Methodology for State and County Household Projections 2020-2050

I. Introduction

County household projections rely on the Department of Administration's county age-sex population projections for 2020 – 2050.[1] The population values anchor the age-specific projections in the household series. The county population projections use 5-year age groups (0-4, 5-9, … 80-84, and 85+). The Census Bureau's Demographic and Housing Characteristics file (table PCT3)[2] uses a mix of 5-year and 10-year groups starting at age 15 (15-24, 25-34, … 75-84, 85+). This limitation of household data requires the household projections to aggregate household population projections into comparable age groups. After a certain point in the process, complexities arising from householders living with people who are not the same sex or not the same age group lead the DSC to use "both sexes" data rather than female data and male data.

The Demographic Services Center developed provisional county population projections using a modified Hamilton-Perry method. (The modifications included excess death calculations and trended Age-Specific Fertility Rates instead of Child-Woman ratios.) These provisional projections were controlled to a state control total developed outside the Hamilton-Perry method. (This state control total involved calculating the historical trend of Wisconsin population as a percentage of U.S. population, assuming the trendline would continue, and applying future percentages to U.S. Census Bureau population projections.)

Household projections start with uncontrolled county household projections and simply sum the 72 county projections to an uncontrolled state household projection. (Household projections are bottom-up, unlike population projections, which are top-down.)

The Census Bureau "household" as follows:

> 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. There are two major categories of households, "family" and "nonfamily."[3]

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[1] See documentation at https://doa.wi.gov/DIR/Method_Pop_Proj_2020_2050.pdf.

[2] See https://data.census.gov/table/DECENNIALDHC2020.PCT3?q=PCT3:+HOUSEHOLD+TYPE+BY+AGE+OF+HOUSEHOLDER.

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

The Census Bureau defines "householder" as follows:

> The person, or one of the people, in whose name the home is owned, being bought, or rented.
>
> If there is no such person present, any household member 15 years old and over can serve as the householder.
>
> Two types of householders are distinguished: a family householder and a nonfamily householder. A family householder is a householder living with one or more people related to him or her by birth, marriage, or adoption. The householder and all people in the household related to him are family members.
>
> A nonfamily householder is a householder living alone or with nonrelatives only. [4]

Each household has exactly one householder, so the number of householders and the number of households will be equal in the rubric used by the U.S. Census Bureau. Wisconsin Department of Administration household projections use Census data and follow Census definitions.

The householder age data starts with the age group 15-24, which is consistent with the above definition stating that any household member 15 years old and over can serve as the householder. (Generally, people under 15 seldom rent or own housing units; people under 15 are often members of households headed by other people who are at least 15 years old.)

In contrast to "household", the Census Bureau says the following about "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.
>
> 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. [5]

College dorms and skilled nursing homes are generally counted as Group Quarters facilities; boarding schools and assisted living facilities are not supposed to be counted as Group Quarters facilities, but outcomes vary.

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[4] See https://www.census.gov/glossary/?term=Householder.

[5] See https://www.census.gov/glossary/?term=Group+Quarters+(GQ).

II. Base & Projected County Household Rates.

County Household projections require two base rates:

- the household population as a share of total population, by age (called the S rates in the formulas that follow); and

- householders as a share of household population, by age (called the householder rate or HR, for short).

Data for the 2030-2050 projections' S rates were obtained from Census 2020 DHC PCT13 (Sex by Age for the Population in Households), and the total population by age and sex used for 2020 county population projections. Two reminders: (a) adjustments had been made to Jefferson and Walworth counties due to the re-assignment of three U.W.-Whitewater dorms from the Village of Fontana-on-Geneva Lake to the Jefferson County portion of the City of Whitewater; and (b) these adjustments to Group Quarters population affect total population (denominator), but do **not** affect household population (numerator).

$$S_{a,c,2020} = \frac{HHPop_{a,c,2020}}{P_{a,c,2020}}$$

Where $S_{a,c,2020}$ is the household population share for age group a in county c in 2020.

$HHPop_{a,c,2020}$ is household population in age group a in county c in 2020; and

$P_{a,c,2020}$ is the total population in age group a in county c in 2020.

The DSC calculated trended household population shares (S rates). The DSC decided that static household population shares (S rates) from Census 2020 would be the better approach.

After the above S rates (household population shares by age group) are calculated, the S rates are multiplied by the both-sexes county population projections, 2030 through 2050, to produce projected household population by 10-year age groups, using the following formula:

$$HHPop_{ac,y} = P_{ac,y} \times S_{ac,2020}$$

Where $HHPop_{ac,y}$ is the household population in age group a at projection year y;

$P_{ac,y}$ is the population in age group a in county c at projection year y; and

$S_{a,c,2020}$ is the household population share for age group a in county c in 2020

The present vintage of household projections assumes that the S rates will remain constant from 2020 through the projection period (2030-2050). This relies on the total population and the household population share. The latter (household population share) can be volatile if there are pronounced group quarters population increases (say a newly built prison) or pronounced group quarters population decreases (say closure of a college, a Catholic facility, or a nursing home).

When this document was drafted, the Department of Administration did not see any appropriate way to forecast future changes to group quarters populations.

The household population projections were then summed to age groups that matched the age groups in 2020 Census householder data (Table PCT3 Household Type by Age of Householder). The age groups are 15-24, 25-34, 35-44,45-54, 55-59, 60-64, 65-74, 75-84, 85 & over. In formulas above, the population age groups were referred to with a. In the householder rate formula, this changes to a', reflecting the shift to householder age groups (instead of population age groups).

The basic householder rate formula is:

$$HR_{a'c,2020} = \frac{HHolder_{a'c,2020}}{HHPop_{a'c,2020}}$$

Where $HR_{a'c,2020}$ is the householder rate for group a' (householder age categories) in county c, in 2020;

$HHolder_{ac,2020}$ is the number of householders in age group a' in county c, at in 2020;

$HHPop_{a'c,2020}$ is the number of people living in households for age group a' in county c, in 2020.

The U.S. Census Bureau's definition of householder seems to exclude people under 15, so the householder rate for ages 0-14 is presumed to be zero.[6]

Static 2020 householder rates were thought to be the most appropriate option among the imperfect options considered. The constant-share method was used in prior DOA projections.

[6] See above, footnote 4, on page 2 of this document.

To project households by age of householder, the formula is:

$$HHolders_{a'c,y} = HR_{a'c,2020} \times HHPop_{a'c,y}$$

Where: $HHolders_{a'c,y}$ is the number of householders (which equals the number of households) in age group a' in county c in projection year y.

$HR_{a'c,b}$ is the householder rate for group a' (householder age categories) in county c, in 2020; and

$HHPop_{a'c,y}$ is the number of people living in households for age group a' in county c, at projection year y.

III. Other Projected County Values

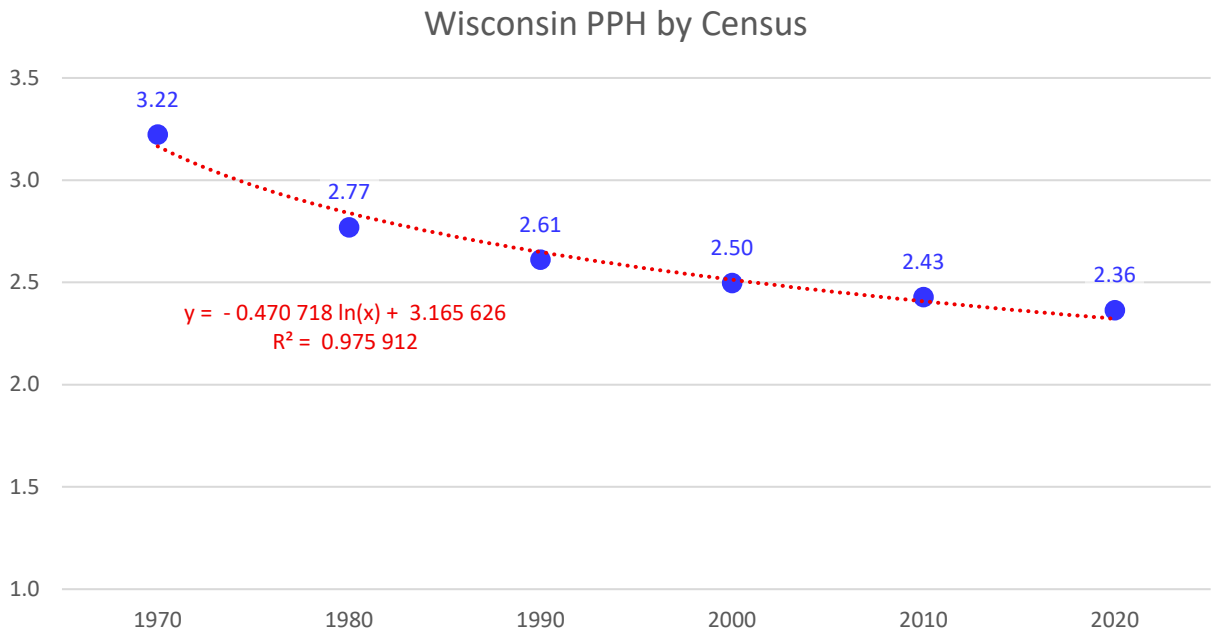
The above-described figures (household projections and household population projections) allow DOA to project county average household size (or household population per household, abbreviated PPH). These county PPH figures will be used in minor civil division (MCD) household projections. For county household size (PPH), the formula is

$$PPH_{c,y} = \sum_{a'=1}^{n} HHPop_{a'c,y} \div \sum_{a'=1}^{n} HHPop_{a'c,y}$$

Where: $PPH_{c,y}$ is the household size (persons per household) in county c in year y.

To repeat an earlier comment, for the summation operations in the equation above, the household population consists of nine age groups (starting at ages 0-14), while the householders consist of only eight age groups (starting at 15-24). Nonetheless, the householder rate for the household population ages 0-14 is presumed to be zero (because Census Bureau definitions do not allow householders under 15).

DOA's population estimates program includes a calculation of Wisconsin PPH from several decennial counts.



Wisconsin PPH trends exhibit two salient features. (1) The household size (PPH) has been consistently decreasing each decade. (2) Although the decrease continues, the decrease has slowed. This trendline suggests that it would not make sense to use 2010 Census figures or an average of 2010 and 2020

Census figures when calculating householder rates. The curve appears to be flattening somewhat (perhaps even more quickly than the natural log trendline), so trending the 2010 and 2020 householder rates forward might overstate the decrease. Using more decades of past data might help reduce county volatility in some cases but might also introduce more volatility if a GQ facility opened that seems significant in relation to total population in a particular county in a particular age group.

The projected county Group Quarters population was inferred by subtracting the aggregated household population from the total projected population. These values are needed as controls in the MCD projections. Written as a formula:

$$GQP_{c,\ y} = P_{c,\ y} - \sum_{a'=1}^{n} HHold\ Pop_{a'\ c,\ y}$$

Where $GQP_{c,\ y}$ is the group quarters population in county c at projection year y,

$P_{c,\ y}$ is the total population in county c at projection year y, and

$HHold\ Pop_{a'\ c,\ y}$ is the number of people living in households for age group a' in county c, at projection year y.