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Income Imputations in the National Study of Caregiving (NSOC) IV

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Overview

The National Study of Caregiving (NSOC) IV asks caregivers to report their total income for the prior calendar year. For those who do not report an exact value, information is collected in broad categories. Spouses/partners of NHATS participants have two potential sources of income: they are asked income questions in NSOC and also have information collected or imputed in NHATS (Freedman et al. 2022).

Exact income values are available from NSOC for about 70% of participants. In order to facilitate use of the income data by researchers, we have developed a set of imputed values for those with missing or categorical income information. We provide five sets of imputed values to enable data users to use multiple imputation variance estimators and analysis techniques (see, for example, Rubin 1996).

This technical paper describes the income imputation methodology used in NSOC IV. These values were included in the NSOC IV final data files released in 2022. A separate technical paper documents income imputation methodology used in NSOC I–III (Hu et al. 2020).

Extent of Missing Data for Total Income

Table 1 shows the extent and type of reported/missing data for Round 11 by source. Exact values are available from NSOC for 69.7% of respondents and categorical values are available from NSOC for 15.6%. The remaining 14.7% were missing both sources of income in NSOC, including a small number that reported zero income. After bringing over information from NHATS for 77 spouse/partners, 511 cases out of 1,938 cases required imputation (268 within a known interval and 243 with no interval specified).

Table 1. Percentages of respondents who reported income questions or have missing income.

	Round 11 (%, n)
% reported exact income value in NSOC > $0	69.7, 1,350
% reported categorical income in NSOC[a]	15.6, 302
% missing both in NSOC[b, c]	14.7, 286
Total	100.0, 1,938

[a]Some spouse/partner caregivers with NSOC categorical information had consistent exact value information from NHATS that was used so imputation was not needed (n=34 in Rd 11). See text for details.
[b]Reports of $0 income are treated as missing. See text for details.
[c]Some spouse/partner caregivers missing NSOC exact and categorical income values had NHATS exact amounts that were used so imputation was not needed (n=43 in Rd 11). See text for details

Imputation Approach

In NSOC IV Round 11, log income was imputed five times (and then transformed back to a non-logged dollar scale before releasing). For respondents missing exact value and category

(including reports of $0), we used multiple imputation by chained equations (MICE) to impute missing income and missing covariates. We used interval regression to impute income, which fills in the missing values of partially observed (censored) income (that is, within a range). We used Stata for all analyses.

We ran models for four separate groups: 1) non-spouse/partner caregivers to living Sample Persons (SPs); 2) spouse/partner caregivers to living SPs; 3) breakoffs (who have fewer covariates available); and 4) caregivers to deceased SPs.

Because spouses/partners of living SPs[1] had two potential sources of information (NSOC exact values or brackets and NHATS reported or imputed values), we developed the following approach for determining which source to use. If the caregiver reported an exact value (above $0) in NSOC, we used the information in NSOC. If the caregiver reported a bracketed amount in NSOC, we compared SP's reported income in NHATS (ia11totinc) or average imputed income (ia11toincim1- ia11toincim5) to the bracket reported and if the value from NHATS fell within $10,000 of the bracket range, we used the NHATS amount. If the bracket from NSOC and reported/imputed value from NHATS disagreed by more than $10,000, we imputed income within the reported NSOC bracket.[2] If the caregiver was missing an exact value and missing bracket information in NSOC we used the reported or average of imputed income from NHATS.

To implement the interval regression approach, we specified a lower and upper limit for all cases. For cases with an exact value, we specified the lower and upper limits to be the log-transform of that value. [3] For cases with only bracketed information, the log-transformed upper and lower amounts of the bracket were used as limits in the imputation. Cases with only an upper limit (e.g., income < $15,000) received zero as their lower limit. Cases with only a lower limit (e.g., income > $100,000) received a missing value for their upper limit, which can take any positive value above the lower limit. For cases reporting $0 income, we assumed that the exact value was in the <$15,000 category. For cases missing both an exact value and bracket, the lower limit was specified as 0 and upper limit set to missing.

Variables Used in Imputation

Table 2 below indicates covariates included in the imputation model for each subgroup. Variables were included as follows:

- For all groups, models include: caregiver's characteristics (e.g., age, gender, education, race / ethnicity, number of other people in the household, spouse/partner's education), geographic indicators of the NHATS Sample Person (census division and metro / non-metro residence), and final survey mode.

[1] Includes spouse/partners of SPs who completed NHATS and died between NHATS and NSOC

[2] To capture the effects of imputation for spouses/partners of SPs whose income was imputed in NHATS, one could also use the five sets of imputed values from NHATS to impute the five sets of imputed values in NSOC. Given the small number of missing cases among spouses/partners of SPs, the two approaches did not differ appreciably.

[3] Prior to log transformation, we added one to the limit variables.

- For all groups except spouse/partner caregivers we also include: relationship of caregiver to sample person and whether the caregiver lives with the SP in the current round.
- For groups other than spouse/partner caregivers and last-month-of-life caregivers, we also include sample person's income from NHATS.
- For all groups except breakoffs we also include: insurance coverage (private insurance, Medicaid enrollment), assets (e.g., whether the CG and their spouse/partner own a home, have a checking account, savings account, certificate of deposit, retirement plan, and stocks or mutual funds), and employment variables (own business/farm and work for pay last week or in the last month of SP's life).

Table 2. Covariates used to impute income in NSOC IV for each subgroup.

	Imputation Group			
Covariates[a]	1 Non-Spouse/ Partner	2 Spouse/ Partner	3 Breakoff	4 LML
Age	Y	Y	Y	Y
Race / ethnicity	Y	Y	Y	Y
Gender	Y	Y	Y	Y
Number of other people live in the household	Y	Y	Y	Y
CG education	Y	Y	Y	Y
CG spouse/partner's education[b]	Y	Y	Y	Y
SP census division	Y	Y	Y	Y
SP Metro / non-metro residence	Y	Y	Y	Y
Relationship to SP	Y		Y	Y
SP's income from NHATS (log-transformed)[c]	Y		Y	
CG in household with SP	Y		Y	Y
CG has private insurance coverage	Y	Y		Y
CG has Medicaid coverage	Y	Y		Y
CG owns home	Y	Y		Y
CG has checking acct	Y	Y[d]		Y
CG has savings account	Y	Y		Y
CG has cert of deposit	Y	Y		Y
CG has retirement plan	Y	Y		Y
CG has stocks mutual funds	Y	Y		Y
Work for pay last week or in the last month of SP's life	Y	Y		Y[e]
Own farm business	Y	Y		
Final survey mode[f]	Y	Y	Y	Y
Number with Reported Income	933	289	-	205

Number with Imputed Income	375	17	28	91
Other Cases with Reported or Imputed Income included in Model	-	-	1,308[g]	1,308[g]
Total Model Sample Size	1,308	306	1,336	1,604
Weight used	w11cgfinwgt0	w11cgfinwgt0	w11cgfinwgt0	w11cgfinwgt0 (for CGs to living SPs) and w11cglmlfinwgt0 (for LML CGs)

[a] For categorical variables, if > 30 cases are missing, we coded the missing cases as a separate category and use it in imputation.
[b] For Group 2, CG spouse's education was imputed using ordinal logistic model. For the other three groups, CG spouse's education was imputed using multinomial logistic model with missing in CG spouse's education coded as a separate category (due to convergence issues).
[c] If SP's income from NHATS is < $100, we recode as missing and impute.
[d] For Group 2, missing values for whether the CG has a checking account were coded as a separate category due to model convergence issues.
[e] Constructed using cel11wrk4pay and cec11wrk4pay.
[f] Final survey mode is used because the income questions are close to the end of the instrument.
[g] Group 1 cases (reported or average of 5 imputed values) are also included in model estimation.

Income Imputation Process

We estimated multiple imputations by chained equations (MICE) to fill in missing values for covariates (starting with the least missing) and logged income separately for each subgroup in Table 2. Interval regression was used to impute five values of logged income. In each imputation, we specified 20 burn-in iterations (i.e., the number of iterations before the first set of imputed values is drawn). We incorporated the NSOC survey design into imputation models as follows (Reiter 2006). NSOC weights were included in the imputation model (using a pweight statement). To account for strata and cluster variables in imputation, we included variables for the SP's census division and a metro / non-metro residence indicator in the model.[4] Imputation model results for income can be found in the appendix. Final imputed variables were transformed back to a non-logged dollar scale, using either reported values repeated five times or the five distinct imputed income values (from either NSOC or NHATS). Flags were created to indicate which values were imputed.

[4] We considered other approaches – e.g. adding a variable for each strata by cluster combination or imputing separately by each unique cluster (Heeringa, West & Berglund, 2017). However, the NHATS' complex sample design has too many cluster/strata combinations to implement these approaches (56 strata and two clusters per stratum).

Income Imputation Variables in NSOC

The following imputed variables are included in each round of NSOC.

Table 3. Imputed variables included in NSOC IV

Variable name	Label	Description
chi11income	C11 HI10 INCOME LAST YEAR	Actual reported $ amount
chi11incimf	C11 F IMPUTED INCOME LAST YEAR FLG	Flag indicating imputation
chi11incim1-chi11incim5	C11 HI10 IMPUTED INCOME LAST YEAR INC1-INC5	Includes reported $ amount, imputed values 1-5 for missing $ amounts and reported bracket amounts

Descriptive Statistics for Income

Table 4 presents the weighted mean and median values for income by imputation groups and for all groups combined.

Table 4. Weighted mean and median income for NSOC IV

Round		1 Non-Spouse/partners	2 Spouse/partners	3 Breakoff	4 Last Month of Life (LML)	All groups
11	n	1,308	306	28	296	1,938
	Mean	90,143	59,117	60,814	78,374	82,727
	Median	60,000	50,000	54,670	54,571	55,108
Note. Weighted means are calculated using "mi estimate" command in Stata, described in the section below. Weighted medians are calculated using "_pctile meaninc [pweight=w11cgfinwgt0] , p(50)" in Stata where meaninc is the mean of the five imputed values or reported income.						

Using the Five Versions of Income in Analyses

For each round, five sets of imputed variables were generated.

To adjust coefficients and standard errors for the variability between imputations following the combination rules by Rubin (1987), users can use the "mi estimate" command in Stata to run estimations on the imputed dataset.

Below is some example code to estimate weighted mean income using NSOC IV.

```
*generate a reported income variable which includes only reported income values from either
NHATS or NSOC
gen chi11incim = chi11incim1
replace chi11incim = . if chi11incimf == 3
replace chi11incim = . if chi11incimf == 4

*save it to a new dataset
save newdataset, replace
```

```
*use this new dataset for analysis
use newdataset, clear

*use mi import to import data that include reported income and additional imputed income
variables
mi import wide, imputed (chi11incim=chi11incim1 chi11incim2 chi11incim3 chi11incim4
chi11incim5) drop
mi set wide

*estimate weighted mean income of caregivers to living SP of NSOC IV Round 11
mi svyset c11varunit [pweight=w11cgfinwgt0], strata(c11varstrat)
mi estimate: svy, subpop(if fl11spdied != 1): mean chi11incim

*estimate weighted mean income of caregivers to deceased SP of NSOC IV Round 11
mi svyset c11varunit [pweight=w11cglmlfinwgt0], strata(c11varstrat)
mi estimate: svy, subpop(if fl11spdied == 1): mean chi11incim

*estimate weighted mean income of all caregivers to living or deceased SP of NSOC IV Round 11
gen w11cgfinwgt=0
replace w11cgfinwgt=w11cgfinwgt0
replace w11cgfinwgt=w11cglmlfinwgt0 if fl11spdied==1
mi svyset c11varunit [pweight=w11cgfinwgt], strata(c11varstrat)
mi estimate: svy: mean chi11incim
```

References

Freedman, Vicki A., Mengyao Hu and Jennifer Wolff. National Study of Caregiving IV User Guide: Final Release. 2022. Baltimore: Johns Hopkins Bloomberg School of Public Health. Available at www.nhats.org.

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Appendix Table 1. Imputation model results for caregivers who are not spouse/partner (Group 1)

	1			2			3			4			5		
	est	SE	p	est	SE	p	est	SE	p	est	SE	p	est	SE	p
SP's income from NHATS	0.01	0.03	0.760	0.01	0.03	0.786	0.01	0.03	0.806	0.01	0.03	0.746	0.01	0.03	0.776
Own farm business															
No	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Yes	0.14	0.08	0.064	0.14	0.08	0.057	0.15	0.08	0.048	0.15	0.08	0.055	0.14	0.08	0.060
Work for pay last week															
Yes	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
No	-0.33	0.09	<0.001	-0.32	0.09	<0.001	-0.32	0.09	<0.001	-0.32	0.09	<0.001	-0.32	0.09	<0.001
Retired/Don't work anymore	-0.30	0.08	<0.001	-0.29	0.08	<0.001	-0.29	0.08	<0.001	-0.30	0.08	<0.001	-0.30	0.08	<0.001
CG education															
Below high school	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
High school	0.55	0.24	0.024	0.55	0.25	0.025	0.55	0.25	0.026	0.55	0.25	0.024	0.55	0.24	0.024
Some college	0.70	0.25	0.004	0.70	0.25	0.005	0.70	0.25	0.004	0.69	0.25	0.005	0.70	0.24	0.004
College and above	0.94	0.25	0.000	0.94	0.25	<0.001	0.94	0.25	0.000	0.93	0.25	<0.001	0.94	0.25	<0.001
Number of other people in household	-0.01	0.03	0.745	-0.01	0.03	0.796	-0.01	0.03	0.750	-0.01	0.03	0.805	-0.01	0.03	0.801
Own your home															
No	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Yes	0.17	0.07	0.016	0.17	0.07	0.014	0.17	0.07	0.015	0.17	0.07	0.013	0.17	0.07	0.013
Medicaid coverage															
No	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Yes	-0.09	0.12	0.429	-0.10	0.12	0.428	-0.10	0.12	0.398	-0.10	0.12	0.424	-0.11	0.12	0.374
Private insurance coverage															
No	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Yes	0.27	0.07	<0.001	0.27	0.07	<0.001	0.28	0.07	<0.001	0.27	0.07	<0.001	0.26	0.07	<0.001
Age	0.01	0.00	0.002	0.01	0.00	0.003	0.01	0.00	0.003	0.01	0.00	0.003	0.01	0.00	0.003
Gender															

Male	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Female	-0.04	0.06	0.557	-0.04	0.06	0.565	-0.03	0.06	0.606	-0.04	0.06	0.558	-0.03	0.06	0.595
SP census division															
1 New England Division	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
2 Middle Atlantic Division	-0.19	0.13	0.144	-0.19	0.13	0.150	-0.19	0.13	0.146	-0.19	0.13	0.144	-0.18	0.13	0.151
3 East North Central Division	-0.24	0.11	0.022	-0.24	0.11	0.022	-0.24	0.11	0.025	-0.24	0.11	0.020	-0.24	0.11	0.022
4 West North Central Division	-0.19	0.11	0.066	-0.19	0.11	0.069	-0.19	0.11	0.067	-0.20	0.11	0.058	-0.19	0.10	0.066
5 South Atlantic Division	-0.13	0.11	0.241	-0.13	0.11	0.254	-0.13	0.11	0.248	-0.13	0.11	0.238	-0.13	0.11	0.257
6 East South Central Division	-0.40	0.12	0.001	-0.40	0.12	0.001	-0.39	0.12	0.001	-0.40	0.12	0.001	-0.39	0.12	0.001
7 West South Central Division	-0.36	0.13	0.006	-0.35	0.13	0.008	-0.35	0.13	0.007	-0.36	0.13	0.007	-0.36	0.13	0.007
8 Mountain Division	-0.21	0.17	0.218	-0.20	0.17	0.229	-0.21	0.17	0.224	-0.21	0.17	0.219	-0.21	0.17	0.225
9 Pacific Division	-0.12	0.11	0.282	-0.11	0.11	0.306	-0.11	0.11	0.312	-0.11	0.11	0.307	-0.11	0.11	0.320
Metro / non-metro residence															
Metropolitan	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Not metropolitan	-0.08	0.07	0.231	-0.08	0.07	0.242	-0.08	0.07	0.207	-0.08	0.07	0.253	-0.08	0.07	0.219
Relationship to SP															
Children	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Other relatives	-0.01	0.07	0.882	-0.01	0.07	0.842	-0.02	0.07	0.821	-0.01	0.07	0.864	-0.02	0.07	0.824
Non-relatives	-0.11	0.07	0.143	-0.10	0.07	0.150	-0.10	0.07	0.144	-0.11	0.07	0.125	-0.11	0.07	0.143
OP in household with SP															
YES	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
NO	0.21	0.08	0.008	0.22	0.08	0.006	0.22	0.08	0.007	0.21	0.08	0.007	0.22	0.08	0.007
CG has checking account															
No	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Yes	0.55	0.16	0.001	0.55	0.16	0.001	0.55	0.16	0.001	0.56	0.16	0.001	0.55	0.16	0.001

Missing	0.67	0.39	0.086	0.79	0.40	0.048	0.77	0.38	0.044	0.77	0.39	0.046	0.83	0.39	0.033
CG has savings account															
No	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Yes	0.06	0.09	0.478	0.06	0.09	0.472	0.06	0.09	0.489	0.06	0.09	0.462	0.06	0.09	0.481
Missing	0.16	0.28	0.572	0.14	0.28	0.616	0.16	0.28	0.568	0.16	0.28	0.570	0.17	0.28	0.550
CG has cert of deposit															
NO	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
YES	0.03	0.09	0.769	0.03	0.09	0.775	0.03	0.09	0.743	0.03	0.09	0.745	0.03	0.09	0.731
Missing	-0.04	0.17	0.796	-0.05	0.17	0.762	-0.04	0.17	0.799	-0.06	0.17	0.749	-0.05	0.17	0.778
CG has retirement plan															
NO	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
YES	0.42	0.08	<0.001	0.42	0.08	<0.001	0.42	0.08	<0.001	0.43	0.08	<0.001	0.43	0.08	<0.001
Missing	-0.58	0.28	0.034	-0.62	0.28	0.025	-0.57	0.27	0.035	-0.58	0.27	0.034	-0.56	0.27	0.040
CG has stocks mutual funds															
NO	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
YES	0.23	0.07	<0.001	0.23	0.07	<0.001	0.23	0.07	<0.001	0.23	0.07	<0.001	0.23	0.07	0.001
Missing	0.21	0.16	0.203	0.23	0.16	0.171	0.20	0.16	0.217	0.22	0.16	0.179	0.20	0.16	0.214
Mode															
Phone	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Web	-0.21	0.07	0.004	-0.20	0.07	0.004	-0.20	0.07	0.004	-0.20	0.07	0.005	-0.21	0.07	0.004
Race / ethnicity															
White, non-Hispanic	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Black, non-Hispanic	0.12	0.08	0.115	0.12	0.08	0.112	0.11	0.08	0.128	0.12	0.08	0.102	0.12	0.07	0.117
Others/DKRF	0.35	0.10	0.001	0.34	0.10	0.001	0.33	0.10	0.001	0.35	0.10	0.001	0.34	0.10	0.001
CG spouse's education															
No spouse	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Below high school	0.86	0.17	<0.001	0.85	0.17	<0.001	0.86	0.17	<0.001	0.85	0.17	<0.001	0.86	0.17	<0.001
High school	0.57	0.09	<0.001	0.57	0.09	<0.001	0.57	0.09	<0.001	0.57	0.09	<0.001	0.57	0.09	<0.001
Some college	0.51	0.08	<0.001	0.51	0.08	<0.001	0.51	0.08	<0.001	0.51	0.08	<0.001	0.51	0.08	<0.001
College and above	0.81	0.10	<0.001	0.82	0.10	<0.001	0.82	0.10	<0.001	0.82	0.10	<0.001	0.81	0.10	<0.001

Missing	0.95	0.23	<0.001	0.96	0.23	<0.001	0.95	0.23	<0.001	0.96	0.23	<0.001	0.96	0.23	<0.001
_cons	7.90	0.63	<0.001	7.91	0.63	<0.001	7.94	0.63	<0.001	7.89	0.63	<0.001	7.92	0.62	<0.001
/lnsigma	-0.34	0.06	<0.001	-0.34	0.06	<0.001	-0.34	0.06	<0.001	-0.33	0.06	<0.001	-0.34	0.06	<0.001
sigma	0.71	0.04		0.71	0.04		0.72	0.04		0.72	0.04		0.72	0.04	

Appendix Table 2. Imputation model results for caregivers who are spouse/partner (Group 2)

	1			2			3			4			5		
	est	SE	p	est	SE	p	est	SE	p	est	SE	p	est	SE	p
Own farm business															
No	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Yes	-0.47	0.53	0.375	-0.46	0.53	0.386	-0.47	0.53	0.373	-0.45	0.53	0.389	-0.46	0.53	0.386
Age	0.01	0.01	0.177	0.01	0.01	0.185	0.01	0.01	0.181	0.01	0.01	0.232	0.01	0.01	0.125
Own your home															
No	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Yes	0.28	0.14	0.048	0.28	0.14	0.049	0.28	0.14	0.051	0.29	0.14	0.035	0.31	0.14	0.030
Work for pay last week															
Yes	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
No	-0.17	0.21	0.420	-0.18	0.21	0.391	-0.17	0.22	0.439	-0.15	0.22	0.489	-0.19	0.22	0.370
Retired/Don't work anymore	-0.12	0.23	0.589	-0.11	0.23	0.634	-0.10	0.23	0.665	-0.09	0.24	0.709	-0.14	0.24	0.553
CG education															
Below high school	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
High school	0.07	0.16	0.668	0.05	0.17	0.769	0.12	0.17	0.496	0.05	0.17	0.774	0.06	0.16	0.716
Some college	0.00	0.16	0.992	-0.04	0.18	0.822	0.06	0.16	0.738	-0.01	0.17	0.960	-0.03	0.16	0.862
College and above	0.01	0.23	0.975	-0.03	0.24	0.894	0.08	0.23	0.732	-0.01	0.24	0.977	-0.01	0.24	0.974
Number of other people in household	-0.07	0.09	0.429	-0.06	0.09	0.520	-0.03	0.09	0.702	-0.04	0.10	0.665	-0.07	0.09	0.419
Private insurance coverage															
No	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Yes	0.12	0.14	0.389	0.11	0.14	0.417	0.14	0.14	0.318	0.13	0.14	0.343	0.12	0.14	0.383
Medicaid coverage															
No	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Yes	-0.51	0.21	0.016	-0.49	0.21	0.020	-0.49	0.21	0.022	-0.48	0.21	0.022	-0.52	0.21	0.013
CG has savings account															

NO	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
YES	0.50	0.16	0.001	0.47	0.15	0.001	0.51	0.16	0.002	0.48	0.16	0.003	0.43	0.16	0.005
CG spouse's education															
Below high school	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
High school	0.17	0.13	0.190	0.13	0.14	0.360	0.05	0.14	0.719	0.07	0.15	0.629	0.08	0.14	0.573
Some college	0.14	0.19	0.469	0.10	0.18	0.582	0.07	0.20	0.745	0.06	0.21	0.775	0.05	0.21	0.804
College and above	0.59	0.18	0.001	0.57	0.17	0.001	0.50	0.17	0.004	0.50	0.18	0.006	0.54	0.18	0.002
CG has retirement plan															
NO	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
YES	0.07	0.11	0.556	0.09	0.12	0.431	0.03	0.12	0.796	0.09	0.12	0.455	0.04	0.11	0.744
CG has stocks mutual funds															
NO	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
YES	0.21	0.13	0.105	0.21	0.13	0.111	0.24	0.13	0.071	0.21	0.14	0.131	0.21	0.13	0.124
CG has cert of deposit															
NO	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
YES	-0.07	0.14	0.639	-0.09	0.15	0.554	-0.06	0.14	0.686	-0.06	0.15	0.680	-0.06	0.14	0.652
Gender															
Male	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Female	0.06	0.10	0.517	0.05	0.10	0.590	0.06	0.10	0.551	0.04	0.10	0.710	0.06	0.10	0.546
SP census division															
1 New England Division	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
2 Middle Atlantic Division	-0.62	0.30	0.036	-0.58	0.29	0.048	-0.55	0.30	0.061	-0.60	0.30	0.043	-0.59	0.30	0.050
3 East North Central Division	-0.53	0.28	0.062	-0.53	0.28	0.065	-0.47	0.28	0.088	-0.50	0.28	0.078	-0.54	0.29	0.060
4 West North Central Division	-0.31	0.27	0.249	-0.30	0.27	0.274	-0.26	0.27	0.330	-0.27	0.28	0.326	-0.28	0.27	0.302
5 South Atlantic Division	-0.42	0.23	0.070	-0.41	0.23	0.080	-0.38	0.23	0.103	-0.40	0.24	0.097	-0.41	0.24	0.081

6 East South Central Division	-0.57	0.29	0.044	-0.57	0.28	0.044	-0.50	0.27	0.068	-0.57	0.28	0.047	-0.55	0.28	0.048
7 West South Central Division	-0.70	0.29	0.018	-0.74	0.29	0.012	-0.64	0.30	0.031	-0.70	0.30	0.019	-0.71	0.30	0.016
8 Mountain Division	-0.28	0.27	0.301	-0.29	0.27	0.291	-0.20	0.26	0.445	-0.27	0.28	0.333	-0.30	0.27	0.265
9 Pacific Division	-0.48	0.29	0.097	-0.47	0.29	0.112	-0.44	0.29	0.134	-0.46	0.29	0.118	-0.45	0.29	0.125
Metro / non-metro residence															
Metropolitan	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Not metropolitan	0.05	0.11	0.677	0.04	0.11	0.708	0.06	0.11	0.581	0.05	0.11	0.670	0.05	0.11	0.678
Mode															
Phone	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Web	-0.28	0.18	0.131	-0.27	0.18	0.134	-0.30	0.18	0.097	-0.28	0.18	0.133	-0.27	0.18	0.138
Race / ethnicity															
White, non-Hispanic	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Black, non-Hispanic	-0.20	0.20	0.312	-0.18	0.20	0.355	-0.22	0.19	0.248	-0.24	0.19	0.224	-0.21	0.20	0.287
Others/DKRF	-0.23	0.19	0.218	-0.25	0.19	0.190	-0.23	0.19	0.227	-0.25	0.19	0.184	-0.23	0.19	0.222
CG has checking acct															
NO	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
YES	-0.10	0.27	0.712	-0.11	0.26	0.683	-0.11	0.27	0.686	-0.11	0.27	0.700	-0.09	0.27	0.744
Missing	-0.06	0.24	0.796	-0.12	0.25	0.643	0.00	0.27	0.998	0.01	0.24	0.956	0.04	0.25	0.869
_cons	9.79	0.72	<0.001	9.87	0.72	<0.001	9.72	0.71	<0.001	9.90	0.72	<0.001	9.79	0.72	<0.001
/lnsigma	-0.26	0.17	0.120	-0.26	0.17	0.128	-0.26	0.16	0.119	-0.25	0.16	0.123	-0.25	0.17	0.128
sigma	0.77	0.13		0.77	0.13		0.77	0.13		0.78	0.13		0.78	0.13	

Appendix Table 3. Imputation model results for caregivers who breakoff before completing the NSOC interview (Group 3)

	1			2			3			4			5		
	est	SE	p	est	SE	p	est	SE	p	est	SE	p	est	SE	p
SP's income from NHATS	0.02	0.04	0.571	0.02	0.04	0.567	0.02	0.04	0.558	0.02	0.04	0.539	0.02	0.04	0.590
Number of other people in household	-0.03	0.03	0.327	-0.03	0.03	0.322	-0.03	0.03	0.314	-0.03	0.03	0.352	-0.03	0.03	0.280
Age	0.01	0.00	0.006	0.01	0.00	0.005	0.01	0.00	0.004	0.01	0.00	0.004	0.01	0.00	0.009
Gender															
Male	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Female	-0.01	0.07	0.828	-0.01	0.07	0.841	-0.02	0.07	0.808	-0.01	0.07	0.843	-0.01	0.07	0.852
SP census division															
1 New England Division	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
2 Middle Atlantic Division	-0.12	0.13	0.375	-0.12	0.13	0.381	-0.12	0.13	0.381	-0.12	0.13	0.381	-0.12	0.13	0.377
3 East North Central Division	-0.14	0.11	0.217	-0.14	0.11	0.209	-0.14	0.11	0.206	-0.14	0.11	0.209	-0.14	0.11	0.214
4 West North Central Division	-0.09	0.12	0.450	-0.09	0.12	0.453	-0.09	0.12	0.447	-0.09	0.12	0.457	-0.09	0.12	0.449
5 South Atlantic Division	0.03	0.12	0.783	0.03	0.12	0.794	0.03	0.12	0.797	0.03	0.12	0.788	0.03	0.12	0.776
6 East South Central Division	-0.31	0.13	0.013	-0.31	0.13	0.015	-0.31	0.13	0.012	-0.31	0.12	0.012	-0.31	0.13	0.013
7 West South Central Division	-0.27	0.13	0.044	-0.27	0.13	0.046	-0.28	0.13	0.041	-0.27	0.13	0.042	-0.27	0.13	0.046
8 Mountain Division	-0.22	0.18	0.209	-0.22	0.18	0.208	-0.22	0.18	0.206	-0.22	0.18	0.217	-0.22	0.18	0.220
9 Pacific Division	0.00	0.12	0.997	0.00	0.12	0.975	0.00	0.12	0.989	0.00	0.12	0.985	0.00	0.13	0.989
Metro / non-metro residence															
Metropolitan	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Not metropolitan	-0.07	0.07	0.366	-0.07	0.07	0.367	-0.06	0.07	0.372	-0.07	0.07	0.362	-0.07	0.07	0.345
Mode															
Phone	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	

Web	-0.17	0.07	0.014	-0.17	0.07	0.015	-0.17	0.07	0.016	-0.17	0.07	0.016	-0.17	0.07	0.015
Race / ethnicity															
White, non-hispanic	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Black, non-hispanic	-0.02	0.08	0.770	-0.02	0.08	0.779	-0.02	0.08	0.805	-0.02	0.08	0.803	-0.02	0.08	0.775
Others/DKRF	0.20	0.09	0.030	0.20	0.09	0.029	0.21	0.09	0.024	0.21	0.09	0.026	0.20	0.09	0.032
Relationship to SP															
Children	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Other relatives	-0.14	0.07	0.044	-0.14	0.07	0.047	-0.13	0.07	0.051	-0.14	0.07	0.048	-0.14	0.07	0.038
Non-relatives	-0.34	0.08	<0.001	-0.35	0.08	<0.001	-0.35	0.08	<0.001	-0.35	0.08	<0.001	-0.34	0.08	<0.001
CG education															
Below high school	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
High school	0.82	0.21	<0.001	0.82	0.21	<0.001	0.82	0.21	<0.001	0.82	0.21	<0.001	0.82	0.21	<0.001
Some college	1.11	0.21	<0.001	1.11	0.21	<0.001	1.11	0.21	<0.001	1.11	0.20	<0.001	1.11	0.21	<0.001
College and above	1.54	0.21	<0.001	1.55	0.21	<0.001	1.55	0.21	<0.001	1.55	0.21	<0.001	1.55	0.21	<0.001
Missing	1.33	0.34	<0.001	1.28	0.33	<0.001	1.31	0.33	<0.001	1.31	0.33	<0.001	1.35	0.33	<0.001
OP in household with SP															
YES	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
NO	0.44	0.09	<0.001	0.44	0.09	<0.001	0.44	0.09	<0.001	0.44	0.09	<0.001	0.44	0.09	<0.001
CG spouse's education															
No spouse	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Below high school	0.98	0.17	<0.001	0.98	0.17	<0.001	0.97	0.17	<0.001	0.98	0.17	<0.001	0.98	0.17	<0.001
High school	0.75	0.09	<0.001	0.75	0.09	<0.001	0.75	0.09	<0.001	0.75	0.09	<0.001	0.75	0.09	<0.001
Some college	0.77	0.08	<0.001	0.77	0.08	<0.001	0.77	0.08	<0.001	0.77	0.08	<0.001	0.77	0.08	<0.001
College and above	1.16	0.10	<0.001	1.16	0.10	<0.001	1.15	0.10	<0.001	1.15	0.10	<0.001	1.16	0.10	<0.001
Missing	0.93	0.19	<0.001	0.94	0.19	<0.001	0.94	0.19	<0.001	0.95	0.19	<0.001	0.94	0.19	<0.001
_cons	8.28	0.54	<0.001	8.27	0.54	<0.001	8.25	0.55	<0.001	8.23	0.55	<0.001	8.32	0.55	<0.001
/lnsigma	-0.22	0.04	<0.001	-0.22	0.04	<0.001	-0.22	0.04	<0.001	-0.22	0.04	<0.001	-0.22	0.04	<0.001
sigma	0.80	0.03		0.80	0.03		0.80	0.03		0.80	0.03		0.80	0.03	

Appendix Table 4. Imputation model results for Last Month of Life (LML) caregivers (Group 4)

	1			2			3			4			5		
	est	SE	p	est	SE	p	est	SE	p	est	SE	p	est	SE	p
Work for pay last week															
Yes	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0	(empty)	
No	-0.35	0.07	<0.001	-0.35	0.07	<0.001	-0.35	0.07	<0.001	-0.35	0.07	<0.001	-0.35	0.07	<0.001
Retired/Don't work anymore	-0.36	0.06	<0.001	-0.36	0.06	<0.001	-0.37	0.06	<0.001	-0.36	0.06	<0.001	-0.36	0.06	0.000
Number of other people in household	-0.02	0.02	0.361	-0.02	0.02	0.358	-0.02	0.02	0.427	-0.02	0.02	0.391	-0.02	0.02	0.419
CG education															
Below high school	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0	(empty)	
High school	0.42	0.18	0.017	0.41	0.18	0.020	0.43	0.18	0.015	0.42	0.18	0.017	0.42	0.18	0.018
Some college	0.55	0.18	0.003	0.54	0.18	0.003	0.55	0.18	0.002	0.55	0.18	0.002	0.55	0.18	0.003
College and above	0.81	0.19	<0.001	0.79	0.19	<0.001	0.80	0.19	0.000	0.81	0.19	<0.001	0.81	0.19	<0.001
Own your home															
No	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0	(empty)	
Yes	0.17	0.06	0.005	0.17	0.06	0.005	0.18	0.06	0.003	0.17	0.06	0.003	0.17	0.06	0.003
Age	0.01	0.00	0.001	0.01	0.00	0.002	0.01	0.00	0.001	0.01	0.00	0.001	0.01	0.00	0.001
Gender															
Male	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0	(empty)	
Female	-0.04	0.05	0.379	-0.04	0.05	0.392	-0.04	0.05	0.419	-0.04	0.05	0.391	-0.04	0.05	0.398
SP census division															
1 New England Division	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
2 Middle Atlantic Division	-0.23	0.11	0.035	-0.22	0.11	0.037	-0.23	0.11	0.036	-0.22	0.11	0.037	-0.22	0.11	0.037
3 East North Central Division	-0.28	0.09	0.002	-0.27	0.09	0.003	-0.27	0.09	0.002	-0.27	0.09	0.003	-0.27	0.09	0.003
4 West North Central Division	-0.24	0.09	0.010	-0.23	0.09	0.011	-0.23	0.09	0.012	-0.24	0.09	0.010	-0.23	0.09	0.012

5 South Atlantic Division	-0.19	0.09	0.044	-0.18	0.09	0.048	-0.18	0.09	0.049	-0.19	0.09	0.047	-0.19	0.09	0.047
6 East South Central Division	-0.36	0.11	0.001	-0.36	0.11	0.001	-0.36	0.11	0.001	-0.36	0.11	0.001	-0.35	0.11	0.001
7 West South Central Division	-0.31	0.10	0.003	-0.30	0.10	0.003	-0.31	0.10	0.003	-0.31	0.10	0.003	-0.30	0.10	0.003
8 Mountain Division	-0.27	0.15	0.068	-0.26	0.15	0.075	-0.25	0.15	0.087	-0.26	0.15	0.071	-0.26	0.15	0.074
9 Pacific Division	-0.13	0.09	0.144	-0.13	0.09	0.152	-0.13	0.09	0.155	-0.13	0.09	0.147	-0.13	0.09	0.157
Metro / non-metro residence															
Metropolitan	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Not metropolitan	-0.08	0.05	0.162	-0.08	0.06	0.158	-0.08	0.05	0.130	-0.08	0.05	0.148	-0.08	0.05	0.125
Relationship to SP															
Spouse/partner	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Children	-0.38	0.17	0.023	-0.38	0.17	0.022	-0.38	0.17	0.022	-0.38	0.17	0.024	-0.38	0.17	0.023
Other relatives	-0.44	0.17	0.011	-0.44	0.17	0.010	-0.44	0.17	0.011	-0.43	0.17	0.012	-0.44	0.17	0.012
Non-relatives	-0.50	0.17	0.003	-0.50	0.17	0.003	-0.50	0.17	0.003	-0.50	0.17	0.003	-0.50	0.17	0.003
OP in household with SP															
YES	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
NO	0.15	0.06	0.015	0.15	0.06	0.016	0.15	0.06	0.015	0.15	0.06	0.015	0.15	0.06	0.015
CG has checking acct															
NO	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
YES	0.43	0.11	<0.001	0.43	0.11	<0.001	0.43	0.11	<0.001	0.43	0.11	<0.001	0.43	0.11	<0.001
Missing	0.79	0.22	<0.001	0.75	0.22	0.001	0.79	0.22	<0.001	0.75	0.22	0.001	0.79	0.22	<0.001
CG has savings account															
NO	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
YES	0.07	0.07	0.317	0.08	0.07	0.295	0.07	0.07	0.307	0.07	0.07	0.324	0.07	0.07	0.340
Missing	0.05	0.21	0.801	0.05	0.21	0.809	0.06	0.21	0.788	0.05	0.21	0.818	0.06	0.21	0.790
CG has cert of deposit															
NO	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
YES	0.04	0.07	0.597	0.04	0.07	0.604	0.04	0.07	0.585	0.04	0.07	0.604	0.04	0.07	0.596

Missing	-0.04	0.13	0.734	-0.04	0.13	0.741	-0.05	0.13	0.693	-0.04	0.13	0.748	-0.05	0.13	0.705
CG has retirement plan															
NO	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
YES	0.37	0.06	<0.001	0.36	0.06	<0.001	0.36	0.06	<0.001	0.37	0.06	<0.001	0.36	0.06	<0.001
Missing	-0.36	0.16	0.026	-0.38	0.16	0.018	-0.36	0.16	0.026	-0.36	0.16	0.022	-0.35	0.16	0.031
CG has stocks mutual funds															
NO	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
YES	0.27	0.06	<0.001	0.27	0.06	<0.001	0.27	0.06	<0.001	0.27	0.06	<0.001	0.27	0.06	<0.001
Missing	0.25	0.12	0.038	0.26	0.12	0.032	0.26	0.12	0.032	0.25	0.12	0.035	0.25	0.12	0.038
Mode															
Phone	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Web	-0.20	0.06	0.001	-0.20	0.06	0.001	-0.20	0.06	0.001	-0.20	0.06	0.001	-0.20	0.06	0.001
Race / ethnicity															
White, non-Hispanic	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Black, non-Hispanic	0.09	0.06	0.147	0.09	0.06	0.149	0.08	0.06	0.166	0.09	0.06	0.144	0.09	0.06	0.156
Others/DKRF	0.27	0.08	0.001	0.26	0.08	0.001	0.27	0.08	0.001	0.26	0.08	0.001	0.26	0.08	0.001
Private insurance coverage															
NO	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
YES	0.26	0.06	<0.001	0.26	0.06	<0.001	0.26	0.06	<0.001	0.26	0.06	<0.001	0.26	0.06	<0.001
Missing	0.02	0.19	0.924	0.01	0.19	0.979	0.00	0.18	0.990	0.01	0.18	0.941	-0.02	0.18	0.919
Medicaid coverage															
No	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Yes	-0.12	0.09	0.192	-0.12	0.09	0.191	-0.12	0.09	0.185	-0.12	0.09	0.200	-0.12	0.09	0.185
Missing	0.55	0.26	0.031	0.54	0.26	0.036	0.57	0.25	0.023	0.56	0.25	0.027	0.52	0.26	0.043
CG spouse's education															
No spouse	0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)		0.00	(empty)	
Below high school	0.67	0.13	<0.001	0.67	0.13	<0.001	0.67	0.13	<0.001	0.68	0.13	<0.001	0.67	0.13	<0.001
High school	0.57	0.07	<0.001	0.57	0.07	<0.001	0.56	0.07	<0.001	0.57	0.07	<0.001	0.57	0.07	<0.001

Some college	0.54	0.07	<0.001	0.53	0.07	<0.001	0.53	0.07	<0.001	0.53	0.07	<0.001	0.53	0.07	<0.001
College and above	0.91	0.08	<0.001	0.91	0.08	<0.001	0.90	0.08	<0.001	0.90	0.08	<0.001	0.91	0.08	<0.001
Missing	0.84	0.14	<0.001	0.88	0.15	<0.001	0.87	0.14	<0.001	0.87	0.15	<0.001	0.86	0.14	<0.001
_cons	8.95	0.40	<0.001	8.97	0.40	<0.001	8.94	0.40	<0.001	8.92	0.40	<0.001	8.93	0.40	<0.001
/lnsigma	-0.39	0.05	<0.001	-0.39	0.05	<0.001	-0.39	0.05	<0.001	-0.39	0.05	<0.001	-0.39	0.05	<0.001
sigma	0.68	0.03		0.68	0.03		0.68	0.03		0.68	0.03		0.68	0.03	