NHATS Technical Paper #1

NATIONAL HEALTH AND AGING TRENDS STUDY (NHATS)
ROUND 1 SAMPLE DESIGN AND SELECTION

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Overview

The National Health and Aging Trends Study (NHATS) has been designed to follow a nationally representative cohort of persons who were ages 65 and older and enrolled in Medicare as of September 30, 2010, through annual in-person interviews. Replenishment is planned for the future so that the sample can be used to study disability trends as well as individual trajectories.

The Medicare enrollment database served as the sampling frame.[1] A Round 1 sample size of 8,500 respondents was targeted, with ample numbers to track disability trends by age and race/ethnicity.

Round 1 of NHATS used a stratified three-stage sample design: 1) selection of 95 primary sampling units (PSUs), which are individual counties or groups of counties, 2) selection of 655 secondary sampling units (SSUs), which are ZIP codes or ZIP code fragments within sampled PSUs, and 3) selection of beneficiaries within sampled SSUs who were age 65 and older as of September 30, 2010, with oversamples of the oldest age groups and of Black non-Hispanic persons. The probabilities of selection at each of the three stages were designed to yield equal probability samples and targeted sample sizes by age group and race/ethnicity.

A total of 14,643 beneficiaries were sampled altogether and 12,411 cases released to the field.

This memo provides details on the sample design and selection for Round 1 of NHATS. Section 2 describes the targeted sample sizes by age and race/ethnicity. Section 3 provides details on the formation and selection of the PSUs. Section 4 describes the procedures used to create and select ZIP clusters within the sampled PSUs. The sampling of Medicare beneficiaries from the selected ZIP clusters is described in Section 5. A final section provides actual Round 1 sample sizes and effective sample sizes.

1. Target Sample Sizes

The overall target sample size was 8,500 responding beneficiaries. Table 1 shows the breakdown of this target sample size by age group and race/ethnicity, along with the targeted effective sample sizes (taking into account the differential sampling by age and race/ethnicity).

The target sample sizes were determined to be sufficient to support the key analytic goals of trends and trajectories by 5-year age groups (65-69, 70-74, 75-79, 80-84, 85-89, and 90+) and by race/ethnicity (non-Hispanic Black and White/Other) (see Appendix Table A1 for minimum detectable differences and half-widths of 95% confidence intervals)**.**

[1] 96% of persons ages 65 and older in the United States are Medicare beneficiaries. According to the 2010 US Census, there are 40.3 million individuals ages 65 and older living in the United States (Howden and Meyer, 2011). CMS estimates Medicare enrollment for its aged beneficiaries to be 38.8 million (excluding Puerto Rico and the Virgin Islands, but including states unknown https://www.cms.gov/MedicareEnRpts/Downloads/10Aged.pdf).

Table 1. Targeted actual and effective sample sizes by age group and race/ethnicity

Age group	Non-Hispanic Black	White/Other	Total
65 to 69	371	1,287	1,658
	(361)	(1,272)	(1,474)
70 to 74	359	1,299	1,658
	(346)	(1,281)	(1,477)
75 to 79	349	1,309	1,658
	(314)	(1,296)	(1,492)
80 to 84	310	1,348	1,658
	(302)	(1,342)	(1,516)
85-89	163	870	1,033
	(163)	(861)	(953)
90 +	108	727	835
	(108)	(722)	(805)
Total 65+	1,661	6,840	8,500
	(1,464)	(5,968)	(6,831)
Total 85+	272	1,596	1,868
	(272)	(1,501)	(1,604)

NOTE: Effective sample sizes are given in parentheses.

2. Selection of Primary Sampling Units

Random subsamples from the Medicare enrollment database (EDB) served as the sampling frame for NHATS. An initial 5 percent random sample was used for PSU formation and selection, including calculation of the PSU measure of size.[2] Beneficiary records were excluded from the frame if:

- age was less than 65 as of September 30, 2010 or the record included a date of death;
- location was outside the contiguous United States; or
- state/county codes were invalid/unidentified (about 0.01 percent of records).

A stratified sample of 95 PSUs was selected from the contiguous United States (i.e., excluding Alaska, Hawaii, and Puerto Rico). The PSUs were mostly single counties, but some counties with small numbers of beneficiaries were combined to yield approximately uniform sample sizes across PSUs (with the exception of the certainty PSUs, described below).

The PSUs were sampled with probability proportionate to size. Eighteen domains (6 age groups by 3 race/ethnicity groups at this stage in the process) were taken into account in computing the PSU measure of size. Specifically, the PSU measure of size is a weighted count of Medicare beneficiaries, in which the domain-level beneficiary counts are weighted by the domain sampling rate.[3]

[2]The Centers for Medicare and Medicaid Services provides random subsamples (technically known as Health Insurance Skeleton Eligibility Write-Off (HISKEW) files) 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.

[3] The domain sampling rates were developed by dividing the target number of study participants in each domain by the estimated number of beneficiaries in the domain (from the 5 percent file), and adjusting for the projected response rates and mortality rates. The projected response rate was 75 percent for

The measure of size was initially computed at the county level, for each of the 3,109 counties and county equivalents in the sampling frame. The county measure of size was then checked against a minimum measure of size (to ensure that the overall sampling rate for each sampling domain could be achieved once the PSUs were sampled) and counties below the minimum were combined with other adjacent counties in order to form PSUs; a total of 1,951 PSUs were constructed. Fifty-eight percent of PSUs were single counties, and 89 percent comprised no more than two counties.

PSUs that would have had a probability of selection of 0.75 or greater with a probability proportional to size selection were selected with certainty (i.e., treated as a stratum). A total of 11 PSUs qualified as certainty PSUs. All noncertainty PSUs were stratified first by Census region, then by sorting the PSUs by a combination of the estimated percentage below poverty in 2008[4], percentage of non-Hispanic Black beneficiaries, and/or percentage of Hispanic beneficiaries. Within each Census region, the strata were formed by grouping PSUs from the sorted list to create roughly equal-sized groups, using a different sort order within each Census region. A total of 42 strata were formed. Within each noncertainty stratum, two PSUs were systematically selected with probabilities proportionate to the PSU measure of size. This resulted in the selection of 84 noncertainty PSUs for a total of 95 distinct PSUs in the sample, including the 11 certainty PSUs.

3. Selection of ZIP Clusters

The second stage of the design called for selection of secondary sampling units (SSUs) within sampled PSUs. The SSUs were ZIP clusters that were formed from ZIP fragments (entire ZIP codes if within one county, and the portion of the ZIP code within a county for ZIP codes that span multiple counties). The ZIP cluster sample frame was constructed from a 20 percent subsample of persons enrolled in Medicare as of September, 30, 2010 who resided in the 95 PSUs sampled for NHATS.[5] The file was subset to individuals age 65 or older as of September 30, 2010 with no date of death. ZIP codes that reflected a single location (point on a map) were subsumed in the surrounding ZIP code as part of the process of forming ZIP clusters.

The target number of ZIP clusters to be selected in each PSU was set at 8. This approach was designed to balance the increased travel-related costs associated with a larger number of sampled ZIP clusters within each PSU against the increased clustering design effects with a smaller number of sampled ZIP clusters. The ZIP clusters were sampled using probability proportional to size sampling.

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each of the age groups; this estimate was based on a variety of considerations, including interview length, expected interviewer experience, and prior data collection experience with older people. Mortality rate assumptions were designed to take into account deaths occurring between September 30, 2010, and contact for study recruitment. The Medicare Current Beneficiary Survey (MCBS) 2009 panel was used for these estimates; mortality rate estimates ranged from about 1.6 percent for those in the 65-69 age group to about 16.5 percent for those in the 90 and older age group.

[4] The estimated percentage below poverty is for the total population in the PSU. It was obtained from the Small Area Income and Poverty Estimates (SAIPE) program at the Census Bureau (Source: http://www.census.gov/did/www/saipe/county.html, last accessed April 6, 2012).

[5] The use of the 20 percent file at this stage rather than the 5 percent file made it possible to limit the geographic sizes of the SSUs.

The measure of size was constructed to reflect the variable sampling rates to be applied by age and race/ethnicity. The measures of size were computed in the same manner as described above; that is, a weighted sum of Medicare beneficiaries in the ZIP fragment, in which domain-level beneficiary counts were weighted by the domain sampling rate. Each ZIP fragment measure of size was checked against the minimum measure of size (to ensure that the overall sampling rate for each sampling domain could be achieved if a ZIP fragment was sampled), and if found to be below the minimum, was combined with one or more nearby ZIP fragments.

ZIP clusters having a measure of size that were at least as large as the within-PSU sampling interval for selecting ZIP clusters were selected with certainty. For each certainty ZIP cluster, the number of hits was calculated (the ratio of the ZIP cluster measure of size to the within-PSU ZIP cluster sampling interval). The number of noncertainty ZIP clusters to be sampled in a PSU was obtained by subtracting the total number of hits of certainty ZIP clusters from 8. A total of 121 ZIP clusters qualified as certainties; all of these were in noncertainty PSUs.

Prior to sampling, the 2,980 noncertainty ZIP clusters were sorted using a geographically based serpentine sort within each PSU. A total of 534 noncertainty ZIP clusters were selected by independently sampling within each PSU from the sorted file of noncertainty ZIP clusters; the ZIP clusters were systematically sampled with probabilities proportionate to the ZIP cluster measure of size. A total of 655 ZIP clusters were selected, including those selected with certainty.

4. Selection of Beneficiaries

The final stage of sample selection was the selection of beneficiaries within sampled ZIP clusters. The 20 percent file was used for this purpose. The beneficiary sampling frame was created by subsetting this file to persons:

- age 65 or older as of September 30, 2010 with no date of death;
- with address indicating that they resided in one of the 655 sampled ZIP clusters.

Prior to sampling, beneficiaries in the frame file were sorted by ZIP cluster, race/ethnicity (non-Hispanic Black, Hispanic, non-Hispanic White/other), age group, and then randomly within age group. A measure of size was also assigned to each beneficiary to facilitate sample selection. This measure was equal to the desired conditional probability of selecting the person for the sample, given that the corresponding PSU and ZIP cluster had been selected (i.e., the sampling rate for the beneficiary's sampling domain, divided by the overall probability of selection of the beneficiary's ZIP cluster).

Prior to selection, the sampling rates were uniformly inflated to allow for a roughly 20% reserve sample. A sample of 14,643 beneficiaries was then selected systematically. Beneficiaries were then subsampled systematically (in the same sort order as the initial selection) with equal probability, to yield a sample of 11,961 beneficiaries designated for the initial release (the remaining 2,682 beneficiaries were held in reserve). A small portion of the reserve sample, 450 cases, was randomly selected and released to the field for interview late in August, 2011. A total of 12,411 cases were released.

5. Actual and Effective Round 1 Sample Sizes

NHATS achieved a 71% response rate, yielding 8,245 complete cases (for further details see Montaquila et al. 2012). The actual Round 1 sample sizes are shown in Table 2, along with effective sample sizes that take into account differential probabilities of selection (shown parenthetically).

Table 2. Actual and Effective Round 1 NHATS Sample Sizes

Age group	Non-Hispanic Black	White/Other	Total
65 to 69	388	1,242	1,630
	(388)	(1,229)	(1,440)
70 to 74	396	1,212	1,608
	(396)	(1,207)	(1,422)
75 to 79	363	1,232	1,595
	(363)	(1,224)	(1,423)
80 to 84	329	1,267	1,596
	(329)	(1,259)	(1,443)
85-89	174	862	1,036
	(174)	(858)	(956)
90 +	113	667	780
	(113)	(666)	(752)
Total 65+	1,763	6,482	8,245
	(1,595)	(5,568)	(6,461)
Total 85+	287	1,529	1,816
	(286)	(1,438)	(1,612)

NOTE: Effective sample sizes are given in parentheses. The age category is age as of September 30, 2010 based on the beneficiary's month and date of birth provided on the 20% HISKEW file (based on the CMS Medicare EDB). The race/ethnicity classification is based on the reported race and Hispanic origin from the Sampled Person Interview; when missing, the race and ethnicity information from the 20% HISKEW file were used.

References

Howden L, Meyer JA. 2011. Age and Sex Composition: 2010. 2010 Census Briefs. Washington, DC: US Census Bureau.

Montaquila J, Freedman VA, & Kasper JD. 2012. National Health and Aging Trends Study Development of Round 1 Survey Weights. NHATS Technical Paper #2. Baltimore: Johns Hopkins University School of Public Health. Available at www.NHATS.org.

Appendix

Table A1 illustrates the statistical power of the targeted NHATS sample (8,500). The table includes a set of minimum detectable differences in estimates of the prevalence of limitations in activities of daily living (ADL)/instrumental activities of daily living (IADL) over time (trends by age and race/ethnicity) and by race/ethnicity (disparities) and by race/ethnicity over time (trends in disparities). It also includes estimates of the precision of cross-sectional estimates of percentage estimates. That is, the table presents half-widths of the 95% confidence intervals for estimated percentages of 10, 30 and 50% respectively. The figures in this table account for expected design effects due to variations in probabilities of selection and due to clustering (assuming an intraclass correlation of 0.0045).

Table A1. Minimum detectable differences and half-widths of 95% confidence intervals for targeted sample size of 8500[1]

			Minimum detectable difference in			Half-width of 95% confidence intervals for estimates of		
	N	Percentage with ADL/IADL limitations[2] at baseline	Change in % with ADL/IADL limitations (over 4 years)[3]	Racial differences in % with ADL/IADL limitation	Change in racial differences over 4 years[2]	10%	30%	50%
AGE GROUP								
65-69	1,658	7.2	2.7			1.6	2.4	2.6
70-74	1,658	12.2	3.4			1.6	2.4	2.6
75-79	1,658	18.6	4.1			1.6	2.4	2.6
80-84	1,658	32.0	4.9			1.6	2.4	2.6
85-89	1,033	47.7	6.5			1.9	3.0	3.2
90+	835	72.2	6.0			2.1	3.2	3.5
Total 65+	8,500	19.9	1.9			0.8	1.3	1.4
Total 85+	1,868	56.5	3.6			1.6	2.4	2.6
RACE/ETHNICITY								
White/Other	6,840	19.4	2.0			0.9	1.3	1.4
Black, non-Hispanic	1,661	27.5	4.1			1.6	2.4	2.6
DISPARITIES								
White/Other vs. Black, non-Hispanic				3.8	4.5			

[1]These estimates assume a two-tailed test, with alpha=0.05, and power=0.8.
[2]The source for these prevalence estimates is the 1999 National Long Term Care Survey (NLTCS).
[3]These calculations assume the sample is replenished in year 5 (4 years after the baseline study) to achieve an allocation equal to the original allocation.