

National Cancer Surveillance System Latest Cancer Statistics

**National Cancer Advisory Board
September 9, 2002**

**Brenda K. Edwards, PhD
Surveillance Research Program, NCI**

Outline

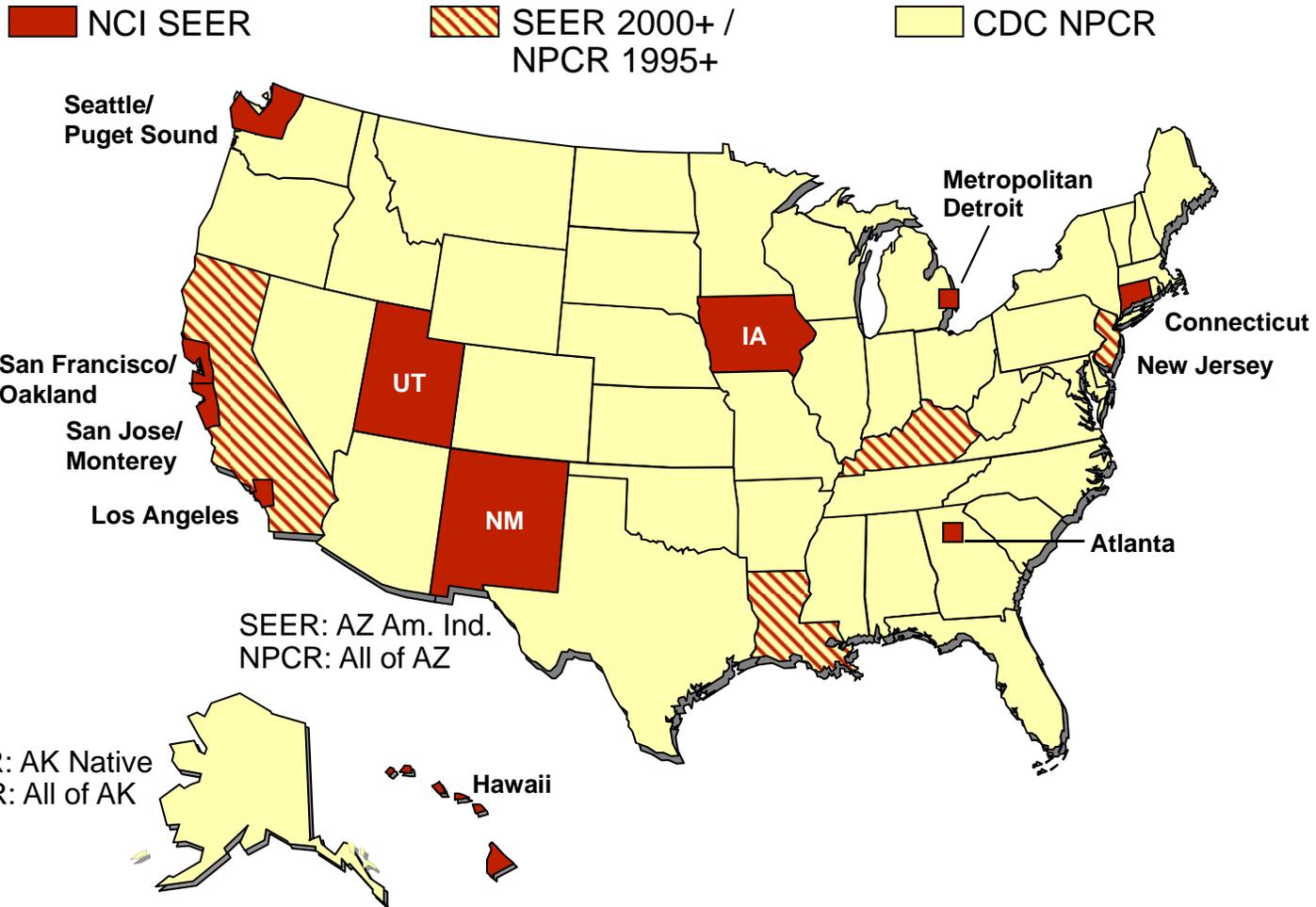
National Cancer Surveillance

- **NCI & Cancer Surveillance**
- **Statistics & Measures**
- **Latest Data**
- **SEER – A Unique Program**
- **Innovative Methods & Tools**
- **Future Directions**

Definition

- **Cancer surveillance** provides a quantitative portrait of cancer and its determinants in a defined population.
- Its **core functions** are the measurement of cancer incidence, morbidity, survival and mortality for persons with cancer; it also includes the assessment of genetic predisposition, environmental and behavioral risk factors, screening practices and the quality of care from prevention through palliation.
- Cancer surveillance tells us where we are in the effort to reduce the cancer burden and also generates the observations that form the **basis for cancer research and interventions for cancer prevention and control.**

U.S. Cancer Registries



Summary of Federal Funding (2000+):

NPCR (CDC): 45 states + Washington, DC (96% of U.S. population)

SEER (NCI): 5 states + 5 metropolitan areas + 4 expansion states + 2 supplemental areas (26% of U.S. population)

*Registries meeting NAACCR standards of data quality for combined 1995-99 data (2002 Report to Nation; 53% of U.S. population)

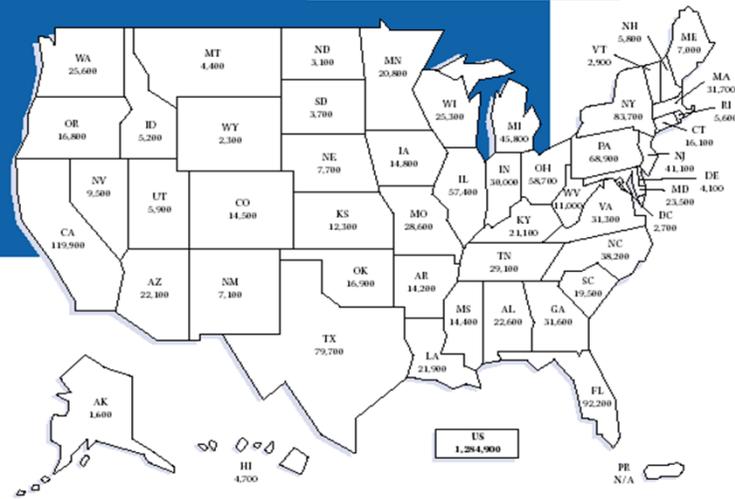
DEPARTMENT OF HEALTH AND HUMAN SERVICES

Estimated New Cancer Cases and Deaths by Gender, US, 2002*

	Estimated New Cases			Estimated New Deaths		
	Both Sexes	Male	Female	Both sexes	Male	Female
All Sites	1,284,900	637,500	647,400	555,500	288,200	267,300
Oral cavity and pharynx	28,900	18,900	10,000	7,400	4,900	2,500
Tongue	7,100	4,700	2,400	1,700	1,100	600
Mouth	9,800	5,200	4,600	2,000	1,100	900
Pharynx	8,600	6,500	2,100	2,100	1,500	600
Other oral cavity	3,400	2,500	900	1,600	1,000	600
Digestive system	250,600	130,300	120,300	102,300	52,000	50,300
Esophagus	13,100	9,800	3,300	12,600	9,500	3,100
Stomach	21,600	13,200	8,400	12,400	7,500	4,900
Small intestine	3,300	2,500	800	2,800	2,100	700
Colon	107,300	50,000	57,300	48,100	22,000	26,100
Rectum	41,000	22,600	18,400	18,500	10,000	8,500
Anus, anal canal, & anorectum	3,900	1,700	2,200	500	200	300
Liver & intraductal bile duct	16,600	11,000	5,600	14,100	9,500	4,600
Gallbladder & other biliary	7,100	3,400	3,700	3,500	1,600	1,900
Pancreas	30,300	14,700	15,600	29,700	14,000	15,700
Other digestive organs	4,400	1,300	3,100	1,800	500	1,300
Respiratory system	182,200	100,700	82,500	161,400	88,000	73,400
Larynx	8,900	6,900	2,000	2,700	2,100	600
Lung & bronchus	168,400	90,200	78,200	154,900	81,000	73,900
Other respiratory organs	4,900	3,600	1,300	2,800	2,000	800
Bones & joints	2,400	1,200	1,200	1,300	600	700
Soft tissue (including heart)	8,300	4,400	3,900	3,900	2,000	1,900
Skin (excluding basal & squamous)	58,300	32,500	25,800	9,600	5,500	4,100
Melanoma-in-situ	53,600	30,100	23,500	7,400	4,300	3,100
Other non-melanoma skin	4,700	2,400	2,300	2,200	1,200	1,000
Breast	205,000	1,500	203,500	40,000	100	39,900
Genital system	278,100	197,700	80,400	57,100	41,000	16,100
Uterine cervix	13,000	13,000	0	4,100	4,100	0
Uterine corpus	39,300	39,300	0	6,600	6,600	0
Ovary	23,300	23,300	0	13,900	13,900	0
Vagina	3,800	3,800	0	800	800	0
Vagina & other genital, female	2,000	2,000	0	800	800	0
Prostate	189,000	189,000	0	38,200	38,200	0
Testis	7,500	7,500	0	400	400	0
Penis & other genital, male	1,200	1,200	0	200	200	0
Urinary system	90,700	62,200	28,500	24,900	17,000	7,900
Urinary bladder	56,500	40,500	16,000	12,600	9,000	3,600
Kidney & renal pelvis	31,800	19,100	12,700	11,600	7,000	4,600
Ureter & other urinary organs	2,400	1,600	800	700	500	200
Eye & orbit	2,200	1,100	1,100	200	100	100
Brain & other nervous system	17,000	9,600	7,400	13,100	7,400	5,700
Endocrine system	22,700	6,000	16,700	2,300	200	2,100
Thyroid	20,700	4,900	15,800	1,300	100	1,200
Other endocrine	2,000	1,100	900	1,000	500	500
Lymphoma	60,900	31,900	29,000	25,800	13,800	12,000
Hodgkin's disease	7,000	3,700	3,300	1,400	700	700
Non-Hodgkin's lymphoma	53,900	28,200	25,700	24,400	13,100	11,300
Multiple myeloma	14,600	7,800	6,800	10,800	5,800	5,000
Leukemia	30,800	17,600	13,200	21,700	12,000	9,700
Acute lymphocytic leukemia	3,800	2,200	1,600	1,400	800	600
Chronic lymphocytic leukemia	7,000	4,100	2,900	4,500	2,600	1,900
Acute myeloid leukemia	10,600	5,900	4,700	7,400	4,000	3,400
Chronic myeloid leukemia	4,400	2,500	1,900	2,000	1,200	800
Other leukemia	5,000	2,900	2,100	6,400	3,500	2,900
Other & unspecified primary sites	30,200	14,000	16,200	43,700	20,000	23,700

*Excludes basal and squamous cell skin cancers and in situ carcinomas except urinary bladder. Carcinoma in situ of the breast and melanoma in situ accounts for about 34,000 new cases annually. Estimates of new cases are based on incidence rates from the NCI SEER program, 1973-1998. ©2002, American Cancer Society.

Cancer Facts & Figures 2002

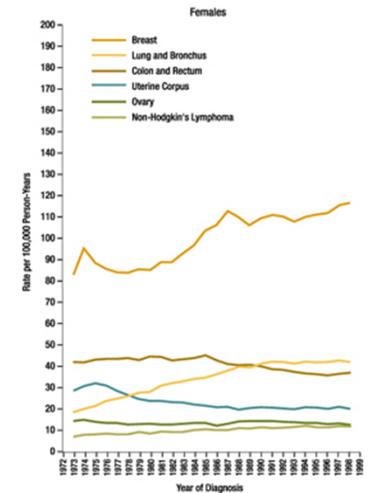


Estimated number of new cancer cases for 2002, excluding basal and squamous cell skin cancers and in situ carcinomas except urinary bladder. Note: These estimates are offered as a rough guide and should be interpreted with caution. They are calculated according to the distribution of estimated cancer deaths in 2002 by state. State estimates may not add to US total due to rounding.



Special Section:
Colorectal Cancer and
Early Detection
see page 20

Among Males and Females for Selected Cancer Sites, US, 1973 to 1998

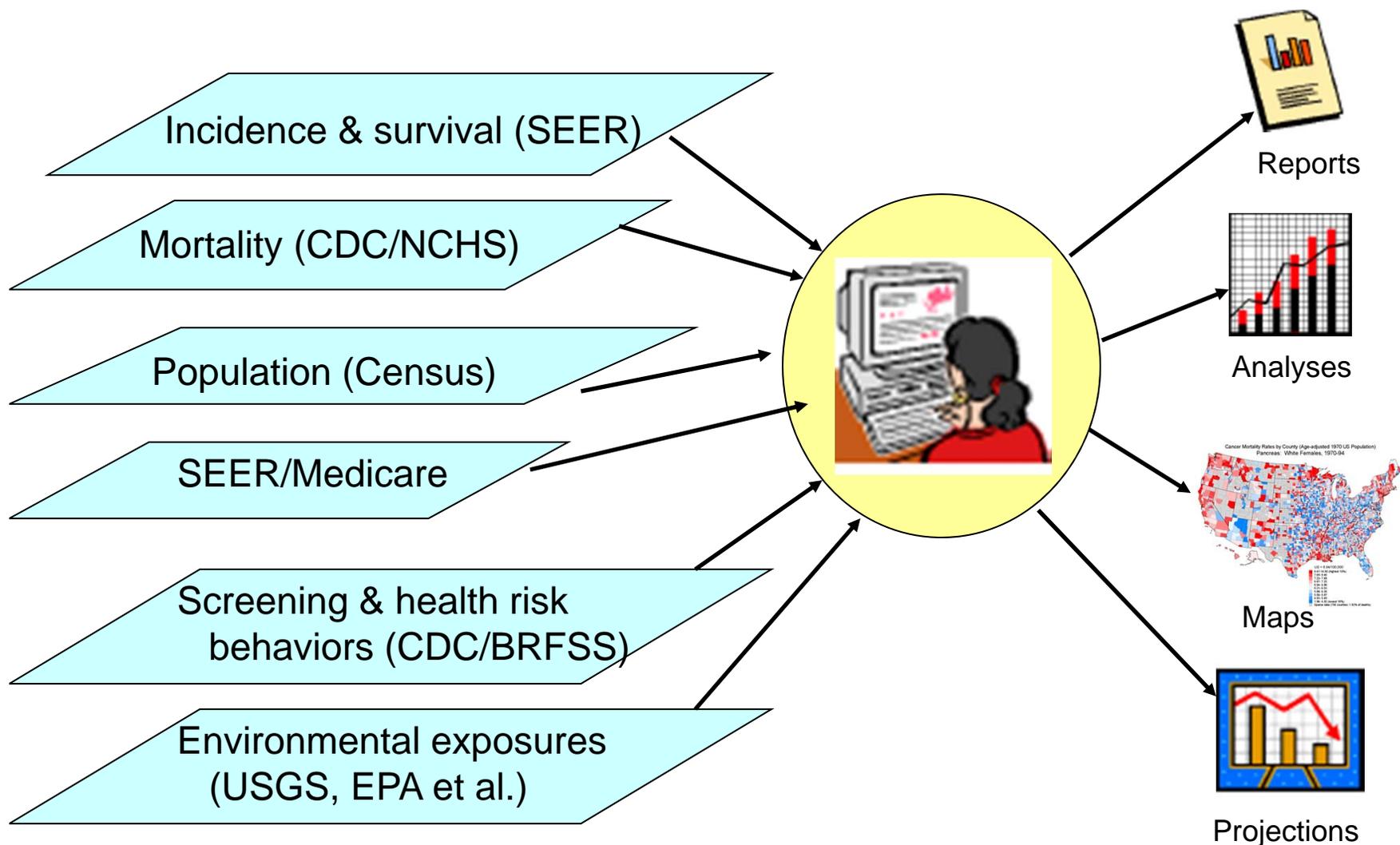


*Rates are age adjusted to the 1970 US standard population. Source: Surveillance, Epidemiology, and End Results program, Division of Cancer Control and Population Sciences, National Cancer Institute, 2001.

Statistics & Measures

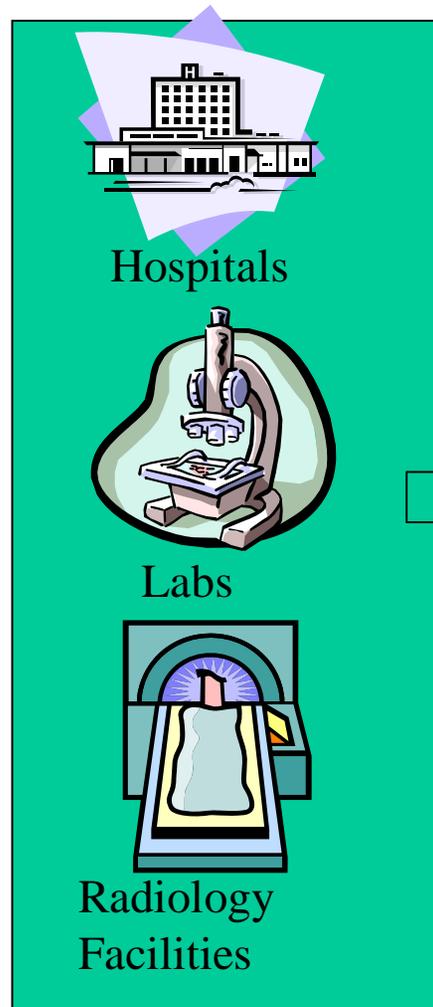
- Incidence – cases or persons (counts)
- Mortality – deaths
- Survival – observed
- Survival – relative
- Prevalence
- Rates – crude
- Rates – specific
- Rates – age adjusted
- Trends – partition
- Trends - joinpoint

National Cancer Surveillance - Data Sources

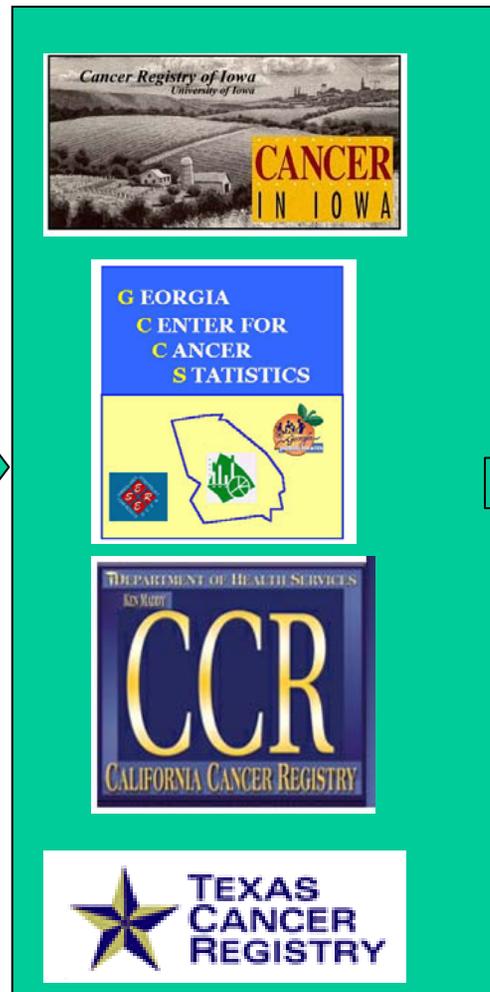


Surveillance - Working Together

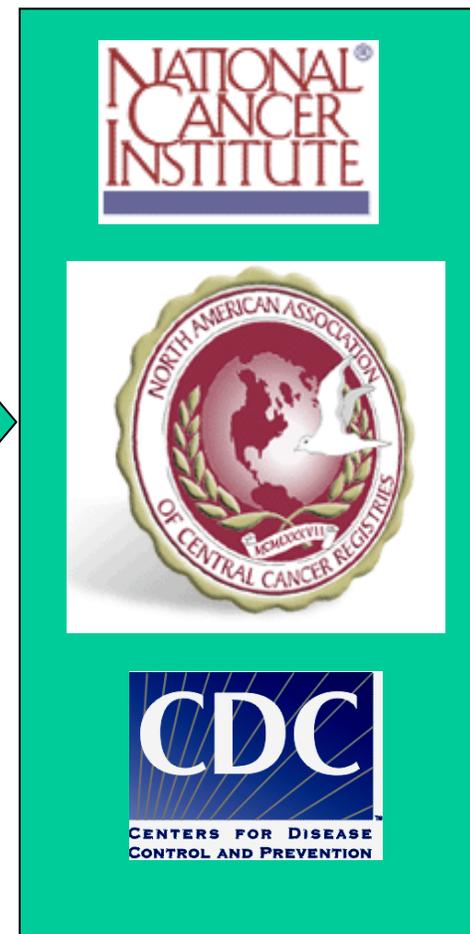
Treatment facilities identify cancer cases.



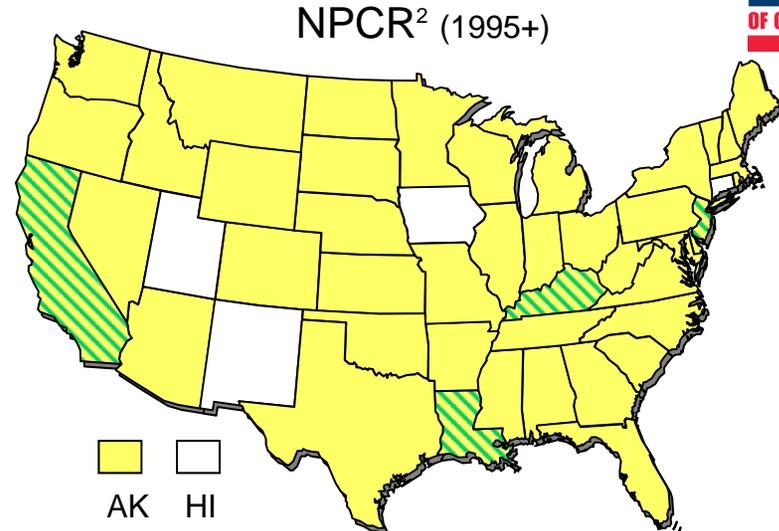
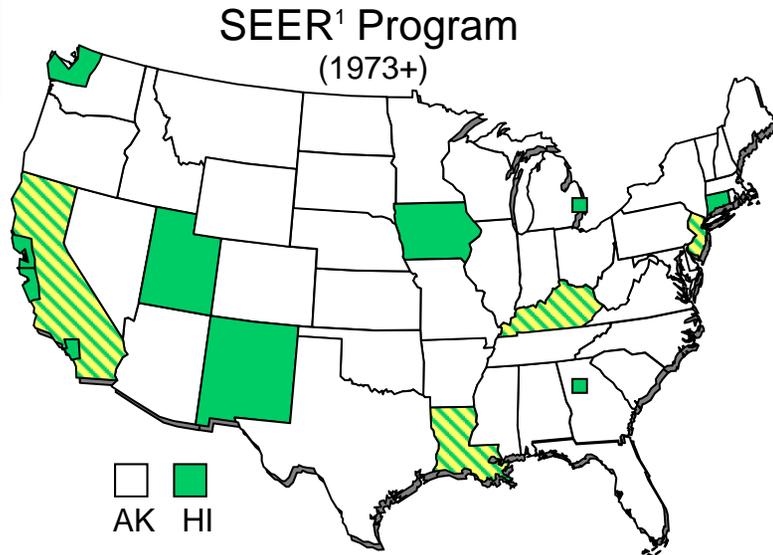
Population-based cancer registries collect and verify cancer cases and deaths.



National organizations certify and consolidate registry data for research, planning and policy use.



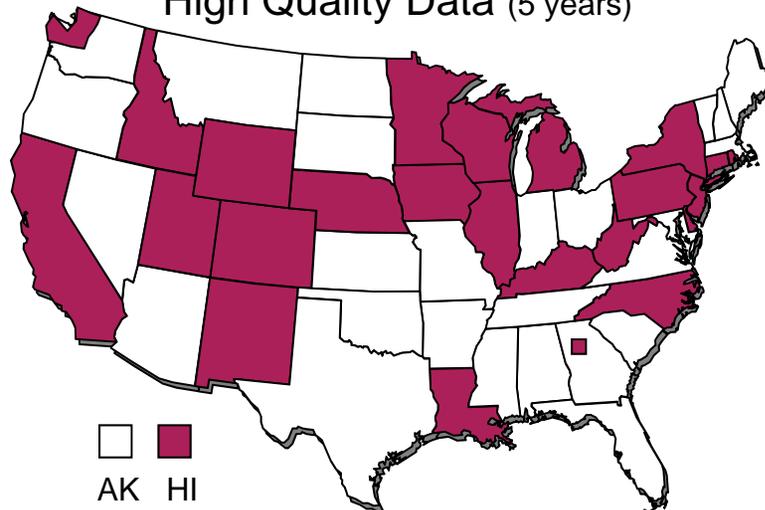
U.S. Cancer Registries



SEER
 SEER 2000+/
 NPCR 1995+

NAACCR³ Certification High Quality Data (5 years)⁴

NPCR
 NPCR 1995+/
 SEER 2000+



Registries contributing data

¹Surveillance, Epidemiology, and End Results, National Cancer Institute

²National Program of Cancer Registries, Centers for Disease Control and Prevention

³North American Association of Central Cancer Registries

⁴Registries meeting NAACCR standards of data quality for combined 1995-99 data (2002 Report to the Nation; 53% of U.S. population)

Annual Report to the Nation on the status of cancer, 1973-1999, featuring implications of age and aging on U.S. cancer burden

Brenda K. Edwards, Ph.D. 1 * , Holly L. Howe, Ph.D. 2, Lynn A. G. Ries, M.S. 1, Michael J. Thun, M.D., M.S. 3, Harry M. Rosenberg, Ph.D. 4, Rosemary Yancik, Ph.D. 5, Phyllis A. Wingo, Ph.D. 6, Ahmedin Jemal, D.V.M., Ph.D. 3, Ellen G. Feigal, M.D. 7

1 Division of Cancer Control and Population Sciences, National Cancer Institute, Bethesda, Maryland

2 North American Association of Central Cancer Registries, Springfield, Illinois

3 Epidemiology and Surveillance Research Department, American Cancer Society, Atlanta, Georgia

4 Division of Vital Statistics, National Center for Health Statistics, Centers for Disease Control and Prevention, Hyattsville, Maryland

5 National Institute on Aging, Bethesda, Maryland

6 Division of Cancer Prevention and Control, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia

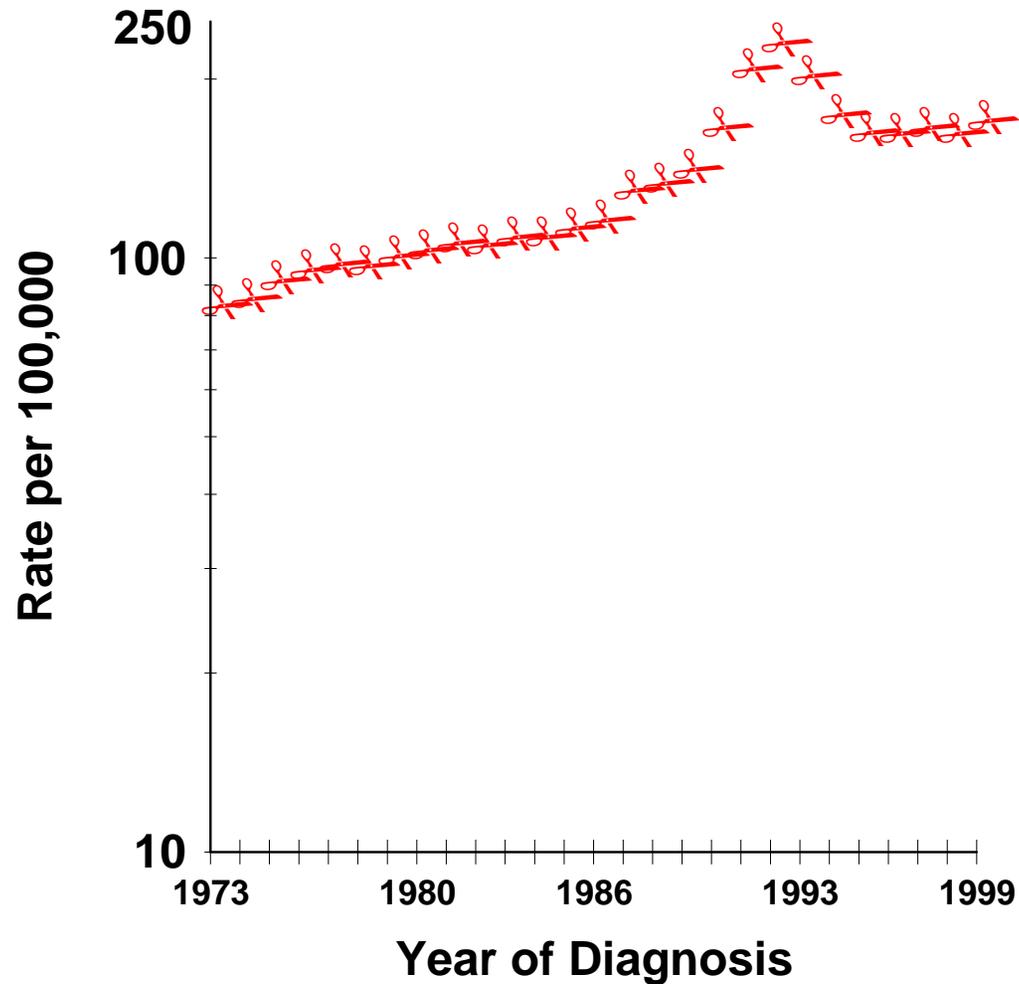
7 Division of Cancer Treatment and Diagnosis, National Cancer Institute, Bethesda, Maryland

Cancer May 15, 2002 / Volume 94 / Number 10

2002 Report to Nation

- **SEER**
 - Long term incidence trends (10% US)
 - Survival (14% US)
 - Race/ethnic incidence rates (14% US)
 - Estimated US prevalence
- **NPCR + SEER reported by NAACCR**
 - Site, gender & age specific incidence (53% US)
- **Nat'l Center for Health Statistics**
 - Death rates (100% US)

An Example of Cancer Incidence Trends

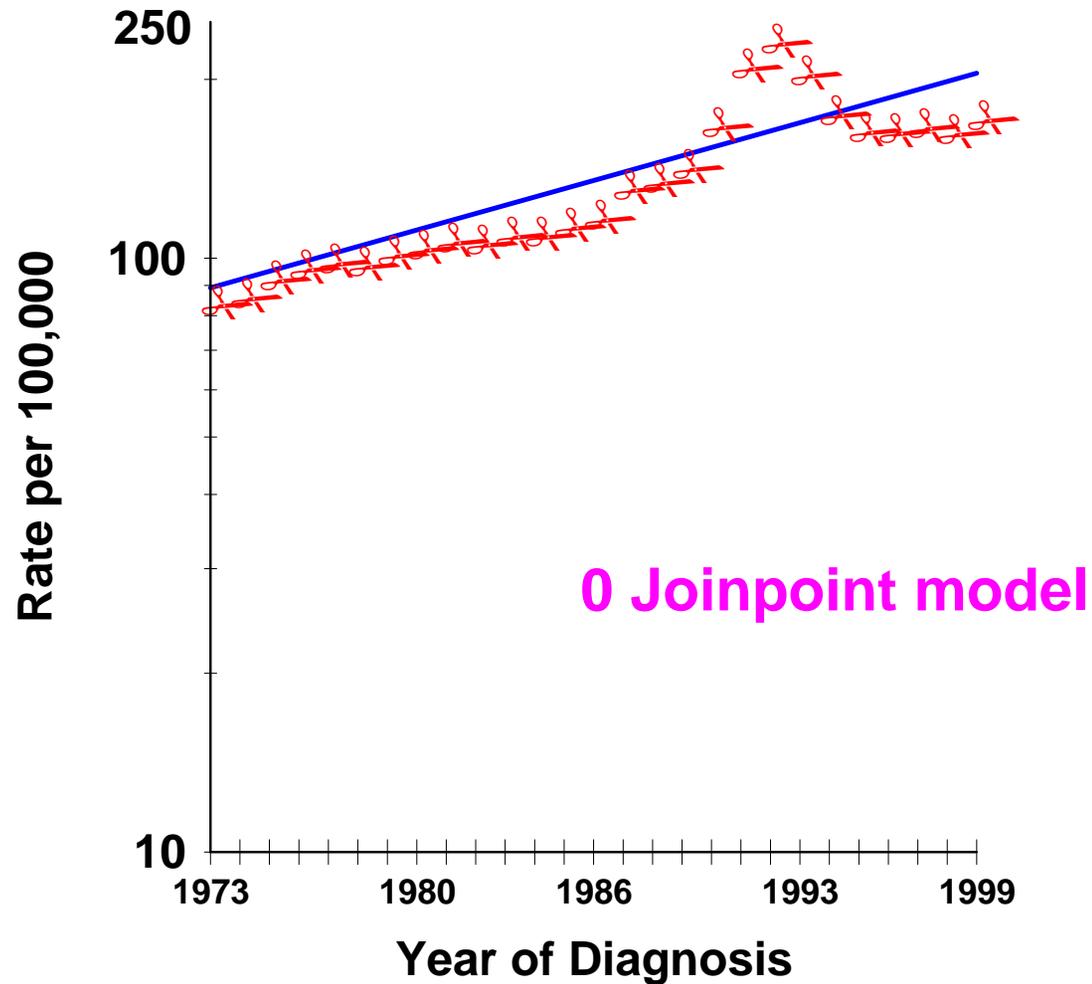


Trends – Joinpoint Analysis

Long-term trends can be described by **joinpoint analysis (JPA)**, a statistical model of joined line (straight lines on a log scale). Each joinpoint represent a statistically significant change in trend.

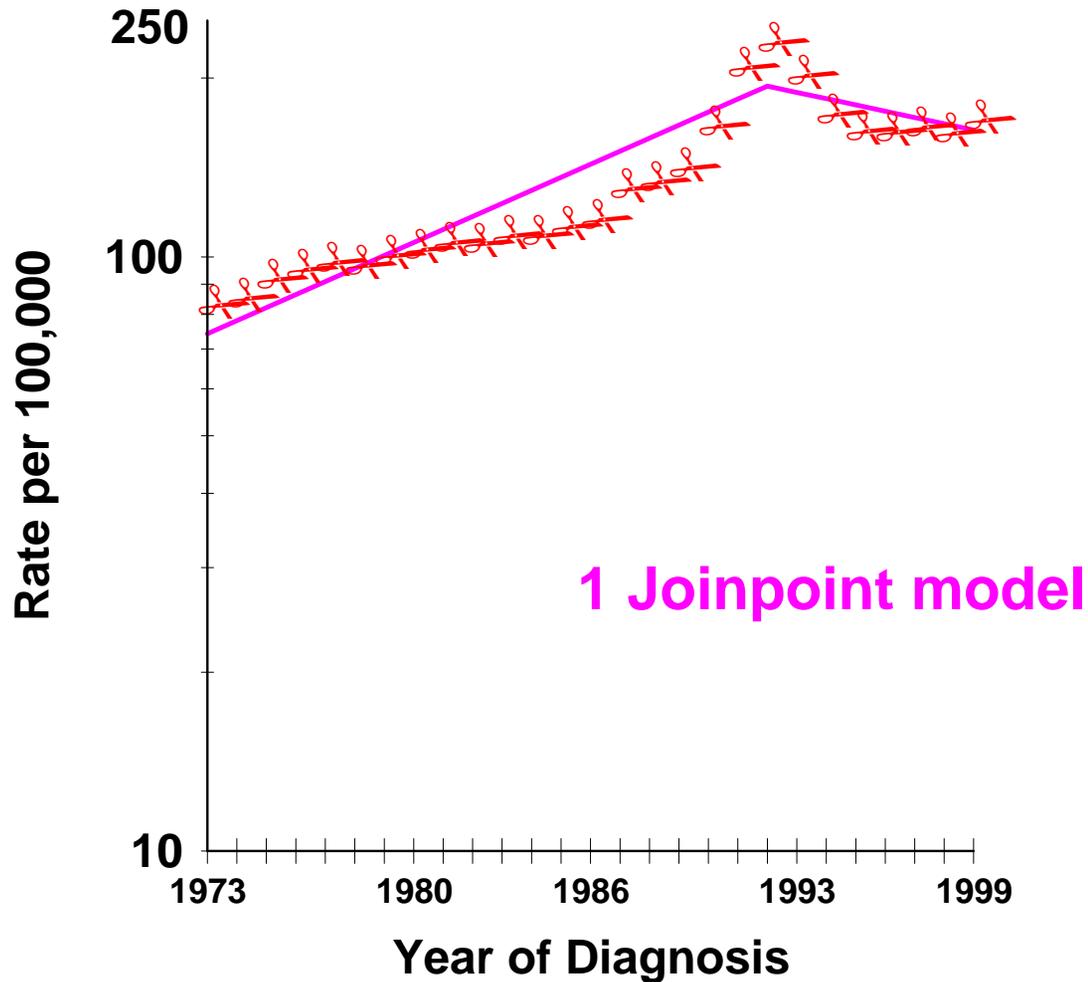
An **annual percent change (APC)** was used to describe the trend for each line segment with statistical significance.

An Example of Cancer Incidence Trends



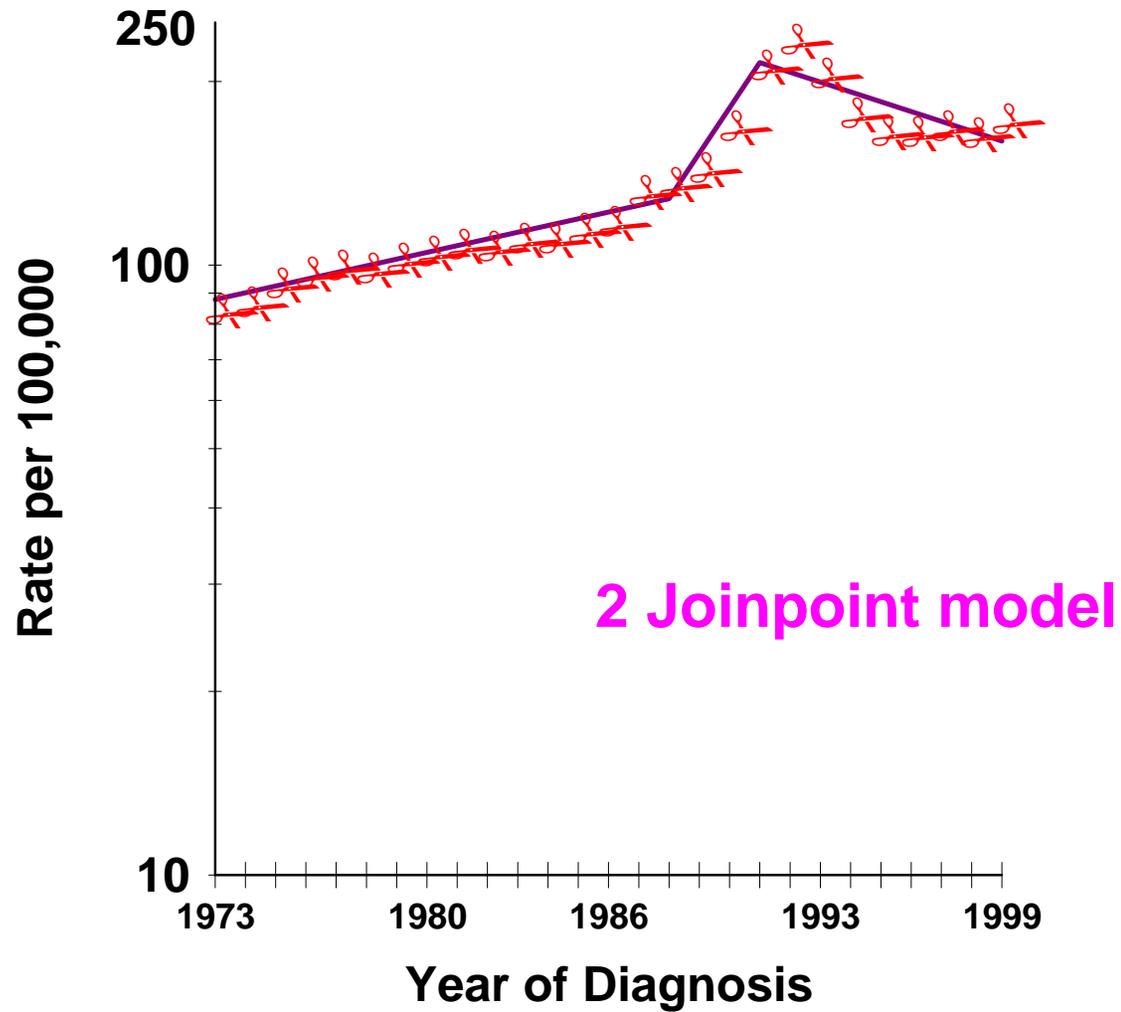
Log Linear Model

An Example of Cancer Incidence Trends



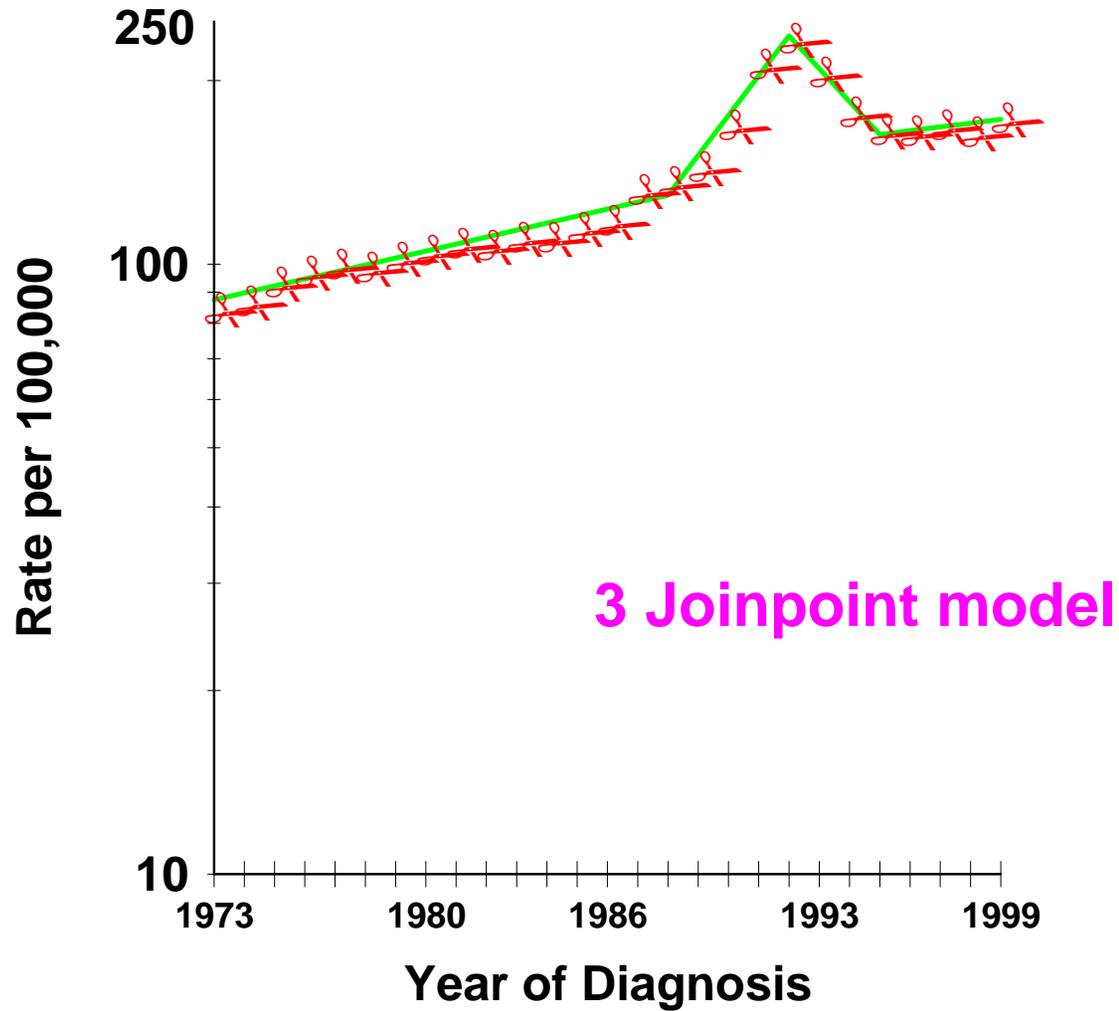
Log Linear Model

An Example of Cancer Incidence Trends



Log Linear Model

An Example of Cancer Incidence Trends



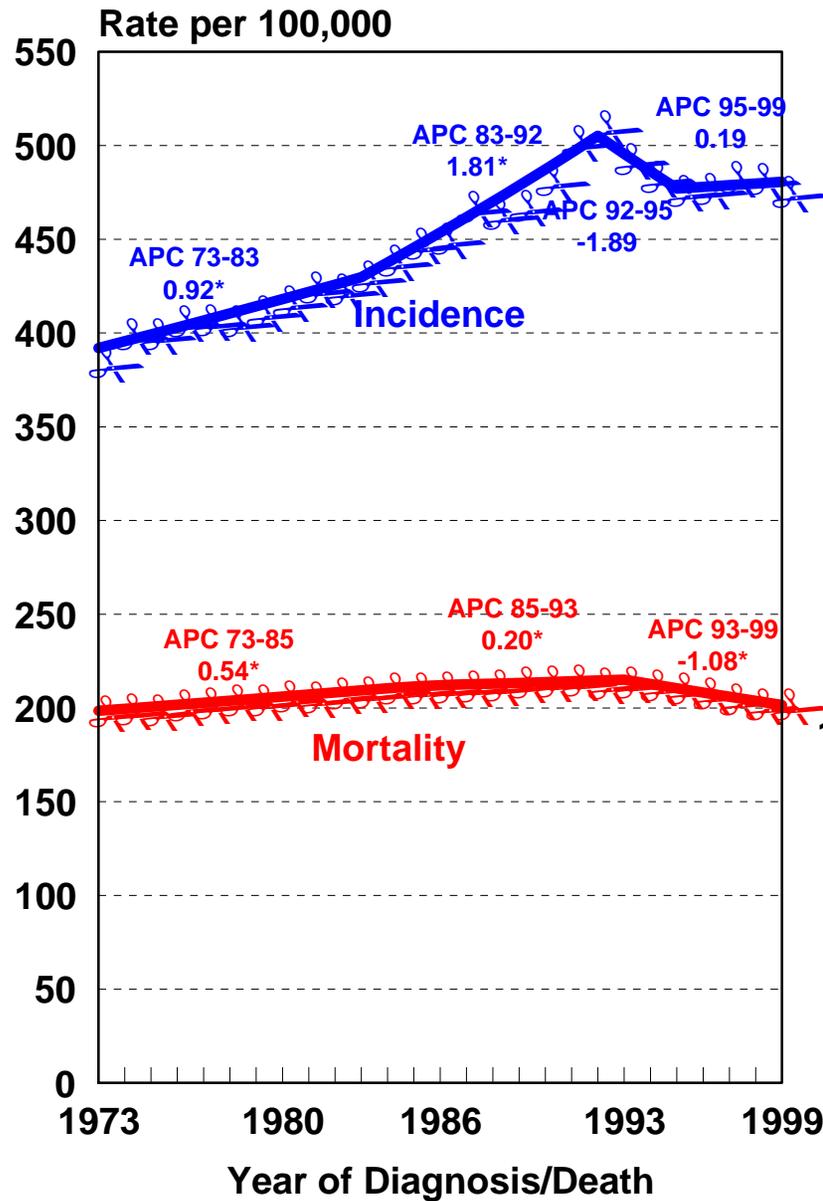
Log Linear Model



All Cancers

SEER Incidence and U.S. Mortality Rates 1973-1999

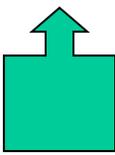
All Races, Both Sexes



2. Incidence rates for all cancers were stable (1995-99)

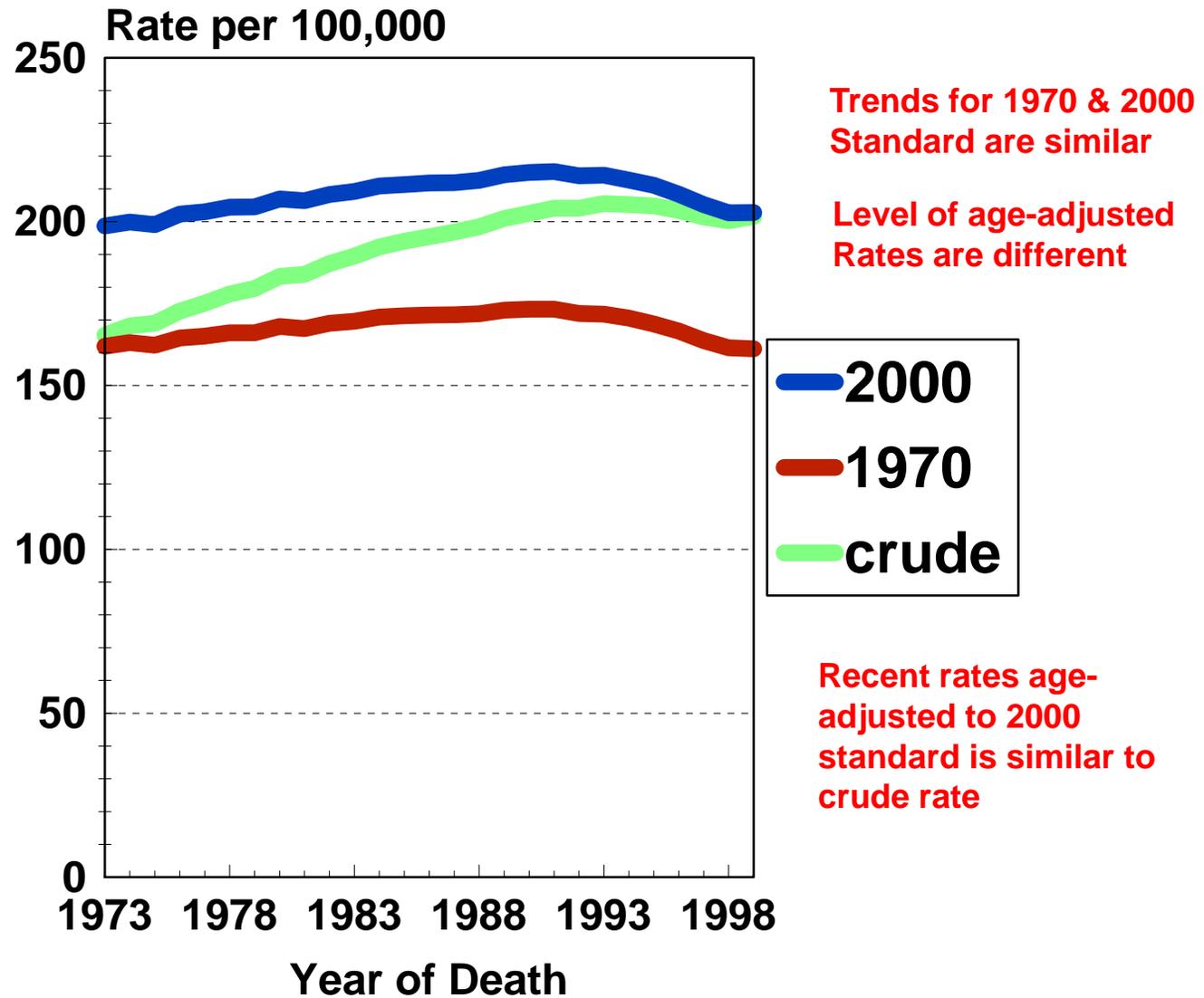
1. Death rates for all cancers continued to decline (1993-95: 1% per yr)

3. Rates are age-adjusted to Year 2000 pop. Std.


New Methodology



U.S. Cancer Mortality Rates Age-adjusted by Different Age Standards, 1973 - 1999



Source: Mortality data are from NCHS as analyzed by NCI.

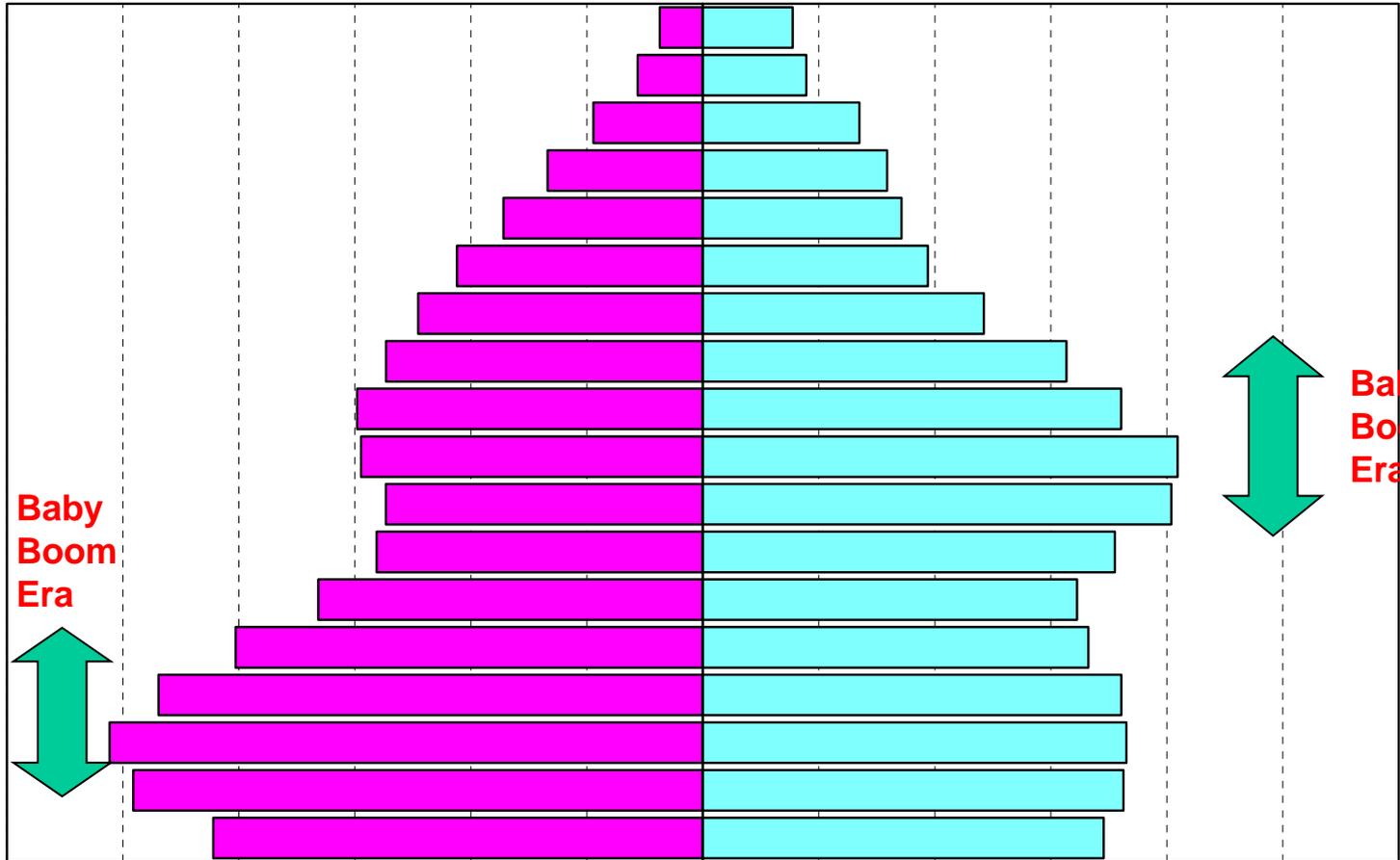
U.S. Standard Millions

U.S. Population is Growing & Aging

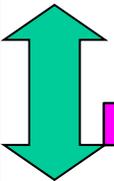
Standard Million for:
1970 2000

Age

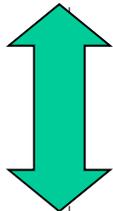
85+
80-84
75-79
70-74
65-69
60-64
55-59
50-54
45-49
40-44
35-39
30-34
25-29
20-24
15-19
10-14
05-09
<05



Baby Boom Era



Baby Boom Era



Thousands Thousands



Partition of trend in mortality rates for the time period 1995-99, All Races, Both Sexes, All Ages

Overall Decreasing Regression Coefficient : -2.24

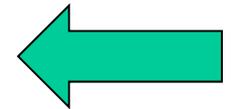
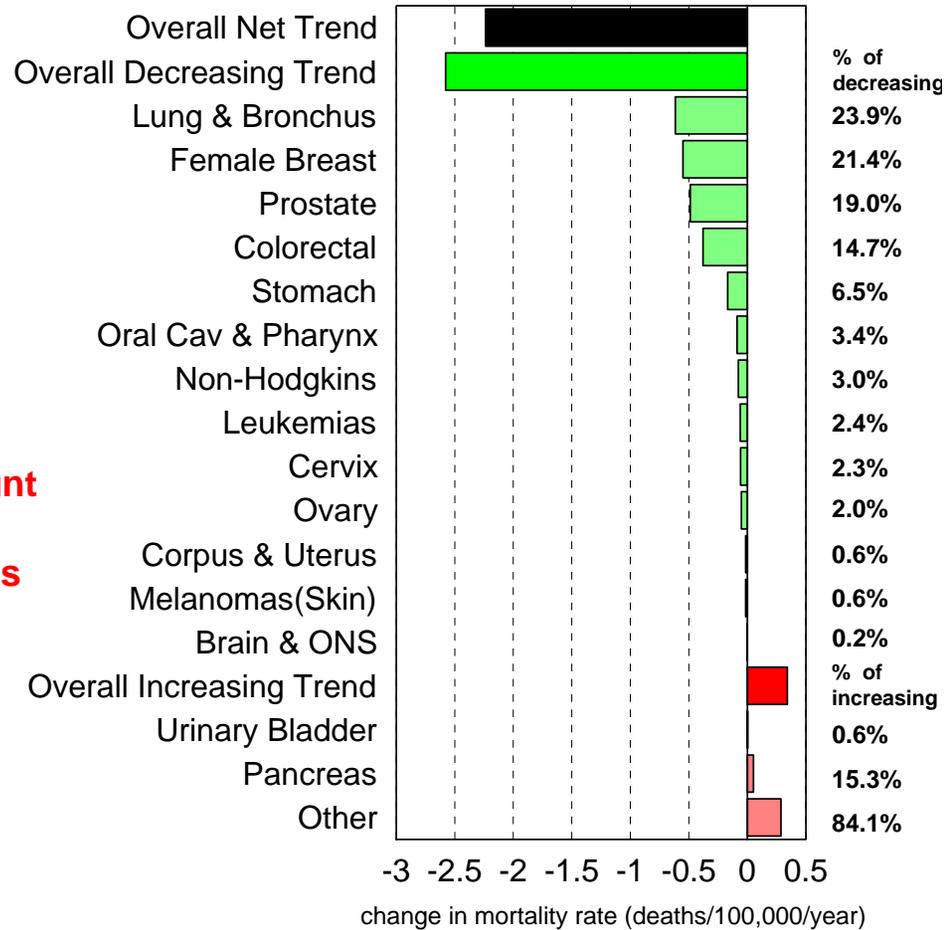
Recent Trend



Decline in death Rates due to:

Lung, Breast, Prostate, Colorectal

4 cancers account For over half of All cancer deaths



Source: NCHS Mortality
 Percents may not add to 100 due to rounding.

Age-adjusted Death Rates 1995-99

Frequency Distribution of Cancers



Age-adjusted U.S. death rates, 1995-99							
		Both sexes	Male	Female	Both sexes	Male	Female
		Rate	Rate	Rate	Percent	Percent	Percent
All ages	All Malignant cancers	206	259	171	100	100	100
	Lung and Bronchus	58	81	41	28	32	24
	Colon and Rectum	22	26	19	11	10	11
	Breast	16	0	29	8	0	16
	Prostate	NA	34	0	6	12	0
	Pancreas	11	12	9	5	5	6
	Non-Hodgkins Lymphomas	9	11	7	4	4	4
	Leukemias	8	10	6	4	4	4
	Ovary	NA	0	9	2	0	5
	Stomach	5	7	4	2	3	2
	Brain and Other Nervous System	5	6	4	2	2	2
	Other	73	71	44	27	28	26

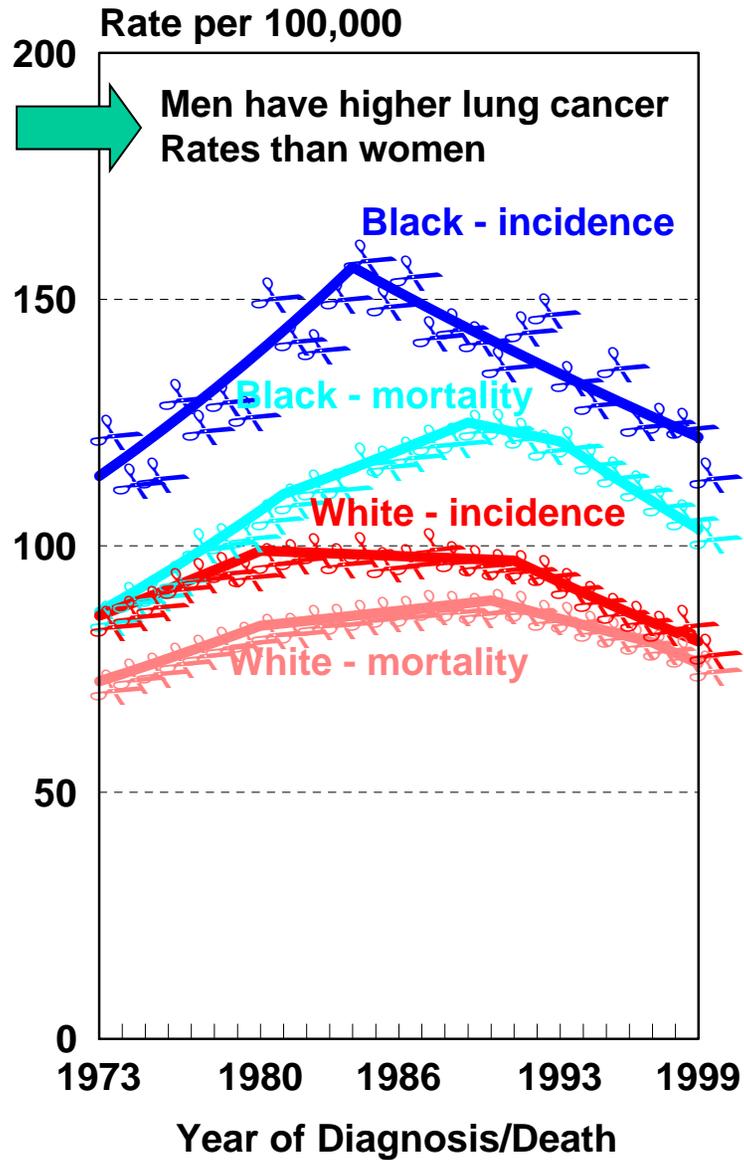


Age adjusted to 2000 population standard

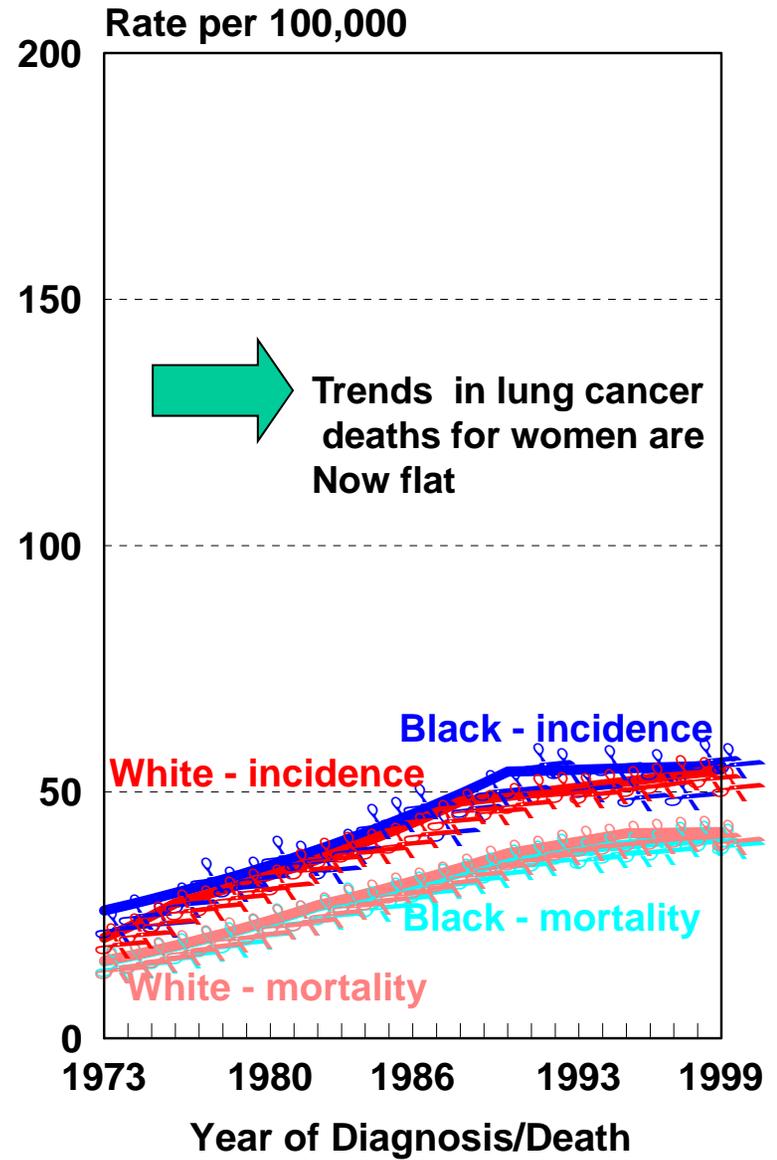


Lung and Bronchus Cancer SEER Incidence and U.S. Mortality Rates 1973-1999

Males



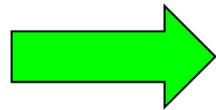
Females





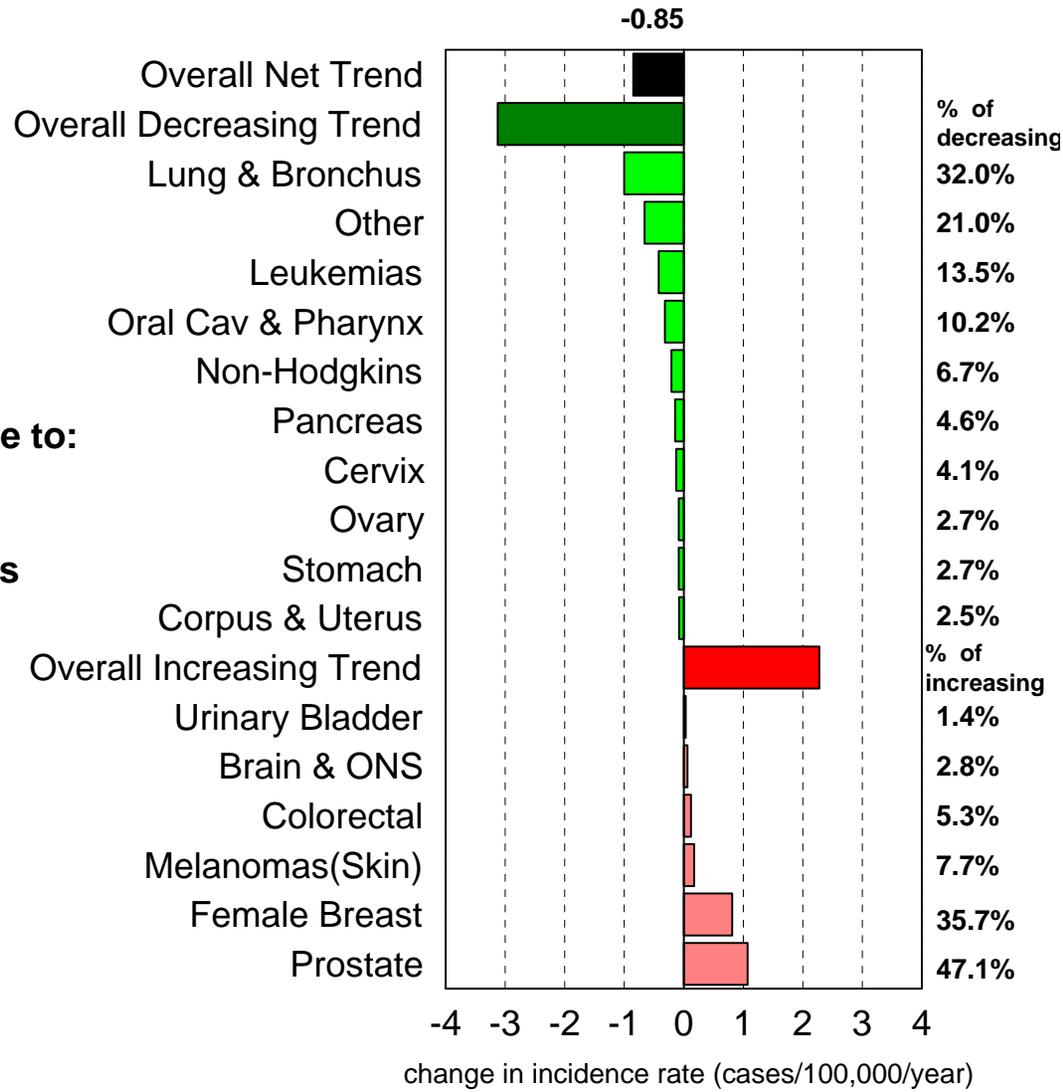
Partition of trend in incidence rates for the time period 1995-99, All Races, Both Sexes, All Ages

← **Recent Trend**



**Decline in cancer
Incidence rates due to:

Lung (men)
Various other types**



← **Increase in cancer
Incidence due to:

Breast & Prostate
(also melanoma
& colorectal)**

Source: SEER 12 Areas.
Percents may not add to 100 due to rounding.

Age-adjusted Incidence Rates 1995-1999

Frequency Distribution of Cancer

SEER 12 1995-99 Age-Adjusted Incidence & Frequency						
	Male and female	Male	Female	Male and female	Male	Female
	Rate	Rate	Rate	Percent	Percent	Percent
All ages						
All sites	469	550	416	100	100	100
Breast	73	1	134	16	0	32
Prostate	72	165	0	15	30	0
Lung and Bronchus	63	82	49	13	15	12
Colon and Rectum	54	64	46	11	11	11
Urinary Bladder	20	35	9	4	6	2
Non-Hodgkins Lymphomas	19	24	15	4	4	4
Melanomas of the Skin	16	20	13	4	4	3
Corpus and Uterus, NOS	NA	0	25	3	0	6
Leukemias	12	16	9	3	3	2
Oral Cavity and Pharynx	11	16	7	2	3	2
Other	115	127	108	25	24	26

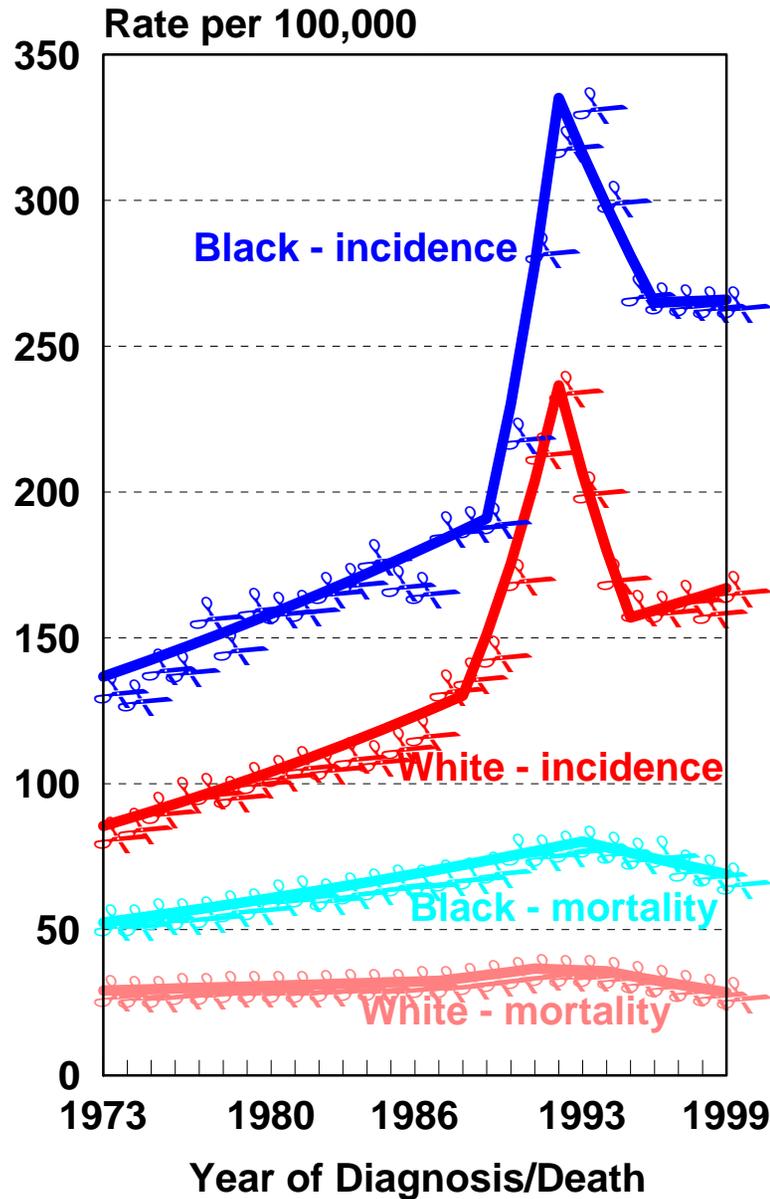
Age – adjusted to 2000 population standard





Prostate Cancer SEER Incidence and U.S. Mortality Rates 1973-1999

Males



Rates for black men
Much higher than for
White men

Dramatic increase in
Incidence in late 1980's
due to PSA

Rapid decline in
Incidence in early
1990's

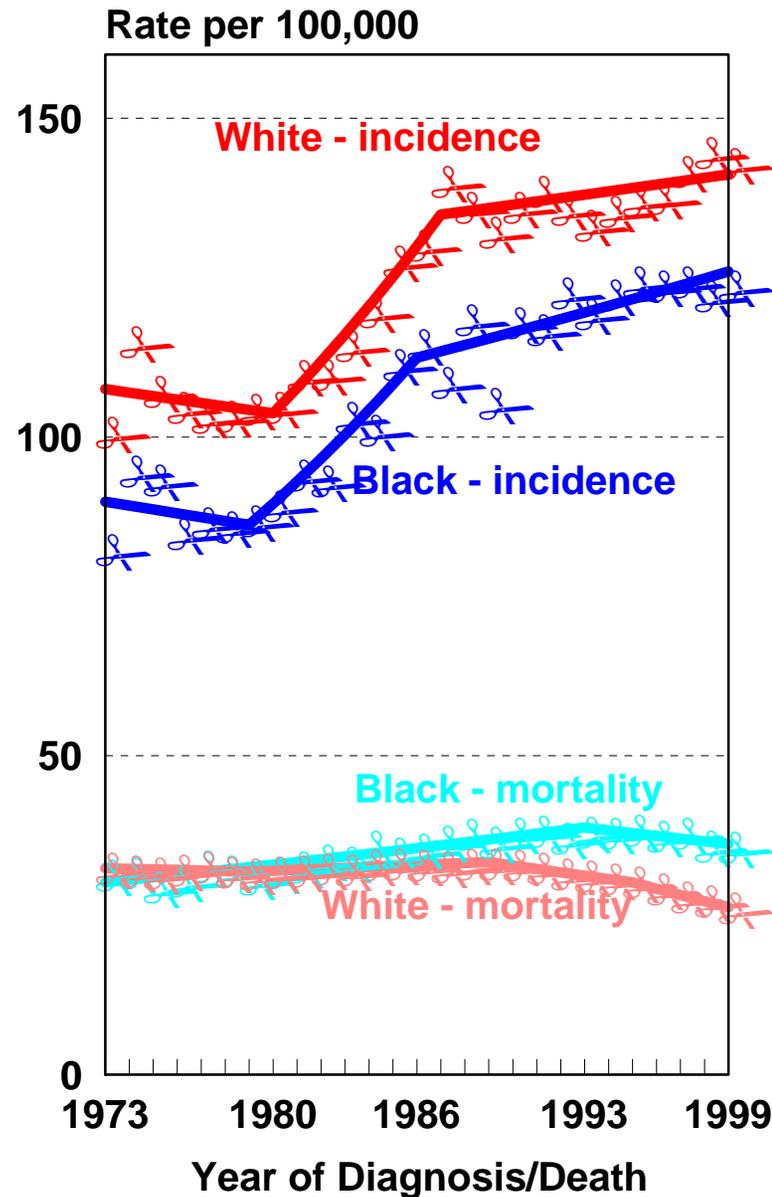
Slow increase in death
Rates with turnaround
In early 1990's

Long term trends
Age-adjusted to 2000
Population standard in
Current report



Female Breast Cancer SEER Incidence and U.S. Mortality Rates 1973-1999

Females



Incidence has been
Increasing since late 1970s
And at slower pace since
Late 1980s

Increasing death rates began
Decline in late 1980s

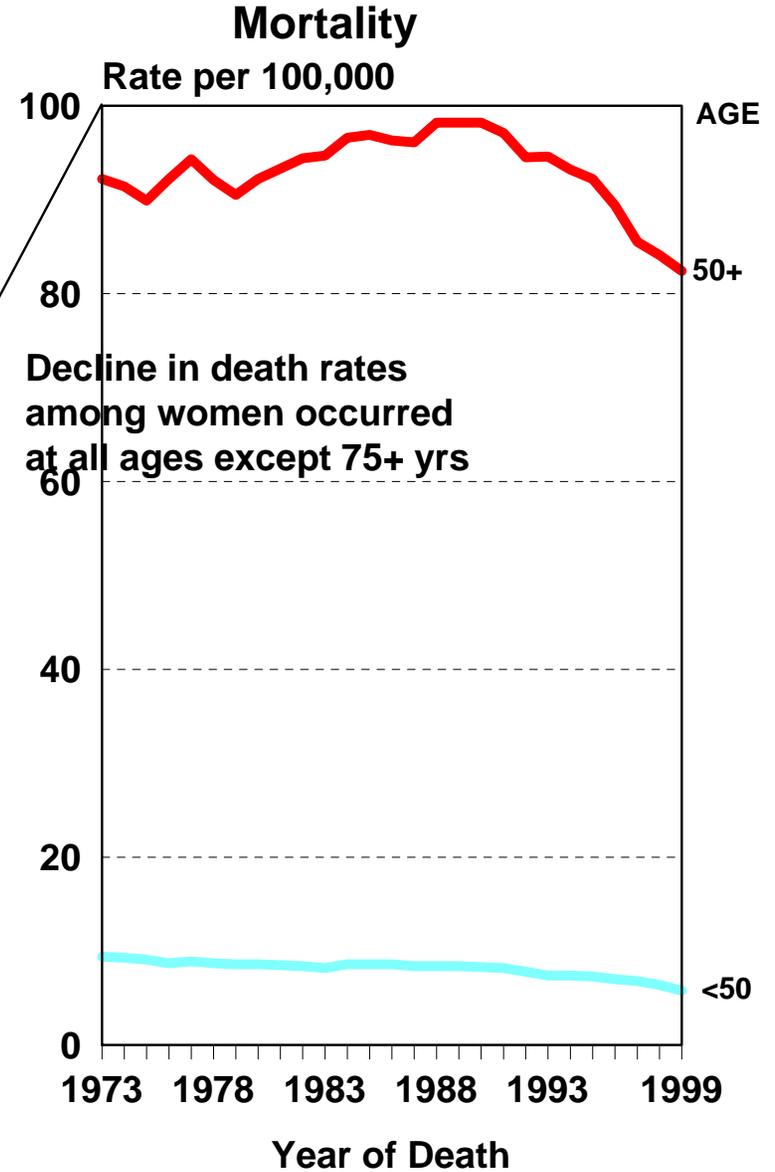
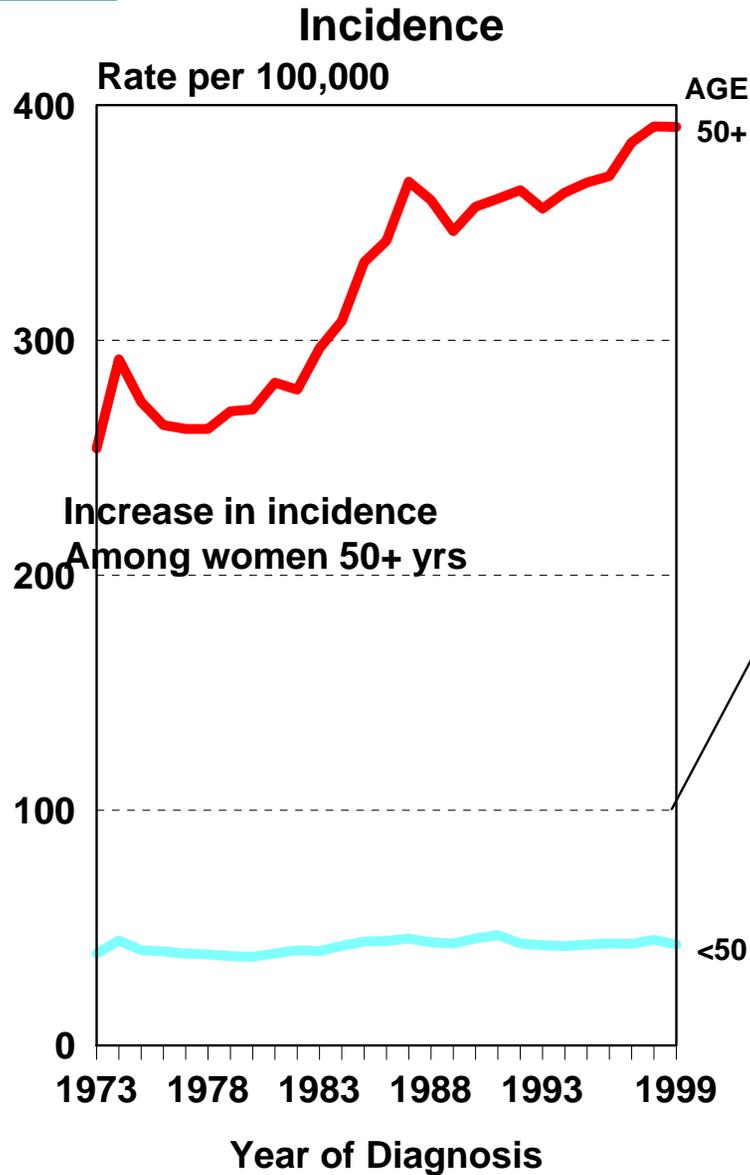
Black women have higher
Death rates than white women

Death rate for black women
Have begun to decline

Disparity gap is widening



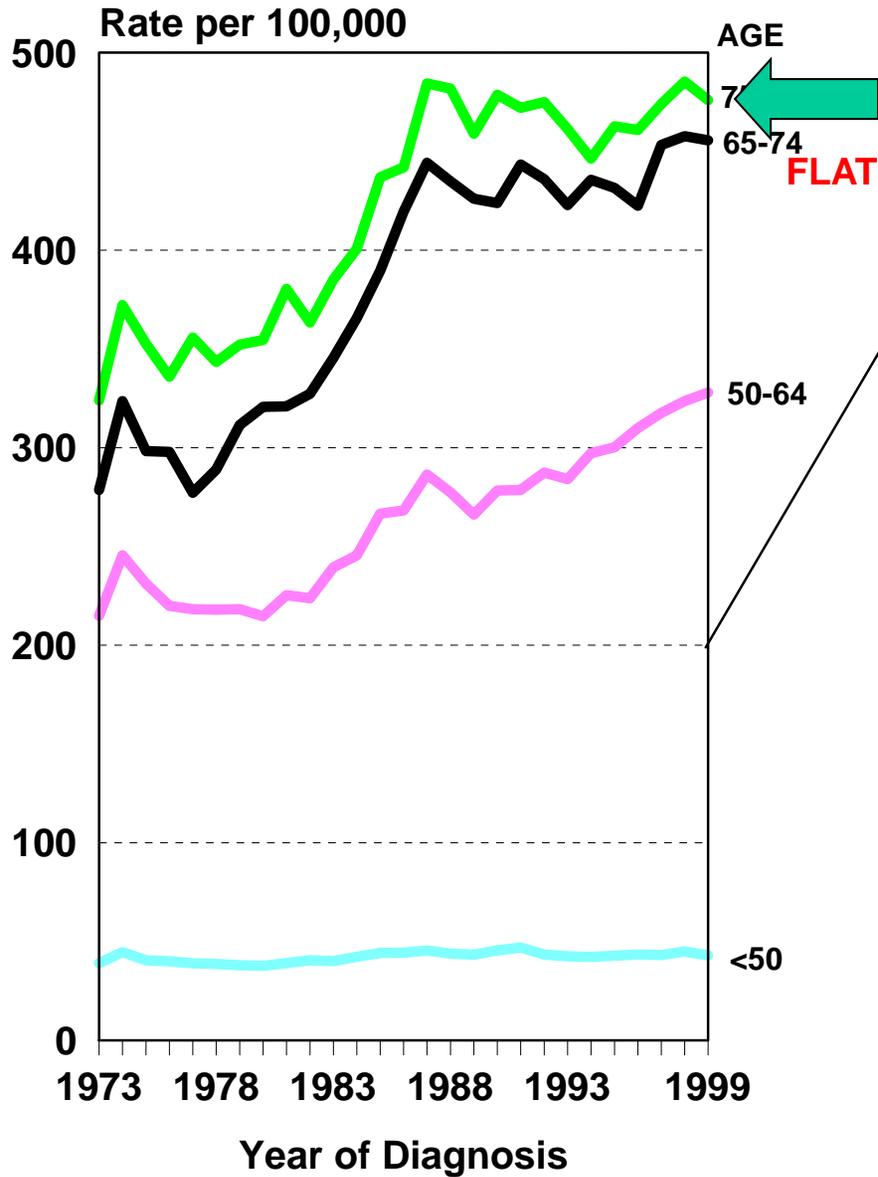
Female Breast Cancer by Age Incidence (SEER) & Mortality (U.S.) Trends, 1973-1999



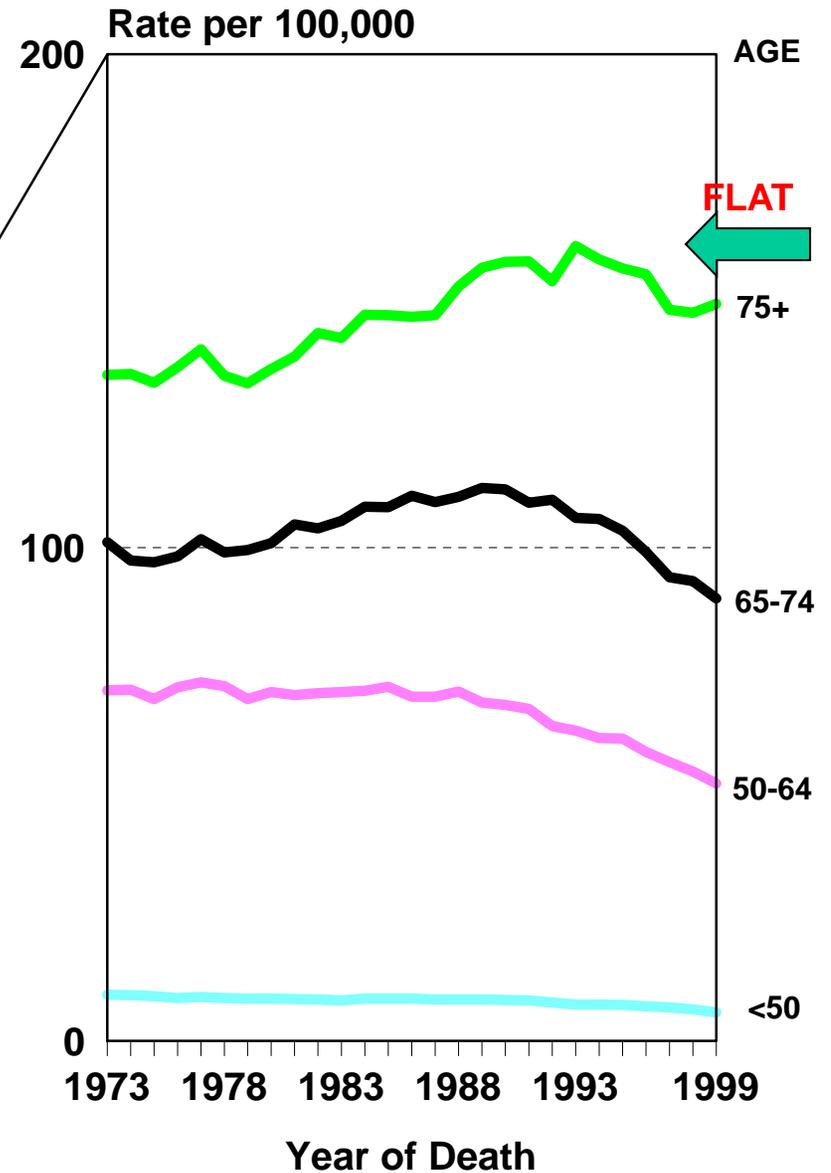


Female Breast Cancer by Age Incidence (SEER) and Mortality (U.S.) Trends, 1973-1999

Incidence



Mortality

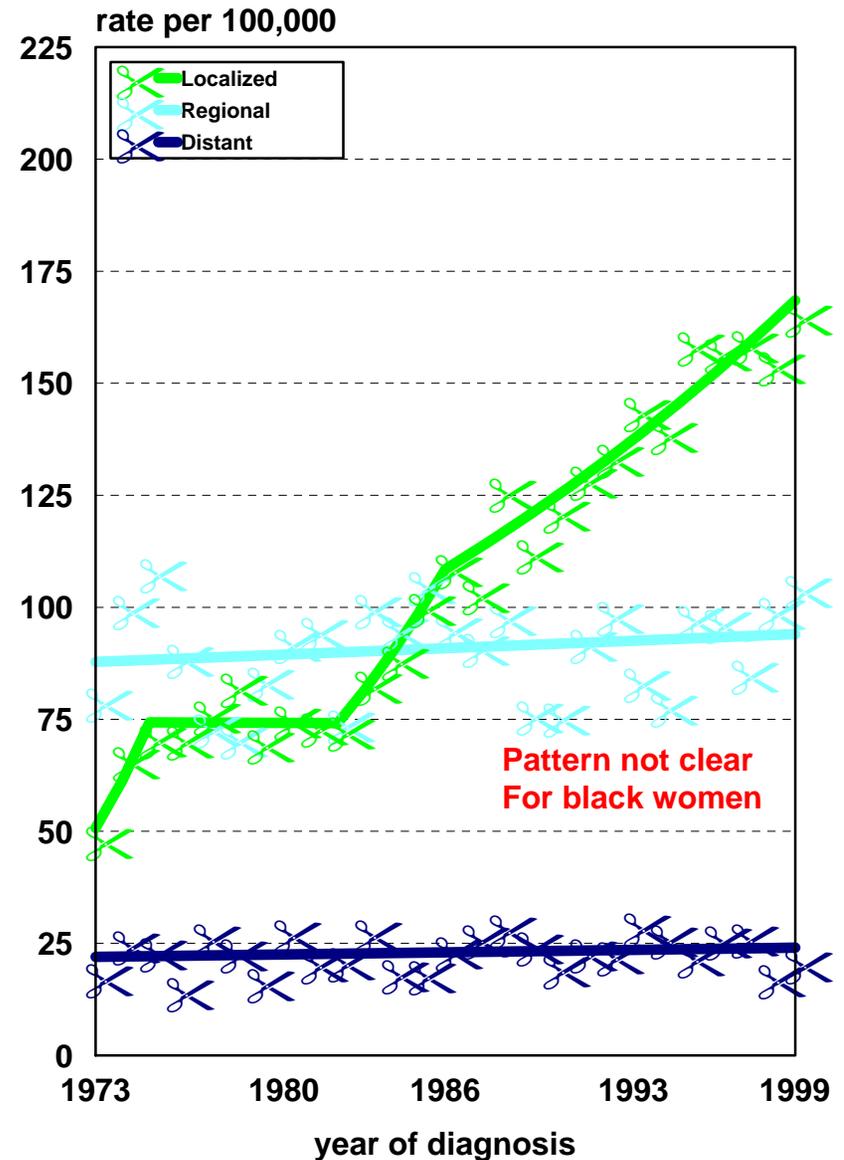
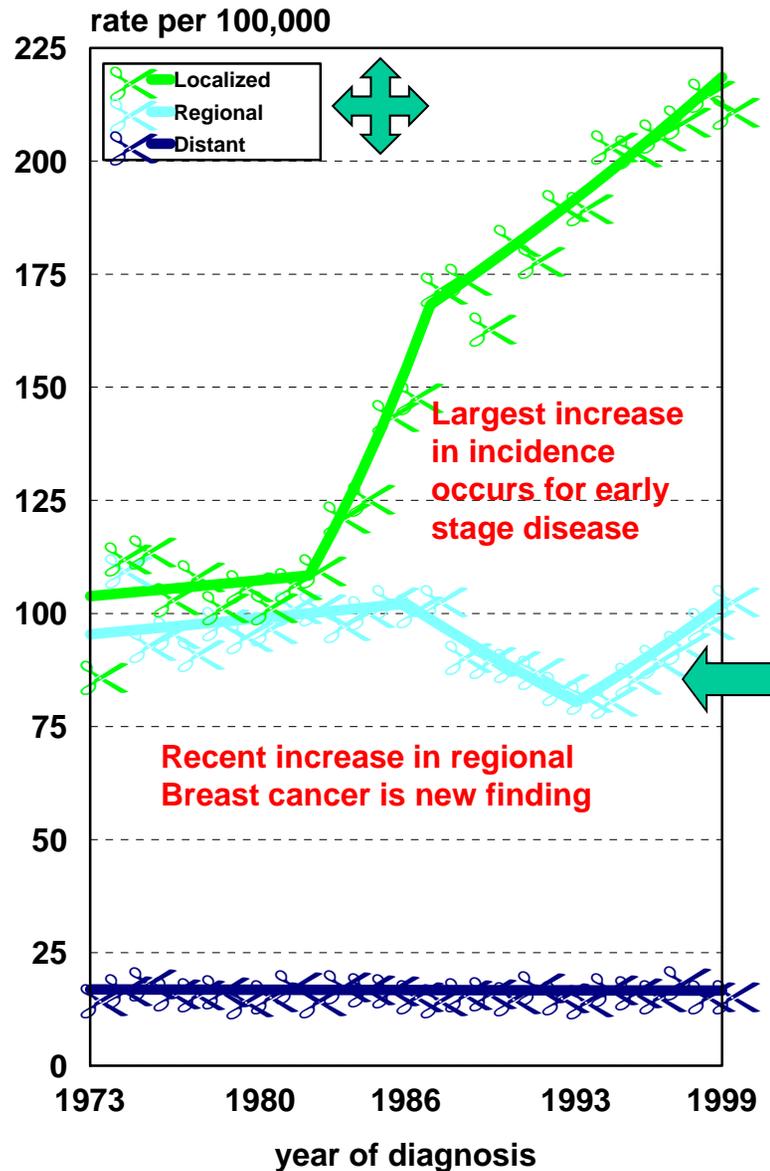




Female breast cancer incidence by race and stage/node, ages 50-64, SEER 1973-1999

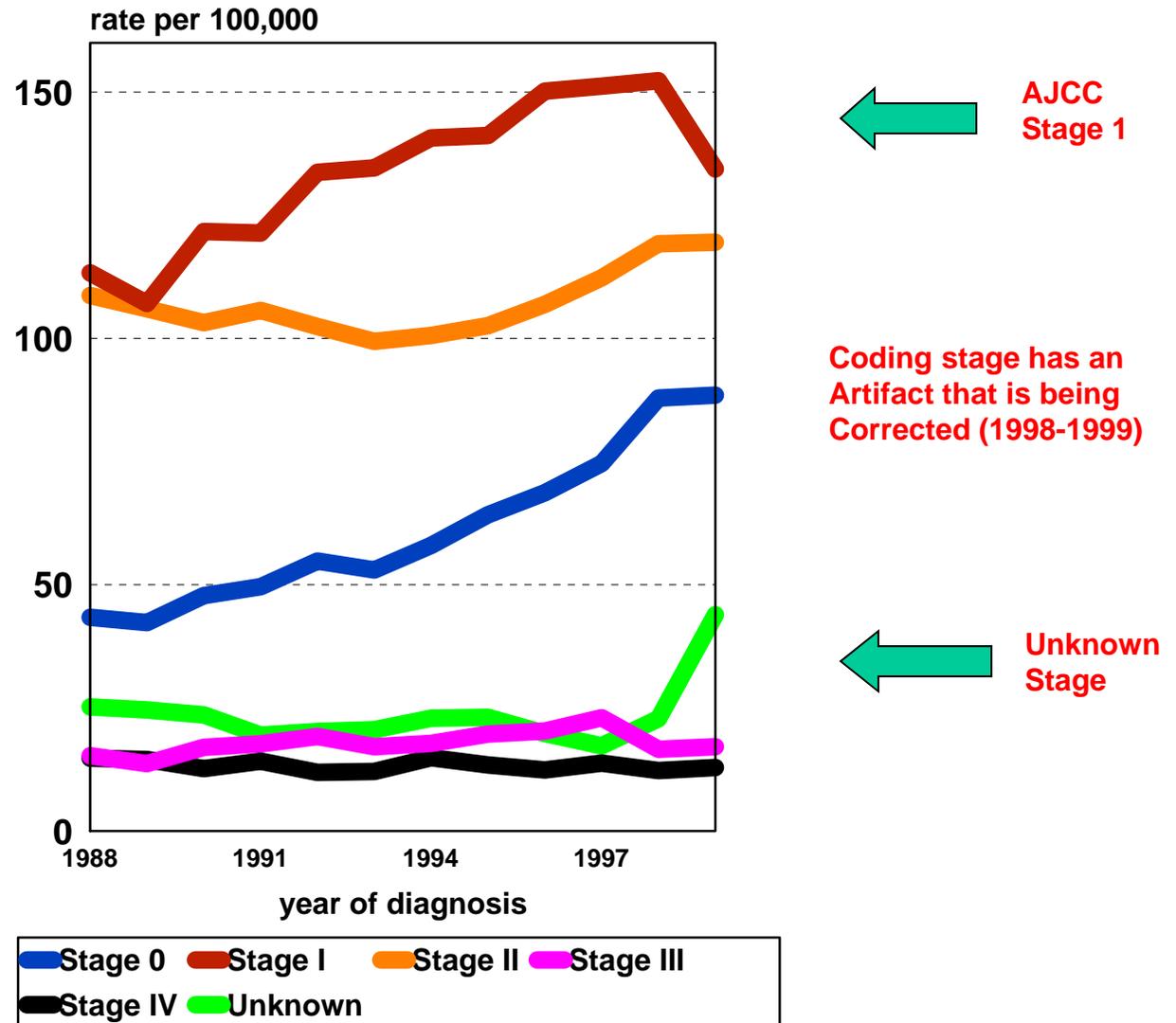
White

Black



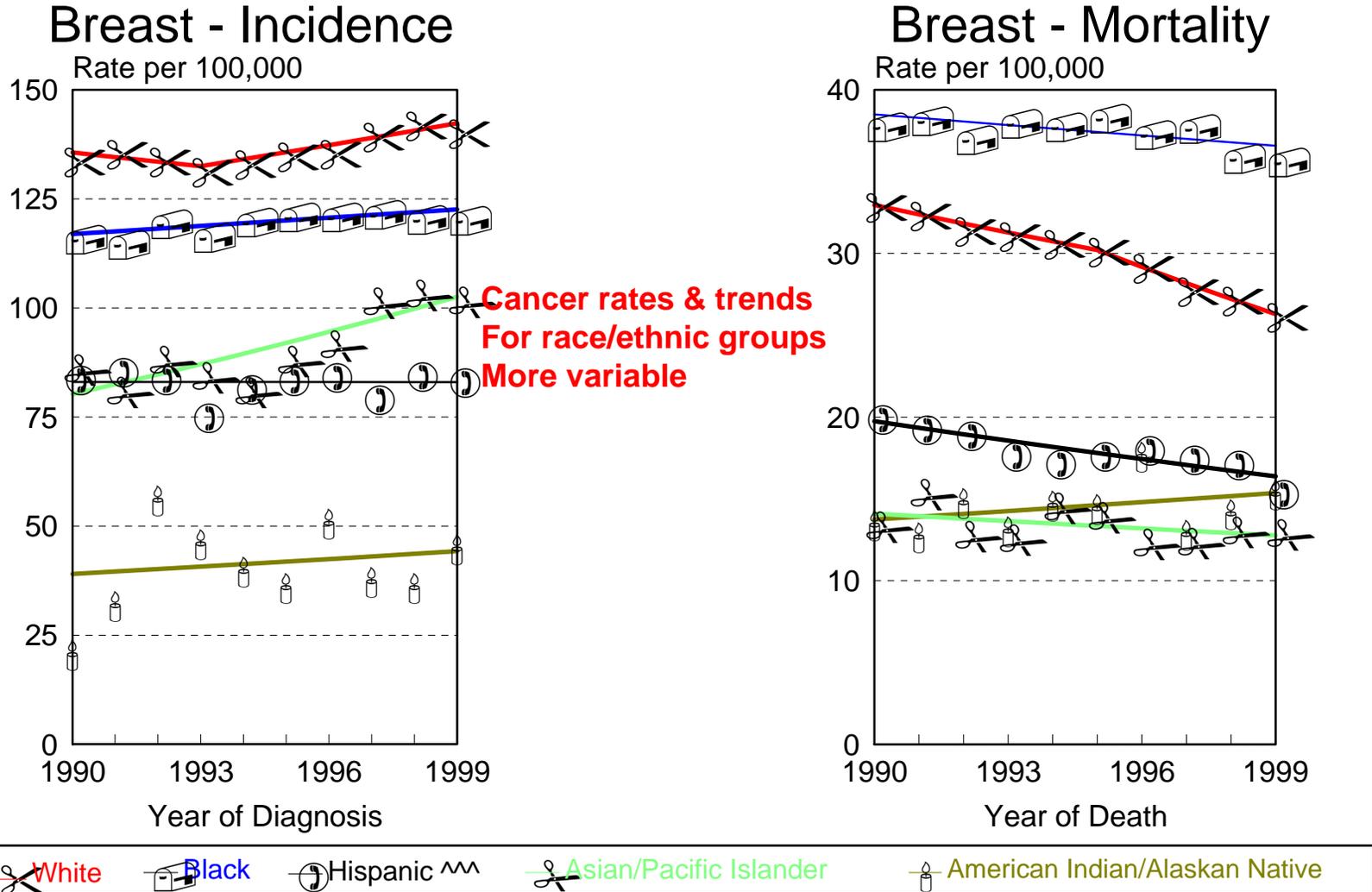


Female breast cancer incidence Ages 50-64 by stage, 1988-1999





Female Breast Cancer, SEER Incidence and U.S. Mortality 1990-1999 by Race/Ethnicity

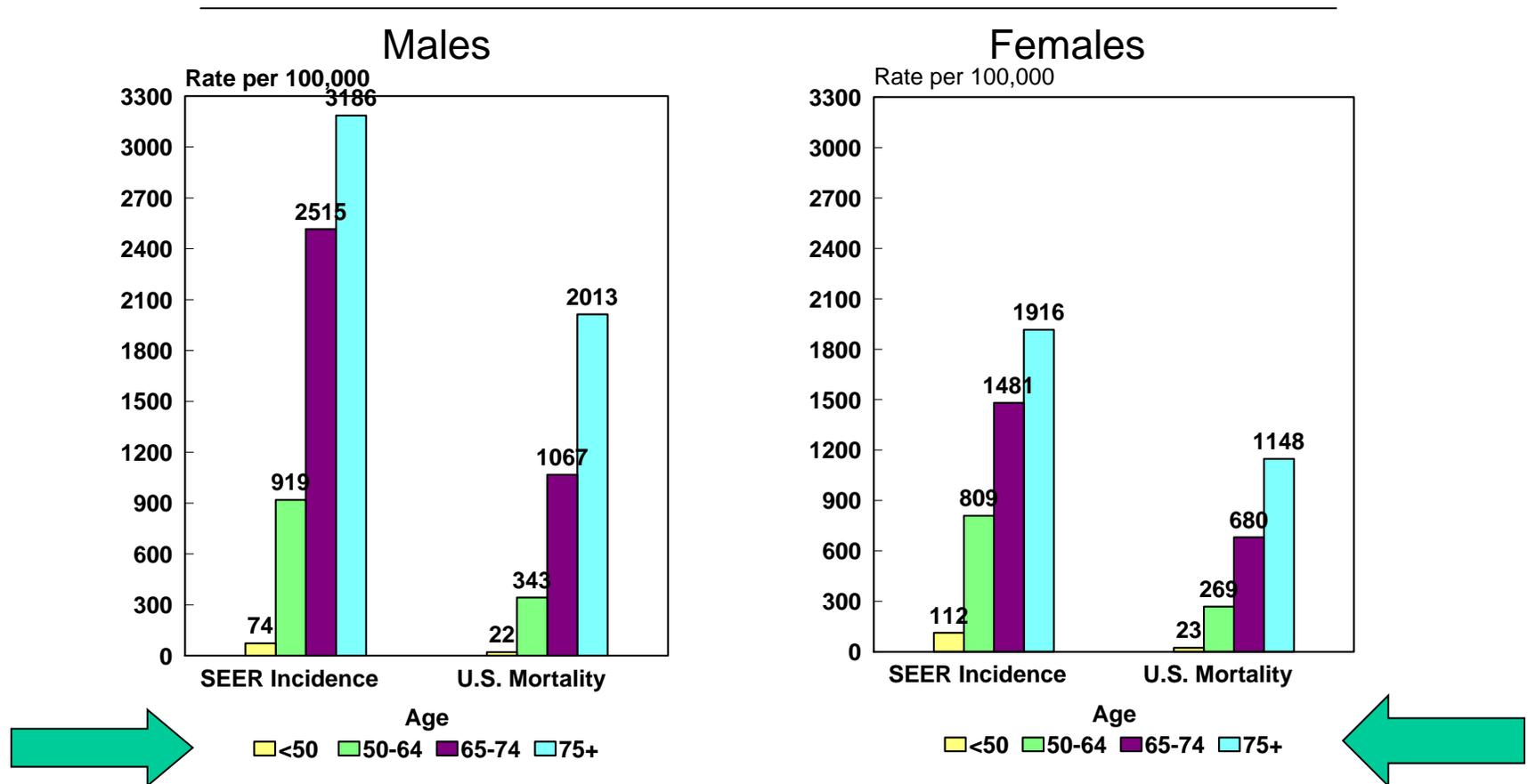


^{^^} Hispanic is not mutually exclusive from whites, blacks, Asian/Pacific Islanders, and American Indians/Alaskan Natives.
 Data Source: SEER 12(San Francisco, Connecticut, Detroit, Hawaii, Iowa, New Mexico, Seattle, Utah, Atlanta, San Jose-Monterey, Los Angeles and Alaska). Incidence data for Hispanics does not include data from Detroit or Hawaii. Mortality data for Hispanics does not include data from Connecticut, Oklahoma, New York, and New Hampshire. Mortality data for all other races are from all U.S. States. Regression lines are calculated using the Joinpoint Regression Program.



Implications of Age & Aging on U.S. Cancer Burden

SEER Incidence and U.S. Death Rates (1995-1999) **Figure 1**
All Cancers Combined, by Age and Sex

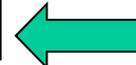
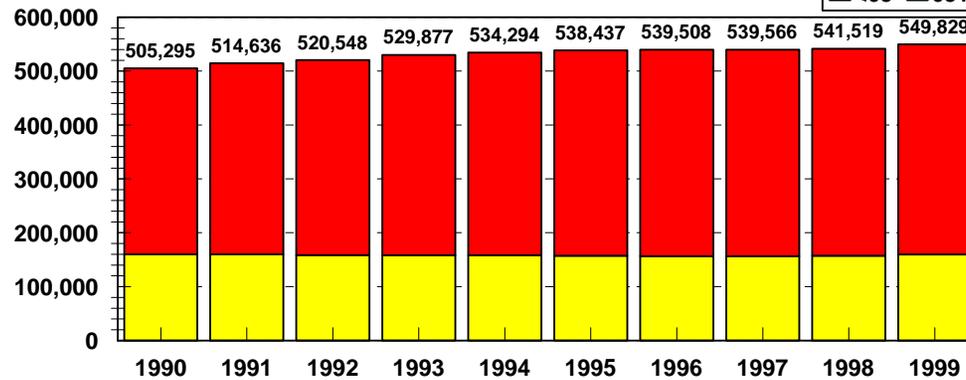


Rates are per 100,000 persons and age-adjusted to 2000,
Incidence - SEER 12 Areas, 1995-1999; Mortality - US from NCHS, 1995-1999

U.S. Cancer Deaths 1990-99

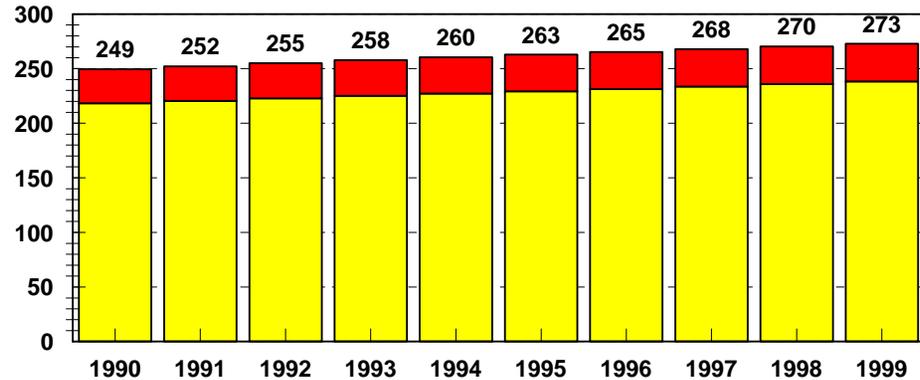
Figure 2

Frequency of Deaths



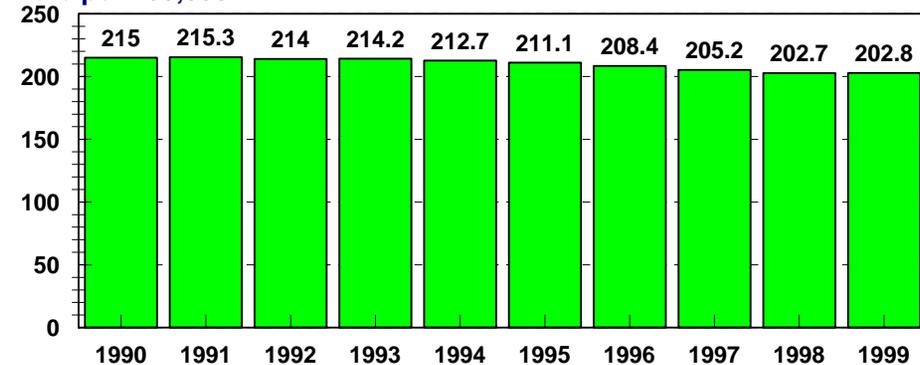
3. Number of deaths due to Cancer is increasing
Occurs among those 65+ yrs

Population in Millions



2. US population size is increasing

Death Rate per 100,000



1. Age-adjusted cancer death Rate is decreasing
Year 2000 standard

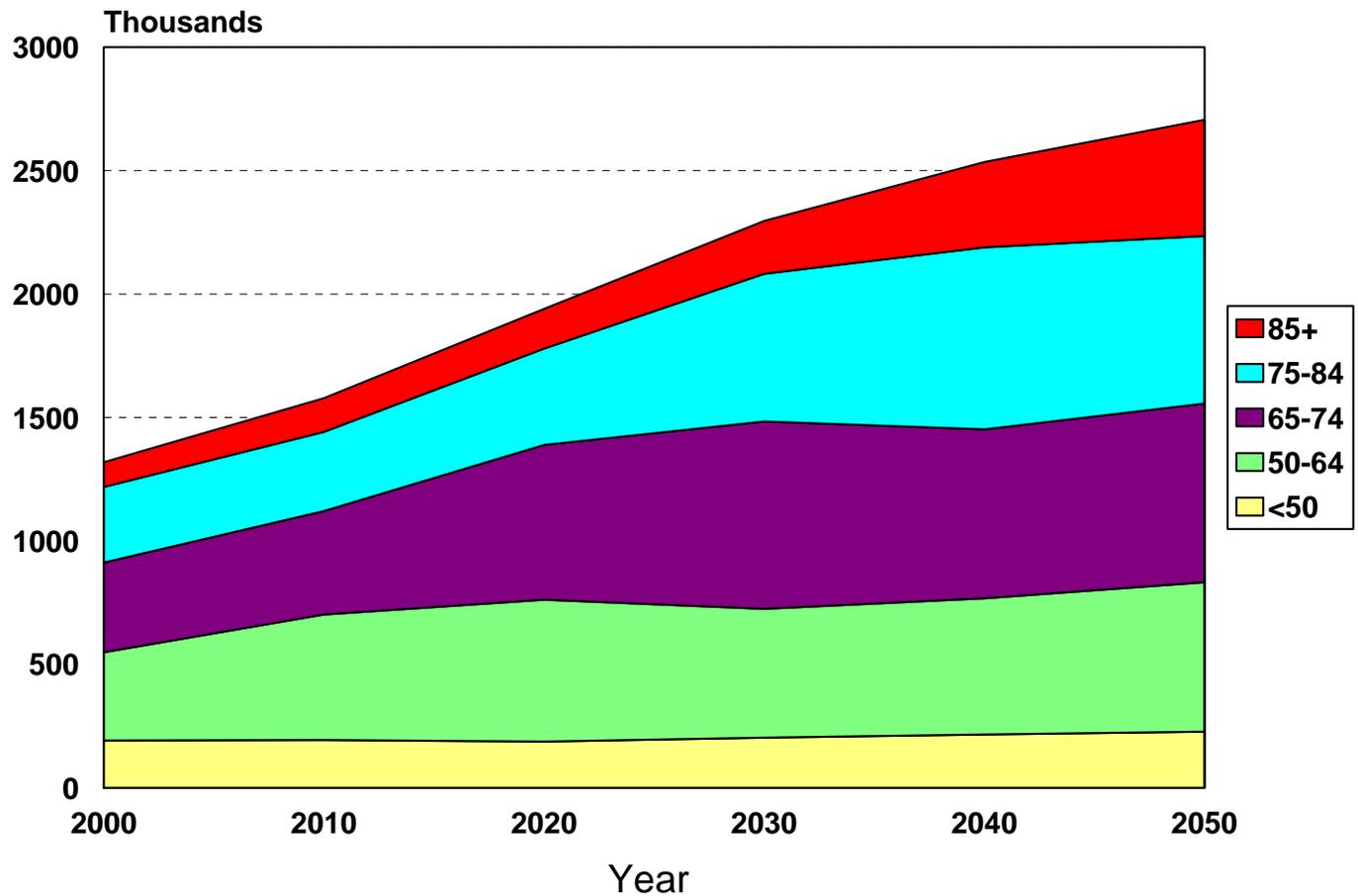
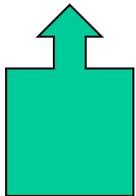
Year



Figure 5

Projections of Cancer Cases between 2000 to 2050 by Age

Number of cancer cases
Expected to increase due to
Growing and aging
population



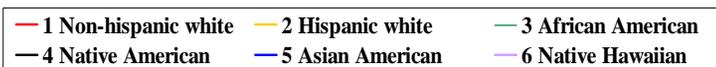
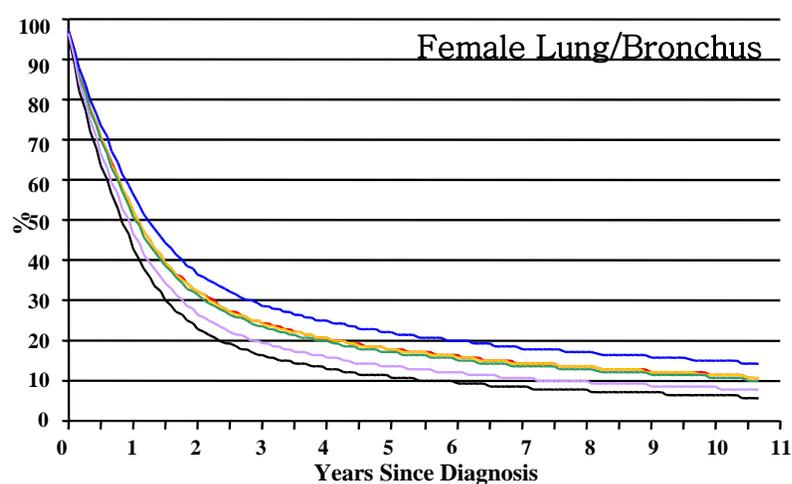
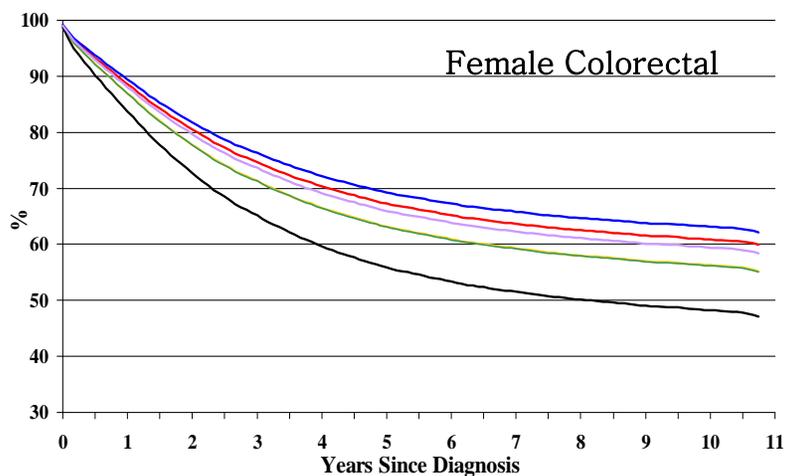
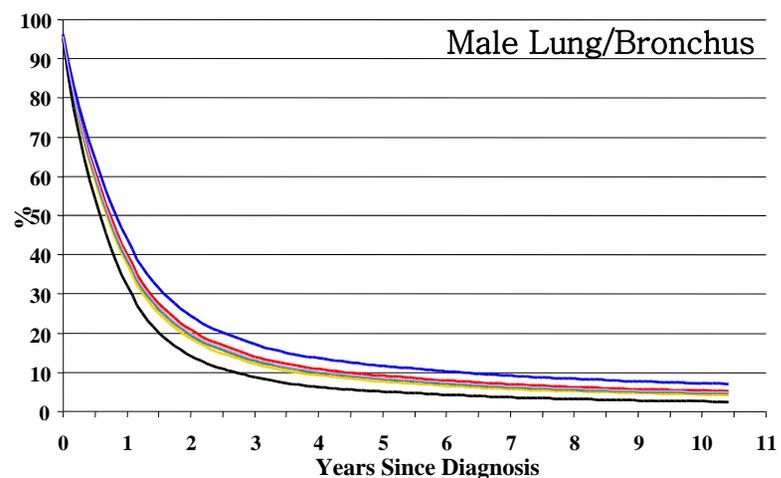
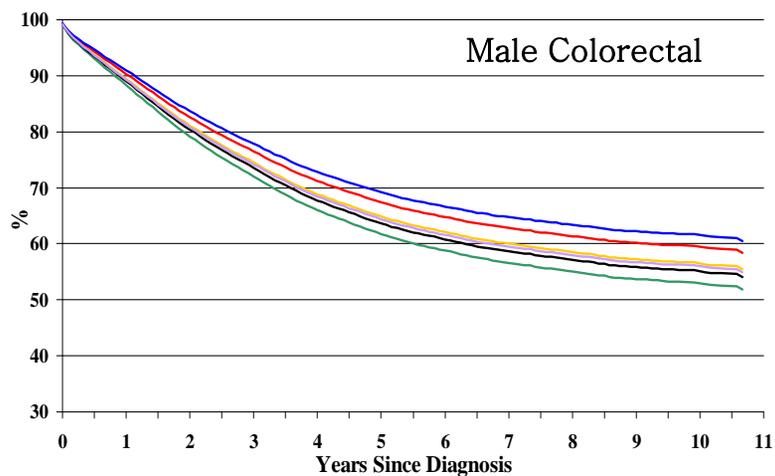
Source: SEER program, NCI and population projections from US Census Bureau

SEER

A Unique Program

- Completeness & Population Coverage
- Survival
- Data Content & Quality
- Duration: 30 years
- Research Resource
- Innovative use of data

SEER Survival Among U.S. Populations



Source: Clegg LX, Li FP, Hankey BF, Chu K, Edwards BK. Cancer survival among U.S. whites and minorities: a SEER population-based study. *Arch Intern Med.* (in press, 2002).

Field Audits & Reliability and Data Quality Profile (DQP)

Diagnosis Year	File Year	QC Year	Type	Comments
1995		1997	Case-finding	NPCR & SEER
1995 – Top 4 sites		1997	Re-abstracting	NPCR & SEER
1996	2/1999	1999	1996 DQP	
1997	8/1999	2000	1997 DQP	
1998	8/2000	2000	1998 DQP	
1998 – Prostate	2/2000	2000	Re-abstracting	Surgery & Rx
10 cases; 5 sites		2001	Reliability I	Registry Staff
10 cases; 5 sites		2002	Reliability II	Registry Staff
1999	11/2001	2002	1999 DQP	SEER Auditors
2000	7/2002	2003	Case-finding	SEER Auditors

1997 SEER Audit – 1995 Data Discrepancy Rates

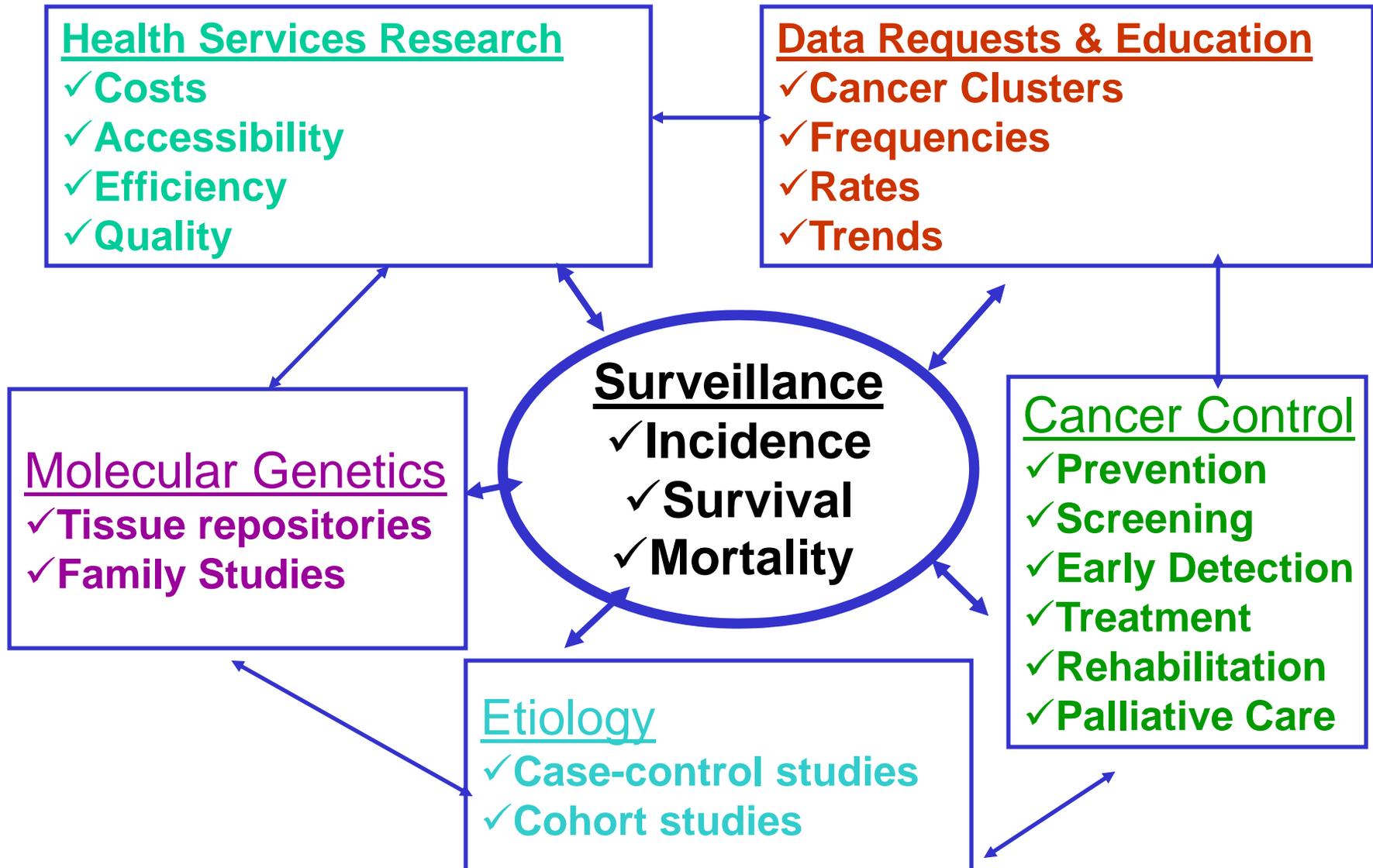
- **Low Rates**

- Sex
- Residence
- Behavior
- Sequence #
- Birth date
- Laterality
- Race
- No. of Positive Nodes

- **High Rates**

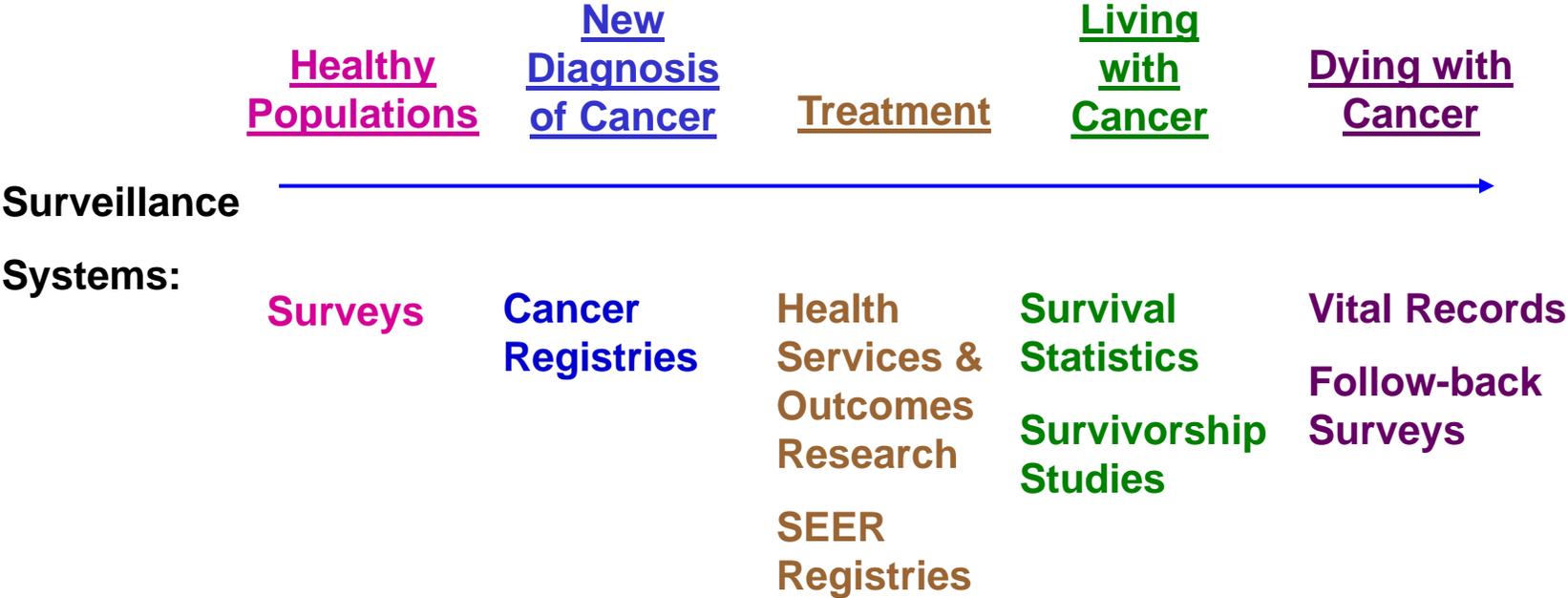
- No. Nodes Examined
- Grade Differentiation
- Histologic Type
- Primary Site
- Date of Diagnosis
- Lymph Nodes
- Tumor Size
- Extension

SEER is an Expanded Registry



Framework for Cancer Surveillance

Cancer Continuum



Adapted from David B. Abrams, Brown University School of Medicine.

Counting Cancer

- **Is it a person or a cancer?**

Example: McCain's melanoma(s)

Example: Bilateral breast cancer

Example: Breast cancer followed by ovarian

- **Is it a newly diagnosed or existing cancer?**

- **What is “cancer”?**

In situ, **invasive**, or metastatic disease

Extent of disease, stage, histology, markers

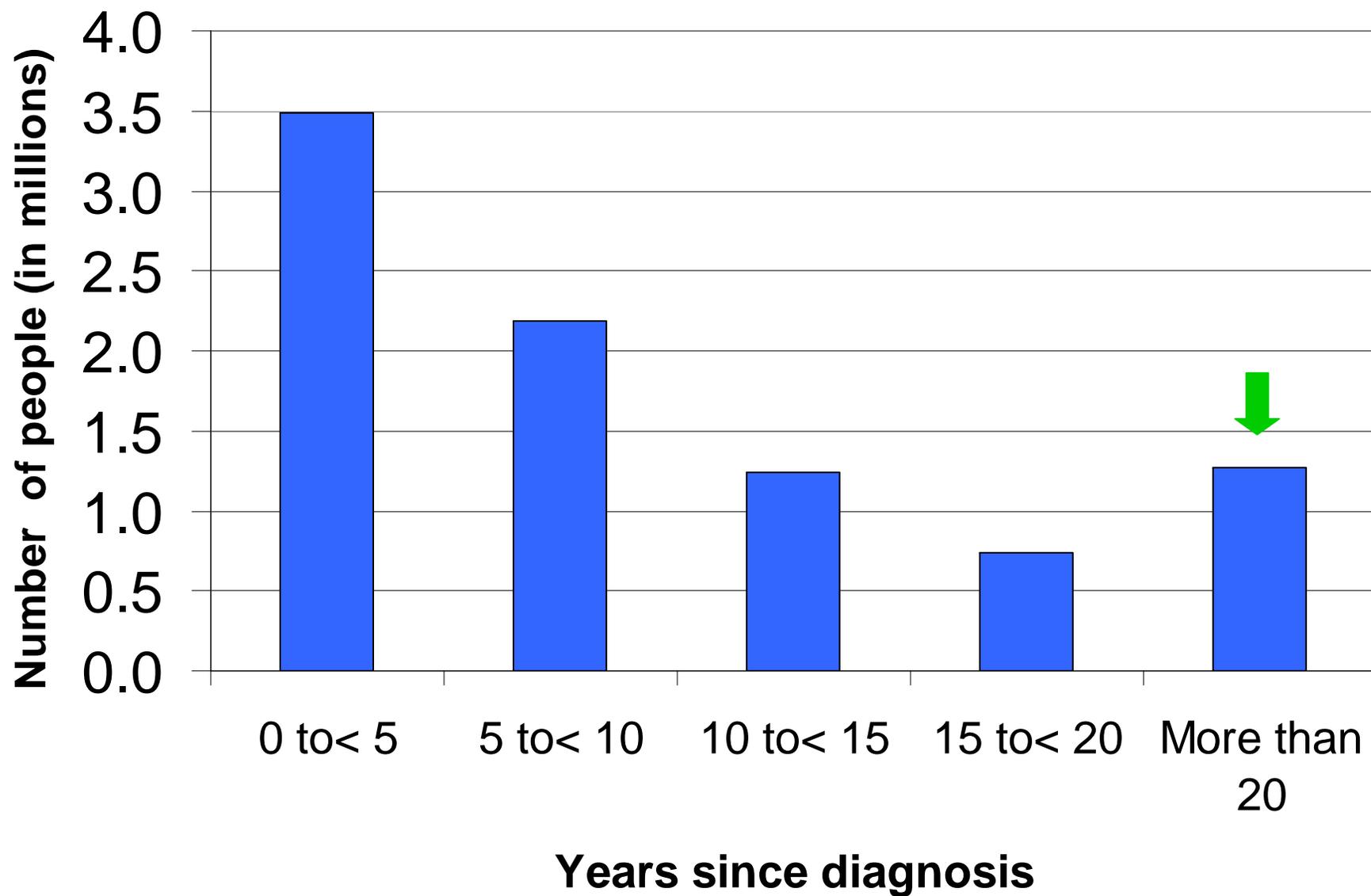


Cancer Prevalence

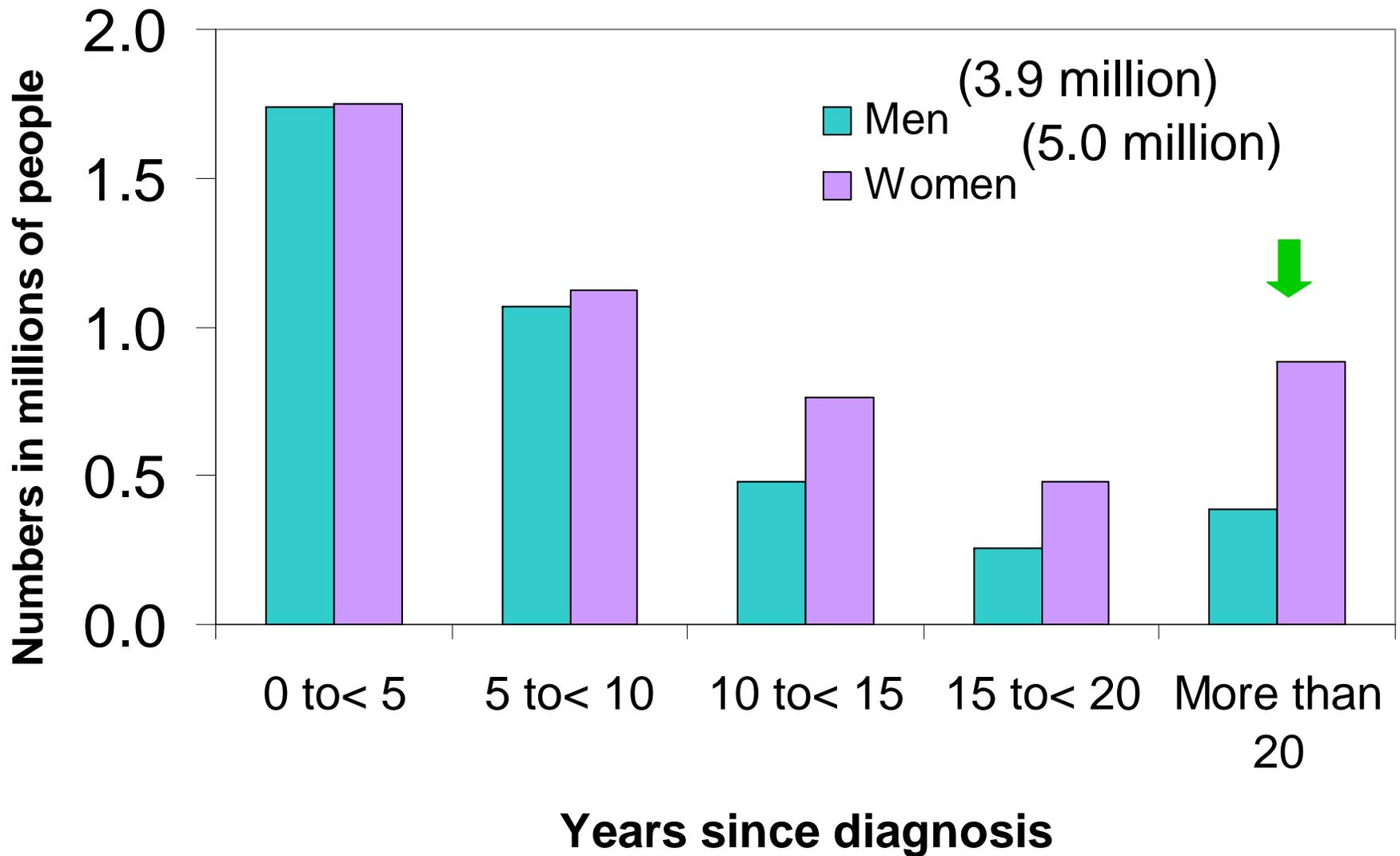
- **SEER prevalence rates extrapolated to the US population**
- **Number of people or the proportion of people alive who have been diagnosed with cancer**
- **Completeness index method***
- **More representative of the US**
- **Prevalence by races**

* Capocaccia et al (1997) Statistics in Medicine

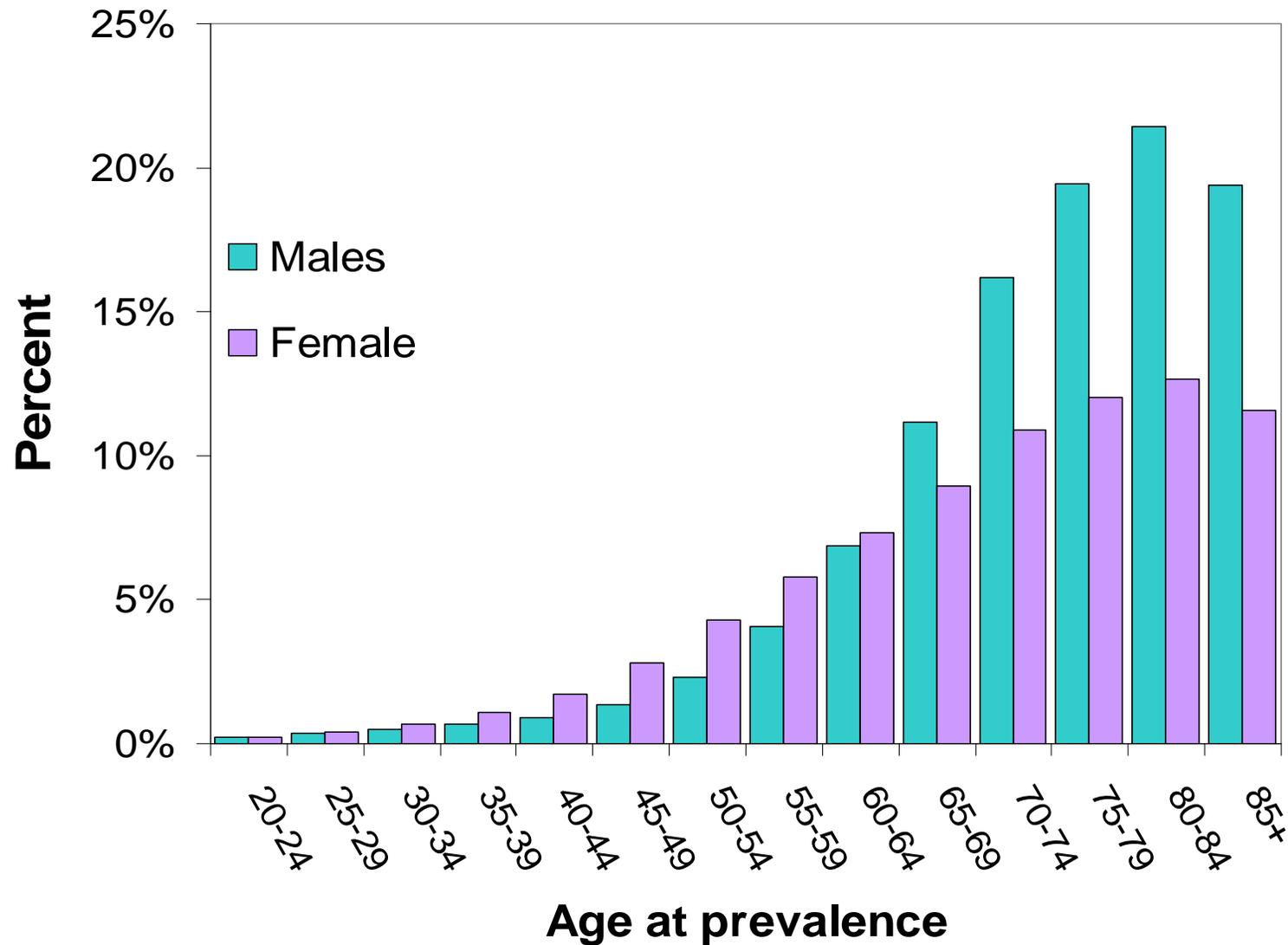
Prevalence All Cancers in the US by Years Since Diagnosis (Total= 8.9 million)



Prevalence of All Cancers in US by Years Since Diagnosis (Total= 8.9 million)



Percent of People Diagnosed with Cancer in Last 20 Years Alive January 1st, 1999 among the US population, By Age



Future Directions

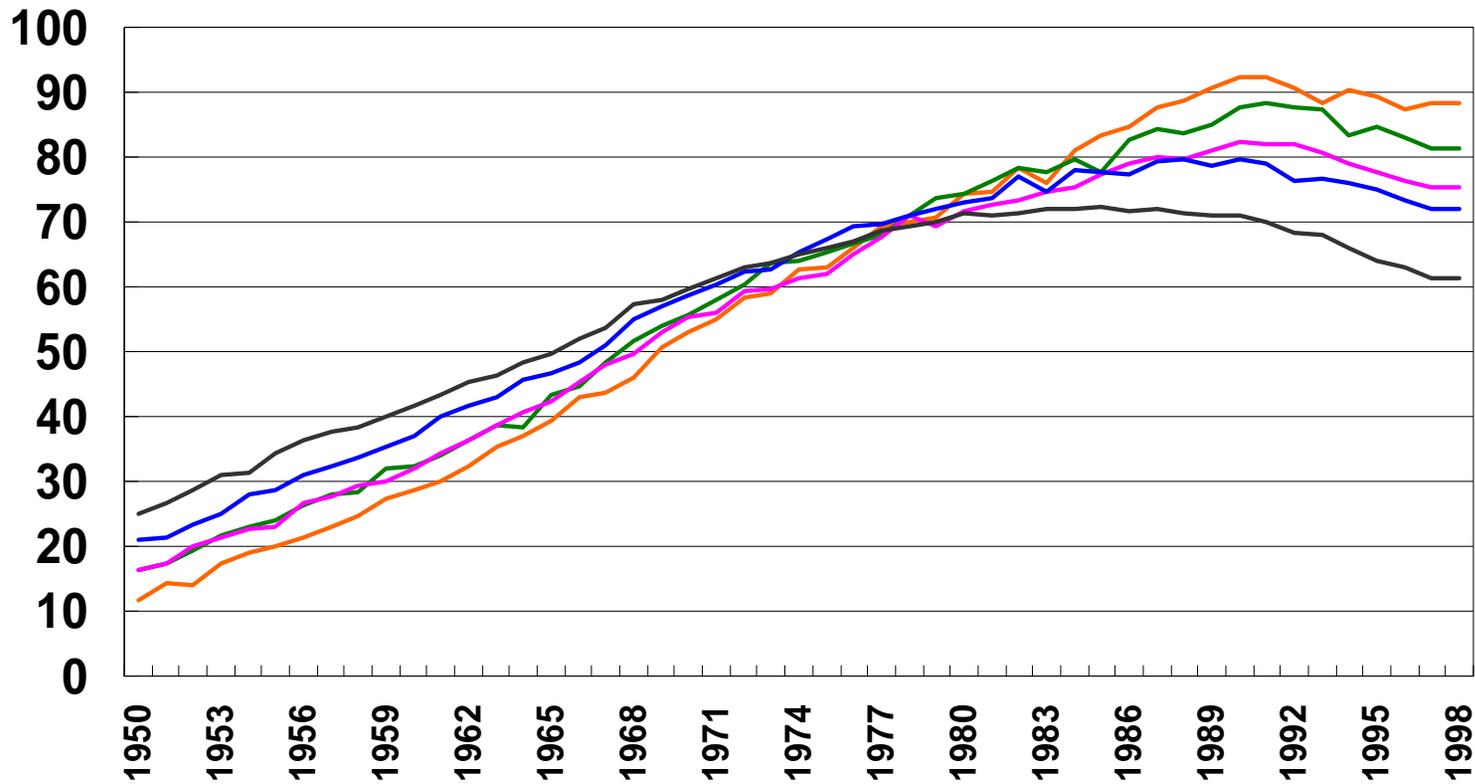


GPS

- Area based statistics: geospatial
- Ecological analyses & data linkage
- Modeling & Model based statistics
- Projected rates
- Tools: Analysis & Interpreting Patterns (**data visualization**)
- **Cancer control** planning & evaluation

Lung Cancer Mortality by Area Socioeconomic Status, US Men, 1950-1998

Age-Adjusted Death Rate per 100,000 1970 US
Standard Population

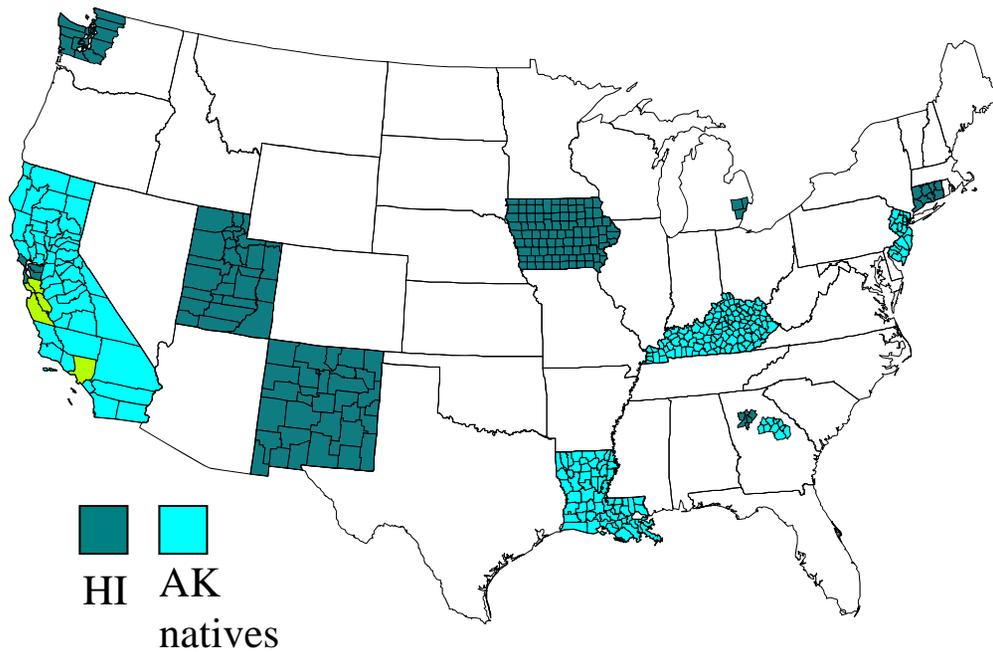


— 1st Quintile (Low SES) — 2nd Quintile — 3rd Quintile
— 4th Quintile — 5th Quintile (High SES)

Predict # new cancer cases for all U.S. states (L W Pickle)

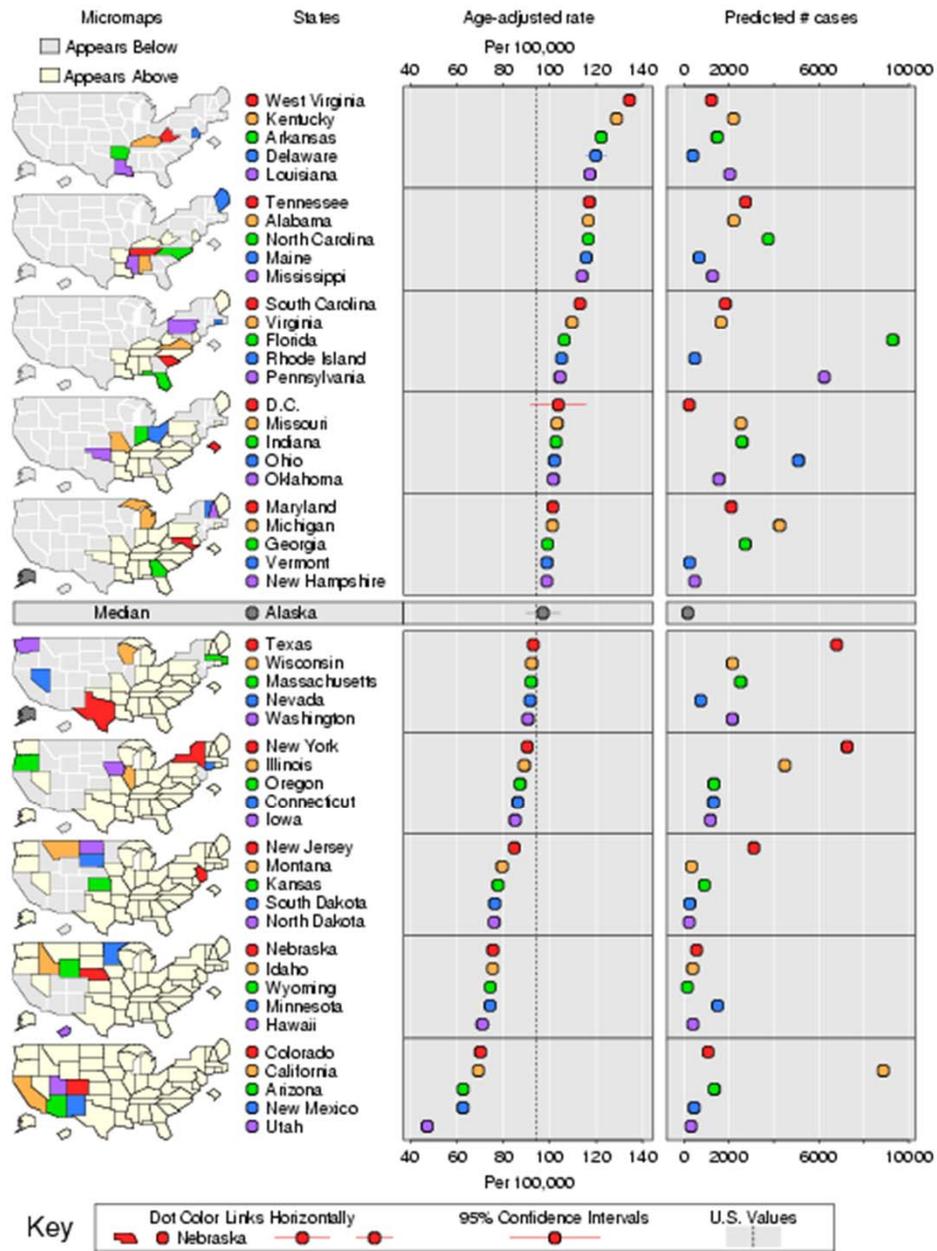
- Uses of predicted counts by small area
 - Cancer control: e.g., where prevention programs needed
 - Health resource planning (measure cancer burden)
 - Surveillance and etiology: study unusual observed geographic patterns which differ from modeled patterns
 - Can estimate rates & counts for U.S., regions, etc.
 - Quality control check for tumor registries

Data Used for 1999 Incidence Prediction

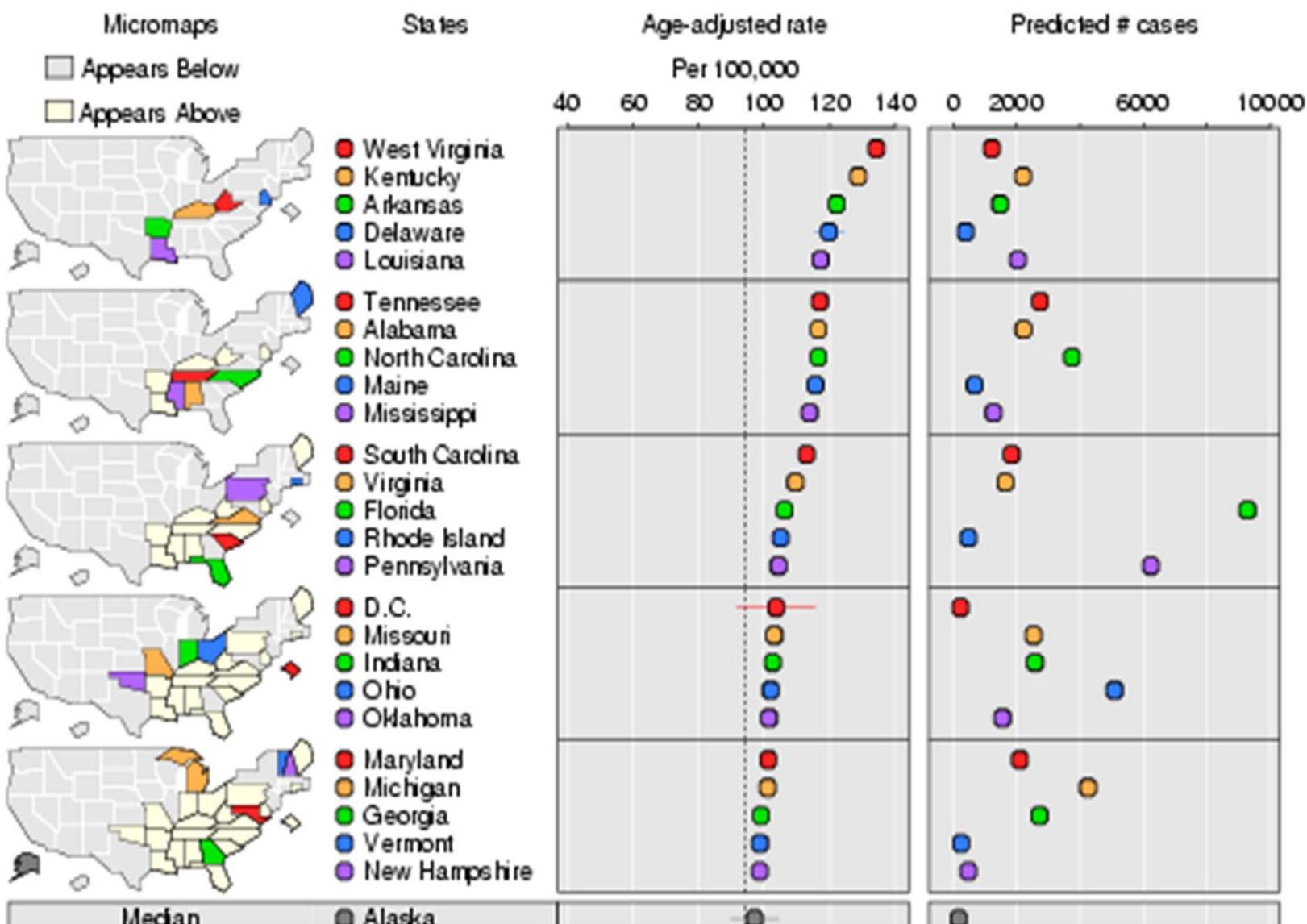


- SEER9 registries
- + Los Angeles, San Jose/Monterey
- + Alaska natives
- + 4 new SEER registries (KY, LA, NJ, rest of CA)
- + rural GA (10 counties)
- = SEER 17

Predicted Lung Cancer Incidence Rates & Counts, Males, 1999



Predicted Lung Cancer Incidence Rates & Counts, Males, 1999



NCI-ACS Collaboration on Improving Mortality Projections

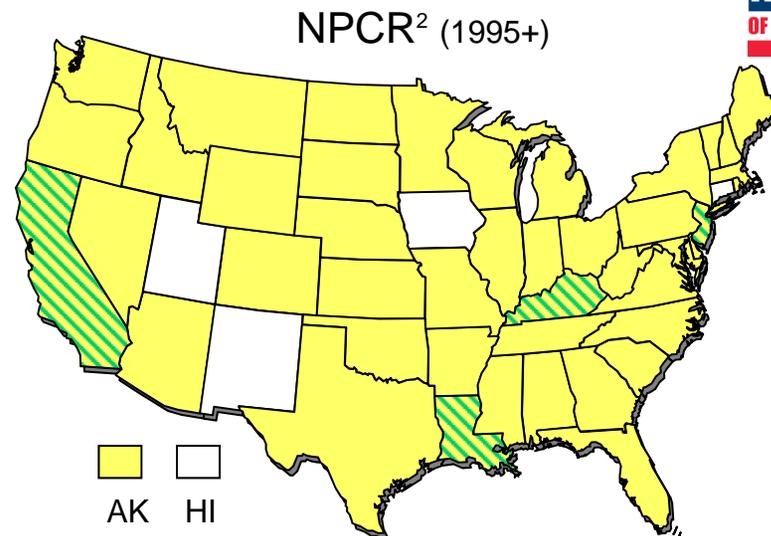
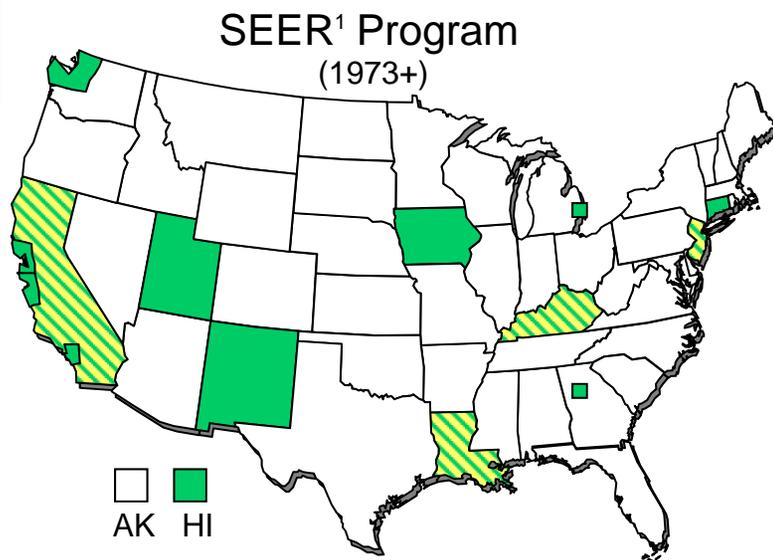
- **3-year lag between the current year and the most recent available death counts (e.g., 1999 deaths available in 2002).**
- **ACS publishes projections to the current year in *Cancer Facts & Figures*.**
 - **Produced at the state and national levels**
 - **Useful for program/resource planning, researchers, and media**
- **NCI and ACS working jointly to improve these projections.**

U.S. Cancer Statistics: 1999 Incidence Nov 2002

- **Technical Notes**
- **All Areas Combined**
- **Rates by State, Metropolitan Area, and U.S. Census Region or Division**
- **Most Common Cancers, by State and Metropolitan Area**
- **Appendices**

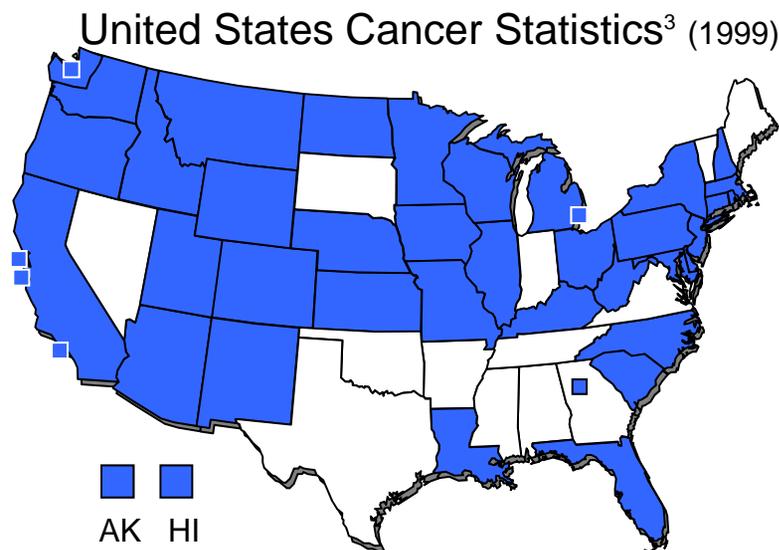
***Publication of the CDC and NCI in collaboration with the
NAACCR***

U.S. Cancer Registries



SEER
 SEER 2000+/
 NPCR1995+

NPCR
 NPCR1995+/
 SEER 2000+



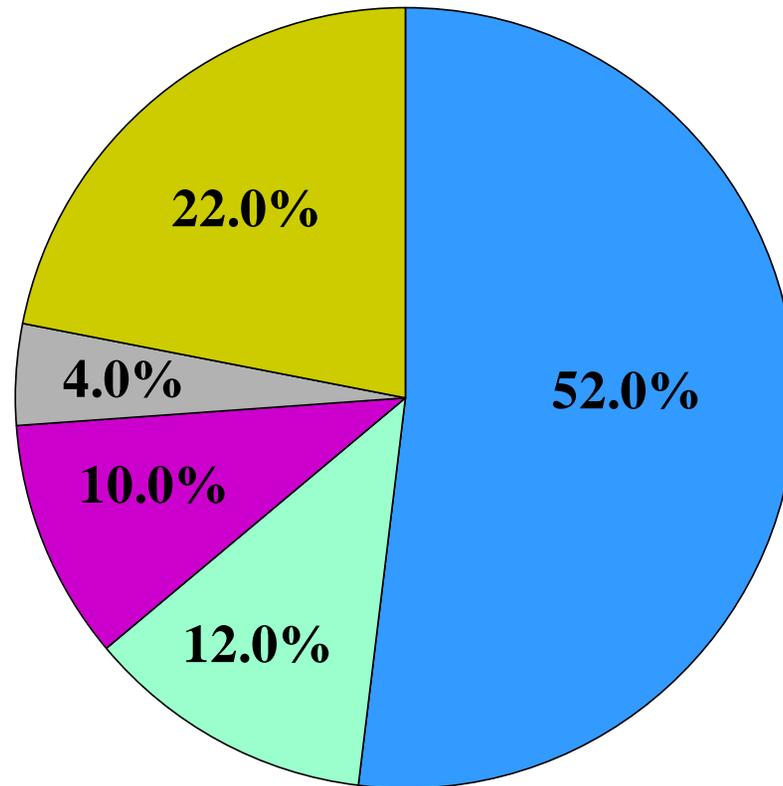
Registry
 contributing data

¹Surveillance, Epidemiology, and End Results, National Cancer Institute

²National Program of Cancer Registries, Centers for Disease Control and Prevention

³Registries meeting high quality data criteria for inclusion in U.S. Cancer Statistics, Incidence, 1999; 78% of U.S. population

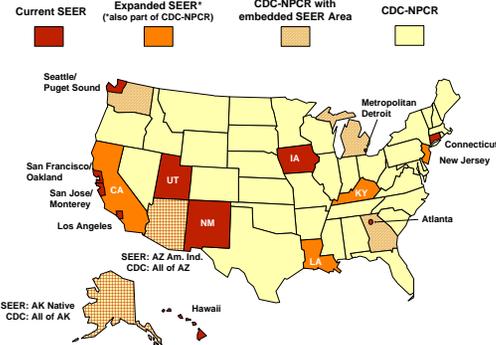
U.S. 1999 Population by Registry States



- Hi Quality NPCR minus SEER (SEER Metro + SEER Expansion)
- SEER Expansion
- SEER metro
- SEER States
- NPCR not Hi Quality

The Emerging U.S. Cancer Surveillance Program

National Cancer Registry System



+Linked data sets
 +Rapid Response Studies



➔ Explain cancer trends 

➔ Explain cancer disparities 

➔ Assess technologies and Rx's 

➔ Provide leads for new research 