Carl Vinson
Institute of Government
UNIVERSITY OF GEORGIA

Methodology

2023 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 2022 through 2060. This series of projections is referred to as the 2023 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 cohort-component projection technique to project resident population by age, race and ethnicity, and sex for the State of Georgia and its counties. Demographers and data scientists 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 regularly refines the model assumptions and parameters to incorporate the latest data and research into these projections.

Projection Methodology

OVERVIEW

The projections were produced using the cohort-component projection method beginning with a base population of Vintage 2021 Population Estimates from the United States Census Bureau. The cohort populations included single-year of age, four race/ethnic groups, and two sex groups for each of Georgia's 159 counties. The components of population change include fertility, mortality, and migration. For each year in the projection period, the survived population is advanced one year of age using projected age-specific survival rates and the net migration schedule.

COHORT-COMPONENT PROJECTION METHOD

In the cohort-component method, separate components of population change (fertility, mortality, and migration) are projected for each population cohort (age, race and ethnicity, and sex).

Cohorts refer to persons with one or more common characteristics: age, race or ethnicity, and sex. Components refer to the components of population change: births, deaths, and migration. 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 future date $t_1 - t_2$,

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 base time period.
2. Determine 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.

POPULATION DATA AND BASELINE RATES

Base Population

The base population is the estimate used as the starting point in the projection model. The Census Bureau's Vintage 2021 population estimates for Georgia's counties with characteristics of age, race and ethnicity, and sex were used as the baseline population for the 2023 Long-Term Population Projections. The population was grouped into single-year age groups (0 to 84, and age 85 and over), 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).

The Census Bureau Population Estimates Program annually releases population estimates by characteristics. The Census Bureau's annual population estimates customarily serve as the population base for the Institute of Government's population projections. Data scientists at the Institute of Government applied the state-wide single-year age distribution to the county-level five-year age groups by categorically sampling the age distribution as a way to account for uncertainty at the county level.

Fertility Data and Rates

Birth data were collected from the Georgia Department of Public Health's (DPH) Office of Health Indicators and Planning (OHIP) Online Analytical Statistics Information System (OASIS)[i]. The data include the age (ages 10-55), race, sex, birth order event, and county of residence of the mother from 2001 to 2021.

Age-specific fertility rates (ASFR) for each birth order event across four racial and ethnic groups were projected for each year in the projection period using Gaussian Process Regressions.

Mortality Data

Death data were collected from the Georgia Department of Public Health's (DPH) Office of Health Indicators and Planning (OHIP) Online Analytical Statistics Information System (OASIS)[i]. The data include single year of age (0-100, and 100 and over), race and ethnicity, sex, and primary county of residence for years 2001 to 2021.

Age, race and ethnicity, and sex specific Mortality Rates were projected for each year in the projection period using Gaussian Process Regressions.

Migration Data

Migration data from the US Internal Revenue Service were used to project migration rates for each year of the projection period using a Gaussian Process Regression. Data scientists calculated residual migration from population estimates to produce an age, race and ethnicity, and sex structure of in- and out- migrants at the county level. A review panel of Institute of Government experts analyzed and evaluated dozens of migration rate scenarios for each county.

Group Quarters Data

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 2023 projections incorporate stochastic simulations for the group quarters population.

PROJECTION APPROACH AND MODEL

The Institute of Government's projection method relies on a bottom-up approach. Institute of Government faculty and staff review produce a state projection by reviewing the projections by age, race and ethnicity, and sex of all of the 159 counties. This review and analysis incorporate faculty and staff expertise on local trends and economic development in Georgia. The state-level projection is cross-validated with other sources, including independent projections, neighboring-state projections, and simple autoregressive integrated moving-average methods.

Projecting Rates and Gaussian Process Regression

Institute data scientists projected fertility, mortality, and migration rates using Gaussian process regression (GPR). GPRs are machine learning algorithms used for regression (i.e., predicting fertility rates and housing prices) and classification problems (i.e., identifying in which categories an observation belongs).

GPRs are flexible non-parametric machine learning models commonly used for modeling spatial and time series data. Deploying GPRs to project population component rates enables data scientists and demographers to consider multiple model specifications that account for long-term (historical) trends and adjusting for seasonality or recent trends.

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[i] oasis.state.ga.us