NHATS Technical Paper #26

NATIONAL HEALTH AND AGING TRENDS STUDY (NHATS)
Development of Round 9 Survey Weights

August 10, 2020

Suggested Citation: DeMatteis, Jill M., Freedman, Vicki A., Jiao, Rui, and Kasper, Judith D. 2020. National Health and Aging Trends Study Development of Round 9 Survey Weights. NHATS Technical Paper #26. Baltimore: Johns Hopkins University School of Public Health. Available at www.NHATS.org. We thank Stephanie Mendoza, who played an instrumental role in the development of the Round 9 weights and produced several tabulations that appear in this paper. This technical paper was prepared with funding from the National Institute on Aging (U01AG032947).

1. Introduction

The NHATS public use data originally supported weighted analysis of Medicare beneficiaries ages 65 and older living in the contiguous United States on September 30, 2010. The original cohort has been interviewed annually. Replenishment took place in Round 5 so that the sample could be used to study disability trends as well as individual trajectories. The replenishment sample was drawn as of September 30, 2014. Details on sample design and selection are available elsewhere (Montaquila et al. 2012a and Dematteis et al. 2016a).

For Round 9, as for Rounds 5, 6, 7, and 8, separate sets of weights are provided for analyses pertaining to the original target population (the "2011 Cohort") and for analyses pertaining to the new target population (the "2015 Cohort"). The survey weights included with the Round 9 public use file account for differential probabilities of selection and adjust for potential bias related to unit nonresponse to the Round 1 through 9 interviews.

As in prior rounds, for Round 9 of NHATS, two types of sampling weights have been produced (for each cohort): a tracker weight (on the Tracker file with the variable names w9trfinwgt0 and w9tr2011wgt0) and an analytic weight (on the Sample Person file with the variable names w9anfinwgt0 and w9an2011wgt0). For variance estimation (see Section 7), NHATS has also included replicate versions of these weights (w9trfinwgt1-w9trfinwgt56 and w9anfinwgt1-w9anfinwgt56 for the 2015 Cohort; w9tr2011wgt1- w9tr2011wgt56 and w9an2011wgt1- w9an2011wgt56 for the 2011 Cohort).

The methodology that was used to develop these weights and appropriate uses of each of these weights are discussed in the following sections. The next section provides an overview of how cases were classified for purposes of weight development. Sections 3 and 4 detail the creation of the tracker and analytic weights, respectively. Section 5 reports on the effect of weighting adjustments on the precision of NHATS survey estimates. Section 6 provides guidance on the use of the tracker and analytic weights. A final section provides information on the proper calculation of variance estimates to account for the complex design and estimation procedures used in NHATS. For additional information on application of weights and variance estimation in NHATS analyses, see *Accounting for Sample Design in NHATS and NSOC Analyses: Frequently Asked Questions* (Freedman et al. 2020).

2. Definition of Respondent

In the development of survey weights, an important first step is the classification of cases into groups based on eligibility and response status. For Round 9 of NHATS, Table 1 shows how the disposition codes map into respondent, ineligible, and nonrespondent statuses.

In the computation of the 2015 Cohort weights, both original sample and replenishment sample cases were included. In the computation of the 2011 Cohort weights, only cases in the original sample were included.

2015 Cohort Weights

For the 2015 Cohort Round 9 Tracker weight, only cases that were eligible as of September 30, 2014, and were classified in Round 9 as Respondents (including cases for whom a Round 9 Last Month of Life (LML) interview was completed) or Ineligible are assigned a positive weight (n=7,094). Cases for which at

least one survey component is available (codes 60, 61, 62, 63 and 64) are considered respondents for purposes of the tracker weight.

Cases who became ineligible for the Round 9 interviews after they were selected, either due to death prior to their first interview (Round 1 for original sample cases, Round 5 for replenishment sample cases) or due to moving outside the contiguous U.S., also have positive Round 9 Tracker weights

For the 2015 Cohort Round 9 Analytic weight, only Respondents (codes 60, 61, 62, 63; n=4,889) are assigned a positive weight. For the SP interview, cases were required to have completed the self-reported disability protocol (through the section on Participation; PA) to be considered complete.

2011 Cohort Weights

For the 2011 Cohort Round 9 Tracker weight, only original sample cases classified as Respondents and Ineligible are assigned a positive weight (N = 5,887). Original sample cases for which at least one survey component is available (codes 60, 61, 62, 63 and 64) are considered respondents for purposes of the tracker weight.

Original sample cases who became ineligible for the Round 1 interview after they were selected, either because they died or moved out of the contiguous U.S. by the time of the fieldwork, have positive Round 9 Tracker weights. Those who became ineligible in subsequent rounds for an interview because they moved out of the contiguous U.S. or completed a Last Month of Life (LML) interview because they died also have positive tracker weights in Round 9. Replenishment sample cases added in 2015 do not have positive 2011 Cohort Round 9 Tracker weights.

For the 2011 Cohort Round 9 Analytic weight, only original sample Respondents (codes 60, 61, 62, 63; n=2,496) are assigned a positive weight. For the SP interview, cases were required to have completed the self-reported disability protocol (through the section on Participation; PA) to be considered complete.

Table 1. Classification of Round 9 NHATS Sample for Weight Development Purposes

	Original Sample			Replenishment Sample		
Disposition code	**N**	**Classification for Tracker Weight**	**Classification for Analytic Weight**	**N**	**Classification for Tracker Weight**	**Classification for Analytic Weight**
60 Complete, community	2,000	Respondent	Respondent	2,043	Respondent	Respondent
60-Complete, NH or residential care	243	Respondent	Respondent	140	Respondent	Respondent
61 Complete, NH facility	19	Respondent	Respondent	36	Respondent	Respondent
62 Complete, SP deceased, proxy interview	215	Deceased respondent+	Respondent+	159	N/A	N/A
63 Complete SP, FQ not complete	19	Respondent	Respondent	15	Respondent	Respondent
64 Complete FQ, SP not complete	52	Respondent	Nonrespondent	36	Respondent	Nonrespondent
75 Physically/mentally unable to participate, no proxy	2	Nonrespondent	Nonrespondent	2	Nonrespondent	Nonrespondent
76 Too ill to participate, no proxy	5	Nonrespondent	Nonrespondent	3	Nonrespondent	Nonrespondent
77 Refusal, Sample Person	33	Nonrespondent	Nonrespondent	72	Nonrespondent	Nonrespondent
78 Language barrier	0	Nonrespondent	Nonrespondent	0	Nonrespondent	Nonrespondent
79 Unable to locate	4	Eligibility unknown++	Eligibility unknown++	6	Eligibility unknown++	Eligibility unknown++
80 Unavailable during field period	4	Nonrespondent	Nonrespondent	7	Nonrespondent	Nonrespondent
82 Outside of Primary Sampling Unit	1	Nonrespondent	Nonrespondent	0	Nonrespondent	Nonrespondent
83 Ineligible (moved out of contiguous US)	2	Ineligible	Ineligible	1	Ineligible	Ineligible
85 Refusal, facility	0	Nonrespondent	Nonrespondent	1	Nonrespondent	Nonrespondent
86 Deceased, no proxy	7	Deceased nonrespondent+	Nonrespondent+	10	N/A	N/A
87 Refusal, proxy	8	Nonrespondent	Nonrespondent	5	Nonrespondent	Nonrespondent
88 Work stopped	0	Nonrespondent	Nonrespondent	0	Nonrespondent	Nonrespondent
89 Final other/specify*	0	Nonrespondent*	Nonrespondent*	0	Nonrespondent*	Nonrespondent*
Not attempted in Round 9						
Deceased in Round 1, 2, 3, or 4	2,127	Ineligible#	Ineligible#	0	N/A	N/A
Deceased in Round 5, 6, 7, or 8	1,083	Ineligible	Ineligible	974	Ineligible	Ineligible
Other Round 1, 2, 3, or 4 ineligible	120	Ineligible#	Ineligible#	0	N/A	N/A
Other Round 5, 6, 7, or 8 ineligible	7	Ineligible	Ineligible	50	Ineligible	Ineligible
Round 1, 2, 3, 4, 5, 6, 7, or 8 nonrespondent	6,460	Nonrespondent**	Nonrespondent**	3,559	N/A	N/A
Total and number assigned weight	12,411	3,640 (5,887##)	2,496	7,119	3,454	2,393

+ For the original sample, the weights of deceased SPs were adjusted separately from those of living SPs. ++ Due to the very low proportion of fielded cases in this category in Round 2 (0.46% of fielded cases), as well as the low proportion of Round 1 respondents that were ineligible for Round 2 (0.38%), these cases were treated as living nonrespondents in the computation of Round 2 weights. The same approach was used in the computation of Round 3 and Round 4.weights, and for original sample cases, in the computation of the Round 5, Round 6, Round 7, Round 8, and Round 9 weights. For the replenishment sample, these cases were treated as cases with unknown eligibility in Round 5, and as living nonrespondents in the computation of Round 6, Round 7, Round 8, and Round 9 weights.

**These cases were previously adjusted for in the Round 1, Round 2, Round 3, Round 4, Round 5, Round 6, Round 7, or Round 8 nonresponse adjustment to the tracker weight; the Round 8 nonresponse adjusted tracker weight was used as input to the Round 9 weighting process, so these cases are not included in the Round 9 nonresponse adjustment.

SP=Sample Person interview; FQ=Facility Questionnaire

#These categories only apply to the 2011 Cohort. ##The number assigned tracker weights for the 2011 Cohort is given in parentheses.

3. Computation of Round 9 Tracker Weights

2015 Cohort Tracker Weights

To produce the 2015 Cohort Round 9 Tracker weight, two adjustments were made to the Round 8 nonresponse adjusted tracker weight—an adjustment for Round 9 nonresponse and a raking adjustment to estimated population totals from the Medicare Enrollment Database (EDB).

Response rates differed between the members of the original 2011 cohort and members of the 2015 cohort. Although the response rates for the two samples are converging, there is still enough of a difference to warrant adjusting the two samples separately for Round 9 nonresponse.

Potential variables for creating nonresponse cells for the 2015 Cohort Round 9 Tracker weights came from five sources:

- Beneficiary information from the sampling frame (the 20% HISKEW File for the original sample; the 20% extract of the EDB for the replenishment sample[1]), including demographic characteristics of the beneficiary (e.g., age as of September 30, 2014, gender) and geographic information (e.g., census division, metro and micropolitan status) based on the beneficiary's address on the frame;
- County-level demographic information based on the 5% HISKEW file or the 5% extract of the EDB (e.g., percent of beneficiaries in the county who are Black; percent of beneficiaries in the county who are Hispanic) for the county linked to the beneficiary's address from the EDB;
- Census tract-level information based on the 2009-2013 5-year American Community Survey (e.g. tract-level demographic information), based on linkages to the beneficiary's address from the EDB;
- For the original sample, variables from the NHATS Rounds 1 through 8 interviews (race/ethnicity, highest education, and residential settings); and
- For the replenishment sample, variables from the NHATS Rounds 5 through 8 interviews (race/ethnicity, highest education, and Rounds 5, 6, 7, and 8 residential settings).

Appendix Table 1 provides weighted response rates (using the 2015 cohort Round 8 Tracker nonresponse adjusted weights) by categories of the various indicators. We used these variables as input to a classification tree analysis to determine which of these variables were associated with nonresponse. This approach uses a search algorithm to identify variables associated with response propensities. At each step in the process, chi-square tests were performed to determine the most significant predictor of response, given the set of conditions already specified in the particular "branch." We also set a minimum cell size of 50.[2]

---

[1] The HISKEW file was a 20% sample of the Medicare EDB (as of Sept. 30, 2010) that served as the sampling frame for the original selection. At the time of selection of the replenishment sample, CMS no longer created HISKEW files, but instead, a customized extract of the EDB was created.

[2] The classification tree analysis is designed to work with categorical predictor variables. Alternatives to this approach are propensity modeling based on logistic regression and Cartesian product cross-classification. The logistic regression approach uses a parametric model to identify predictors of response. When the pool of potential predictors includes continuous variables and categorizing the continuous variables would result in substantial losses of information, logistic regression modeling would be preferred over classification tree analysis. The Cartesian product cross-classification approach involves specifying a set of adjustment cell variables based on prior experience (generally, (1) prior analyses that identified predictors associated with response propensities;

We fit separate classification trees for the original sample and the replenishment sample. For the original sample, separate trees were fit for all living non-nursing home cases (Figure 1), nursing home residents (Figure 2), and deceased SPs (Figure 3) because underlying nonresponse processes differed for these three groups. Likewise, for the replenishment sample, separate trees were fit for living non-nursing home cases (Figure 4), nursing home residents (Figure 5), and deceased SPs (Figure 6). For the original sample, nursing home residents include both Round 1 residents who were not required to complete an SP Interview in Round 5 and new nursing home cases who were eligible for the SP interview in Round 5. Respondents to the LML interview conducted when the SP was deceased were proxy respondents. We included all variables as input for each of the trees.

Appendix Table 1 indicates the variables used in the final non-response cells for the 2015 Cohort Round 9 Tracker weights; an "a" indicates variables retained in the non-nursing home tree for the original sample, a "b" indicates those retained in the nursing home tree for the original sample, a "c" indicates those retained in the deceased original sample tree, a "d" indicates those retained in the non-nursing home tree for the replenishment sample, an "e" indicates those retained in the nursing home tree for the replenishment sample, and an "f" indicates those retained in the deceased replenishment sample tree.

For living SPs in the original sample who were living in the community and other residential settings (not nursing homes) in Round 8, final nonresponse cells included 16 indicators. For living SPs in the original sample who were living in nursing homes in Round 8, there was no nonresponse in Round 9, thus, no classification tree was fit for this group. For deceased SPs in the original sample, final nonresponse cells included two indicators. Combinations of these variables created 26 nonresponse cells among the original sample in the non-nursing home group, 1 nonresponse cell among the nursing home group, and 4 nonresponse cells for the deceased group (See Appendix Figures 1, 2, and 3, respectively). For living SPs in the replenishment sample who were residing in the community and other residential settings (not nursing homes) in Round 8, final nonresponse cells included 13 indicators. Combinations of these variables created 26 nonresponse cells (See Appendix Figure 4). For living SPs in the replenishment sample who were residing in nursing homes in Round 8, the sample size was small enough to warrant the use of just a single nonresponse cell (See Appendix Figure 5). For deceased SPs in the replenishment sample, the total of 3 final nonresponse cells included 2 indicators (See Appendix Figure 6).

The final step in creating the 2015 Cohort Round 9 Tracker weight involved raking the nonresponse adjusted weights to control totals developed from the 5% EDB extract (of Medicare beneficiaries as of September 30, 2014) that was used for sampling. For consistency, the raking adjustment also included the ineligibles (primarily deaths), since the frame that served as the source of the control totals also includes beneficiaries who were ineligible for NHATS. In Round 9, weight trimming was done in conjunction with this raking adjustment, due to a few outlier weights; this is discussed further in section 5.

As in Rounds 1 through 8, four dimensions were used in this Round 9 raking adjustment[3]:

and/or (2) predictors associated with response and/or subject matter expertise that informs the choice of variables).

[3] For purposes of raking, age categories refer to age at Round 5 sampling.

(1) Age category (65-69, 70-74, 75-79, 80-84, 85-89, 90+) by sex by race from the EDB (Black; non-Black);
(2) Age category (65-69, 70-74, 75-79, 80-84, 85-89, 90+) by Census region;
(3) Age category (65-69, 70-74, 75-79, 80-84, 85-89, 90+) by MSA status (from the EDB); and
(4) Age category (65-69, 70-74, 75-79, 80-84, 85-89, 90+) by a binary indicator of whether the SP was enrolled in Medicare prior to age 65.

In addition, as in Rounds 5 through 8, a fifth dimension—whether or not the beneficiary was eligible for selection into the original sample (i.e., age 65 or older and enrolled in Medicare as of September 30, 2010)—was used.

2011 Cohort Weights

The 2011 Cohort Round 9 Tracker weight applies only to the original sample, and followed the approach used to compute the Rounds 1 through 8 Tracker weights. This process began with the Round 8 nonresponse adjusted tracker weight (prior to raking). This Round 8 weight accounted for differential probabilities of selection and included adjustments for nonresponse to Rounds 1 through 8, but was not raked to the HISKEW[4]. See Montaquila et al. (2012b) for details on the specific methodology used in computing and adjusting the Round 1 weights; also, refer to Montaquila et al. (2014, 2015a, 2015b) and DeMatteis et al. (2016b, 2017, 2018, 2019) for information about the specific adjustments applied in Rounds 2 through 8, respectively.

To produce the 2011 Cohort Round 9 Tracker weight, two adjustments were made to the Round 8 nonresponse adjusted tracker weight—an adjustment for Round 9 nonresponse and a raking adjustment to estimated population totals from the EDB. Potential variables for creating nonresponse cells for the 2011 Cohort Round 9 Tracker weights came from four sources:

- Beneficiary information from the sampling frame (the 20% HISKEW File for the original sample), including demographic characteristics of the beneficiary (e.g., age computed as of September 30, 2014 based on birthdate, gender) and geographic information (e.g., census division, metro and micropolitan status) based on the beneficiary's address in the EDB;
- County-level demographic information based on the 5% HISKEW file (e.g., percent of beneficiaries in the county who are Black; percent of beneficiaries in the county who are Hispanic) for the county linked to the beneficiary's address from the EDB;
- Census tract-level information based on the 2009-2013 5-year American Community Survey (e.g. tract-level demographic information), based on linkages to the beneficiary's address from the EDB; and
- Variables from NHATS Rounds 1 through 8 (race/ethnicity, highest education, and residential settings).

Appendix Table 2 provides weighted response rates (using the Round 8 nonresponse adjusted tracker weights that were the basis for the 2011 Cohort Round 9 Tracker weights) by categories of the various indicators. We used these variables as input to a classification tree analysis to determine which of these

[4] The HISKEW file was a 20% sample of the Medicare enrollment database (as of Sept. 30, 2010) that served as the sampling frame for the original selection.

variables were associated with nonresponse. This approach uses a search algorithm to identify variables associated with response propensities. At each step in the process, chi-square tests were performed to determine the most significant predictor of response, given the set of conditions already specified in the particular "branch." We also set a minimum cell size of 50.[5]

Separate trees were fit for all living non-nursing home cases (Figure 7), nursing home residents (Figure 8), and deceased SPs (Figure 9) because underlying nonresponse processes differed for these three groups. For the original sample, nursing home residents include both Round 1 residents who were not required to complete an SP Interview and new Rounds 2 through 8 nursing home residents who were eligible for the SP interview in Round 9. Respondents to the LML interview conducted when the SP was deceased were proxy respondents. We included all variables as input for each of the trees.

Appendix Table 2 indicates the variables used in the final nonresponse cells for the 2011 Cohort Tracker weights, with an "a" for the non-nursing home tree, a "b" for the Round 8 nursing home residents tree, and a "c" for the deceased SP tree. For living SPs who were living in the community and other residential settings (not nursing homes) in Round 8, final nonresponse cells included 14 indicators; combinations of these variables created 26 nonresponse cells. Among living SPs who were nursing home residents in Round 8, the sample size was small enough to warrant a single nonresponse cell. For deceased SPs, final non-response cells included 2 indicators, resulting in 4 nonresponse cells (See Appendix Figures 7, 8, and 9).

The final step in creating the 2011 Cohort Round 9 Tracker weight involved raking the nonresponse adjusted weights to control totals developed from the 5% HISKEW as of September 30, 2010 that was used for sampling of the original sample. For consistency, the raking adjustment also included the ineligibles (primarily deaths), since the frame that served as the source of the control totals also includes beneficiaries who were ineligible for NHATS. In Round 9, weight trimming was done in conjunction with this raking adjustment, due to a few outlier weights; this is discussed further in section 5.

As in Rounds 1 through 8, four dimensions were used in this Round 9 raking adjustment[6]:

(1) Age category (65-69, 70-74, 75-79, 80-84, 85-89, 90+) by sex by race from the EDB (Black; non-Black);
(2) Age category (65-69, 70-74, 75-79, 80-84, 85-89, 90+) by Census region;
(3) Age category (65-69, 70-74, 75-79, 80-84, 85-89, 90+) by MSA status (from the HISKEW); and
(4) Age category (65-69, 70-74, 75-79, 80-84, 85-89, 90+) by a binary indicator of whether the SP was enrolled in Medicare prior to age 65.

[5] The classification tree analysis is designed to work with categorical predictor variables. Alternatives to this approach are propensity modeling based on logistic regression and Cartesian product cross-classification. The logistic regression approach uses a parametric model to identify predictors of response. When the pool of potential predictors includes continuous variables and categorizing the continuous variables would result in substantial losses of information, logistic regression modeling would be preferred over classification tree analysis. The Cartesian product cross-classification approach involves specifying a set of adjustment cell variables based on prior experience (generally, (1) prior analyses that identified predictors associated with response propensities; and/or (2) predictors associated with response and/or subject matter expertise that informs the choice of variables).

[6] For purposes of raking, age categories refer to age at Round 1 sampling.

4. Computation of Round 9 Analytic Weights

As with the tracker weights, separate Round 9 Analytic weights were computed for the 2015 Cohort (designed for analysis of the original and replenishment samples combined) and for the 2011 Cohort (designed for analysis of the original sample alone).

The computation of the analytic weights begins with the final Round 9 Tracker weight for the respective cohort. A weighting class adjustment was developed for the class of nonrespondents who were eligible for but did not complete the SP interview: those living in nursing homes or non-nursing home residential care in Round 9 who had completed a facility interview but not a Sample Person interview (n=88 for the 2015 Cohort and n=52 for the 2011 Cohort; designated as code 64). (Round 9 nursing home residents who were nursing home residents at the time of their baseline interview (code 61) were not eligible for an SP interview in Round 9, thus are not part of the analytic weight nonresponse adjustment). The approach was designed to preserve the tracker weight distributions by Round 9 residence type (nursing home, non-nursing home). That is, we allowed the weights of residential care cases with both a completed FQ and a completed SP interview (n=383 for the 2015 Cohort and n=243 for the 2011 Cohort) to be adjusted to account for similar cases missing the SP Interview.

2015 Cohort Analytic Weights

Because it was believed that response mechanisms may be different for the two samples (since members of the original sample had been engaged in the study for several rounds, whereas Round 9 was the fifth contact and attempt at gaining cooperation with the replenishment sample), the two samples were adjusted separately for Round 9 analytic nonresponse. Since the sample size is much smaller for this nonresponse adjustment, only a subset of variables used in tracker weight classification tree analysis was considered for the analytic weight nonresponse adjustments; additionally, three variables that characterize the Round 9 nursing home status, non-nursing home residential care status, and area of the facility where the SP lives were included (see Appendix Table 3). In order to preserve the tracker weight distribution, for each sample separately by Round 9 residence type, the first split in each tree was forced to be Round 9 nursing home status. (All subsequent splitting was based on response propensities.) For the original sample, 3 variables (designated with “o” in Appendix Table 3) were retained in the final classification tree, forming 4 cells (see Appendix Figure 10); for the replenishment sample, 2 variables designated with ”r” in Appendix Table 3) were retained in the final classification tree, forming 3 cells (see Appendix Figure 11).

As a final step, we applied a raking procedure so that marginal totals based on the analytic weights would match the totals at replenishment sampling by: 5-year age groups, sex, race, region, micro/metropolitan status, and whether Medicare was received before age 65.

2011 Cohort Analytic Weights

As with the 2011 Cohort Round 9 Tracker weights, the 2011 Cohort Round 9 Analytic weight applies only to the original sample. Since the sample size is much smaller for this nonresponse adjustment, only a subset of variables used in tracker weight classification tree analysis was considered for the analytic weight nonresponse adjustments; additionally, three variables that characterize the Round 9 nursing home status, non-nursing home residential care status, and area of the facility where the SP lives were

included (see Appendix Table 4). In order to preserve the tracker weight distribution by Round 9 residence type, the first split was forced to be Round 9 nursing home status. (All subsequent splitting was based on response propensities.) Three variables (designated with "*" in Appendix Table 4) were retained in the final classification tree, forming 4 cells (see Appendix Figure 12).

As a final step, we applied a raking procedure so that marginal totals based on the analytic weights would match the totals at sampling by: 5-year age groups, sex, race, region, micro/metropolitan status, and whether Medicare was received before age 65.

5. Design Effects Related to Weighting

Although weighting adjustments are aimed at reducing bias, increased variation in weights generally increases the variances of survey estimates (Kish, 1965). Thus, in the development and implementation of the weighting methodology for NHATS, care was taken to balance the bias reductions against the potential increases in variance.

The estimated overall design effect due to variation in the Round 1 nonresponse adjusted tracker weights was 1.28. After applying Round 2 nonresponse adjustments within cells determined by the classification tree results, the estimated overall design effect due to unequal weighting increased to 1.33. Incorporating the Round 3 nonresponse adjustments, the estimated overall design effect due to unequal weighting was 1.35, and after Round 4 nonresponse adjustment this overall design effect was 1.34.

2015 Cohort Weights

The composited weights used in computing the 2015 Cohort Round 5 Tracker weights had an overall design effect (due to variation in the weights) of 1.34. After Round 5 nonresponse adjustment, the overall design effect was 1.55, with the increase being due to the extent of variation in response propensities between and within the two samples (the original sample and Round 5 replenishment sample). The nonresponse adjusted Tracker weights for Rounds 6, 7, and 8 had overall design effects of 1.62, 1.64, and 1.65, respectively. The nonresponse adjusted Round 9 Tracker weights had an overall design effect of 1.66. In order to limit the variation in the weights, after the raking adjustment, trimming of the tracker weights was considered; no cases were identified as influential outliers. After the raking adjustment, the design effect for the final 2015 Cohort Round 9 Tracker weights was 1.66.

After the adjustments applied in computing the analytic weight (nonresponse adjustment and raking), four cases were identified as influential outliers, and their analytic weights were trimmed; following trimming, the weights were re-raked. After the re-raking, the design effect for the final 2015 Cohort Round 9 Analytic weights was 1.65 overall, and 1.63 for living SPs and 1.70 for deceased SPs.

2011 Cohort Weights

For the 2011 Cohort weights, after Round 5 nonresponse adjustment, the overall design effect was 1.33. After adjusting for Round 6 nonresponse, for Round 7 nonresponse, and for Round 8 nonresponse, the overall design effects were 1.32, 1.32, and 1.31, respectively. After adjusting for Round 9 nonresponse, the overall design effect was 1.30. In order to limit the variation in the weights, after the raking adjustment, the tracker weights were trimmed and then re-raked; four cases with extreme weights were

trimmed at this point. After the raking adjustment and trimming, the design effect for the final 2011 Cohort Round 9 Tracker weights was 1.33.

After the adjustments applied in computing the analytic weight (nonresponse adjustment and raking), no cases were identified as influential outliers. After raking, the design effect for the final 2011 Cohort Round 9 Analytic weights was 1.32 overall; and 1.30 for living SPs and 1.45 for deceased SPs.

6. Use of the Tracker vs. Analytic Weight

When using the tracker weight from any round, respondents are weighted up to represent all Medicare beneficiaries ages 65 and older who were alive on or as of the target date for the cohort (September 30, 2014 for the 2015 Cohort; September 30, 2010 for the 2011 Cohort) and residing in the contiguous United States. In contrast, the analytic weight at a given round reproduces only those alive and eligible for NHATS during the prior round fieldwork period (with the exception of a small number of persons from the prior round who are deemed ineligible in the current round because they relocated outside the contiguous U.S.). Thus, the Round 9 Analytic weight reproduces those alive and eligible for NHATS during the Round 8 fieldwork period.

The only other difference between the two sets of weights is the treatment of respondents who live in residential care settings other than nursing homes. In cases where an FQ interview was completed but an (eligible) SP interview was not completed in Round 9, a positive Round 9 weight sits in the Tracker file and a zero Round 9 weight in the Analytic file. The analytic weights of individuals with both an SP and FQ interview have been adjusted to represent these cases (persons assigned both an SP and FQ interview but with only an FQ). For all other respondents (including cases with proxy responses to the LML interview) the analytic and tracker weights are equal.

Most often analyses will use the analytic weight. The tracker weight is appropriate for making national estimates using the FQ information (e.g. for services available to older adults living in residential care settings) and for investigating the role of mortality on Round 1 disability estimates and successive cross-sections.

Another important consideration is whether to use a round-specific weight and, for Rounds 5 through 9, whether to use the 2015 Cohort weight or the 2011 Cohort weight. A useful rule of thumb is to always consider the population to which an estimate is being generalized. To estimate, for example, the proportion of the population in Round 1 who has a particular characteristic in Round 2, 3, 4, 5, 6, 7, 8, or 9 (measured in the SP interview) or who was in a particular type of residential care in Round 2, 3, 4, 5, 6, 7, 8, or 9 (measured in the FQ interview), a Round 1 weight should be used. The former would use the Round 1 Analytic weight and the latter the Round 1 Tracker weight. To estimate characteristics of people ages 75 and older in Round 9, or the characteristics of those living in residential care settings in Round 9 as measured in the Round 9 FQ interview, the Round 9 weight should be used. The former would use the Round 9 Analytic weight and the latter the Round 9 Tracker weight. To estimate characteristics (as of Round 9) of people 65 and older in Round 5, the 2015 Cohort Round 9 weight should be used. To examine associations between a characteristic in Round 9 and a characteristic in Round 1 (or any round prior to Round 5), the 2011 Cohort Round 9 weight should be used.

7. Variance Estimation

Two broad classes of methods have been developed for computation of standard errors of estimates from complex sample surveys: (1) Taylor series linearization and (2) replication methods. The NHATS data files contain the information necessary for analysts to use either of these approaches to compute standard errors. The "stratum" and "cluster" variables that allow users to compute variance estimates using Taylor series linearization are provided on the NHATS Tracker and SP files as the variables w5varstrat and w5varunit, respectively.

The replication approach that was used in NHATS (Montquila et al. 2012b) is the modified balanced repeated replication (BRR) method suggested by Fay (Judkins 1990). When estimating the variance of ratios of rare subsets, one problem that occasionally arises from standard BRR is that one or more replicate estimates will be undefined due to zero denominators. Instead of increasing the weights of one half-sample by 100 percent and decreasing the weights of the other half-sample to zero as in standard BRR, Fay's method perturbs the weights by ±100(1-K) percent where K is referred to as "Fay's factor." The perturbation factor for standard BRR is 100 percent, or K=0. For NHATS, K = 0.3 was used.

Nonresponse adjustment and raking were repeated for each of the replicates. For Round 9, the final tracker replicate weights are provided in the variables w9trfinwgt1-w9trfinwgt56 for the 2015 Cohort and w9tr2011wgt1- w9tr2011wgt56 for the 2011 Cohort, and the analytic replicate weights are provided in the variables w9anfinwgt1-w9anfinwgt56 for the 2015 Cohort and w9an2011wgt1-w9an2011wgt56 for the 2011 Cohort. Through the creation of person-level replicate weights, Fay's method approximately reflects the contribution of variance due to nonresponse adjustments, calibration adjustments (e.g., poststratification or raking), and other weight adjustment factors that are dependent on the observed sample.

For additional information on application of weights and variance estimation in NHATS analyses, see *Accounting for Sample Design in NHATS and NSOC Analyses: Frequently Asked Questions* (Freedman et al. 2020).

References

DeMatteis, JM, Freedman VA, & Kasper, JD. 2016a. *National Health and Aging Trends Study Round 5 Sample Design and Selection*. *NHATS Technical Paper #16*. Baltimore: Johns Hopkins University School of Public Health. Available at www.nhats.org.

DeMatteis, JM, Freedman, VA, & Kasper, JD. 2016b. *National Health and Aging Trends Study Development of Round 5 Survey Weights. NHATS Technical Paper #14.* Baltimore: Johns Hopkins University School of Public Health. Available at www.nhats.org.

DeMatteis, JM, Freedman, VA, & Kasper, JD. 2017. *National Health and Aging Trends Study Development of Round 6 Survey Weights. NHATS Technical Paper #18.* Baltimore: Johns Hopkins University School of Public Health. Available at www.nhats.org.

DeMatteis, JM, Freedman, VA, & Kasper, JD. 2018. *National Health and Aging Trends Study Development of Round 7 Survey Weights. NHATS Technical Paper #20.* Baltimore: Johns Hopkins University School of Public Health. Available at www.nhats.org.

DeMatteis, JM, Freedman, VA, & Kasper, JD. 2019. *National Health and Aging Trends Study Development of Round 8 Survey Weights. NHATS Technical Paper #21.* Baltimore: Johns Hopkins University School of Public Health. Available at www.nhats.org.

Freedman, VA, Hu, M, DeMatteis, JM, & Kasper, JD. Accounting for Sample Design in NHATS and NSOCI Analyses: Frequently Asked Questions. NHATS Technical Paper #23. Baltimore: Johns Hopkins University School of Public Health. Available at www.nhats.org.

udkins, DR. (1990). Fay's method for variance estimation. *Journal of Official Statistics, 6(3)*, 223-239.

Kish, L. (1965). *Survey sampling*. New York: John Wiley and Sons.

Montaquila J, Freedman VA, Edwards, B, & Kasper, JD. 2012a. *National Health and Aging Trends Study Round 1 Sample Design and Selection*. *NHATS Technical Paper #1*. Baltimore: Johns Hopkins University School of Public Health. Available at www.nhats.org.

Montaquila, J, Freedman, VA, Spillman, B, & Kasper, JD. 2012b. *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.

Montaquila, J, Freedman, VA, Spillman, B, & Kasper, JD. 2014. *National Health and Aging Trends Study Development of Round 2 Survey Weights. NHATS Technical Paper #6.* Baltimore: Johns Hopkins University School of Public Health. Available at www.nhats.org.

Montaquila, J, Freedman, VA, Spillman, B, & Kasper, JD. 2015a. *National Health and Aging Trends Study Development of Round 3 Survey Weights. NHATS Technical Paper #9.* Baltimore: Johns Hopkins University School of Public Health. Available at www.nhats.org.

Montaquila, J, Freedman, VA, Spillman, B, & Kasper, JD. 2015b. *National Health and Aging Trends Study Development of Round 4 Survey Weights. NHATS Technical Paper #11.* Baltimore: Johns Hopkins University School of Public Health. Available at www.nhats.org.

Appendix: Variables Used in Nonresponse Adjustment for Round 9 NHATS Weights

Appendix Table 1. Response Rates by Various Indicators: NHATS Round 9 2015 Cohort

Variable & Values		Weighted Response Rate
OVERALL		96.0%
BENEFICIARY INDICATORS		
Age[1 a d]	(H_AGECAT_R5)	
1: 65-69		95.1%
2: 70-74		96.0%
3: 75-79		96.6%
4: 80-84		97.1%
5: 85- 89		97.8%
6: 90+		97.4%
Gender[1 a]	(H_SEX)	
1: Male		96.2%
2: Female		95.8%
Census Region[2 a]	(S_REGION)	
1: Northeast		95.7%
2: Midwest		95.3%
3: South		95.8%
4: West		97.6%
Census Division[2 a c d]	(DIVISION)	
1: New England		96.8%
2: Middle Atlantic		95.2%
3: East North Central		95.1%
4: West North Central		95.5%
5: South Atlantic		95.3%
6: East South Central		95.2%
7: West South Central		97.0%
8: Mountain		97.7%
9: Pacific		97.5%
Census Metro/Micro Area Designation (2013)[2]	(S_METMICRO)	
1: Metropolitan area		96.3%
2: Micropolitan area		95.4%
3: Non-metro		93.3%
Health Maintenance Organization Beneficiary[1 d]	(HMOTYPE)	
0: Yes		97.3%
9: No		95.4%
Age First Enrolled in Medicare[1]	(MEDIC_BEG)	
1: Prior to age 65		95.9%
2: At or after age 65		96.0%
R5 RACE ETHNICITY[4 a]	(RL5DRACEHISP_R)	
1: White, non-Hispanic		96.0%
2: Black, non-Hispanic		96.2%
3: Other, non-Hispanic		97.3%
4: Hispanic		94.9%
5: DK/RF		96.0%
R5 HIGHEST EDUCATIONY [4 ^]	(EL5HIGSTSCHL_R)	
0: Not applicable		96.6%
1: DK/RF		95.4%
2: Below high school		95.3%
3: High school		94.0%
4: Above High school		95.9%
TRACT-LEVEL INDICATORS (Quartiles)		
Household Income[3]	(C_AGG_HH_INC)	
1: 1st quartile		94.8%
2: 2nd quartile		96.5%
3: 3rd quartile		95.6%
4: 4th quartile		96.5%
9: Missing		100.0%
Median Household Income[3 a]	(C_MED_HH_INC)	
1: 1st quartile		95.2%
2: 2nd quartile		96.0%
3: 3rd quartile		96.2%
4: 4th quartile		96.3%
9: Missing		100.0%
Median Household Income 65+[3 d]	(C_MED_HH_INC_65)	
1: 1st quartile		95.1%
2: 2nd quartile		96.3%
3: 3rd quartile		95.8%
4: 4th quartile		96.6%
9: Missing		100.0%
% Households with Adult 65+[3]	(C_PCT_HH_65)	
1: 1st quartile		96.1%
2: 2nd quartile		96.3%
3: 3rd quartile		95.7%
4: 4th quartile		96.0%
% Households in Poverty[3 a d]	(C_PCT_HH_POV)	
1: 1st quartile		96.5%
2: 2nd quartile		96.1%
3: 3rd quartile		95.9%
4: 4th quartile		95.2%
% Households Reporting Public Assistance[3 a d]	(C_PCT_HH_PUBASST)	
1: 1st quartile		95.7%
2: 2nd quartile		96.9%
3: 3rd quartile		96.5%
4: 4th quartile		94.8%
% Households Reporting Retirement Income[3 d]	(C_PCT_HH_RETIREINC)	
1: 1st quartile		96.4%
2: 2nd quartile		96.4%
3: 3rd quartile		96.0%
4: 4th quartile		95.4%
% Households Reporting Social Security[3 a]	(C_PCT_HH_SOCSEC)	
1: 1st quartile		96.4%
2: 2nd quartile		96.8%
3: 3rd quartile		95.3%
4: 4th quartile		95.8%

Variable & Values	Weighted Response Rate
R1 HIGHEST EDUCATIONY[4 # a] (EL1HIGSTSCHL_R)	
0: Not applicable	94.9%
1: DK/RF	81.0%
2: Below high school	97.6%
3: High school	97.5%
4: Above High school	97.9%
COUNTY LEVEL INDICATORS	
% Black 65+ (deciles)[2 a] (PCTBLK)	
0: 1st decile	96.3%
1: 2nd decile	96.7%
2: 3rd decile	95.5%
3: 4th decile	96.5%
4: 5th decile	95.7%
5: 6th decile	95.6%
6: 7th decile	98.1%
7: 8th decile	94.3%
8: 9th decile	95.7%
9: 10th decile	95.5%
% Hispanic 65+ (deciles)[2 a d f] (PCTHISP)	
0: 1st decile	94.8%
1: 2nd decile	95.8%
2: 3rd decile	96.5%
3: 4th decile	96.1%
4: 5th decile	95.0%
5: 6th decile	95.1%
6: 7th decile	96.0%
7: 8th decile	95.9%
8: 9th decile	97.5%
9: 10th decile	97.9%
% Poverty (deciles)[2 c d f] (PCTPOV)	
0:1st decile	95.9%
1: 2nd decile	95.1%
2: 3rd decile	96.9%
3: 4th decile	95.1%
4: 5th decile	95.1%
5: 6th decile	97.7%
6: 7th decile	95.6%
7: 8th decile	97.7%
8:9th decile	95.2%
9: 10th decile	95.9%

Variable & Values	Weighted Response Rate
TRACT-LEVEL INDICATORS (Quartiles)	
% Households Reporting SSI[3 a d] (C_PCT_HH_SSS)	
1: 1st quartile	97.2%
2: 2nd quartile	95.6%
3: 3rd quartile	95.7%
4: 4th quartile	95.5%
% Households Owning Their Home[3 a d] (C_PCT_OWNHOME)	
1: 1st quartile	95.1%
2: 2nd quartile	97.2%
3: 3rd quartile	95.2%
4: 4th quartile	96.2%
% Households 65+ Owning Their Home[3 a d] (C_PCT_OWNHOME_65)	
1: 1st quartile	95.5%
2: 2nd quartile	96.5%
3: 3rd quartile	97.0%
4: 4th quartile	94.9%
% Households 65+ Below Poverty[3 a d] (C_PCT_POV_65)	
1: 1st quartile	96.2%
2: 2nd quartile	96.3%
3: 3rd quartile	96.8%
4: 4th quartile	94.7%
Per Capita Income[3] (C_PER_CAP_INC)	
1: 1st quartile	96.1%
2: 2nd quartile	95.5%
3: 3rd quartile	95.9%
4: 4th quartile	96.4%
OTHER INDICATORS	
R8 RESIDENTIAL CARE STATUS[4] (R8DRESID)	
1: R8 Community	95.9%
2: R8 Residential Care Resident not nursing home (SP interview complete)	99.1%
3: R8 Residential Care Resident not nursing home (FQ only)	91.8%
4: R8 nursing home (SP interview complete)	98.0%
5: R8 nursing home (FQ only)	92.2%
7: R1 to R7 Residential Care Resident not nursing home (FQ only)	98.1%
8: R1 to R7 nursing home	95.2%

[1]Based on Information either on the September 30, 2010 CMS 20% Health Insurance Skeleton Eligibility Write-Off (HISKEW) file if the case is in the original sample, or on the September 30, 2014 CMS 20% Enrollment Database (EDB) extract if the case is in the replenishment sample .

[2]Based on county-level information from the September 30, 2014 CMS 5% EDB extract linked to the beneficiary's EDB address.
[3]Based on tract-level information from the 2009-2013 5-year American Community Survey file linked to the beneficiary's EDB address.
[4]Based on responses to items in the Rounds 1 to 8 interviews.
[#]Response rates were computed only for the original sample.
[^] Response rates were computed only for the replenishment sample.
a=retained in classification tree analysis for living SP non-nursing home branch of the original sample
b=retained in classification tree analysis for living SP nursing home branch of the original sample
c=retained in classification tree analysis for deceased SP branch of the original sample
d= retained in classification tree analysis for living SP non-nursing home branch of the replenishment sample
e= retained in classification tree analysis for living SP nursing home branch of the replenishment sample
f= retained in classification tree analysis for deceased SP branch of the replenishment sample
N=5,147 (4,977 respondents and 170 non-respondents)
Variable names used in classification trees shown parenthetically.

Appendix Table 2. Response Rates by Various Indicators: NHATS Round 9 Cohort 2011

Variable & Values		Weighted Response Rate
OVERALL		97.6%
BENEFICIARY INDICATORS		
Age[1] [a] [c]	(H_AGECAT)	
1: 65-69		97.3%
2: 70-74		98.7%
3: 75-79		96.7%
4: 80-84		97.2%
5: 85- 89		98.9%
6: 90+		100.0%
Gender[1]	(H_SEX)	
1: Male		98.0%
2: Female		97.4%
Census Region[1] [a]	(S_REGION)	
1: Northeast		97.6%
2: Midwest		98.4%
3: South		96.5%
4: West		98.8%
Census Division[1] [a] [c]	(DIVISION)	
1: New England		98.1%
2: Middle Atlantic		97.4%
3: East North Central		99.0%
4: West North Central		97.5%
5: South Atlantic		96.2%
6: East South Central		95.6%
7: West South Central		97.7%
8: Mountain		100.0%
9: Pacific		98.6%
Census Metro/Micro Area Designation (2013)[2]	(S_METMICRO)	
1: Metropolitan area		97.5%
2: Micropolitan area		98.3%
3: Non-metro		99.1%
Health Maintenance Organization Beneficiary[1]	(HMOTYPE)	
0: Yes		97.7%
9: No		97.6%
Age First Enrolled in Medicare[1]	(MEDIC_BEG)	
1: Prior to age 65		97.6%
2: At or after age 65		97.6%
R1 RACE ETHNICITY[4] [a]	(RL1DRACEHISP_R)	
1: White, non-Hispanic		97.6%
2: Black, non-Hispanic		97.5%
3: Other, non-Hispanic		100.0%
4: Hispanic		97.0%
5: DK/RF		91.6%
R1 HIGHEST EDUCATIONY[4] [a]	(EL1HIGSTSCHL_R)	
0: Not applicable		94.3%
1: DK/RF		81.8%
2: Below high school		97.7%
3: High school		97.6%
4: Above High school		97.9%

Variable & Values		Weighted Response Rate
TRACT-LEVEL INDICATORS (Quartiles)		
Household Income[3]	(C_AGG_HH_INC)	
1: 1st quartile		96.9%
2: 2nd quartile		98.3%
3: 3rd quartile		97.6%
4: 4th quartile		97.6%
Median Household Income[3] [a]	(C_MED_HH_INC)	
1: 1st quartile		96.2%
2: 2nd quartile		98.2%
3: 3rd quartile		97.6%
4: 4th quartile		98.2%
Median Household Income 65+[3] [a]	(C_MED_HH_INC_65)	
1: 1st quartile		96.6%
2: 2nd quartile		97.6%
3: 3rd quartile		97.9%
4: 4th quartile		98.2%
9: Missing		100.0%
% Households with Adult 65+[3]	(C_PCT_HH_65)	
1: 1st quartile		98.0%
2: 2nd quartile		97.5%
3: 3rd quartile		97.8%
4: 4th quartile		97.5%
% Households in Poverty[3] [a]	(C_PCT_HH_POV)	
1: 1st quartile		98.1%
2: 2nd quartile		97.4%
3: 3rd quartile		98.3%
4: 4th quartile		96.5%
% Households Reporting Public Assistance[3] [a]	(C_PCT_HH_PUBASST)	
1: 1st quartile		97.4%
2: 2nd quartile		97.8%
3: 3rd quartile		98.1%
4: 4th quartile		97.3%
% Households Reporting Retirement Income[3]	(C_PCT_HH_RETIREINC)	
1: 1st quartile		97.2%
2: 2nd quartile		97.4%
3: 3rd quartile		98.3%
4: 4th quartile		97.4%
% Households Reporting Social Security[3] [a]	(C_PCT_HH_SOCSEC)	
1: 1st quartile		99.2%
2: 2nd quartile		97.4%
3: 3rd quartile		97.6%
4: 4th quartile		97.2%

Variable & Values		Weighted Response Rate
COUNTY LEVEL INDICATORS		
% Black 65+ (deciles)[2]	(PCTBLK)	
0: 1st decile		99.0%
1: 2nd decile		97.6%
2: 3rd decile		98.1%
3: 4th decile		95.8%
4: 5th decile		97.2%
5: 6th decile		97.7%
6: 7th decile		98.2%
7: 8th decile		96.9%
8: 9th decile		98.8%
9: 10th decile		97.9%
% Hispanic 65+ (deciles)[2] [a]	(PCTHISP)	
0: 1st decile		97.4%
1: 2nd decile		97.3%
2: 3rd decile		99.2%
3: 4th decile		98.2%
4: 5th decile		96.4%
5: 6th decile		97.4%
6: 7th decile		97.6%
7: 8th decile		97.8%
8: 9th decile		97.0%
9: 10th decile		98.6%
% Poverty (deciles)[2]	(PCTPOV)	
0:1st decile		96.8%
1: 2nd decile		96.3%
2: 3rd decile		98.7%
3: 4th decile		98.9%
4: 5th decile		96.4%
5: 6th decile		98.6%
6: 7th decile		98.2%
7: 8th decile		98.1%
8: 9th decile		96.9%
9: 10th decile		97.7%

Variable & Values		Weighted Response Rate
TRACT-LEVEL INDICATORS (Quartiles)		
% Households Reporting SSI[3]	(C_PCT_HH_SSS)	
1: 1st quartile		98.2%
2: 2nd quartile		97.4%
3: 3rd quartile		97.5%
4: 4th quartile		97.4%
% Households Owning Their Home[3] [a]	(C_PCT_OWNHOME)	
1: 1st quartile		95.8%
2: 2nd quartile		98.5%
3: 3rd quartile		97.8%
4: 4th quartile		97.8%
% Households 65+ Owning Their Home[3] [a]	(C_PCT_OWNHOME_65)	
1: 1st quartile		97.2%
2: 2nd quartile		97.4%
3: 3rd quartile		97.8%
4: 4th quartile		98.0%
% Households 65+ Below Poverty[3] [a]	(C_PCT_POV_65)	
1: 1st quartile		99.0%
2: 2nd quartile		97.3%
3: 3rd quartile		98.3%
4: 4th quartile		96.4%
Per Capita Income[3]	(C_PER_CAP_INC)	
1: 1st quartile		97.3%
2: 2nd quartile		97.4%
3: 3rd quartile		97.7%
4: 4th quartile		98.0%
OTHER INDICATORS		
R8 RESIDENTIAL CARE STATUS[4]	(R8DRESID)	
1: R8 Community		97.7%
2: R8 Residential Care Resident not nursing home (SP interview complete)		98.6%
3: R8 Residential Care Resident not nursing home (FQ only)		85.4%
4: R8 nursing home (SP interview complete)		100.0%
5: R8 nursing home (FQ only)		100.0%
7: R1-R7 Residential Care Resident not nursing home (FQ only)		93.1%
8: R1- R7 nursing home		96.2%

[1]Based on Information on the September 30, 2010 CMS 20% Health Insurance Skeleton Eligibility Write-Off (HISKEW) file.
[2]Based on county-level information from the September 30, 2014 CMS 5% EDB extract linked to the beneficiary's EDB address.
[3]Based on tract-level information from the 2009-2013 5-year American Community Survey file linked to the beneficiary's EDB address.
[4]Based on responses to items in the Rounds 1 and 8 interviews.
a=retained in classification tree analysis for living SP non-nursing home branch
b=retained in classification tree analysis for living SP nursing home branch
c=retained in classification tree analysis for deceased SP branch
N=2,612 (2,548 respondents and 64 non-respondents)
Variable names used in classification trees shown parenthetically.

Appendix Table 3. Sampled Person Interview Response Rates Among Cases with Completed Facility Questionnaires, by Various Indicators: NHATS Round 9 2015 Cohort

Variable & Values		Weighted Response Rate
OVERALL		80.7%
BENEFICIARY INDICATORS		
Age[1] [O]	(H_AGECAT_R5)	
1: 65-69		98.2%
2: 70-74		82.5%
3: 75-79		81.6%
4: 80-84		78.0%
5: 85- 89		77.9%
6: 90+		75.0%
R5 Race Ethnicity[8]	(RL5DRACEHISP_R)	
1: White, non-Hispanic		83.4%
2: Black, non-Hispanic		79.6%
3: Other, non-Hispanic		81.1%
4: Hispanic		81.5%
5: DK/RF		32.2%
Gender[1]	(H_SEX)	
1: Male		81.9%
2: Female		80.1%
Census Region[1]	(S_REGION)	
1: Northeast		73.2%
2: Midwest		81.6%
3: South		84.5%
4: West		81.7%
Census Division[1]	(DIVISION)	
1: New England		72.9%
2: Middle Atlantic		73.3%
3: East North Central		82.3%
4: West North Central		80.9%
5: South Atlantic		80.8%
6: East South Central		98.9%
7: West South Central		80.6%
8: Mountain		95.7%
9: Pacific		78.0%
Census Metro/Micro Area Designation (2013) [1]	(S_METMICRO)	
1: Metropolitan area		80.6%
2: Micropolitan area		76.3%
3: Non-metro		91.2%
Health Maintenance Organization Beneficiary[1]	(HMOTYPE)	
0: Yes		76.7%
9: No		82.1%
Age First Enrolled in Medicare[1]	(MEDIC_BEG)	
1: Prior to age 65		85.9%
2: At or after age 65		80.1%

Variable & Values		Weighted Response Rate
COUNTY LEVEL INDICATORS		
% Black 65+ (deciles)[2]	(PCTBLK)	
0: 1st decile		84.6%
1: 2nd decile		77.4%
2: 3rd decile		83.8%
3: 4th decile		73.2%
4: 5th decile		90.0%
5: 6th decile		78.5%
6: 7th decile		83.8%
7: 8th decile		71.7%
8: 9th decile		86.0%
9: 10th decile		77.0%
% Hispanic 65+ (deciles)[2]	(PCTHISP)	
0: 1st decile		89.4%
1: 2nd decile		86.3%
2: 3rd decile		72.0%
3: 4th decile		78.3%
4: 5th decile		93.0%
5: 6th decile		83.6%
6: 7th decile		71.2%
7: 8th decile		82.8%
8: 9th decile		73.5%
9: 10th decile		79.5%
% Poverty (deciles)[2]	(PCTPOV)	
0: 1st decile		73.5%
1: 2nd decile		70.9%
2: 3rd decile		84.1%
3: 4th decile		76.9%
4: 5th decile		89.7%
5: 6th decile		89.2%
6: 7th decile		85.8%
7: 8th decile		81.4%
8: 9th decile		76.6%
9: 10th decile		84.7%
OTHER INDICATORS		
Facility Type Indicator[3]	(FQ9DLOCSP)	
1: Independent living/other		83.2%
2: Assisted Living		84.1%
3: Special care/memory care/Alzheimers unit		61.8%
4: Nursing home		78.2%
8: Not reported		100.0%
R1 RESIDENTIAL CARE STATUS[4] [#]	(R1DRESID_R)	
1: Community		87.4%
2: Residential Care Resident not nursing home		70.0%

Variable & Values		Weighted Response Rate
OTHER INDICATORS		
R2 NURSING HOME STATUS[5] #	(R2NH)	
1: Yes		66.9%
2: No		83.1%
R3 NURSING HOME STATUS[6] #	(R3NH)	
1: Yes		47.4%
2: No		84.3%
R4 NURSING HOME STATUS[7] #	(R4NH)	
1: Yes		44.2%
2: No		85.1%
R5 NURSING HOME STATUS[8]	(R5NH)	
1: Yes		47.0%
2: No		81.6%
R6 NURSING HOME STATUS[9]	(R6NH)	
1: Yes		50.4%
2: No		82.9%
R7 NURSING HOME STATUS[10]	(R7NH)	
1: Yes		69.1%
2: No		82.3%
R8: NURSING HOME STATUS[11]	(R8NH)	
1: Yes		71.3%
2: No		82.7%
R9: NURSING HOME STATUS[11] o r	(R9NH)	
1: Yes		77.6%
2: No		82.0%

Variable & Values		Weighted Response Rate
R2 RESIDENTIAL CARE STATUS[5] #	(R2DRESID_R)	
1: Community in R2		87.5%
2: Residential care in R2		72.9%
3: Nursing home in R2		66.9%
R3 RESIDENTIAL CARE STATUS[6] #	(R3DRESID_R)	
1: Community in R3		88.5%
2: Residential care in R3		74.9%
3: Nursing home in R3		47.4%
R4 RESIDENTIAL CARE STATUS[7] #	(R4DRESID_R)	
1: Community in R4		89.3%
2: Residential care in R4		78.2%
3: Nursing home in R4		44.2%
R5 RESIDENTIAL CARE STATUS[8] r	(R5DRESID_R)	
1: Community in R5		92.9%
2: Residential care in R5		64.5%
3: Nursing home in R5		47.0%
R6 RESIDENTIAL CARE STATUS[9] o	(R6DRESID_R)	
1: Community in R6		93.8%
2: Residential care in R6		70.0%
3: Nursing home in R6		50.4%
R7 RESIDENTIAL CARE STATUS[10]	(R7DRESID_R)	
1: Community in R7		93.2%
2: Residential care in R7		75.8%
3: Nursing home in R7		69.1%
R8 RESIDENTIAL CARE STATUS[11]	(R8DRESID_R)	
1: Community in R8		96.8%
2: Residential care in R8		78.1%
3: Nursing home in R8		71.3%
R9 RESIDENTIAL CARE STATUS[12]	(R9DRESID_R)	
2: Residential care in R9		82.0%
3: Nursing home in R9		77.6%

[1]Based on Information either on the September 30, 2010 CMS 20% Health Insurance Skeleton Eligibility Write-Off (HISKEW) file if the case is in the original sample, or on the September 30, 2014 CMS 20% Enrollment Database (EDB) extract if the case is in the replenishment sample .

[2]Based on county-level information from the September 30, 2014 CMS 5% EDB extract linked to the beneficiary's EDB address.

[3]Based on the responses to two items on the type of facility from the FQ, FQ6 (fq6facdescri; including answers from FQ6A) and FQ10 (fq6faaretype).

[4]Based on responses to items in the Round 1 interview or interview process.

[5]Based on responses to items in the Round 2 interview or interview process.

[6]Based on responses to items in the Round 3 interview or interview process.

[7]Based on responses to items in the Round 4 interview or interview process.

[8]Based on responses to items in the Round 5 interview or interview process.

[9]Based on responses to items in the Round 6 interview or interview process.

[10]Based on responses to items in the Round 7 interview or interview process.

[11]Based on responses to items in the Round 8 interview or interview process.

[12]Based on responses to items in the Round 9 interview or interview process.

[#]Response rates were computed only for the available original sample.

[^] Response rates were computed only for the available replenishment sample.

o=retained in classification tree analysis for adjustment of missing SP interview of the original sample.

r=retained in classification tree analysis for adjustment of missing SP interview of the replenishment sample.

N=471 (383 respondents and 88 nonrespondents); Variable names used in classification trees shown parenthetically.

Appendix Table 4. Sampled Person Interview Response Rates Among Cases with Completed Facility Questionnaires, by Various Indicators: NHATS Round 9 2011 Cohort

Variable & Values		Weighted Response Rate
OVERALL		84.2%
BENEFICIARY INDICATORS		
Age[1] *	(H_AGECAT)	
1: 65-69		94.0%
2: 70-74		88.7%
3: 75-79		85.7%
4: 80-84		75.6%
5: 85- 89		74.4%
6: 90+		77.8%
R1 Race Ethnicity[4]	(RL1DRACEHISP_R)	
1: White, non-Hispanic		84.5%
2: Black, non-Hispanic		80.3%
3: Other, non-Hispanic		89.1%
4: Hispanic		81.8%
5: DK/RF		0.0%
Gender[1]	(H_SEX)	
1: Male		87.3%
2: Female		83.0%
Census Region[1]	(S_REGION)	
1: Northeast		72.0%
2: Midwest		89.2%
3: South		85.9%
4: West		87.5%
Census Division[1]	(DIVISION)	
1: New England		74.4%
2: Middle Atlantic		71.1%
3: East North Central		85.8%
4: West North Central		93.2%
5: South Atlantic		80.6%
6: East South Central		100.0%
7: West South Central		88.6%
8: Mountain		100.0%
9: Pacific		84.0%
Census Metro/Micro Area Designation (2013)[2]	(S_METMICRO)	
1: Metropolitan area		85.2%
2: Micropolitan area		71.7%
3: Non-metro		89.3%
Health Maintenance Organization Beneficiary[1]	(HMOTYPE)	
0: Yes		88.5%
9: No		83.0%
Age First Enrolled in Medicare[1]	(MEDIC_BEG)	
1: Prior to age 65		90.8%
2: At or after age 65		83.4%

Variable & Values		Weighted Response Rate
COUNTY LEVEL INDICATORS		
% Black 65+ (deciles)[2]	(PCTBLK)	
0: 1st decile		93.1%
1: 2nd decile		93.4%
2: 3rd decile		78.9%
3: 4th decile		88.0%
4: 5th decile		88.0%
5: 6th decile		84.3%
6: 7th decile		70.2%
7: 8th decile		81.6%
8: 9th decile		89.4%
9: 10th decile		86.4%
% Hispanic 65+ (deciles)[2]	(PCTHISP)	
0: 1st decile		93.1%
1: 2nd decile		93.4%
2: 3rd decile		78.9%
3: 4th decile		88.0%
4: 5th decile		88.0%
5: 6th decile		84.3%
6: 7th decile		70.2%
7: 8th decile		81.6%
8: 9th decile		89.4%
9: 10th decile		86.4%
% Poverty (deciles)[2]	(POVERTY_PCT)	
0: 1st decile		74.5%
1: 2nd decile		77.6%
2: 3rd decile		93.1%
3: 4th decile		84.6%
4: 5th decile		81.0%
5: 6th decile		98.5%
6: 7th decile		88.2%
7: 8th decile		89.5%
8: 9th decile		81.2%
9: 10th decile		79.1%
OTHER INDICATORS		
Facility Type Indicator[3]	(FQ9DLOCSP)	
1: Independent living/other		91.3%
2: Assisted Living		84.0%
3: Special care/memory care/Alzheimer's unit		78.1%
4: Nursing home		100.0%
R1 RESIDENTIAL CARE STATUS[4]	(R1DRESID_R)	
1: Community		88.2%
2: Residential Care Resident not nursing home		72.6%

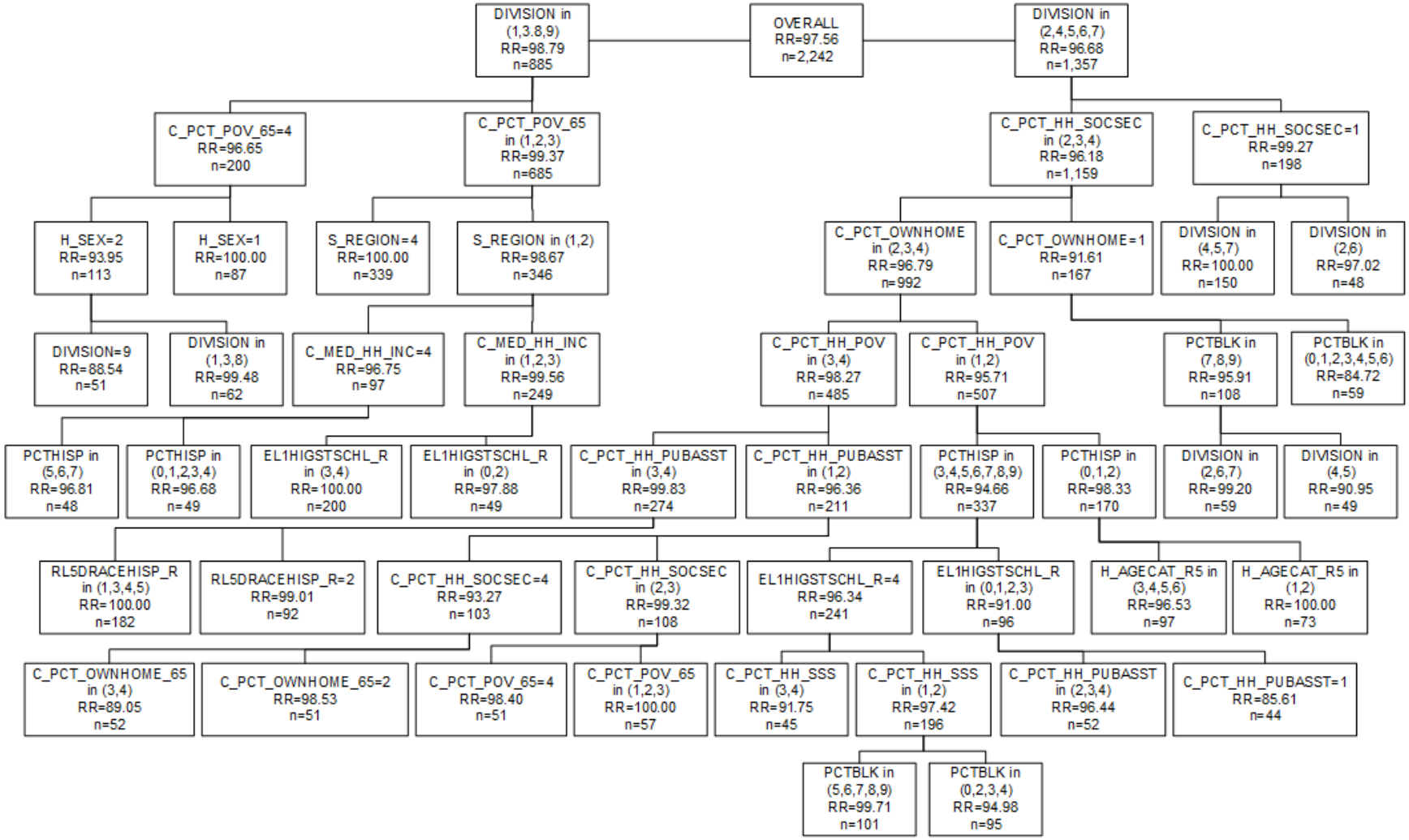
Variable & Values		Weighted Response Rate
OTHER INDICATORS		
R2 NURSING HOME STATUS[5]	(R2NH)	
1: Yes		68.1%
2: No		84.5%
R3 NURSING HOME STATUS[6]	(R3NH)	
1: Yes		51.5%
2: No		85.5%
R4 NURSING HOME STATUS[7]	(R4NH)	
1: Yes		45.8%
2: No		86.5%
R5 NURSING HOME STATUS[8]	(R5NH)	
1: Yes		48.2%
2: No		86.5%
R6 NURSING HOME STATUS[9]	(R6NH)	
1: Yes		64.3%
2: No		86.3%
R7 NURSING HOME STATUS[10]	(R7NH)	
1: Yes		72.8%
2: No		86.5%
R8 NURSING HOME STATUS[11]	(R8NH)	
1: Yes		72.9%
2: No		86.8%
R9 NURSING HOME STATUS[12] *	(R9NH)	
1: Yes		73.9%
2: No		88.2%

Variable & Values		Weighted Response Rate
OTHER INDICATORS		
R2 RESIDENTIAL CARE STATUS[5]	(R2DRESID_R)	
1: Community in R2		88.3%
2: Residential care in R2		75.3%
3: Nursing home in R2		68.1%
R3 RESIDENTIAL CARE STATUS[6]	(R3DRESID_R)	
1: Community in R3		89.3%
2: Residential care in R3		77.0%
3: Nursing home in R3		51.5%
R4 RESIDENTIAL CARE STATUS[7]	(R4DRESID_R)	
1: Community in R4		90.0%
2: Residential care in R4		80.4%
3: Nursing home in R4		45.8%
R5 RESIDENTIAL CARE STATUS[8]	(R5DRESID_R)	
1: Community in R5		92.7%
2: Residential care in R5		78.1%
3: Nursing home in R5		48.2%
R6 RESIDENTIAL CARE STATUS[9] *	(R6DRESID_R)	
1: Community in R6		93.1%
2: Residential care in R6		79.4%
3: Nursing home in R6		64.3%
R7 RESIDENTIAL CARE STATUS[10]	(R7DRESID_R)	
1: Community in R7		93.6%
2: Residential care in R7		82.6%
3: Nursing home in R7		72.8%
R8 RESIDENTIAL CARE STATUS[11]	(R8DRESID_R)	
1: Community in R8		93.7%
2: Residential care in R8		85.0%
3: Nursing home in R8		72.9%
R9 RESIDENTIAL CARE STATUS[12]	(R9DRESID_R)	
2: Residential care in R9		88.2%
3: Nursing home in R9		73.9%

[1]Based on Information on the September 30, 2010 CMS 20% Health Insurance Skeleton Eligibility Write-Off (HISKEW) file.
[2]Based on county-level information from the September 30, 2014 CMS 5% EDB extract linked to the beneficiary's EDB address.
[3]Based on the responses to two items on the type of facility from the FQ, FQ6 (fq6facdescri; including answers from FQ6A) and FQ10 (fq6faaretype).
[4]Based on responses to items in the Round 1 interview or interview process.
[5]Based on responses to items in the Round 2 interview or interview process.
[6]Based on responses to items in the Round 3 interview or interview process.
[7]Based on responses to items in the Round 4 interview or interview process.
[8]Based on responses to items in the Round 5 interview or interview process.
[9]Based on responses to items in the Round 6 interview or interview process.
[10]Based on responses to items in the Round 7 interview or interview process.
[11] Based on responses to items in the Round 8 interview or interview process.
[12] Based on responses to items in the Round 9 interview or interview process.

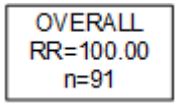
*=retained in classification tree analysis for adjustment of missing SP interview.
N=295 (243 respondents and 52 nonrespondents); Variable names used in classification trees shown parenthetically.

Figure 1. Round 9 2015 Cohort Tracker weight nonresponse adjustment cells – non nursing home cases in original sample



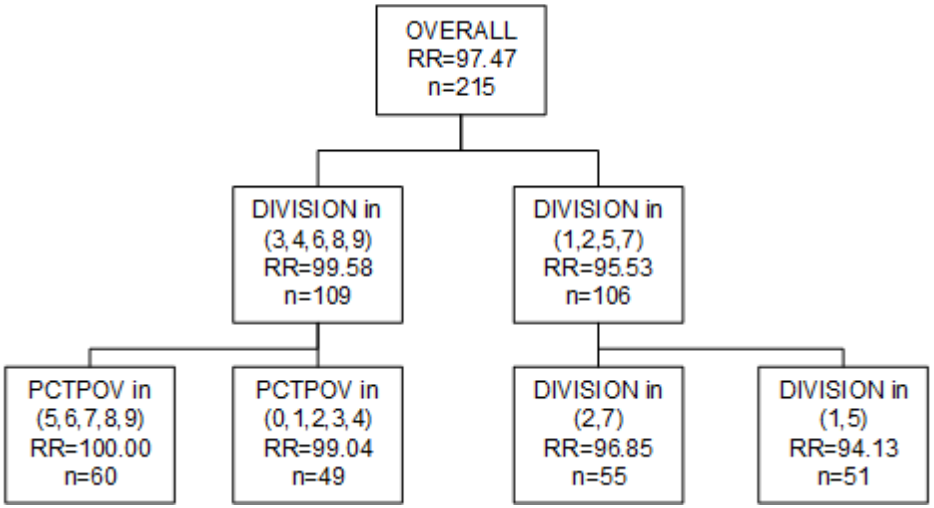
Note: "RR" is the weighted response rate for the particular cell, and "n" is the number of respondents in the cell

Figure 2. Round 9 2015 Cohort Tracker weight nonresponse adjustment cells – nursing home cases in original sample



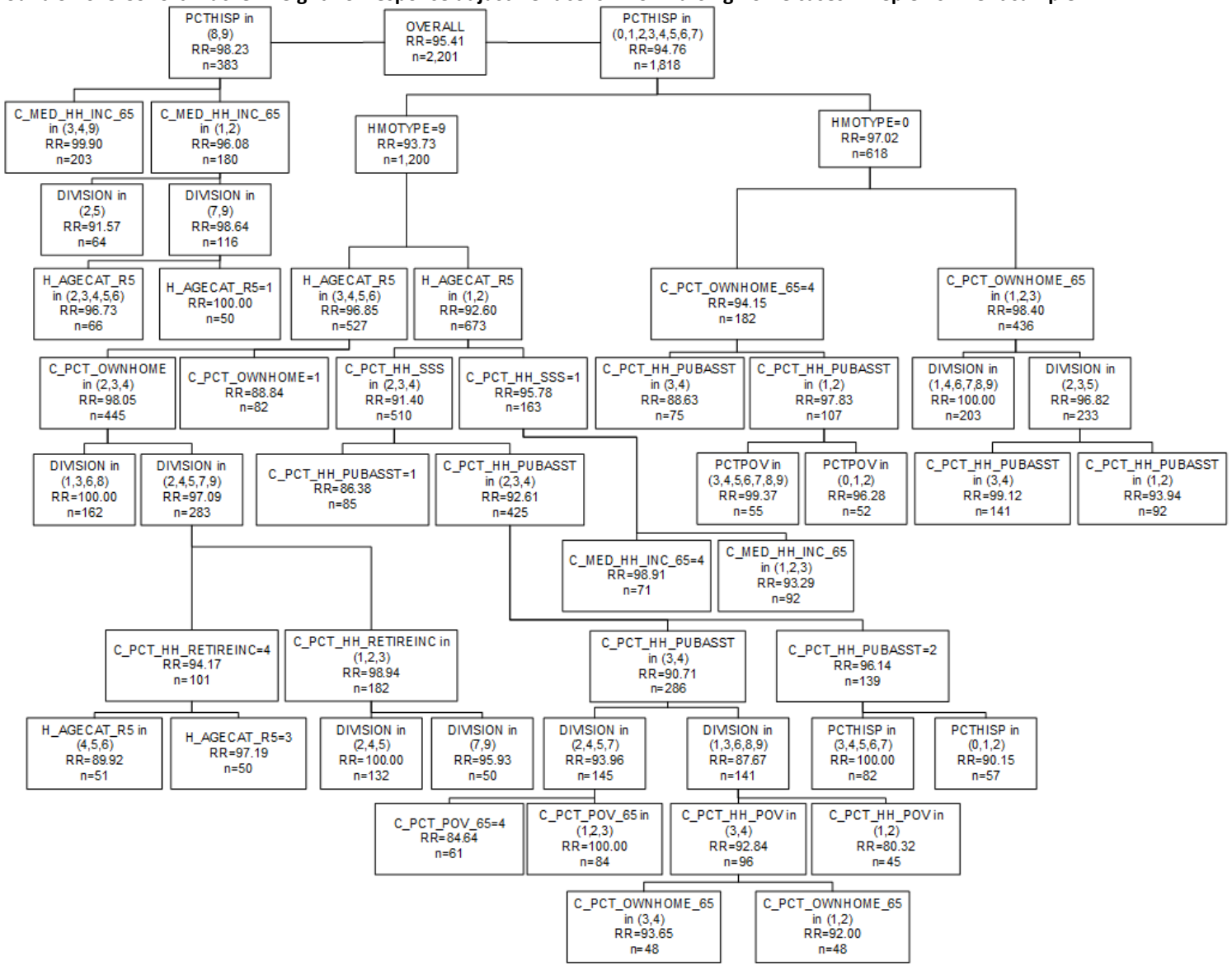
Note: “RR” is the weighted response rate for the particular cell, and “n” is the number of respondents in the cell

Figure 3. Round 9 2015 Cohort Tracker weight nonresponse adjustment cells – deceased cases in original sample



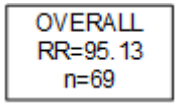
Note: "RR" is the weighted response rate for the particular cell, and "n" is the number of respondents in the cell

Figure 4. Round 9 2015 Cohort Tracker weight nonresponse adjustment cells – non nursing home cases in replenishment sample



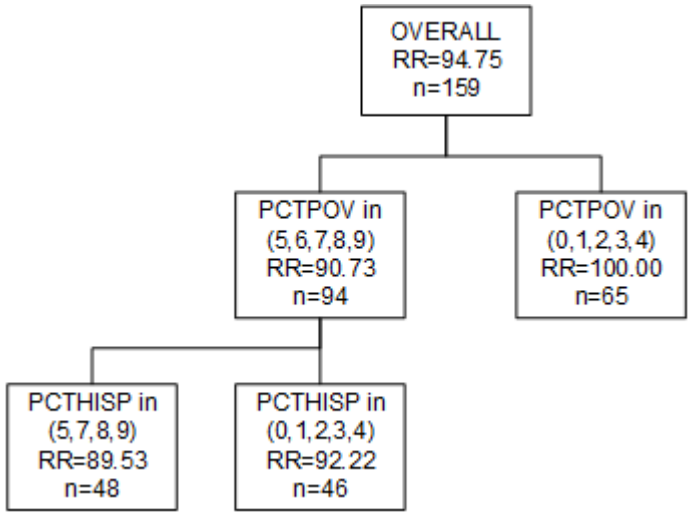
Note: "RR" is the weighted response rate for the particular cell, and "n" is the number of respondents in the cell

Figure 5. Round 9 2015 Cohort Tracker weight nonresponse adjustment cells – nursing home cases in replenishment sample



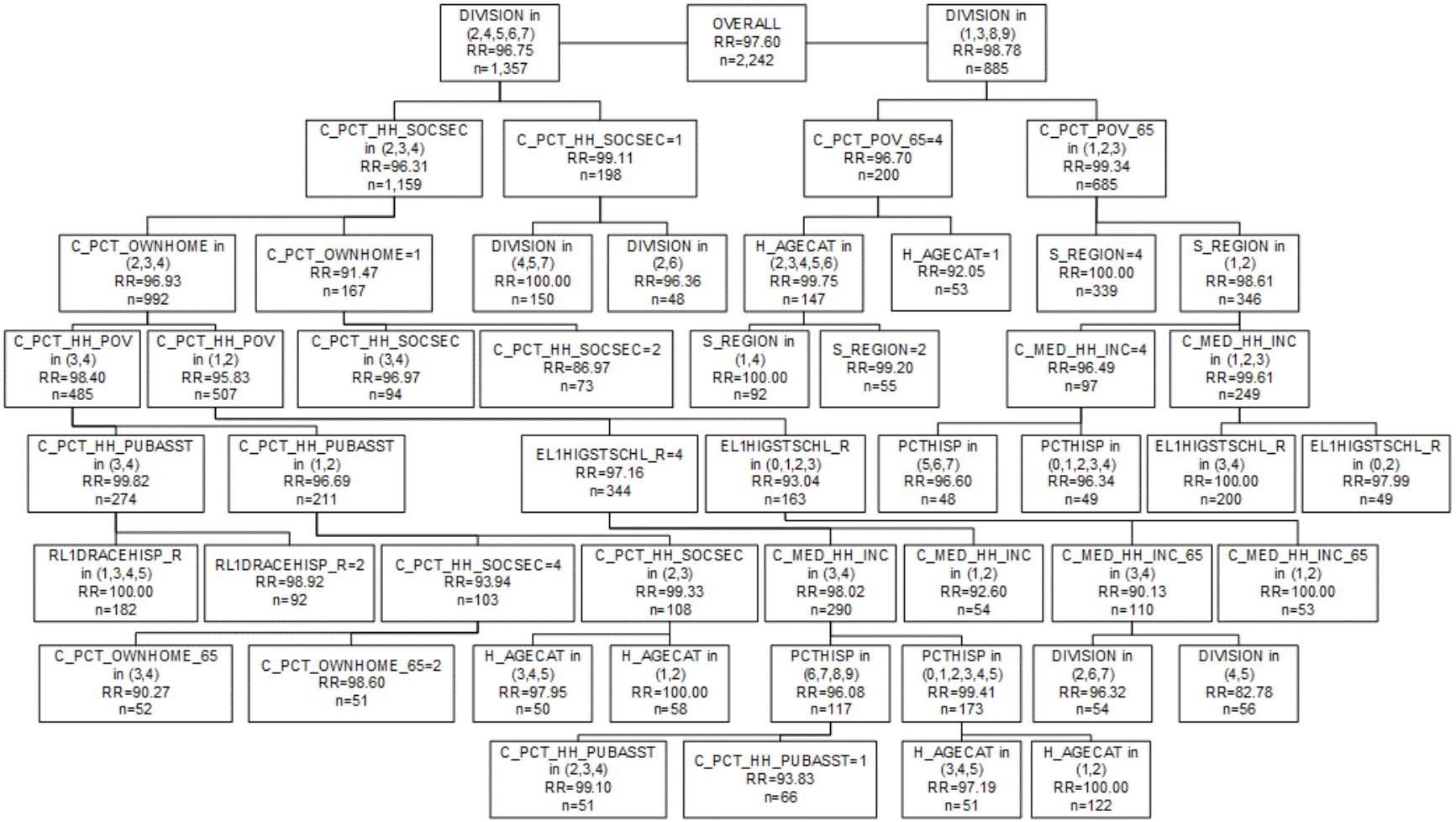
Note: “RR” is the weighted response rate for the particular cell, and “n” is the number of respondents in the cell

Figure 6. Round 9 2015 Cohort Tracker weight nonresponse adjustment cells – deceased cases in replenishment sample



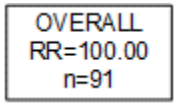
Note: "RR" is the weighted response rate for the particular cell, and "n" is the number of respondents in the cell

Figure 7. Round 9 2011 Cohort Tracker weight nonresponse adjustment cells – non nursing home cases in original sample



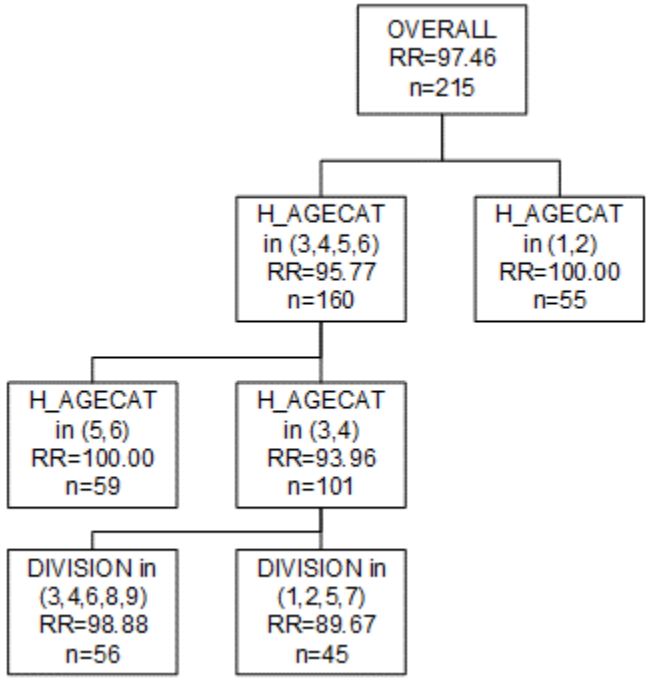
Note: "RR" is the weighted response rate for the particular cell, and "n" is the number of respondents in the cell

Figure 8. Round 9 2011 Cohort Tracker weight nonresponse adjustment cells – nursing home cases in original sample



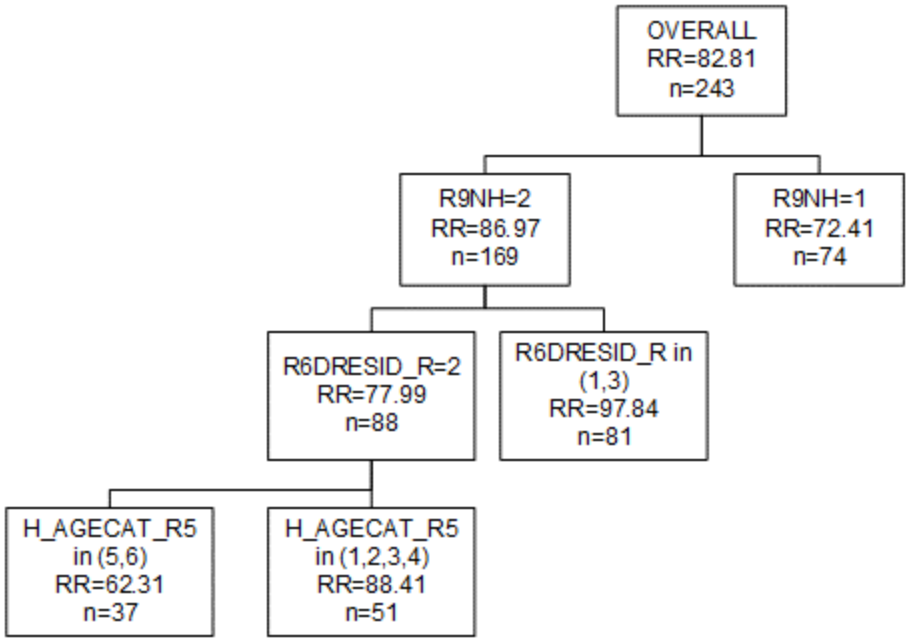
Note: "RR" is the weighted response rate for the particular cell, and "n" is the number of respondents in the cell

Figure 9. Round 9 2011 Cohort Tracker weight nonresponse adjustment cells – deceased cases in original sample



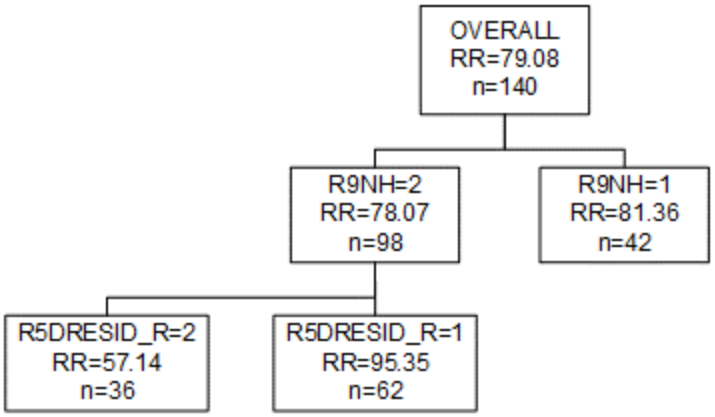
Note: "RR" is the weighted response rate for the particular cell, and "n" is the number of respondents in the cell

Figure 10. Round 9 2015 Cohort Analytic weight nonresponse adjustment cells – original sample residential care (not nursing home) and nursing home cases with both an SP and FQ interview



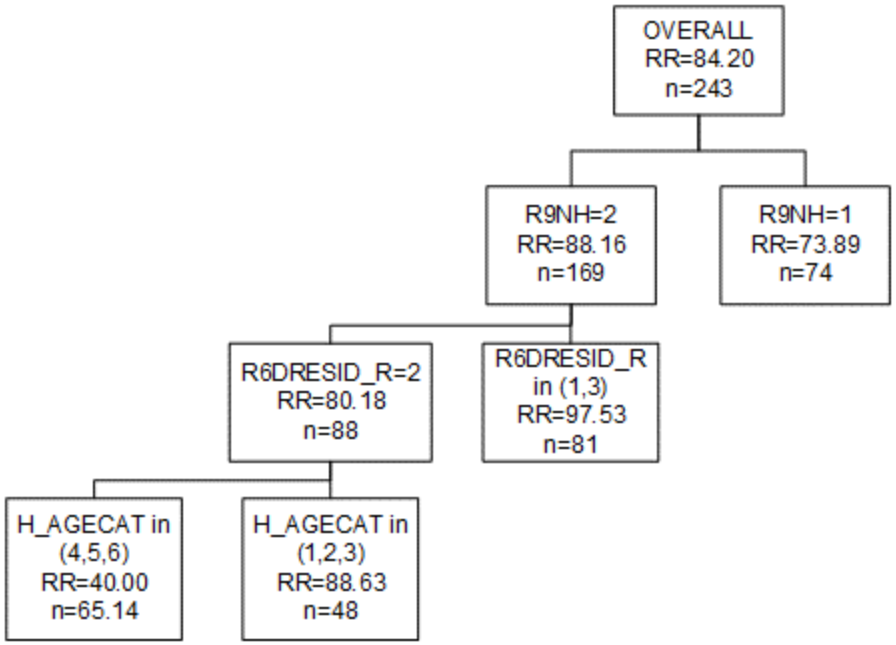
Note: "RR" is the weighted response rate for the particular cell, and "n" is the number of respondents in the cell

Figure 11. Round 9 2015 Cohort Analytic weight nonresponse adjustment cells – replenishment sample residential care (not nursing home) and nursing home cases with both an SP and FQ interview



Note: "RR" is the weighted response rate for the particular cell, and "n" is the number of respondents in the cell

Figure 12. Round 9 2011 Cohort Analytic weight nonresponse adjustment cells –original sample residential care (not nursing home) and nursing home cases with both an SP and FQ interview



Note: "RR" is the weighted response rate for the particular cell, and "n" is the number of respondents in the cell