

# Modelling Methodology for the State and County Population Projections

California State Department of Finance  
Demographic Research Unit (DRU)  
915 L Street  
Sacramento, CA 95814  
(916) 323-4086

December 2014

The Department of Finance uses a baseline cohort-component method to project population by age, gender, and race/ethnicity. A baseline projection assumes that people have the right to migrate where they choose and that no major natural catastrophes or wars will befall the state or the nation. A cohort-component method traces people born in a given year throughout their lives. As each year passes, cohorts change due to the mortality and migration assumptions. Applying fertility assumptions to women of childbearing age forms new cohorts.

These projections, like all projections, involve the use of assumptions about future events that may or may not occur. Users of these projections are cautioned that although the projections have been prepared with the use of detailed methodologies and attempt to account for existing demographic patterns, they may not accurately project the future population of the state or the counties within the state. These projections should be used with an awareness of the inherent limitations of population projections in general and with an understanding of the procedures and assumptions presented below.

The starting population is projected using the fertility, mortality and migration assumptions. As gender-, race/ethnic-, and age-specific survival rates are applied to the population at risk, the population ages with time. The total county migration assumptions by race/ethnicity are distributed by age and gender using calculated migration proportions. The process is carried forward for 50 years, starting with 2010. Special populations are then added to produce total population projections. For the years where the Department has published population estimates in its E-2 Report, the county and state total population projections are held within a close range of these E-2 estimates, although they are not controlled to exactly match them.

## Assumptions and Specific Details

The fundamental cohort component equation describes tomorrow's population as today's base population supplemented with changes in births, deaths, and net migration:

$$\text{Population}_{t+1} = \text{Population}_t + \text{Birth}_{t+1} - \text{Death}_{t+1} + \text{Net Migration}_{t+1}$$

**Base Population**—For the benchmark (or starting population), the Department of Finance used the 2010 Census counts as modified by the Bureau of the Census to eliminate the “Other” race category. These counts represent a modification to the race distribution of the census count and not an adjustment for an undercount of the total population. These race groups are consistent with the categories used by the Census Bureau for current estimates and national projections, as well as by the Office of Management and Budgets.

**Births**— A set of six 5-year age-specific fertility rates (ASFRs for the age range 15-44) for each of the seven race/ethnic groups was calculated by county for each year of the period 2010-2013. For the numerators of these rates, births to mothers under age 15 were added to the youngest age group (15-19), births to mothers of unknown age were added to the births of the largest birth group, and births to mothers over age 44 were added to births of the oldest age group (40-44). For the denominator, population counts were used from the Census Bureau's Modified Race data file by age, sex and race/ethnic group for each county. ASFRs were then averaged for each race/ethnic group by county to derive beginning fertility rates for the projections. In counties with small populations, in which the base

## Modelling Methodology for the State and County Population Projections

population used as the denominator to compute rates and/or the number of birth events used in the numerator were too small to produce reliable and reasonable rates, it was necessary to average state rates with county-specific rates to obtain reasonable estimates. As a final step, fertility-rate-generated births were adjusted to be consistent with actual fiscal birth totals for 2010-2013. For most counties, the projections assume that county race/ethnic- and age-specific fertility rates will eventually merge toward the state rates by 2075. However, depending on historical trends, fertility for a few counties was assumed to merely follow state trends starting in 2014 rather than fully merge by 2075.

The state fertility norms as expressed in term of total fertility rates (TFR) are as follows:

- Non-Hispanic Whites: 1.75
- Non-Hispanic Blacks: 1.89
- Non-Hispanic American Indians: 1.70
- Non-Hispanic Asians: 1.83
- Non-Hispanic Native Hawaiian and Other Pacific Islanders: 1.96
- Non-Hispanic Multi-Race: 1.78
- Hispanic 2.07

**Deaths**—Deaths are generated by applying state-level survival rates, constructed separately for men and women in each of seven race/ethnic groups, to the population in each county. The basis of the survival rates are life tables created for each race/ethnic group by sex using a three-year average of deaths. Over time, state-level survival rates are merged to the 2060 state-level rates, which are based on national-level race/ethnic and gender-specific survival rates published by the U.S. Census Bureau. It is assumed that the higher of the state rate or the national rate for each race/ethnic-, age-, and gender-specific group will form the group's 2060 survival rate.

The difference in life-expectancy between Hispanics and Non-Hispanics that currently exists is projected to grow smaller over time. Current research is unclear whether the disparity is a real or a statistical artifact. Therefore, the Hispanic 2060 survival rate is modeled as the average of the 2060 survival rates of non-Hispanic Whites and Hispanics.

The baseline 2013 and implied 2060 life expectancies by race/ethnic group and sex are:

Life Expectancy		Non-Hispanic White	Non-Hispanic Black	Non-Hispanic American Indian and Alaskan Native	Non-Hispanic Asian	Non-Hispanic Native Hawaiian and Other Pacific Islanders	Non-Hispanic Multi-Race	Hispanic
		F	2013	82.0	77.4	79.2	86.7	84.3
	2060	83.9	79.7	80.9	88.3	86.1	78.6	84.8
M	2013	77.5	72.3	76.4	82.8	79.8	73.9	79.1
	2060	78.9	74.5	78.9	84.2	81.1	74.4	81.7

**Migration**—Migration proportions are developed using a survived population method. The base Census population is aged forward ten years by adding recorded births to form new cohorts and subtracting deaths from existing cohorts. The survived population is then compared to the ten-year-later Census population and any differences are assumed to be migration. The resulting migration is then divided by the respective total population to form migration proportions by age.

## **Modelling Methodology for the State and County Population Projections**

Initial projection of county migration flows are derived using a weighted average of two methods: The first is a time-series model fit on the 20 previous years of historical migration for each county, The independent variables include the ratio between the changes in CA per capita GDP and U.S. per capita GDP, and the ratio between the changes of CA and U.S. civilian employment. The second method uses the ratio of the most recent Employment Development Department (EDD) labor force projections to the existing projected population age 15-64 to derive a labor demand-driven migration series for each county. Estimates of past ratios of migrants age 15-64 to total migrants are then used to complete the series. For years beyond existing EDD and GDP forecasts, migration is held to trend, subject to modification from local input.

Where possible, projected migration flows are evaluated in consultation with county planning agencies and Councils of Government, which contribute assessments of future migration and notable future developments for their jurisdictions. Where local input is not available, the migration assumptions are made by the Department of Finance based on an historical analysis of the county's migration patterns.

**Special Populations**—Examples of special populations are prisons, colleges, and military installations. Special populations display very different demographic characteristics and behavior than the general population. In counties where special populations represent a significant proportion of a specific race/ethnic population, they are removed from the base population, are projected separately, and are then added back in at the end. Except where detailed future plans are known (ie. dorm expansion or prison realignment), the special populations are held at the 2010 level.

### **Acknowledgments**

Walter Schwarm prepared this population projection series. Karen Duong provided assistance with model validation and testing. Bill Schooling, Chief and John Malson, Assistant Chief provided consultation.

### **Suggested Citation**

State of California, Department of Finance, *State and County Population Projections by Race/Ethnicity, Sex, and Age 2010-2060*, Sacramento, California, December 2014.

These population projections were prepared under the mandate of Government Code, Sections 13073 and 13073.5. In addition, the State Administrative Manual, Section 1100 on state plans, sets the general policy of ..."(3) The use of the same population projections and demographic data that is provided by the State's Demographic Research Unit."