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
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 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

National Center for Health Statistics

U.S. Census Bureau

Mortality files

Population counts, Bridged pops, & County attributes

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

18 SEER Registries

SEER*DMS

Quality Studies: Web-based Reliability, Case-finding, etc.
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
- 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 (with WHO/IARC)
- Cancer Trends Progress Report
- Monographs

Research Databases & Linkages
- SEER*Stat
- Public-Use Data
- SEER-Medicare
- National Longitudinal Mortality Study
- Residual Tissue Repository
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

Millions

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

Est vint 2009
Est vint 2008
Census 2010
Changes in Population Estimates

New Jersey

Est vint 2009
Est vint 2008
Census 2010
Changes in Population Estimates

Pennsylvania

- Est. vint 2009
- Est. vint 2008
- Census 2010

Rural Georgia

- White
- Black
- American Indian/Alaska Native
- Asian or Pacific Islander
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.
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.
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

- White
- Black
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

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.
Post-Hurricane Population Estimates
Conceptual Model – Step 1

Evacuation Parishes

Destination Parishes
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

Evacuation Parishes

Destination Parishes
Acknowledgements

❖ Zaria Tatalovich, PhD
❖ Kathy Cronin, PhD.
❖ Carol Kosary, D.Mgt.

❖ Special thanks to:
❖ Judith Swan, M.H.S.
❖ Heather Lasseter, Ph.D.
❖ Hillary Hoffman, Ph.D.
For more information:

Brenda K. Edwards
edwardsb@mail.nih.gov

SEER program website
seer.cancer.gov