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UNIVERSITY OF GEORGIA

Methodology

2025 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 the 2025 Long-Term Population Projections, anticipating the resident population for Georgia's counties in single-year intervals for the period 2025 through 2060. Population projections serve as a resource for local and state decision-makers as these leaders plan for the future.

This report describes the methodology, assumptions, and data sources used to produce the 2025 Long-Term Population Projections. The Institute of Government used a demographic projection technique called the cohort-component method to project resident population by age, race and ethnicity, and sex for the state of Georgia and its counties. Demographers and data scientists leveraged publicly available data from state and federal agencies, regional expertise, and current research on US population and demographic trends to produce the projections.

These projections, like all projections, involve assumptions about future events that may or may not occur. Just as exogenous factors such as federal policy can influence international migration, and global challenges, such as a worldwide pandemic, can influence population change, decisions made today by Georgia's leaders can influence the population trajectory. Users should be aware that, although these projections were prepared using standard methodologies and extensive attempts were made to account for existing demographic patterns, the projections may not accurately project the future population of the state or any specific county. The Applied Demography Program at the Carl Vinson Institute of Government regularly refines model assumptions and parameters to incorporate the latest research and data into these projections. Furthermore, these projections are purely demographic, focusing on the historical and current rates of population components like aging, birth rates, and migration for the resident population. These projections should be used with full awareness of the limitations of population projections and with knowledge of the procedures and assumptions described in this report.

Projection Methodology

OVERVIEW

The projections in this report were produced using a cohort-component projection method, a method used throughout the United States for conducting population projections. This method uses current components of population: fertility, mortality, and migration, and assumptions about those rates over time, to project a base population into the future. The Institute used the Census Bureau's Vintage 2024 Population Estimates as the base population for Georgia, and 2025 as the launch year. The cohort populations are constructed for single year of age, four race/ethnic groups, and two sex groups for each of Georgia's 159 counties. For each year in the projection period, the survived population is advanced by one year of age using projected age-specific survival rates and net migration rates.

COHORT-COMPONENT PROJECTION METHOD

In the cohort-component method, separate rates for the components of population change are projected for each population cohort. In this case, cohorts refer to persons that share the

following characteristics in a projection year: 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. Model 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 baseline population for the 2025 Long-Term Population Projections used the Census Bureau's Vintage 2024 population estimates for Georgia's counties. Institute faculty and staff modified the Census population estimates to project cohorts. Specifically, 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).

Faculty and staff at the Institute developed population estimates because a consistent panel of cohorts is necessary for accurate projections. At the time of production, Vintage 2024 county-level population estimates were only available for the total population. These estimates did not include 2024 age, sex, and race characteristics. Further, the Census Bureau does not produce single year of age estimates at the county level. This level of detail is necessary for our projection strategy. The Institute applied the age, sex, and race distribution from the Vintage 2023 postcensal estimates to our produced 2024 population characteristics. The 2024 total were controlled to the totals for the Vintage 2024 total population. We constructed an independent

set of adjusted population estimates for 2020-2023 broken down by single-year age, race, and sex using the Das Gupta error closure, the same strategy used by the Census Bureau for producing intercensal estimates. This constructed set allowed for a projection of each cohort to 2060.

Fertility

The Institute collected birth data 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 2000 to 2024. Institute faculty and staff modified the race and ethnicity characteristics into the same four groups used in the base population. Historical (2000-2024) age-specific fertility rates (ASFR) for each birth order event across the four racial and ethnic groups were calculated using the internal intercensal estimates developed by the Institute of Government.

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, described below. These rates were projected at the state level and applied to the base population in each county.

Mortality

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 2000 to 2024. Institute faculty and staff modified the race and ethnicity characteristics of the mortality data into the same four groups used in the base population. Historical (2000-2024) age, race and ethnicity, and sex specific mortality rates were calculated using the internal intercensal estimates developed by the Institute.

Age, race and ethnicity, and sex-specific Mortality Rates were projected for each year in the projection period using Gaussian Process Regressions. These rates were projected at the state level and applied to the base population in each county.

After evaluating multiple scenarios, institute researchers chose to remove mortality data from 2020, 2021, and 2022, due to the elevated number of deaths during those years. This removal produced a more stable projection of long-term mortality rates.

Migration

Institute of Government faculty and staff calculated residual net migration rates and schedules from the 2000-2024 population estimates to produce an age, race and ethnicity, and sex structure at the county level and at the Georgia Department of Community Affairs (DCA) regional level. Historical (2000-2024) age, race and ethnicity, and sex-specific migration rates were calculated using the internal intercensal estimates developed by the Institute of Government.

Age, race and ethnicity, and sex-specific migration rates were projected for each year in the projection period using Gaussian Process Regressions. Rates were calculated at the county level

and region level. County and region migration rates were evaluated for each county and cohort combination.

A review panel of Institute of Government experts evaluated county and region migration rates for each county cohort combination. In some cases, county migration rates were adapted from other jurisdictions outside of the target county's DCA region, where appropriate, based on comparable geographic and demographic characteristics.

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 2025 projections incorporate stochastic simulations for the group quarters population.

The base group quarters population file provides estimates of the total group quarters population by county for 2020, broken down by five-year age groups, race, and sex, for use as a reference in projecting future group quarters populations. This population file was created from two component census tables, both descending from the 2020 Census Demographic and Housing Characteristics File (DHC):

1. A combined version of tables PCT18A - PCT18H: Group Quarters Population by Sex by Age by Major Group Quarters Type (All Races)
2. Table PCO1: Group Quarters Population by Sex by Age

Table 1 was used as the base table, as it had a total estimate closer to the official Census Bureau total. Each five-year age group in Table 2 was classified into one of the three larger age groups from Table 1. Then, in Table 1, the total population by sex was calculated for each of the three larger age groups. The individual race estimates were then divided by the sex-age group totals to find the proportion of each age group accounted for by each race group.

The tables were then combined based on county, sex, and the three larger age groups from Table 1, and new estimates were calculated for each five-year age group using the race proportions calculated earlier, rounding down to ensure only whole persons were counted. This process is summarized by the equation below. It occurred four times for each sex and five-year age group combination and once for each race group.

*New Estimate = Old Estimate * (Race total for large age group/Total for large age group)*

POPULATION APPROACH AND MODEL

The Institute of Government's projection method relies on a bottom-up approach. Institute of Government faculty and staff produce a state projection by summing the projections by age, race and ethnicity, and sex of all of the 159 counties in Georgia. Institute faculty and staff review and analysis incorporate 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 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 (e.g., modeling housing prices, predicting fertility rates) and classification problems (i.e., identifying in which categories an observation belongs). GPRs check numerous possible models that can fit the data points to derive an optimal, selected model that makes the regression-based projection.

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 adjust for seasonality or recent trends. This method is suitable for the context of changes in each of these demographic rates, which are beholden to policy changes, natural disasters, and other outside factors.

[i] oasis.state.ga.us