Methodology For Minor Civil Division Household Projections 2020-2050

I. Introduction

Minor Civil Division (MCD).[1] Household projection development relies on three sets of pf projections developed earlier. First the Demographic Services Center's county population projections by age and sex serve as the basis for subsequent projection series because they provide county control totals. Second, MCD population projections were developed. Although they lack age-sex detail, the MCD population projections are controlled to county total populations. Third, projected county household, household population, group quarters population, and average household size were generated; these projections contain details about householder age.

All three of these projection products – county age-sex population projections, MCD population projections, and county household-by-age-of-householder projections – provide various controls for the MCD household projections, as will be described in the formulas below.

The U.S. Census Bureau glossary says this about the term household:

> A household includes all the people who occupy a housing unit (such as a house or apartment) as their usual place of residence.
>
> A household includes the related family members and all the unrelated people, if any, such as lodgers, foster children, wards, or employees who share the housing unit. A person living alone in a housing unit, or a group of unrelated people sharing a housing unit such as partners or roomers, is also counted as a household. The count of households excludes group quarters.
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> There are two major categories of households, "family" and "nonfamily."[2]

All residents of an MCD are either part of the household population or the group quarters population, so it may be useful to review the glossary entry for group quarters:

> The Census Bureau classifies all people not living in housing units as living in group quarters. A group quarters is a place where people live or stay, in a group living arrangement, that is owned or managed by an entity or organization providing housing and/or services for the residents.

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[1] Minor Civil Divisions are also called county subdivisions in Census Bureau products. Both terms refer to local units of government or parts of local units of government that nest within county boundaries. In Wisconsin, in January 2023 (the estimate year whose list of MCDs was used for MCD population projections), 58 municipalities (cities and villages) straddled county boundaries, so they had two or more component MCDs. Most municipalities have borders coextensive with the corresponding MCD. This document uses "MCDs" and "communities" interchangeably to refer to Minor Civil Divisions.

[2] See https://www.census.gov/glossary/?term=Household.

This is not a typical household-type living arrangement. These services may include custodial or medical care as well as other types of assistance, and residency is commonly restricted to those receiving these services. People living in group quarters are usually not related to each other.

Group quarters include such places as college residence halls, residential treatment centers, skilled nursing facilities, group homes, military barracks, correctional facilities, and workers' dormitories

Household population projections calculate group quarters population as an inferred residual (total population minus household population). Household population projections do not actively model group quarters population.

II. Base MCD Household Population and Households

The Demographic Services Center's approach to projecting MCD households begins with the Census 2020 data about household population and households. The base data was modified to reflect changes made by the Census Bureau's County Question Resolution program and additional cases researched by the Demographic Services Center.

The first quotient calculates household population rates in the base year (2020 Census). The formula is:

$$HH\ Pop\ Rate_{m,c,2020} = \frac{HH\ Pop_{m,c,2020}}{Tot\ Pop_{m,c,2020}}$$

where $HH\ Pop\ Rate_{m,c,2020}$ is the household population rate for MCD m in county c in 2020.
$HH\ Pop_{m,c,2020}$ is the household population for MCD m in county c in 2020, and
$Tot\ Pop_{m,c,2020}$ is the total population for MCD $m$in county c in 2020.

This household population rate is assumed to hold constant across the span of the projections period (2020-2050). This single rate allows (and may require) the projections to assume consistent definitions of household population and group quarters population until 2050. Living arrangements certainly changed in the 30 years before the projections period (1990-2020). For example, county nursing homes (which the Census Bureau counts as group quarters facilities) were sometimes replaced by assisted living facilities (which the Census Bureau sometimes counts as housing units). The Demographic Services Center's projections cannot anticipate such changes.

MCD population projections used annualized changes from two periods (2010-Census to 2020 Census and 2020 Census to 2023 DSC estimate). For annualized change calculations, the DSC adjusted population figures for the purpose of mitigating known distortions. The known distortions were often attributable to Group Quarters facility closures and known distortions attributable to MCD changes (like

incorporations, cooperative agreements, annexations/detachments, etc.) Changes made to 2010 Census figures to mitigate distortion of 2010-2020 annualized change will not affect the present discussion. Without going into detail, this document lists changes made to 2020 Census figures to mitigate distortion of 2020-2023 change.

The household projections are based on 2020 Census data. At the time of the 2020 Census, there was no Village of Greenleaf in Brown County. DOA projections are required to use the 2020 Census as a base, so they do not include the Village of Greenleaf.

At the time of the 2020 Census, the Town of Rib Mountain in Marathon County had not yet become the Village of Rib Mountain. The projections call this entity the Town of Rib Mountain.

At the time of the 2020 Census, the Town of Lisbon in Waukesha County had not yet become the Village of Lisbon. The projections call this entity the Town of Lisbon.

Effective 11/1/2027, the Town of Blooming Grove in Dane County will be attached to the City of Madison. The 2020-2050 projections took this into account because there was not a single projection point (not even 2030) when the Town Blooming Grove would exist. The 2020-2050 MCD population projections reassigned these 1,622 household residents (no GQ residents) to the City of Madison and completely omitted the Town of Blooming Grove.

III. Projected MCD Household Population and Households

For each MCD, an initial population is projected at 2030, 2050, and 2050 using this formula:

$$HH\ Pop'_{m,c,y} = HH\ Pop\ Rate_{m,c,2020} \times Tot\ Pop_{m,c,y}$$

Where: $HHP'_{m,c,y}$ is the initial household population in MCD m in county c in projection year y, $HH\ Pop\ Rate_{m,c,2020}$ is the household population rate for MCD m in county c, and $Tot\ Pop_{m,c,y}$ is the projected total population in MCD m in county c in projection year y

Then, projected group quarters population at each projection year can be derived for each MCD by subtracting the initial household population from the total population:

$$GQPop'_{m,c,y} = Tot\ Pop_{m,c,y} - HHPop'_{m,c,y}$$

Where $GQPop'_{m,c,y}$ is the initial GQ population projection in MCD m in county c in projection year y,

$Tot\ Pop_{m,c,y}$ is the projected total population in MCD m in county c in projection year y, and

$HHPop'_{m,c,y}$ is the initial household population in MCD m in county c in projection year y.

These initial MCD group quarters populations are then controlled to their respective counties' totals (from the county household projections) to generate controlled MCD group quarters population projections.

$$GP\ Pop_{m,c,y} = \left(\frac{GQ\ Pop_{c,y}}{\sum_{m=1}^{n} GQPop'_{m,c,y}}\right) \times GQ\ Pop'_{m,c,y}$$

Where: $GP\ Pop_{m,c,y}$ is the controlled group quarters population in MCD m in county c in projection year y, and

$GQ\ Pop_{c,y}$ is the group quarters population in county c in projection year y (from county household projections).

$\sum_{m=1}^{n} GQPop'_{m,c,y}$ is the sum of initial group quarters population projections for all the MCDs in the county, and

$GQ\ Pop'_{m,c,y}$ is the initial GQ pop projection in MCD m in county c in projection year y.

To establish finished MCD household populations, these controlled group quarters populations are subtracted from the total populations.

$$HH\ Pop_{m,c,y} = Total\ Pop_{m,c,y} - GQ\ Ppo_{m,c,y}$$

Where: $HH\ Pop_{m,c,y}$ is the controlled household population in MCD m in county c in projection year y

With projected household and group quarters populations completed, attention turns to projecting MCD households. The first step is to project average household sizes. The quotient, (household population ÷ occupied housing units) is also called PPH or persons per household. The ratios of county projected PPH (from the county household projections) to the county base year PPH is applied to the MCD's base year PPH. Spelled out in formula:

$$PPH'_{m,c,y} = PPH_{m,c,2020} \times \frac{PPH_{c,y}}{PPH_{c,2020}}$$

Where: $PPH'_{m,c,y}$ is the initial projected PPH for MCD m in county c in projection year y, $PPH_{m,c,,2020}$is the PPH for MCD m, in county c in the base year 2020, and $PPH_{c,2020}$ is the PPH for county $c$in the base year 2020.

For illustrating the concept, the above transcription might make the most sense. For spreadsheet calculation, this formula can be rewritten, keeping the year-2020 constant values together.

$$PPH'_{m,c,y} = PPH_{c,y} \times \frac{PPH_{m,c,2020}}{PPH_{c,2020}}$$

As a practical consideration, a floor of 1.00 was set for projected PPH. Each occupied housing unit must have at least one household resident, so PPH cannot dip below 1.00. Mainly these were anomalous situations like the zero-population Town of Harrison or zero-person portions of split municipalities.

Next, the initial projected household figures were calculated by dividing the projected household populations (computed earlier in the process) by the projected initial PPH figures.

$$HH'_{m,c,y} = \frac{HH\ Pop_{m,c,y}}{PPH'_{m,c,y}}$$

where $HH'_{m,c,y}$ is the initial projected household figure for MCD m in county c in projection year y.

These initial projected household figures are controlled to the county household projections derived previously.

$$HH_{m,c,y=}\left(HH_{c,y} \div \sum_{m=1}^{n} HH'_{m,c,y}\right) \times HH'_{m,c,y}$$

Where: $HH_{m,c,y}$ is the controlled household figure for MCD m in county c in projection year y,

$HH_{c,y}$ is the number of households in county c in projection year y,

$\sum_{m=1}^{n} HH'_{m,c,y}$
is the sum of initial projected households for all MCDs in county c in projection year y, and

$HH'_{m,c,y}$ is the initial projected household figure for MCD m in county c in projection year y.

With finished household figures and household population figures, it is possible to calculate projected household sizes (persons per household or PPH) for each MCD.

$$PPH_{m,c,y} = \frac{HH\ Pop_{m,c,y}}{HH_{m,c,y}}$$

Where: $PPH_{m,c,y}$ is the controlled average household size for MCD m in county c in projection yr y.