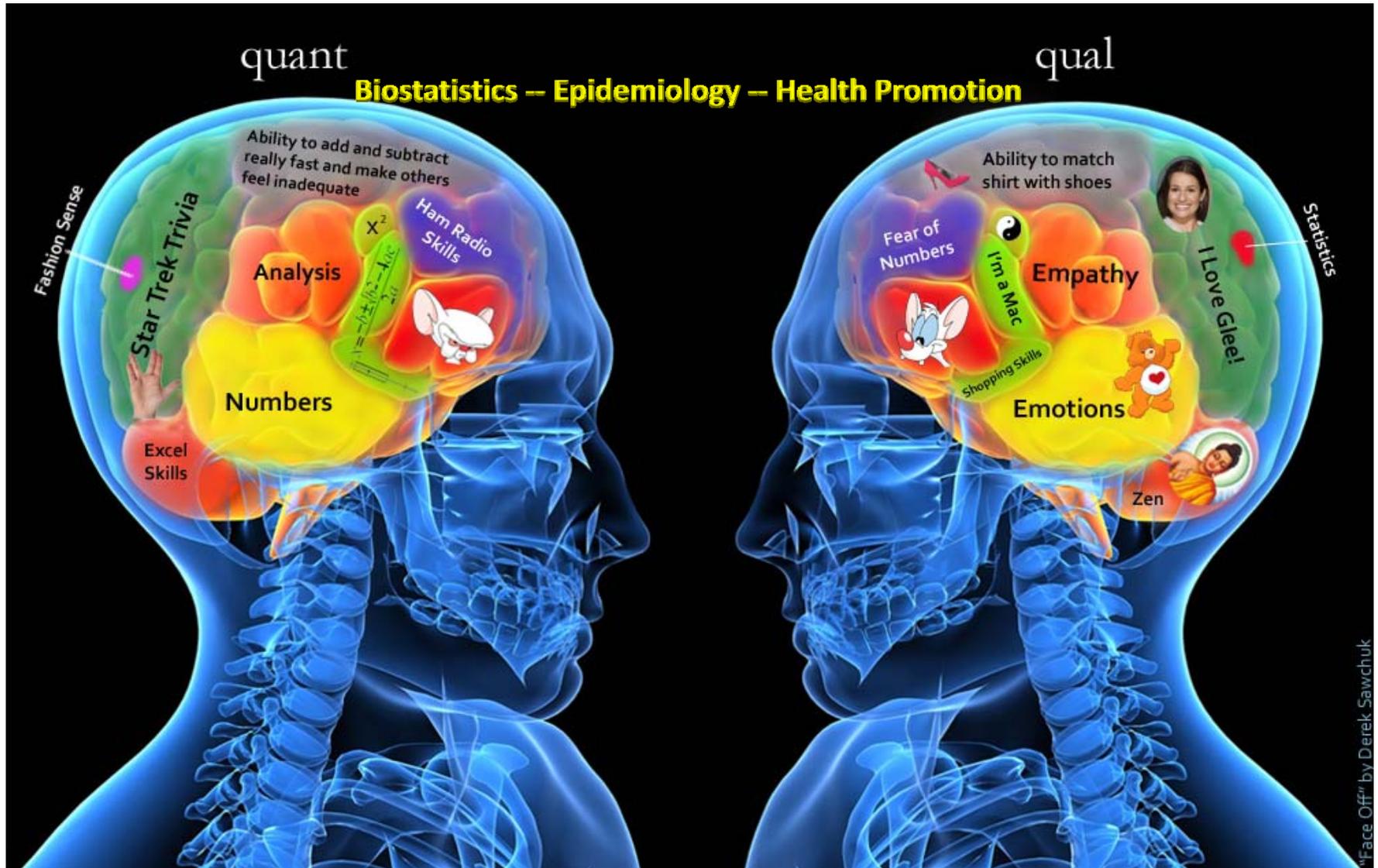




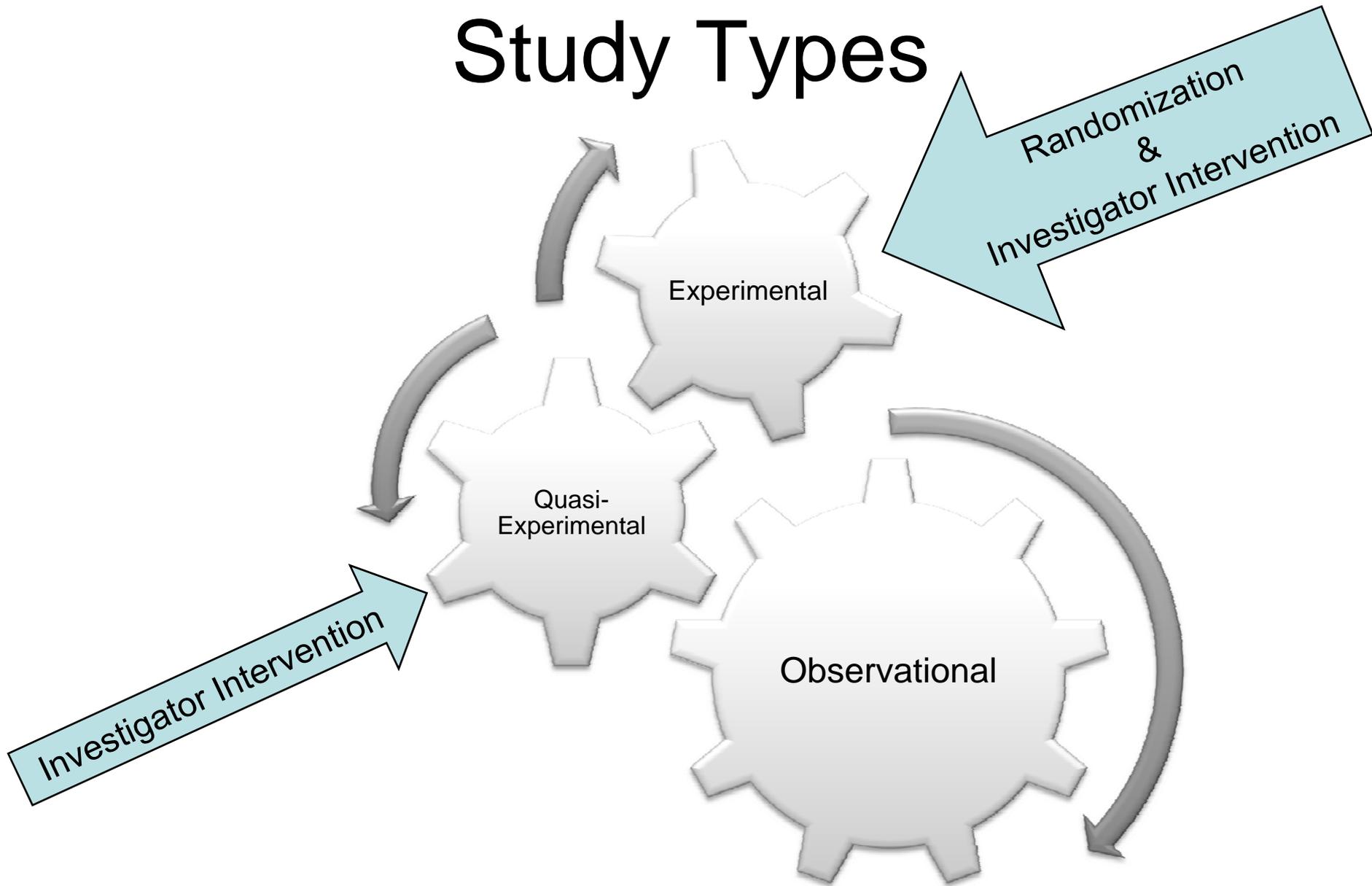
# The Why and What of Epidemiology

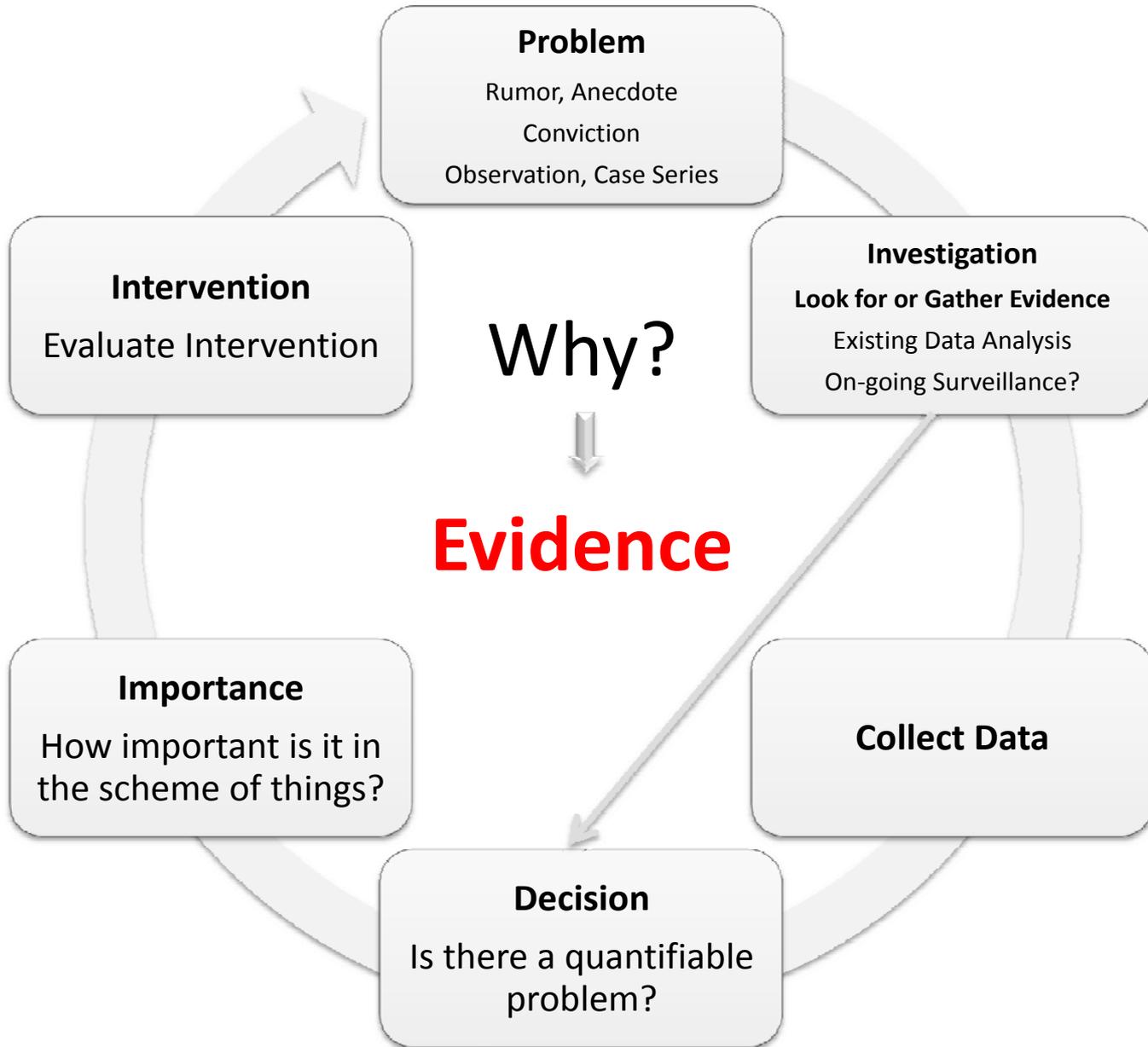
William E. Moore, Ph.D.  
University of Oklahoma HSC  
College of Public Health  
Department of Biostatistics and Epidemiology

# Quantitative vs. Qualitative



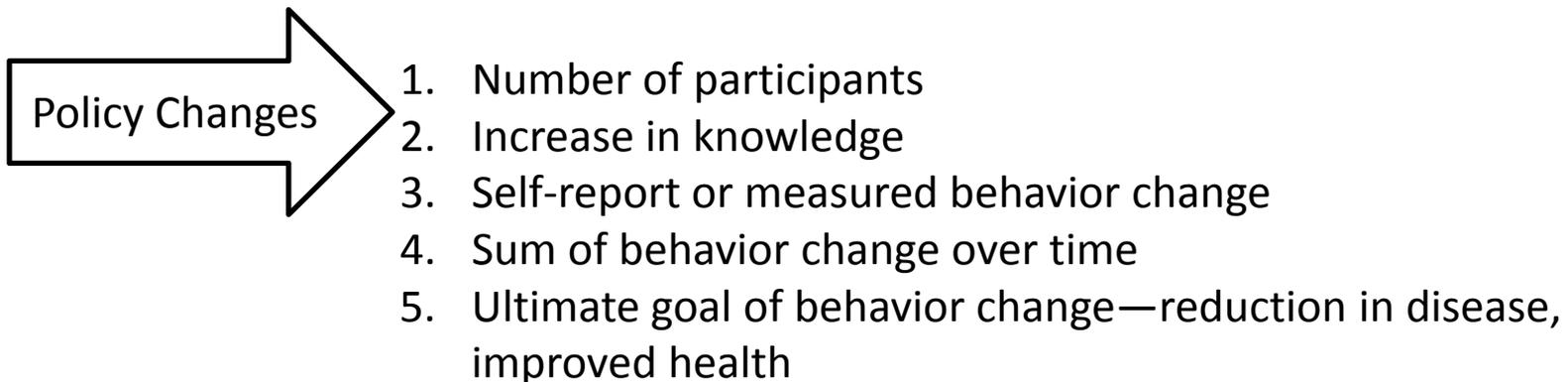
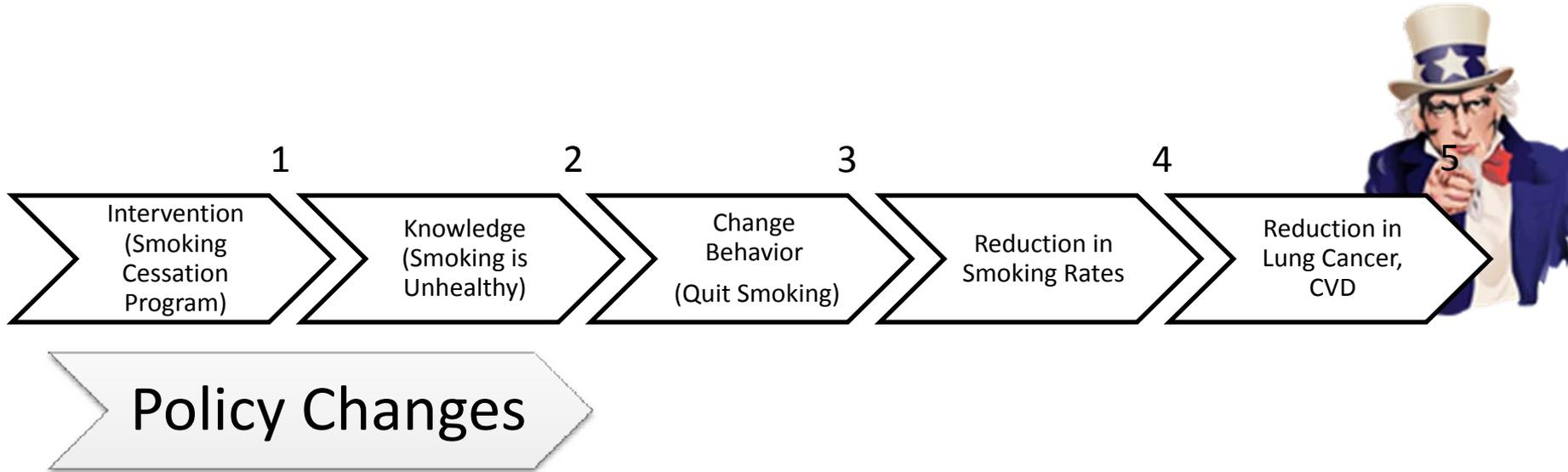
# Study Types





# Causal Pathway

## For an Intervention



# How do you know you are an epidemiologist?



Everyone thinks you are a  
biostatistician except  
biostatisticians.

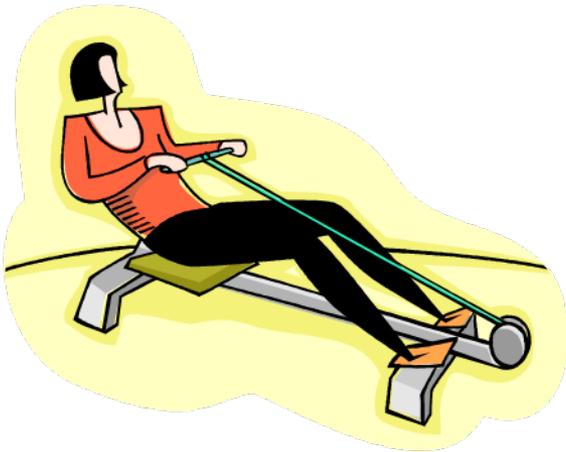
And, you can't explain what you do to your relatives.



# Social Marketing Interlude



- It's better to wear out than rust out.



# First Off - What is public health?

- “Organized community efforts aimed at the prevention of disease and the promotion of health” (Institute of Medicine, Future of Public Health)
- “The science and art of protecting and improving the health of communities through education, promotion of healthy lifestyles, and research for disease and injury prevention” (ASPH)

# Academic Disciplines of Public Health

- **Epidemiology**
- Biostatistics
- Environmental and Occupational Health
- Health Administration
- Health Promotion

# Epidemiology

- Tools of logic and analysis to find, evaluate, and use **evidence** to affect health and disease.

Bill Moore

# What is epidemiology?

“The study of the distribution and determinants of health-related states and events in populations, and the application of this study to control health problems”

John M. Last, *Dictionary of Epidemiology*

“The **study** of the distribution and determinants of health-related states and events in populations, and the application of this study to control health problems”

**Study** – refers to measurement of disease frequency, involving quantification of the existence or occurrence of disease.

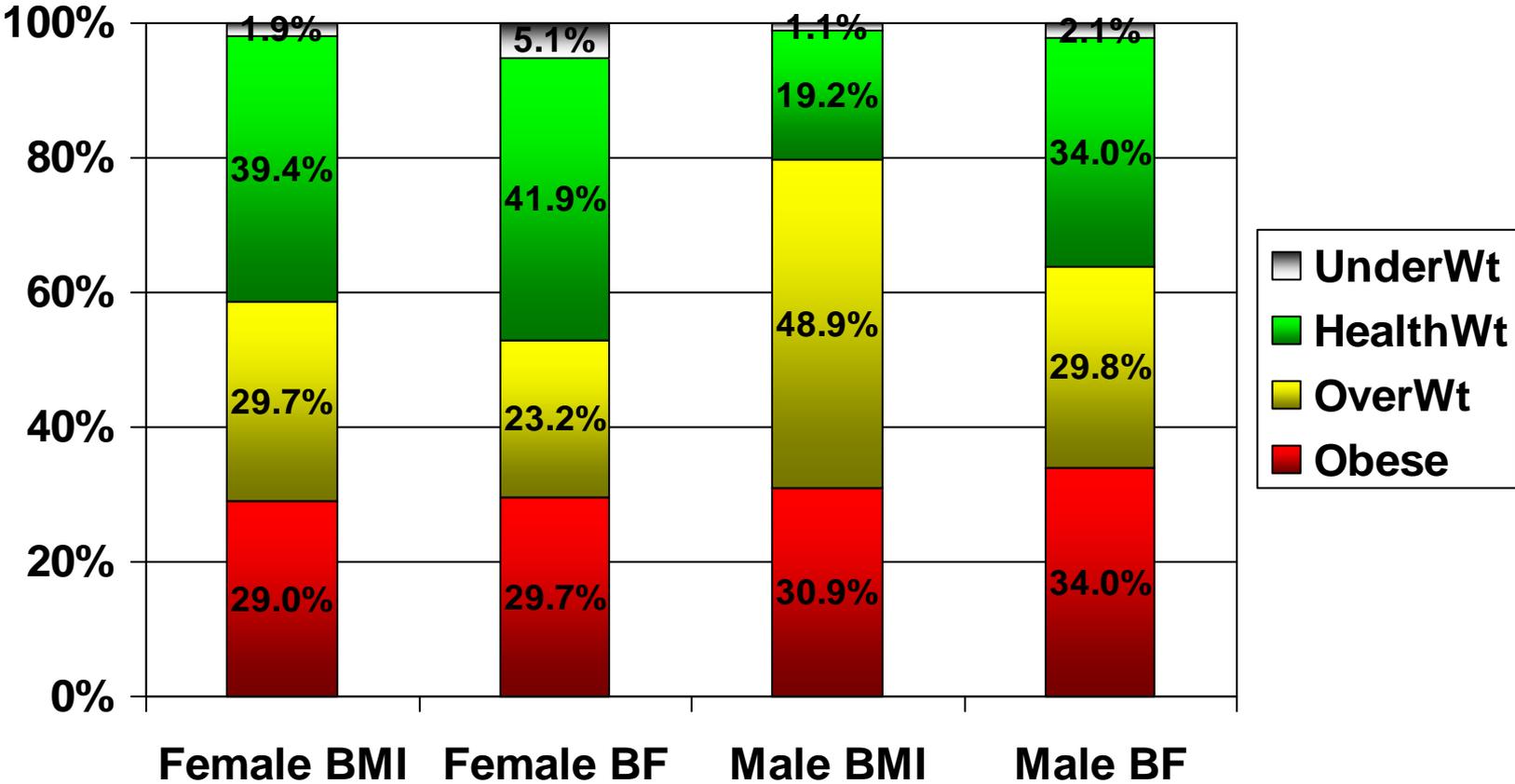
Examples: observation, descriptive research, hypothesis generation, analytic research, experimental research, surveillance, screening

“The study of the **distribution** and determinants of health-related states and events in populations, and the application of this study to control health problems”

**Distribution** – frequency of disease by person, place and time

- Look for variations from a uniform distribution, i.e., does disease cluster?

# Weight Status: BMI and Body Fat by Gender: Oklahoma Health Fairs



Epidemiology is the study of the distribution and **determinants** of health-related states and events in populations, and the application of this study to control health problems.

**Determinants** – any factor or event that brings about a change in a health condition

- physical, biological, social, cultural and behavioral factors that influence health

Epidemiology is the study of the distribution and determinants of health-related states and events in populations, and the application of this study to control health problems.

**Health-related states and events –**  
infectious diseases, chronic diseases,  
deaths, injuries, disabilities, mental  
disorders, suicide, substance abuse,  
behaviors, use of health services, adverse  
events

# What is epidemiology, really?

- The study of health and disease in populations.
- The basic science of public health
  - Who gets disease?
  - What causes disease?
  - How does disease spread?
  - What prevents disease?
  - What works in controlling disease?

# The Scope of Epidemiology

- To **describe** the health status of populations
- To **explain** the etiology of disease
- To **predict** the occurrence of disease
- To **control** the distribution of disease

# Fundamental Assumption

- Human disease has causal and preventive factors that can be identified through systematic investigation
- 
- Essence of epidemiology = Comparison

# The Descriptive Essence

- Counts (How many have the disease?)
- Proportions (What proportion of the population has the disease?)
- Rates (The proportion standardized per a fixed unit—per hundred, per thousand, etc. so that it is a whole number)

# The Analytic Essence

## The 2 x 2 Table

	<b>Disease</b>	<b>Disease</b>	<b>Total</b>	<b>Odds Ratio (95% C.I.)</b>	<b>Risk Ratio (95% C.I.)</b>
<b>Exposed</b>	20	3	23	22.2	3.77
Exposed	3	10	13	(3.0 to 188.8)	(1.4 to 10.3)
Total	23	13	36		
Disease	Proportion	23/36	Rate	63.9%	<b>46.2 to 79.2</b>
	<b>Disease</b>	<b>Disease</b>	<b>Total</b>	<b>Odds Ratio (95% C.I.)</b>	<b>Risk Ratio (95% C.I.)</b>
<b>Exposed</b>	2,000	300	2,300	22.2	3.77
Exposed	300	1,000	1,300	(18.5 to 26.6)	(3.4 to 4.2)
Total	2,300	1,300	3,600		
Disease	Proportion	2300/3600	Rate	63.9%	<b>62.3 to 65.5</b>

# The Analytic Essence

## The 2 x 2 Table

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	<b>Disease</b>	<b>Disease</b>	<b>Total</b>	<b>Odds Ratio (95% C.I.)</b>	<b>Risk Ratio (95% C.I.)</b>
<b>Exposed</b>	2,000	30,000	2,300	22.2	20.9
Exposed	300	100,000	1,300	(19.6 to 25.2)	(18.5 to 23.6)
Total	2,300	130,000	132,300		
Disease	Proportion	2,300/132,00	Rate	1.7%	<b>1.7 to 1.8</b>

# Measurement

- **Validity**
  - Does it measure the intended construct?
- **Reliability**
  - Is it repeatable—the same result every time?
    - Precision
- **Accuracy**
  - Accuracy—valid and reliable

Valid



Reliable



Accurate



# The Logic of Epidemiology

- Bias: Deviation of results or inferences from the truth
  - Ascertainment
  - Recall
  - Volunteer
  - Confounding

# Measured versus Self-report NHANES 2005-2006 v. BRFSS 2006

- NHANES 2005-2006  
Obesity Prevalence

34.3%

Measured

- BRFSS 2006  
Obesity Prevalence

25.1%

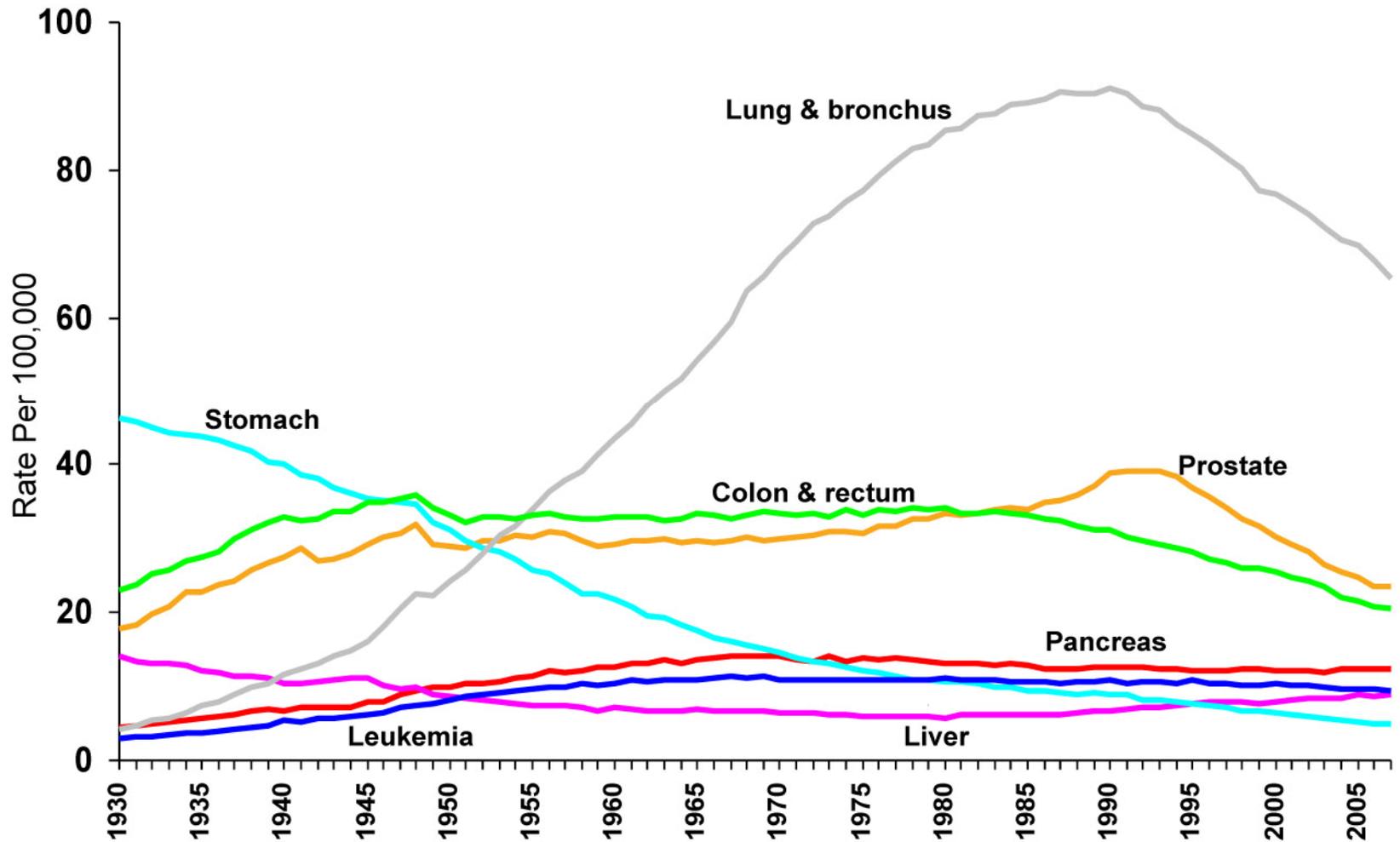
Self-Report

**9.2 percentage point difference**

# Epidemiology: Hits and Misses

- Low fat diet
  - BMI increase?
  - decrease in lung cancer, heart disease, stroke
- Smoking Cessation
  - decrease in lung cancer, heart disease, stroke
- Beta Carotene
  - increase in lung cancer
- Hormone Replacement Therapy
  - increase in cardiac events
  - less osteoporosis

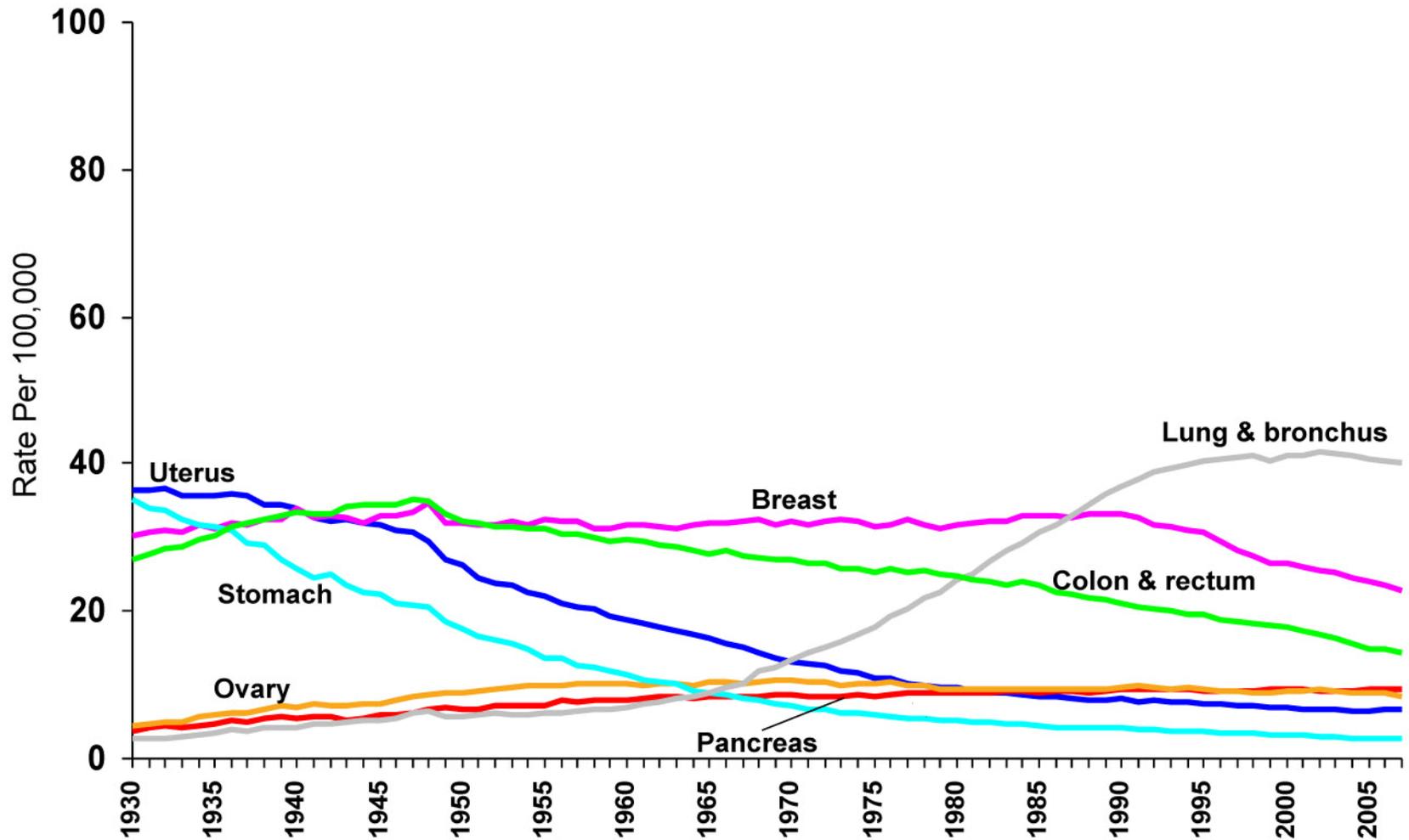
# Cancer Death Rates\* Among Men, US, 1930-2007



\*Age-adjusted to the 2000 US standard population.

Source: US Mortality Data 1960-2007, US Mortality Volumes 1930-1959, National Center for Health Statistics, Centers for Disease Control and Prevention.

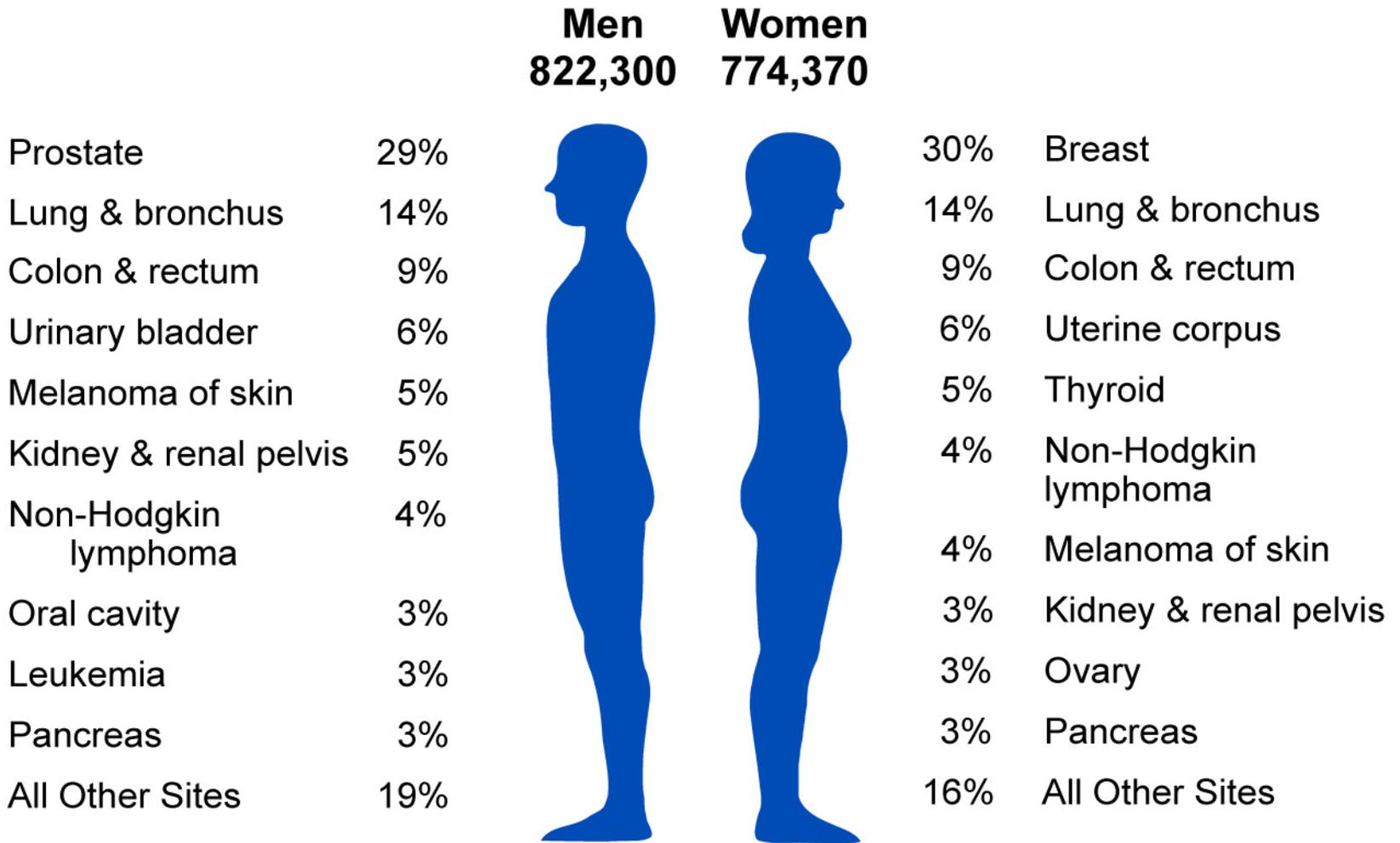
# Cancer Death Rates\* Among Women, US, 1930-2007



\*Age-adjusted to the 2000 US standard population.

Source: US Mortality Data 1960-2007, US Mortality Volumes 1930-1959, National Center for Health Statistics, Centers for Disease Control and Prevention.

# 2011 Estimated US Cancer Cases\*

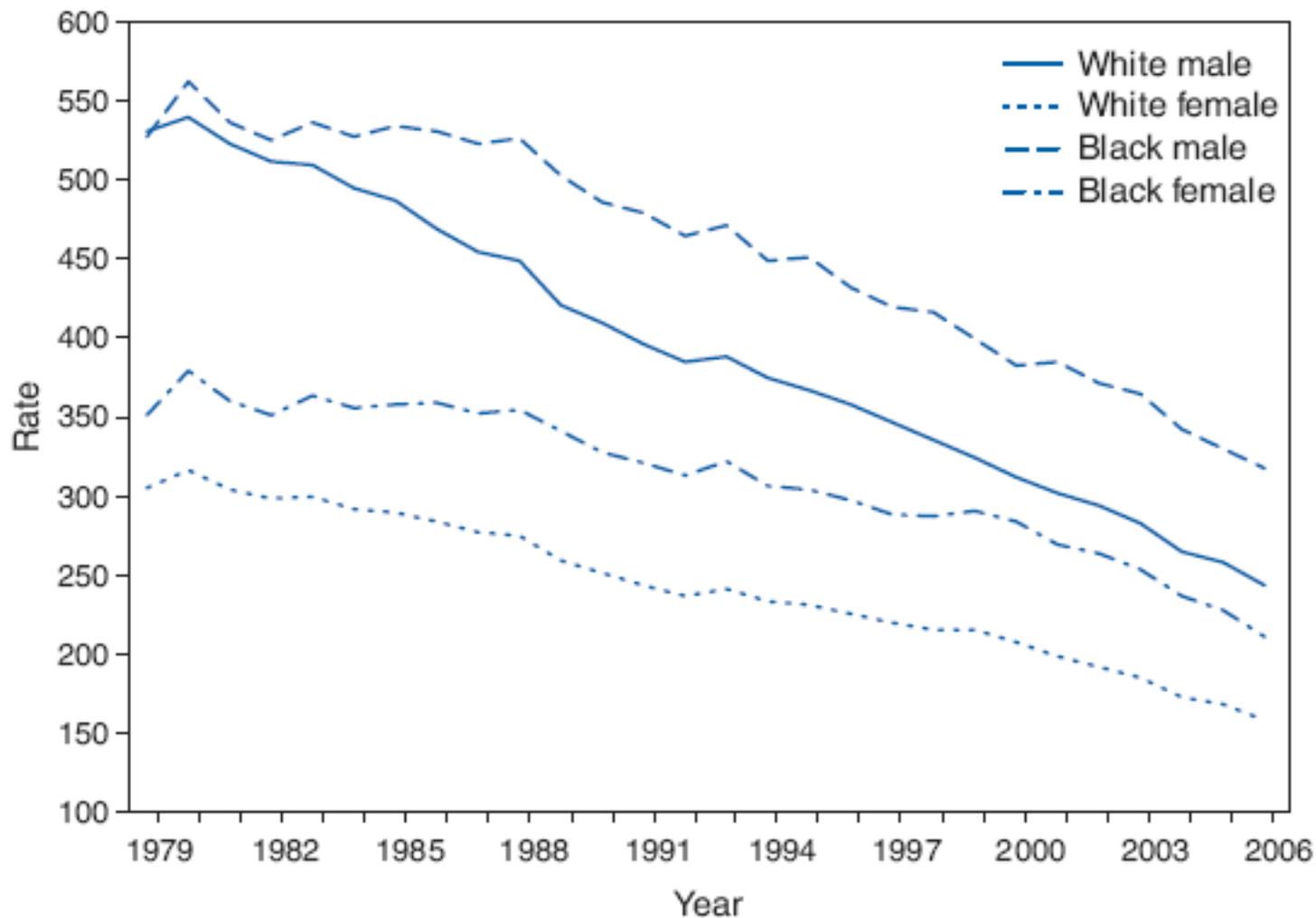


Source: American Cancer Society, 2011

Source: American Cancer Society, 2011.

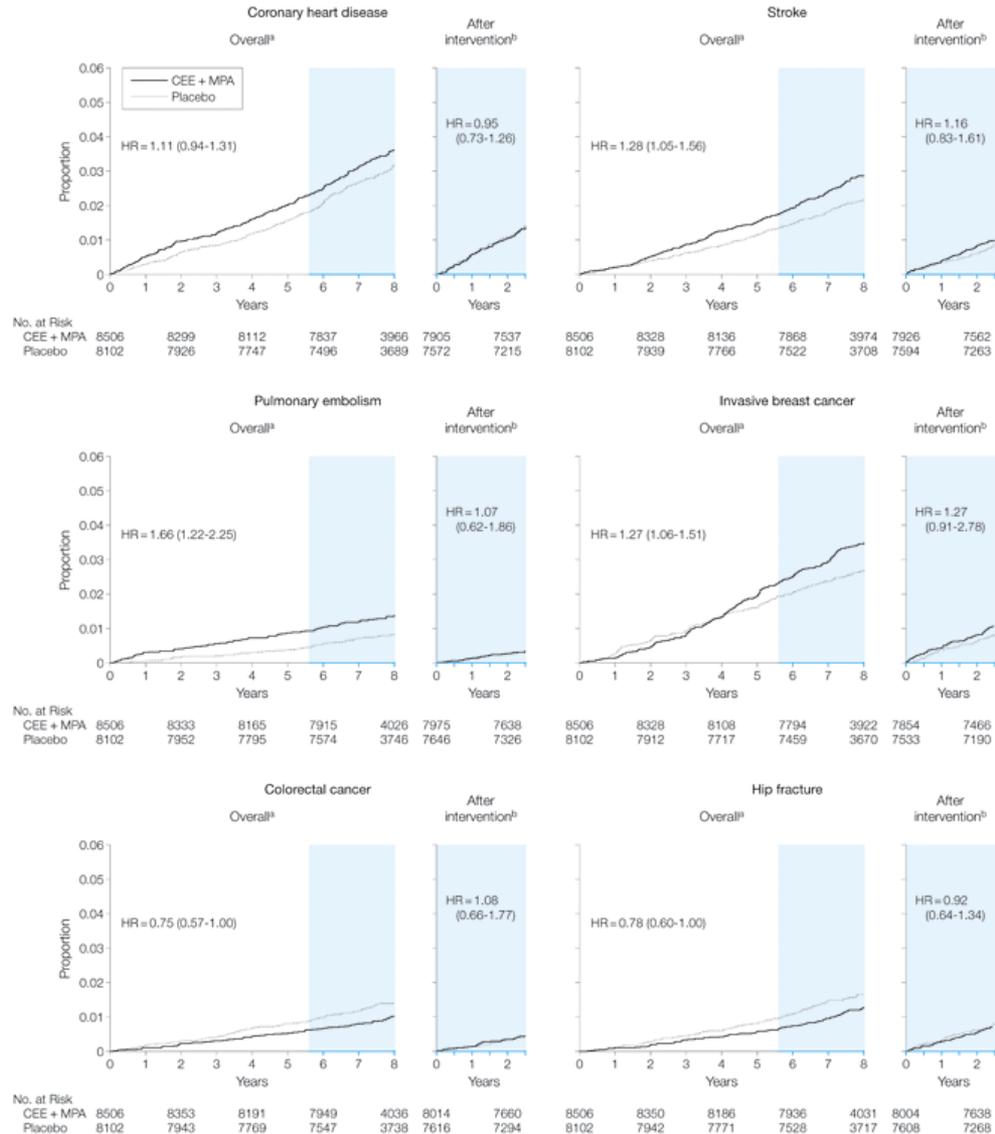
\*Excludes basal and squamous cell skin cancers and in situ carcinomas except urinary bladder.

# QuickStats: Age-Adjusted Rates\* of Death from Heart Disease, by Race and Sex --- United States, 1979--2006†



**SOURCE:** Heron MP, Hoyert DL, Xu JQ, Scott C, Tejada-Vera B. Deaths: preliminary data for 2006. Natl Vital Stat Rep 2008;56(16).

# Figure 1. Risks and Benefits by Randomized Assignment to Conjugated Equine Estrogens Plus Medroxyprogesterone Acetate or Placebo Before and After Termination of the Intervention in the Women's Health Initiative Estrogen Plus Progestin Trial



Heiss, G. et al. JAMA 2008;299:1036-1045





Figure 19-4 Risk of what? How the end-point may affect an individual's perception of risk and willingness to act. (S. Kelley. &#169; 1998 San Diego Union Tribune. Copley News Service.)

# J. N. Morris

- The challenges to epidemiology are great: in a wide range of research, in information of the public, health service, and government, in teaching, *in the example we set*, and, as part of the wider public health movement, in our collective political message.