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Institute of Government
UNIVERSITY OF GEORGIA

Methodology

2021 Interim Long-Term Population Projections

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Introduction

The Applied Demography Program at the University of Georgia's Carl Vinson Institute of Government produced resident population projections for Georgia's counties in single-year intervals for the period 2021 through 2060. This series of projections is referred to as the 2021 Interim Long-Term Population Projections. This report describes the methodology, assumptions, and data sources used to produce the population projections. The Institute of Government used a stochastic cohort-component projection technique to project resident population by age and sex for the State of Georgia and its counties. The demographers relied on publicly available data from state and federal agencies, regional expertise, and current research on US population and demographic trends to produce these population projections.

These projections, like all projections, involve the use of certain assumptions about future events that may or may not occur. Users should be aware that although these projections were prepared using standard methodologies and extensive attempts were made to account for existing demographic patterns, they may not accurately project the future population of the state or any specific county. The projections are based on historical trends and current estimates. These projections should be used only with full awareness of the inherent limitations of population projections in general and with knowledge of the procedures and assumptions described in this report.

Population projections serve as a resource for local and state decision-makers as they plan for the future. Just as exogenous factors such as federal policy can influence international migration and global challenges such as a worldwide pandemic can influence all three components of population change, decisions made today by Georgia's leaders can influence the population trajectory. The Applied Demography Program at the Carl Vinson Institute of Government continually refines the model assumptions and parameters to incorporate the latest data and research into these projections.

Projection Methodology

COHORT-COMPONENT PROJECTION TECHNIQUE

The cohort-component projection technique was used to prepare the projections. The basic characteristics of this technique are the use of separate cohorts—persons with one or more common characteristics—and the separate projection of each of the major components of population change—fertility, mortality, and migration—for each of the cohorts. These projections of components for each cohort are then combined as follows:

$$P_{t2} = P_{t1} + B_{t1-t2} - D_{t1-t2} + M_{t1-t2,}$$

where P_{t2} = the population projected at some future data $t_1 - t_2$,

P_{t1} = the population at the base year t_1,

B_{t1-t2} = the number of births that occur during the interval $t_1 - t_2$,

D_{t1-t2} = the number of deaths that occur during the interval $t_1 - t_2$, and

M_{t1-t2} = the net migration that takes place during the interval $t_1 - t_2$.

Appropriately adapting the cohort-component technique involves four steps:

1. Select a baseline set of cohorts for the projection area or areas of interest for the baseline time period.
2. Determine appropriate baseline migration, survival, and fertility measures for each cohort for the baseline time period.
3. Determine a method for projecting trends in fertility, survival, and migration rates over the projection period.
4. Apply the rates to the baseline population and component trends for the projection period.

BASELINE POPULATION

The baseline population refers to the population total for each cohort that serves as the base for the projection model. The Census Bureau's vintage 2020 population estimates for Georgia's counties with characteristics of age, race and ethnicity, and sex were used as the baseline population for the 2021 Interim Long-Term Population Projections. The population was grouped into single-year age groups from 0 to 85, two sex groups (male and female), and four racial and ethnic groups (non-Hispanic White, non-Hispanic Black or African American, non-Hispanic Other, and Hispanic).

Population Estimates and Decennial Census Detail

The publication of these long-term population projections follows closely on the release of limited 2020 Decennial Census count population totals, released in August 2021. While ideally, the demographers would have relied on these new data, the information included, unfortunately, did not provide the level of detail necessary for the cohort-component projection model used by the Institute of Government. The release of these more detailed data has been delayed, in part, due to challenges associated with data collection during the global pandemic and modifications to the data privacy protection procedures used in the 2010 Decennial Census.

The initial data released in August 2021 included race and ethnic groups, voting-age population, and group quarters totals, but it did not include detailed age information (one- or five-year groups) or sex of the population. Therefore, the Institute of Government demographers had to rely on the vintage 2020 population estimates, the latest census data released that contain the detailed age, race and ethnicity, and sex data required for the population projection model. Given the potential confusion between 2020 population estimates and 2020 Decennial Census counts, the Institute of Government refers to this series of projections as the 2021 Interim Long-Term Population Projections.

Disclaimer: The 2020 Census Redistricting data were not the baseline population for the 2021 Interim Long-Term Population Projections. Vintage 2020 Population Estimates were used in the stochastic cohort component model to produce the 2021 Interim Long-Term Population Projections. In their review of each county-cohort combination, Institute demographers and faculty and staff considered the Decennial Census count in their evaluation of each cohort projection.

The Census Bureau's annual population estimates customarily serve as the population base for the Institute of Government's population projections. The Census Bureau releases population estimates annually. The Census Bureau's Population Estimates Program uses vital statistics and migration data to estimate county-level population for US states and counties.

BASELINE COHORTS AND COHORT COMPONENT RATES

Fertility Cohort and Fertility Rates

Birth data were collected from the Georgia Department of Public Health's (DPH) website, oasis.state.ga.us. DPH obtains these data from the Georgia Office of Vital Records. The birth data available from DPH include race, age, and sex for each county in Georgia. The birth is assigned to the county of residence. Fertility rates have declined in Georgia since 2007. Fertility rates are calculated for each racial and ethnic group and county combination. The 159 counties and four racial and ethnic groups results in 636 combinations simulated through the model. The stochastic model stabilized total fertility rate assumptions by including a trend toward the current statewide average (1.65).

Mortality Cohort and Survival Rates

Death data were also collected from the DPH website: oasis.state.ga.us. DPH obtains these data from the Georgia Office of Vital Records. The death data available from DPH include race, age, and sex for each county in Georgia. The death is assigned to the primary county of residence. The Institute of Government used the Heligman-Pollard model to project rates. This parametric model accounts for changes in early (infant), young adult, and later life mortality. Finally, the Institute of Government incorporated actuarial life table adjustments to project survival rates in the 85 and older population.

Migration Rates

Migration is the most difficult component of change to project and for which to obtain baseline rates. For the 2021 Interim Long-Term Population Projection Series, the Institute of Government used migration data available from the US Internal Revenue Service for each county. For rates, the demographers at the Institute weighted county-level migration data from the past three years. After calculating rates, the demographers simulated different migration scenarios by letting migration rates either jitter or random-walk forward. A review panel of experts evaluated the scenarios for each of Georgia's counties.

Group Quarters

A "group quarters" is a place where people live or stay in a group living arrangement that is owned or managed by an organization providing housing and/or services for the residents. Examples include nursing homes, university housing, and prisons. The interim projections incorporate stochastic simulations for the group quarters population. The Institute demographers applied a modified college fix methodology to counties with large special populations—students, military personnel, incarcerated persons, or migrant detainees—removing a fraction of the household population and treating it as living in group quarters.

PROJECTION MODEL AND APPROACH

The Institute's projection method relies on a bottom-up approach: County populations were projected and summed to produce a state projection. That projection was then cross-validated with other sources, including independent projections, neighboring-state projections, and simple autoregressive integrated moving-average methods. The cohort-component rates described above were applied to a Leslie matrix. In each progression, the group quarters population was removed from the resident population to produce a household population, which was survived forward using cohort-component rates, with migration added to the total.

As a part of the bottom-up approach, Institute Demographers and Faculty and Staff reviewed the age, race and ethnicity, and sex projection for all 159 counties. This review and analysis incorporated Faculty and Staff expertise on local trends and economic development in Georgia.

Stochastic Approach

Institute demographers and data scientists used stochastic simulation to generate potential population scenarios by forecasting ranges for the underlying components of change (e.g. fertility, mortality, and migration rates) using probability distributions. Realizations of these random components of changes were generated and inserted into the model's autoregressive structure. After one million simulations at each forecast step (e.g. 50 years), the residential population counts (i.e. the model output) are recorded. This process is then repeated with a new set of random rates for each component of change.

In a limited number of counties, an inaccurate trend occurred because of a lack of accurate information around the components of the model. In these areas, a different statistical methodology was applied to produce more parsimonious models. Time series models were formed via model selection using an automated methodology to select the best seasonal autoregressive moving average based on the model's Akaike information criterion (AIC), which estimates the quality of each tested model. Using their working knowledge of the state, the Institute demographers compiled another alternative model to help control for overly linear or exponential trends while maintaining seasonality where necessary. To this end, the demographers used the Holt Winters' triple exponential smoothing methodology to forecast the time series with more conservative and realistic estimates in later years.