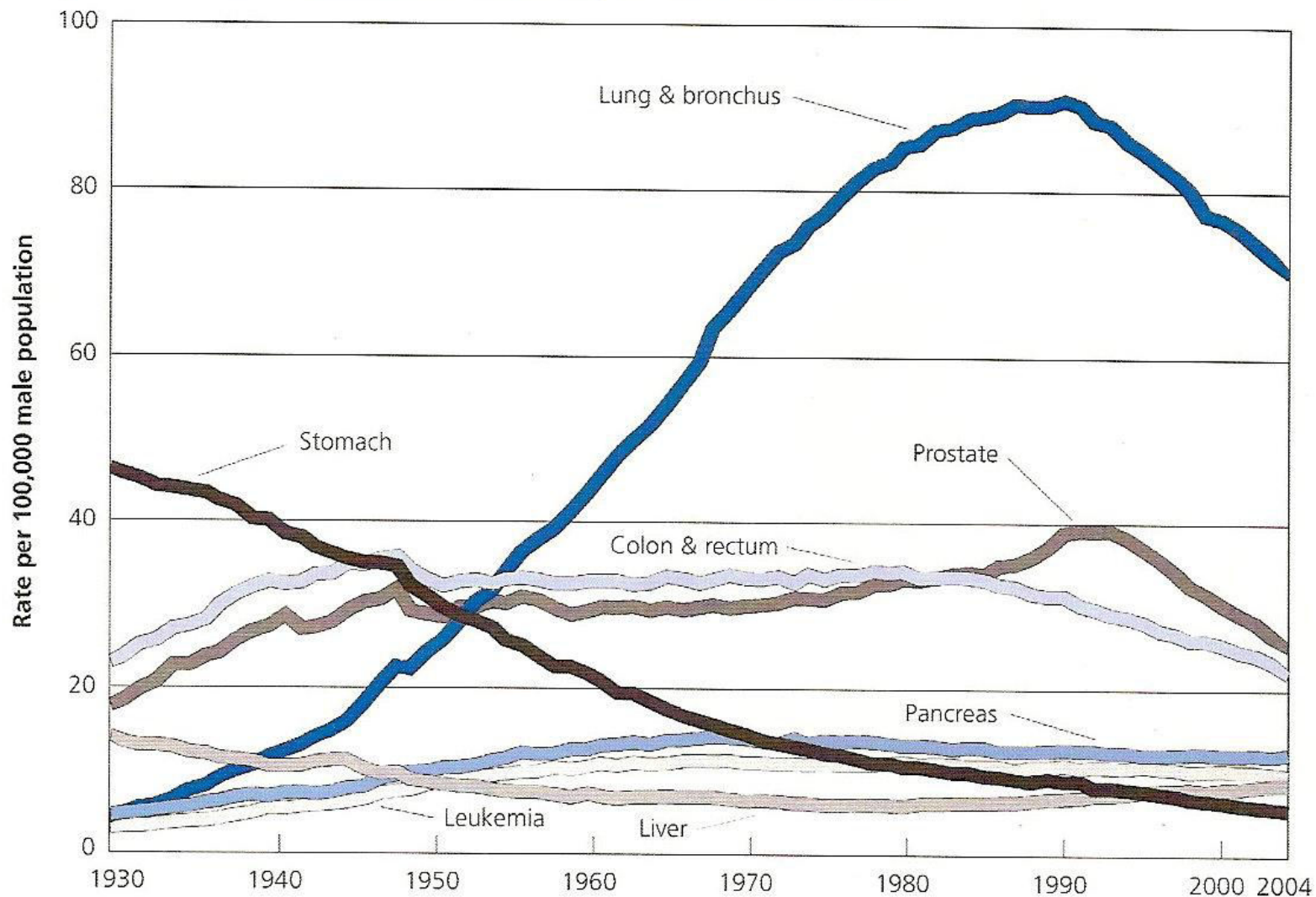**Lung Cancer Deaths in 2008**
161,840

Colon Cancer Deaths =	49,960
Breast Cancer Deaths =	40,480
Prostate Cancer Deaths =	28,660
Combined Cancer Deaths =	**119,100**

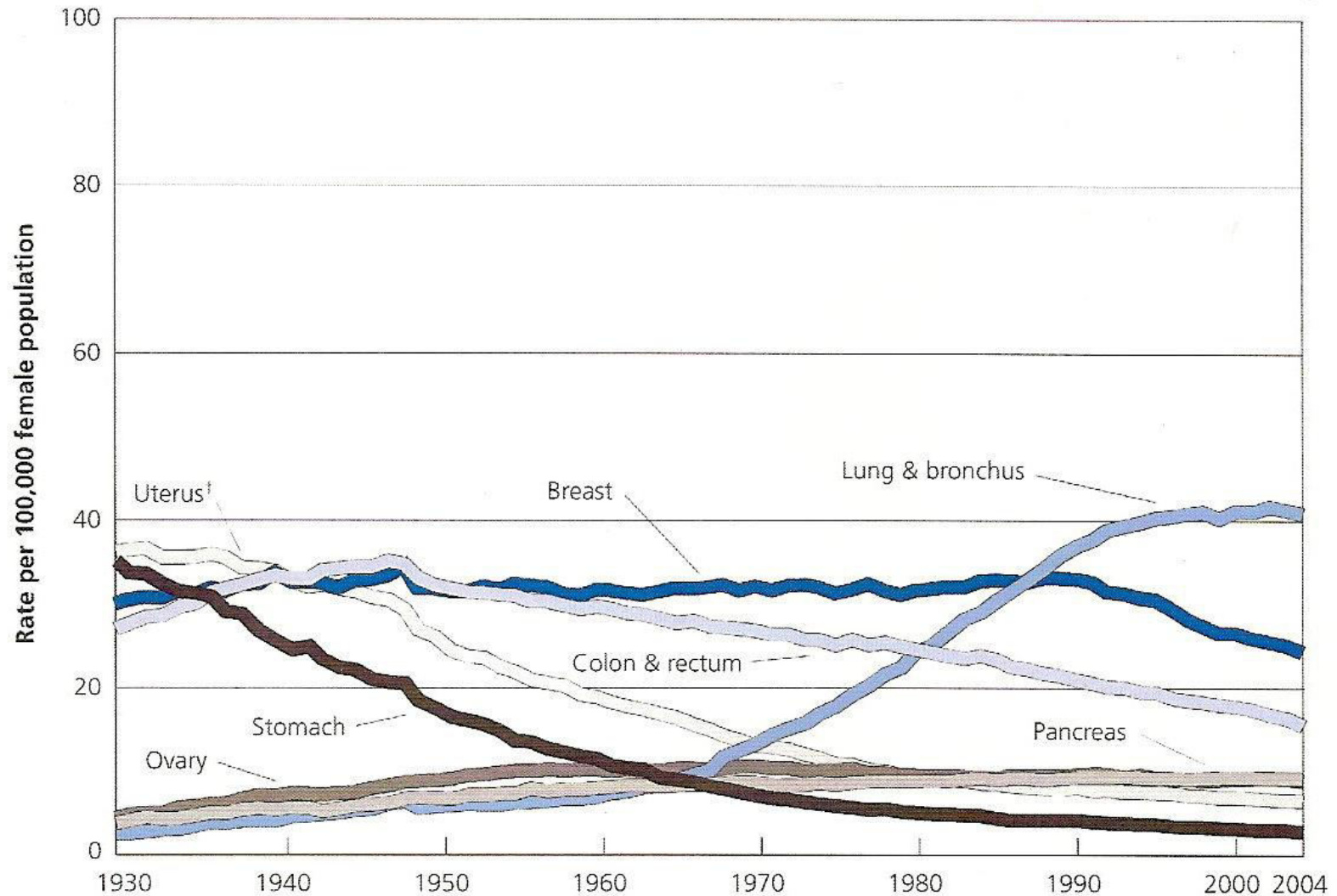# Age-Adjusted Cancer Death Rates,* Males by Site, US, 1930-2004

*Per 100,000, age-adjusted to the 2000 US standard population.

Note: Due to changes in ICD coding, numerator information has changed over time. Rates for cancer of the liver, lung and bronchus, and colon and rectum are affected by these coding changes.

Source: US Mortality Data 1960 to 2004, US Mortality Volumes 1930 to 1959, National Center for Health Statistics, Centers for Disease Control and Prevention, 2006.

American Cancer Society, Surveillance Research, 2008

Age-Adjusted Cancer Death Rates,* Females by Site, US, 1930-2004

*Per 100,000, age-adjusted to the 2000 US standard population. †Uterus cancer death rates are for uterine cervix and uterine corpus combined.

Note: Due to changes in ICD coding, numerator information has changed over time. Rates for cancer of the lung and bronchus, colon and rectum, and ovary are affected by these coding changes.

Source: US Mortality Data 1960 to 2004, US Mortality Volumes 1930 to 1959, National Center for Health Statistics, Centers for Disease Control and Prevention, 2006.

American Cancer Society, Surveillance Research, 2008

Worldwide Lung Cancer

➢ **Estimated 1.5 million new cases of Lung cancer expected each year**

➢ **Accounts for 12% of total cancer diagnoses**

➢ **More than 1.3 million people expected to die from Lung cancer each year**

➢ **Leading cause of cancer death in Men**

➢ **Second leading cause of cancer death in Women**

Risk Factors

- **Smoking**
    - Responsible for **87%** of Lung Cancer Deaths Annually
    - Latent period of 20-25 years
    - Dose related
        - (9-10 fold risk average smoker, **20 fold risk for heavy smoker**)

- **Secondhand smoke**
    - Non-smoking spouses who live with a smoker have a **20-30%** greater risk

- **Air pollution**
    - *Worldwide, 5% of deaths from Lung cancer may be due to air pollution*
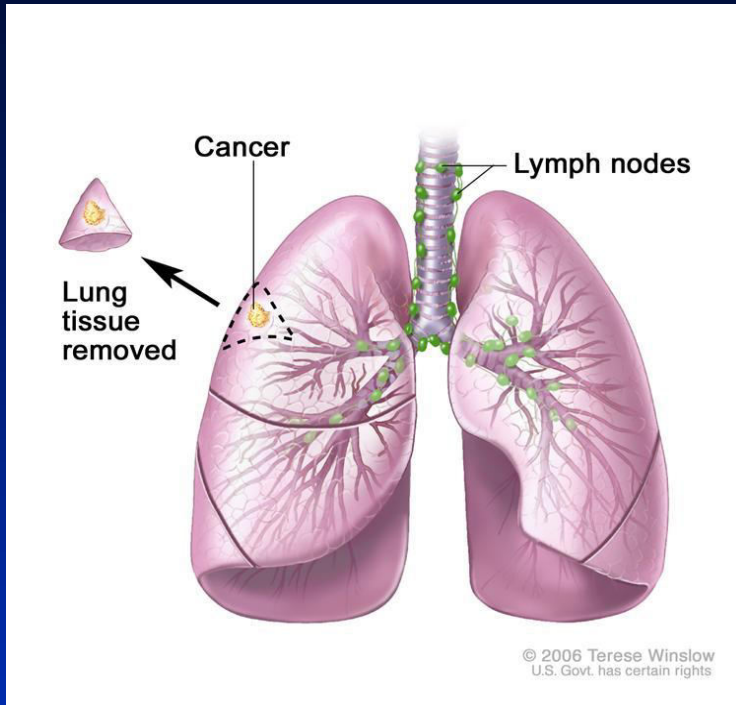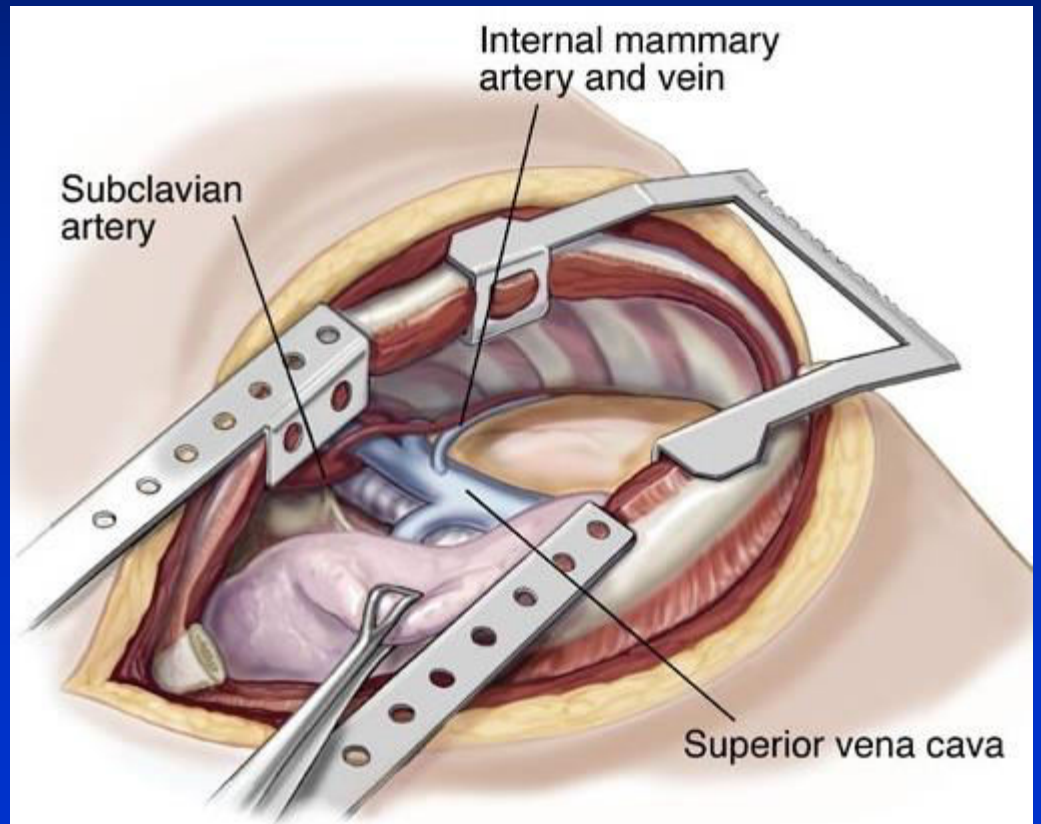
C-STATS Report
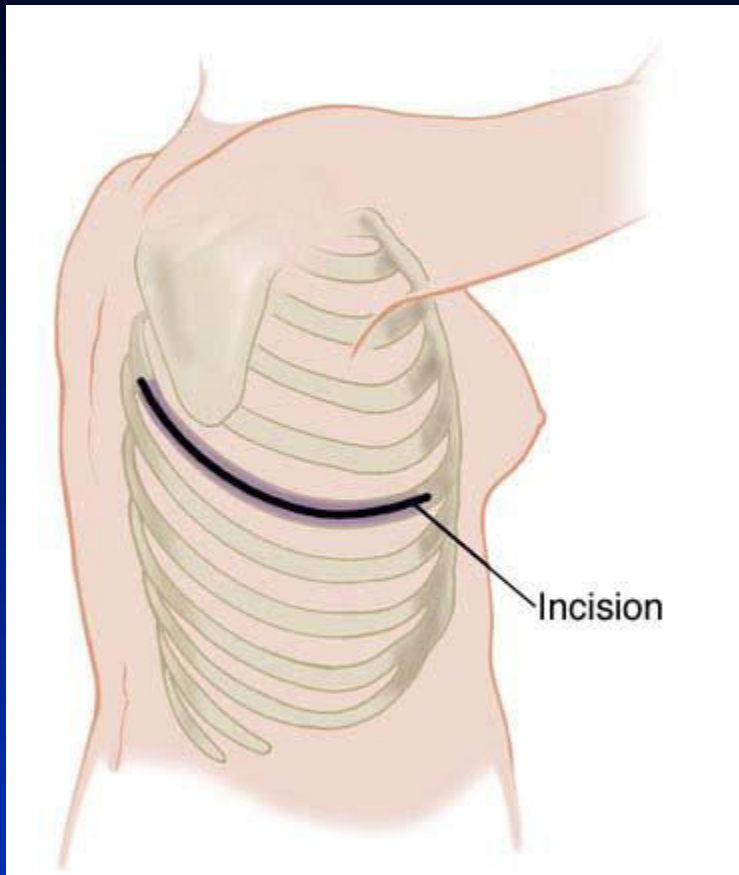
Age-adjusted lung cancer mortality rates

MORTALITY(age-adjusted)

	Number of cases	Rate
• NAPA	78	50.4
• SOLANO	198	54.0
• SONOMA	229	45.6
• STATEWIDE	13,168	40.4

Surgery

Types of Resection

Cancer
Lymph nodes
Lung tissue removed
© 2006 Terese Winslow
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Cancer
Lymph nodes
Lobe removed
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Incision

Subclavian artery

Internal mammary artery and vein

Superior vena cava
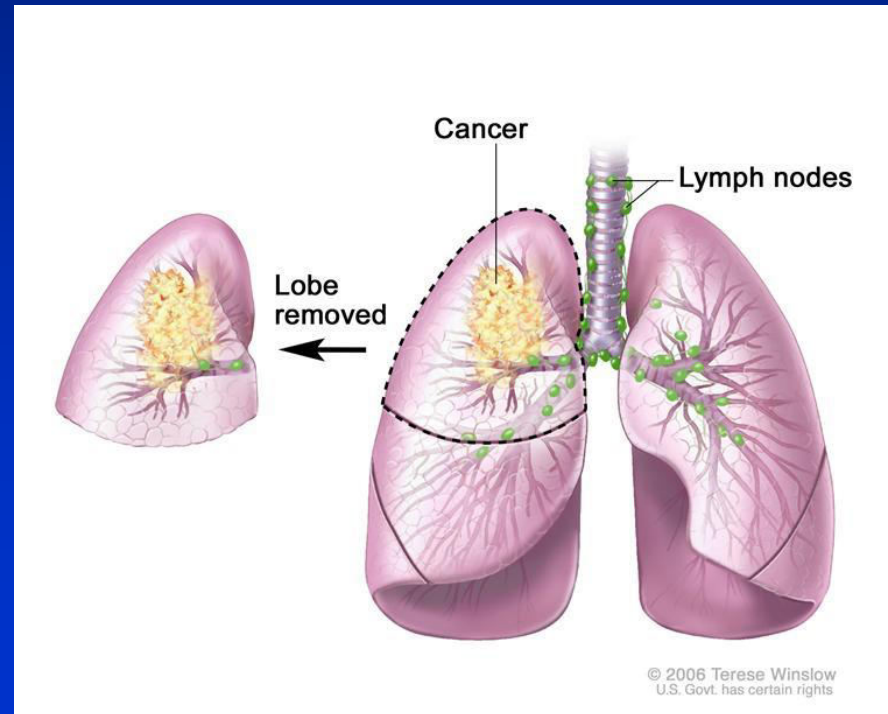
VATS Lobectomy

Video Assisted Thorascopic Surgery

➢ **Standardize the definition of a VATS lobectomy to encompass a true anatomic lobectomy with individual ligation of lobar vessels and bronchus as well as hilar lymph node dissection or sampling using the video screen for guidance, two or three ports, and no retractor use or rib spreading.**
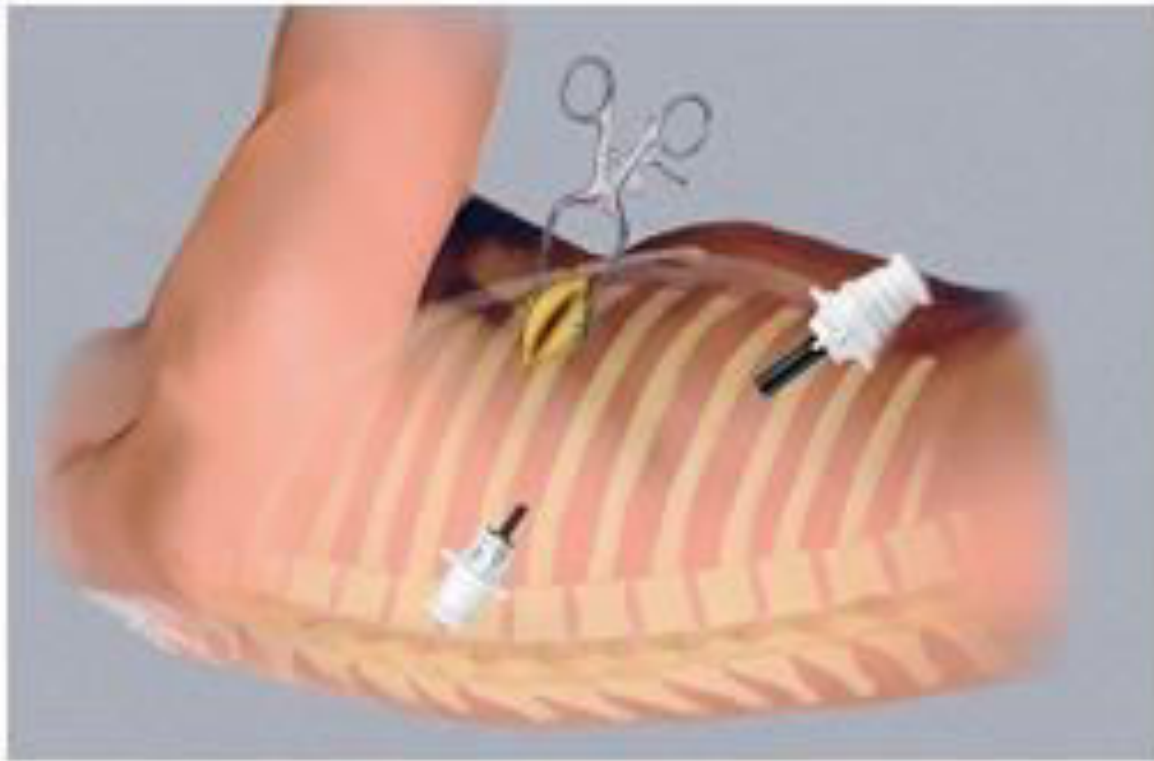
Example of VATS Incisions

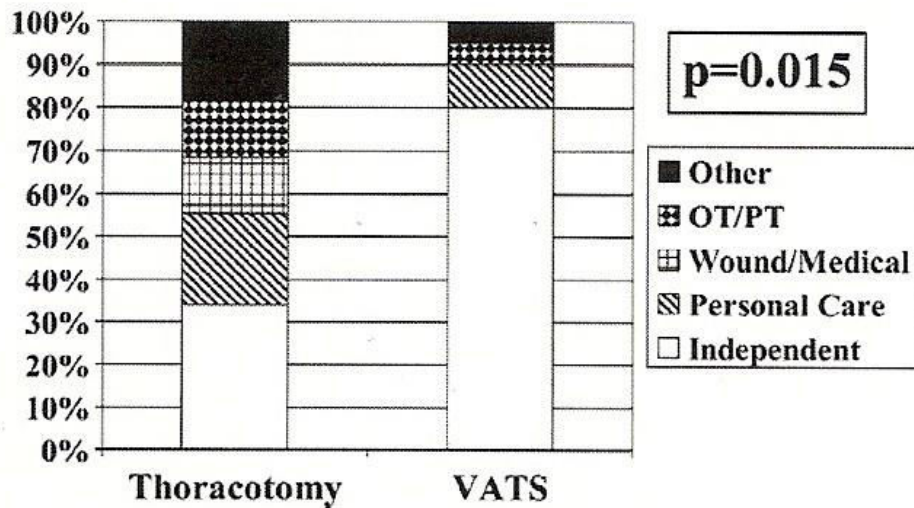# Quality of Life:
Demmy et al, *Ann Thor Surg* 2008

Fig 1. Discharge independence after thoracoscopic lobectomy. The bar graphs demonstrate a much lower need for home health services in the video-assisted thoracic surgery (VATS) group. The types of services needed for each procedure type are displayed as well. (OT = occupational therapy; other = other miscellaneous care needs; PT = physical therapy.) Adapted from Demmy TL, et al. Discharge independence with minimally invasive lobectomy. Am J Surg 2004;188:698–702.
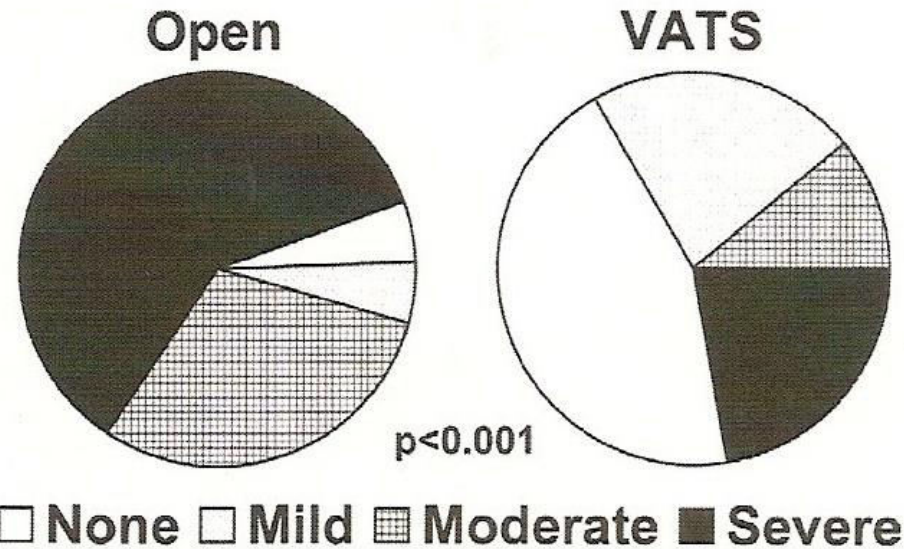

Fig 2. Pain control at 3 weeks after video assisted thoracic surgery (VATS) lobectomy. The pie charts show that VATS patients have significantly (p < 0.01) less pain as measured by the most potent analgesic still required: severe——schedule 2 narcotic; moderate—schedule 3 or lower; mild–nonsteroidal anti-inflammatory drugs or acetaminophen. These data represent an updated series of high-risk reported previously [49, 61].

Video Clips

VATS_Utility_Incision_Placement.rm

RUL_Bronchus_Division.rm

Right_Superior_Pulmonary_Vein_Division.rm

Right_Major_and_Minor_Fissure_Division.rm

Right_Pulmonary_Artery_Division.rm

RUL_Specimen_Removal.rm

VATS Summary

- ➢ **Enhanced visualization**

- ➢ **Decreased trauma to the tissue**

- ➢ **Decreased postoperative pain**

- ➢ **Decreased postoperative respiratory and other complications**

- ➢ **Decreased Hospital Stay**

- ➢ **Shortened Recovery time, allowing return to work and daily activities sooner**

- ➢ **Ability to offer surgery to higher risk patients who would not be candidates otherwise**

Heart Disease

Diseases and Risk Factors	Both Sexes
Total Cardiovascular Disease	
Prevalence 2006**	80.0 M (36.3%)
Mortality 2005++	864.5 K
Coronary Heart Disease	
Prevalence 2006 CHD**	16.8 M (7.6%)
Prevalence 2006 MI**	7.9 M (3.6%)
Prevalence 2006 AP**	9.8 M (4.4%)
New and recurrent CHD* ##	1.26 M
New and recurrent MI##	935.0 K
Incidence AP (stable angina) #	500.0 K
Mortality 2005 CHD++	445.7 K
Mortality 2005 MI++	151.0 K

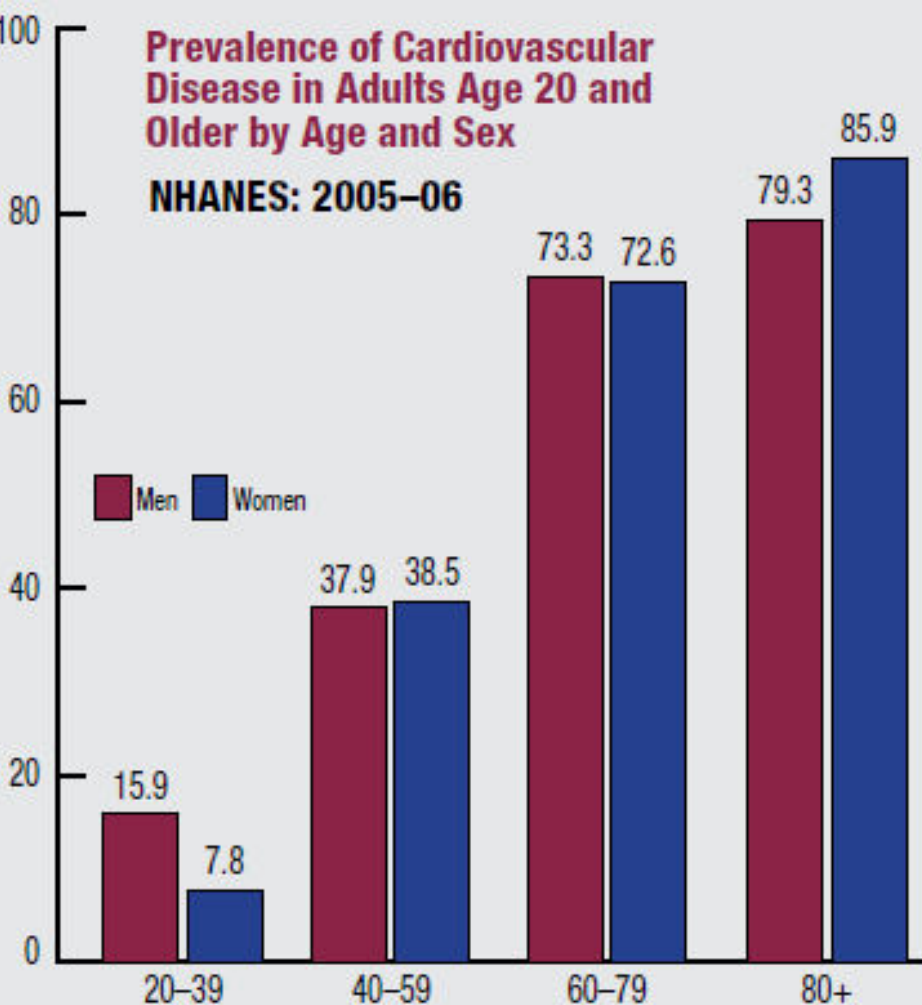| **Stroke**	
Prevalence 2006**	6.5 M (2.9%)
New and recurrent strokes++	795.0 K
Mortality 2005++	143.6 K
High Blood Pressure	
Prevalence 2006**	73.6 M (33.3%)
Mortality 2005++	57.4 K
Heart Failure	
Prevalence 2006**	5.7 M (2.5%)
Mortality 2005++ ≠	292.2 K
Tobacco	
Prevalence 2006+	47.1 M (20.8%)
Blood Cholesterol	
Prevalence 2006:	
Total cholesterol ≥200 mg/dL**	98.6 M (45.1%)
Total cholesterol ≥240 mg/dL**	34.4 M (15.7%)
LDL cholesterol ≥130 mg/dL**	71.8 M (32.8%)
HDL cholesterol <40 mg/dL**	33.9 M (15.5%)

Estimated 80 million Americans have one or more type of Cardiovascular Disease → 1 in 3 American Adults

Prevalence of Cardiovascular Disease in Adults Age 20 and Older by Age and Sex
NHANES: 2005–06

Men   Women

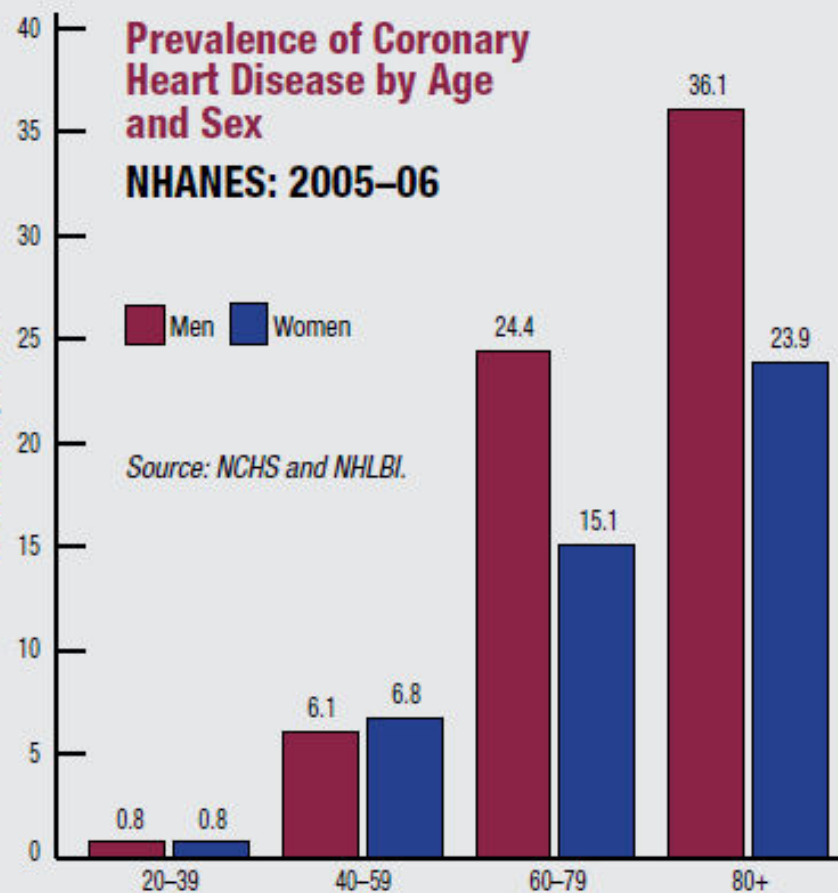| Age	Men	Women
20–39	15.9	7.8
40–59	37.9	38.5
60–79	73.3	72.6
80+	79.3	85.9

Source: NCHS and NHLBI.
These data include CHD, HF, stroke and hypertension.

Prevalence of Coronary Heart Disease by Age and Sex
NHANES: 2005–06

Men   Women

Age	Men	Women
20–39	0.8	0.8
40–59	6.1	6.8
60–79	24.4	15.1
80+	36.1	23.9

Source: NCHS and NHLBI.

Mortality

Table 2-1. Cardiovascular Disease

Population Group	Prevalence, 2006 Age ≥20 y	Mortality, 2005 All Ages*
Both sexes	80 000 000 (36.3%)	864 480
Males	38 700 000 (37.6%)	409 867 (47.4%)†
Females	41 300 000 (34.9%)	454 613 (52.6%)†
NH white males	37.8%	329 607
NH white females	33.3%	372 191
NH black males	45.9%	47 384
NH black females	45.9%	52 401

Cardiovascular Disease accounts for 35.3% of all deaths in 2005, or one of every 2.8 deaths in the United States.

2,400 Americans die of CVD each day → one death every 37 seconds

In every year since 1900 except 1918, CVD accounted for more deaths than any other cause.

Deaths from Cardiovascular Disease
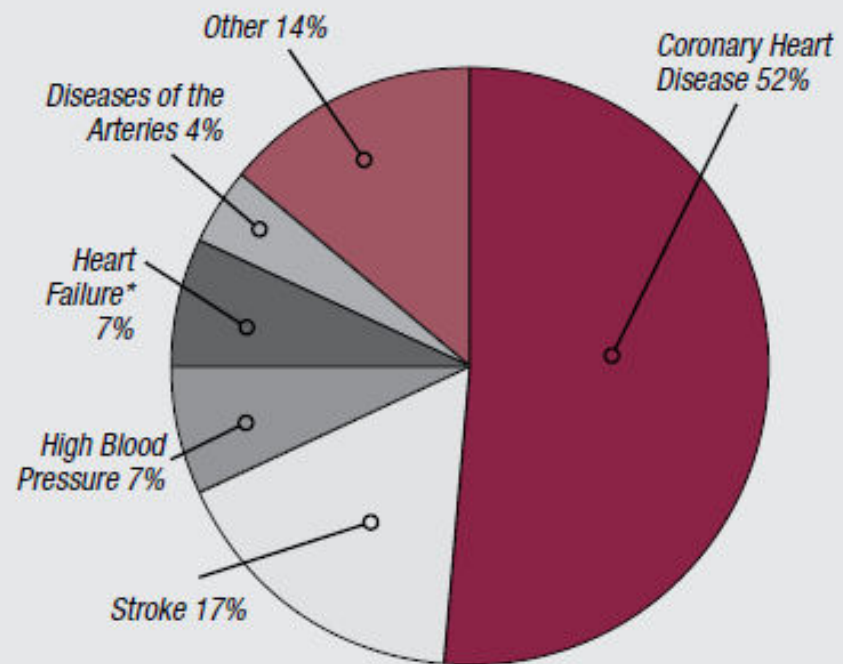**United States: 1900–2006**
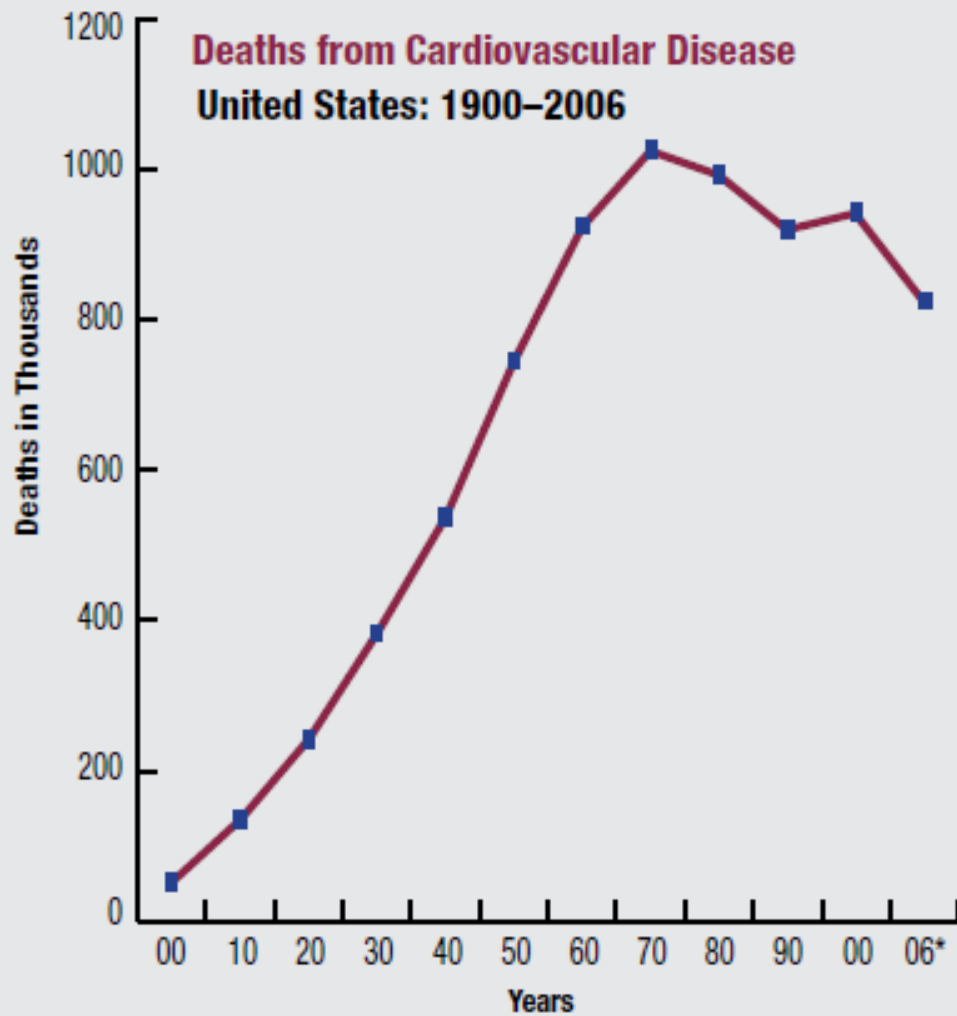
Source: NCHS.
Note: Cardiovascular disease does not include congenital heart disease.

*Preliminary

Percentage Breakdown of Deaths from Cardiovascular Diseases
United States: 2006 (Preliminary)

Other 14%

Coronary Heart Disease 52%

Diseases of the Arteries 4%

Heart Failure* 7%

High Blood Pressure 7%

Stroke 17%

Source: NCHS. *Not a true underlying cause.
Note: May not add to 100% due to rounding.

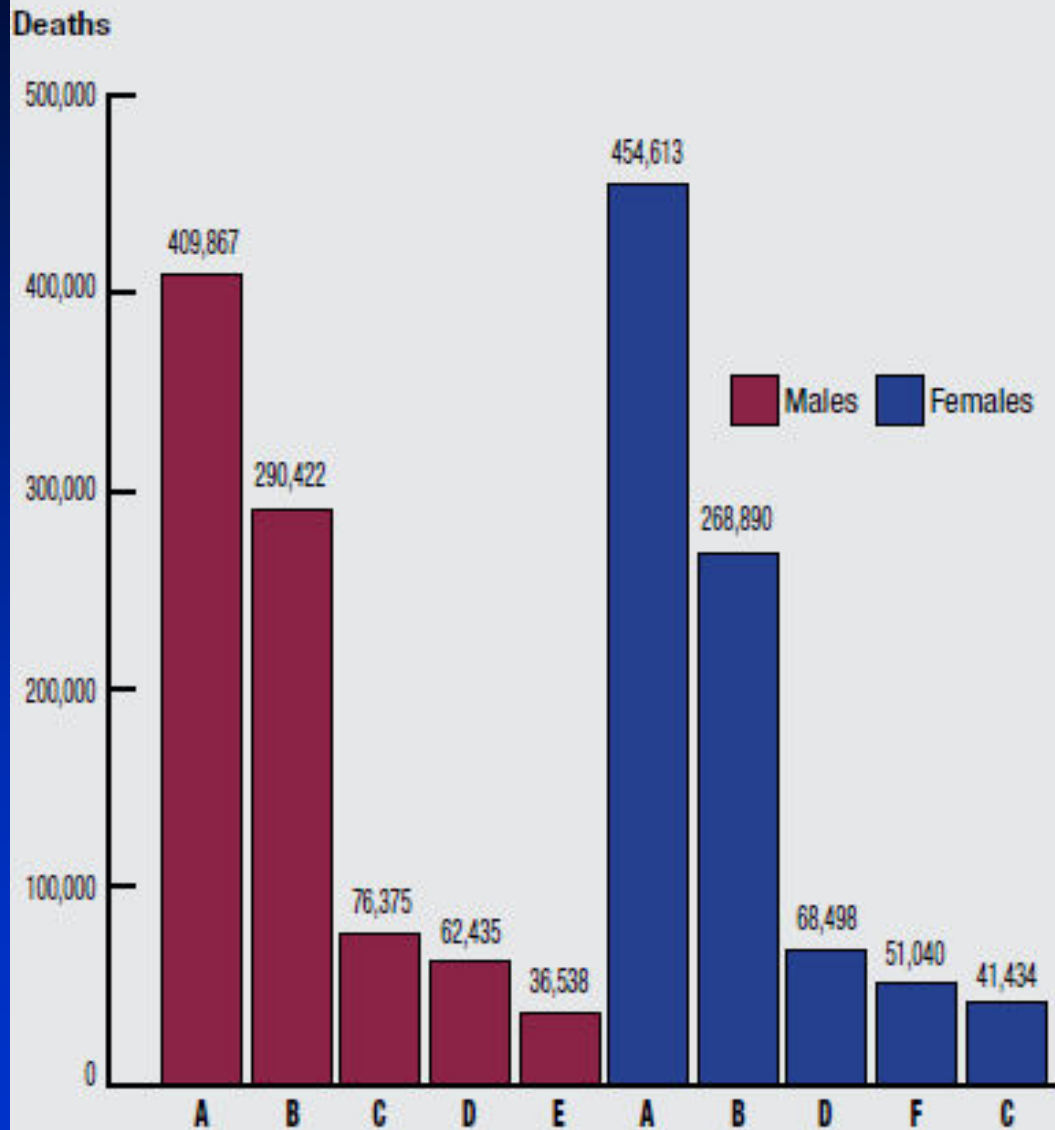**Cardiovascular Disease and Other Major Causes of Death for All Males and Females**

United States: 2005

Deaths

Category	Value
A (Males)	409,867
B (Males)	290,422
C (Males)	76,375
D (Males)	62,435
E (Males)	36,538
A (Females)	454,613
B (Females)	268,890
D (Females)	68,498
F (Females)	51,040
C (Females)	41,434

Males Females

Source: NCHS and NHLBI.

Cardiovascular Disease claims *more* lives each year than **Cancer**, **Chronic Lower Respiratory Diseases**, **Accidents**, and **Diabetes Mellitus** **COMBINED**!
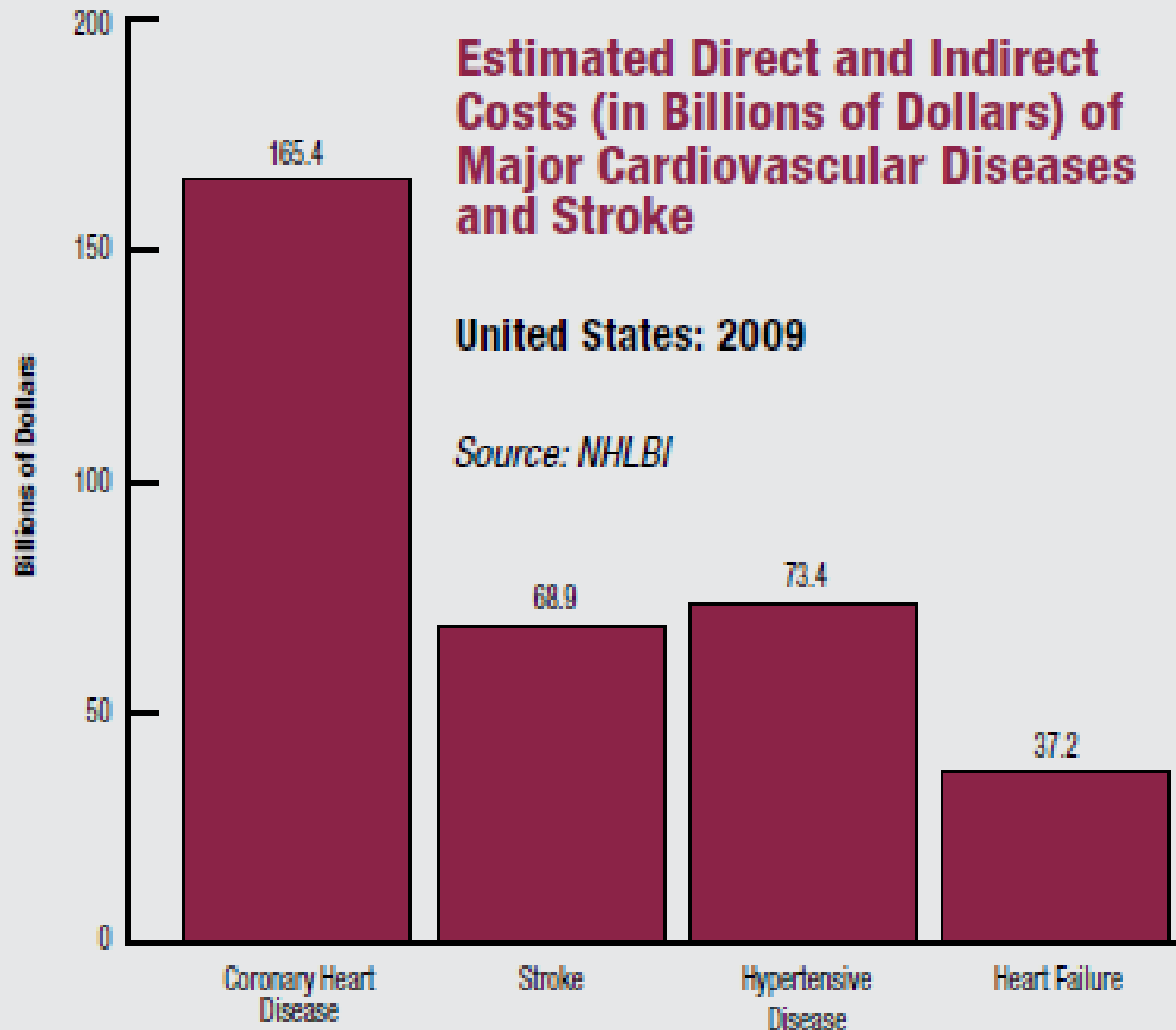
Males

CVD+Congenital Cardiovascular Defects	A
Cancer	B
Accidents	C
Chronic Lower Respiratory Disease	D
Diabetes	E

Females

CVD+Congenital Cardiovascular Defects	A
Cancer	B
Chronic Lower Respiratory Disease	D
Alzheimer's	F
Accidents	C

Cost

Estimated Direct and Indirect Costs (in Billions of Dollars) of Major Cardiovascular Diseases and Stroke

United States: 2009

Source: NHLBI

Cost

Table 20-1. Estimated Direct and Indirect Costs (in Billions of Dollars) of CVD and Stroke: United States: 2009[1–5]					
	Heart Diseases*	CHD	Stroke	Hypertensive Disease	HF	Total CVD†
Direct costs						
Hospital	$106.3	$54.6	$20.2	$8.2	$20.1	$150.1
Nursing home	$23.4	$12.3	$16.2	$4.8	$4.5	$48.2
Physicians/other professionals	$23.8	$13.4	$3.7	$13.4	$2.4	$46.4
Drugs/other						
Medical durables	$22.1	$10.3	$1.4	$25.4	$3.3	$52.3
Home health care	$7.4	$2.2	$4.4	$2.4	$3.4	$16.8
Total expenditures†	$183.0	$92.8	$45.9	$54.2	$33.7	$313.8
Indirect costs						
Lost productivity/morbidity	$24.0	$10.6	$7.0	$8.4	. . .	$39.1
Lost productivity/mortality‡	$97.6	$62.0	$16.0	$10.8	$3.5	$122.4
Grand totals†	$304.6	$165.4	$68.9	$73.4	$37.2	$475.3

Risk Factors

➢ **Healthy Lifestyle Characteristics**

    ➢ **Non Smoking**   **76.0 %**

    ➢ **Healthy Weight**   **40.1 %**

    ➢ **Five Fruits & Vegetables per day**   **23.3 %**

    ➢ **Regular Physical Activity**   **22.2 %**

    ➢ **All 4 Above**   **3.0 %**

Risk Factors

- **Family History**
  - CVD in parent or sibling associated with **two-fold increase** risk of CVD, **independent** of other risk factors

- **Optimal Risk Factor Profile**
  - 7900 men and women
  - Blood pressure below 120/80 mm Hg
  - Total cholesterol below 180 mg/dL
  - Non smoker
  - No diabetes
  - Median **life expectancy was 10 or more years longer** than those with 2 or more major risk factors

- **Diet and Activity**
  - People age 70-90 eating **Mediterrean-style diet** and **Greater physical activity** → **65-73% lower rate of mortality**, including CVD and Cancer

Nutrition

"America's Obesity Problem"

Overweight and Obesity

Adults

- Overweight (BMI > 25)
- Obesity (BMI > 30)

- **145 million** Americans are **Overweight or Obese** → **66.7%** of the Adult Population
- **71 million Overweight**
- **74 million Obese**

- **1999 to 2003**
  - Overweight ↑ **1.8%**
  - Obesity ↑ **3.8%**
  - Extreme Obesity (BMI >40) ↑ **1.2%**

- **Cost**
  - Between **$92 - $117 billion** annually (2002)

Worldwide
By 2015,
number of **overweight** people will be **2.3 billion**
and
obese people will number **700 million**

Table 13-1. Overweight and Obesity

Population Group	Prevalence of Overweight and Obesity in Adults, 2006 Age ≥20 y	Prevalence of Obesity in Adults, 2006 Age ≥20 y
Both sexes, n (%)	145 000 000 (66.7)	74 100 000 (33.9)
Males, n (%)	76 900 000 (73.0)	34 700 000 (32.7)
Females, n (%)	68 100 000 (60.5)	39 400 000 (35.0)
NH white males, %	72.4	32.3
NH white females, %	57.5	32.7
NH black males, %	73.7	36.8
NH black females, %	77.7	52.9
Mexican American males, %	74.8	26.8
Mexican American females, %	73.0	41.9
Hispanic or Latino age ≥18 y,† %	67.8	27.5
Asian-only, age ≥18 y,† %	38.1	8.9
American Indian/Alaska Native, age ≥18 y,† %	67.1	32.4

Overweight and Obesity

Youth

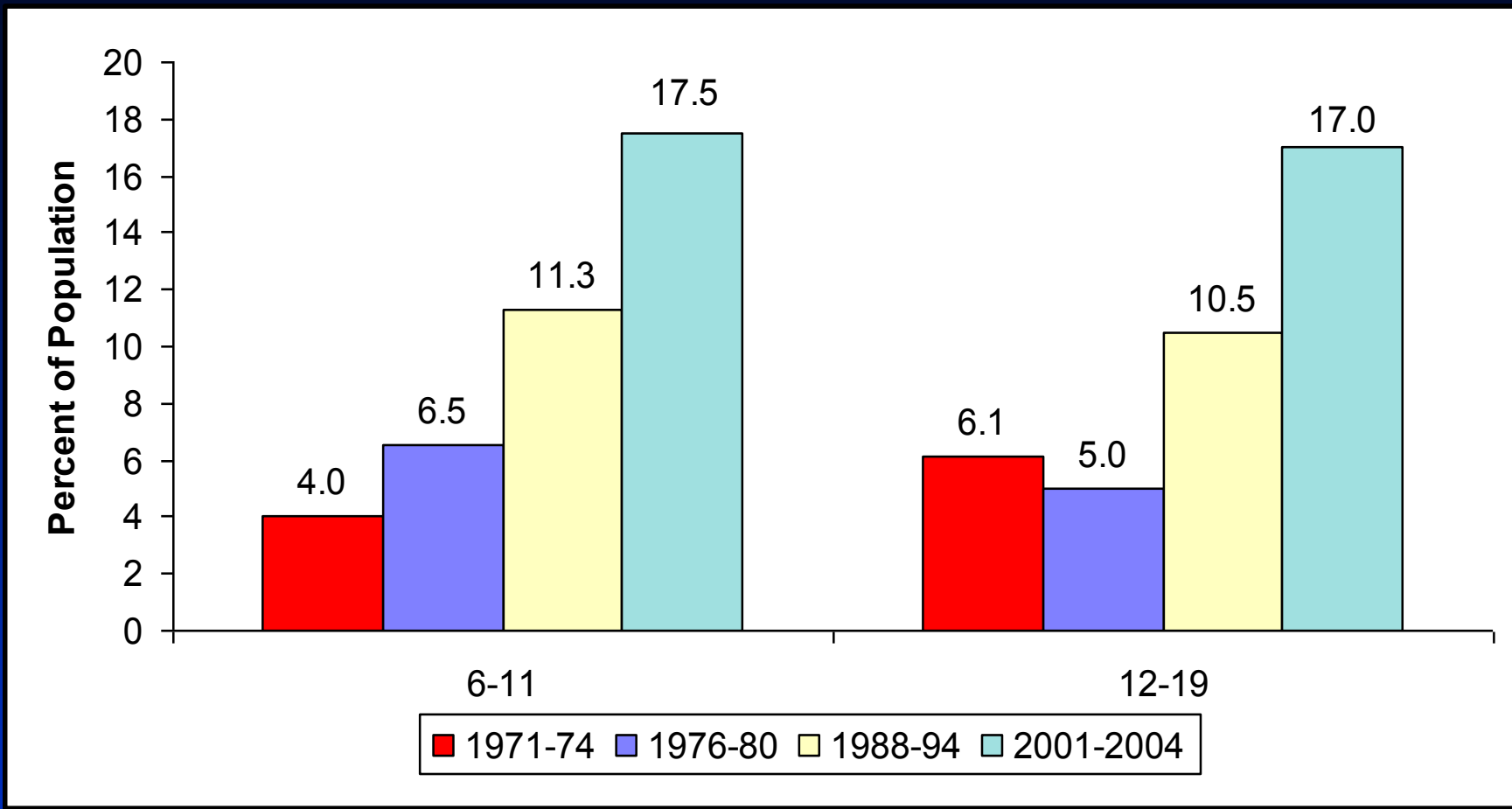- Overweight (BMI > 25)
- Obesity (BMI > 30)

- **23 million** children & adolescents are **Overweight or Obese** → **31.9%** of the Population
- **11 million Overweight**
- **12 million Obese**

- **1971-1974 to 2003-2006**

  - Overweight ↑ from 4.0% to 17.0% (ages 6-11)

  - Overweight ↑ from 6.1% to 17.6% (ages 12-19)

Worldwide
In 2005,
number of **overweight** children
under the age of 5 was
20 million

Population Group	Prevalence of Overweight and Obesity in Children, 2006 Ages 2–19 y	Prevalence of Obesity in Children, 2006 Ages 2–19 y
Both sexes, n (%)	23 400 000 (31.9)	12 000 000 (16.3)
Males, n (%)	12 300 000 (32.7)	6 400 000 (17.1)
Females, n (%)	11 100 000 (31.0)	5 600 000 (15.5)
NH white males, %	31.9	15.6
NH white females, %	29.5	13.6
NH black males, %	30.8	17.4
NH black females, %	39.2	24.1
Mexican American males, %	40.8	23.2
Mexican American females, %	35.0	18.5
Hispanic or Latino age ≥18 y,† %	...	...
Asian-only, age ≥18 y,† %	...	...
American Indian/Alaska Native, age ≥18 y,† %	...	...

Trends in prevalence of overweight among U.S. children and adolescents by age and survey. (NHANES, 1971-74, 1976-80, 1988-94 and 2001-2004).
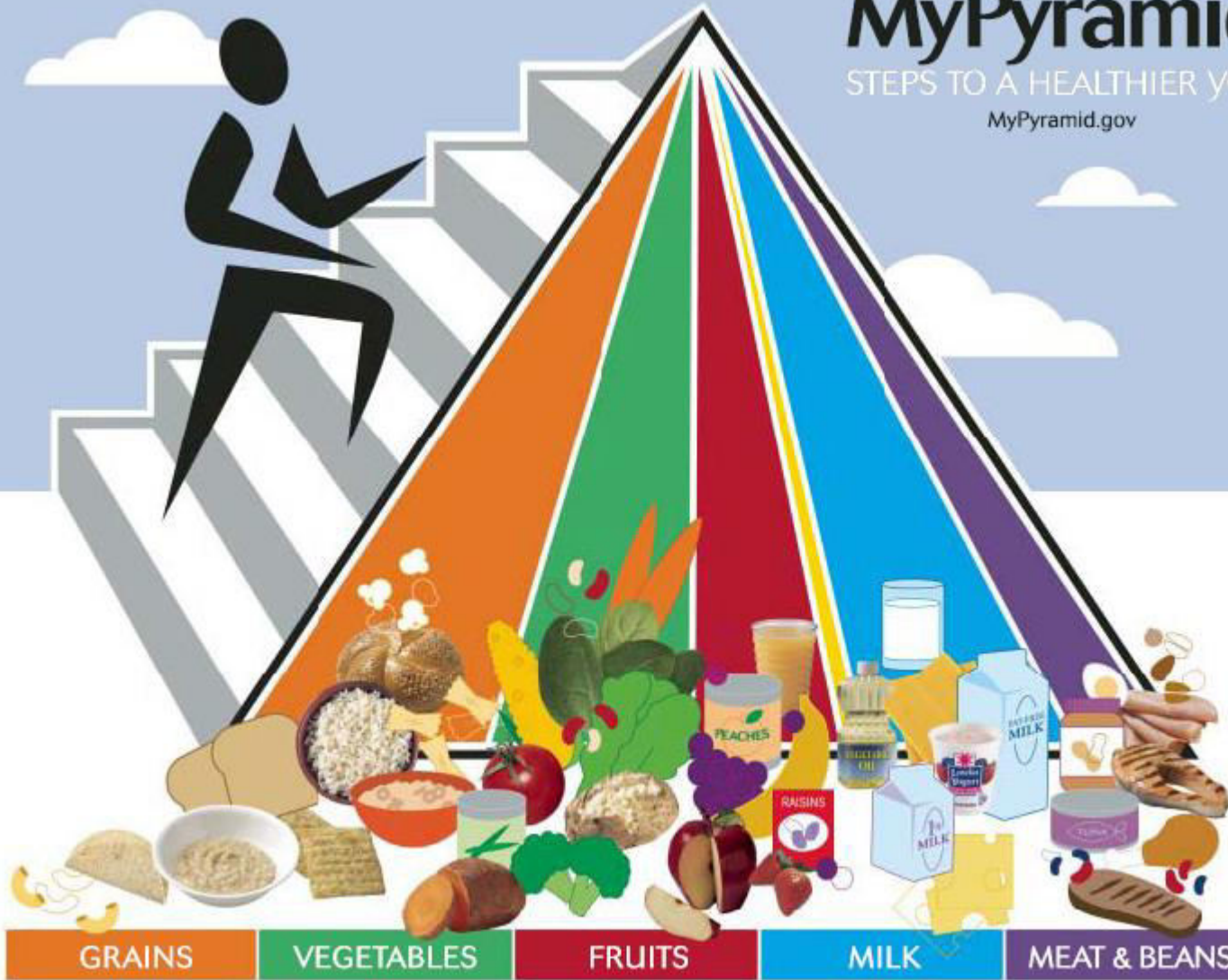**Source: Health, United States, 2007. NCHS.**

Nutrition

MyPyramid
STEPS TO A HEALTHIER YOU
MyPyramid.gov

GRAINS | **VEGETABLES** | **FRUITS** | **MILK** | **MEAT & BEANS**

GRAINS	VEGETABLES	FRUITS	MILK	MEAT & BEANS
Make half your grains whole	**Vary your veggies**	**Focus on fruits**	**Get your calcium-rich foods**	**Go lean with protein**
Eat at least 3 oz. of whole-grain cereals, breads, crackers, rice, or pasta every day 1 oz. is about 1 slice of bread, about 1 cup of breakfast cereal, or ½ cup of cooked rice, cereal, or pasta	Eat more dark-green veggies like broccoli, spinach, and other dark leafy greens Eat more orange vegetables like carrots and sweetpotatoes Eat more dry beans and peas like pinto beans, kidney beans, and lentils	Eat a variety of fruit Choose fresh, frozen, canned, or dried fruit Go easy on fruit juices	Go low-fat or fat-free when you choose milk, yogurt, and other milk products If you don't or can't consume milk, choose lactose-free products or other calcium sources such as fortified foods and beverages	Choose low-fat or lean meats and poultry Bake it, broil it, or grill it Vary your protein routine -- choose more fish, beans, peas, nuts, and seeds

For a 2,000-calorie diet, you need the amounts below from each food group. To find the amounts that are right for you, go to MyPyramid.gov.

Eat 6 oz. every day	Eat 2½ cups every day	Eat 2 cups every day	Get 3 cups every day; for kids aged 2 to 8, it's 2	Eat 5½ oz. every day

Average consumption:

	Whole Grains	Vegetables	Fruits	Meat
Adults	0.5 to 2.0 (rec: 6 – 8)	1.2 to 2.1 (rec: 4 – 5)	1.1 to 1.8 (rec: 4 – 5)	1.5 to 3.7
Children	0.4 to 0.5 (rec: 6)	0.8 to 0.9 (rec: 3 – 4)	0.8 to 0.9 (rec: 4)	2.1 to 3.4
	servings per day	servings per day	servings per day	servings per week

Sugar Sweetened Beverages: Adults 6 – 18 servings (8 ounces) per week   Children 8 – 23 servings per week

Sweets and Bakery Desserts: Adults 4 – 8 servings per day
(rec: less than 5 per week)   Children 9 – 10 servings per week
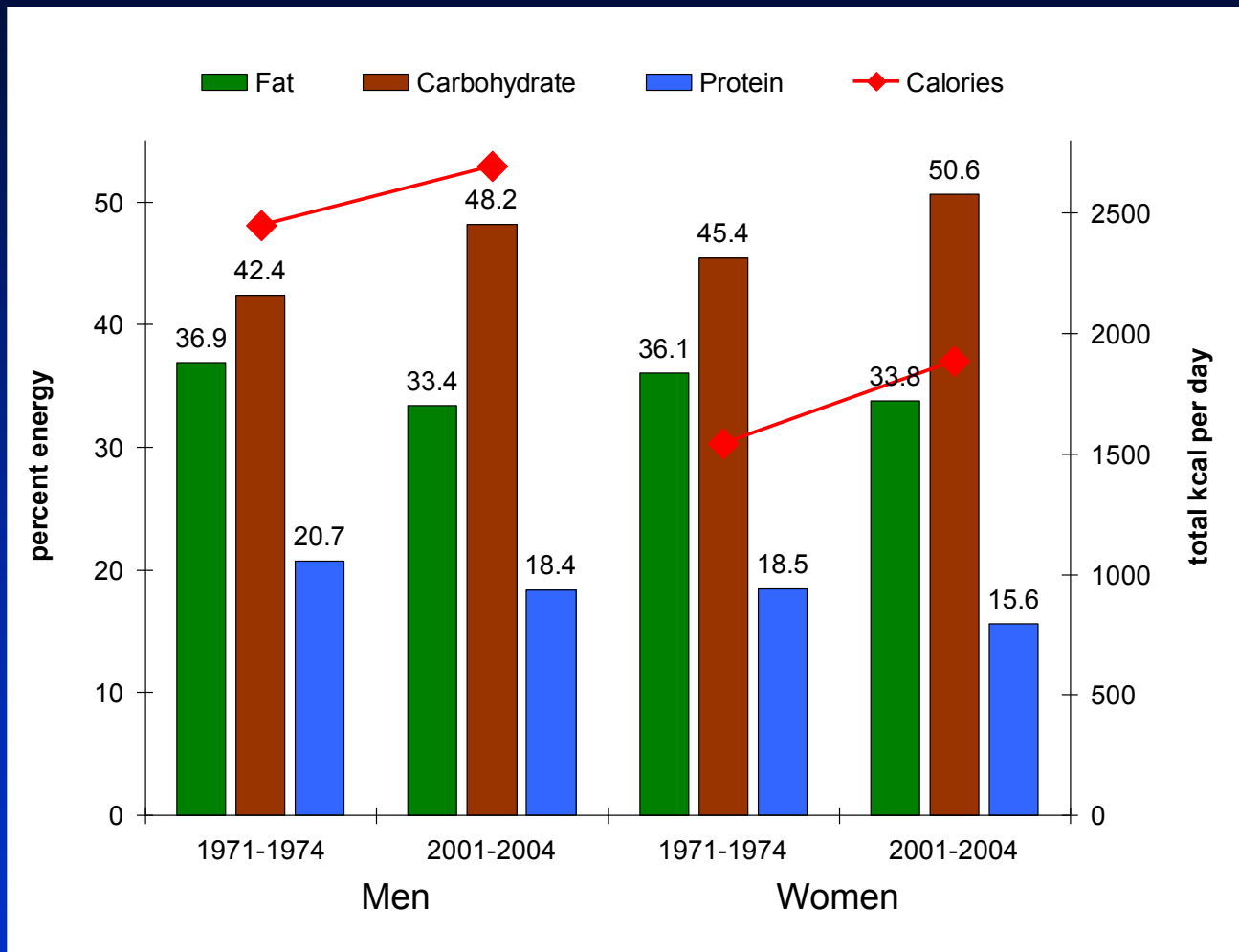(rec: 0 per week)

Figure 16-1. Age-Adjusted Trends in Macronutrients and Total Calories Consumed by U.S. Adults (20-74 years), 1971-2004.

Source: National Center for Health Statistics. *Health, United States 2007, With Chartbook on Trends in the Health of Americans.* Hyattsville, Md: National Center for Health Statistics; 2007
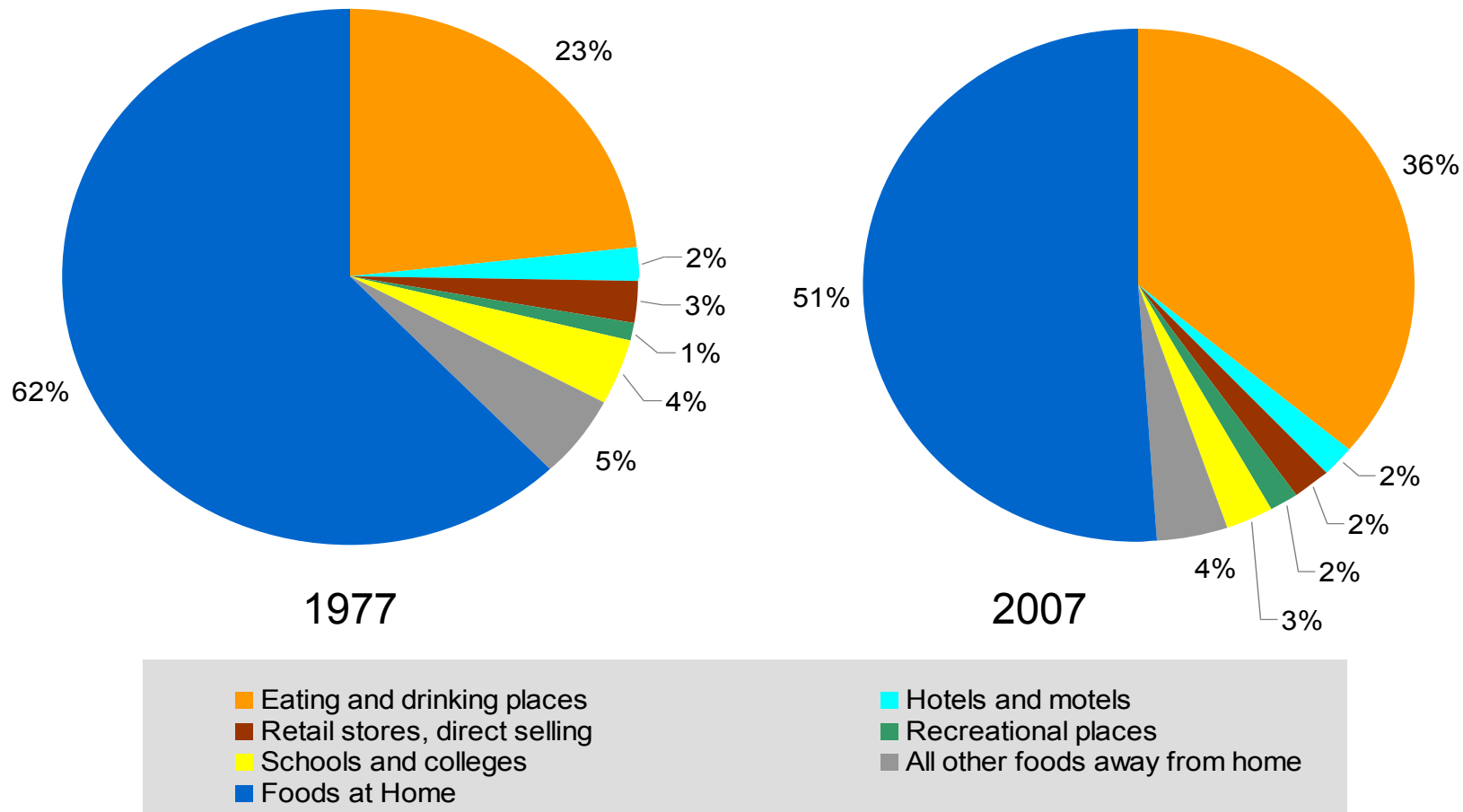
Figure 16-3. Total U.S. Food Expenditures Away from Home and At Home, 1977 and 2007.

Source: United States Department of Agriculture Economic Research Service

Recommendations

- **Choose lean meats and poultry**
    - Prepare without added saturated or trans fat
    - Remove visible fat from meat and skin from poultry
    - Choose white meat when eating poultry
    - Grill, bake or broil meats and poultry

- **Select fat-free, 1 percent fat, and low-fat dairy products**

- **Reduce *trans* fat**
    - Cut back on foods containing partially hydrogenated vegetable oils
    - Limit cakes, cookies, crackers, pastries, pies, muffins, doughnuts, and French fries

- **Eat less than 300 milligrams of cholesterol each day**
    - 200mg per egg yolk, Shellfish 50-100mg per ½ cup, 30mg per cup whole milk

- **Cut back on beverages and foods with added sugars**

- **Eat less than 2,300 milligrams of sodium per day**

- **Drink in moderation**
    - one drink per day for women
    - two drinks per day for men

Lipid Goals

- **Total Cholesterol <200**

- **HDL Cholesterol >40**
    - **Eliminate Saturated Fat**
    - **Use Unsaturated Fat instead**
    - **Reduce alcohol consumption**
    - **Increase exercise**

- **LDL Cholesterol <100**
    - **Reduce Fat → Decrease Saturated Fat and Eliminate Trans Fat**
    - **Eat less than 300 milligrams of cholesterol each day**

- **Triglycerides   < 150**
    - **Reduce High Fat foods**
    - **Reduce High simple sugar foods**
    - **Reduce red meat intake**
    - **Reduce or Eliminate alcohol consumption**
    - **Increase exercise**

Nutrition Facts

Serving Size 1 slice (47g)		
Servings Per Container 6		

Amount Per Serving

Calories 160	Calories from Fat 90	
		% Daily Value*
Total Fat 10g		15%
Saturated Fat 2.5g		11%
Trans Fat 2g		
Cholesterol 0mg		0%
Sodium 300mg		12%
Total Carb 15g		5%
Dietary Fiber less than 1g		3%
Sugars 1g		
Protein 3g		
Vitamin A 0%	Vitamin C 4%	
Calcium 45%	Iron 6%	
Thiamin 8%	Riboflavin 6%	
Niacin 6%		

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Start here

Check the total calories per serving

Limit these nutrients

Get enough of these nutrients

Quick Guide to % Daily Value:
5% or less is low
20% or more is high

➢ **Trans Fat**
Hydrogenated

➢ **Saturated Fat**
Animal Fat
Palm oil / Palm kernel oil
Coconut oil

➢ **Monounsaturated Fat**
(may decrease LDL)
(may maintain HDL)

Olive oil
Peanut oil
Canola oil
Avocado, Nuts, Seed

➢ **Polyunsaturated Fat**
(may decrease LDL and HDL)

Safflower oil
Sunflower oil
Corn oil
Soybean oil
Omega 3 and Omega 6

Exercise

Recommendations

TABLE 4. Physical activity recommendations for healthy adults aged 18–65 yr—2007.

1. To promote and maintain good health, adults aged 18–65 yr should maintain a physically active lifestyle. I (A)

2. They should perform moderate-intensity aerobic (endurance) physical activity for a minimum of 30 min on five days each week or vigorous-intensity aerobic activity for a minimum of 20 min on three days each week. I (A)

3. Combinations of moderate- and vigorous-intensity activity can be performed to meet this recommendation. For example, a person can meet the recommendation by walking briskly for 30 min twice during the week and then jogging for 20 min on two other days. IIa (B)

4. These moderate- or vigorous intensity activities are in addition to the light intensity activities frequently performed during daily life (e.g., self care, washing dishes, using light tools at a desk) or activities of very short duration (e.g., taking out trash, walking to parking lot at store or office).

5. Moderate-intensity aerobic activity, which is generally equivalent to a brisk walk and noticeably accelerates the heart rate, can be accumulated toward the 30-min minimum by performing bouts each lasting 10 or more minutes. I (B)

6. Vigorous-intensity activity is exemplified by jogging, and causes rapid breathing and a substantial increase in heart rate.

7. In addition, at least twice each week adults will benefit by performing activities using the major muscles of the body that maintain or increase muscular strength and endurance. IIa (A)

8. Because of the dose-response relation between physical activity and health, persons who wish to further improve their personal fitness, reduce their risk for chronic diseases and disabilities, or prevent unhealthy weight gain will likely benefit by exceeding the minimum recommended amount of physical activity. I (A)

Recommendations

TABLE 4. Summary of physical activity recommendations for older adults – 2007.

1. To promote and maintain good health, older adults should maintain a physically active lifestyle. I (A)

2. They should perform moderate-intensity aerobic (endurance) physical activity for a minimum of 30 min on five days each week or vigorous-intensity aerobic activity for a minimum of 20 min on three days each week. I (A) Moderate-intensity aerobic activity involves a moderate level of effort relative to an individual's aerobic fitness. On a 10-point scale, where sitting is 0 and all-out effort is 10, moderate-intensity activity is a 5 or 6 and produces noticeable increases in heart rate and breathing. On the same scale, vigorous-intensity activity is a 7 or 8 and produces large increases in heart rate and breathing. For example, given the heterogeneity of fitness levels in older adults, for some older adults a moderate-intensity walk is a slow walk, and for others it is a brisk walk.

3. Combinations of moderate- and vigorous-intensity activity can be performed to meet this recommendation. IIa (B) These moderate- or vigorous intensity activities are in addition to the light intensity activities frequently performed during daily life (e.g., self care, washing dishes) or moderate-intensity activities lasting 10 min or less (e.g., taking out trash, walking to parking lot at store or office).

4. In addition, at least twice each week older adults should perform muscle strengthening activities using the major muscles of the body that maintain or increase muscular strength and endurance. IIa (A) It is recommended that 8–10 exercises be performed on at least two nonconsecutive days per week using the major muscle groups. To maximize strength development, a resistance (weight) should be used that allows 10–15 repetitions for each exercise. The level of effort for muscle-strengthening activities should be moderate to high.

5. Because of the dose-response relationship between physical activity and health, older persons who wish to further improve their personal fitness, reduce their risk for chronic diseases and disabilities, or prevent unhealthy weight gain will likely benefit by exceeding the minimum recommended amount of physical activity. I (A)

6. To maintain the flexibility necessary for regular physical activity and daily life, older adults should perform activities that maintain or increase flexibility on at least two days each week for at least 10 min each day. IIb (B)

7. To reduce risk of injury from falls, community-dwelling older adults with substantial risk of falls should perform exercises that maintain or improve balance. IIa (A)

8. Older adults with one or more medical conditions for which physical activity is therapeutic should perform physical activity in a manner that effectively and safely treats the condition(s). IIa (A)

9. Older adults should have a plan for obtaining sufficient physical activity that addresses each recommended type of activity. IIa (C) Those with chronic conditions for which activity is therapeutic should have a single plan that integrates prevention and treatment. For older adults who are not active at recommended levels, plans should include a gradual (or stepwise) approach to increase physical activity over time. Many months of activity at less than recommended levels is appropriate for some older adults (e.g., those with low fitness) as they increase activity in a stepwise manner. Older adults should also be encouraged to self-monitor their physical activity on a regular basis and to reevaluate plans as their abilities improve or as their health status changes.

Physical Inactivity

- **Adults**
  - 2007 Prevalence of regular physical activity is **30.8%**
    - **Males 33.9%**   **Females 28.9%**
  - **66.3% of Women** report **NEVER** engaging in vigorous physical activity
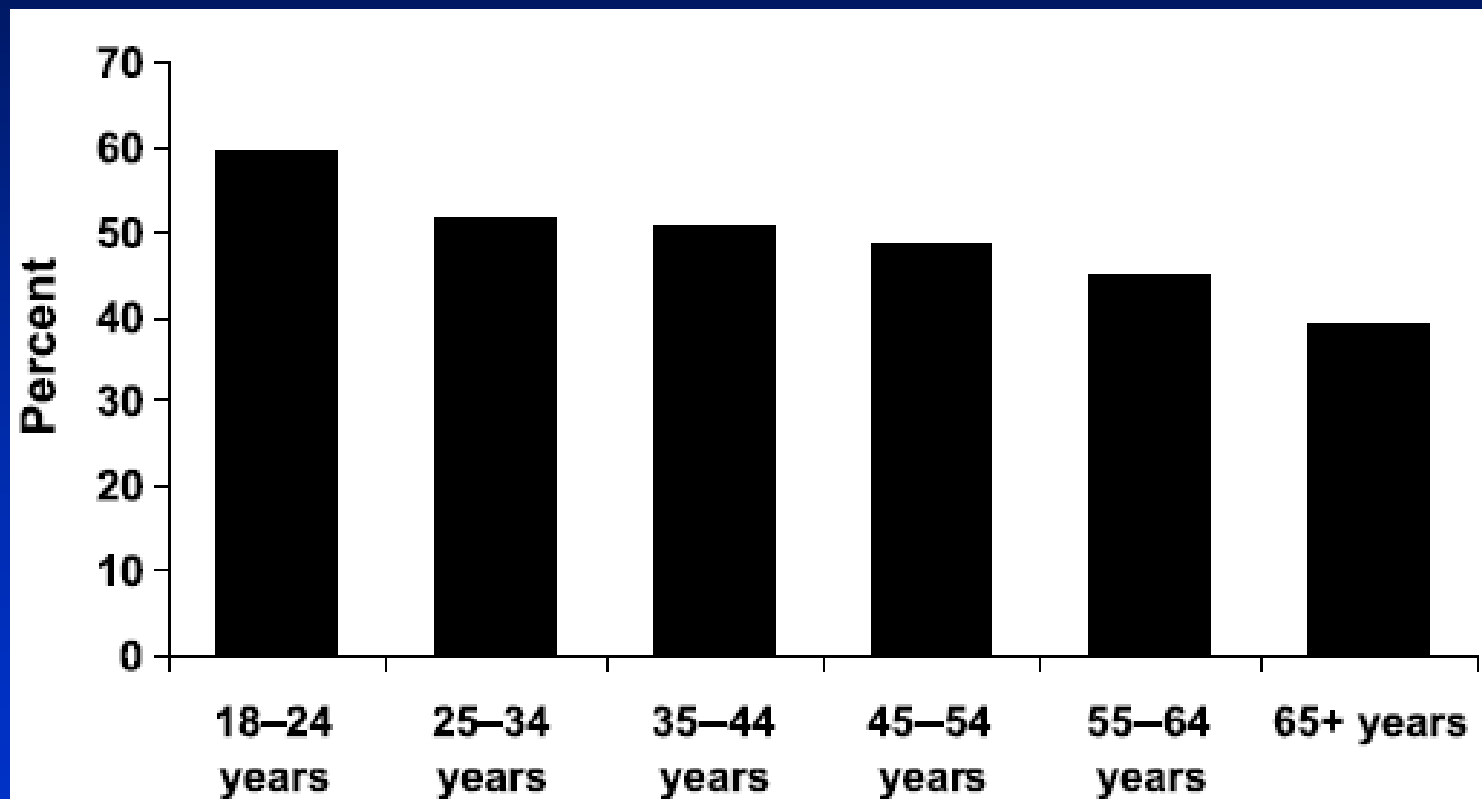 - **56.0% of Men** report **NEVER** engaging in vigorous physical activity

FIGURE 2—Prevalence of U.S. men and women meeting the CDC/ ACSM physical activity recommendations by age, 2005.

Physical Inactivity

Youth

- **61.5%** of children ages 9-13 **DO NOT** participate in any organized physical activity during non-school hours

- **22.6%** **DO NOT** engage in any free-time physical activity

- **Girls by the age of 16 or 17**:
  - **31%** white girls and **56%** of black girls have **NO** habitual leisure-time activity

- **Students grades 9-12**:
  - **24.9%** spent 3 or more hours per day using computers outside of school

  - **35.4%** spent 3 or more hours per day watching television
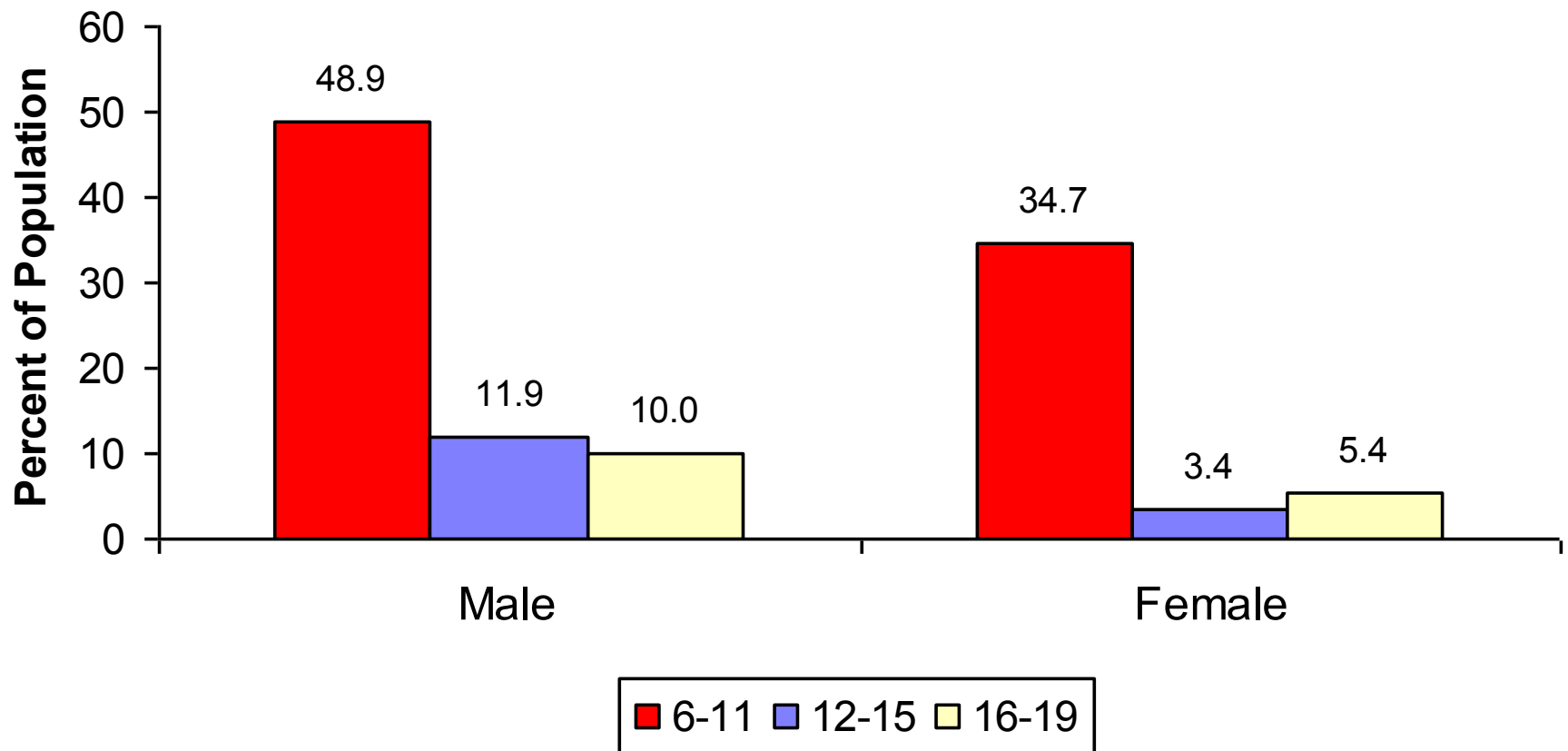
Prevalence of children ages 6-19 who attained sufficient moderate-to-vigorous physical activity to meet public health recommendations of >60 minutes/day on >5 of 7 days by sex and age.
(NHANES: 2003-04). Source: MSSE 2008;40:181-8.
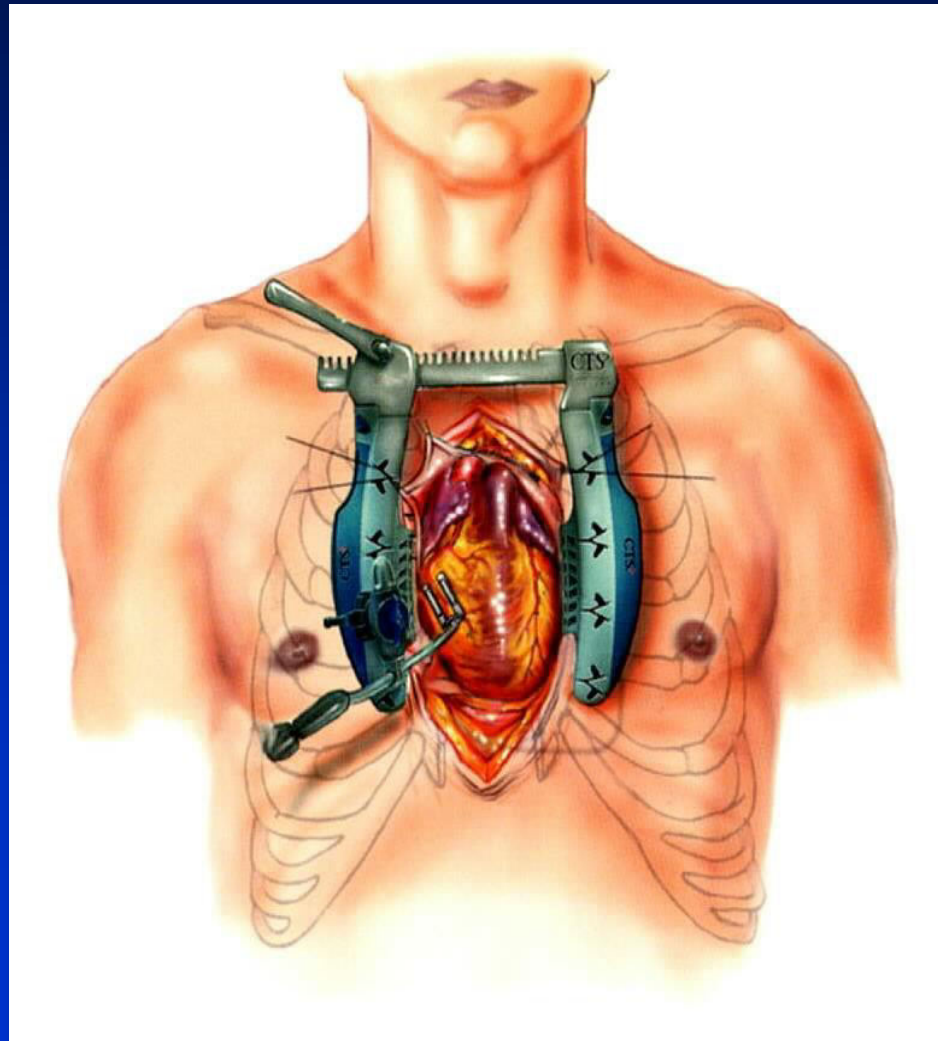
OPCABG / EVH
Robotic CABG

Schematic for CPB

Venous Blood From Body

Aorta

Venous Reservoir

X

Cardioplegia

CO_2 O_2

CPB Console
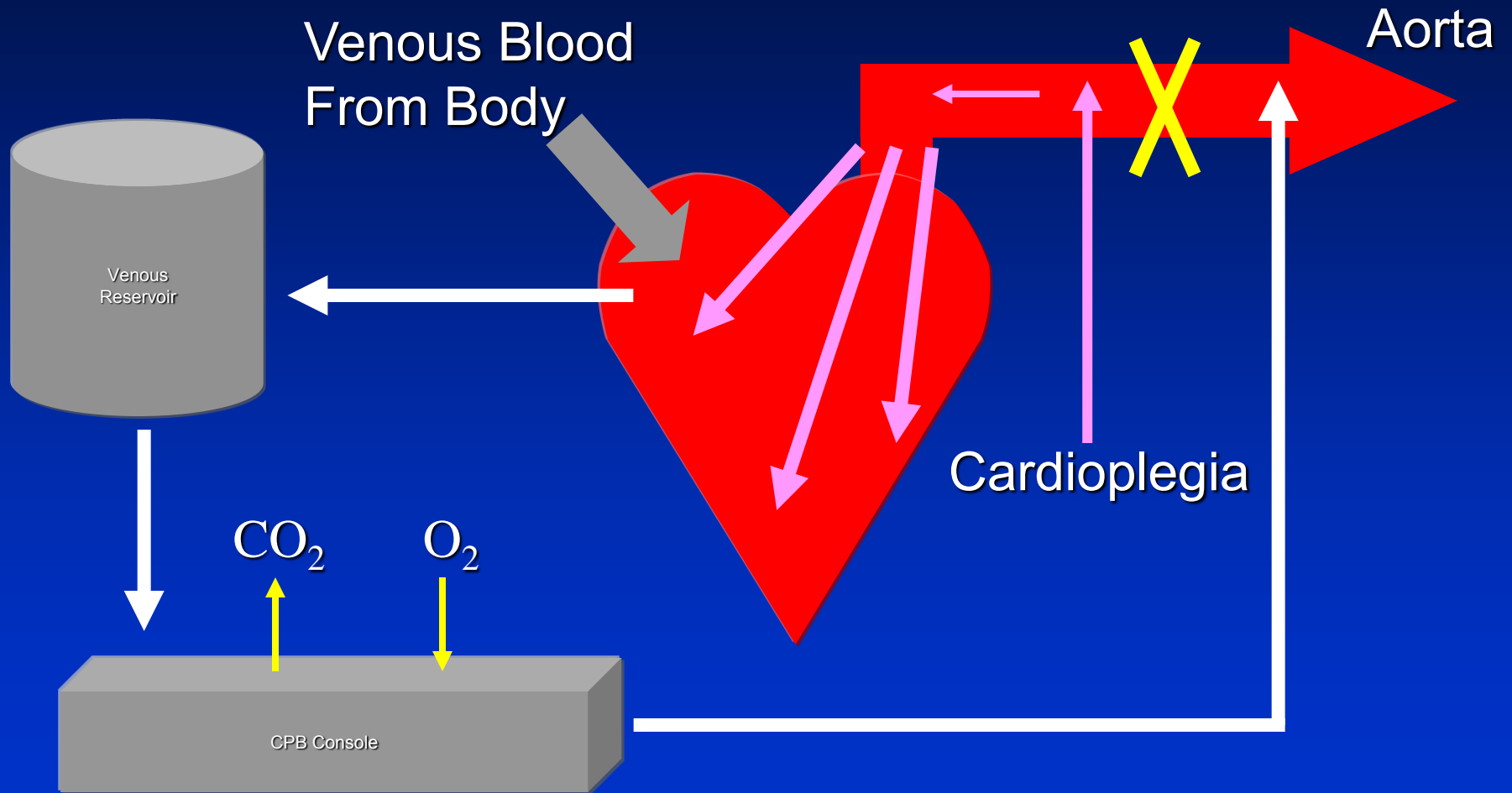
Complications of CPB

- Neurological complications
- Immune system compromise
- Systemic inflammatory response
- Bleeding complications
- Hemolysis
- Renal system complications
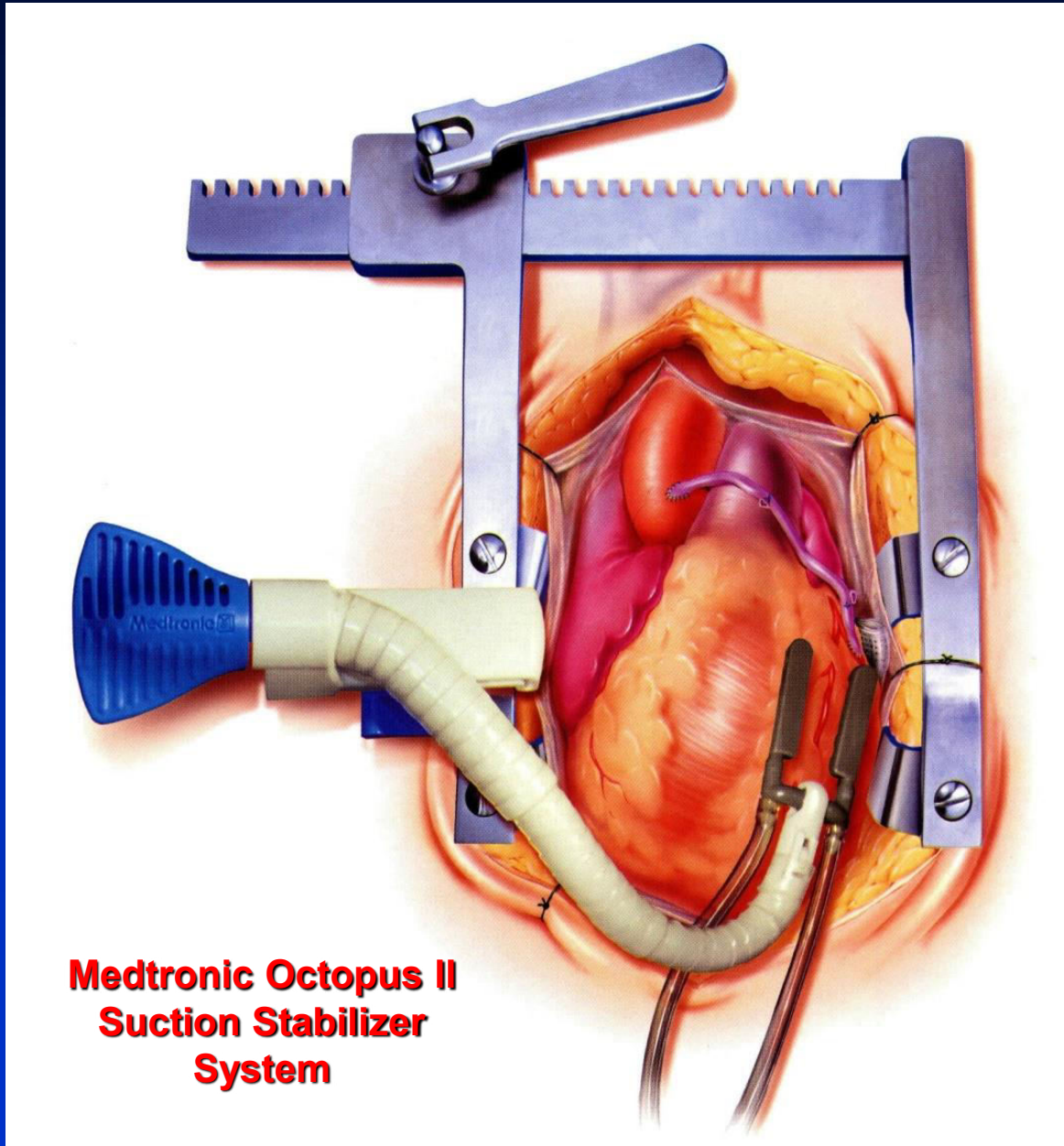- Atrial fibrillation

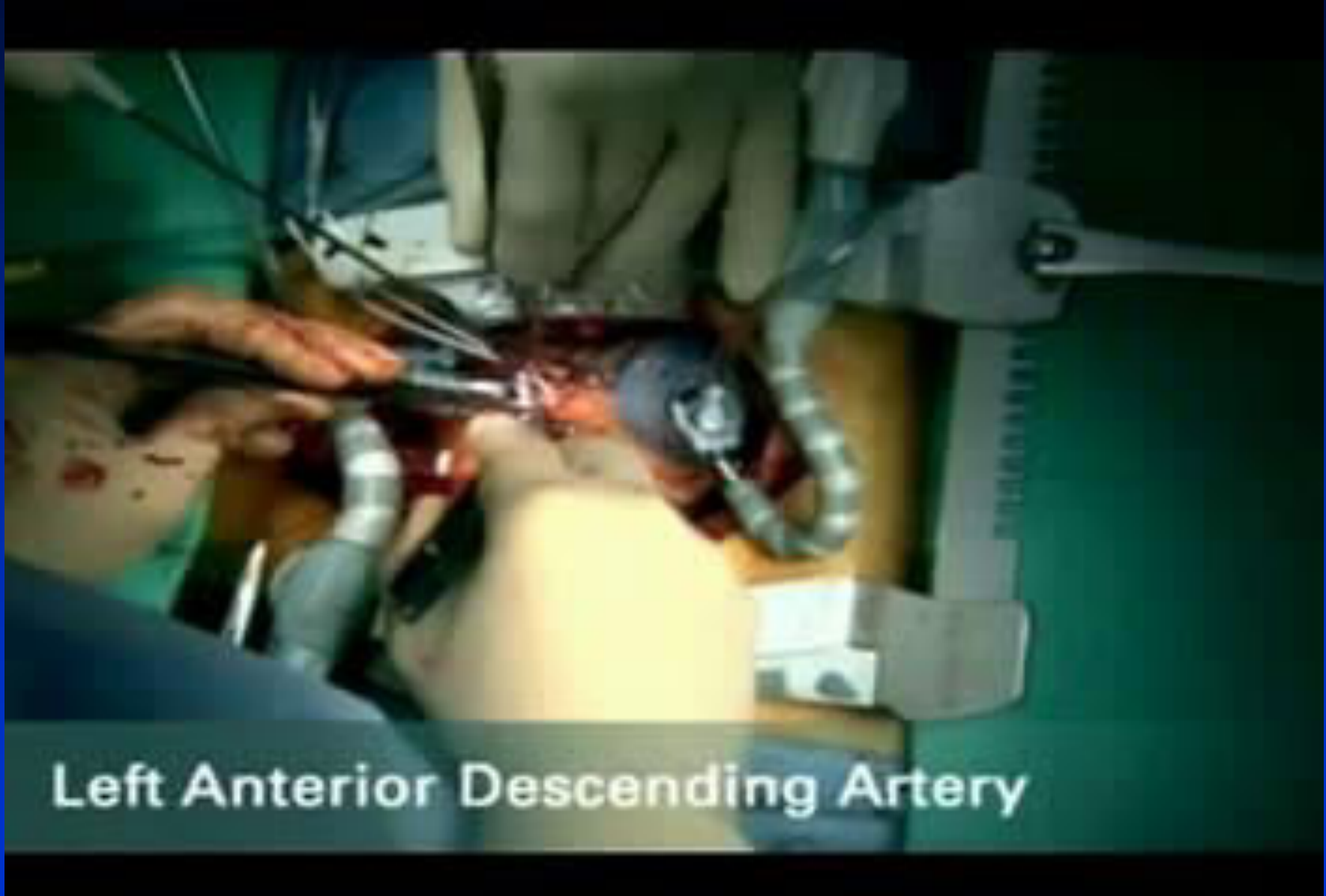# OPCAB Surgical Exposure

OPCAB Surgical Instrumentation

CTS/Guidant Access Ultima Stabilizer and Retractor
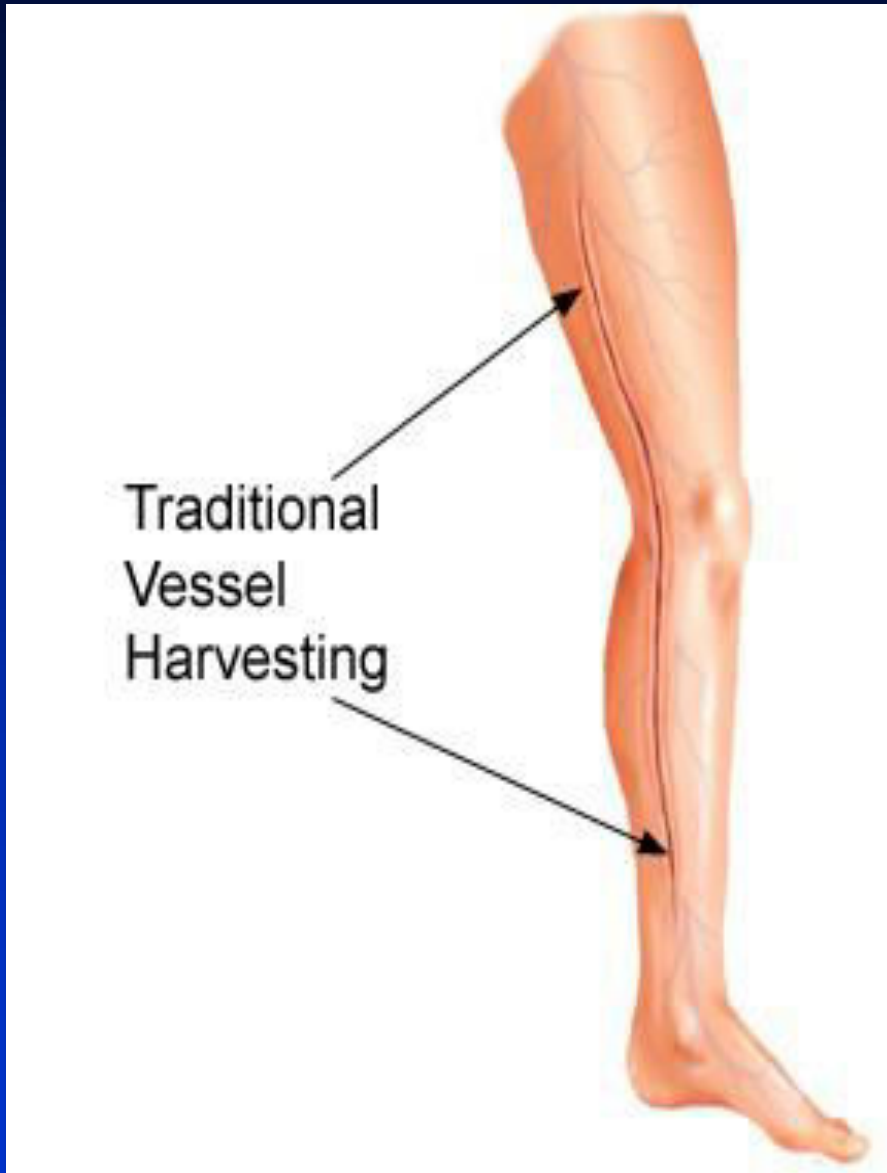
OPCAB Surgical Instrumentation

Medtronic Octopus II Suction Stabilizer System

OPCAB Surgical Procedure

Left Anterior Descending Artery

Traditional SVG Harvesting

Traditional Vessel Harvesting

Traditional vessel harvesting has some associated risks:

➢ **Patients often experience complications and infection as the leg wound heals.**

➢ **Some patients experience more postoperative pain from the leg incision than from the chest incision.**

➢ **Rehabilitation may be delayed if the long leg incision makes it difficult for the patient to stand or walk after surgery**

Endoscopic SVG Harvesting

Endoscopic
Vessel
Harvesting

Endoscopic vessel harvesting has been shown to:

➢ **Reduce surgical trauma to the patient**

➢ **Decrease the occurrence of complications and infection as the wound heals**

➢ **Eliminate the long scar associated with traditional vessel harvesting**

Endoscopic SVG Harvesting

Video-assisted endoscopic technique:

➢ **Insertion of video endoscope and blunt dissection up along the front and back plane of the Greater Saphenous Vein**

➢ **CO_2 insufflation creates a tunnel**

➢ **Lateral branches and attachments dissected free and divided using bipolar cautery scissors**

➢ **Vein divided proximally and distally, and removed from tunnel**

Medical Videos - Endoscopic Vein Harvest - Cardio-Thoracic Surgeries.flv
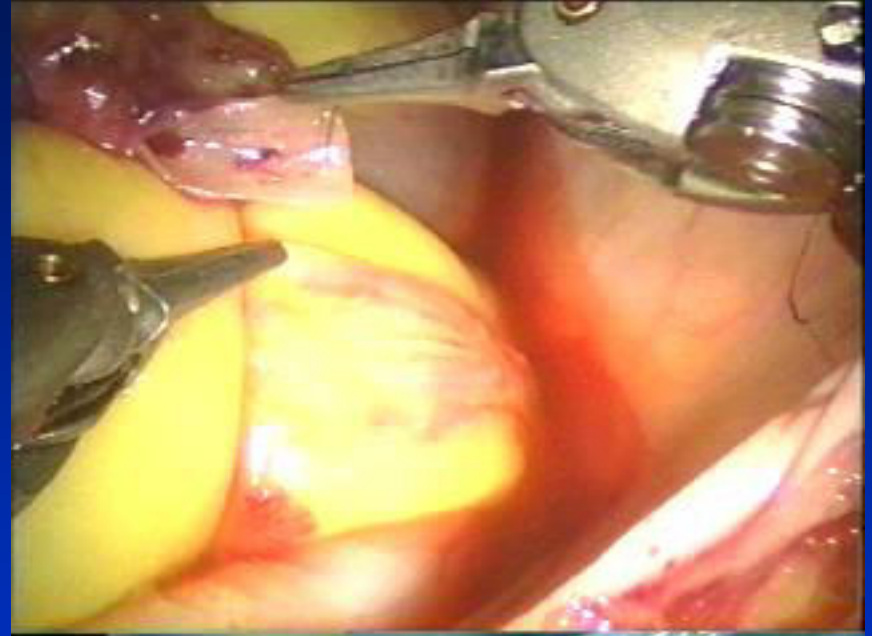
daVinci Robotic Surgery System

The daVinci ™ Surgical System instrument hand control

Robotic CABG Surgery

Mobilization of IMA

IMA-to-RCA Anastomosis

Take Home Message

- LOBBY AGAINST AIR POLLUTION AND SUPPORT CLEANER AIR

- DO NOT SMOKE

- QUIT TODAY AND LIVE LONGER

- PROTECT OUR CHILDREN FROM ADVERTISING AND SECOND-HAND SMOKE EXPOSURE

- EAT LESS

- EAT BETTER – LESS MEAT, LESS SUGAR, MORE FRUITS AND VEGETABLES

- EXERCISE

- ENCOURAGE AND SUPPORT OUR YOUTH TO EAT BETTER AND EXERCISE → OUR FUTURE AND THEIRS DEPENDS ON IT