

Updates to HRS Sample Weights

Documentation Report

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Introduction

This report provides a brief overview of the sample design and sample weight construction for the Health and Retirement Study. It updates previous reports covering parts of the study (Heeringa and Connor, 1995; Heeringa, 1995; HRS, 2006; HRS website, 2011a; HRS website, 2011b.) The primary motivation for this update is to document some recent revisions to the HRS sample weights and evaluate the impact of those revisions on the weights themselves and on weighted sample distributions for a number of key indicators.

This re-evaluation of HRS sampling weights was initially motivated by reports of errors in the age distributions in the Census products on which the HRS relies to establish population benchmarks. HRS uses the Current Population Survey (CPS) and the American Community Survey (ACS) to post-stratify sampling weights to the US population for a given survey year. There were errors in the way Census applied age perturbation for disclosure risk avoidance in several waves of both the CPS and the ACS in the years following the 2000 Census. This includes the 2004 CPS and the 2006 ACS, which were used for post-stratification of the 2004 and 2006 HRS sample weights, respectively. The Census Bureau released a new version of the 2006 ACS data, necessitating a revision of the 2006 HRS sample weights using the new ACS data for post-stratification. The ACS correction had little impact on the HRS sample weights, as discussed later in this report. After careful evaluation, the Census Bureau decided not to release new versions of the CPS data,¹ so it was not possible to redo the post-stratification for the 2004 HRS weights.

Prior to implementing the revision of the 2006 weights we undertook an evaluation of the sample weights for all waves. That review revealed calculation errors in two prior waves: one in the post-stratification of the 1995 respondent weights for the AHEAD cohort, and the other in the sample selection factor for the new cohort EBB baseline weights in the 2004 wave. The 1995 respondent-level weight for the AHEAD cohort was mistakenly post-stratified to the 1993 CPS, rather than 1995 CPS, and the 2004 baseline weight for the EBB cohort did not account for sub-sampling of non-minority respondents in minority domains. Because follow-up wave weights rely on baseline weights for each cohort, the 2004 issue also affects the 2006 and 2008 weights. Both of these issues are described in detail in later sections of the report.

The analyses later in this report show that these revisions do not substantially alter the weights and do not significantly affect weighted distributions of key variables. Analyses done with the earlier versions of sampling weights should not in general require revision. Some possible exceptions include analyses that present population estimates (counts or percentages) for the 1995 AHEAD cohort or for the EBB non-minority (White/other) sample. Analyses that compare the EBB non-minority cohort to other subgroups may also be affected by the new weights. Even for this specific subgroup, however, the impact is likely to be minimal (as shown later in Table

¹For details see the report by Alexander, Davern and Stevenson at this link: <http://bpp.wharton.upenn.edu/betseys/papers/Inaccurate%20Age%20and%20Sex%20Data%20in%20Census%20PUMS%20Files.pdf>, ACS Errata Notes No. 47 and 50 at this link: http://www.census.gov/acs/www/data_documentation/errata/, and the CPS User Note at this link: http://www.census.gov/cps/user_note_age_estimates.html.

B5). Results based on analyses that make use of the full EBB sample or that combine cohorts in the HRS sample should not be affected by the new weights.

HRS sample weights have been updated for the following waves:

1995: Household weight (DWGTHH) and respondent weight (DWGTR)
2004: Household weight (JWGTHH) and respondent weight (JWGTR)
2006: Household weight (KWGTHH) and respondent weight (KWGTR)
2008: Household weight (LWGTHH) and respondent weight (LWGTR)

In addition, because sample weights for the supplemental studies and components depend on the core weights, the following supplement weights have also been updated:

2004 physical measures (JPMWGTR)
2004 psychosocial leave-behind (JWGTR_PS)
2004 disability vignette leave-behind (JWGTR_DB)
2005 Prescription Drug Study (PDS) (P1QXWT and P1MEDWT)
2006 physical measures (KPMWGTR)
2006 biomarkers (KBLOWGTR)
2006 psychosocial leave-behind (KLBWGTR)
2008 physical measures (LPMWGTR)
2008 psychosocial leave-behind (LLBWGTR)

An explanation for the updates and analyses of the impact of the changes on the distribution of the weights are presented in this report.

With the exception of the 2005 PDS sample weight, which is provided on the PDS sample file, all of the revised core and supplement weights are available on Early 2010 Version 1.0 of the Cross-Wave Tracker File. The original weights have been replaced with the revised weights on this file. Researchers who need access to earlier versions of sampling weights can request them at hrsquest@isr.umich.edu.

Overview of Sample Design and Sample Weights

The HRS began in 1992 as a longitudinal study of a pre-retirement cohort of individuals born in 1931-1941, and their spouses of any age. This birth cohort is referred to as the original HRS cohort. It was joined in 1993 by a companion study, the Study of Asset and Health Dynamics of the Oldest Old (AHEAD), comprised of a cohort of persons born before 1924 and their spouses of any age (the AHEAD cohort). In 1998, the study design was modified to convert the HRS sample from a set of specific cohorts into a steady state sample that represents the community-dwelling U.S. population over age 50. This was achieved by adding new cohorts in 1998 to fill in the age range over 50 (the CODA cohort consisting of persons born between 1925 and 1930 and the War Baby cohort born between 1942 and 1947) and by adding a new six-year cohort of persons entering their 50s every six years thereafter. The Early Baby Boom cohort (born 1948-

1953) was added in 2004 and the Mid Baby Boom cohort (born 1954-1959) is being added in 2010.

The HRS sample is based on a multi-stage, area-clustered, stratified sample design. Two household screening efforts were conducted in 1992 and in 2004; these served as the sources for most of the HRS sample. The 1992 household screen was used to identify the original HRS cohort, most of the AHEAD cohort, and the War Baby cohort (added in 1998). The 2004 screen was used to identify the Early Baby Boom cohort and part of the Mid Baby Boom cohort. The CODA cohort and the remainder of the AHEAD cohort were drawn from a list of Medicare enrollees obtained from the Health Care Financing Administration (now the Center for Medicare and Medicaid Studies). For the HRS, AHEAD, EBB and MBB cohorts, Black and Hispanic respondents were oversampled at a rate of about 2 to 1. To achieve these oversamples, geographic areas (segments) with higher than average concentrations of minority population (10+% Black, 10+% Hispanic, or 10+% Black and 10+% Hispanic) were selected at higher sampling rates. In addition, in those areas, all Black and Hispanic age-eligible sample members (and their spouses) were selected into the sample, whereas non-minority sample members were subsampled at a rate of about 50%. The original 1992 screen that generated the HRS, AHEAD and War Baby cohorts contained an oversample of Florida residents. (See Heeringa and Connor, 1995 for a detailed description of the sample design for the original HRS cohort; and Heeringa, 1995 for a description of the sample design for the AHEAD cohort.)

The implication of the multi-stage, stratified design is that different sample units (both households and individuals) had differential probabilities of being selected into the sample. The sample weights account for these differential selection probabilities.

HRS provides both household and respondent-level sample weights for each wave of the survey. The sample weights are constructed in a way to make the HRS weighted sample representative of all US households containing at least one person in the age-eligible range (in the case of household weights) or of all non-institutionalized individuals in the US population in the age-eligible range.

The baseline sample weight is a composite of two factors. The first factor is the inverse of the probability of selection for the housing unit (for household weights), and for the individual (for respondent weights). The second factor is a post-stratification factor that adjusts for differential non-response to the baseline HRS survey. The post-stratification is based on the age of the respondent and his/her spouse or partner (if coupled), gender, and race/ethnicity (Hispanic, Black non-Hispanic, other non-Hispanic). The baseline sample weights are also adjusted for geographic differences in baseline non-response (based on the Primary Sampling Unit or PSU).

Sample weights for followup waves are the product of the baseline sample weight and a non-response adjustment factor that is based on post-stratification of the sample to the Current Population Survey or American Community Survey for the survey year. Whereas the baseline post-stratification adjusts for *survey* non-participation, the post-stratification adjustment in followup waves adjusts for *wave-specific* non-response among those who participated at baseline. For waves 1992-2004, the Current Population Survey (CPS) was used as reference survey for the

post-stratification. For the 2006 and subsequent waves, the American Community Survey (ACS) has served as the basis for post-stratification.

Changes to the HRS Sample Weights

A. 1995 Respondent Weight

Our review of the full series of sample weights revealed a problem with the 1995 respondent weight (for the AHEAD cohort). The weighted sample size for the 1995 AHEAD sample (born in 1923 or earlier) was larger than the published population estimates based on the Current Population Survey (see Table A1), and it was also out of line relative to the weighted sample sizes for the 1993 and 1998 waves. We would expect some decline in the weighted sample size in each subsequent wave due to mortality; however, as shown in Table A2, the 1995 weighted sample was very close in size to the 1993 weighted sample. In contrast, as shown in Table A3, the sum of the household weights showed the expected pattern of decline over the waves and the 1995 weighted HRS count matches the 1995 weighted CPS count very closely.

A detailed investigation of the 1995 sample weights revealed that the household weights were calculated correctly. However the respondent weights were post-stratified to the 1993 CPS, rather than to the 1995 CPS. As a result, the population counts used to adjust the HRS respondent sample were too high, resulting in erroneously large sample weights.

The 1995 respondent sample weights have now been adjusted using the 1995 CPS as the post-stratification source. The weighted counts and distributions for the old and new respondent weights are given in Table A4. The original 1995 respondent weights overstated the size of the community-dwelling population born in 1923 and earlier by 16%, and overstated the mean age of that population by 0.07 years (78.90 vs. 78.83).

The original sample weights were too large for each of the four birth ranges as shown in the ratios in the far right column, however the differential is most pronounced for the oldest two birth cohorts, for which mortality is highest. Thus, the oldest-old (born in 1913 or earlier) will be slightly overrepresented relative to those born between 1914 and 1923 in analyses based on the original 1995 sample weights. The impact of this error in the original weights is likely to be minimal for multivariate analyses that adjust for age; however, it could be more significant for descriptive analyses, e.g., prevalence estimates for health conditions, that are not age-adjusted. Also, analyses that present estimates of population counts for the AHEAD cohort based on 1995 data (e.g., the number of persons age 72 or over living with diabetes) will be over-estimated.

In revising the 1995 weights, we made use of the most recent information available on birth year and other eligibility indicators for the HRS sample. This resulted in some changes in respondent and household eligibility. The most significant change is that 55 respondents who had non-zero values on the original respondent weights are not cohort eligible (they were born in 1924 or later) and are, thus, assigned zero values on the revised respondent weights. Conversely, three respondents who were assigned zero weights originally are now determined to be eligible and have non-zero values on the revised weights. At the household level, five households changed

from eligible on the original weights to non-eligible (deceased) on the revised weights, and one household changed from non-eligible to eligible.

B. 2004 Household and Respondent Weights

As noted in the sample design overview, Black and Hispanic households were oversampled in the HRS, AHEAD, EBB, and MBB cohorts. These oversamples are achieved by oversampling high density minority segments and subsampling (i.e., selecting only a random subset of) non-minority households within those segments. The weights are designed to account for the oversampling of minority respondents, along with other factors that lead to differential selection probabilities.

Our review of the sample weights revealed that the original baseline sample weights for the EBB cohort had not been adjusted to account for the subsampling of non-minority respondents in high density minority areas—non-minority respondents were treated as if their selection probabilities had been the same as minority respondents in those areas, whereas in fact they had only half the probability of being included. The 2004 weights have now been corrected to account for this. As expected, the main impact occurred for non-minority respondents in the EBB cohort. For some of this subgroup (those living in areas of high minority densities) the original weights were too small. Because the sample weights are generated for the entire sample concurrently, the weights for other respondents also changed slightly. Correlations between the original and revised weights, as well as comparisons on several key parameters are presented in Tables B1-B4. Figures B1 and B2 plot the original and revised weights at the household and respondent-level, respectively.

The corrections resulted in minor overall changes to the weights. The correction resulted in a difference of less than 1 percent in the household weight for 63% of households and less than 5 percent for 83% of households. At the respondent level, the difference in the weights was less than 1 percent for 65% of respondents and less than 5 percent for 86% of respondents.

We used the latest, most accurate information available on birth date and coupleness status to generate the revised weights. As a result, eligibility changed for a small number of households and respondents. Eight people in six HHs that were determined to be eligible when the original 2004 weights were calculated are now ineligible. At the respondent level, ten respondents that were originally determined to be eligible are now known to be ineligible. The net result is six fewer eligible households and ten fewer eligible respondents for the revised versus original weights.

As shown in Table B1, the correlations between the original and revised weights are extremely high. The lowest correlation is found for the EBB cohort, particularly those in the White/other race/ethnicity group.

Tables B2 and B3 show the sample size, mean, median, variance, and coefficient of variation for the original and revised weights, separately for the household weights (Table B2) and the respondent weights (Table B3). These statistics are shown in total, by cohort and, for the EBB cohort, by race and ethnicity.

There is very little shift in the distribution of the weights for all cohorts except the EBB cohort. Even for the EBBs, the shift is fairly modest. The mean and median shift upwards slightly, and the variance is reduced. Again, the distributional shift is more pronounced for the White/other group in the EBB cohort. These patterns are further illustrated in Figures B1 and B2, which plot the original weight against the revised weight at the household and individual level separately for Black, Hispanic and non-minority EBBs and for non-EBBs. Black and Hispanic EBBs and non-EBBs tend to cluster around the diagonal, indicating that the original and revised weights are very close. It is only non-minority EBBs for which the cluster departs from the diagonal, and for most of those cases, the revised weight is larger than the original weight. Even for this group, however, the correlations between the original and revised household and respondent weights are very high, as shown in Table B1.

A major concern for users will be what impact these changes have on the results of substantive analyses that were based on the original weights. Tables B4-B5 provide some insight into this issue. Table B4 presents weighted distributions and standard errors for key demographic, health, and economic indicators for both the total 2004 sample and the EBB cohort, for which the correction resulted in the largest change in weights.

As shown here, the distributions and standard errors based on the original and revised weights are extremely close. The primary difference is found for the respondent-level race/ethnic distribution for the EBB cohort, for which the weighted percent is slightly higher for the White/other group and slightly lower for the two minority groups using the revised weight. This difference is not statistically significant. Where the standard errors differ between the original and revised weights, they tend to be slightly lower based on the revised weights.

Table B5 presents distributions and standard errors for the same set of indicators for two additional subgroups—first the total White/other sample and second for the EBB White/other sample. The latter group is the group for which we would expect to see the largest differences. For the total White/other sample in 2004, the distributions and means for all of the indicators are very close. The same is true for most indicators for the White/other sample in the EBB cohort. The percentages with health insurance coverage, home ownership and IRA/Keogh accounts and the estimates of mean income and net worth are slightly lower based on the revised weight compared to the original weight, but none of these differences are statistically significant. For other indicators, the distributions are essentially identical.

Additional comparisons of research findings using the original versus revised weights based on replications of published and unpublished studies are presented in Section F.

C. 2006 and 2008 Household and Respondent Weights

Because the baseline household weight is used as the starting point for generating sample weights in each subsequent wave, the 2006 and 2008 weights were also affected by the error in the 2004 EBB weights. We have updated and replaced all of these weights on the tracker file.

The impact on the 2006 and 2008 weights was even smaller than that for the 2004 weights. Table C1 presents correlations between the original and revised weights. Correlations for the total sample are 0.995 or higher for both waves, and within subgroups, the lowest correlation is 0.946. Correlations between the original and revised weights are high for the EBB cohort in both waves.

As with the 2004 weights, eligibility changed for a small number of households and respondents in 2006 and 2008.

D. 2006 ACS Revision and Impact on HRS Weights

As noted above, the Census Bureau determined that the way in which the age perturbation was handled for several years of the Current Population Survey (CPS) and American Community Survey (ACS) was incorrect and it led to a distortion in the sex ratios particularly at the older ages. The Census Bureau has since released a new version of the 2006 ACS, which corrects for the error. The Census Bureau determined that the error in the 2004 CPS data had minimal impact on the data, however, and they opted not to release a new version of the 2004 CPS. The new ACS data was used in the revision of the 2006 HRS weights. Analyses comparing the sample weights based on the old and new ACS data showed that the change had very little impact on the HRS weights. As shown in Table D1, the correlations between the weights using the old and new ACS data are extremely high for all age and sex groups.

E. Revisions to Supplement Weights

Sample weights for the supplemental studies (mail and Internet surveys) and components of the core survey (physical measures, biomarkers, leave-behind questionnaires) are based on the core sample weights. As a result, any supplement weights that relied on core weights from 2004, 2006 and 2008 had to be revised. The revisions were made by first multiplying the original supplement weight by the ratio of the revised to original core sample weight. This initial adjustment scaled the supplement weight appropriately. The supplement weights were then post-stratified to the weighted core sample (based on the revised core weights) from the prior core wave. The post-stratification adjustment was based on age, gender and race/ethnicity.

The revisions to the supplement weights resulted in minor changes in the weights for most respondents. Table E1 provides distributional statistics for the original and revised supplement weights, along with correlations between the two weights.

F. Replication of Published and Unpublished Analyses

To further evaluate the impact of revisions to the sample weights, we are attempting to replicate analyses that have been conducted by other researchers. Results from one replication of analyses presented in a paper by Zivin et al. (2010) are provided in Tables F1 and F2. The paper is based on respondents who participated in the 2005 Prescription Drug Study, a mail survey of a subsample of HRS respondents. The analysis focused on medication non-adherence in this sample (n=3,071). Tables F1 and F2 present odds-ratios and confidence intervals for regression analyses based on the original and revised 2005 PDS weights. There are marginal changes in

significance around the $p < .05$ level for a few odds-ratios (in bold), but the revised weights do not result in any changes to the substantive findings of the study.

A second replication is based on unpublished analyses of total assets conducted by Gretchen Lay at the University of Michigan. Table F3 provides a comparison of mean assets by asset percentile for the 2004, 2006 and 2008 waves based on the original and revised weights. The impact of the revised weights on total assets is small overall, but there is some variation across waves. The impact is larger for the 2004 asset distribution than for 2006 or 2008. In addition, for 2004 the revised weights lead to slightly lower percentile estimations, whereas in 2006 and 2008 they lead to slightly higher percentile estimations.

Results from other replications will be added to this report as they become available. We welcome any contributions from researchers who wish to replicate their own work.

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Table A1. Weighted samples sizes for persons born in 1923 or earlier: 1995 HRS vs. 1995 CPS

Birth range	1995 HRS		1995 CPS		Ratio HRS/ CPS
	Weighted N	Percent	Weighted N	Percent	
<=1923	22,248,170	100.0	19,219,159	100.0	1.16
<1909	2,510,034	11.3	2,149,321	11.2	1.17
1909-13	4,687,751	21.1	3,377,709	17.6	1.39
1914-18	6,197,476	27.8	5,542,565	28.8	1.12
1919-23	8,852,909	39.8	8,149,564	42.4	1.09

Table A2. Weighted sample sizes for the AHEAD cohort, 1993-2000

Birth range	Weighted respondent counts			
	1993	1995	1998	2000
<=1923	22,264,875	22,248,170	15,250,770	12,674,325
<1909	2,866,302	2,510,034	1,001,384	559,657
1909-13	4,433,396	4,687,751	2,378,348	1,850,112
1914-18	6,348,496	6,197,476	4,670,702	3,847,808
1919-23	8,616,681	8,852,909	7,200,336	6,416,748

Table A3. Weighted household sample for the AHEAD cohort: 1993-2000

Birth range	Weighted household counts				
	1993	1995 HRS	1998	2000	1995 CPS
<=1923	17,534,877	15,588,700	11,929,586	9,926,973	15,635,192

Table A4. Weighted respondent sample sizes and distributions for the AHEAD cohort based on original vs. revised respondent sample weights.

Birth range	Original weights		Revised weights		Ratio revised/ original
	Weighted N	Percent	Weighted N	Percent	
<=1923	22,248,170	100.0	19,220,715	100.0	0.86
<1909	2,510,034	11.3	1,961,110	10.2	0.78
1909-13	4,687,751	21.1	3,572,708	18.6	0.76
1914-18	6,197,476	27.8	5,642,589	29.4	0.91
1919-23	8,852,909	39.8	8,044,308	41.8	0.91

Table B1. Correlation between original and revised 2004 sample weights

Weight Cohort	Total	Hispanic	Black	White/other
Household weight				
Total	0.9770	0.9946	0.9943	0.9707
AHEAD	0.9999	--	--	--
CODA	0.9993	--	--	--
HRS	0.9987	--	--	--
War Baby	0.9985	--	--	--
EBB	0.8878	0.9841	0.9813	0.8238
Respondent weight				
Total	0.9798	0.9919	0.9939	0.9753
AHEAD	0.9999	--	--	--
CODA	0.9991	--	--	--
HRS	0.9988	--	--	--
War Baby	0.9991	--	--	--
EBB	0.8894	0.9622	0.9753	0.8376

Table B2. Sample sizes and distributional statistics for original and revised 2004 household weights

	N	Mean	Median	Variance	Coeff var (%)	Sum of weights	N	Mean	Median	Variance	Coeff var (%)	Sum of weights
	Original weights						Revised weights					
Total	13078	4406	3742	7517029	62.22	57624655	13072	4408	3751	7225680	60.98	57618170
Cohort												
AHEAD	2440	3466	3557	2621457	46.71	8458145	2439	3466	3549	2570806	46.26	8454337
CODA	1236	4263	3745	2218608	34.94	5269396	1236	4262	3732	2162158	34.5	5267335
HRS	5854	3030	3083	1922313	45.75	17739325	5852	3022	3074	1837189	44.85	17685014
War Baby	1393	8685	8107	6339178	28.99	12098273	1393	8667	8076	5978524	28.21	12072636
EBB	2155	6524	5771	9590624	47.47	14059516	2152	6570	6112	8221210	43.64	14138848
Race/ethnicity												
Hispanic	1353	3393	2483	6052941	72.51	4590776	1352	3385	2455	5982617	72.27	4576022
Black	2121	2993	2059	4662038	72.14	6348225	2118	2978	2099	4452711	70.86	6307637
Other	9604	4861	4012	7562370	56.57	46685654	9602	4867	4047	7204166	55.15	46734511
EBB sample												
Hispanic	357	4603	3848	4841110	47.8	1643155	356	4434	3639	4747154	49.14	1578341
Black	424	4711	4339	4538559	45.22	1997353	422	4448	3966	4207025	46.11	1877101
Other	1374	7583	7329	9295103	40.21	10419008	1374	7775	7469	6340882	32.39	10683406

Table B3. Sample sizes and distributional statistics for original and revised 2004 respondent weights

	N	Mean	Median	Variance	Coeff var (%)	Sum of weights	N	Mean	Median	Variance	Coeff var (%)	Sum of weights
	Original weights						Revised weights					
Total	18588	4395	3720	7542620	62.49	81691803	18578	4395	3739	7290354	61.43	81651345
Cohort												
AHEAD	3006	3533	3614	2742186	46.87	10620486	3005	3534	3608	2701630	46.51	10618693
CODA	1722	3963	3057	2084519	36.43	6824051	1722	3961	3048	2038052	36.04	6820770
HRS	9012	3067	3169	18885430	44.77	27638321	9010	3060	3160	1812419	43.99	27572918
War Baby	2158	8647	8188	6345286	29.13	18659331	2156	8641	8162	6139088	28.67	18629891
EBB	2690	6673	5932	9771235	46.85	17949614	2685	6707	6239	8353964	43.09	18009073
Race/ethnicity												
Hispanic	1724	3274	2328	5678564	72.77	5645161	1720	3256	2372	5591495	72.63	5599941
Black	2668	2941	2009	4418588	71.47	7846984	2664	2928	2048	4233431	70.28	7799452
Other	14193	4804	3966	7638467	57.53	68199658	14191	4809	3988	7337058	56.33	68251952
EBB sample												
Hispanic	394	4571	3912	4465792	46.24	1800783	391	4366	3577	4350000	47.77	1707101
Black	475	4717	4442	3895929	41.85	2240344	473	4442	4026	3615657	42.81	2101099
Other	1821	7638	7530	9570377	40.50	13908487	1821	7798	7431	6747597	33.31	14200873

Figure B1. Scatterplot of original vs. revised HRS 2004 household weights

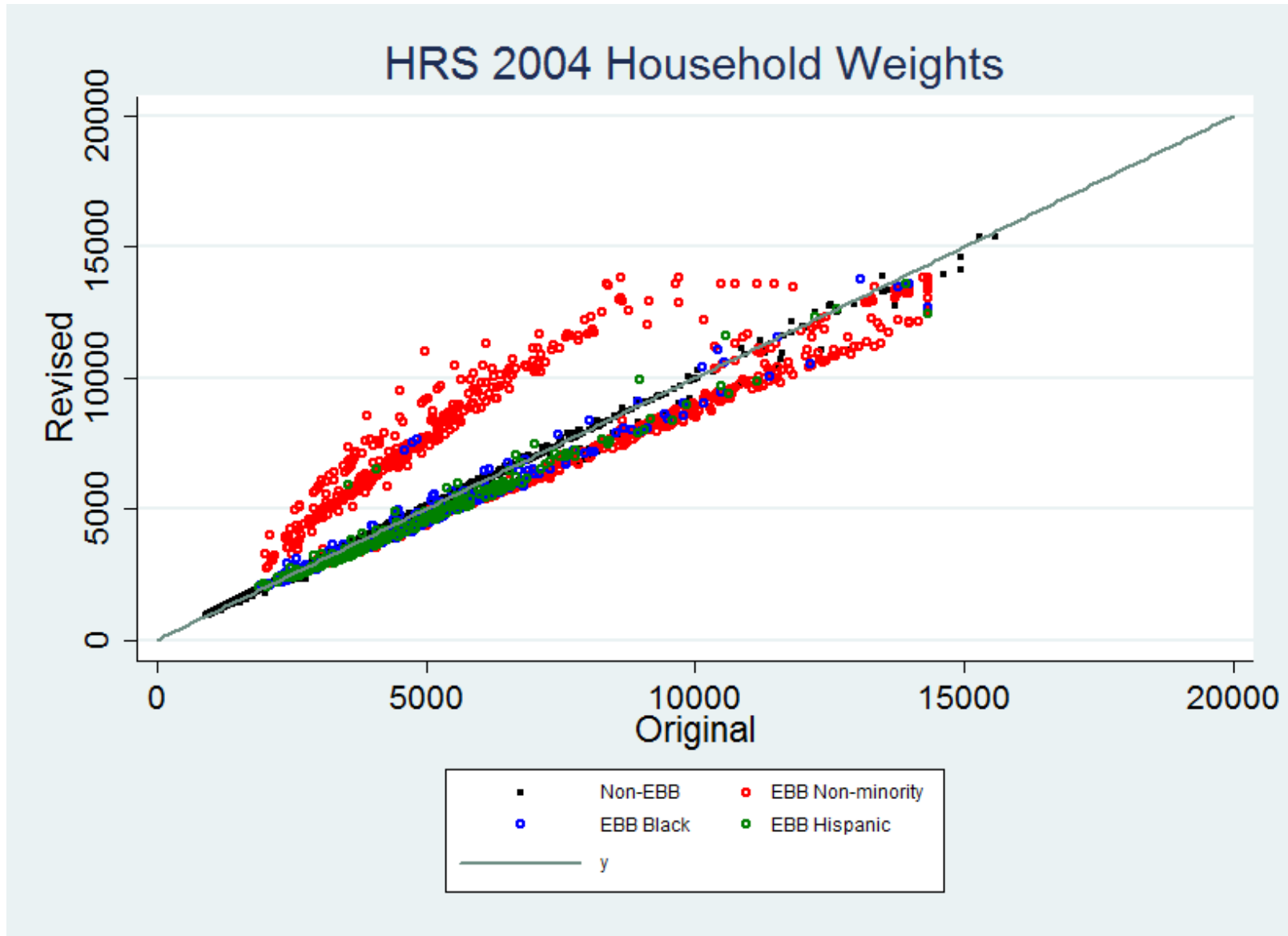


Figure B2. Scatterplot of original vs. revised HRS 2004 respondent weights

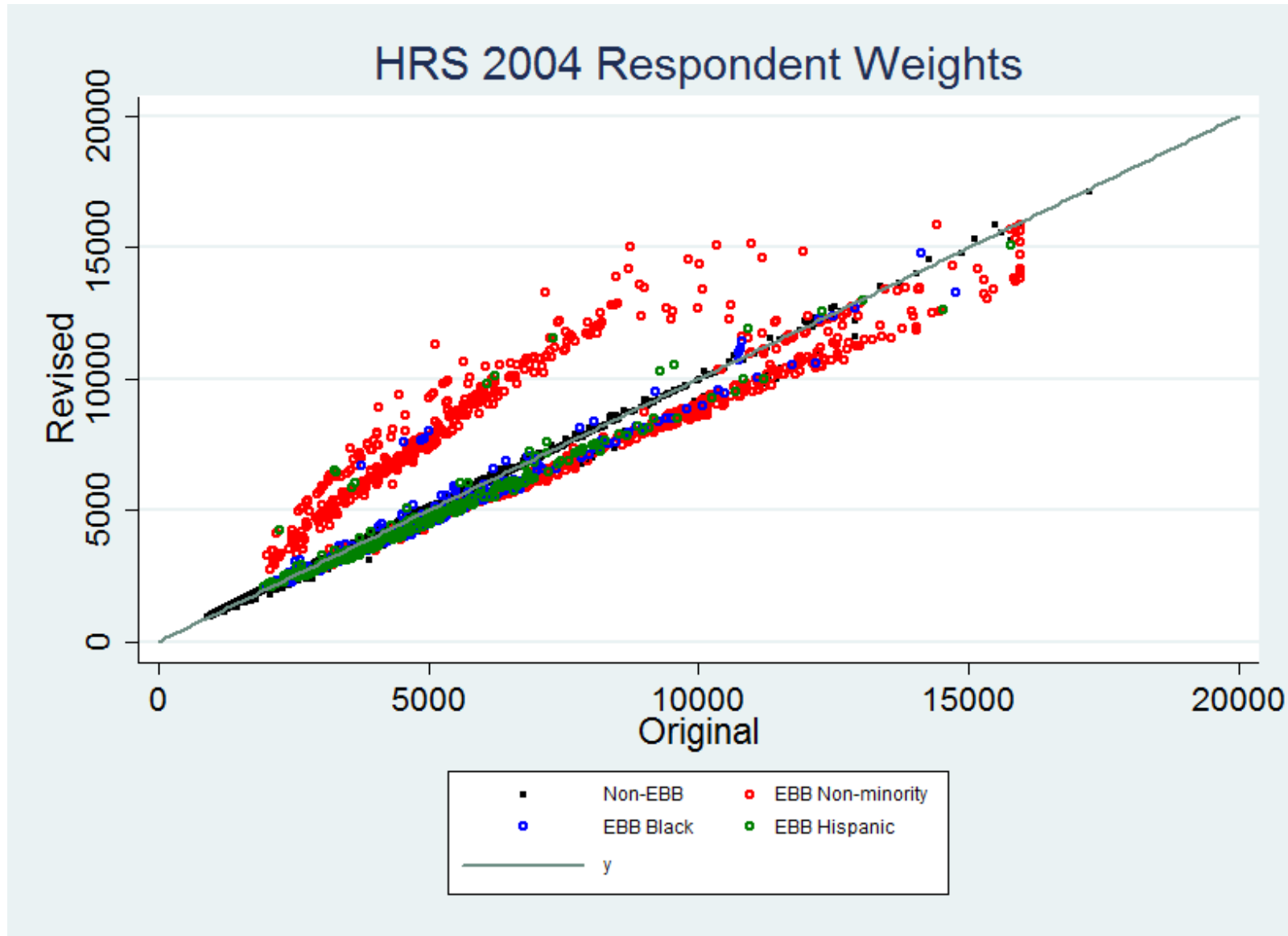


Table B4. Weighted estimates for substantive variables using old vs. new weights for total sample and EBB cohort

	Total sample				EBB cohort			
	Original wt		Revised wt		Original wt		Revised wt	
	Est.	SE	Est.	SE	Est.	SE	Est.	SE
<i>Respondent indicators</i>								
<i>Age group</i>								
< 55	20.88	0.59	20.81	0.59	78.57	1.10	78.33	1.09
55-59	20.17	0.46	20.22	0.46	21.43	1.10	21.67	1.09
60-64	15.59	0.36	15.59	0.36	--	--	--	--
65-69	12.19	0.25	12.19	0.25	--	--	--	--
70-74	10.66	0.25	10.66	0.25	--	--	--	--
75+	20.51	0.62	20.52	0.62	--	--	--	--
<i>Gender</i>								
Male	45.92	0.31	45.93	0.31	55.39	0.88	55.29	0.86
Female	54.08	0.31	54.07	0.31	44.61	0.88	44.71	0.86
<i>Race/ethnicity</i>								
Hispanic	6.90	0.82	6.84	0.81	9.94	2.02	9.39	1.84
Black	9.55	0.51	9.50	0.50	12.39	1.10	11.58	1.00
White/other	83.55	0.90	83.66	0.88	77.67	2.16	79.03	1.95
<i>Education</i>								
< 12 years	20.12	0.73	20.12	0.72	11.36	1.39	11.09	1.29
12 years	32.89	0.56	32.89	0.56	26.08	1.13	26.24	1.19
13-15 years	22.31	0.45	22.31	0.46	28.69	1.13	28.71	1.14
16+ years	24.68	0.79	24.68	0.78	33.86	1.73	33.96	1.75
% working for pay	46.77	0.63	46.73	0.62	78.13	1.13	78.02	1.03
% unemployed	1.38	0.13	1.38	0.12	3.95	0.49	3.90	0.46
% with hypertension	50.07	0.53	50.13	0.53	34.77	1.13	34.92	1.08
% with diabetes	16.37	0.33	16.45	0.33	11.39	0.63	11.64	0.68
% with heart disease	72.02	0.83	21.66	0.41	10.61	0.61	10.58	0.61
% with health insurance	72.02	0.83	71.99	0.80	76.21	1.75	76.24	1.58
<i>Household indicators</i>								
% who own primary residence	77.43	0.60	77.40	0.59	76.75	1.30	76.76	1.28
% who have IRA/Keogh	39.28	0.79	39.10	0.78	40.22	1.76	39.75	1.73
Mean income	61,777	1,480	61,658	1,435	84,667	3,293	84,202	3,151
Mean net worth	427,145	19,422	423,379	19,210	386,357	40,793	373,560	37,289

Table B5. Weighted estimates for substantive variables using old vs. new weights for selected subsamples

	Total White/other				EBB White/other			
	Original wt		Revised wt		Original wt		Revised wt	
	Est.	SE	Est.	SE	Est.	SE	Est.	SE
<i>Respondent indicators</i>								
<i>Age group</i>								
< 55	19.60	0.73	19.80	0.71	78.63	1.33	78.37	1.28
55-59	19.74	0.52	19.78	0.52	21.37	1.33	21.63	1.28
60-64	15.53	0.42	15.46	0.42	--	--	--	--
65-69	12.37	0.28	12.32	0.28	--	--	--	--
70-74	11.05	0.30	11.00	0.29	--	--	--	--
75+	21.71	0.74	21.62	0.73	--	--	--	--
<i>Gender</i>								
Male	46.55	0.34	46.54	0.34	56.93	1.02	56.61	0.99
Female	53.45	0.34	53.46	0.34	43.07	1.02	43.39	0.99
<i>Education</i>								
< 12 years	15.45	0.46	15.44	0.46	5.81	0.58	5.95	0.57
12 years	34.42	0.67	34.41	0.68	26.74	1.39	26.92	1.46
13-15 years	23.00	0.48	23.02	0.49	29.08	1.30	29.02	1.31
16+ years	27.13	0.88	27.13	0.87	38.37	1.97	38.11	1.97
% working for pay	47.03	0.74	47.09	0.73	80.79	1.27	80.38	1.17
% unemployed	1.17	0.14	1.18	0.14	3.26	0.53	3.26	0.50
% with hypertension	48.50	0.64	48.54	0.64	31.55	1.45	32.06	1.35
% with diabetes	14.66	0.35	14.73	0.35	9.76	0.72	10.18	0.75
% with heart disease	22.41	0.47	22.36	0.46	10.60	0.72	10.60	0.72
% with health insurance	76.67	0.74	76.57	0.73	82.62	1.47	81.97	1.33
<i>Household indicators</i>								
% who own primary residence	81.23	0.58	81.08	0.56	83.35	1.36	82.62	1.28
% who have IRA/Keogh	44.58	0.78	44.31	0.77	48.01	1.93	46.69	1.90
Mean income	67,117	1,655	66,924	1,632	96,113	3,642	94,292	3,694
Mean net worth	494,104	22,390	488,719	22,216	471,290	51,758	446,658	46,389

Table C1. Correlation between original and revised 2006 and 2008 sample weights

Weight Cohort	2006	2008
Household weight		
Total sample	0.9958	0.9967
Cohort		
AHEAD	0.9974	0.9983
CODA	0.9753	0.9878
HRS	0.9952	0.9974
War Baby	0.9679	0.9703
EBB	0.9996	0.9999
EBB cohort		
Hispanic	0.9955	0.9999
Black	0.9996	0.9996
White/other	0.9999	1.0000
Respondent weight		
Total sample	0.9910	0.9949
Cohort		
AHEAD	0.9967	0.9982
CODA	0.9725	0.9903
HRS	0.9913	0.9960
War Baby	0.9461	0.9598
EBB	0.9923	0.9993
EBB cohort		
Hispanic	0.9882	0.9996
Black	0.9907	0.9995
White/other	0.9901	0.9990

Table D1. Correlation between original and updated 2006 HRS sample weights
(update based on new 2006 ACS data)

Age group	Household	Respondent	
		Male	Female
< 55	0.9999	0.9998	0.9999
55-59	0.9999	0.9999	0.9999
60-64	0.9999	0.9998	0.9999
65-69	0.9996	0.9995	0.9995
70-74	0.9990	0.9990	0.9990
75-79	0.9965	0.9975	0.9965
80-84	0.9982	0.9986	0.9982
85+	0.9989	0.9995	0.9990
Total	0.9998	0.9968	0.9970

Table E1. Sample sizes and distributional statistics for original and revised supplement weights

	N	Mean	Median	Variance	CV	Corr
Core Components						
2004 physical measures						
Original	3274	24952	16352	495624615	89.22	0.945
Revised	3272	24955	16624	448258853	84.84	
2004 disability leave-behind						
Original	2671	24309	17614	349491740	76.90	0.972
Revised	2670	24300	18096	330664519	74.83	
2004 psychosocial leave-behind						
Original	3005	27187	20520	362432731	70.03	0.970
Revised	3002	27199	20587	348424128	68.63	
2006 physical measures						
Original	7167	10664	8818	40846225	59.93	0.992
Revised	7167	10856	8838	44241924	61.27	
2006 biomarkers						
Original	6103	12523	10294	55778966	59.64	0.992
Revised	6103	12748	10349	59931399	60.73	
2006 psychosocial leave-behind						
Original	7168	10663	8671	42221013	60.94	0.992
Revised	7168	10854	8685	45786059	62.34	
2008 physical measures						
Original	6422	11485	9107	59730196	67.29	0.997
Revised	6422	11485	9118	58596213	66.65	
2008 psychosocial leave-behind						
Original	6177	11940	9264	67973095	69.05	0.996
Revised	6177	11940	9265	66995421	68.55	
Mail Surveys						
2005 PDS questionnaire						
Original	4624	10234	9144	38900911	60.95	0.838
Revised	4621	10642	10022	53111134	68.48	
2005 PDS medications list						
Original	4320	10954	9854	44225740	60.71	0.840
Revised	4317	11317	10729	58559649	67.62	

Table F1. Cost-related medication nonadherence regression analyses with original and revised 2005 PDS questionnaire weights – Model selection

		Unadjusted models				Full model				Final model			
		Original		Revised		Original		Revised		Original		Revised	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Financial characteristics													
OOP Rx cost per month (ref \$0.00-\$20.00)	\$20.01-\$50.00	1.45	1.07-1.96	1.58	1.15-2.16	1.56	1.12-2.17	1.71	1.20-2.43	1.61	1.16-2.22	1.74	1.23-2.44
	\$50.01-\$110.00	2.28	1.57-3.30	2.59	1.73-3.87	2.29	1.42-3.70	2.50	1.49-4.21	2.40	1.61-3.58	2.63	1.68-4.13
	≥\$110.01	4.13	3.09-5.53	4.65	3.40-6.36	4.38	2.95-6.50	4.83	3.22-7.24	4.74	3.56-6.30	5.04	3.62-7.01
Other OOP medical costs (ref \$0.00-\$580.00)	\$580.01-\$1,792.50	1.04	0.77-1.39	1.02	0.73-1.41	1.07	0.74-1.55	1.05	0.68-1.63				
	\$1792.51-\$4,570.00	1.27	0.97-1.67	1.33	0.99-1.79	1.05	0.74-1.50	1.12	0.74-1.68				
	≥\$4,570.01	2.03	1.50-2.75	2.12	1.55-2.89	1.16	0.75-1.80	1.15	0.75-1.79				
Net worth (ref ≤ \$38,000.00)	\$38,000.01-\$154,500.00	0.89	0.67-1.18	0.87	0.63-1.20	0.88	0.64-1.21	0.85	0.58-1.25	0.80	0.58-1.09	0.81	0.56-1.16
	\$154,500.01-\$425,000.00	0.56	0.43-0.73	0.56	0.42-0.74	0.60	0.42-0.88	0.60	0.40-0.90	0.52	0.37-0.72	0.55	0.38-0.79
	≥\$425,000.01	0.30	0.21-0.43	0.30	0.21-0.45	0.40	0.26-0.59	0.39	0.24-0.63	0.28	0.18-0.43	0.31	0.19-0.50
Total household income (ref \$0.00-\$14,042.11)	\$14,042.12-\$25,660.00	0.97	0.73-1.28	0.95	0.71-1.26	0.97	0.67-1.40	0.93	0.62-1.40				
	\$25,660.01-\$48,384.00	0.69	0.52-0.90	0.66	0.49-0.87	0.92	0.63-1.33	0.87	0.58-1.31				
	≥\$48,384.01	0.42	0.28-0.62	0.42	0.28-0.64	0.65	0.40-1.06	0.64	0.38-1.08				
Any drug coverage (ref no)	Yes	0.59	0.44-0.79	0.59	0.43-0.81	0.77	0.54-1.09	0.75	0.51-1.11				
Demographic characteristics													
Age (ref 65-74)	75-84	0.80	0.61-1.04	0.82	0.61-1.10	0.69	0.51-0.94	0.69	0.50-0.96	0.71	0.54-0.94	0.75	0.56-1.01
	≥85	0.52	0.35-0.77	0.55	0.36-0.84	0.36	0.21-0.63	0.37	0.21-0.68	0.38	0.25-0.58	0.41	0.25-0.67
Gender (ref male)	Female	1.86	1.50-2.30	1.89	1.50-2.37	1.47	1.12-1.94	1.41	1.05-1.90	1.51	1.16-1.96	1.60	1.20-2.12
Education (ref high school grad or less)	At least some college	0.59	0.49-0.71	0.61	0.51-0.73	0.86	0.67-1.12	0.90	0.67-1.19				
Job status (ref working)	Not working	1.10	0.72-1.69	1.14	0.74-1.76								
	Retired	1.06	0.74-1.51	1.05	0.73-1.49								
Marital status (ref married)	Never married	1.68	1.00-2.82	1.58	0.88-2.84	1.80	0.97-3.36	1.84	0.88-3.82				
	Separated/divorced	1.37	1.05-1.78	1.38	1.05-1.82	1.16	0.66-2.03	1.17	0.66-2.08				
	Widowed	1.37	1.07-1.76	1.44	1.12-1.87	1.07	0.73-1.58	1.13	0.73-1.75				
Race (ref white)	Black	1.71	1.24-2.36	1.63	1.17-2.29	1.15	0.76-1.73	1.19	0.72-1.95				
	Hispanic	1.78	0.79-4.01	1.68	0.71-3.95	0.67	0.17-2.60	0.66	0.16-2.62				
	Other	0.50	0.22-1.14	0.53	0.22-1.26	0.53	0.23-1.22	0.56	0.23-1.33				
Lives alone (ref no)	Yes	1.19	0.96-1.47	1.25	1.01-1.56	0.83	0.56-1.23	0.83	0.54-1.27				
Child lives within 10 miles (ref no)	Yes	1.24	1.00-1.54	1.26	1.02-1.56	1.06	0.83-1.35	1.07	0.84-1.38				
Disease characteristics													
Ever had high blood pressure (ref no)	Yes	1.18	0.93-1.50	1.09	0.83-1.44	0.73	0.55-0.98	0.67	0.49-0.91	0.75	0.57-0.98	0.68	0.50-0.91
Ever had lung disease (ref no)	Yes	2.03	1.50-2.74	2.29	1.67-3.14	1.51	1.08-2.12	1.67	1.14-2.44	1.48	1.10-1.98	1.67	1.21-2.31
Ever had stroke (ref no)	Yes	0.86	0.63-1.18	0.79	0.56-1.12								
Ever had arthritis (ref no)	Yes	1.67	1.33-2.11	1.79	1.42-2.26	1.91	0.85-1.68	1.27	0.89-1.80				
Ever had a psych disorder (ref no)	Yes	2.03	1.59-2.59	2.20	1.69-2.85	1.10	0.78-1.53	1.24	0.88-1.74				

		Unadjusted models				Full model				Final model			
		Original		Revised		Original		Revised		Original		Revised	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Ever had heart problems (ref no)	Yes	1.01	0.83-1.23	1.02	0.84-1.25								
Ever had diabetes (ref no)	Yes	1.13	0.91-1.40	1.05	0.82-1.34								
Ever had cancer (ref no)	Yes	0.93	0.70-1.25	0.89	0.66-1.21								
Self-rated health (ref poor)	Excellent	0.31	0.18-0.53	0.30	0.17-0.53	1.28	0.58-2.82	1.32	0.56-3.10				
	Very good	0.37	0.26-0.54	0.36	0.24-0.52	1.08	0.63-1.84	1.15	0.64-2.06				
	Good	0.52	0.37-0.74	0.50	0.36-0.72	1.08	0.65-1.77	1.11	0.64-1.94				
	Fair	0.79	0.55-1.14	0.71	0.48-1.05	1.18	0.71-1.96	1.15	0.65-2.05				
ADLs (ref 0)	≥1	1.58	1.29-1.93	1.53	1.22-1.92	0.96	0.65-1.42	0.94	0.60-1.46				
IADLs (ref 0)	≥1	1.46	1.11-1.92	1.41	1.05-1.89	1.01	0.71-1.44	0.95	0.64-1.41				
CES-D score (ref 0)	1-3	1.81	1.38-2.38	1.71	1.30-2.33	1.53	1.13-2.07	1.51	1.08-2.12	1.64	1.25-2.14	1.54	1.14-2.09
	≥4	2.96	2.28-3.84	2.89	2.17-3.87	2.09	1.38-3.17	2.04	1.28-3.27	2.25	1.59-3.20	2.13	1.41-3.23
Cognitive impairment (ref no)	Yes	1.15	0.72-1.84	1.09	0.68-1.77								
Regimen complexity													
# of monthly prescriptions (ref 0-2)	3-4	1.49	1.13-1.97	1.57	1.16-2.12	1.06	0.73-1.54	1.11	0.75-1.64				
	5-6	1.60	1.07-2.40	1.65	1.07-2.52	0.85	0.51-1.40	0.86	0.51-1.44				
	≥7	1.91	1.34-2.71	2.00	1.36-2.94	0.83	0.53-1.30	0.88	0.54-1.42				
Medication characteristics													
Adverse events (ref no)	Yes	2.19	1.77-2.71	2.19	1.75-2.74	1.87	1.43-2.45	1.80	1.35-2.40	1.75	1.36-2.24	1.74	1.32-2.29
Clinician characteristics													
Trust for insurance decisions (ref no one)	Family/friend	1.44	1.11-1.86	1.30	0.98-1.73	1.37	0.99-1.91	1.29	0.91-1.81				
	Professional	1.21	0.80-1.83	1.02	0.66-1.59	1.41	0.89-2.24	1.25	0.75-2.07				

Source: Table 2

Zivin, K.; Ratliff, S.; Heisler, M. M.; Langa, K. M.; Piette, J. D., "Factors influencing cost-related nonadherence to medication in older adults: A conceptually based approach," Value in Health, 13:4, p338-345 [2010]

Table F2. Cost-related medication nonadherence regression analyses with original and revised 2005 PDS questionnaire weights – Individual items

		Not fill				Stop taking				Skip doses			
		Previous		Revised		Previous		Revised		Previous		Revised	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Financial characteristics													
OOP Rx cost per month (ref \$0.00-\$20.00)	\$20.01-\$50.00	1.34	0.87-2.05	1.41	0.92-2.16	1.30	0.80-2.12	1.22	0.70-2.14	2.70	1.75-4.16	2.73	1.72-4.32
	\$50.01-\$110.00	1.92	1.20-3.07	2.04	1.22-3.41	2.48	1.50-4.11	2.46	1.39-4.34	3.05	1.89-4.93	3.08	1.80-5.27
	≥\$110.01	3.06	2.03-4.62	3.41	2.24-5.21	3.55	2.26-5.59	3.53	2.10-5.93	8.37	5.38-13.04	7.96	4.94-12.8
Net worth (ref ≤ \$38,000.00)	\$38,000.01-\$154,500.00	0.82	0.60-1.14	0.78	0.53-1.15	0.86	0.55-1.35	0.83	0.48-1.42	0.73	0.51-1.05	0.68	0.46-1.01
	\$154,500.01-\$425,000.00	0.54	0.37-0.80	0.54	0.36-0.83	0.51	0.34-0.77	0.51	0.31-0.82	0.46	0.30-0.71	0.47	0.29-0.75
	≥\$425,000.01	0.26	0.15-0.45	0.30	0.16-0.55	0.29	0.15-0.56	0.33	0.16-0.68	0.45	0.29-0.70	0.44	0.28-0.71
Total household income (ref \$0.00-\$14,042.11)	\$14,042.12-\$25,660.00									1.18	0.79-1.76	1.08	0.68-1.70
	\$25,660.01-\$48,384.00									0.78	0.51-1.19	0.77	0.49-1.22
	≥\$48,384.01									0.51	0.30-0.88	0.48	0.27-0.86
Any drug coverage (ref no)	Yes	0.64	0.48-0.85	0.69	0.51-0.94	0.55	0.39-0.78	0.59	0.41-0.86				
Demographic characteristics													
Age (ref 65-74)	75-84	0.69	0.51-0.94	0.74	0.52-1.06	0.63	0.45-0.87	0.64	0.45-0.90	0.67	0.51-0.89	0.73	0.55-0.98
	≥85	0.38	0.25-0.58	0.42	0.27-0.65	0.48	0.31-0.74	0.54	0.34-0.86	0.35	0.20-0.59	0.39	0.21-0.71
Gender (ref male)	Female	1.44	1.08-1.93	1.47	1.06-2.03								
Disease characteristics													
Ever had high blood pressure (ref no)	Yes												
Ever had lung disease (ref no)	Yes	1.56	1.10-2.22	1.71	1.16-2.51								
Ever had cancer (ref no)	Yes					0.59	0.39-0.90	0.60	0.38-0.94				
CES-D score (ref 0)	1-3	2.31	1.78-3.00	2.23	1.66-2.99	2.19	1.48-3.26	2.10	1.35-3.25	1.59	1.14-2.21	1.54	1.06-2.24
	≥4	3.21	2.29-4.49	2.96	2.01-4.35	2.79	1.85-4.20	2.56	1.63-4.04	2.27	1.49-3.48	2.23	1.38-3.60
Medication characteristics													
Adverse events (ref no)	Yes	2.27	1.75-2.94	2.22	1.66-2.97	2.96	2.10-4.17	2.97	2.01-4.38				

Source: Table 3

Zivin, K.; Ratliff, S.; Heisler, M. M.; Langa, K. M.; Piette, J. D., "Factors influencing cost-related nonadherence to medication in older adults: A conceptually based approach," Value in Health, 13:4, p338-345 [2010]

Table F3. Mean total assets (including primary residence) by asset percentile: HRS 2004, 2006, 2008

Percentile	2004 (51 and older)			2006 (53 and older)			2008 (55 and older)		
	Original	Revised	Difference (rev-orig)	Original	Revised	Difference (rev-orig)	Original	Revised	Difference (rev-orig)
1%	-23,700	-23,000	700	-25,418	-25,000	418	-37,670	-37,670	0
5%	0	0	0	0	0	0	-350	-300	50
10%	1,000	1,000	0	613	700	87	500	500	0
25%	39,000	38,950	-50	40,100	40,250	150	40,300	41,000	700
50%	157,300	156,000	-1,300	188,000	188,000	0	187,000	187,000	0
75%	435,285	431,000	-4,285	509,000	511,679	2,679	527,000	530,000	3,000
90%	937,000	930,000	-7,000	1,118,000	1,123,700	5,700	1,107,000	1,108,000	1,000
95%	1,447,700	1,440,000	-7,700	1,736,000	1,739,000	3,000	1,757,645	1,759,212	1,567
99%	3,707,339	3,645,000	-62,339	4,753,000	4,871,365	118,365	4,700,000	4,708,000	8,000
Total	434,109	429,857	-4,252	547,922	548,713	791	513,005	514,089	1,084