"Breathing is truly a strange phenomenon of life, caught midway between the conscious and unconscious and peculiarly sensitive to both."

Dickenson Richards, M.D.
Columbia University College of Physicians and Surgeons
Nobel Laureate in Medicine, 1956

Roses are red,
Violets are blue;
Without your lungs,
Your blood would be, too

Goals and objectives for the pulmonary section: I

- Understand important categories and causes of lung disease in the United States and around the world
- Understand lung mechanics in health and disease
  - Lung mechanics determination efficiency of ventilation
    - Work of breathing
    - Compliance
      - $\Delta V/\Delta P$
    - Resistance
      - P_{alv}-P_{mouth}/ flow
    - PEEP and Auto-PEEP

Goals and objectives for the pulmonary section: II

- Understand gas exchange in health and disease
  - Alveolar air equation and calculation of alveolar-arterial (A-a) gradient
    - $P_AO_2 = P_IO_2 - (PCO_2/R)$
  - Oxygen delivery to tissues
    - Oxyhemoglobin dissociation curve
    - $DO2 = CO \times CaO_2$
    - $CaO2 = ([Hgb] \times 1.39 \times \%sat) + (pO_2 \times .0036)$
  - Mechanisms of hypoxemia
    - Shunt
      - Does not correct with oxygen breathing
    - V/Q mismatch
      - Corrects with oxygen breathing
      - Exacerbated by exercise
    - Alveolar hypoventilation
      - Normal A-a gradient
      - Corrects with oxygen breathing
    - Diffusion limitation
      - Corrects with oxygen breathing
      - Exacerbated by exercise

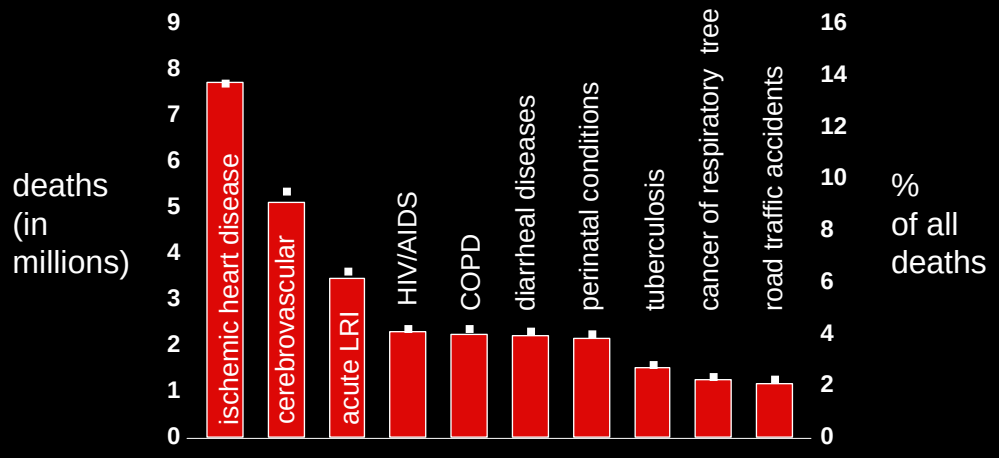
Goals and objectives for the pulmonary section: III

- Understand symptoms and signs of pulmonary disease
  - Symptoms
    - Dyspnea
      - Onset
      - Severity
      - Triggers
      - Progression
  - Signs
    - Wheezing
    - Crackles (rales and rhonchi)
    - Diminshed breath sound
    - Hyperresonant breath sounds
- Understand use of diagnostic testing in pulmonary disease
  - Pulmonary function testing
    - Restrictive and obstructive physiology
  - Arterial blood gas analysis
  - Chest radiograph
  - Lung pathology
    - Major types and patterns of injury and abnormality

Goals and objectives for the pulmonary section: IV

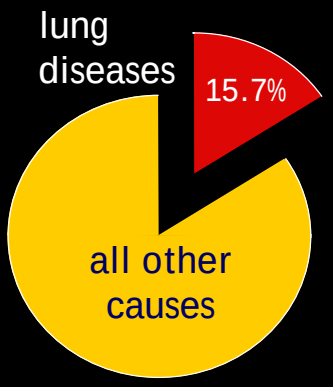
- Understand treatment approaches to patients with lung diseases
  - Symptomatic treatments
    - Oxygen therapy
    - Bronchodilators
    - Mechanical ventilation and PEEP
  - Disease specific treatments
    - Understand cellular and molecular basis of treatments for specific diseases
      - Steroids
      - Other immunosuppressives
      - Antibiotics
      - Anti-neoplastics
      - Pulmonary vasodilators

Leading causes of global mortality



WHO, World Health Report, 2004

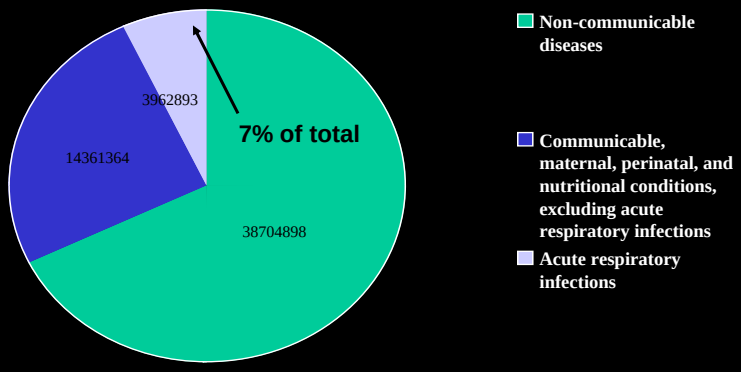
Impact of respiratory illness on global mortality



respiratory illnesses account for 8.43 million deaths per year, or 15.7% of total deaths in WHO member nations

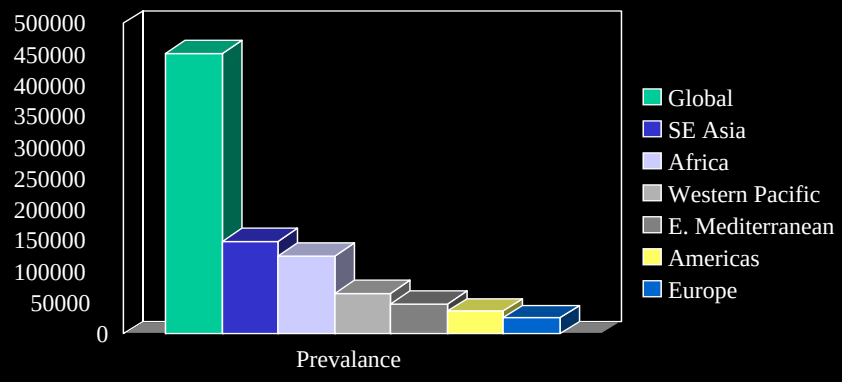
WHO, World Health Report, 2004

Global deaths due to acute respiratory infections



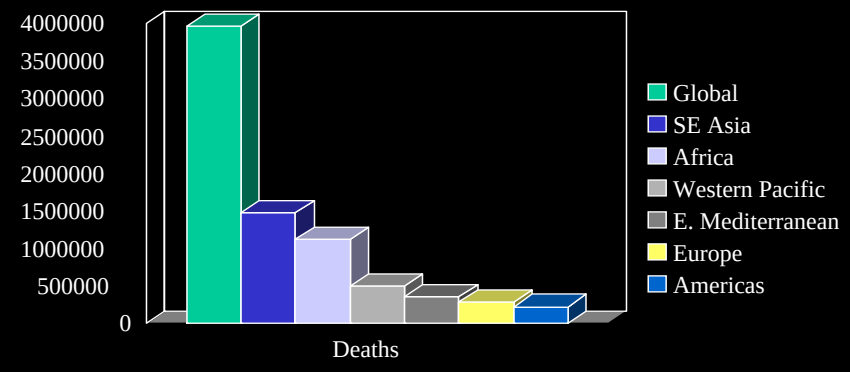
Source: WHO Global Disease Burden Report

Yearly prevalence (in 000s) of acute respiratory infections (ARI), by WHO region



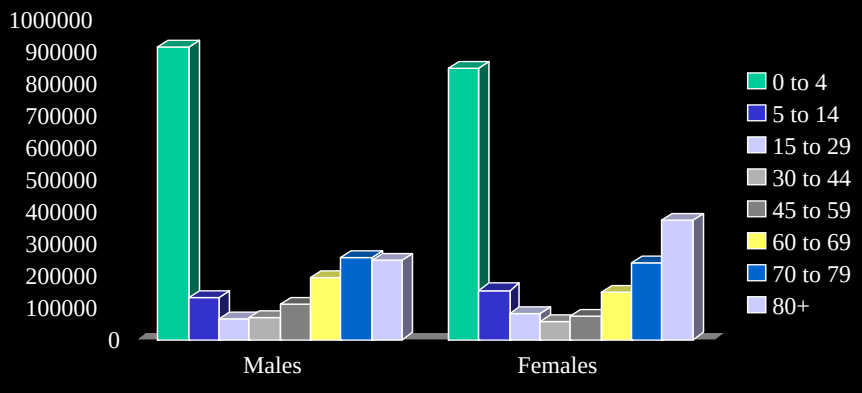
Source: WHO Global Disease Burden Report

Deaths due to ARI, by WHO region



Source: WHO Global Disease Burden Report

Deaths due to ARI, by age and sex, worldwide



Source: WHO Global Disease Burden Report

Cause of death among children less than 5 years of age

Cause of Death	Africa	Global
	percent	
Acute respiratory infection	16	18
Diarrheal disease	14	15
Malaria	22	10
Measles	8	5
HIV or AIDS	8	4
Neonatal deaths	13	23
Other causes	19	25
	number	
All causes	4.5 million	10.9 million

Source: NEJM, WHO

Serotypes of *S. pneumoniae* and *H. influenzae* in bacteremia-related isolates from Kenya

- *S. pneumoniae serotypes*
  - 1 (66 patients)**
  - 14 (39 patients)*
  - 6A (26 patients)
  - 6B (24 patients)*
  - 23F (21 patients)*
  - 18C (13 patients)*
  - 4 (11 patients)*
  - 3 (10 patients)
  - 19F (10 patients)*
- *H. influenzae*
  - 113/136 (83%) type B

*Serotype included in commercially available 7-valent conjugate pneumococcal vaccine

**Serotype included in 9-valent conjugate pneumococcal vaccine

Overall, 298/398 (75%) isolates were of serotypes covered by vaccines

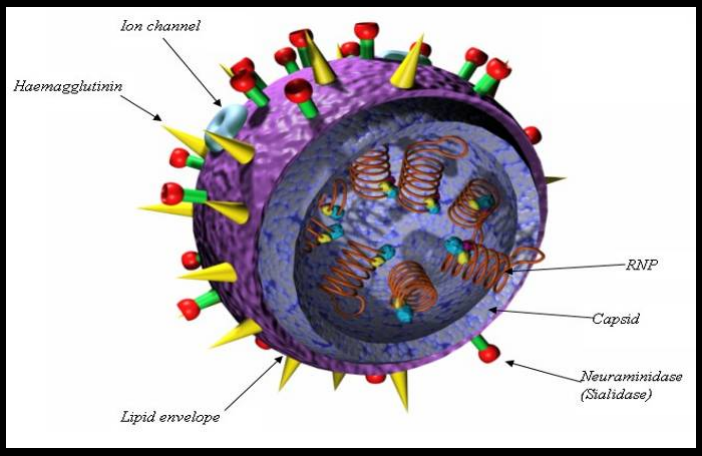
Berkley, JA. N Eng J Med 2005; 352: 38-47

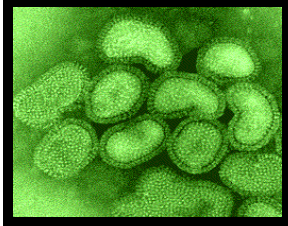
Notice of Prevnar Price Increase

Effective 9/25/04, Wyeth Pharmaceuticals will charge $326 for a 5 dose package (an increase of $5 per dose) of Prevnar (CPT 90669 pneumococcal conjugate vaccine, for children under 5 years, for intramuscular use).

American Academy of Pediatrics website

Influenza



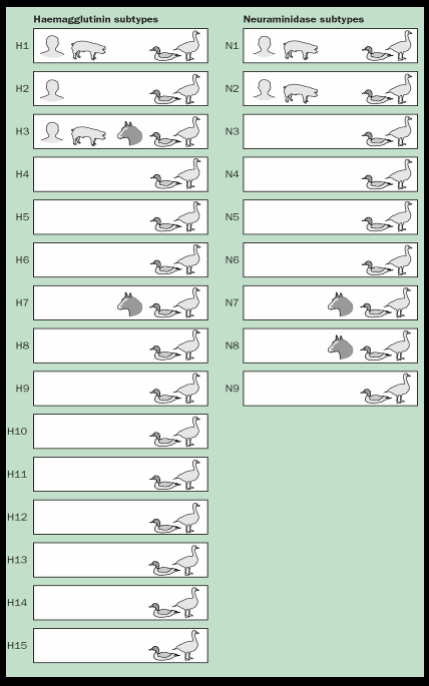


Influenza

- Roughly 20% of children and 5% of adults develop symptomatic influenza infections each year
- Infection is continuous in tropics, seasonal elsewhere
- Three types of influenza virus: A, B, C
- Only types A and B cause outbreaks
- Two major surface proteins:
  - Hemagglutinin: facilitates entry into host cells through sialic acid receptors
  - Neuraminidase: catalyzes cleavage of glycosidic linkages to sialic acid and assists in release of progeny virions from infected cells; drug target
- Influenza A:
  - 15 hemagglutinin subtypes
  - 9 neuraminidase subtypes

Natural hosts of influenza viruses

At present, only H1N1 and H3N2 are in circulation among humans



Pandemic influenza

- Caused by sudden appearance of a new subtype: antigenic shift
- 1918-1919
  - H1N1 “Spanish flu”
  - Arose in swine (?)
  - 20 million deaths in first year; 50 million deaths total
- 1957-1958
  - H2N2 “Asian flu”
  - Arose in fowl
  - Severe pandemic: 70,000 deaths in U.S.
- 1968-1969
  - H3N2 “Hong Kong flu”
  - Arose in fowl
  - Moderately severe: 34,000 deaths in the U.S.
- Future pandemics-
  - ?H5N1 (“Avian flu”)
  - ? H7N7
  - Both are highly lethal, though little if any person-to-person transmission yet documented

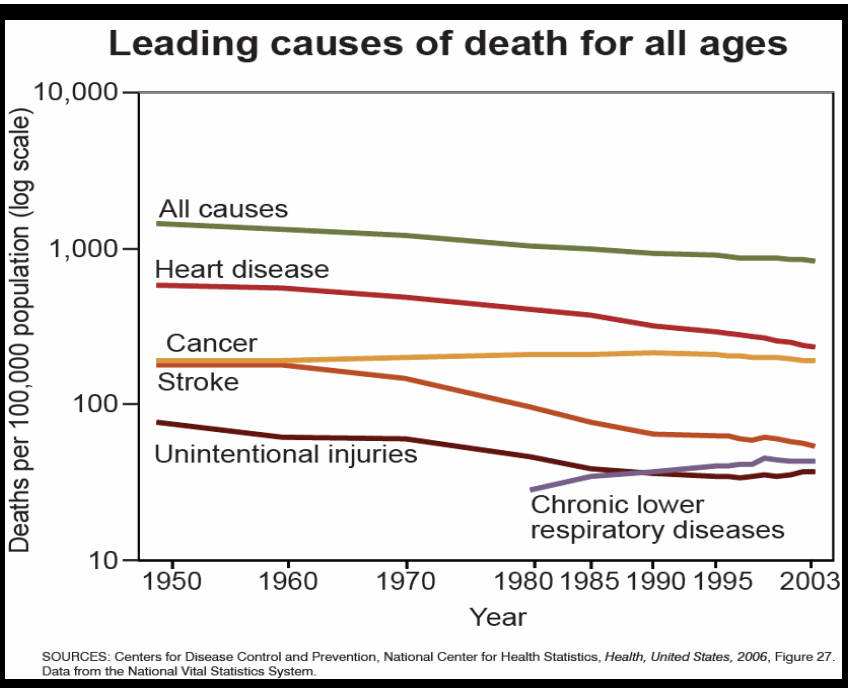
Strategies for controlling influenza

- Surveillance
- Vaccination
- Treatment

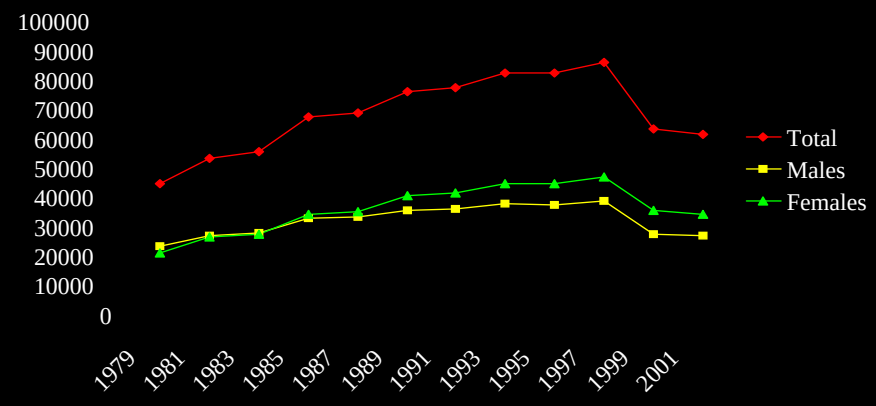
Leading causes of death in the U.S., 1980 and 2004

1980	1997
1. Heart disease	1. Heart disease
2. Cancer	2. Cancer
3. Cerebrovascular disease	3. Cerebrovascular disease
4. Unintentional injuries	4. COPD
5. COPD	5. Unintentional injuries
6. Pneumonia and influenza	6. Diabetes
7. Diabetes	7. Alzheimer's Disease
8. Chronic liver disease	8. Pneumonia and influenza
9. Atherosclerosis	9. Renal disease
10. Suicide	10. Sepsis

National Center for Health Statistics

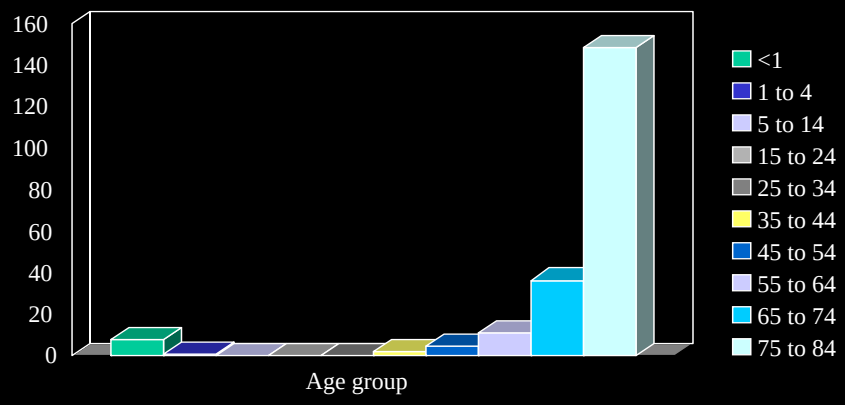


Deaths due to pneumonia and influenza, U.S., by year and sex



Source: National Center for Health Statistics

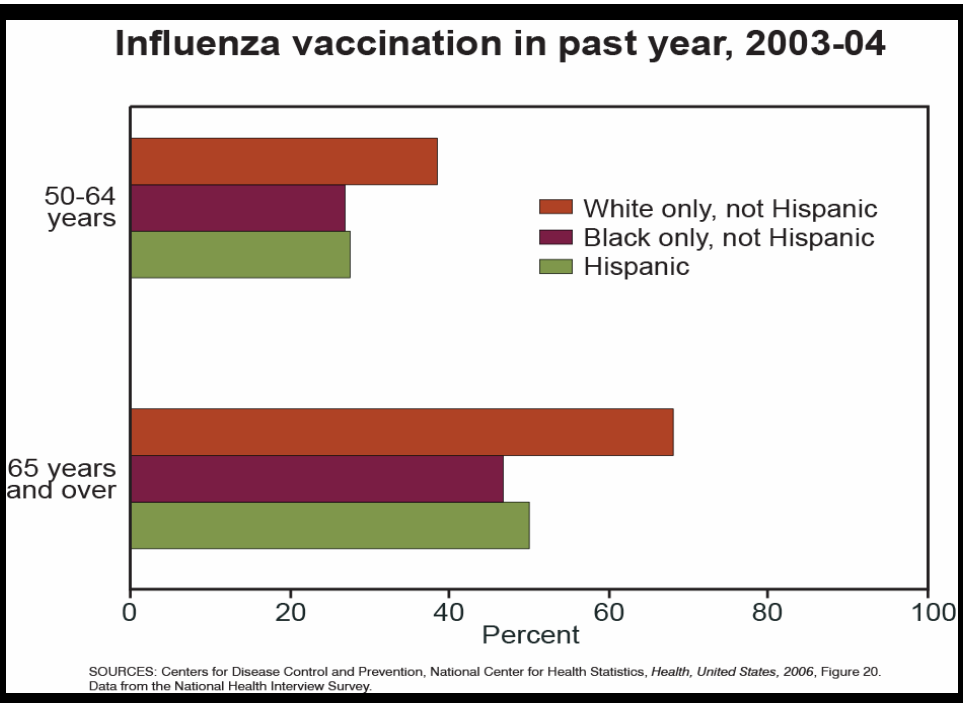
Age-specific mortality for ARI, US, 2001



Source: National Center for Health Statistics

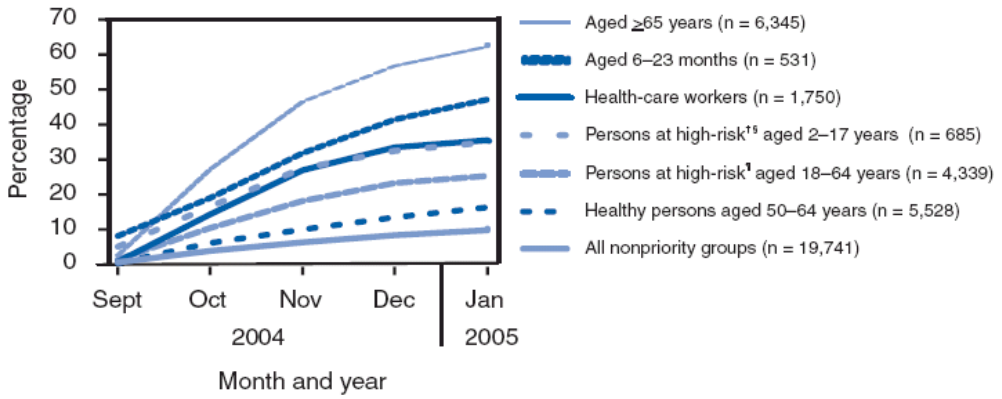
Risk factors for community acquired pneumonia

- Advancing age
- Tobacco use
- Air pollution
- Underlying chronic disease
- Malnutrition
- Alcohol use
- Chronic obstructive pulmonary disease
- Others including immunodeficiency, treatment with immunosuppressive drugs, malignancy, etc.



Influenza vaccine coverage, United States, 2004-2005

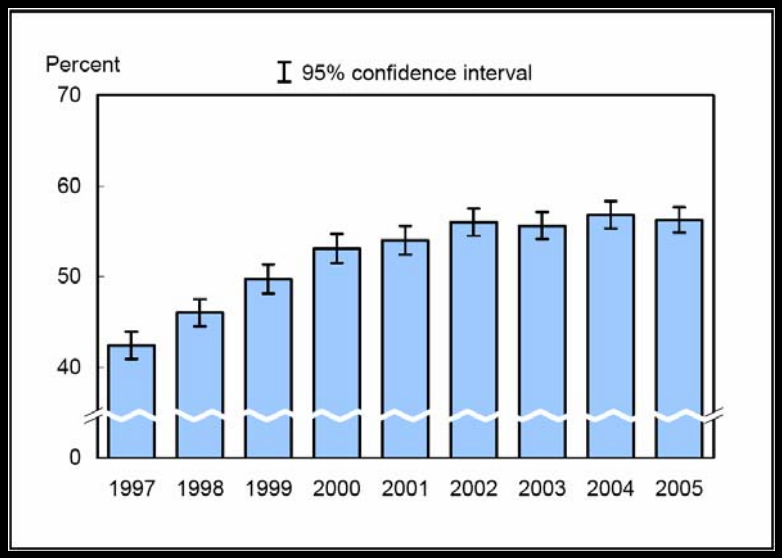
FIGURE. Monthly influenza vaccination coverage among selected priority populations, by month — Behavioral Risk Factor Surveillance System, United States, 2004–05 influenza season*



* Interviews were conducted during February 1–27, 2005.
† Does not include persons in households with infants aged <6 months, out-of-home caregivers of infants aged <6 months, or others with rare, high-risk conditions.
§ Asthma; other lung, heart, or kidney problems; diabetes; weakened immune system; anemia; or aspirin therapy for chronic conditions.
¶ Asthma; other lung, heart, or kidney problems; diabetes; weakened immune system; anemia; or pregnancy.

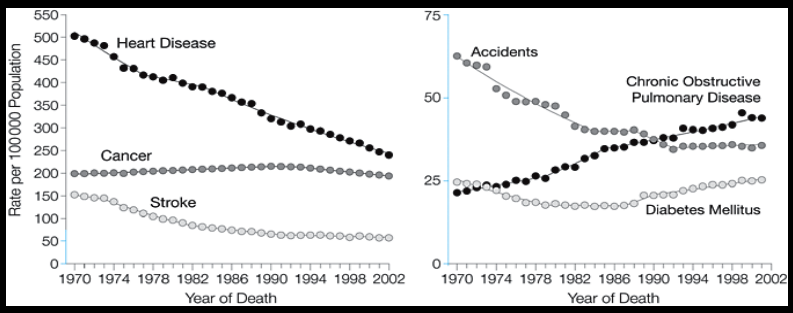
MMWR 2005; 54: 304-307

Pneumococcal vaccine coverage in persons > 65 years, U.S., 1997-2005



CDC, 2006

Trends in Age-Standardized Death Rates for the 6 Leading Causes of Death in the United States, 1970-2002



Jemal, A. et al. JAMA 2005;294:1255-1259.

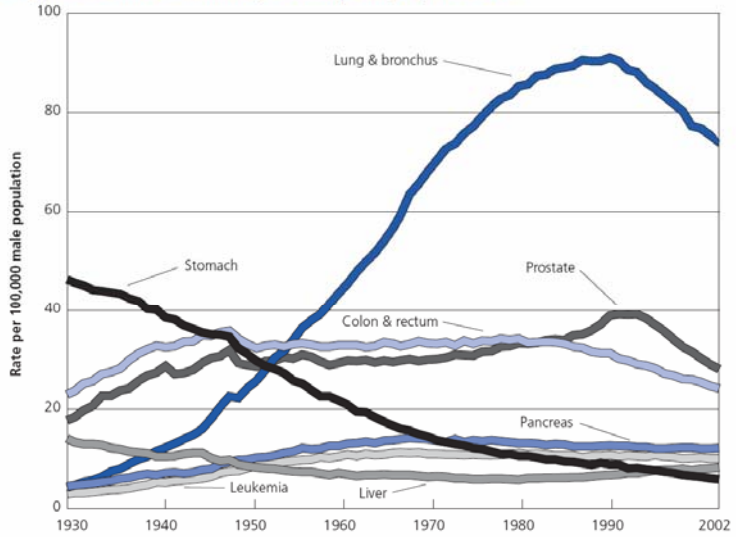
Leading Sites of New Cancer Cases and Deaths – 2006 Estimates

Estimated New Cases*		Estimated Deaths	
Male	Female	Male	Female
Prostate 234,460 (33%)	Breast 212,920 (31%)	Lung & bronchus 90,330 (31%)	Lung & bronchus 72,130 (26%)
Lung & bronchus 92,700 (13%)	Lung & bronchus 81,770 (12%)	Colon & rectum 27,870 (10%)	Breast 40,970 (15%)
Colon & rectum 72,800 (10%)	Colon & rectum 75,810 (11%)	Prostate 27,350 (9%)	Colon & rectum 27,300 (10%)
Urinary bladder 44,690 (6%)	Uterine corpus 41,200 (6%)	Pancreas 16,090 (6%)	Pancreas 16,210 (6%)
Melanoma of the skin 34,260 (5%)	Non-Hodgkin lymphoma 28,190 (4%)	Leukemia 12,470 (4%)	Ovary 15,310 (6%)
Non-Hodgkin lymphoma 30,680 (4%)	Melanoma of the skin 27,930 (4%)	Liver & intrahepatic bile duct 10,840 (4%)	Leukemia 9,810 (4%)
Kidney & renal pelvis 24,650 (3%)	Thyroid 22,590 (3%)	Esophagus 10,730 (4%)	Non-Hodgkin lymphoma 8,840 (3%)
Oral cavity & pharynx 20,180 (3%)	Ovary 20,180 (3%)	Non-Hodgkin lymphoma 10,000 (3%)	Uterine corpus 7,350 (3%)
Leukemia 20,000 (3%)	Urinary bladder 16,730 (2%)	Urinary bladder 8,990 (3%)	Multiple myeloma 5,630 (2%)
Pancreas 17,150 (2%)	Pancreas 16,580 (2%)	Kidney & renal pelvis 8,130 (3%)	Brain & other nervous system 5,560 (2%)
All sites 720,280 (100%)	All sites 679,510 (100%)	All sites 291,270 (100%)	All sites 273,560 (100%)

*Excludes basal and squamous cell skin cancers and in situ carcinoma except urinary bladder.
Note: Percentages may not total 100% due to rounding.

Source: American Cancer Society

Age-Adjusted Cancer Death Rates,* Males by Site, US, 1930-2002



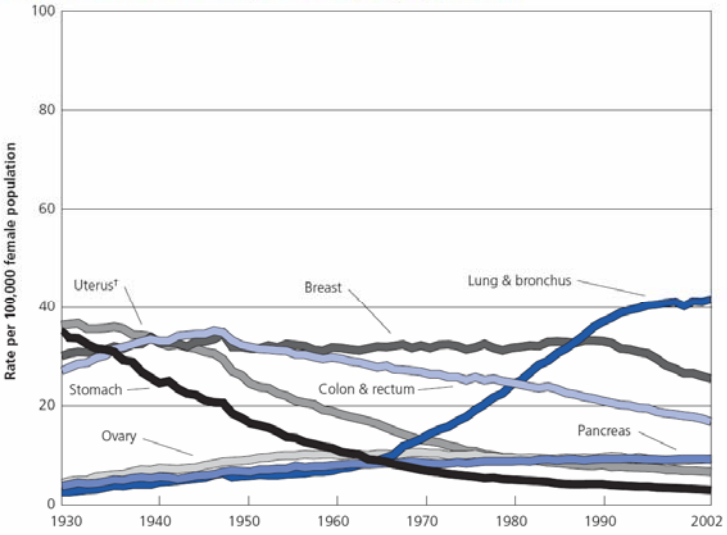
*Per 100,000, age-adjusted to the 2000 US standard population.

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 Public Use Data Tapes 1960 to 2002, US Mortality Volumes 1930 to 1959, National Center for Health Statistics, Centers for Disease Control and Prevention, 2005.

American Cancer Society, Surveillance Research, 2006

Age-Adjusted Cancer Death Rates,* Females by Site, US, 1930-2002



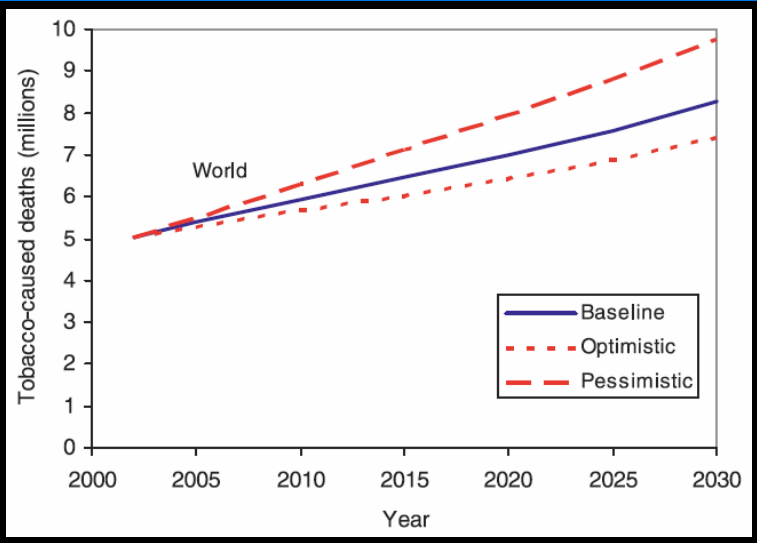
*Per 100,000, age-adjusted to the 2000 US standard population. †Uterus cancer death rates are for uterine cervix and uterine corpus combined.

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 Public Use Data Tapes 1960 to 2002, US Mortality Volumes 1930 to 1959, National Center for Health Statistics, Centers for Disease Control and Prevention, 2005.

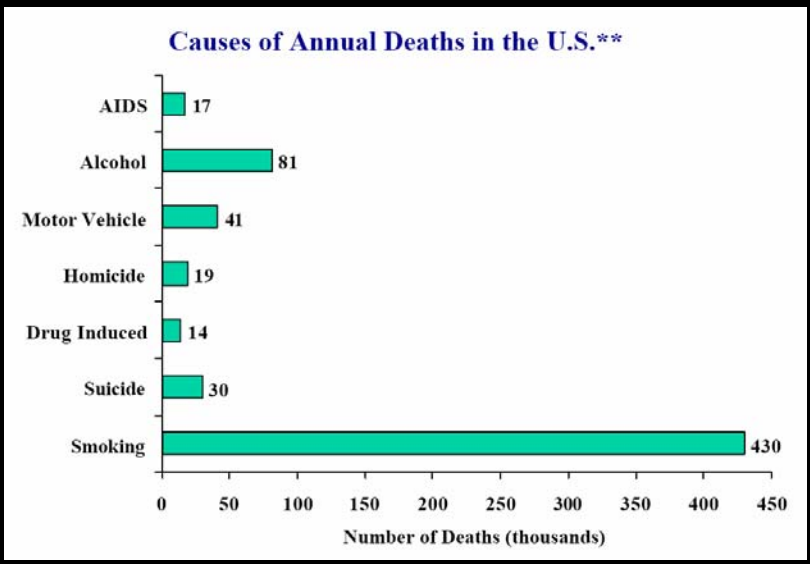
American Cancer Society, Surveillance Research, 2006

Global tobacco-related mortality, 2002-2030



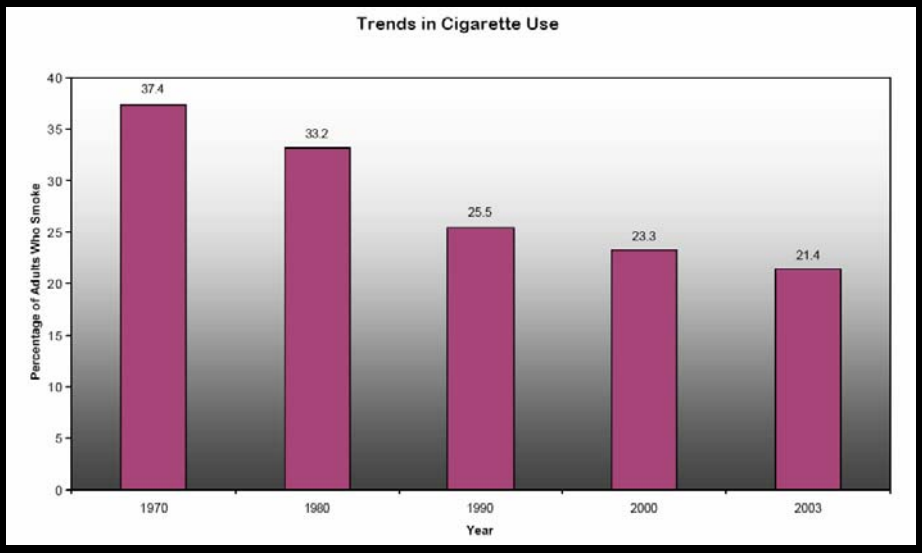
Mathers and Loncar, PLOS 2006; 3: e442

Tobacco-related deaths annually, U.S.

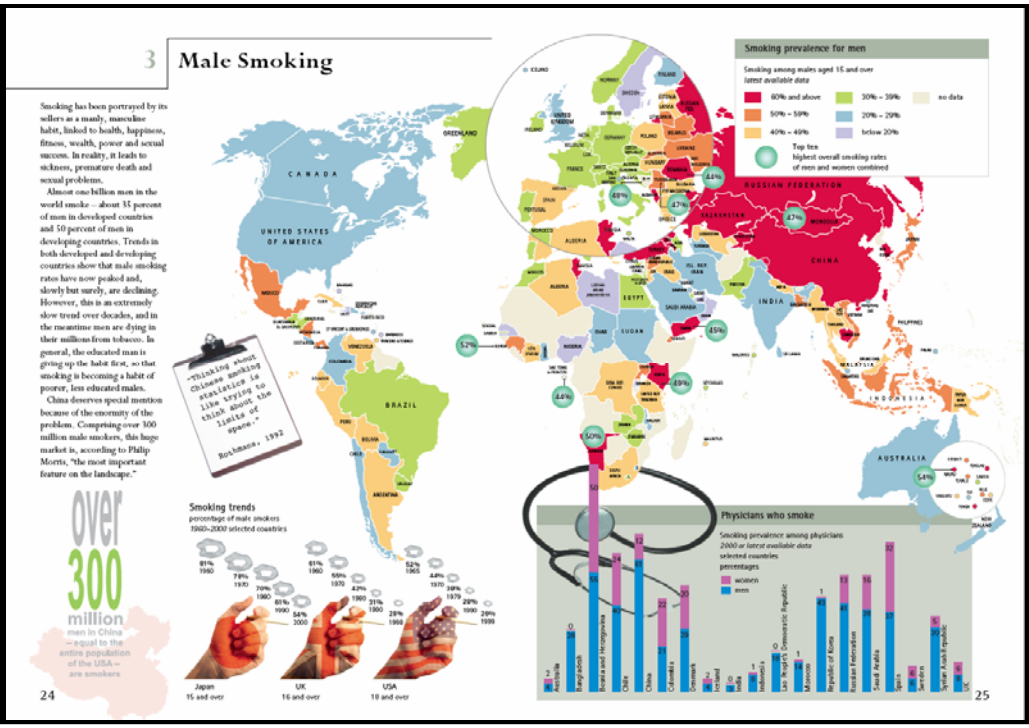


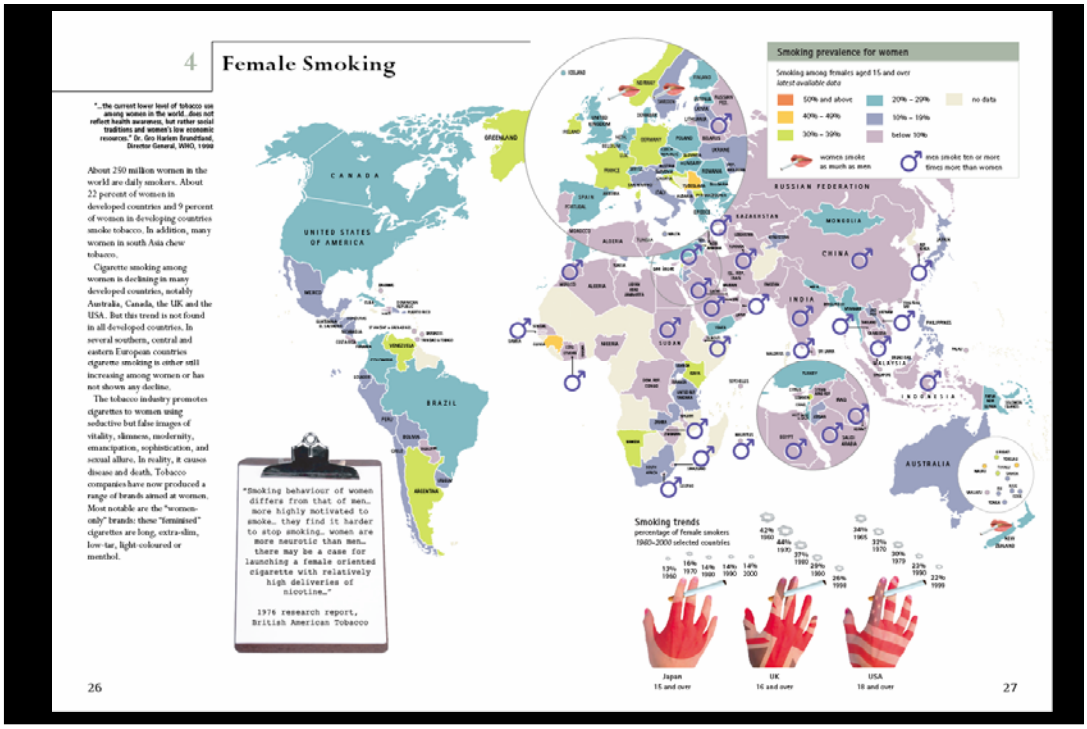
Source: CDC, ALA

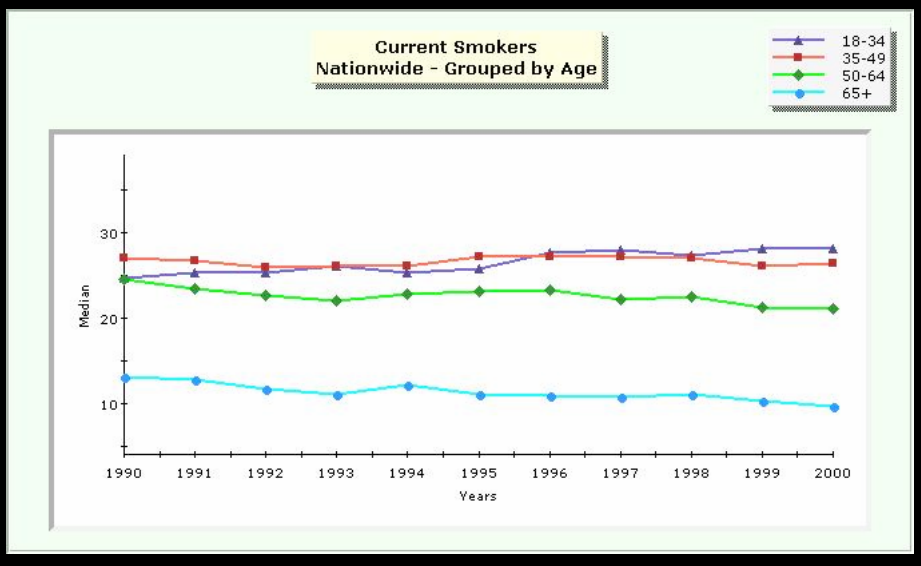
U.S. smoking trends



Source: CDC, National Center for Chronic Disease Prevention and Health Promotion, 2002

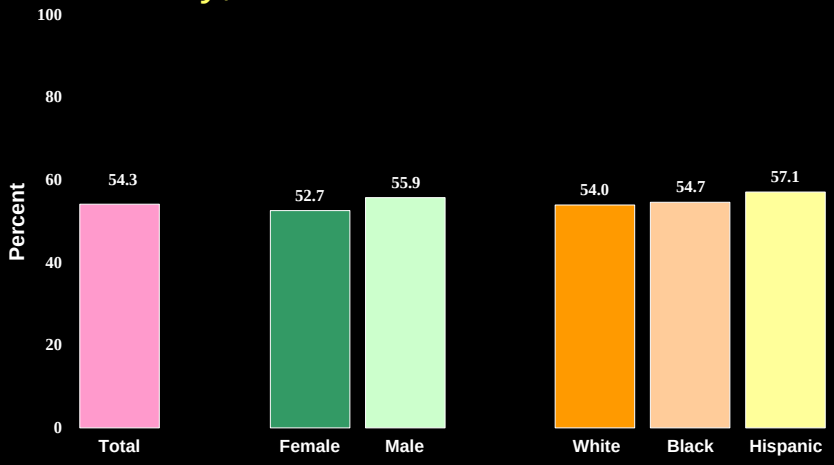






Source: CDC, National Center for Chronic Disease Prevention and Health Promotion, 2002

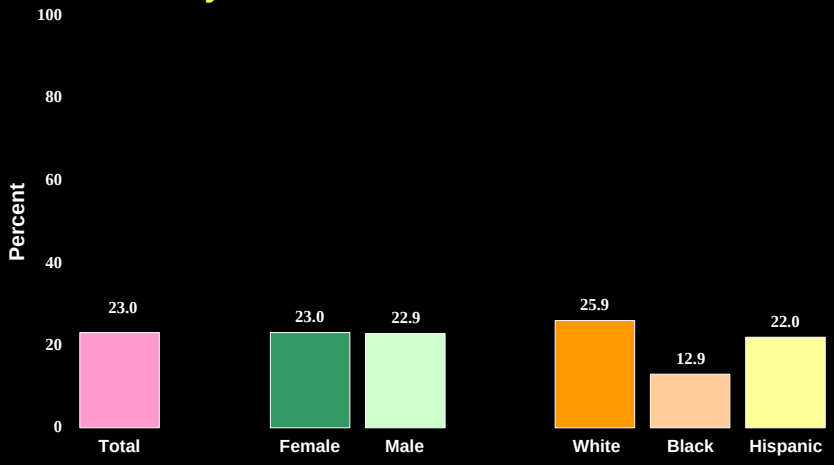
Percentage of High School Students Who Reported Lifetime Cigarette Use,* by Sex** and Race/Ethnicity, 2005



* Ever tried cigarette smoking, even one or two puffs
** M > F

National Youth Risk Behavior Survey, 2005

Percentage of High School Students Who Reported Current Cigarette Use,* by Sex and Race/Ethnicity,** 2005



* Smoked cigarettes on ≥ 1 of the 30 days preceding the survey
** W, H > B

National Youth Risk Behavior Survey, 2005

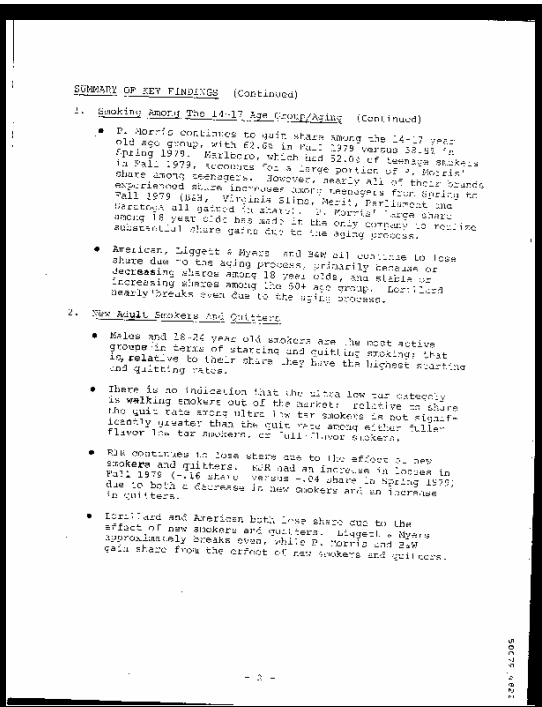
Summary

It is important to know as much as possible about teenage smoking patterns and attitudes. Today's teenager is tomorrow's potential regular customer, and the overwhelming majority of smokers first begin to smoke while still in their teens. In addition, the ten years following the teenage years is the period

Because of our high share of the market among the youngest smokers, Philip Morris will suffer more than the other companies from the decline in the number of teenage smokers. For at least the next decade, however, the population trends will have a much more powerful influence, and in this regard we would appear to be the least vulnerable of all the companies, as will be discussed later in this report.

Philip Morris Co. memorandum, March 31, 1981

RJR
July 18, 1980



SUMMARY OF KEY FINDINGS (Continued)

1. Smoking Among The 14-17 Age Group/Aging (Continued)

- P. Morris continues to gain share among the 14-17 year old age group, with 62.0% in Fall 1979 versus 58.4% in Spring 1979. Marlboro, which had 52.0% of teenage smokers in Fall 1979, accounts for a large portion of P. Morris' share among teenagers. However, nearly all of their brands experienced share increases among teenagers from Spring to Fall 1979 (B&H, Virginia Slims, Merit, Parliament and Benson & Hedges all gained in share). P. Morris' large share among 18 year olds has made it the only company to realize substantial share gains due to the aging process.

- American, Liggett & Myers and B&W all continue to lose share due to the aging process, primarily because of decreasing shares among 18 year olds, and stable or increasing shares among the 50+ age group. Lorillard nearly breaks even due to the aging process.

2. New Adult Smokers And Quitters

- Males and 18-24 year old smokers are the most active groups in terms of starting and quitting smoking; that is, relative to their share they have the highest starting and quitting rates.

- There is no indication that the ultra low tar category is walking smokers out of the market: relative to share the quit rate among ultra low tar smokers is not significantly greater than the quit rate among either full-flavor low tar smokers, or full-flavor smokers.

- RJR continues to lose share due to the effect of new smokers and quitters. RJR had an increase in losses in Fall 1979 (-.16 share) versus -.04 share in Spring 1979; due to both a decrease in new smokers and an increase in quitters.

- Lorillard and American both lose share due to the effect of new smokers and quitters. Liggett & Myers approximately breaks even, while P. Morris and B&W gain share from the effect of new smokers and quitters.

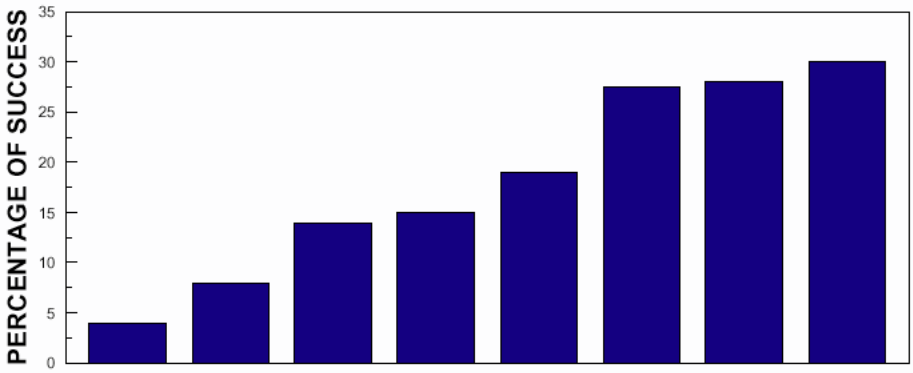
- 2 -

1284 42305

Limiting morbidity and mortality from tobacco use

- Medical model
  - Smoking cessation
  - Early detection and treatment of smoking related illness:
    - Lung cancer screening
    - Prevention and treatment of COPD
- Public health model
  - Limiting access to tobacco
    - Raising cigarette tax
    - Enforcing age limits for purchase
    - Smoking restrictions in workplaces and public facilities
  - Discouraging use of tobacco
    - School-based initiatives
    - Counter advertising

FIGURE 10: SUCCESS RATES FOR VARIOUS CESSATION METHODS, 1998



Self Help Only	Patch	Gum	Behavioral	Inhalers	Rplcmt + Bhvr	Prescriptions	Nasal Spray
4.0	8.0	14.0	15.0	19.0	27.5	28.0	30.0

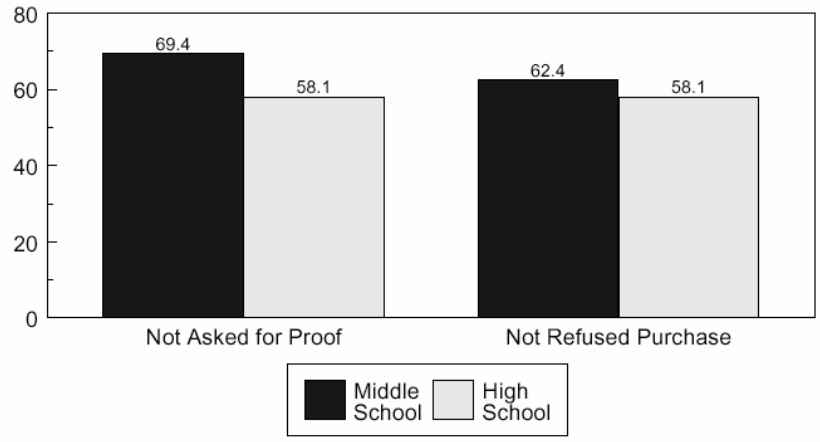
Source: CDC Office on Smoking & Health - Cessation Division

Hutchinson Smoking Prevention Project: Long-Term Randomized Trial of School-Based Tobacco Use Prevention

- 40 school districts in Washington State randomized to provide comprehensive anti-tobacco curriculum (based on CDC and NCI recommendations) in grades 3-12 or standard health curriculum
- Main study endpoints were smoking in grade 12 and 2 years after high school
- 8388 students entering third grade were subjects in the study; follow-up data available on 93%
- Prevalence of daily smoking at study conclusion: 24.66% in control districts, 24.41% in experimental districts

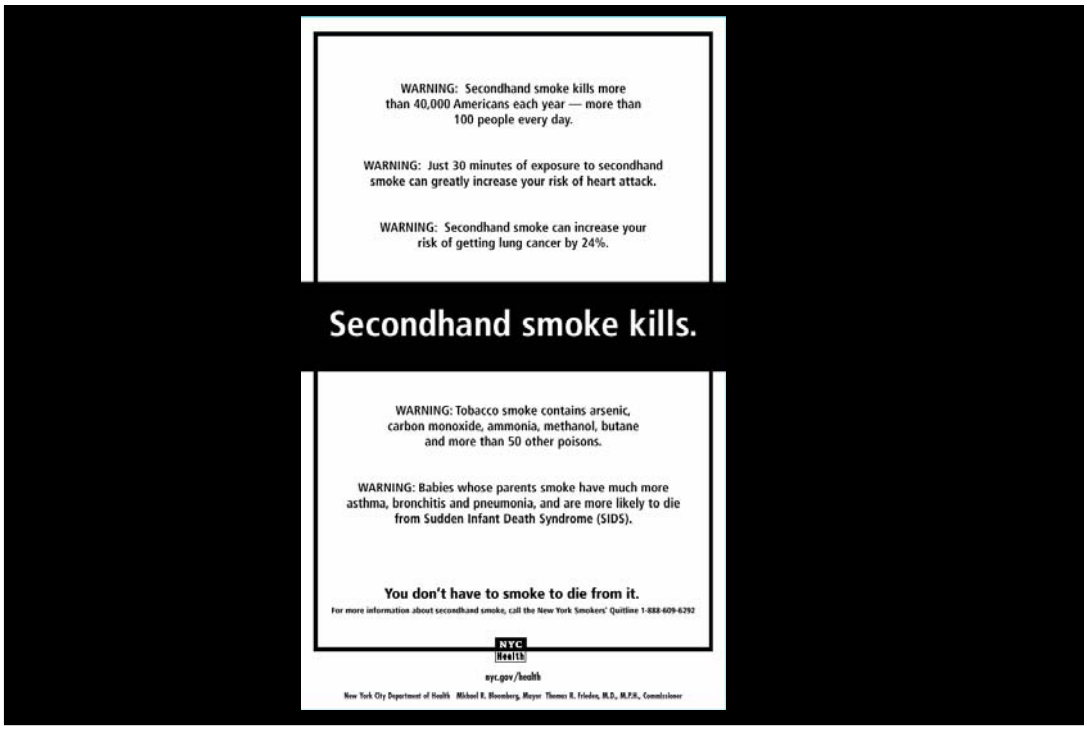
Peterson et. al., J Natl Can Inst 2000; 92: 1979-1991

PERCENTAGE OF CURRENT SMOKERS AGED <18 YEARS WHO PURCHASED CIGARETTES IN A STORE AND WERE NOT ASKED TO SHOW PROOF OF AGE OR WHO WERE NOT REFUSED PURCHASE BECAUSE OF THEIR AGE, 2000



SOURCE: NATIONAL YOUTH TOBACCO SURVEY, 2000


You've got 6 months to live.
If reading the above sentence startled you, imagine hearing it from your doctor. Unfortunately, this scenario is all too real for some of the 440,000 people nationwide who will die this year from tobacco-related disease. It doesn't have to be this way. Using state tobacco settlement money on public health programs, especially those dedicated to tobacco prevention and control, saves lives and money. Smoking-related disease costs Americans more than $85 billion in health care each year. According to a recent Legacy study, reducing smoking rates by 25% would collectively save the states' taxpayers more than $550 million a year in state Medicaid costs alone - and more importantly, help save lives. For a copy of the study, check out www.americanlegacy.org.
Legacy
American Cancer Society / American Heart Association / American Lung Association / Campaign For Tobacco-Free Kids


WARNING: Secondhand smoke kills more than 40,000 Americans each year — more than 100 people every day.
WARNING: Just 30 minutes of exposure to secondhand smoke can greatly increase your risk of heart attack.
WARNING: Secondhand smoke can increase your risk of getting lung cancer by 24%.
Secondhand smoke kills.
WARNING: Tobacco smoke contains arsenic, carbon monoxide, ammonia, methanol, butane and more than 50 other poisons.
WARNING: Babies whose parents smoke have much more asthma, bronchitis and pneumonia, and are more likely to die from Sudden Infant Death Syndrome (SIDS).
You don't have to smoke to die from it.
For more information about secondhand smoke, call the New York Smokers' Quitline 1-888-609-6292
NYC Health
nyc.gov/health
New York City Department of Health Michael R. Bloomberg, Mayor Thomas R. Frieden, M.D., M.P.H., Commissioner

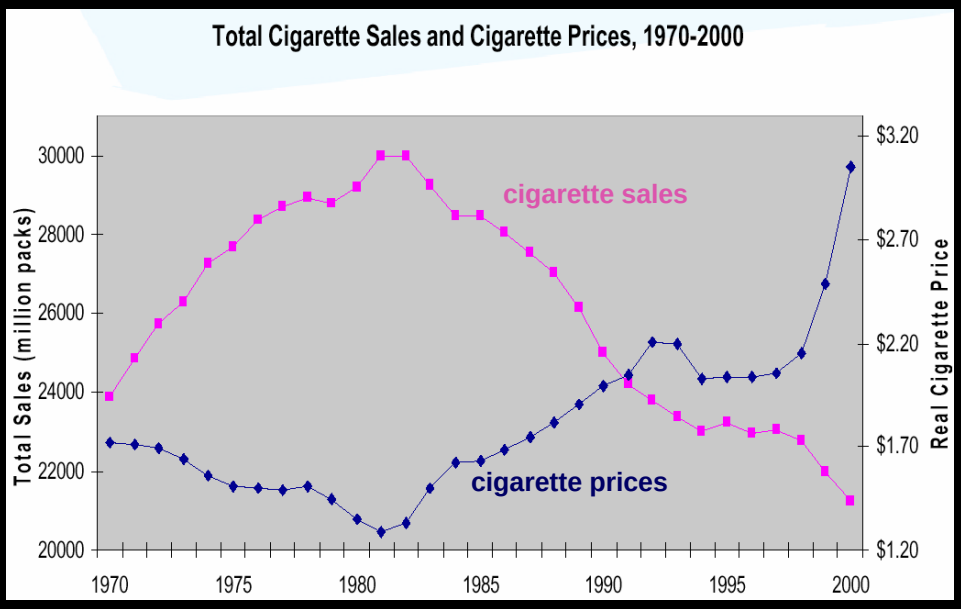
THERE'S NO SUCH THING AS A NON-SMOKING SECTION

Just 30 minutes of exposure to second-hand smoke increases the risk of heart disease in non-smokers. Bartenders who work an 8-hour shift in a smoky bar inhale the same amount of cancer-causing chemicals as if they'd smoked more than half a pack of cigarettes.

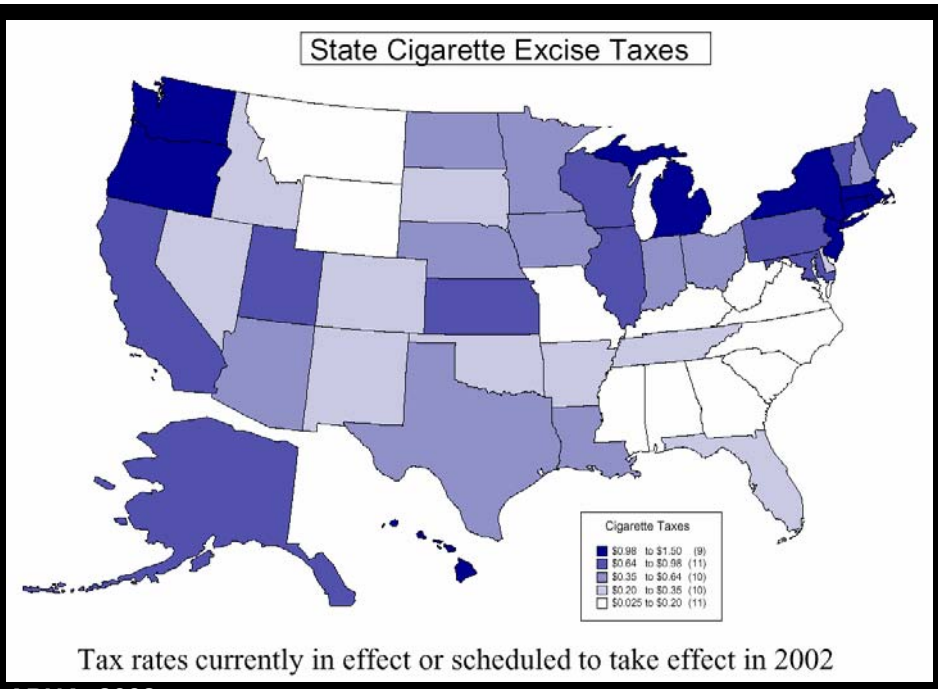
Second-hand smoke kills.
For more information, call the New York Smokers' Quitline at 1-888-609-6292.

nyc.gov/health

New York City Department of Health and Mental Hygiene
Michael R. Bloomberg, Mayor · Thomas R. Frieden, M.D., M.P.H., Commissioner



APHA, 2002



APHA, 2002

Smoke-Free Workplace Act of 2002 (NYC Local Law 47)

- Law took effect March 30, 2003
- Bans smoking in all indoor workplaces in New York City, including bars and restaurants of any size.
- Exemptions for 7 currently existing cigar bars.
- Exemptions for owner operated bars.
- Restaurants will be allowed to build completely enclosed, negative pressure ventilated smoking rooms into which no employee will be allowed until the last customer of the day has left. Clause sunsets after three years.
- New York State has adopted a similar law that covers the entire state

The New York Times ON THE WEB

Legislators Pass Smoking Ban in New Jersey

By RICHARD LEZIN JONES and JOSH BENSON
Published: January 10, 2006

TRENTON, Jan. 9 - New Jersey lawmakers approved a far-reaching ban Monday on smoking in indoor public places that includes virtually all of the state's bars and restaurants but not the gambling areas of Atlantic City's 12 casinos.

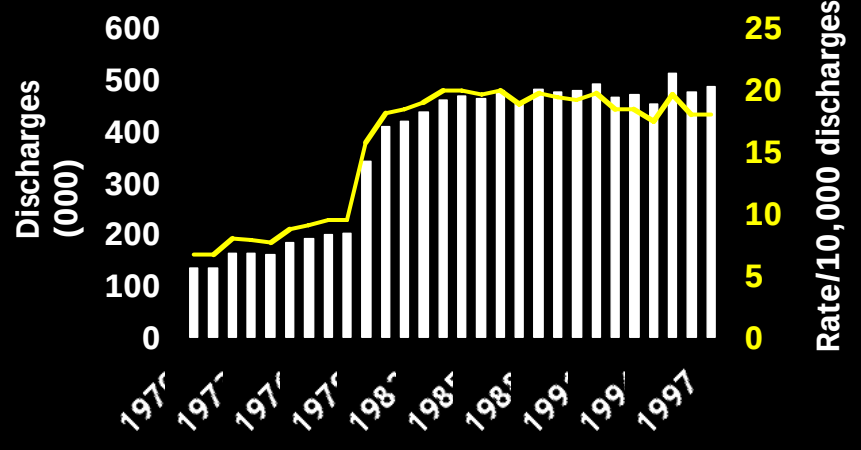
Workplace smoking ban, Ireland

from McElvaney NG. NEJM 2004; 2231-2234


VIETATO FUMARE


Reductions in carcinogens are in comparison to similar competitive brand styles.
WARNING: Smoking is addictive and dangerous to your health. Reductions in carcinogens (PAHs, nitrosamines, and catechols) have NOT been proven to result in a safer cigarette. This product produces tar, carbon monoxide, and other harmful by-products.
NEW! Omni
Reduced carcinogens.
Premium taste.™
We believe every smoker deserves both.
Introducing the first premium cigarette created to significantly reduce carcinogenic PAHs, nitrosamines, and catechols, which are the major causes of lung cancer in smokers.
www.omnicigs.com

U.S. asthma discharges, 1970-1997



National Center for Health Statistics, National Hospital Discharge Survey