

# Vintage 2008 Minor Civil Division Household Projection Methodology: Some Salient Points

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## Introduction

The development of household projections at the minor civil division (MCD) level is a multiple-step process that relies on a series of previously derived projections. Demographic Services Center's county-level population projections by age and sex serve as the basis for subsequent projection series because they provide county control totals. Based on these county projections, we then calculated projected county households, household population, group quarters and average household size. In addition, we produced a set of MCD population projections. While lacking age-sex detail, the MCD projections within each county are controlled to the respective county's values.<sup>1</sup>

Once all of these elements were in place, municipal household projections could be calculated.<sup>2</sup> By producing detailed projections in this manner, all of the projection series are consistent in their basic assumptions about population change and household formation.

Our definition of a household follows the standard Census Bureau definition at Census 2000: all persons who occupy a room or group of rooms as their separate living quarters—that is, a housing unit in which the occupants live and eat separately from any other person or persons in the building and which has direct access from outside the building or through a common hall.

Persons living in nursing homes, correctional institutions, mental care facilities, dormitories, convents, rooming and boarding houses, halfway houses and the like constitute group quarters population. Persons living in households constitute the household population. Thus, the household population equals the total population minus persons living in group quarters.

## Estimated MCD Household Population and Households at 2005

To begin, we calculated the interpolated population estimate, for April 1, 2005, for each MCD from Demographic Services' annual series. Within our estimation data, we also had estimated group quarters, aggregated to the MCD level. Hence, subtracting the latter from the former produced estimated MCD household populations. Furthermore, we computed the proportion of household population at 2005—the household population rate—which will be applied in projections mode.

$$HHPR_{mc,2005}^{\wedge} = HHP_{mc,2005}^{\wedge} \div P_{mc,2005}^{\wedge}$$

Where  $HHPR_{mc,2005}^{\wedge}$  is the estimated household population rate for municipality  $m$  in county  $c$  at 2005,  
 $HHP_{mc,2005}^{\wedge}$  is the estimated household population for municipality  $m$  in county  $c$  at 2005,  
And  $P_{mc,2005}^{\wedge}$  is the estimated population for municipality  $m$  in county  $c$  at 2005.

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<sup>1</sup> The small population size of many of Wisconsin's minor civil divisions—more than 1,000 MCDs have fewer than 1,000 in population—makes age-sex detailed municipal projections too unreliable.

<sup>2</sup> In this document, the terms "minor civil division," "municipality" and "community" are used interchangeably, but all computations occur at the minor civil division level of geography. In the Census Bureau's parlance, "county subdivision" is more commonly used now.

To determine the estimated number of households at 2005, an estimated average household size (or persons per household, abbreviated as PPH) needed to be established. Drawing upon the county-level household projections, we multiplied the MCD PPH at 2000 by the ratio of the estimated county PPH at 2005 to the county PPH at 2000.

$$PPH_{mc,2005}^{\wedge} = PPH_{mc,2000} \times (PPH_{c,2005}^{\wedge} \div PPH_{c,2000})$$

- Where  $PPH_{mc,2005}^{\wedge}$  is the estimated average household size for municipality  $m$  in county  $c$  at 2005,  
 $PPH_{mc,2000}$  is the average household size for municipality  $m$  in county  $c$  at 2000,  
 $PPH_{c,2005}^{\wedge}$  is the estimated average household size for county  $c$  at 2005,  
 And  $PPH_{c,2000}$  is the average household size for county  $c$  at 2000.

Dividing the estimated household population by the estimated PPH for each MCD produced an initial estimated count of MCD households.

$$HH'_{mc,2005} = HHP_{mc,2005}^{\wedge} \div PPH_{mc,2005}^{\wedge}$$

- Where  $HH'_{mc,2005}$  is the initial estimated number of households for municipality  $m$  in county  $c$  at 2005,  
 $HHP_{mc,2005}^{\wedge}$  is the estimated household population for municipality  $m$  in county  $c$  at 2005,  
 And  $PPH_{mc,2005}^{\wedge}$  is the estimated average household size for municipality  $m$  in county  $c$  at 2005,

Summing all component MCDs within a county may not have equaled the county estimated households exactly (the maximum difference in one county was 1.8%, with the other 71 counties within 0.5%), so the MCD households were controlled proportionally to the county estimate to produce a final estimate of MCD households.

$$HH_{mc,2005}^{\wedge} = \left( \sum_{m=1}^n HH'_{mc,2005} \div HH_{c,2005}^{\wedge} \right) \times HH'_{mc,2005}$$

- Where  $HH_{mc,2005}^{\wedge}$  is the (final) estimated number of households for municipality  $m$  in county  $c$  at 2005,  
 $\sum HH'_{mc,2005}$  is the sum of initial estimated households for all municipalities in county  $c$  at 2005,  
 And  $HH_{c,2005}^{\wedge}$  is the estimated number of households for county  $c$  at 2005.

### Projected MCD Household Population and Households, 2005-2030

In projecting household population forward, we assume that the household population rate at the base year—in this vintage, 2005—will remain constant across time. While this assumption is a rather broad one, we cannot anticipate the openings or closings of large institutions, or extensive shifts in smaller group quarters. Generally, group quarters are concentrated in larger cities and villages, and it is reasonable to presume that, as a community's population grows or contracts, the group quarters population will increase or decrease in similar proportions.

Multiplying the household population rate by the projected total population, as computed in the MCD population projection series from 2005 through 2030, produced an initial, uncontrolled household population. Subtracting the initial household population from the total population generated an uncontrolled group quarters population.<sup>3</sup>

$$HHP'_{mc,p} = HHPR_{mc,2005}^{\wedge} \times P'_{mc,p}$$

$$P'_{mc,p} - HHP'_{mc,p} = GQP'_{mc,p}$$

- Where  $HHPR_{mc,2005}^{\wedge}$  is the estimated household population rate for municipality  $m$  in county  $c$  at 2005,  
 $P'_{mc,p}$  is the projected population for municipality  $m$  in county  $c$  at year  $p$ ,  
 $HHP'_{mc,p}$  is the initial projected household population for municipality  $m$  in county  $c$  at year  $p$ ,  
 And  $GQP'_{mc,p}$  is the initial projected group quarters population for municipality  $m$  in county  $c$  at year  $p$ .

<sup>3</sup> Conversely, one could compute a “group quarters population rate” and multiply by the MCD total projected population to produce the uncontrolled group quarters projected population.

We then aggregated these initial group quarters values to county levels. In most cases, these sums did not match the “targets” from our county-level household projections, so the MCD values were iterated to match the county results.

$$GQP''_{mc,p} = \left( \sum_{m=1}^n GQP'_{mc,p} \div GQP'_{c,p} \right) \times GQP'_{mc,p}$$

Next, we subtracted these controlled MCD-level group quarters populations from the projected total populations to generate revised projected household populations.

$$P'_{mc,p} - GQP''_{mc,p} = HHP''_{mc,p}$$

In order to calculate MCD-level projected households, we again returned to the relationship of each county’s projected average household size to the base 2005 average household size. This ratio was calculated at each projection interval, then multiplied by the base MCD estimated PPH to produce projected average household sizes.

$$PPH'_{mc,p} = PPH^{\wedge}_{mc,2005} \times (PPH'_{c,p} \div PPH^{\wedge}_{c,2005})$$

- Where  $PPH'_{mc,p}$  is the projected average household size for municipality  $m$  in county  $c$  at year  $p$ ,  
 $PPH^{\wedge}_{mc,2005}$  is the estimated average household size for municipality  $m$  in county  $c$  at 2005,  
 $PPH'_{c,p}$  is the projected average household size for county  $c$  at year  $p$ ,  
 And  $PPH^{\wedge}_{c,2005}$  is the estimated average household size for county  $c$  at 2005,

Dividing the revised projected household population by the projected PPH produced an initial projected household count.

$$HH'_{mc,p} = HHP''_{mc,p} \div PPH'_{mc,p}$$

We then aggregated these initial municipal household values to county levels. As with the estimated households at 2005, the slight differences with county-level projected households were corrected through simple proportions to match the county results and generate the final projected MCD households.

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