Certified Estimates of the Total Populations of Counties in North Carolina for July 1, 2016 and Estimates of the Total Populations and Populations by Age, Sex, Race, and Hispanic Origin of Counties in North Carolina for 2010 through 2016

Technical Documentation

Demographic & Economic Analysis Section
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Introduction

This document provides an overview of the methods and data used to prepare the certified estimates of the total population of counties in North Carolina that were released by the North Carolina Office of State Budget and Management in September of 2017. These population estimates replace those produced by this office in September of 2016. These population estimates incorporate recent trends in population change for the state and counties for July 1, 2010 through July 1, 2016. Total population was estimated for each county and the state as a whole. In addition, population by sex, single years of age, five categories of race, and separately by Hispanic origin was estimated for the state and all 100 counties for July 1, 2010 through July 1, 2016.

Methodology

The population estimates produced by the Office of State Budget and Management are the result of an average of two sets of population estimates: (1) a modified version of the U.S. Census Bureau, Vintage 2016 Population Estimates[1] and (2) estimates produced through a composite method estimating different segments of the overall population. This section provides an overview of the methods used to derive these population estimates.

Understanding Population Change: The Demographic Balancing Equation

Populations change through two main component processes: (1) natural increase (or decrease) and (2) net migration. Natural increase (or decrease) is the change that occurs as a result of the difference between births and deaths. Natural increase occurs when births to a population exceed deaths within that same population. Net migration is the difference between the number of in-migrants and out-migrants. A population growing as a result of migration, will show positive net migration (more in-migrants than out-migrants). Migrants include both migrants to and from other countries (international migration) as well as domestic migrants (those moving to and from other states and counties). In context of population estimates, any permanent move from one county to another (or from another country) is considered migration. The demographic balancing equation is useful in understanding population change and in developing methods for estimating population or any of the components of population change. Demographers use a variety of methods to estimate population, including those described in this document (see Murdock et al. 2006; Murdock and Ellis 1992; Siegel 2002; Swanson and Tayman 2012).

Modified Census Bureau Estimates

In March of 2017, the Population Division of the United States Bureau of the Census released their Vintage 2016 population estimates for North Carolina counties. The Census Bureau uses administrative records to measure change for each component of the demographic equation. Using a cohort component technique, the Census Bureau begins with a base population (the previous decennial census or the previous year for a population estimate) and subtracts deaths

[1] See https://www.census.gov/programs-surveys/popest.html

and adds births and net migration.[2] Vital statistics data (birth and death statistics) are used to estimate natural increase (or decrease) and several different sources are used to estimate international and domestic migration. The base population estimates from the U.S. Census Bureau incorporated corrections to the 2010 Census count as a result of the Count Question Resolution (CQR) program and revisions to data inputs for historical estimates since the decennial census of 2010. The CQR correction included a major change in the group quarters population for Durham and Granville Counties (the population of several prison facilities were incorrectly counted in Granville County rather than Durham County in 2010).

As a result of delays in obtaining information on group quarters population, the Census Bureau's Vintage 2016 population estimates assumed that the July 2016 group quarters population for each county would be the same as that present in July 2015. The Office of State Budget and Management works closely with North Carolina's military bases to obtain current counts of the population living in military quarters. In addition, throughout the year, this office collects information on housing for a variety of group quarters facilities from state agencies and local governments.[3] These include nursing homes, children's homes, and college and university dormitories, among other facilities. By March of 2017, the July 2016 population for several institutions were obtained by this office. This included updated information for military bases in North Carolina as well as other major institutions. In addition, minor changes were made to group quarters populations based upon corrected input for individual group quarters facilities for April 2010 and for yearly estimates through July 2016. Thus, the Office of Management and Budget modified the Census Bureau's 2016 population estimates to include the updated population counts for several group quarters facilities.

Alternative Estimates

The population age 65 years and older was assumed to be the same as that estimated by the U.S. Census Bureau in their Vintage 2016 population estimates and the population living in group quarters was assumed to be the same as the adjusted group quarters population as described above. Then a ratio/correlation technique was used to estimate the household population younger than age 65 for all 100 component counties. The ratio/correlation method is a form of linear regression that incorporates ratios of indicators correlated with population change (hence the name: ratio/correlation). The Office of State Budget and Management (and its predecessor organizations) has used some form of the ratio/correlation method to estimate population since it began estimating county populations in the 1960s. In the regression model used for the current population estimates, the independent variables are expressed as the percentage share of an indicator variable for a county to the state's value of the same indicator value for the current year to the corresponding percentage shares for 2010. Likewise, the dependent variable is expressed as the percentage share of the population for a county to the state's population for the current

[2]For a detailed description of the methods, see: https://www2.census.gov/programs-surveys/popest/technical-documentation/methodology/2010-2016/2016-natstcopr-meth.pdf

[3]The Office of State Budget and Management works closely with the U.S. Census Bureau through the Federal-State Cooperative for Population Estimates program by collecting and sharing group quarters population and other aggregated data for the U.S. Census Bureau's population estimates program.

year to the percentage share of the population for a county to the state's population for 2010 (for further discussion on ratio/correlation models see Siegel 2002:415–16 and Swanson and Tayman 2012:165–85). After reviewing historical relationships among various symptomatic indicators with decennial census population counts for counties, the Office of State Budget and Management selected three symptomatic indicators to include in its current population estimation model. These include: (x_1) automobile and truck registrations; (x_2) school enrollment in grades 1 through 8[4]; and (x_3) a three-year sum of births[5].

The current prediction equation is given by:

$$y = 0.06592 + (0.42101 * x_1) + (0.29168 * x_2) + (0.21554 * x_3) + \varepsilon,$$

where y, the dependent variable, represents the estimated ratio of the percentage shares of household population under age 65, each of the series indicators (x_1, x_2, and x_3) represents the ratio of percentage shares of the indicator variables as described in the paragraph above, and ε represents random error.

The estimated household population age 0 to 64 for counties that was derived from the ratio/correlation linear regression equation was then combined with the independent estimates of the population of military barracks, college dormitories, and other group quarters facilities to yield the estimate of the total population age 0 to 64. These resulting county population estimates were combined with the estimated population age 65 and older (derived from the U.S. Census Bureau) and controlled to the modified Census Bureau estimates of the state population.

Prior to the release of these population estimates, the county population estimates were evaluated for consistency and reasonableness by the Demographic and Economic Analysis section of the Office of State Budget and Management as well as by local governments.

Age, Race, and Sex Detail

This office also produced estimates of the demographic characteristics of the population of the state and each county. These characteristics include sex (male, female); single years of age from birth to age 99 and age 100 and older; five categories of race (American Indian/Alaska Native, Asian, Black, White, and All Others); and Hispanic origin (Hispanic/Non-Hispanic).

In addition to estimating population for counties on a yearly basis, this office produces projections of the total population and the characteristics of the population of the State and all 100 counties in North Carolina. These projections serve as a basis for the characteristics of the population estimated here. The projections that were used for these estimates are those that will be released in October 2017. These projections use historical trends to project the total

[4] School enrollment includes children enrolled in public schools (including charters), private schools and home schools.

[5] Automobile and truck registrations data were provided by North Carolina Division of Motor Vehicles; school enrollment data was obtained from the North Carolina Department of Public Instruction and the North Carolina Division of Non-Public Education; and vital statistics were obtained from the North Carolina State Center for Health Statistics.

population and the total population by race and Hispanic origin from July 1, 2010 through July 1, 2037. Then a cohort component technique was used to estimate the age characteristics of the population by "aging" the population using the April 1, 2010 Census as a base and adding births and net migration and subtracting deaths based on recent trends in fertility, mortality and net migration through the projection period. The 2010 through 2016 values were then adjusted to account for reported births and deaths. Finally, the demographic characteristics of the population were controlled to the total population for each county as estimated in the certified and revised county population estimates for 2010 through 2016.

Comparisons to the U.S. Census Bureau Estimates

These population estimates differ from those released by the U.S. Census Bureau in March and May of 2017 and are not directly comparable to the U.S. Census Bureau estimates. In addition to using different techniques to estimate the population, these population estimates incorporate more recent data regarding vital statistics (births and deaths) and group quarters population.

Limitations

The methods used to produce the population estimates for North Carolina counties are widely used and accepted methods for estimating population. However, like any estimates, these population estimates have several limitations:

1) For the estimates produced from the regression model, it is assumed that the statistical relationships between the indicator variables and population that were present historically are the same for the estimation period (Siegel 2002:416). Any change in that relationship will affect estimated population;
2) Several different data sources are used as inputs to the estimation model. Any errors in these data sources may have impacts on the resulting population estimates (Bryan 2004:549).

Every effort has been made to collect current and accurate data for group quarters populations, vital statistics, building permits, school enrollment, and vehicle registrations. This office evaluates the data collected from other sources for consistency. In addition to standard data checks, the use of an averaging of two different population estimates as done by this office has shown to be a robust method for accounting for estimation error (Bryan 2004; Murdock et al. 2006; Murdock and Ellis 1992; Siegel 2002:428–30).

Citations

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