NHATS Technical Paper #17

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 (for details see Montaquila et al. 2012a; DeMatteis et al. 2016a). 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 in prevalence 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. For characteristics not available for NHATS respondents initially living in nursing home settings, analysts may wish to standardize to population counts representing the non-nursing home population. For analysts working with both NHATS and the National Study of Caregiving (NSOC), which interviews informal caregivers of NHATS respondents, standardization of the number of caregivers to recipient counts consistent with Medicare or Census may also be of interest.

This technical paper provides details on how to standardize NHATS estimates to the Medicare frame and Census totals. The first section compares age-sex totals drawn from the Medicare frame with those from NHATS. It also provides age-sex totals from Census Bureau data. Next, we illustrate the standardization 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. We also demonstrate how the same technique can be used to adjust prevalence estimates over time to account for shifts in the age and sex distribution of the population. Finally, we provide age-sex population counts for the subgroup of older adults living in settings other than nursing homes and for informal caregivers to older adults. The latter can be used to adjust estimates from the National Study of Caregiving (NSOC) by age and sex of the NHATS care recipient.

Standardizing to the Total Population Ages 65 and Older

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.[1]

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

	Medicare in Contiguous US		NHATS w/Analytic Weights	
	Population as of Sept. 30, 2010	Population as of Sept. 30, 2014	2011	2015
Age Group				
Men				
65-69	5,491,440	6,855,860	4,649,902	5,758,383
70-74	4,087,340	4,941,100	4,097,017	4,981,047
75-79	3,027,820	3,367,300	3,001,146	3,530,715
80-84	2,169,060	2,257,880	2,173,979	2,206,928
85-89	1,194,880	1,307,620	1,224,397	1,361,759
90+	524,540	648,680	463,619	627,331
Women				
65-69	6,124,980	7,601,440	5,250,466	6,319,253
70-74	4,781,940	5,695,060	4,843,444	5,971,358
75-79	3,886,940	4,182,460	3,878,674	4,191,165
80-84	3,249,940	3,165,560	3,215,654	3,144,850
85-89	2,230,480	2,253,980	2,257,969	2,162,670
90+	1,382,160	1,577,880	1,329,677	1,531,301
Total	38,151,520	43,854,820	36,385,944	41,786,760

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.[2] 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).[3]

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,

[1]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.ccwdata.org/cs/groups/public/documents/document/wls_ucm1-013656.pdf.

[2] We used w1anfinwgt0 to generate the 2011 estimates and w5anfinwgt0 to generate the 2015 estimates.

[3] Age group is measured at the time of sampling for the Medicare frame estimates and at the time of survey for the NHATS estimates.

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
Age Group		
Men		
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
Women		
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
Total	39,680,325	45,291,962

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).

Except for the number of age groups (e.g. terminal group 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 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

	2011				2015			
	Community	Retirement Community	Residential Care	Nursing Home	Community	Retirement Community	Residential Care	Nursing Home
Age Group								
Men								
65-69	93.5%	4.9%	1.1%	0.5%	95.7%	2.7%	1.0%	0.6%
70-74	89.2%	7.2%	1.8%	1.7%	92.3%	6.0%	0.9%	0.9%
75-79	90.6%	5.7%	2.1%	1.5%	89.6%	6.9%	2.4%	1.1%
80-84	84.3%	6.9%	6.0%	2.8%	85.3%	6.3%	6.1%	2.4%
85-89	77.7%	5.4%	13.0%	4.0%	78.9%	6.1%	11.5%	3.5%
90+	65.5%	8.6%	15.5%	10.4%	70.4%	2.5%	19.0%	8.1%
Women								
65-69	93.4%	5.1%	1.2%	0.3%	93.2%	4.2%	1.0%	1.6%
70-74	87.9%	7.3%	3.6%	1.3%	91.3%	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%	77.2%	8.9%	8.9%	4.9%
85-89	66.6%	8.0%	15.7%	9.7%	71.3%	7.1%	13.9%	7.7%
90+	46.6%	9.0%	26.2%	18.2%	52.2%	8.0%	23.7%	16.0%
Total	85.0%	6.7%	5.4%	3.0%	87.2%	5.7%	4.5%	2.5%

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. The totals across all settings do not match Tables 1 and 2 exactly due to rounding/precision.

Table 4. Number and Percentage of Older Adults by Residential Setting: By Year and Standardization Source (2011/2015 Standardized to Closest Year)

Year	Standardization Source	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)	36,447,303	2,387,289	1,893,878	1,057,641
		87.2%	5.7%	4.5%	2.5%
	2014 Medicare	38,370,096	2,454,554	1,932,799	1,096,583
		87.5%	5.6%	4.4%	2.5%
	2014 Census	39,616,386	2,535,039	2,003,457	1,136,265
		87.5%	5.6%	4.4%	2.5%

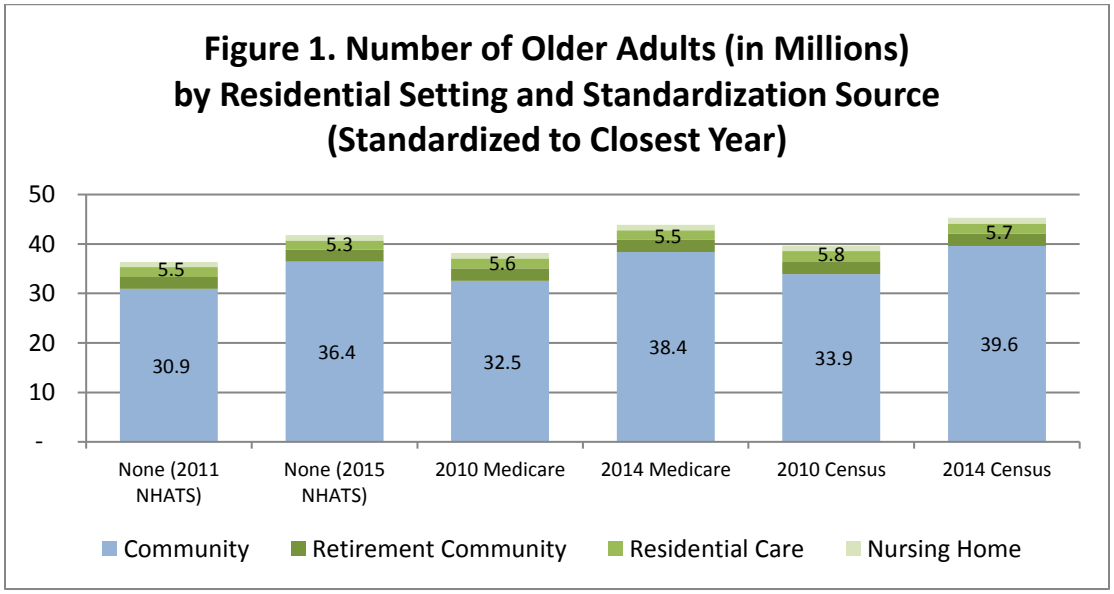
In this example, standardization makes only a small difference in the *percentage* of older adults in each setting. In 2011, for instance, only 0.3% more older adults are living in traditional community settings using Medicare as the source of standardization (85.3% vs. 85.0%). Standardization to Census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

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.[4] The 2015 numbers are 1.06 million, 1.10 million and 1.14 million, respectively.

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

[4] 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.

2015. The reduction of older adults in nontraditional settings is similar across the three sets of estimates – decreasing by about 100,000-120,000. Similarly, the growth of the older population living in traditional community-based settings is 5.5-5.8 million for all three scenarios.

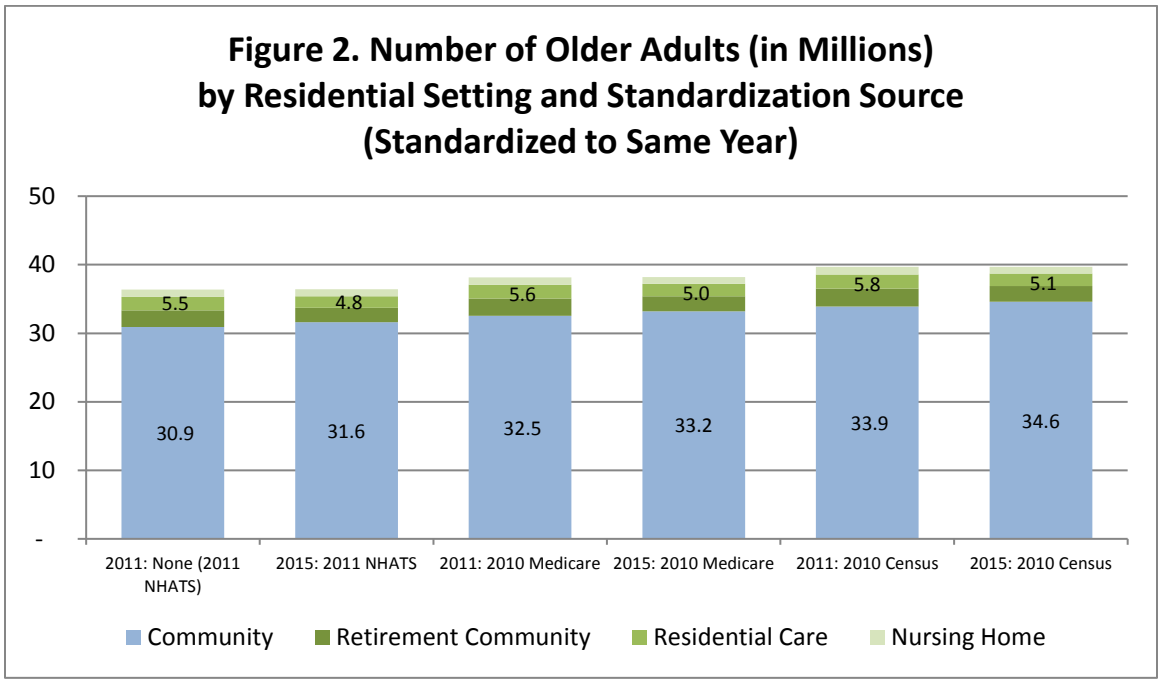


Example 2. Table 5 shows estimates from the 2011 and 2015 rounds of NHATS standardized to frame estimates in the same survey years. The top half of the table is identical to Table 4. The bottom half of the table shows 2015 estimates standardized to three 2010/2011 sources. These estimates convey how the 2011 population would have been distributed across settings in 2015 if the population had not grown and the age-sex distribution had remained the same.

Table 5. Number and Percentage of Older Adults by Residential Setting: By Year and Standarization Source (2011/2015 Standardized to Same Year)

Year	Standardization Source	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)	36,447,303	2,387,289	1,893,878	1,057,641
		87.2%	5.7%	4.5%	2.5%
	2011 NHATS	31,563,079	2,121,084	1,736,372	964,873
		86.7%	5.8%	4.8%	2.7%
	2010 Medicare	33,198,858	2,184,212	1,772,302	995,516
		87.0%	5.7%	4.6%	2.6%
	2010 Census	34,570,358	2,268,367	1,819,685	1,021,259
		87.1%	5.7%	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. Estimates of the *number* of older adults living in each setting are more sensitive to the standardization source; however, the decline over time in the (standardized) number living in residential care settings is approximately 700,000 irrespective of the standardization source (see Figure 2).



Standardizing to the Non-Nursing Home Population

Individuals who were living in nursing home settings at the time they were enrolled in the study were not administered a sample person interview. Analysts may be interested in making estimates of the population living in settings other than nursing homes. To standardize NHATS estimates to the Medicare frame or Census totals, we recommend the following steps:

First, omit individuals initially sampled in nursing homes (r1dresid=4 in 2011; r5dresid=8 in 2015). For 2015 also omit persons initially living in other settings who subsequently moved to a nursing home (r5dresid=4) and decedents in 2015 (r5dresid=6).

Second, follow the steps outlined above to standardize to the population estimates in Table 6 (Medicare or NHATS) or Table 7 (Census), using the NHATS analytic weight (w1anfinwgt0 or w5anfinwgt0) in Step 1.

Table 6. Population Ages 65 and Older Living in Settings Other than Nursing Homes, by 5-year age group and sex: Medicare and NHATS

	Medicare in Contiguous US		NHATS w/Analytic Weights	
	Population as of Sept. 30, 2010	Population as of Sept. 30, 2014	2011	2015
Age Group				
Men				
65-69	5,466,280	6,814,468	4,628,598	5,723,617
70-74	4,018,275	4,896,765	4,027,788	4,936,354
75-79	2,982,998	3,328,790	2,956,719	3,490,336
80-84	2,109,489	2,203,815	2,114,273	2,154,083
85-89	1,147,283	1,262,011	1,175,624	1,314,262
90+	469,781	596,351	415,220	576,724
Women				
65-69	6,109,059	7,479,448	5,236,818	6,217,838
70-74	4,721,968	5,647,119	4,782,701	5,921,091
75-79	3,781,126	4,112,683	3,773,085	4,121,243
80-84	3,101,606	3,009,795	3,068,885	2,990,104
85-89	2,013,818	2,081,393	2,038,637	1,997,075
90+	1,130,199	1,324,930	1,087,283	1,285,818
Total	37,051,882	42,757,569	35,305,631	40,728,545

Note: Calculations omit individuals living in nursing home settings based on proportions estimated from the 2011 and 2015 NHATS.

Table 7. Population Ages 65 and Older Living in Settings Other than Nursing Homes, by 5-year age group and sex: Census

	Population as of July 1 2010	Population as of July 1 2014
Age Group		
Men		
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
Women		
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
Total	39,680,325	45,291,962

Note: Excludes Alaska, Hawaii, and Puerto Rico. Calculations omit individuals living in nursing home settings based on proportions estimated from the 2011 and 2015 NHATS.

Standardizing to the Informal Caregiver Population

NSOC provides detailed information on informal caregivers to older adults with limitations in daily activities. Analysts who wish to make estimates of the number of informal caregivers to older adults may wish to standardize estimates of caregivers to be consistent with estimates of care recipients in the Medicare frame or Census.

To standardize NSOC estimates consistent with Medicare frame or Census totals, we recommend the following steps:

First, merge the NHATS' sample person's age group and sex onto NSOC from the NHATS SP file using the identifier "spid" with a one to many merge.

Second, following the steps outlined above, standardize counts to the population caregiver estimates in Table 8 (Medicare or NHATS) or Table 9 (Census), using the NSOC caregiver weight in Step 1 (w1cgfinwgt0 or w5cgfinwgt0).

Table 8. Informal Caregivers, by 5-year Age Group and Sex of Care Recipient: Medicare and NSOC

	Medicare in Contiguous US		NSOC w/Analytic Weights	
	Population as of Sept. 30, 2010	Population as of Sept. 30, 2014	2011	2015
Age Group				
Men				
65-69	981,256	1,709,659	830,883	1,435,979
70-74	735,643	1,495,045	737,385	1,507,132
75-79	1,251,386	1,229,686	1,240,362	1,289,363
80-84	1,232,691	1,180,159	1,235,487	1,153,527
85-89	951,592	1,041,414	975,099	1,084,531
90+	529,827	613,113	468,292	592,934
Women				
65-69	2,217,438	1,768,840	1,900,836	1,470,477
70-74	1,626,188	2,387,434	1,647,104	2,503,261
75-79	1,990,724	2,521,730	1,986,491	2,526,979
80-84	2,757,211	2,903,894	2,728,123	2,884,896
85-89	2,509,067	2,932,542	2,539,989	2,813,744
90+	1,912,270	2,370,565	1,839,658	2,300,586
Total	18,695,295	22,154,081	18,129,709	21,563,409

Note: Counts in these tables were estimated by multiplying the weighted number of caregivers in NSOC in each age-sex group by an age-sex specific adjustment factor. The adjustment factors are the ratio of Medicare population to NHATS analytic weighted population (in Table 1).

Table 9. Informal Caregivers, by 5-year Age Group and Sex of Care Recipient: Census

	Population as of July 1 2010	Population as of July 1 2014
Age Group		
Men		
65-69	1,031,577	1,771,856
70-74	753,242	1,511,577
75-79	1,291,028	1,255,625
80-84	1,286,862	1,218,867
85+	1,516,268	1,735,529
Women		
65-69	2,348,999	1,841,857
70-74	1,686,419	2,453,212
75-79	2,074,860	2,604,779
80-84	2,877,226	3,035,486
85+	4,481,092	5,491,425
Total	19,347,572	22,920,213

Note: Counts in these tables were estimated by multiplying the weighted number of caregivers in NSOC in each age-sex group by an age-sex specific adjustment factor. The adjustment factors are the ratio of Census population (in Table 2) to NHATS analytic weighted population (in Table 1).

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. We have also provided estimates of age-sex specific Medicare frame and Census totals for the subgroup of individuals living in settings other than nursing homes and for informal caregivers to older adults.

Analysists may want to standardize to the Medicare or Census totals in the closest year if they plan to publish national estimates of the number of older adults (or caregivers) with a particular characteristic. Alternatively, analysts may want to standardize prevalence estimates to 2011 or 2015 frame estimates 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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