Projections of the Total Population of Texas and Counties in Texas, 2020-2060

Produced by

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Introduction

The projections of the population of Texas and of each county were prepared by the Texas Demographic Center (hereafter referred to as TDC).

These projections, like all projections, involve the use of certain assumptions about future events that may or may not occur. Users of these projections should be aware that although the projections have been prepared with the use of detailed methodologies and with extensive attempts being made to account for existing demographic patterns, they may not accurately project the future population of the State or of particular counties in the State. These projections should be used only with full awareness of the inherent limitations of population projections in general and with particular and detailed knowledge of the procedures and assumptions delineated below which characterize the projections presented in this report.

The current projections are of the resident population of the State and of all counties in the State for each year from 2020 through 2060, with the 2020 population equal to the 2020 census counts for the State of Texas and for all counties in Texas.

This summary provides a relatively detailed description of the projection methodology and then discusses the bases for, and the assumptions used in the projection. It concludes with a description of the products available from the projection process.

Projection Methodology

The projections were completed using a Cohort Component projection technique. As the name implies, the basic characteristics of this technique are the use of separate cohorts -- persons with one or more common characteristics -- and the separate projections of each of the major components of population change--fertility, mortality and net migration--for each of the cohorts. These projections of components for each cohort are then combined in the familiar demographic bookkeeping equation as follows:

$$P_{t_2} = P_{t_1} + B_{t_1-t_2} - D_{t_1-t_2} + M_{t_1-t_2}$$

Where: P_{t_2} =   the population projected at some future date t_1-t_2 years hence

P_{t_1} =   the population at the base year t_1

$B_{t_1-t_2}$ =   the number of births that occur during the interval t_1-t_2

$D_{t_1-t_2}$ =   the number of deaths that occur during the interval t_1-t_2

$M_{t_1-t_2}$ =   the amount of net migration that takes place during the interval t_1-t_2

When several cohorts are used, P_{t_2} may be seen as:

$$P_{t_2} = \sum_{i=1}^{n} P_{c_i,t_2}$$

Where: P_{t_2} is as in the equation above

P_{c_i,t_2} = population of a given cohort at time t_2 and

$$P_{c_i,t_2} = P_{c_i,t_1} + B_{c_i,t_1-t_2} - D_{c_i,t_1-t_2} + M_{c_i,t_1-t_2}$$

Where: all terms are as noted above but are specific to given cohorts c_i

In producing the current projections, as in any other use of the cohort-component technique, at least four major steps must be completed:

1. The selection of a baseline set of cohorts for the projection area or areas of interest for the baseline time period (usually the last census and for other dates for which detailed base data are available);

2. The determination of appropriate baseline migration, mortality, and fertility measures for each cohort for the baseline time period;

3. The determination of a method for projecting trends in fertility, mortality, and migration rates over the projection period;

4. The selection of a computational procedure for applying the rates to the baseline cohorts to project the population for the projection period.

Each of these steps as performed for the current TDC projections are briefly discussed in the following pages.

Selection of the Baseline Cohorts

Our previous projections have always used the most recent decennial census available as the baseline for the single-year-of-age cohorts of males and females by major race/ethnic groups; however, the COVID-19 Pandemic and the new privacy protection measures implemented by the U.S. Census Bureau have significantly delayed the release of the 2020 Census data products. At the time when we produced this projection, the total population counts were available for the State of Texas and its counties in the 2020 Decennial Census P.L. 94-171 Redistricting Data. However, the 2020 Census Demographic and Housing Characteristics File (DHC) that we would need for the detailed baseline cohort was not yet released.

We explored two options available to us, the 2020 base population of the Census Bureau Vintage 2021 Population Estimates, and the TDC vintage 2018 population projections for the year 2020. In comparing the 2020 state population distributions from these two sources, we concluded that the comparable race/ethnic distributions were similar, but the TDC 2020 projected population provided race/ethnic categories that were consistent and comparable with other TDC products. Specifically, the TDC population projections consist of five mutually exclusive groups derived from the census categories: non-Hispanic White alone, non-Hispanic Black or African American alone, Hispanics of all races, non-Hispanic Asian alone, and persons in all other non-Hispanic race groups, referred to as the Other population group. This last group (the Other population) also includes all persons identified as two or more races. We then used the TDC 2020 population projections by age, sex and race/ethnicity and allocated the total population counts from the P.L. 94-171 Redistricting Data to obtain our baseline population cohort. At the county level, it was determined that the 5-year age distributions of the 2020 base population that the Census Bureau used for its Vintage 2021 Population Estimates were more reliable and therefore used as the base population for the county-level projections.

This "combined population bases" was used in calculating the baseline fertility, survival and migration rates, as explained in more detail in later sections.

It is essential to note these population bases were not derived from the Census counts and may carry errors resulting from the estimation and the projection process. It is also important to note that both the base population of the Vintage 2021 Census Population Estimates and the Vintage 2018 TDC Population Projections were produced from the 2010 Decennial Census and were more consistent with the race/ethnic distributions in 2010. Since the 2020 Decennial Census has adopted changes in the questions and the procedures used to produce the race/ethnic data, the combined population base used in these projections may not be comparable to the 2020 race/ethnic data.

In constructing the baseline population, it was also necessary to adjust the base population for "special populations." Special populations are populations who reside in an area, usually in institutional settings, who do not generally experience the same demographic processes over time as the residential population in the area. Rather, they tend to come into and leave an area at fixed intervals. Such populations include college, prison, military base, and other populations in institutional settings. Special populations must be removed from the projection areas' base populations before applying the birth, death, and migration rates to the base population, as their movement into and out of an area is a function of events (e.g. enrollment, graduation, incarceration) that are not determined by local socioeconomic conditions. If special populations of substantial size are not removed, they will create distortions in age and other characteristics of the population that will remain in the population through the cohort aging process and create inaccuracies in the projections. Therefore, special populations are generally removed from the cohort base, the base cohorts are projected forward, and a separate projection of the special population for the projection date is added to the projected base cohorts to obtain the projected total population.

In Texas, several existing special population groups are especially large and must be removed from base populations. These are college and university populations, state prison populations, military populations, and populations in other state institutions. In the projections presented here, each of these

groups was removed from the base population of the counties in which they are located by subtracting these special populations from the 2020 population reported in the Census for these counties.

These procedures for baseline cohorts were completed for all counties in the State. However, following standard practice, special populations were removed from the base population only when they made up a significant portion of the population of the area. For counties with special populations of sufficient size, the baseline cohorts without special populations are projected forward and projections of special populations for the projection years are added to the projections for the baseline cohorts to obtain projections of the total population.

Determination of the Baseline and Projected Fertility, Mortality, and Migration Rates

Fertility Rates

Baseline age-sex-race/ethnicity-specific fertility rates were computed using births by age, sex, and race/ethnicity and place of residence of the mother. The numerators for such rates are the average number of births for 2019, 2020, and 2021 for mothers in each age, sex, and race/ethnicity group, and the denominators are the base population of 2020 by age, sex, and race/ethnicity, as described in the previous section. Birth data to compute the rates were obtained from the Texas Department of State Health Services and data on females by age (15-49 years).

At the state level, these data showed total fertility rates for non-Hispanic Whites (1.58), non-Hispanic Blacks (1.71), Hispanics (2.07), non-Hispanic Asians (1.35), and non-Hispanic Others (2.52) in 2020. There were clear signs of declines in fertility across the groups in recent years. Thus, fertility rates were linearly trended over the projection period from 2020 to 2060 toward targeted rates deemed to be reasonable on the basis of change in national patterns for such groups over time. These targeted rates for 2060 were 1.55 for non-Hispanic Whites, 1.71 for non-Hispanic Blacks, 1.88 for Hispanics, 1.39 non-Hispanic Asians, and 1.64 for non-Hispanic Others.

At the county level, unrealistic fertility rates were observed in counties with small populations and among race/ethnicity groups with small populations. To reduce random noises in the data, counties are pooled into groups to calculate their fertility rates in 2020, based on their similarity in fertility patterns and their rural/urban status. The counties' fertility trends from 2020 to 2060 were then projected by assuming that the county's future fertility would follow the state trend. Specifically, this involved computing a ratio between the age and race/ethnicity specific birth rate for each age and racial/ethnic group for each county and the comparable state age and race/ethnicity specific birth rate at the baseline. This ratio for each age and race/ethnicity specific birth rate for each county was then multiplied by the projected state rate for each of the projection years.

The Redistribution of Race/Ethnicity for Newborns

In our previous projections, and many other research works that use race-specific fertility rates to estimate or project the zero-age population, an assumption has been made that the race/ethnicity of the newborn is the same as his/her mother. This has been demonstrated to be a reasonable approach in the past at the population level, when the estimated births were compared to the zero-year-old population in national surveys and the census counts. However, with the increase in inter-race and inter-ethnic marriage and the possibility of multi-race identification in census and more surveys, the discrepancy between the estimated race/ethnic distribution of the newborns based on their mothers' race/ethnicity and the race distribution of the zero year-old population observed in surveys has increased. Thus, an additional step to adjust the race distribution of the projected new cohort is necessary.

We used the IPUMS USA data to link children with their mothers and found a significant number of children whose reported race/ethnicity differed from their mothers. We calculated the race/ethnicity

distribution of the children born to mothers of each of the five race/ethnicity groups used in our projection. We then applied these distributions to our projected births based on the race/ethnicity of the mothers.

Baseline Mortality Rates and Projection of Race/Ethnicity Specific Mortality

Survival rates by single years of age, for both sexes and each of the racial/ethnic groups are required to obtain baseline mortality measures. Survival rates for non-Hispanic Whites, non-Hispanic Blacks, Hispanics, non-Hispanic Asians, and the non-Hispanic Other racial/ethnic categories were computed using death data from the Texas Department of State Health Services for 2019, 2020, and 2021. Because there were no projections of detailed survival rates available for Texas for future dates and no adequate means of discerning how such rates would change using state data alone, projections made by the Census Bureau using national trends in mortality by age, sex, and race/ethnicity derived from analysis from the National Center for Health Statistics were used as the basis for projecting state rates.

This involved calculating the ratio of each state-level age, sex, and race/ethnicity specific survival rates for Texas to those for the same population subgroups in the nation in 2020, and then assuming that state age, sex, and race/ethnicity specific rates would remain at the ratios to national rates for 2020 but trend in the same manner as national projections of survival over time. Although this involves assuming no closure between Texas and national rates over time, it provides projections of survival rates for Texas that reflect expected patterns of change in mortality levels over time. The projected national rates were obtained from the 2017 Population Projections for the United States from 2020 to 2060 produced by the U.S Census Bureau.

Migration Rates and Projections of Migration

Net migration rates were derived using a standard residual migration formula for projecting the population of Texas. Thus, births between 2010-2020 were added and deaths between 2010-2020 were subtracted from each corresponding age cohort of the 2010 population to produce an expected 2020 population for each cohort. This expected population was compared to the 2020 population base to derive net migration for 2010-2020 and subsequently for later post-2020 time periods.

Migration is the most challenging component process to project. The approach most commonly used is one that assumes the observed historical patterns will hold true for the future. In a state like Texas, where population dynamics have been changing very rapidly, we believe the best approach would be to utilize the latest data available to project future patterns, with the understanding that some of the patterns may not hold further along the projection horizon.

In our current projection, we used two migration scenarios, one assuming the 2010-2020 migration rates (the 1.0 migration scenario) and the other, half of the 2010-2020 migration rates (the 0.5 migration scenario). These migration rates were held constant throughout our projection period in each of the scenario. Age-sex-and-race/ethnicity specific migration rates were used for the state level projection whereas age-specific rates, and in some cases, county total migration rates were used in projecting county level populations.

Special Considerations in the Projection of Component Rates

The computation and projection of fertility and migration rates at the county level were sometimes problematic for counties with small base populations. Given the use of five racial/ethnic groups, two sexes, and 95 age groups, a total of 950 cells of data were employed for each county. In counties with small populations, in which either the baseline population used as the denominator to compute rates

and/or the number of events used in the numerator (i.e., births or net migrants) was too small to produce reliable and reasonable rates, it was necessary to develop a means of obtaining more reasonable rates.

In calculating and projecting the mortality rates, we evaluated the benefits of using county-specific mortality rates versus the state rates and determined that using the latter would yield more stable and reasonable results for the majority of the counties.

Our regression analyses in county fertility suggested that rural-urban status was a significant predictor of age-specific fertility patterns. Therefore, we used the 2013 Urban Influence Code published by the U.S. Department of Agriculture (USDA) and grouped the counties based on their rural-urban status to obtain a more reliable set of fertility rates for all the counties.

Migration rates were more variable across areas such that the use of grouped means may alter rates for rapidly and slow growing areas. The delay in the release of the DHC data further complicated the issue. In our research using the combined 2020 base population with age, sex and race/ethnic details to derive the age-sex-and-race/ethnicity specific migration rates, we found that these rates were relatively stable and reasonable and were, in general, fit for use. At the county level, however, detailed migration rates were deemed unreliable for many counties. In the absence of the 2020 Census DHC data, we were not able to decide whether these were due to errors in the population estimates. Therefore, we made the decision to use race -sex-and- age-group-specific migration rates for the state projections but age-group-specific migration rates for the county projections.

Computation of Future Populations

Given the projected rates noted above, the computation of the projected population was completed using standard cohort-component techniques as described above with all computations being completed on an individual year and age basis. The combined base population for 2020 were used as the starting values and populations were projected for each year from 2020-2060. Because of the need to ensure that the sum of county projections produces reasonable future populations for the state as a whole, the state's future population by age, sex, and race/ethnicity was first independently projected. County base cohorts were projected to the projection date and projected special populations added to the projected base populations for the appropriate counties. We assumed that special populations would maintain at the 2020 level as indicated in the 2020 Census. The state-level projections were then used as control totals for the sum of county projections for each age group.

Limitations of the TDC Population Projections

The Cohort Component methodology used by the TDC is the most commonly used method by the federal and state governments, and by demographers to project future population. While the advantages are well documented by demography textbooks and researchers, there are limitations associated with the method and the process of projecting the components.

One limitation is that the formula used in the method is a deterministic function with the assumption that all the inputs, that is, the base population, the births, the deaths, and the migrant population are true without errors. Although projections of an area or a group with a small population size tend to be unreliable, there are no statistical measures available to indicate that. We do warn users of these projections to be cautious when interpreting and using projections of small populations. In these cases, we highly suggest the use of broader age groups, merging race groups, or shifting the geographic unit to a larger region.

There are limitations in our effort to project future rates of demographic components. A wide range of socio-economic, environmental, policy, technological, and other factors can affect future

trajectories of fertility, mortality, and migration. Due to constraints in time, resources and data availability, we cannot take all of these factors into consideration. Our assumption is that the recent trends we observed were a result of a range of factors, and if these factors remain relatively stable, the demographic trends would continue into the future. Therefore, we expect that our projections to be more accurate in the near future and in areas that have not experienced unusual or rapid changes. We will continue observing the demographic trends in Texas and regularly update our projections in a timely manner.

Data Available from the Projections

This publication describes the projection methodology and provides several appendices showing the base populations for the state for 2020, and the base rates for fertility, mortality, and migration for 2020 for the state. Due to the volume of data involved, rates for other years and areas can be provided only upon request.

The full projections are available free on our website and may be requested in additional formats on a cost-recovery basis.

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