Effect of Population Counts on Cancer Rates and Trends

Brenda K. Edwards, Ph.D.

Office of Director & Surveillance Research Program

Division of Cancer Control and Population Sciences

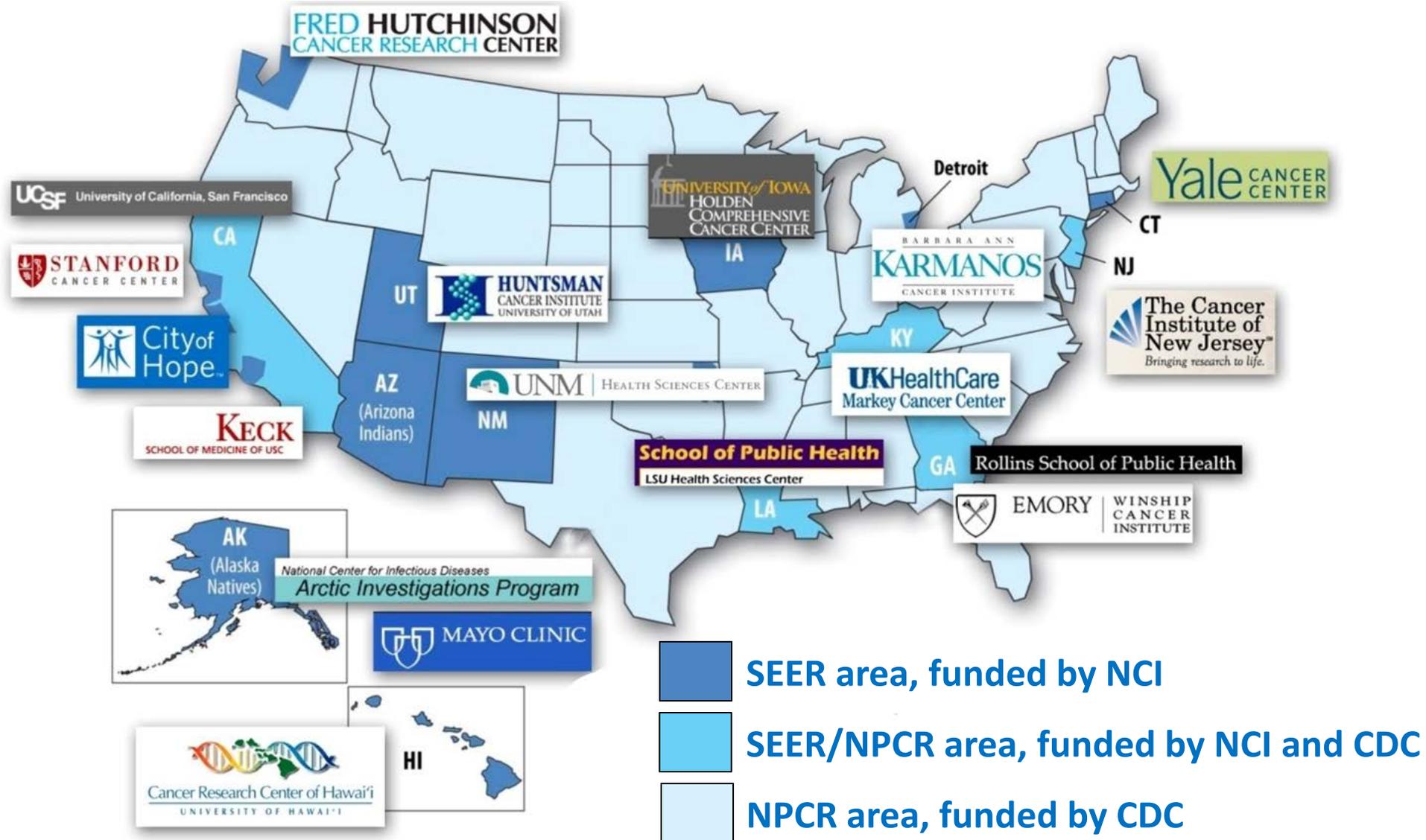**National Cancer Institute**

August 7, 2012

Surveillance Research Program

❖ **The Surveillance Research Program (SRP) collects and analyzes data to answer key questions about cancer rates and trends**

❖ **SRP manages the Surveillance, Epidemiology, and End Results (SEER) program:**
  - ❖ **Collects comprehensive information on cancer incidence and survival**
  - ❖ **Covers 18 population-based cancer registries (28% of US population)**
  - ❖ **Captures patient heterogeneity: race/ethnicity, gender, age, and geographic location**
  - ❖ **Captures tumor heterogeneity: pathology, histology, and molecular characteristics**
  - ❖ **Run by academic and cancer centers who perform epidemiological studies**

❖ **SRP develops statistical methodologies to analyze trends and evaluate cancer control interventions**

SRP Collaborations
SEER Registries
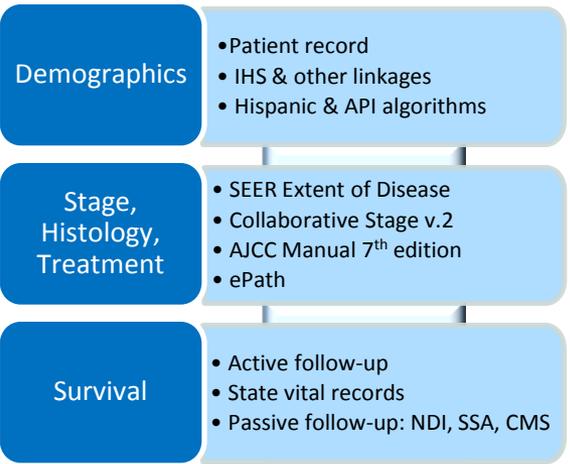
SRP Data Utilization

- ❖ **SEER collects data on cancer incidence and survival, calculates prevalence, and compiles these factors plus mortality data.**

- ❖ **SRP reports data collected by SEER in the *Cancer Statistics Review* and other publications available to the public.**

- ❖ **SRP also makes data available to researchers through SEER tools and resources, such as SEER*Stat software and linked data files.**
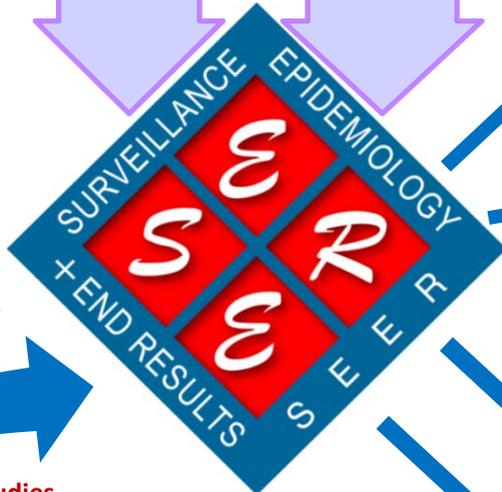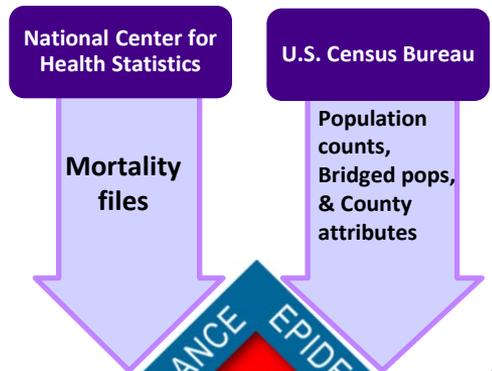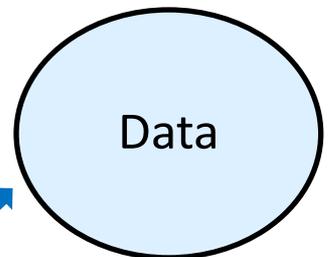
# The SEER Process: Overview

Case Ascertainment

Demographics
- Patient record
- IHS & other linkages
- Hispanic & API algorithms

Stage, Histology, Treatment
- SEER Extent of Disease
- Collaborative Stage v.2
- AJCC Manual 7th edition
- ePath

Survival
- Active follow-up
- State vital records
- Passive follow-up: NDI, SSA, CMS

Multi-tiered Data Collection

Case Records
Patterns of Care Studies
Data Quality Profiles

18 SEER Registries
*SEER*DMS*

National Center for Health Statistics

Mortality files

U.S. Census Bureau

Population counts, Bridged pops, & County attributes

SURVEILLANCE EPIDEMIOLOGY + END RESULTS SEERS

SEER Manuals

SEER Online Training

Quality Studies: Web-based Reliability, Case-finding, etc.

OUTPUT

Data
- SEER*Stat
- SEER Public-Use Research Files
- Online Statistical Fact Sheets
- Online Fast*Stats
- Data Documentation & Variable Recodes
- Rapid Response Special Studies
- State Cancer Profiles
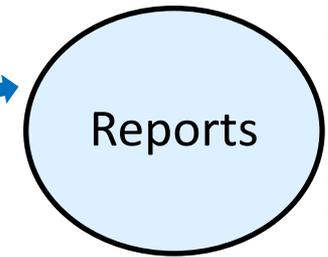
Reports
- *Annual Report to the Nation* (With CDC, ACS, NAACCR, others)
- *SEER Cancer Statistics Review*
- *US Cancer Statistics* (with CDC)
- *Cancer Facts & Figures* (with ACS)
- *Cancer in North America* (with NAACCR)
- *Cancer in Five Continents* (WHO/IARC)
- *Cancer Trends Progress Report*
- *Monographs*

Research Databases & Linkages
- SEER-Medicare
- State Cancer Profiles
- National Longitudinal Mortality Study
- Residual Tissue Repository
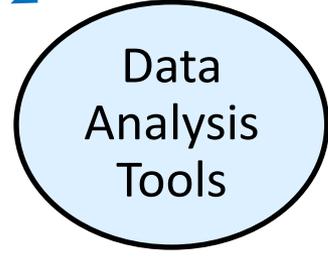
Data Analysis Tools
- SEER*Stat
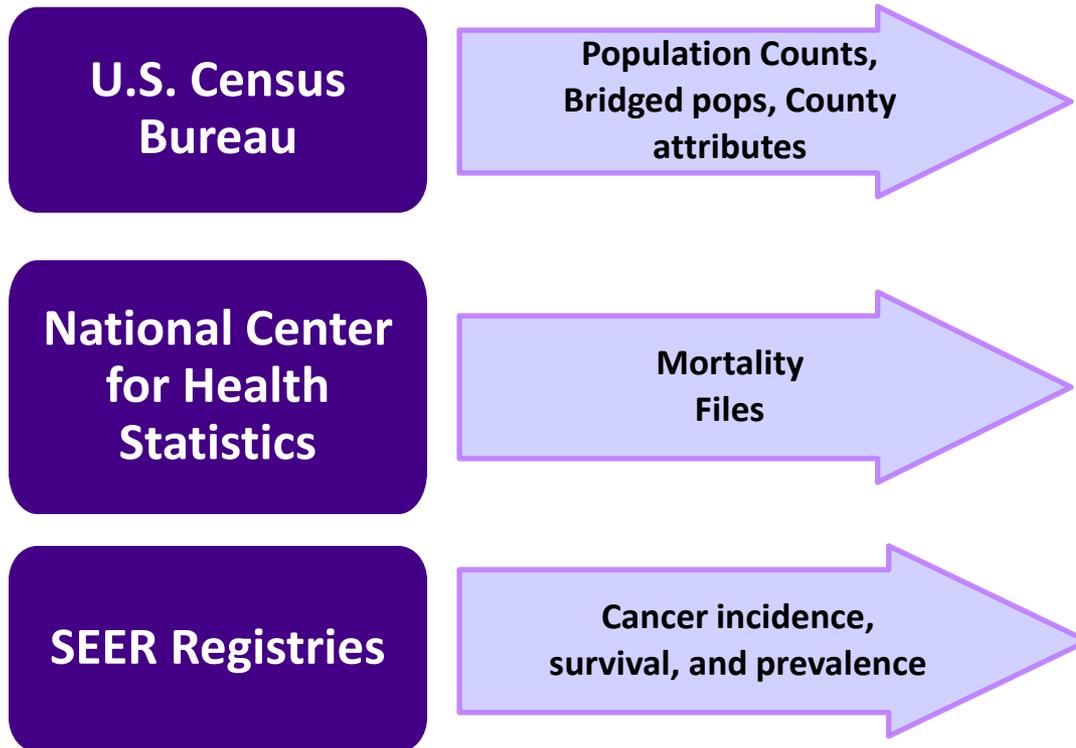- Joinpoint
- Delay Adjustment
- VA Case Adjustment
- CanSurv
- ComPrev
- HD*Calc

The SEER Process: Input

U.S. Census Bureau → Population Counts, Bridged pops, County attributes

National Center for Health Statistics → Mortality Files

SEER Registries → Cancer incidence, survival, and prevalence

The SEER Process: Output

Data

- SEER Public-Use Research Files
- Rapid Response Special Studies
- Patterns of Care Studies

Online Resources

- State Cancer Profiles
- Cancer Fact Sheets
- Fast Stats
- Cancer Statistics Review
- Cancer Query System
- Population Data

Data Analysis Tools

- SEER*Stat
- SEER*Stat Bridge
- SEER*Prep
- Joinpoint
- Delay Adjustment
- VA Case Adjustment
- CanSurv
- ComPrev
- HD*Calc
- DevCan
- ProjPrev

Reports

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Research Databases & Linkages

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Population Counts
Impact on Cancer Rates

❖ **Cancer surveillance depends on accurate population estimates**
  - ❖ Estimating completeness
  - ❖ Calculating rates

❖ **Inaccurate population counts can impact reported cancer rates and trends, affecting demographic data (age, race/ethnicity, gender) at different geographic levels (state, county, tract).**
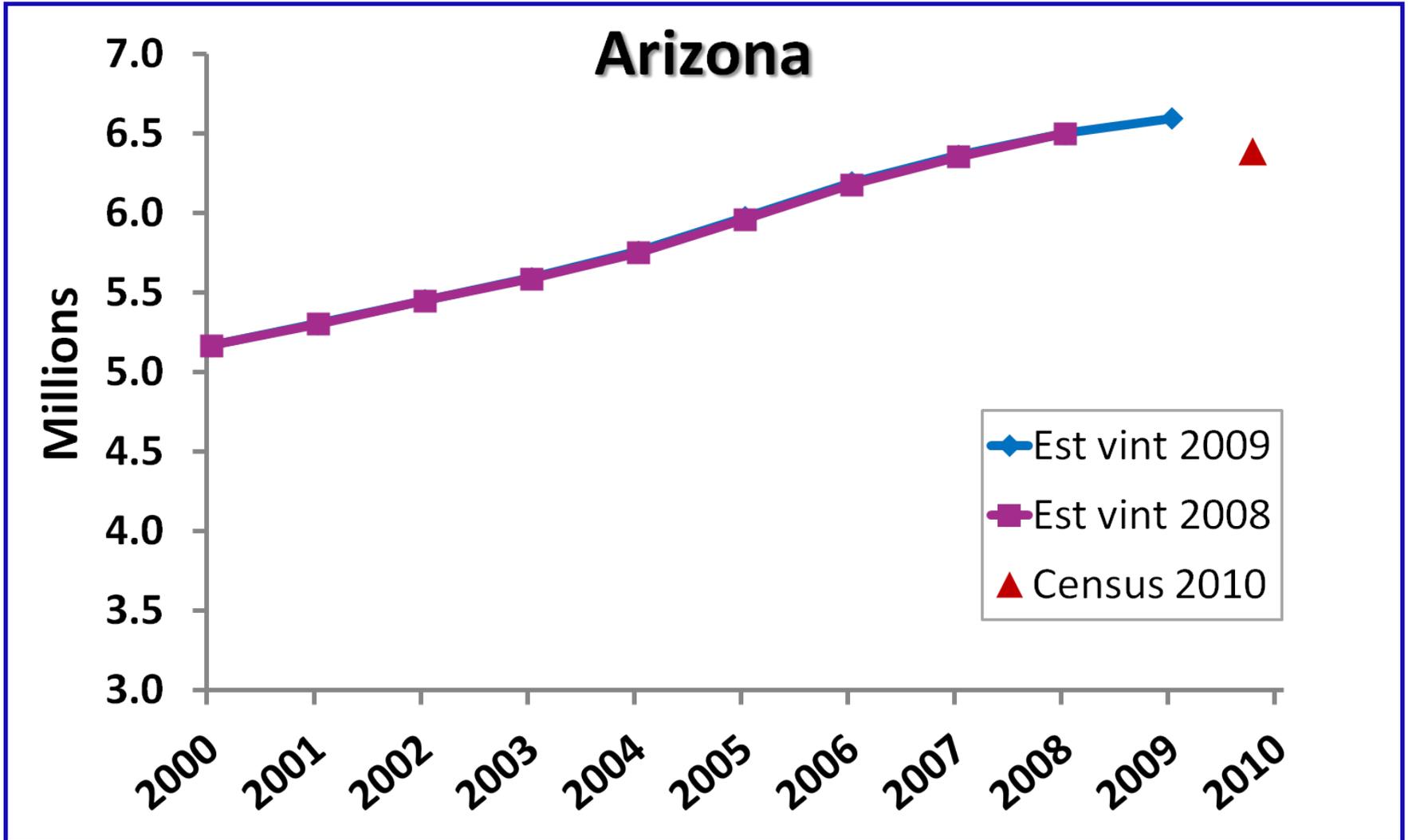
Factors that Impact Population Counts

- ❖ **Population estimation methods**

- ❖ **Changes in boundaries, i.e., by addition of new counties**

- ❖ **Failure to capture population shifts, e.g., immigration and domestic migration**

- ❖ **Large displacements in populations; i.e., by natural disasters**
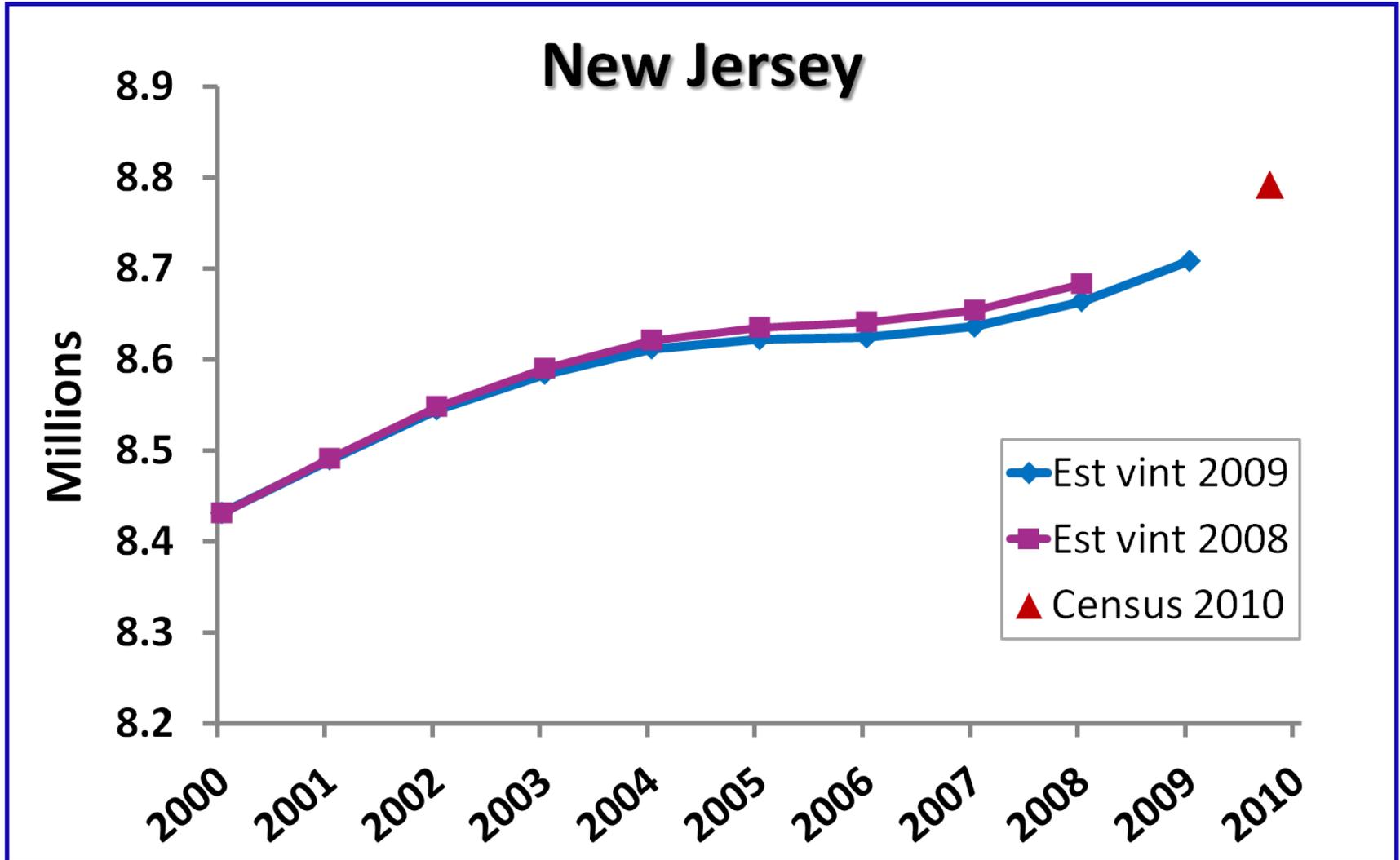
Population Estimation Methods

- ❖ **Each year the US Census produces a complete annual time-series of estimates from the most recent Census to the current year (Vintage Year) with age, race, sex, and Hispanic origin detail.**

- ❖ **Methodological changes in estimating populations can produce inconsistencies between Census &Vintage Years. For instance, changes were made for estimating:**
  - ❖ **Race categories (2000)**
  - ❖ **State-level age and sex distributions (2006)**
  - ❖ **Domestic migration (2007)**

- ❖ **This can impact cancer rates and trends due to changes in the denominator.**

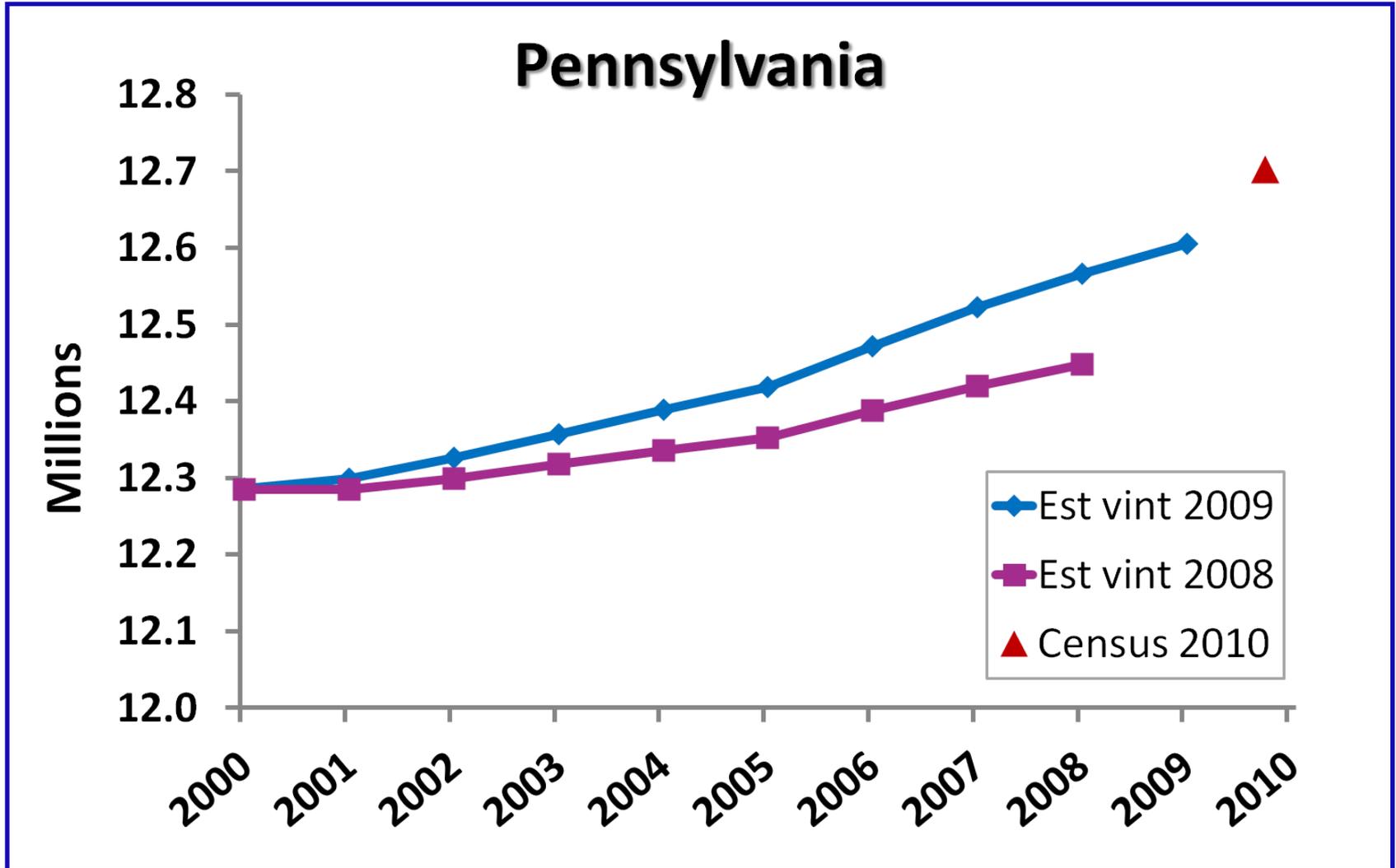- ❖ **The degree of impact on cancer rates and trends can vary based on specific geographical location.**

Changes in Population Estimates

Arizona

Changes in Population Estimates

New Jersey population estimates chart showing Millions (y-axis, 8.2 to 8.9) versus years 2000–2010 (x-axis), with lines for Est vint 2009, Est vint 2008, and a Census 2010 data point.
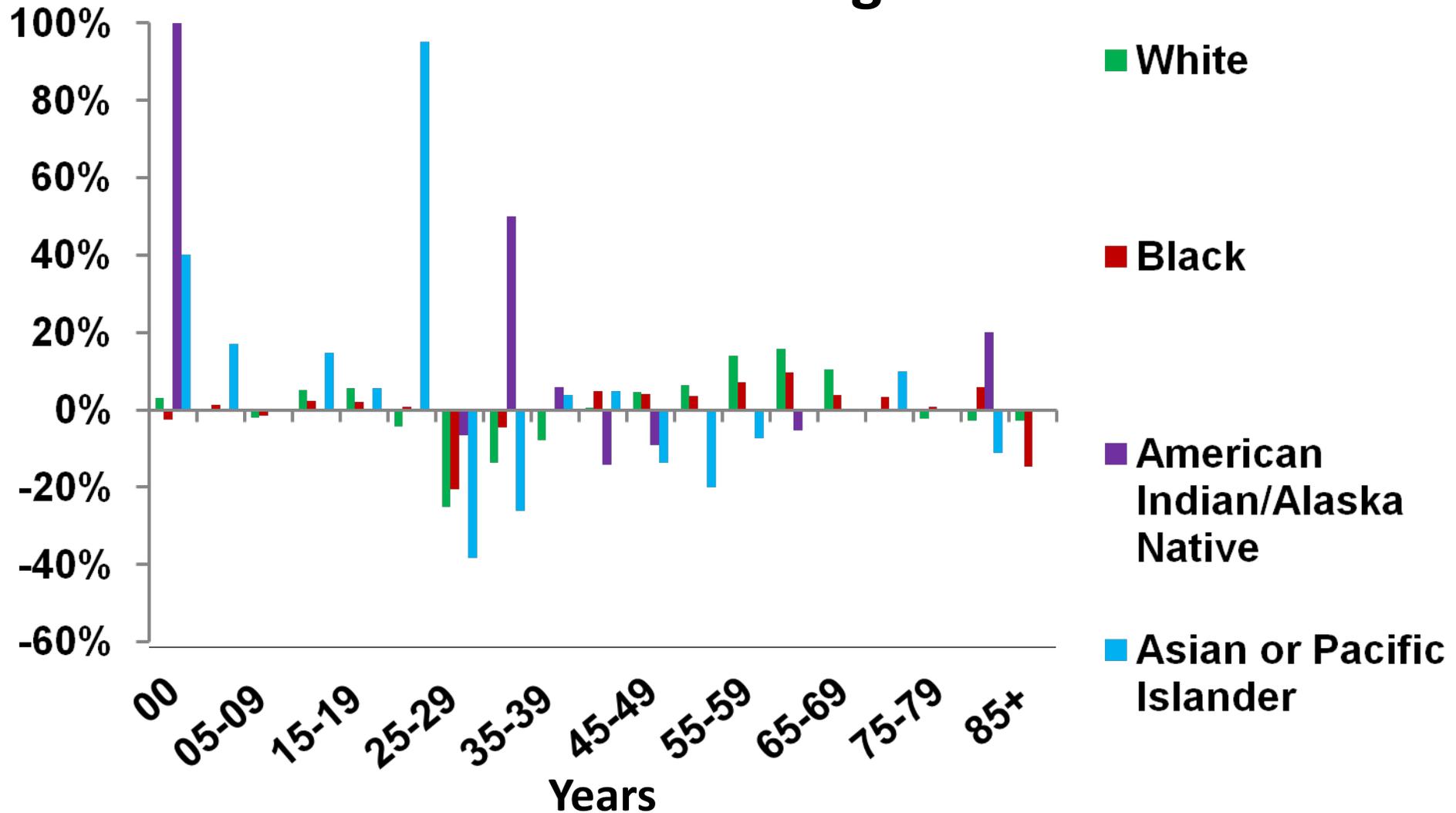
Changes in Population Estimates

Pennsylvania

Percent Change in 2007 Population between the 2008 and 2009 Vintage Population Estimates

Rural Georgia

Population Estimation Methods
Example: Race Conversion Issues

❖ **Prior to 2000, estimates were produced for four races: White, Black, American Indian or Alaska Native (AIAN), and Asian or Pacific Islander (API), and respondents could only select one race.**

❖ **In Census 2000, the API category was split into Asian and Native Hawaiian or Other Pacific Islander (NHOPI), and respondents were allowed to select more than one race.**

❖ **This change made it difficult to accurately compare cancer trends by race.**

Population Estimates by County

❖ **Changes in population boundaries, such as changes in state counties, between years can alter distribution of cancer cases, affecting cancer rates and trends at the county level.**

❖ **Such changes make it difficult to compare cancer rates and trends over time because this creates new geographical units.**

Example: Addition of Broomfield County in Colorado

Through a constitutional amendment, the City of Broomfield became Colorado's 64th county by annexing portions of Adams, Boulder, Jefferson, and Weld counties on 11/15/01. Starting in 2002, residents of Broomfield County who were diagnosed with cancer were coded to Broomfield County.

Failure to Capture Population Shifts

❖ **Population estimates can fail to capture population shifts.**

❖ **This can cause inaccuracies in calculating cancer rates and trends based on population demographics and geographic locations.**

Example: Atlanta, Georgia

Differential patterns of migration by Non-Hispanic Whites and Blacks in Atlanta, GA in 1999 introduced inaccuracies in county-level population counts that affected cancer rates assessed by race/ethnicity.

1999 Age-Adjusted Cancer Incidence Rates
(Adjusted to 2000 U.S. Population)

Clayton County, GA: Female Breast Cancers
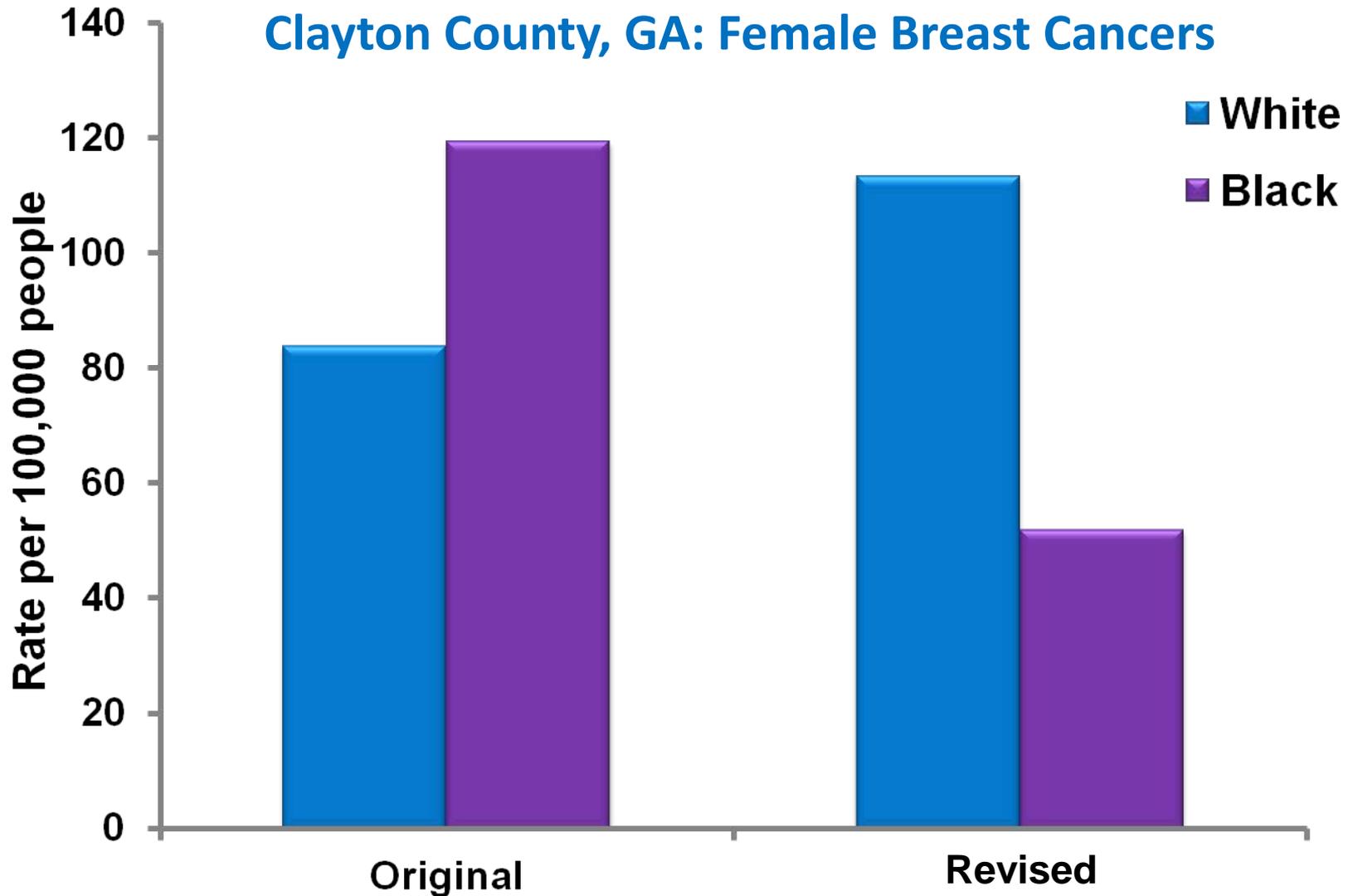
Large Displacement in Populations

❖ **Populations normally change gradually**

  ❖ **For each year and each geographic area, constant growth is assumed to occur throughout the year.**

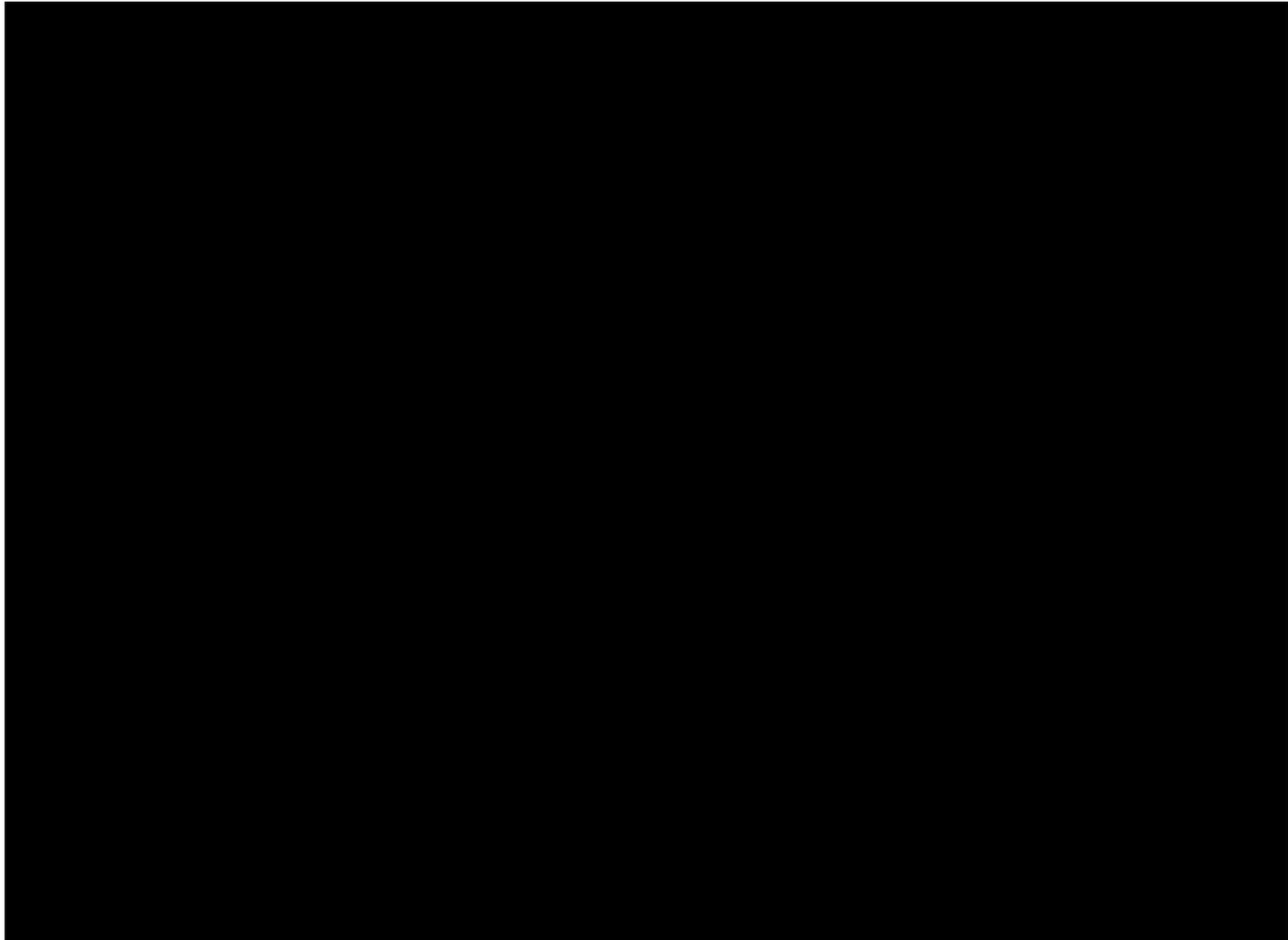❖ **However, natural disasters can dramatically change populations within a year.**

Example: Hurricanes Katrina and Rita

❖In 2005, hurricanes Katrina and Rita caused major shifts in populations away from impacted areas and to other, nearby areas.

❖As services were restored, some people returned to rebuild, but others did not.

Result: significant population shifts over time throughout the region

Population Impact of 2005 Hurricanes:
Percent Shift in Population as of January 1, 2006

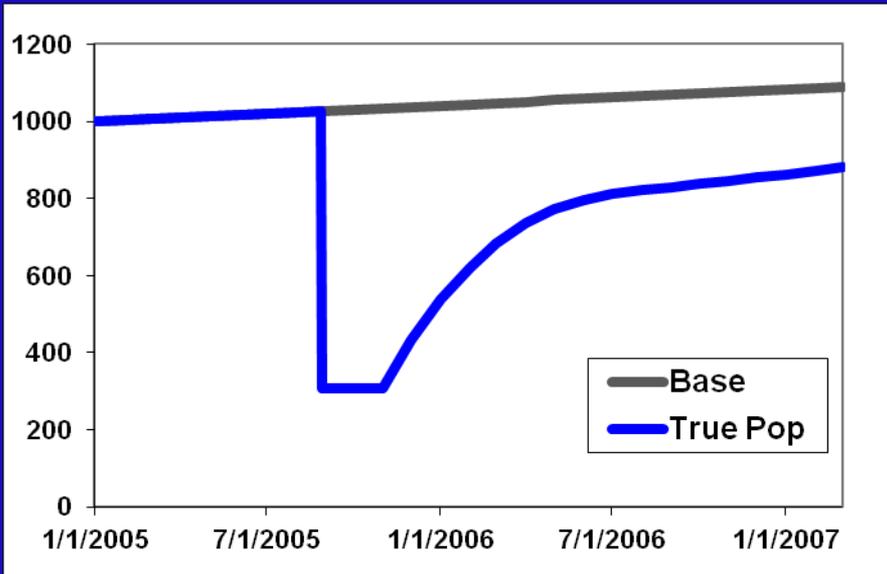# Adjusting for 2005 Hurricane Impact on Population Counts

❖ **SEER adjusted the US populations based on the displacement in populations due to hurricanes Katrina and Rita. Population shifts affected 62 counties and parishes in Alabama, Mississippi, Louisiana, and Texas.**

❖ **Once the populations were adjusted, the resulting total US population was lower than the July 1 total US population. This difference represents people who were displaced by the hurricanes and went to other parts of the US.**

❖ **SEER introduced a separate dummy state to represent these people called "Hurricane Katrina/Rita Evacuees - Populations Only – 2005." It is included by default in rate calculations over the total US population.**
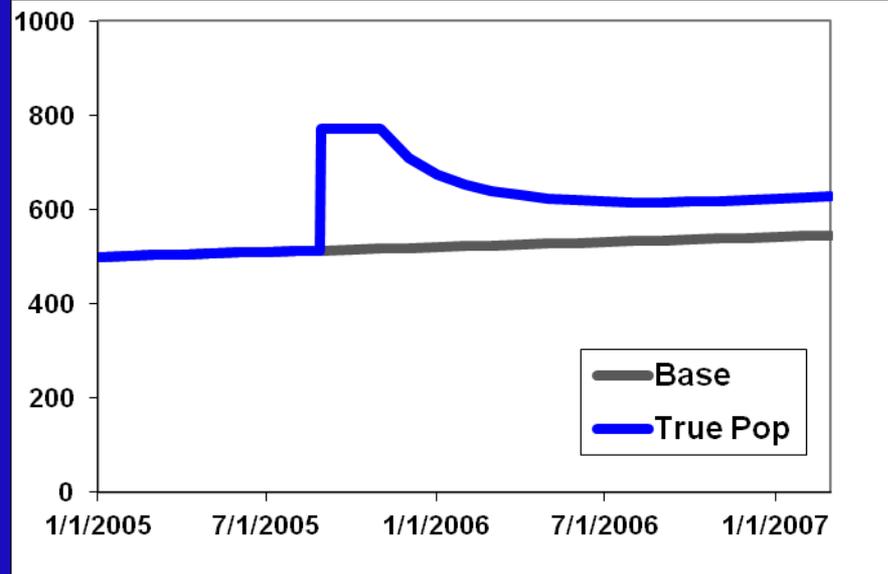
2005 Hurricane Impact on Cancer Cases

❖ **Cancer registration is based on self-reported "permanent" residence.**

❖ **This was a problem following the 2005 Hurricanes because for hurricane displaced cancer cases:**

  ❖ **People initially reported their original parish as their residence,**

  ❖ **But eventually some reported their new parish if they decided they were not returning to place of origin.**

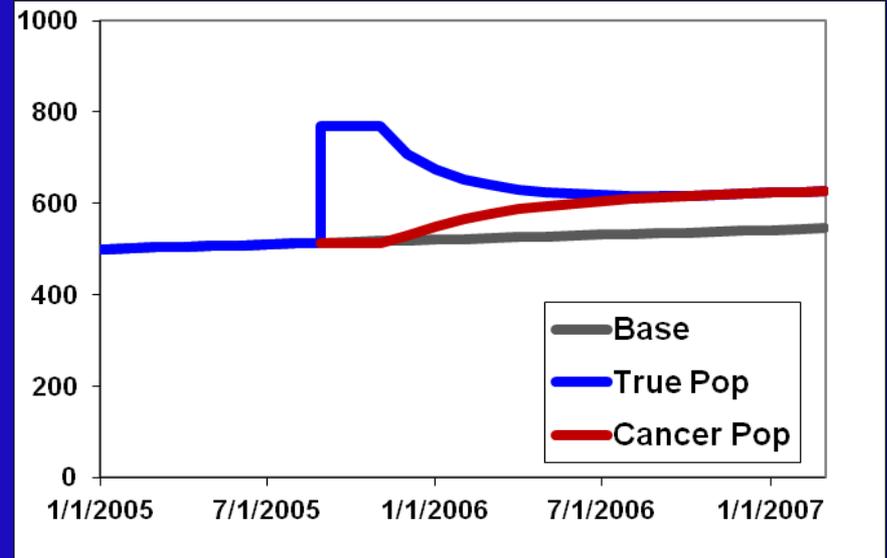# Post-Hurricane Population Estimates
Conceptual Model – Step 2
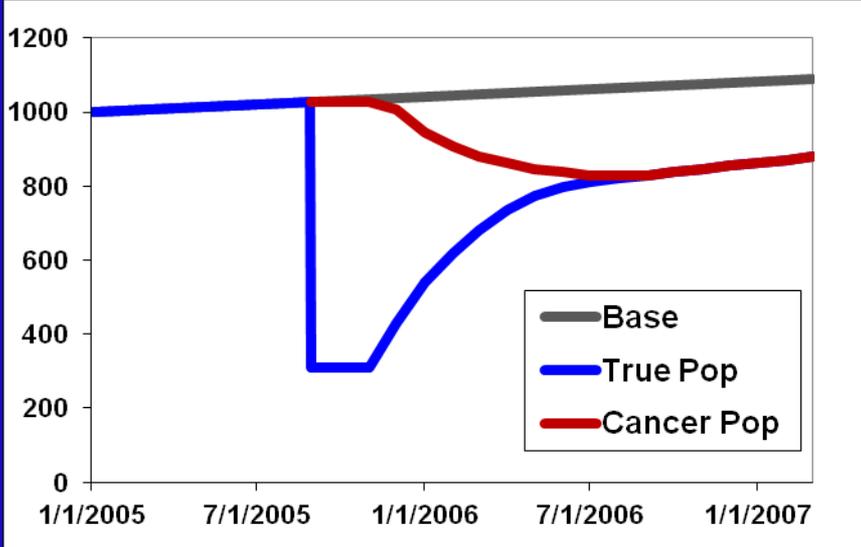
Acknowledgements

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For more information:

Brenda K. Edwards
edwardsb@mail.nih.gov

SEER program website
seer.cancer.gov