

Making National Estimates with the  
National Health and Aging Trends Study

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## **Introduction**

The National Health and Aging Trends Study (NHATS) was designed to follow successive nationally representative cohorts of persons ages 65 and older. The baseline sample was initially interviewed in 2011 and the first replenishment sample was initially interviewed in 2015. Future replenishments at 5-year intervals are in the planning stages. This design supports analysis of late-life disability trends and individual trajectories.

NHATS samples were drawn from the Medicare enrollment file in October preceding initial fieldwork. Because interviews do not begin until May of the following year and continue through early November, there is a gap of between 7 and 13 months between sampling and when individuals are interviewed. During this gap, the sample ages and deaths occur. Consequently, the resulting sample that is interviewed represents a slightly smaller and older population than the Medicare frame.

The Medicare enrollment file includes approximately 96% of all older adults living in the US. Data from the US Census Bureau captures the additional 4% of older adults in the US who are not enrolled in Medicare. Older adults who are not enrolled in Medicare include individuals who were born in another country and never qualified for Social Security benefits in the US and persons who defer Medicare enrollment because of continued health insurance coverage through an employer.

For many estimates of distributions within the older population and for the study of relationships among factors related to disability, these issues are not of consequence and can be ignored. Analysts interested in producing national estimates of the number of older adults with a particular characteristic may, however, wish to standardize their findings by age and sex to either the Medicare frame or, in some cases, to Census Bureau estimates. For those interested in tracking national trends over time, controlling for shifts in the age- sex- distribution of the population, post-stratification of multiple years to the same source might be of interest.

This technical paper provides details on how to standardize NHATS estimates to the Medicare frame and Census totals. The Background section describes in more detail the Medicare frame and NHATS sample and how they differ. It also describes age-sex totals drawn from Census Bureau data. The following section illustrates the approach by estimating the size of the older population by residential setting, first using only NHATS weights and then standardizing weighted estimates to Medicare and to Census controls. Finally, we demonstrate how the same technique can be used to adjust population estimates over time to account for shifts in the age and sex distribution of the population.

## **Background**

The Centers for Medicare and Medicaid Services (CMS) provides random subsamples of the Medicare enrollment file (technically known as the Enrollment Database (EDB)) for use as sampling frames. The random subsamples help keep the data files manageable in size and limit overlap among surveys using the EDB as a sampling frame.

Beneficiary records were excluded from the frame if: age was less than 65 as of September 30, 2010 (or 2014 for the 2015 replenishment), if the record indicated the individual was deceased, if the location was outside the contiguous United States; or if state/county codes were invalid/unidentified (about 0.01 percent of records). A multi-stage design was implemented to draw the sample in each year (for details see Montaquila et al. 2012a; DeMatteis et al. 2016a).

Weighted population counts of the Medicare population living in the contiguous US are provided in Table 1 by age and sex. On September 30, 2010, 38.2 million older adults were in the enrollee file; on September 30, 2014, the figure had grown to 43.9 million.<sup>1</sup>

**Table 1. Population Ages 65 and Older, by 5-year age group and sex: Medicare and NHATS**

Age Group	Medicare in Contiguous US		NHATS w/Analytic Weights	
	Population as of Sept. 30, 2010	Population as of Sept. 30, 2014	2011	2015
<b>Men</b>				
65-69	5,491,440	6,855,860	4,649,902	5,671,878
70-74	4,087,340	4,941,100	4,097,017	5,071,147
75-79	3,027,820	3,367,300	3,001,146	3,524,465
80-84	2,169,060	2,257,880	2,173,979	2,208,455
85-89	1,194,880	1,307,620	1,224,397	1,358,952
90+	524,540	648,680	463,619	624,319
<b>Women</b>				
65-69	6,124,980	7,601,440	5,250,466	6,226,214
70-74	4,781,940	5,695,060	4,843,444	6,077,509
75-79	3,886,940	4,182,460	3,878,674	4,196,832
80-84	3,249,940	3,165,560	3,215,654	3,137,807
85-89	2,230,480	2,253,980	2,257,969	2,157,300
90+	1,382,160	1,577,880	1,329,677	1,534,438
<b>Total</b>	<b>38,151,520</b>	<b>43,854,820</b>	<b>36,385,944</b>	<b>41,789,316</b>

The NHATS Sample was interviewed from May through November of the following year. Analytic weights, which account for differential probabilities of selection and (non)response, yield a weighted population of 36.4 million in 2011 and 41.8 million in 2015 (see Montaquila et al. 2012b, DeMatteis et al. 2016b for details).<sup>2</sup> Because of deaths between sampling and interview, the weighted sample represents approximately 95% of the frame. The other key difference between the Medicare frame numbers and the weighted NHATS numbers is that the youngest age group is about 80%-85% of its original size (because individuals aged 68 or 69 moved into the next age group during the gap between sampling and interview).<sup>3</sup>

<sup>1</sup>Estimates provided by CMS based on program data describe the Medicare population ages 65 and older as 41,702,773 in 2010 and 47,582,380 in 2014. These figures are larger than the point in time estimates used as the frame for the NHATS sample because they include individuals ever on Medicare during the calendar year (including those who died) as well as those living outside the contiguous United States. For details see: [https://www.cdwdata.org/cs/groups/public/documents/document/wls\\_ucm1-013656.pdf](https://www.cdwdata.org/cs/groups/public/documents/document/wls_ucm1-013656.pdf).

<sup>2</sup> We use w1anfinwgt0 to generate the 2011 estimates. For 2015, the NHATS SP file includes two analytic weights, w5anfinwgt0, which provides a 2015 estimate, and w5an2011wgt0, which weights continuing sample persons back to 2011 totals. For this exercise we used the former.

<sup>3</sup> Age group is measured at the time of sampling for the Medicare frame estimates and at the time of survey for the NHATS estimates.

The Census Bureau’s American Community Survey also provides estimates of the resident population ages 65 and older (US Census 2016). In Table 2, we present estimates after removing individuals living in Alaska, Hawaii, and Puerto Rico to yield counts of individuals by age and sex as of July 2010 and July 2014 in the contiguous US. Note that the top age group for the ACS is 85 and older.

**Table 2. Population Ages 65 and Older, by 5-year age group and sex: Census**

	Population as of July 1 2010	Population as of July 1 2014
<u>Age Group</u>		
<u>Men</u>		
65-69	5,773,054	7,105,274
70-74	4,185,119	4,995,740
75-79	3,123,735	3,438,329
80-84	2,264,379	2,331,936
85+	1,773,244	2,057,940
<u>Women</u>		
65-69	6,488,377	7,915,224
70-74	4,959,052	5,851,969
75-79	4,051,216	4,320,201
80-84	3,391,403	3,309,010
85+	3,670,746	3,966,339
<u>Total</u>	<u>39,680,325</u>	<u>45,291,962</u>

Note: Excludes Alaska, Hawaii and Puerto Rico.

In July 2010, 39.7 million adults were ages 65 and older (see Table 2); the figure was 45.3 million in July 2014. In other words, the NHATS weighted estimates are approximately 92% of the Census estimates and the Medicare frame estimates are approximately 96%-97% of the Census estimates.

Analysts interested in making estimates of population counts (e.g. the number of Medicare beneficiaries with a particular characteristic) may wish to standardize estimates from NHATS to the Medicare frame numbers in Table 1 or to the Census numbers in Table 2. Standardization to the Medicare frame assumes no major differences within age and sex groups between the weighted survey and the frame. This assumption is reasonable given the relatively short time gap between sampling and survey. Standardization to the Census data requires an additional assumption that the 4% of older adults living in the US who do not appear in the Medicare frame do not differ systematically from those who are eligible for Medicare. The latter assumption may be reasonable for some estimates but not for others (e.g. estimates of the foreign born population may be biased).

## Basic Steps

Except for the terminal age group (e.g. 90+ vs. 85+), the steps for standardizing are identical for Medicare and Census totals:

Step 1. Estimate age- and sex-specific percentages of the characteristic of interest.

Step 2. Multiply the age- and sex- specific percentages in Step 1 by external population estimates.

Step 3. Sum the age- and sex- specific population estimates from Step 2 to yield the standardized number of older adults with the characteristic of interest.

Step 4. Divide by the population estimate obtained in Step 3 by the total size of the standardized population to obtain the percentage of the standardized population with the characteristics of interest.

Equivalently, analysts may prefer to post-stratify the NHATS analytic weights by multiplying the weights by the ratio of the frame population to the survey population for each age- and sex- group.

## Two Examples: Distribution and Size of The Older US Population by Residential Setting

We provide two examples below: (1) standardizing the 2011 and 2015 rounds of NHATS to the Medicare frame/Census closest to the survey year, and (2) standardizing the 2011 and 2015 rounds of NHATS to the same year. The latter illustrates one way to control for shifts in the age and sex distribution of the older population over time.

In this illustration we create a variable indicating residential setting. For 2011, we used a combination of r1dresid and fl1retirecom to define four groups: traditional community housing, retirement or senior housing, independent or assisted living in residential care, and nursing home care (for details see Freedman and Spillman 2014). For 2015, we repeated the tabulations with r5dresid and fl5retirecom, leaving out cases that have a value of 6 (deceased) for r5dresid. Percentages are provided in Table 3.

**Table 3. Weighted Percentage of Population Ages 65 Living in the Community and Residential Care Settings, 2011 and 2015, by Age Group and Sex**

Age Group	2011				2015			
	Community	Retirement Community	Residential Care	Nursing Home	Community	Retirement Community	Residential Care	Nursing Home
<b>Men</b>								
65-69	93.5%	4.9%	1.1%	0.5%	96.0%	2.5%	0.9%	0.6%
70-74	89.2%	7.2%	1.8%	1.7%	92.5%	5.7%	0.8%	1.0%
75-79	90.6%	5.7%	2.1%	1.5%	89.8%	6.8%	2.2%	1.2%
80-84	84.3%	6.9%	6.0%	2.8%	85.4%	6.1%	6.1%	2.4%
85-89	77.7%	5.4%	13.0%	4.0%	78.8%	6.0%	11.6%	3.6%
90+	65.5%	8.6%	15.5%	10.4%	70.5%	2.7%	18.6%	8.2%
<b>Women</b>								
65-69	93.4%	5.1%	1.2%	0.3%	93.5%	4.0%	0.9%	1.5%
70-74	87.9%	7.3%	3.6%	1.3%	91.2%	5.4%	2.5%	0.8%
75-79	84.7%	7.3%	5.3%	2.7%	87.6%	7.2%	3.5%	1.7%
80-84	79.2%	8.3%	7.9%	4.6%	77.3%	8.9%	8.9%	4.9%
85-89	66.6%	8.0%	15.7%	9.7%	71.6%	7.0%	13.7%	7.6%
90+	46.6%	9.0%	26.2%	18.2%	52.6%	7.7%	23.7%	16.1%
<b>Total</b>	<b>85.0%</b>	<b>6.7%</b>	<b>5.4%</b>	<b>3.0%</b>	<b>87.4%</b>	<b>5.6%</b>	<b>4.5%</b>	<b>2.5%</b>

**Example 1.** Table 4 shows estimates from the 2011 and 2015 rounds of NHATS standardized to frame estimates in the year closest to the survey year. For each year we provide three sets of estimates: 1) no standardization (NHATS analytic weights only); 2) standardization to the Medicare frame; and 3) standardization to Census estimates.

**Table 4. Number and Percentage of Older Adults by Residential Setting: By Year and Standardization Source**

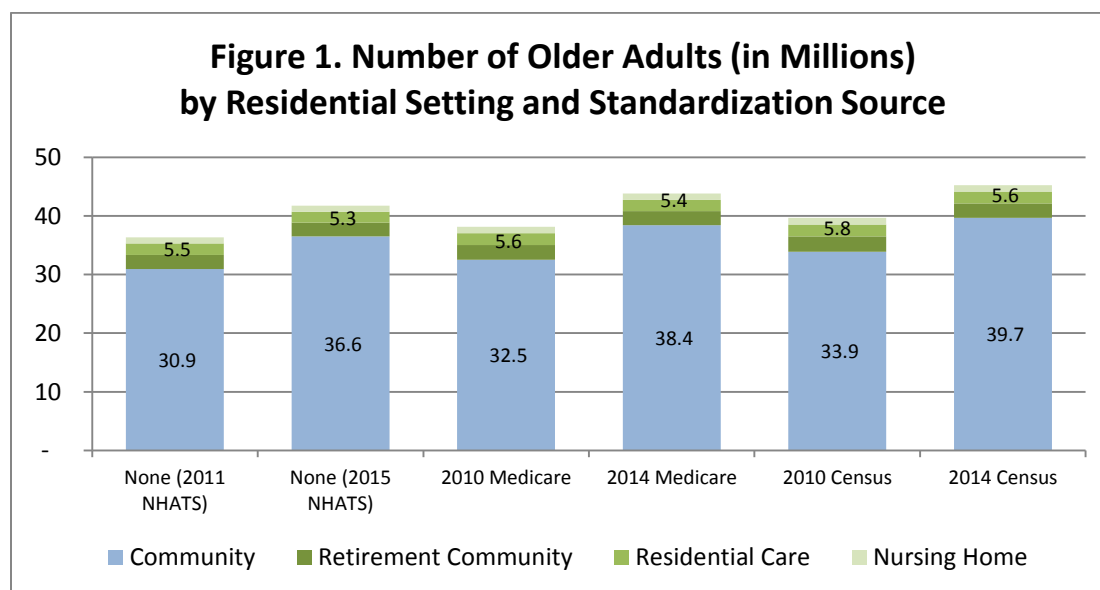
Year	Standardization Source	Community	Retirement Community	Residential Care	Nursing Home
		Community	Community	Care	Home
2011	None (2011 NHATS)	30,929,177 85.0%	2,426,005 6.7%	1,950,997 5.4%	1,079,940 3.0%
	2010 Medicare	32,547,860 85.3%	2,518,027 6.6%	1,986,518 5.2%	1,099,284 2.9%
	2010 Census	33,901,515 85.4%	2,612,467 6.6%	2,042,657 5.1%	1,123,864 2.8%
2015	None (2015 NHATS)	36,514,938 87.4%	2,332,549 5.6%	1,880,888 4.5%	1,059,276 2.5%
	2014 Medicare	38,447,232 87.7%	2,390,697 5.5%	1,917,611 4.4%	1,097,494 2.5%
	2014 Census	39,695,352 87.6%	2,469,180 5.5%	1,988,268 4.4%	1,137,329 2.5%

In this example, standardization makes only a small difference in the *percentage* of older adults in each setting. In 2011, for instance, only 0.3% more older adults are living in traditional community settings using Medicare as the source of standardization (85.3% vs. 85.0%). Standardization to Census results in 0.4% more older adults in the community (85.4% vs. 85.0%). In 2015, percentages differ by an even smaller amount before and after post-stratification.

In terms of absolute *numbers*, the differences are more substantial, depending on the specific group of interest. For example, using just the NHATS analytic weights in 2011, the traditional community population is 30.9 million whereas standardizing to the Medicare frame yields an estimate of 32.5 million – an addition of 1.6 million. Standardization to Census estimates increases the estimate by 3 million to 33.9 million, a 10% increase. However, nursing home estimates fall within a relatively narrow range. NHATS yields an estimate of 1.08 million. When standardized to the Medicare frame, the estimate is 1.10 million and when standardized to Census estimates it is 1.12 million.<sup>4</sup> The 2015 numbers are 1.06 million, 1.10 million and 1.14 million, respectively.

<sup>4</sup> The American Community Survey provides estimates of the population living in institutional and noninstitutional group quarters. Besides nursing facilities, the definition of institutional group quarters includes correctional facilities and other institutional and non-institutional facilities. Estimates for 2010 (from the US Census) suggest 1.30 million people (395,351 men and 902,503 women) ages 65 and older in nursing facilities and other institutional settings. Considering the additional settings included in the ACS institutional group quarters population, the 2011 NHATS estimate of the nursing home population standardized to Census estimates (1.12 million) seem reasonably in line. For details see Voss and Martin 2012.

Figure 1 shows estimates (in millions) of the older population in traditional community and all other settings (retirement, residential care, and nursing home combined) by standardization source in 2011 and 2015. The reduction of older adults in nontraditional settings is similar across the three sets of estimates – decreasing by about 200,000. Similarly, the growth of individuals in traditional community-based settings is just under 6 million for all three scenarios.



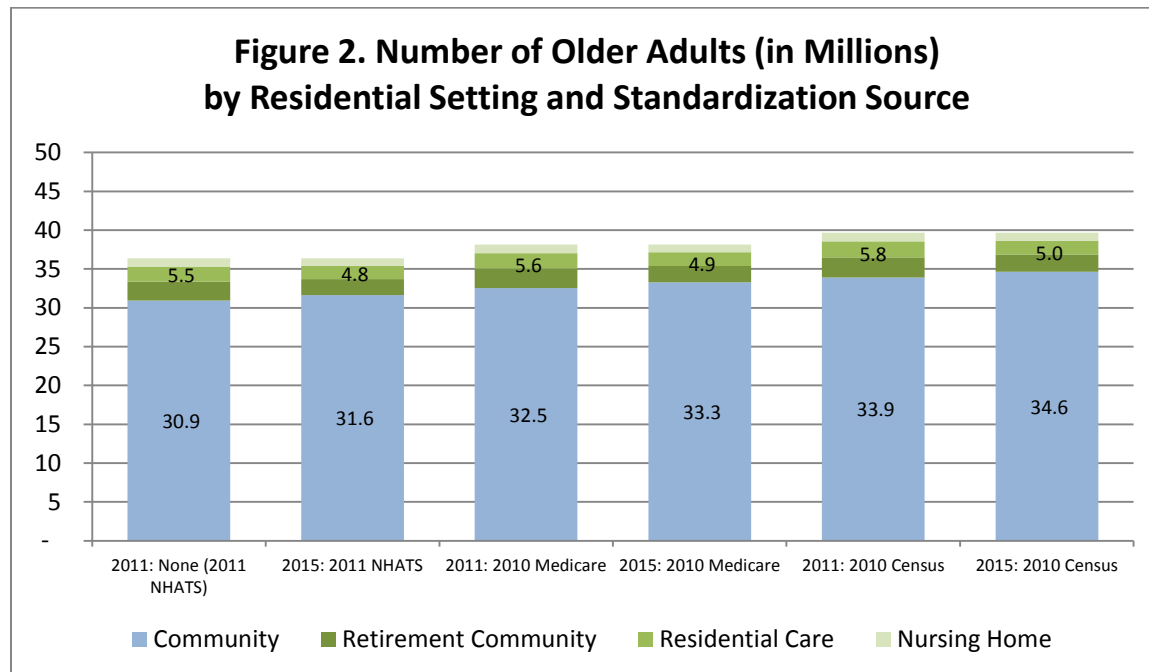
**Example 2.** Table 5 illustrates how to use standardization to control for changes in the age and sex distributions of the older population. The 2015 estimates are standardized to three 2010/2011 sources.

**Table 5. Number and Percentage of Older Adults by Residential Setting: By Year and Standardization Source**

Year	Standardization Source	Residential Setting			
		Community	Retirement Community	Residential Care	Nursing Home
2011	None (2011 NHATS)	30,929,177	2,426,005	1,950,997	1,079,940
		85.0%	6.7%	5.4%	3.0%
2010	Medicare	32,547,860	2,518,027	1,986,518	1,099,284
		85.3%	6.6%	5.2%	2.9%
2010	Census	33,901,515	2,612,467	2,042,657	1,123,864
		85.4%	6.6%	5.1%	2.8%
2015	None (2015 NHATS)	36,514,938	2,332,549	1,880,888	1,059,276
		87.4%	5.6%	4.5%	2.5%
2011	NHATS	31,622,051	2,071,000	1,724,873	966,567
		86.9%	5.7%	4.7%	2.7%
2010	Medicare	33,263,792	2,130,347	1,759,426	996,420
		87.2%	5.6%	4.6%	2.6%
2010	Census	34,638,006	2,212,315	1,806,510	1,021,904
		87.3%	5.6%	4.6%	2.6%

Standardization of the 2015 estimates to 2011 NHATS, 2010 Medicare, and 2010 Census makes only a small difference in the *percentage* of older adults in each setting. In terms of absolute *numbers*, the differences are again more substantial, particularly for the group living in traditional community settings.

Figure 2 shows the reduction in the number of older adults in non-traditional settings between 2011 and 2015 would have been even larger if the age and sex distribution had not also shifted. Again, the reduction of older adults in nontraditional settings is similar across the three sets of estimates – decreasing by about 700,000, compared with the change of about 200,000 in Figure 1. Similarly, the growth of individuals in traditional community-based settings is about 700,000 for all three standardizations.



## Conclusions

We have provided users with the age-sex specific Medicare frame and Census totals so that they may standardize NHATS estimates to these sources if they choose. We have also illustrated how to calculate age- and sex- standardized estimates with NHATS, both at a point in time and over time, using the weighted survey estimates, the Medicare frame, and Census totals.

In this particular illustration, standardizing to the frame closest to the survey did not alter percentages much but absolute numbers (population estimates) were affected. Standardizing to 2015 NHATS estimates to three different 2010/2011 frames, which controlled for age and sex shifts over time, yielded similar conclusions about changes between 2011 and 2015 in residential settings.

We recommend that analysts consider standardizing to the Medicare or Census totals in the closest year if they plan to publish national estimates of the number of older adults with a particular characteristic and to a 2011 frame if they plan to draw conclusions about changes over time net of shifts in the age and sex distribution of the population.



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