

2018 PROJECTIONS METHODOLOGY

INTRODUCTION

On September 21, 2018 the Cornell Program on Applied Demographics (PAD) published the results of a set of county population projections. The projections were produced using a cohort component model and the assumption is that components of demographic change in the future will remain similar to recent components of demographic change.

This document describes the principles behind a cohort component method and how recent change was measured and used in the projection model.

URL: <http://pad.human.cornell.edu/counties/projections.cfm>

PRINCIPLES BEHIND A COHORT COMPONENT MODEL:

- Population change can be defined using the Demographic Balancing Equation:
$$\text{Pop}_{\text{end}} = \text{Pop}_{\text{start}} + \text{Births} - \text{Deaths} + \text{In-migration} - \text{Out-migration}$$
- The size and sex/age structure of each of the components (terms in the balancing equation) depends on the sex/age structure of $\text{Pop}_{\text{start}}$
- Survivors age (end – start) years and thus a sex/age structure of Pop_{end} can be calculated. This Pop_{end} makes the $\text{Pop}_{\text{start}}$ for a next period.

PAD 2018 PROJECTIONS:

Age specific rates were calculated from recent data for each county.

Projections are done annually for single years of age with an open ended top-group 85+.

START POPULATION

We start with the population in 2015 (Data source: Vintage 2017 Bridged-Race Postcensal Population Estimates, downloaded through CDC-Wonder)

URL: <https://wonder.cdc.gov/Bridged-Race-v2017.HTML>

BIRTHS

Age specific fertility rates were derived from Births by age of Mother (numerator) and Vintage 2017 Bridged-Race Postcensal Population Estimates (denominator).

URL: <https://wonder.cdc.gov/natality-current.html>
<https://wonder.cdc.gov/Bridged-Race-v2017.HTML>

DEATHS

Life tables were created using age specific mortality rates that were derived from Deaths by sex and age (numerator) and Vintage 2017 Bridged-Race Postcensal Population Estimates (denominator).

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URL: <https://wonder.cdc.gov/cmfi-icd10.html>
<https://wonder.cdc.gov/Bridged-Race-v2017.HTML>

Mortality rates for the 85+ age are corresponding with a life expectancy of 7.4 for males and 8.6 for females. We assumed this is the same throughout the state.

URL: https://www.health.ny.gov/statistics/vital_statistics/2015/table03.htm

MIGRATION

ACS BASED MIGRATION RATES

5 year ACS 2012-2016 data from tables B07001 (migration by age, tabulated by current place of residence) and B07401 (migration by age, tabulated by previous place of residence) was used to get estimates of the inflows and outflows by age groups.

URL: https://factfinder.census.gov/bkmk/table/1.0/en/ACS/16_5YR/B07001/0400000US36.05000
https://factfinder.census.gov/bkmk/table/1.0/en/ACS/16_5YR/B07401/0400000US36.05000

These estimates were taken as initial numerators for rates. As the denominator we took:

- the universe of the estimated county population for the domestic out-migration,
- the surviving US population for domestic in-migration and
- total international in-migration by age (from abroad to the US) to create a share of total immigration by age

In the model projected domestic out-migration is calculated using the assumed rates and multiplying them by the age structure of the start population. Domestic in-migration is calculated using the assumed rates and multiplying them by the projected US population and immigration from abroad is calculated by multiplying the shares by the projected net international migration to the US. We used the national projection data from the 2017 National Projections from the US Census Bureau.

URL: <https://www.census.gov/data/datasets/2017/demo/popproj/2017-popproj.html>

However, review of the results with this set of assumptions showed that it led to implausible results. The implausible results were most noticeable in counties with high migration rates in certain age groups, for example counties with a large student age in- and outflow. With the ACS based rates student populations aged in place instead of moving out and the size of the student body also changed dramatically in some counties. To overcome this problem, we looked into drawing upon more data from the population estimates.

POPULATION ESTIMATES BASED MIGRATION RATES FOR AGE 15-34

We decided to calculate Cohort Change based on the Vintage 2017 Bridged-Race Postcensal Population Estimates. Cohort Changes are defined as the size of a group of persons born in the same year (or group of years) in the end year minus the size of the same cohort group in the start year. We calculated cohort changes for single cohorts and subsequent years, for example 24 year old in 2014 minus 23 year old in 2013 is a single cohort change.

Cohort change is a result of migration and mortality. In the PAD projection model we used the cohort change as is to estimate net-migration for the 15-34 years old, an age group with high mobility and low mortality.

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If the cohort change for a certain age was positive, that is more people moved in than moved out, we calculated that change as a share of the national population for that cohort and used that share and the projected national population to project future net-migration for that age.

If the cohort change for a certain age was negative, we calculated a rate by taking that cohort change and dividing it by the county population for that age. The projected net-migration is calculating using this rate and projected county population.

MIGRATION RATE ADJUSTMENTS

As a last step all remaining ACS migration rates and shares were adjusted such that it resulted in a crude migration rate, corresponding with recently observed crude migration. Crude migration is total net migration divided by total population.

REVIEW

For review purposes we produced two sets of projections, using the same set of assumptions:

1. A set of projections with the July 1, 2010 population estimates as the starting population and 2015 as the final year. Since all assumptions are based on the same period, one would expect the 'projected' 2015 to be very close in size and composition to the estimates for the 2015 population. After replacing some of the ACS based migration rates with the Bridged-Race Postcensal Population Estimates based migration rates, the projected results were indeed close to the estimates
2. The set of projections starting in 2015 going through 2040. We combined historic trends with estimated trends to see if projected trends were in line with history. We also validated the 2040 age structures with special attention to counties with relatively many students, as these are counties that are very sensitive to migration assumptions. Trends in median age and sex ratios were also part of this review process.

Before publication we shared the projections with experts with local knowledge asking for their feedback.