NATIONAL HEALTH AND AGING TRENDS STUDY (NHATS)
Development of Round 11 Accelerometry Weights

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NHATS Accelerometry Sample and Need for Weights

In Round 11 of the National Health and Aging Trends Study (NHATS), physical activity data were collected using wrist accelerometry in a subsample of participants. Data were collected using the Actigraph CentrePoint Insight Watch ("Activity Watch").

The Round 11 NHATS Accelerometry Sample is designed to represent Medicare beneficiaries ages 65 and older as of October 1, 2014 who were still alive in 2021.[1] Prior to Round 11 data collection, a representative sample of 1000 Round 10 NHATS living respondents were flagged to receive Activity Watches during Part 2 of the Round 11 NHATS SP interview; 872 were eligible to wear the Activity Watch. Of those eligible, 747 (86%) returned an Activity Watch with usable data.

To generate population estimates, the Accelerometry sample must be weighted to account for: (1) different probabilities of selection, (2) nonresponse to the NHATS Sample Person (SP) interview, and (3) failure or inability to provide complete Activity Watch data. In addition, design variables must also be used in variance estimation to account for the complex design of NHATS.

This technical paper describes the development of the Round 11 NHATS Accelerometry SP weights and design variables for variance estimation.

Overview of Weight and Design Variables

The Accelerometry Summary File contains the weights (1 full sample weight, 56 replicate weights) and design variables (stratum, cluster) for making population estimates and proper variance estimation.

File	Full sample weight	Replicate weights	Stratum	Cluster
Accelerometry Summary File : NHATS_Round_11_Accel_Summ_File	w11agfinwgt0	w11agfinwgt1-w11agfinwgt56	w11agvarstrat	w11agvarunit

The weights are designed for generating Sample Person-level estimates. The design variables (stratum and cluster) should be specified when using software that uses Taylor series linearization to estimate the variances of estimates from complex sample surveys.

Replicate weights are also provided and may be used with software that uses replication methods to estimate the variances of estimates from complex sample surveys. The replication approach that was used is the modified balanced repeated replication (BRR) method suggested by Fay (Judkins 1990). Fay's method perturbs the weights by ±100 (1-K) percent where K is

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[1] All but four sample persons with accelerometry data are age 72 or older.

referred to as "Fay's factor" or a perturbation factor. The perturbation factor for standard balanced repeated replication (BRR) is K=0 or 100 percent. For NHATS and Accelerometry samples, K = 0.3 was used.

How to Use Sample Weights and Design Variables

Stata Example for Full Weights and Sample Design Variables. In Stata, users should specify the following svyset command to use full sample weights and design variables (Taylor series method) with the summary file.

```
/*Summary file*/
        svyset w11agvarunit [pweight=w11agfinwgt0], strata(w11agvarstrat)
        svy: [stata procedures]
```

Stata Example for Replication Weighting Methods. In Stata, users should specify the following svyset command to use replicate weights with the summary file.

```
/*Summary file*/
        svyset [pweight= w11agfinwgt0], brrweight(w11agfinwgt1-w11agfinwgt56) fay(.3) vce(brr) mse
        svy: [stata procedures]
```

SAS Example for Full Weights and Sample Design Variables. In SAS, users should specify the following command to use full sample weights and design variables (Taylor series method) with the summary file.

```
/*Summary file*/
        [sas survey procedure]
        weight w11agfinwgt0;
        cluster w11agvarunit;
        strata w11agvarstrat;
        [model or other statement]
        run;
```

SAS Example for Replication Weighting Methods In SAS, users should specify the following command when using replicate weights with the summary file.

```
/*Summary file*/
        [sas survey procedure] varmethod=brr (fay=.30);
        weight w11agfinwgt0;
        repweight w11agfinwgt1- w11agfinwgt56;
        [model or other statement]
        run;
```

R Example for Full Weights and Sample Design Variables. In R, users should specify the following command when using full sample weights and design variables (Taylor series method) with the summary file.

```
/*Summary file*/
        library(survey) #need this line only once per session
        nhats.dsgn <- svydesign(id=~w11agvarunit, strata=~w11agvarstrat,
        weights=~w11agfinwgt0, data = [data frame name], nest=TRUE)
        [model or other statement]
```

R Example for Replication Weighting Methods. In R, users should specify the following command when using replication weights with the summary file.

```
        library(survey) #need this line only once per session
        nhatsrep<-svrepdesign(weights=~w11agfinwgt0, data=[data frame name], type="Fay",
        rho = 0.3, repweights="w11agfinwgt[1-56]+")
        [model or other statement]
```

For more information about how to account for sample design in NHATS, please refer to "Accounting for Sample Design in NHATS and NSOC Analyses: Frequently Asked Questions" (Freedman et al. 2020), available at www.NHATS.org.

Calculation of Weights

The eligible Accelerometry sample cases, Round 11 NHATS living respondents who completed an SP interview and were flagged for Accelerometry sample, received an initial Accelerometry SP weight (n=872), calculated as the product of the final Round 11 NHATS analytic weight for the 2015 cohort (DeMatteis et al. 2022) and the inverse of the conditional probability of Accelerometry sample selection.

The eligible cases were then classified into two response categories, respondents (n=747) and nonrespondents (n=125). Cases who returned the Activity Watch with at least one day of valid data were considered respondents. Cases were considered nonrespondents if they either (1) refused to complete Part 2 of the NHATS Round 11 interview, or (2) completed the Part 2 interview but refused to wear the Activity Watch, or (3) returned the Activity Watch but the data was invalid.

A single stage nonresponse adjustment was then made to the initial weight. In the adjustment, a set of variables were input into a classification tree analysis to determine which variables were associated with nonresponse. This approach uses a classification tree algorithm to identify variables associated with response propensities. Chi-square tests were performed to determine the most significant predictor of response, given the set of conditions already specified in the particular "branch." The cell size was set to be at least 30 respondents. Appendix Table 1 shows variables that were input to the classification tree analysis, along with weighted response rates

for each level of each of these variables. Final nonresponse cells included a total of five indicators (designated with "*" in Appendix Table 1). Combinations of these variables created 12 unique nonresponse cells for the nonresponse adjustment (see Appendix Figure 1). Within each cell, the initial Accelerometry SP weights for the respondents were inflated by the adjustment factor of the cell.

Finally, a raking adjustment was applied so that the marginal totals based on the Accelerometry SP weights match the totals among living NHATS respondents who completed the NHATS Round 11 SP interview, weighted by the analytic weights. The raking adjustment consisted of six dimensions: 5-year age groups, sex, race, region, micro/metropolitan status, and whether Medicare was received before age 65. No cases were identified as influential outliers, thus no trimming was needed. After the raking adjustment, the design effect for the final Round 11 Accelerometry SP weights was 1.03.

REFERENCES

Jiao, Rui, Freedman, Vicki A., Kasper, JD, and Schrack, Jennifer 2022. National Health and Aging Trends Study Development of Round 11 Survey Weights. NHATS Technical Paper #30. Baltimore: Johns Hopkins University School of Public Health. Available at www.NHATS.org.

Freedman, V. A., Hu, M., DeMatteis, J., & Kasper, J. D. 2020. Accounting for sample design in NHATS and NSOC analyses: Frequently asked questions. NHATS Technical Paper #23. Baltimore: Johns Hopkins University School of Public Health. Available at www.NHATS.org.

Appendix Table 1. Weighted Responses Rates for Variables used in Nonresponse Adjustment for Accelerometry Sample Person Weights

	SP returned Actigraph watch with at least one day of valid data (Weighted Response Rate)
OVERALL	85.5
R1/R5 SP Education*– (EL5DHIGSTSCHL_R2)	
1: Below high school	81.6
2: High school	85.3
3: Above high school	86.5
Census Metro/Micro Area Designation (2013) – (S_METMICRO_N)	
1: Metropolitan area	85.1
2: Micropolitan area	85.5
3: Non-metro	92.8
R11 SP Age at interview* – (R11D2INTVRAGE)	
2: 70-74	85.7
3: 75-79	86.7
4: 80-85	87.6
5: 86-89	80.9
6: 90+	79.8
SP gender – (SPGENDER_1)	
1: Male	86.1
2: Female	85.0
R11 SP mobility* - (MO1_1)	
1: Every day (7 days a week)	86.8
2: Most days (5-6 days a week)	87.5
3: Some days (2-4 days a week)	87.8
4: Rarely (once a week)	75.4
5: Never	29.6
SP Race/Ethnicity* – (RL5DRACEHISP_R)	
1: White non-Hispanic	86.5
2: Black non-Hispanic	86.2
3: Other non-Hispanic	90.3
4: Hispanic	72.7
5: DK/RF	86.2
Census Division* – (DIVISION_N)	
1: New England	88.1
2: Middle Atlantic	87.5
3: East North Central	88.1
4: West North Central	92.6
5: South Atlantic	85.4
6: East South Central	79.0
7: West South Central	87.4
8: Mountain	78.9
9: Pacific	80.4
SP Residence – (R11DRESID)	
1: Community	86.2
2: Residential Care Resident not nursing home (SP interview complete)	79.4
4: Nursing home (SP interview complete)	58.2

* Retained in classification tree analysis for nonresponse adjustment.

Variable names used in classification trees shown in parentheses

Appendix Figure 1. Accelerometry SP Weight nonresponse adjustment cells
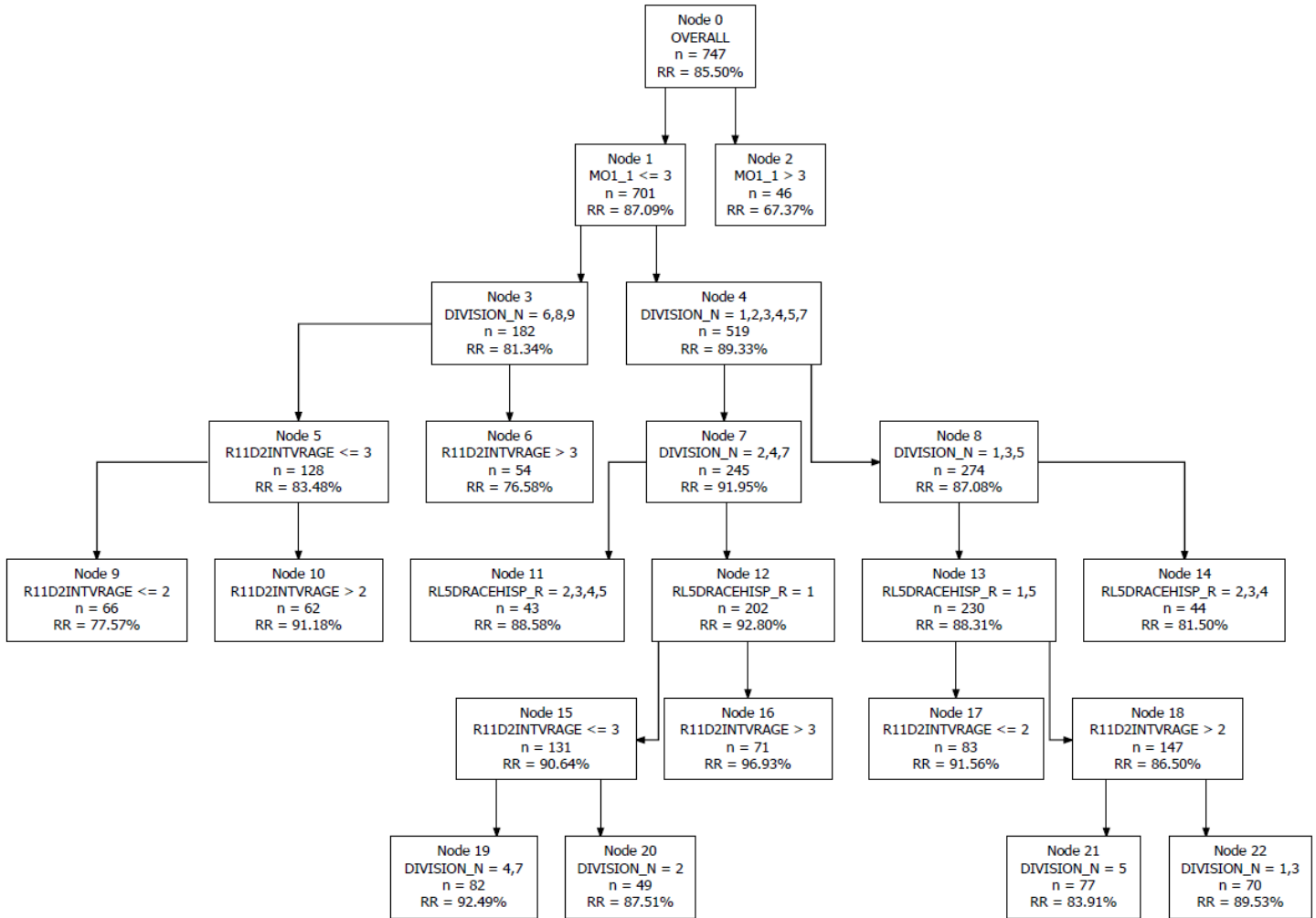
NOTE: "RR" is the weighted response rate for the particular cell, and "n" is the number of respondents in the cell.