

# Testing the Hypothesis of Similar Errors: Evaluating 80 Years of Demographic Analysis Estimates

Lauren Medina, Demetric Sewell, and Eric B. Jensen; U.S. Census Bureau

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## INTRODUCTION

Since 1960, the U.S. Census Bureau has used Demographic Analysis (DA) to evaluate the quality of the decennial census. DA is a technique that combines historical vital records on births and deaths and data on international migration to develop estimates of the population. The two primary outputs from DA are sex ratios and net coverage error rates. Central to the DA method is the hypothesis of similar errors, which states that errors in the census should be alike from one census to the next. In this paper, we test this hypothesis by comparing sex ratios and net coverage errors from 1940-2010 using synthesized DA estimates and census counts. The analysis highlights ages where sex ratios and net coverage errors are highest and any potential cohort aging patterns in the estimates. The results will inform research to develop the methods for the next DA and assist in evaluating the 2020 Census.

**Hypothesis of Similar Errors**  
 Errors in census counts should be consistent at particular ages across time.

- Net coverage rates by age are similar from one census to the next
- Systematic aging of the estimates could indicate errors in the input data

## DATA AND METHODS

**Census Counts:** We use the 100-percent counts from the 1940 through 2010 decennial censuses. Race is coded as Black and Non-Black using the race categories available for that census.

**Historical Demographic Analysis File:** We use a file with the DA estimates from 1940 through 2010 that has been harmonized to use a consistent methodology.

**Sex Ratios:** We calculate age-specific sex ratios using the equation

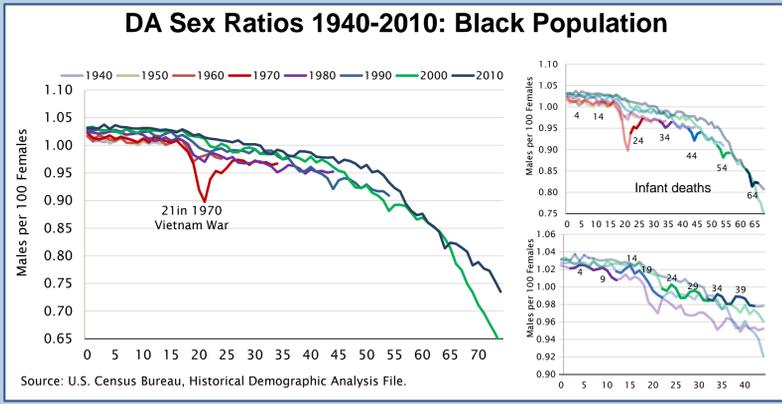
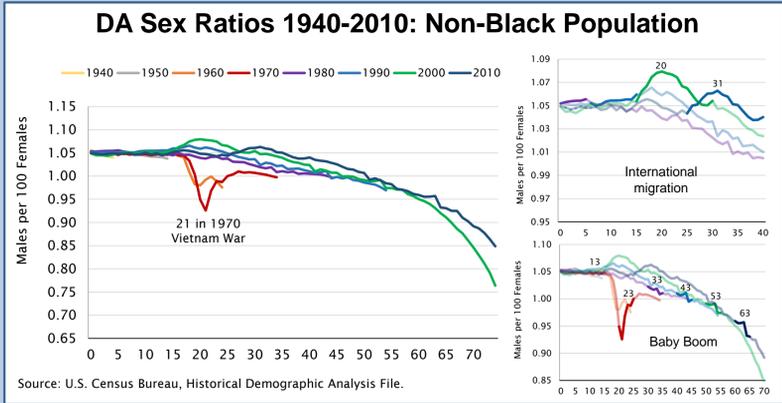
$$Sex\ Ratio = \left( \frac{Males}{Females} \right) \times 100$$

**Net Coverage Error:** We calculate net coverage error for age groups using the equation

$$Net\ Coverage\ Error = \left( \frac{Census\ count - DA\ estimate}{DA\ estimate} \right) \times 100$$

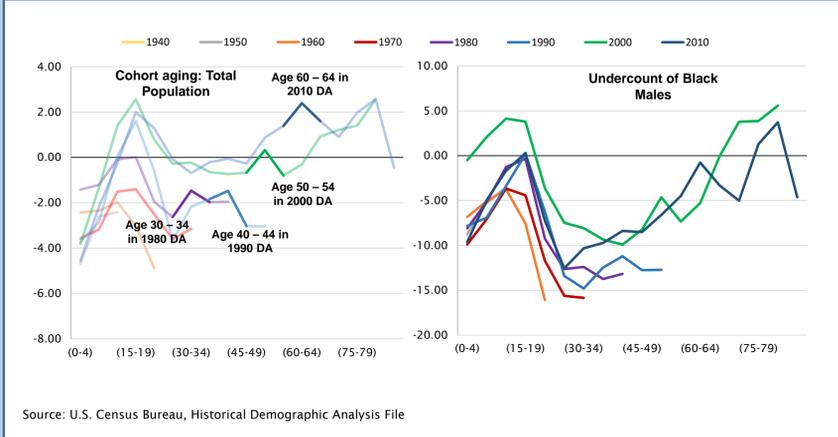
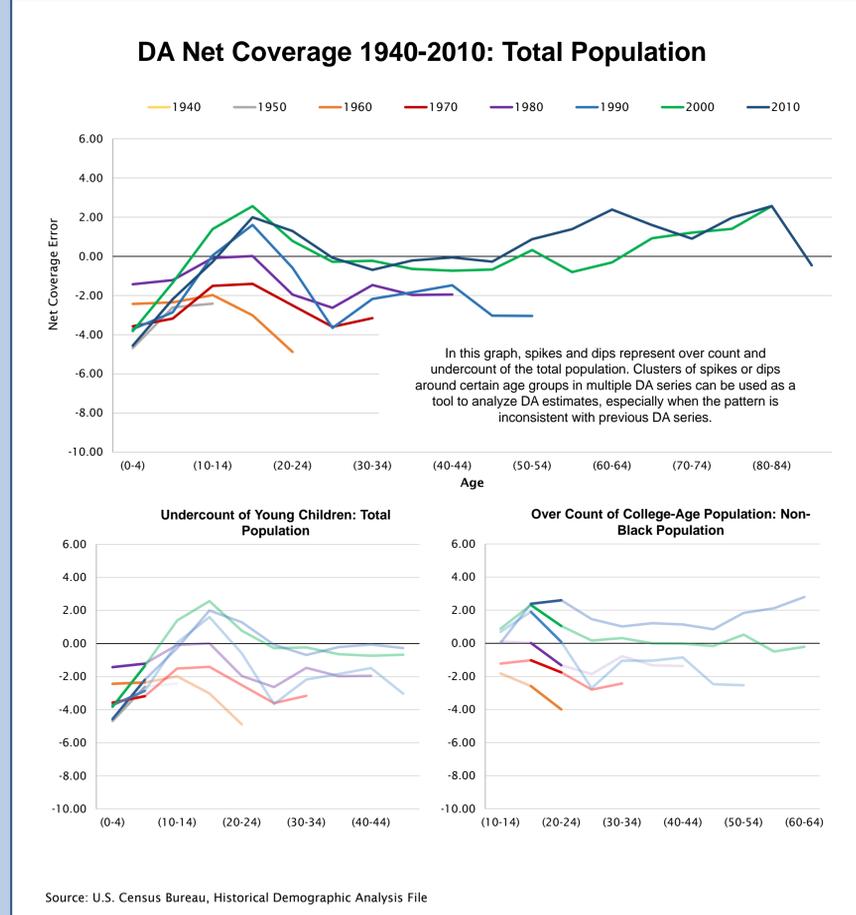
## SEX RATIOS

- The ratio of males per 100 females.
- The sex ratio at birth is 105 indicating 105 males per 100 females
  - Differential mortality, migration, and coverage by sex increases or decreases the sex ratio
  - We assume that dips and spikes in the sex ratios should be consistent for a particular age across several decades
  - Cohort patterns in sex ratios may indicate an error with the underlying data used to develop the DA estimates



## NET COVERAGE ERROR

- The percent difference between the census counts and DA estimates.
- Net coverage error measures omissions, duplicates, and other errors in the census counts
  - Positive values indicate a net over count while negative values indicates a net undercount



- There are four key patterns that appear when addressing net coverage:
- The undercount of young children, which is apparent for both sexes and race groups
  - The over count of the college population, which is seen more for the Non-Black population
  - Over count for older ages (60-64) in 2010, which consistently appears in earlier DA estimates
  - General undercount for Black males with diverging patterns for 2000 and 2010

## PREPARING FOR 2020

Demographic Analysis will be used to evaluate net coverage error in the 2020 Census. We are currently preparing the methodology for the 2020 DA estimates. This research shows consistent patterns in sex ratios and net coverage error by age across different censuses, which supports the Hypothesis of Similar Errors. We have also shown examples of spikes and dips in sex ratios and net coverage error that may indicate errors in the DA estimates. This research has helped us to identify age groups and birth cohorts that we will need to focus on for the 2020 DA estimates. These include:

- Impact of international migration on sex ratios
- Sex ratios of the 1947 birth cohort
- Estimates of young children aged 0 to 4
- Undercount for adult Black males



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