

Michigan County Population Projections through 2050: Vintage 2024 Methodology

The Michigan Center for Data and Analytics (MCDA) 2024 vintage county projections were produced using the cohort component method. The cohort component method advances the population forward in time, while accounting for the structural characteristics of its age and sex distribution. The “component” aspect refers to the three components of demographic change: births, deaths, and migration. The 2024 vintage county projections adjust baseline data for each county by using the projected births, deaths, and migration trends from the vintage 2024 state projections.

County births were projected using dynamic total fertility rates (TFR).

The first step in projecting births was to use data from 2020 to 2022 to calculate baseline age-specific fertility rates (15-54 years of age). Counties with smaller populations can have substantial variation in age-specific fertility due to relatively large annual variation in births. Thus, for smaller counties, i.e., counties with fewer than 70,000 women, baseline age-specific fertility rates were smoothed using a two-year age average.

The state’s projected 20 percent decline in fertility by 2050 was applied to the baseline county fertility rates each projection year. A linear interpolation was applied to project a uniform annual decline in fertility for all Michigan counties from 2023 to 2050.

County deaths were projected using dynamic survival rates based on life expectancy trends.

County specific baseline single-year age survival rates were calculated using data from 2015 through 2019. The decision to use 2015–2019 rather than a more recent time interval was due to the COVID-19 pandemic and corresponding decrease in survival rates. Using the lower survival rates from the pandemic period could negatively bias projections.

Some counties with smaller populations have large variation in age-specific survival estimates. Therefore, a two-year age rolling mean was applied to smooth single year of age survival estimates for counties with fewer than 200,000 people.

The first step to incorporating dynamic survival rates entailed calculating life expectancy from 2015 to 2019 for each county. The total percent change in sex-specific life expectancies from the state projections was then calculated (5.1 and 3.5 percent increases for men and women, respectively). A linear interpolation was then applied to each county to project a uniform annual increase in life expectancy from 2023 to 2050. Finally, life expectancies were translated to age-specific survival probabilities using the `copmd` function from the `MortCast` package in the statistical software R.

County migration trends were projected by distributing the state's projected net migration to counties.

There were several steps to incorporating migration into county projections. First, age-specific migration was used to help maintain population age structure, which is typically influenced by younger, more mobile subpopulations. For example, counties with a significant college or university population experience substantial inflows of 18-year-olds followed, generally, by out-migration of people ages 22 to 35. Failure to maintain these migration patterns would project too many young people advancing into older age classes in these counties. Second, each county's portion of the state's projected net migration needed to be distributed.

A residual method was used to achieve the goals of maintaining age structure and accounting for intrastate migration. The average net migrants for each age class from 2015 to 2019 was estimated using this residual method.

$$M_{i,t} = P_{i,t} - [P_{i-1,t-1} \times S_{i-1}]$$

Where:

$M_{i,t}$ is the net migrants of age i in year t

$P_{i,t}$ is the Census Bureau estimate of the number of persons age i in year t

S_{i-1} is the survival of persons age $i-1$

Additionally, estimates from the residual method established an initial number of age-specific net migrants for each county. These initial net migrants were adjusted each projected year to reflect the portion of the state's net migrants distributed to each county.