

## **Methodology for the United States Resident Population Estimates by Age, Sex, Race, and Hispanic Origin (Vintage 2008): April 1, 2000 to July 1, 2008**

The U.S. Census Bureau produces monthly estimates of resident population for the United States on an annual basis. We revise the estimates time series each year as final input data become available. These postcensal estimates from April 1, 2000 through July 1, 2008 supersede all previous estimates produced since Census 2000. The estimate for the total national resident population is obtained by summing the national resident population estimates across all age, sex, race, and Hispanic origin categories for each month in the time series. The following documentation describes the process by which we produce the April 1, 2000 through July 1, 2008 resident population estimates at the national level.

### **Population Universe**

Estimates of the U.S. *resident population* include persons resident in the 50 states and the District of Columbia. These estimates exclude residents of the Commonwealth of Puerto Rico and residents of the Island areas under U.S. sovereignty or jurisdiction (principally American Samoa, Guam, United States Virgin Islands, and the Commonwealth of the Northern Mariana Islands). The definition of residence conforms to the criteria used in Census 2000, which defines a resident of a specified area as a person "usually resident" in that area. Estimates of the resident population exclude the U.S. Armed Forces overseas, as well as civilian U.S. citizens whose usual place of residence is outside the United States.

While this document focuses on the method we use to produce the U.S. resident population, we also produce and publish estimates of three other population universes: the *resident population plus Armed Forces overseas*, the *civilian population*, and the *civilian noninstitutionalized population*. In general, we calculate each of these populations by adding another population to or subtracting a subpopulation from the official resident population estimates.

Estimates of the *resident population plus Armed Forces overseas* include U.S. residents and members of the Armed Forces on active duty stationed outside the United States, but do not include military dependents and other U.S. citizens living abroad.

*Civilian population* estimates include only those U.S. residents not in the active duty Armed Forces. The difference between the resident population and the civilian population is the active duty Armed Forces population residing in the United States. The Defense Manpower Data Center (DMDC) is the source of the data on the active duty Armed Forces, reserves, and National Guard populations stationed abroad and within the United States.

Estimates of the *civilian noninstitutionalized population* exclude persons residing in institutions, primarily nursing homes, prisons and jails, mental hospitals, and juvenile facilities as well as the active duty Armed Forces population residing in the United States. To estimate this population universe, we use the DMDC data and data on the institutionalized population provided by members of the Federal-State Cooperative Program on Population Estimates (FSCPE) and the Department of Veterans' Affairs.

## Overview

We produce quarterly estimates of the U.S. population by age, sex, race, and Hispanic origin by updating the modified Census 2000 base population with data on the demographic components of population change. The basic procedure we use to estimate population is:

- (1) base population
- (2) plus births to U.S. resident women
- (3) minus deaths to U.S. residents
- (4) plus net international migrants

We calculate the population for each age, sex, race, and Hispanic origin group. We may also incorporate other changes due to corrections made since Census 2000. These corrections are the result of successful local challenges or special censuses.

## Method

### Base Population

The enumerated resident population in Census 2000 is the starting point for the post-2000 population estimates. We modify this enumerated population in two ways to produce the April 1, 2000 population estimates base. First, we reconcile the Census 2000 race categories with the race categories that appear in our administrative records data by recoding the "Some other race" Census 2000 responses to one or more of the five 1997 Office of Management and Budget (OMB) race categories: White; Black or African American; American Indian and Alaska Native; Asian; and Native Hawaiian and Other Pacific Islander.<sup>1,2</sup> Second, we update the population estimates base to reflect changes to the Census 2000 population due to the Count Question Resolution program and geographic program revisions.<sup>3</sup>

### Demographic Components of Population Change

#### *Births*

We estimate births to U.S. resident women based on data collected by the National Center for Health Statistics (NCHS). NCHS provides final data on births by month of birth, sex of child, age of mother, and race and Hispanic origin of both mother and father through 2006. NCHS also provides preliminary data on total births for the calendar year of 2007.

NCHS provides the birth certificate data in the 1977 OMB race categories of White; Black; American Indian, Eskimo or Aleut; and Asian or Pacific Islander, under the "mark one race" scenario. To produce post-2000 population estimates in the 1997 OMB race categories, we must model births by child's sex, race, and Hispanic origin to produce the full 31 possible single and multiple race combinations.

To model the NCHS births by month of birth, sex, and race and Hispanic origin of the mother and father from the file, we first convert both parents' race and Hispanic origin from the 1977

OMB race categories to the 1997 OMB race categories using race bridging factors from NCHS.<sup>4</sup> Then, we use information from Census 2000 on race and Hispanic origin reporting within family households for the population under 1 year of age and their parent(s) to impute the race and Hispanic origin of each birth. Finally, we benchmark the births by race and Hispanic origin to the Census 2000 population under 1 year of age by race and Hispanic origin by proportionally adjusting the births to the original NCHS data within categories of mother's age, the month of birth, and sex.<sup>5</sup>

To estimate the distribution of births for calendar year 2007, we distribute preliminary 2007 births received from NCHS according to the 2006 births by month of birth, sex, and modeled race and Hispanic origin.

To estimate the number and distribution of births by race and Hispanic origin of mother for the first half of 2008, we calculate calendar year, age-specific birth rates for women by race and Hispanic origin for 2006 (the last year of final data from NCHS). We apply these rates to the projected populations of resident women by age, race, and Hispanic origin for each of the first two quarters of 2008 and then proportionally adjust for the observed seasonality in births by quarter.

### *Deaths*

We estimate deaths to U.S. residents based on data collected by NCHS. NCHS provides final data on deaths by month of death, age, sex, race, and Hispanic origin through 2006. NCHS also provides preliminary data on total deaths for the calendar year of 2007 by Hispanic origin.

As with the birth certificate data, NCHS provides death certificate data in the 1977 OMB race categories of White; Black; American Indian, Eskimo or Aleut; and Asian or Pacific Islander, under the "mark one race" scenario. Therefore, we model deaths by age, sex, race, and Hispanic origin to produce the full 31 possible single and multiple race combinations.

To estimate the age, sex, race, and Hispanic origin distribution of deaths for calendar year 2006 and earlier years, we calculate separate death rates for the NCHS race categories by age, sex, and Hispanic origin using the 1998 deaths and 1998 population estimates from Vintage 2000.<sup>6</sup> We apply the death rates for the White; Black; and American Indian, Eskimo or Aleut groups to the corresponding White alone; Black alone; and American Indian and Alaska Native alone populations. We apply the Asian and Pacific Islander death rate to both the Asian alone population and the Native Hawaiian and Other Pacific Islander alone population. We estimate multiple-race deaths as the difference between total 2006 deaths reported by NCHS and the sum of deaths estimated for the single-race groups. Consequently, we apply the same death rate to each of the 26 multiple-race groups.

To estimate the age, sex, race, and Hispanic origin distribution of deaths for calendar year 2007, we distribute preliminary 2007 deaths by Hispanic origin received from NCHS according to the 2006 deaths by month of death, age, sex, and modeled race.

To estimate the distribution of deaths by age, sex, race, and Hispanic origin for the first half of 2008, we calculate calendar year, age-specific mortality rates by sex, race, and Hispanic origin for 2006 (the last year of final data from NCHS). We apply these rates to the projected populations by age, sex, race, and Hispanic origin for each of the first two quarters of 2008 and then proportionally adjust for the observed seasonality in deaths by quarter.

### *Net International Migration*

International migration, in its simplest form, is any change of residence across the borders of the United States (50 states and District of Columbia). The net international migration component of the population estimates combines four parts: (a) net international migration of the foreign born, (b) net migration between the United States and Puerto Rico, (c) net migration of natives to and from the United States, and (d) net movement of the Armed Forces population between the United States and overseas.

Net international migration of the foreign-born population is estimated in two parts, immigration and emigration. The estimate of immigration utilizes information from the American Community Survey (ACS) on the reported residence of the foreign-born population in the prior year. The foreign born who reported being abroad in the year prior to the survey are considered immigrants. Emigration of the foreign born is estimated using a residual method. We age forward the foreign-born household population in Census 2000 using NCHS life tables to obtain the expected population in 2005, 2006, and 2007. Then, we compare the expected foreign-born population to the foreign-born population estimated by ACS 2005, ACS 2006, and ACS 2007. Subtracting the estimated from the expected populations produces a residual, which serves as the basis for emigration rates for the 2000 to 2005, 2000 to 2006, and 2000 to 2007 time periods. We perform this calculation for two period-of-entry groups: those who entered the United States between 1990 and 1999; and those who entered before 1990. The averaged rates for each period-of-entry group are then applied to the population at risk of emigrating each year (i.e., the foreign-born population in the ACS who indicated that they lived in the United States one year ago) to obtain annual estimates of emigrants for 2000 to 2007.

We produce the estimate of net international migration of the foreign-born population by subtracting the number of emigrants from the number of immigrants. We apply the age, sex, race, and Hispanic origin distribution of the noncitizen foreign-born population from Census 2000 who entered in 1995 or later to the national-level estimate of net international migration of the foreign born.

Net migration between the United States (the 50 states and the District of Columbia) and Puerto Rico is also estimated in two parts, immigration and emigration, when possible. For 2005 and later years, the ACS and the Puerto Rico Community Survey (PRCS) allow us to estimate the annual migration flows directly, using the question on place of residence one year ago.<sup>7</sup> People who indicated on the ACS that they lived in Puerto Rico one year ago are considered immigrants (i.e., they moved from Puerto Rico to one of the 50 states or the District of Columbia). People who indicated on the PRCS that they lived in the United States one year ago are considered emigrants (i.e., they moved from one of the 50 states or the District of Columbia to Puerto Rico).

For 2000 to 2004, we use prior research to establish a base estimate of net migration between the United States and Puerto Rico for 2000 and linearly interpolate between the 2000 net estimate and the 2005 net estimate to generate the estimates for 2001 to 2004.<sup>8</sup> We base the age, sex, race, and Hispanic origin distribution of these net migrants on the demographic characteristics of the Census 2000 population born in Puerto Rico who entered the United States in 1995 or later.

We estimate the net migration of natives to and from the United States using levels observed during the 1990s.<sup>9</sup> We assume these net migrants are likely to have the same demographic characteristics distribution as natives who resided in the United States. Therefore, we apply the Census 2000 age, sex, race, and Hispanic origin distribution of natives residing in the 50 states and the District of Columbia to the native net migrant population.

We derive the estimate of the net overseas movement of the Armed Forces population from data collected by the DMDC. DMDC provides data by age, sex, Hispanic origin, and individual branches of service in the Department of Defense. We apply the race distribution from the Census 2000 active military population to the Armed Forces movement overseas component.

#### Estimation of the Population by Quarter and Month

The calendar quarter is the basic time interval we employ for estimating the national population by age, sex, race, and Hispanic origin, but we are also required to produce national population estimates by age, sex, race, and Hispanic origin for each month of the time series. To do this, we need components of change (births, deaths, and international migration data) by month.

NCHS and DMDC each supply their data by month. No seasonal information is available for net migration of the foreign-born, net emigration of natives, or net movement between Puerto Rico and the United States, so we assume that each part of the international migration component occurs at the same level throughout the year.

Once we produce the quarterly population estimates as described above, we use the monthly components of change and the component method to produce population estimates for the intervening months.

#### Other Population Change

We incorporate data from other administrative sources into the estimates as necessary. These other sources include revisions from the population estimates review and update program (challenges) to the population estimates and the results of whole-entity special censuses.<sup>10</sup>

#### **Data Notes Concerning the Population Estimates**

In our ongoing evaluation of these population estimates, research indicates that the coverage of vital statistics administrative record data and decennial census data differ, with Census 2000 enumerating a smaller young child population (including children under 1 year of age) than expected from the birth data collected by NCHS.

As stated in the method described above, we base our estimates in large part on these Census 2000 population counts. As the population ages over the time series and we use the administrative records to update the census population, the level of the young child population is increasingly based on birth records. Therefore, in the annual estimates by age, there is a discontinuity between the population based mainly on administrative record birth data and the population based mainly on census data.

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<sup>1</sup> Detailed information on the race modification is available at <http://www.census.gov/popest/archives/files/MRSF-01-US1.html>. The modified race data summary file is available at <http://www.census.gov/popest/archives/files/MR-CO.txt>.

<sup>2</sup> Office of Management and Budget, "Revisions to the Standards for the Classification of Federal Data on Race and Ethnicity," Notice, Vol. 62, No. 210, Thursday, October 30, 1997. <http://www.whitehouse.gov/omb/fedreg/1997standards.html>.

<sup>3</sup> For more information on the Census 2000 Count Question Resolution program, see <http://www.census.gov/dmd/www/CQR.htm>.

<sup>4</sup> For more information on the NCHS race bridging factors, see <http://www.cdc.gov/nchs/about/major/dvs/popbridge/popbridge.htm>.

<sup>5</sup> When we impute the race and Hispanic origin of infants from the race and Hispanic origin of their mother and father, we use an abbreviated distribution of race by Hispanic origin. This distribution consists of the largest 20 of the 62 cross-categories of Hispanic origin with race. The other 42 cross-categories, which represent less than half of one percent of the total population, are aggregated into two residual categories by Hispanic origin. At the end of the process, we disaggregate the births in the two residual categories back into the 42 categories of births by race and Hispanic origin based on the Census 2000 race and Hispanic origin distribution of children under one year of age.

<sup>6</sup> We use death rates from 1998 estimates as the basis for mortality by race, because the rate calculation was free of the inconsistencies between the race definition in vital registration data and the race definition in census data that followed the implementation of the 1997 OMB guidelines on race reporting in census-based population estimates after 2000. Even prior to the revision of OMB guidelines, there were evident inconsistencies of reporting between census and vital registration data by race, especially for the American Indian, Eskimo and Aleut category. For this reason, we estimated mortality through the application of rates calculated for the sum of this category and the larger Asian and Pacific Islander category, proportionately adjusting deaths to match the registration data for these two categories combined. We estimated Hispanic origin deaths using a single age-sex-specific mortality rate schedule applied to each race category. We determined non-Hispanic deaths by race by subtracting Hispanic origin deaths for each racial category from the total for the category.

<sup>7</sup> The Puerto Rico Community Survey was first fielded in 2005. See <http://www.census.gov/acs/www/SBasics/FlyerPR.htm> for more information.

<sup>8</sup> For more information on the net movement from Puerto Rico, see Christenson, M., 2002, "Evaluating Components of International Migration: Migration Between Puerto Rico and the United States," Population Division Working Paper No. 64. <http://www.census.gov/population/www/documentation/twps0064.html>

<sup>9</sup> For information on estimates of net native migration, see Gibbs, J., G. Harper, M. Rubin, and H. Shin, 2003, "Evaluating Components of International Migration: Native-Born Emigrants," Population Division Working Paper No. 63. <http://www.census.gov/population/www/documentation/twps0063.html>

<sup>10</sup> For more information on the challenge program, see <http://www.census.gov/popest/archives/challenges.html>. For more information on the special census program, see

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[http://www.census.gov/field/www/specialcensus/files/program\\_overview.htm](http://www.census.gov/field/www/specialcensus/files/program_overview.htm). For more information on the incorporation of challenges, see <http://www.census.gov/popest/topics/methodology/2008-est-relnotes.pdf>.