# PPS Subsampling from NHIS to MEPS - Effect on Precision of MEPS Estimates[1]

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## Abstract

The sample for the Medical Expenditure Panel Survey (MEPS) Household Component is selected from the responding households to the prior year's National Health Interview Survey (NHIS). The selection probability in MEPS varies considerably due to variations in both selection probability and response propensity in NHIS. The resulting high variability in the MEPS base weight contributes to the variance of MEPS estimates. Since 2010, a probability proportional to size (PPS) sampling from NHIS to MEPS has been introduced where the size measure is used as the NHIS interim household weight. The purpose of the PPS sampling is to reduce the variation in MEPS base weight and thereby increase the precision of MEPS estimates. This report presents the results of an evaluation of the PPS sampling on the precision of MEPS estimates. The comparison of CVs of weights across different stages of weighting shows some impact of the PPS sampling at earlier stages but the impact disappears at later stages of weighting. As a result, the PPS sampling does not make any detectable impact on the precision of MEPS estimates as observed by comparing precisions of estimates from pre- and post-PPS panels. The high sampling rate from the NHIS to MEPS is preventing the PPS scheme from significantly reducing the variation in MEPS weights. However, the PPS sampling has no negative impact. It has theoretical appeal and it may be effective in the event the MEPS sampling rate is reduced.

**Key Words:** MEPS, PPS, Subsampling, Variance

## 1. Introduction

The Medical Expenditure Panel Survey (MEPS) is an annual survey that has been conducted since 1996 by the Agency for Healthcare Research and Quality (AHRQ). It provides nationally representative estimates of health care use, expenditures, sources of payment, and health insurance coverage for the U.S. civilian non-institutionalized population. The MEPS Household Component (henceforth referred to as MEPS) also provides estimates of respondents' health status, demographic and socio-economic characteristics, employment, access to care, and satisfaction with health care. Estimates can be produced for individuals, families, and selected population subgroups. Each new panel of sample households in MEPS is selected as a sub-sample of the responding

[1]The views expressed in this paper are solely those of the authors and do not necessarily reflect those of the Agency for Healthcare Research and Quality or the Department of Health and Human Services.

households to the previous year's National Health Interview Survey (NHIS) conducted by the National Center for Health Statistics. Once a panel is selected, it is followed up through five rounds of interviews covering two full calendar years. From 1996 through 2009 (MEPS Panels 1-14), the MEPS subsample from NHIS was obtained using a systematic equal probability sampling procedure within each sampling domain defined by household race-ethnicity[2] as collected in the NHIS. In this method of sample selection, the combined selection probability (reflecting probability of selection in both NHIS and MEPS) become proportional to the NHIS final weight which varies considerably due to nonresponse and other adjustments in NHIS. This variation in the selection probability and hence in the sample base weight increases the variance of MEPS estimates. Since 2010 (MEPS Panel 15), AHRQ implemented a probability proportional to size (PPS) method of subsampling with the NHIS household weight as the measure of size. The purpose of the PPS sampling approach was to reduce the sampling variance of the MEPS estimates by reducing the variation in the overall MEPS selection probability (Machlin et al., 2009). This report presents an evaluation of the impact of this PPS sampling on the precision of MEPS estimates. This is an extension of a preliminary evaluation done earlier by Baskin et al. (2012).

## 2. **Selection of MEPS Sample from NHIS**

The frame for selecting the MEPS sample is created by using a subset of the NHIS responding sample because NCHS allows only two of the four NHIS panels to be used for MEPS and also data from the NHIS fourth interview quarter is not available in time for MEPS selection. So the MEPS sample is selected from about three-eighths (2/4 panels times 3/4 quarters) of the eligible responding households in NHIS.

The available NHIS households on the MEPS frame are stratified hierarchically into mutually exclusive sampling domains as Asian, Hispanic, Black, and Other as follows.

1) If a household contained any Asian member the entire household is classified as an Asian household.
2) Among the remaining households, if a household contained any Hispanic member the household is classified as a Hispanic household.
3) Then among the remaining households, if a household contained any member classified as Black the household is classified as a Black household.
4) Finally if a household is not in any of the three previous strata it is classified as an Other household.

In some years, special sampling domains of interest are created. For example, in 2008 (Panel 13), a poor or low-income domain was defined where at least one family in the household with probability >0.30 of having low family income is defined as a Poor household. In 2011, a cancer domain was used where a household with one or more members with cancer in the household was defined as a Cancer household. When such a special domain is used, this domain is placed at the top of the hierarchy in forming the strata. That means these households are identified first and defined as the first domain, and then remaining domains are defined hierarchically as described above. Also, since 2011 (Panel 16), the 'Other domain' has been separated into two domains – households

[2]Occasionally other characteristics of special interest such as households with low income or cancer patients were also used as sampling domain.

with a complete response in NHIS (Other-complete) and households with a partial response in NHIS (Other-partial). Since the households in the Other-partial domain are generally less cooperative and require extra follow up, these households are selected at a lower rate than the complete households to make the design more responsive.

The sample is selected independently within each domain. The number of eligible households on the frame and the number selected in different sampling domains for Panels 13 to 17 are presented in Table 1. The sample is selected systematically with equal weight within each domain up to 2009 (MEPS Panel 14) and since 2010 (MEPS Panel 15), the sample has been selected using the PPS sampling scheme with the objective to reduce the variation in the MEPS base weight. However, as Table 1 shows that the sampling rates from the frame to the MEPS sample is mostly 100% in minority domains, the PPS sampling is targeted to reduce the variation in base weights mainly in the Other-complete and Other-partial domains.

For the PPS selection, since the NHIS final household weight is not available when the MEPS sample needs to be selected, a proxy/predicted version of the NHIS final household weight is used as the measure of size. For the first interview quarter of NHIS, the NHIS interim weight is used as a proxy for the MEPS final weight, and for the second and the third interview quarters, since even the NHIS interim household weight is not available a predicted version of the NHIS interim household weight is used as the measure of size. The prediction is done using a model with appropriate factors from the NHIS sample selection process.

**Table 1.** MEPS households (HHs) selected from the frame (NHIS)[1] for Panels 13 to 17

| | Year/ Panel | Frame/ Sample | Asian/Poor/ Cancer[2] | Hispanic HH | Black HH | Other HH–Complete[3] | Other HH–Partial | All HH |
|---|---|---|---|---|---|---|---|---|
| Pre-PPS | 2008/P13 | Frame | 2,632 | 1,855 | 1,498 | 6,467 | n/a | 12,452 |
| | | Sample | 2,632 | 1,855 | 1,498 | 3,718 | n/a | 9,703 |
| | | % Selected | 100% | 100% | 100% | 57% | n/a | 78% |
| | 2009/P14 | Frame | 834 | 2,386 | 2,019 | 6,942 | n/a | 12,181 |
| | | Sample | 834 | 2,066 | 1,816 | 4,984 | n/a | 9,700 |
| | | % Selected | 100% | 87% | 90% | 72% | n/a | 80% |
| Post-PPS | 2010/P15 | Frame | 860 | 2,579 | 1,994 | 6,957 | n/a | 12,390 |
| | | Sample | 860 | 1,961 | 1,705 | 4,224 | n/a | 8,750 |
| | | % Selected | 100% | 76% | 86% | 61% | n/a | 61% |
| | 2011/P16 | Frame | 1,708 | 2,386 | 1,894 | 4,272 | 1,807 | 12,067 |
| | | Sample | 1,708 | 2,386 | 1,894 | 3,354 | 838 | 10,180 |
| | | % Selected | 100% | 100% | 100% | 79% | 46% | 84% |
| | 2012/P17 | Frame | 1,075 | 2,762 | 2,053 | 6,426 | 1,385 | 13,701 |
| | | Sample | 1,075 | 2,762 | 2,053 | 3,256 | 554 | 9,700 |
| | | % Selected | 100% | 100% | 100% | 51% | 40% | 71% |

[1]MEPS frame includes 3/8th of the NHIS full responding sample.
[2]Poor households in Panel 13 only and Cancer households in Panel 16 only.
[3]Up to Panel 15, since Other HH-partials were not selected separately these households were included with the Other HH-complete domain.

## 3. Variation in MEPS Weights

The MEPS base household weight, $BW\_HH_i$ , for household, $i$ , within domain, δ, can be defined as

$$BW\_HH_i = WTFA\_HH_i * \frac{1}{P_i} \qquad i \in d$$

where, $WTFA\_HH_i$ is the NHIS final household weight and $P_i$ is the conditional probability of selecting the *i*-th household from NHIS to MEPS.
Under the systematic selection with equal probability,

$$P_i = \frac{n_d}{N_d} \text{ and } BW\_HH_i = WTFA\_HH_i * \frac{N_d}{n_d} \qquad i \in d$$

where $N_d$ is the available number of households on the frame and $n_d$ is the number of households selected for MEPS. Since $\frac{n_d}{N_d}$ is fixed within a domain, the variation in MEPS base weight is proportional to the variation in the NHIS weight which is considerable due to nonresponse and other adjustments in NHIS. Therefore, under the systematic selection with equal probability, the MEPS base weight inherits the variation in the NHIS weight and contributes to the variation in MEPS estimates.

For PPS selection, since the NHIS final household weight is not available at the time of selecting the MEPS sample, a proxy/predicted version of NHIS household weight (say $WTFA\_HH^*$) is used as the measure of size. Therefore, the MEPS base weight under the PPS selection is

$$BW\_HH_i = WTFA\_HH_i * \frac{\sum WFIA\_HH_i^*}{n_d * WFIA\_HH_i^*} \qquad i \in d,$$

$$\text{if } WTFA\_HH_i^* \approx WTFA\_HH_i \text{ then}$$

$$BW\_HH_i \approx \frac{\sum WTFA\_HH_i^*}{n_d} = s_d$$

where, $s_d$ is the sampling skip interval in domain, $d$, which is a constant. Even if $WTFA\_HH^*$ is approximately proportional to $WTFA\_HH$, the variation in $BW\_HH$ within a domain should decrease with the PPS sampling depending on the strength of correlation between $WTFA\_HH^*$ and $WTFA\_HH$. However, when the conditional sampling rate from NHIS to MEPS is very high, many cases are selected with certainty and the MEPS base weight for these cases becomes proportional to the NHIS weight again. In that case, the PPS sampling scheme is less effective for reducing the variation in the MEPS weight.
As Kish (1992) discussed, the design effect due to variation in sampling weights can be expressed as

$$Deff = (1 + CV^2)$$

where, $Deff$ =design effect and *CV*=coefficient of variation in weights. CV is the standard deviation of the weights divided by the mean of the weights and design effect indicates the efficiency of a complex design compared to a simple random sample design of the same sample size. Therefore, the lower the design effect, the higher the efficiency of a design and hence precision of estimates. This can also be expressed using the following relationship between the effective sample size and design effect.

$$n_{effect} = n/Deff$$

So generally a reduction in the CV of weights should increase the design effect, effective sample size, and hence the precision of survey estimates.

## 4. Method of Evaluation

The data used for this evaluation come from MEPS years 2008 to 2012 (Panel 13 to Panel 17). The Panel 13 and Panel 14 samples were selected using the systematic sampling whereas Panel 15 to Panel 17 samples were selected using the PPS sampling. For evaluation, we mainly concentrate on the 'Other–complete' domain because sampling rates in the remaining domains are equal or close to100% and the 'Other–partial' domain is not available in all panels. Up to Panel 15, since the Other–partial households were not selected at a different rate these households were included as part of the Other–complete domain.

The immediate impact of the PPS sampling is expected to be on the variation of base weight and the ultimate impact is expected on the precision of estimates. So the evaluation is done by comparing the variation in weights and the precision of estimates produced from point-in-time (PIT) and full year (FY) files.

Two types of information are compared from the panels or FY files before and after the introduction of PPS sampling. The first comparison is based on the CV of the weights and the second comparison is based on the standard errors (SEs) of health insurance and healthcare expense estimates between the pre- and the post-PPS panels using data from PIT and FY files. More specifically, estimates of the percent insured at any time during the early part of the year based on the PIT files were made using the variable INSRDyyX and the insurance status on 12/31 were derived from the FY file using variables PRIVyy and PUByyX variables. The estimates of mean of person-level total healthcare expenses from the FY file were computed from the variable TOTEXPyy. Detailed definitions of these variables can be found in the documentation of MEPS FY Public Use File (PUF). Percents, SEs, CVs, and design effects were computed using SAS Survey procedures and compared between the pre- and the post-PPS panels.

Since the sample size varies from panel to panel or year to year, the evaluation of the PPS sampling must be independent of the effect of variation in sample size. Since SEs or CVs are dependent on the sample size while design effect is generally independent of moderate variations in sample size, the emphasis will be mostly on the comparison of design effects for the purpose of this evaluation.

## 5. Results

### 5.1 Comparison of CVs of Weights

Table 2 presents the CVs of weights, starting with NHIS household weights to different stages of MEPS weights. Since the NHIS interim (or predicted) household weight is used for the PPS selection and the final household weight is used for calculating the MEPS base weight, the CVs of both NHIS interim and final household weights are included in the table. The NHIS final weight reflects the selection probability, nonresponse and post-stratification adjustments while the NHIS interim weight does not include the post-stratification adjustment to Census population control totals. The MEPS base weight is

derived by applying the probability of selection in MEPS to the NHIS final weight. The CVs of two other subsequent stages of MEPS household or dwelling unit (DU) weight are presented in the table – the raked household weight and the final household weight. The raked weight is derived by applying a raking adjustment to the base weight using control totals from the NHIS. The final household weight represents the responding households in MEPS, and is derived by applying a nonresponse adjustment to the raked weight. The last three columns in the table present the CVs of weights at different stages of person-level weighting. The panel-specific PIT is the Round 1 weight specific to the panel, the PIT final weight is the Round 1 and Round 3 combined-panel final weight, and the panel-specific final FY weight is the final weight representing the whole year specific to the panel in the first year in MEPS. Details on different stages of MEPS weighting can be found in Machlin, Chowdhury, et al. (2010).

The table compares CVs (in percent) of Panel 13 through Panel 17 by sampling domain and overall. In Panel 13 and Panel 14 (selected with systematic sampling) CVs of MEPS base weights in all domains are almost the same as the CVs of the NHIS final weight. In Panel 15 to Panel 17 (selected with PPS sampling) the CVs of the MEPS base weight in the Other-complete sampling domain decreased from the CVs of the NHIS final weight. The reduction in CV in the Other-complete domain is about 7.6 percentage points (from 28.57% to 20.95%) in Panel 15, nearly 2 percentage points (from 30.84% to 29.09%) in Panel 16, and about 6 percentage points (from 36.30% to 30.63%) in Panel 17. The smaller decrease in CV in Panel 16 compared to Panel 15 or Panel 17 may be due to the higher sampling rate in the Other-complete domain in Panel 16 than in Panel 15 or Panel 17. The sampling rate in the Other-complete domain is 79% in Panel 16, compared to 61% in Panel 15 and 51% in Panel 17 (Table 1). Since the Other-partial domain is only available in Panel 16 and Panel 17 and not in earlier panels, a pre- and post-PPS comparison is not possible. However, the CVs in the Other-partial domain have also decreased (by 1.7 and 6 percentage points) from the NHIS final weight to the MEPS base weight in Panel 16 and Panel 17. So this indicates that the CVs of weights in the post-PPS panels have decreased initially in the Other-complete domain due to the PPS sampling. The reduction in CVs as discussed above is not visible for minority domains where the PPS sampling is not relevant except in Panel 15 when Hispanic and Black households were selected at less than 100% rate. This reconfirms that at the initial stages of weighting the PPS sampling has an impact on CVs.

However, as the subsequent weighting adjustments are made to produce the raked household weight or the final household weight and so on, the CVs in the Other-complete domain increased at faster rates in the post-PPS panels than in the pre-PPS panels. It appears that the difference in CVs between the pre- and the post-PPS panels have almost disappeared at the stage of the final household weight. In subsequent person-level weights, there is no difference at all between the pre- and post-PPS panels. One of the reasons for this disappearance of difference may be that all weighting adjustments on the MEPS base weight are made by combining all domains, i.e., when the weights with different means are combined the effect of reduction in CVs due to PPS sampling get diluted with the weights of all other domains where the PPS sampling is not relevant due to sampling rate equal or close to 100%.

The last three columns in Table 2 show the CVs for PIT and FY person-level weights. The CVs for these weights are not consistently lower for Panel 15 to Panel 17 than for Panel 13 and Panel 14. In other words, there is no indication that the reductions in CVs of

weights due to the PPS sampling at the household level were carried forward to the CVs of the weights at the person level.

**Table 2.** Comparison of CVs of weight across panels and stages of weighting

| Sampling Domain | Panel | Household (HH) Level | | | | | Person Level | | |
|---|---|---|---|---|---|---|---|---|---|
| | | NHIS HH Weight (on MEPS Frame) | | MEPS HH Weight | | | MEPS Person Weight | | |
| | | Interim | Final | Base weight | Raked weight | Final weight | Panel-spec PIT weight | PIT Final weight | Panel-spec FY final weight |
| Asian HH | 13 | 42.70 | 50.76 | 50.79 | 52.03 | 56.45 | 61.40 | 61.64 | 69.39 |
| | 14 | 42.12 | 46.53 | 46.56 | 41.17 | 45.30 | 56.92 | 58.21 | 67.10 |
| | 15 | 38.81 | 44.78 | 44.84 | 42.08 | 44.36 | 52.81 | 53.37 | 58.10 |
| | 16 | 35.29 | 40.95 | 40.92 | 42.49 | 55.24 | 57.34 | 57.80 | 62.04 |
| | 17 | 36.34 | 41.47 | 41.27 | 42.31 | 45.24 | 53.06 | 57.12 | n/a |
| Hispanic HH | 13 | 39.91 | 43.59 | 43.58 | 43.44 | 45.19 | 58.02 | 59.28 | 65.20 |
| | 14 | 43.68 | 49.21 | 47.90 | 44.29 | 47.10 | 57.50 | 58.13 | 66.75 |
| | 15 | 41.57 | 48.33 | 33.40 | 30.38 | 32.48 | 53.59 | 54.11 | 61.54 |
| | 16 | 35.58 | 42.36 | 42.36 | 41.99 | 50.05 | 58.06 | 58.49 | 64.99 |
| | 17 | 33.37 | 41.27 | 41.22 | 41.67 | 43.55 | 49.40 | 50.07 | n/a |
| Black HH | 13 | 29.56 | 35.08 | 35.07 | 35.37 | 40.40 | 49.68 | 33.79 | 53.62 |
| | 14 | 41.67 | 44.61 | 44.32 | 44.66 | 38.66 | 47.61 | 48.15 | 53.88 |
| | 15 | 30.29 | 35.75 | 29.26 | 30.76 | 34.23 | 47.97 | 48.36 | 57.56 |
| | 16 | 29.22 | 36.53 | 36.52 | 36.40 | 41.50 | 50.36 | 51.05 | 58.20 |
| | 17 | 31.25 | 36.84 | 36.82 | 36.10 | 37.00 | 45.39 | 46.27 | n/a |
| Other HH - Complete | 13 | 24.83 | 30.20 | 30.08 | 27.63 | 29.90 | 37.27 | 38.20 | 41.06 |
| | 14 | 25.89 | 31.09 | 29.36 | 31.07 | 34.78 | 44.05 | 44.53 | 50.15 |
| | 15 | 22.61 | 28.57 | 20.95 | 22.16 | 28.37 | 39.36 | 40.08 | 49.14 |
| | 16 | 26.71 | 30.84 | 29.09 | 30.86 | 34.63 | 41.31 | 42.24 | 50.52 |
| | 17 | 31.93 | 36.30 | 30.63 | 31.80 | 34.19 | 45.39 | 41.73 | n/a |
| Other HH - Partial | 13 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | 14 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | 15 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | 16 | 20.46 | 28.20 | 26.50 | 28.08 | 37.32 | 42.81 | 43.02 | 53.82 |
| | 17 | 30.21 | 35.36 | 29.37 | 30.64 | 34.75 | 41.00 | 41.65 | n/a |
| All HH | 13 | 42.46 | 45.75 | 68.11 | 65.94 | 70.06 | 77.76 | 78.37 | 82.02 |
| | 14 | 43.25 | 46.50 | 52.78 | 51.23 | 56.06 | 67.04 | 67.49 | 72.13 |
| | 15 | 40.21 | 44.06 | 51.37 | 49.40 | 56.68 | 69.37 | 69.88 | 76.00 |
| | 16 | 40.41 | 44.43 | 62.91 | 61.08 | 71.60 | 80.41 | 80.38 | 87.35 |
| | 17 | 41.17 | 45.09 | 71.99 | 72.51 | 80.54 | 88.84 | 89.13 | n/a |

Table 3 presents the comparison discussed above in a different manner. It summarizes the changes in CVs over different stages of weighting for the Other-complete domain in

terms of ratios where the base of the ratio is the final NHIS household weight. The ratio of CVs generally decreased from the NHIS final weight to the MEPS base weight after implementing the PPS sampling. The decrease is not pronounced for Panel 16 as for Panel 17 due to the higher sampling rate. The ratios of CVs decrease below 1.00 to a greater extent for the post-PPS panels for the first 2-3 steps (i.e., for MEPS household weights) than for the pre-PPS panels. For the MEPS base weight, the average of ratios for the pre-PPS panels is 0.97 and for the post-PPS panels is 0.84. For the MEPS raked household weight, the average for the pre-PPS panels is 0.96 and for the post-PPS panels is 0.87. For the MEPS final household weight, the same averages are 1.06 and 1.01 for the pre- and post-PPS panels. However, for the person-level weights, the ratios of post-PPS panels than pre-PPS panels are not that consistently lower. For example, for the panel-specific PIT weights, the average of ratios is 1.33 for the pre-PPS panels and 1.32 for the post-PPS panels; for the PIT final weight, the averages are 1.35 and 1.31 for the pre- and the post-PPS panels; and for the panel-specific FY final weight, the averages are 1.49 and 1.68 for the pre- and the post-PPS panels.

**Table 3.** Rates of decrease/increase in CVs compared to the NHIS final weight for the Other-complete domain

| | | Ratios[1] of CVs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Household Weight | | | | Person Weight | | | |
| | | NHIS | MEPS | | | MEPS | | | Sampling Rate |
| | Panel | A/A | B/A | C/A | D/A | E/A | F/A | G/A | |
| Pre-PPS | P13 | 1.00 | 1.00 | 0.91 | 0.99 | 1.23 | 1.26 | 1.36 | 57% |
| | P14 | 1.00 | 0.94 | 1.00 | 1.12 | 1.42 | 1.43 | 1.61 | 72% |
| Post-PPS | P15 | 1.00 | 0.73 | 0.78 | 0.99 | 1.38 | 1.40 | 1.72 | 61% |
| | P16 | 1.00 | 0.94 | 1.00 | 1.12 | 1.34 | 1.37 | 1.64 | 85% |
| | P17 | 1.00 | 0.84 | 0.88 | 0.94 | 1.25 | 1.15 | n/a | 51% |

[1]A=NHIS Final HH Weight, B=MEPS HH Base Weight, C=MEPS HH Raked Weight, D=MEPS HH Final Weight, E=MEPS Panel-Specific PIT Weight, F=MEPS PIT Combined Panel Final Weight, G=MEPS FY Panel-Spec Final Weight

Table 4 compares the CVs of the final FY weight for 2009 and 2011. These two FY files consist of either two pre-PPS or two post-PPS panels. The relative change in CV in the Other-complete domain compared to minority domains is not less, indicating that the effect of the PPS sampling is not at all noticeable in the final FY weight.

**Table 4.** Comparison of CVs of final FY weights between FY 2009 (Pre-PPS) and FY 2011 (post-PPS) for the main sampling domains

| Sampling Domain[1] | 2009 (P13-14) | 2011 (P15-16) | Ratio (2011/2009) |
|---|---|---|---|
| Asian HH | 67.47 | 62.03 | 91.9% |
| Hispanic HH | 66.05 | 66.26 | 100.3% |
| Black HH | 54.21 | 58.47 | 107.9% |
| Other HH - Complete | 47.93 | 50.85 | 106.1% |
| ALL HH | 77.41 | 82.89 | 107.1% |

[1]Poor/Cancer and Other-partial domains are excluded.

## 5.2 Comparison of Precision of Estimates

To examine the impact of PPS sampling on MEPS estimates, Table 5 presents a comparison of health insurance rates in different domains in different panels estimated from the first year of PIT files using the panel-specific PIT weight. As mentioned before, since the sample size varies across panels we will concentrate more on design effects instead of SEs and CVs.

**Table 5.** Estimates of percent insured and accuracy measures from Point-in-Time (PIT) files with panel-specific PIT weights

| Sampling Domain[1] | Panel | N | Insured (%) | Standard Error | CV% | Design Effect |
|---|---|---|---|---|---|---|
| Asian HH | 13 | 1,646 | 81.48 | 1.50 | 1.84 | 2.45 |
| | 14 | 1,708 | 82.39 | 1.59 | 1.93 | 2.98 |
| | 15 | 1,726 | 81.01 | 1.98 | 2.45 | 4.40 |
| | 16 | 1,727 | 81.44 | 1.42 | 1.74 | 2.30 |
| | 17 | 2,274 | 80.73 | 1.43 | 1.77 | 2.99 |
| Hispanic HH | 13 | 4,798 | 66.92 | 1.23 | 1.84 | 3.28 |
| | 14 | 5,547 | 67.31 | 1.54 | 2.29 | 5.98 |
| | 15 | 5,223 | 66.89 | 1.18 | 1.77 | 3.28 |
| | 16 | 6,655 | 65.65 | 1.19 | 1.81 | 4.18 |
| | 17 | 7,646 | 66.09 | 0.96 | 1.45 | 3.14 |
| Black HH | 13 | 3,143 | 78.01 | 1.12 | 1.43 | 2.30 |
| | 14 | 3,676 | 79.01 | 1.02 | 1.30 | 2.31 |
| | 15 | 3,571 | 78.06 | 1.09 | 1.39 | 2.48 |
| | 16 | 3,971 | 75.87 | 1.09 | 1.44 | 2.58 |
| | 17 | 4,392 | 76.38 | 1.01 | 1.32 | 2.48 |
| Other HH - Complete | 13 | 6,645 | 85.35 | 0.69 | 0.81 | 2.53 |
| | 14 | 8,260 | 86.19 | 0.65 | 0.76 | 2.93 |
| | 15 | 6,726 | 85.47 | 0.63 | 0.73 | 2.15 |
| | 16 | 5,884 | 85.18 | 0.66 | 0.78 | 2.03 |
| | 17 | 5,693 | 85.70 | 0.78 | 0.91 | 2.83 |
| All HH | 13 | 20,609 | 80.17 | 0.56 | 0.70 | 4.01 |
| | 14 | 19,191 | 81.84 | 0.57 | 0.70 | 4.20 |
| | 15 | 17,246 | 80.94 | 0.52 | 0.64 | 2.98 |
| | 16 | 20,956 | 80.83 | 0.56 | 0.69 | 4.18 |
| | 17 | 20,818 | 79.87 | 0.65 | 0.82 | 5.49 |

[1]Poor/Cancer and Other-partial domains are excluded.

The table shows, for the Other-complete domain, the design effects of the estimates of percent insured in the post-PPS panels do not show any consistent decreasing effect compared to that in the pre-PPS panels. The variation in design effects across panels within the Other-complete domain is very much within the range of variations in design effects within other minority domains. In Panel 15 and Panel 16, a decreasing tendency in design effect is observed but that decrease did not occur in Panel 17 even though the

sampling rate is lower in Panel 17 compared to Panel 16. Therefore, the precision of estimates of percent insured estimated from PIT files do not show any sustained effect of the PPS sampling.

Table 6 presents similar comparison across panels for estimates of percent uninsured from FY files. Again the design effects do not show any consistent decrease in the post-PPS panels than in the pre-PPS panels for the Other-complete domain. A slight indication of decrease is observed in Panel 16 but not in Panel 15. Also, the variation in design effects across panels within the Other-complete domain is very much within the range of variations in design effects within other minority domains.

**Table 6.** Estimates of percent uninsured and accuracy measures from FY files with panel-specific FY weights

| Sampling Domain[1] | Domain/ Panel[2] | Sample Size | Uninsured (%) | Standard Error | CV% | Design Effect |
|---|---|---|---|---|---|---|
| Asian HH | 13 | 1,429 | 16.88 | 1.84 | 10.87 | 3.45 |
| | 14 | 1,470 | 16.05 | 1.68 | 10.49 | 3.08 |
| | 15 | 1,480 | 16.65 | 1.87 | 11.25 | 3.73 |
| | 16 | 1,503 | 13.74 | 1.50 | 10.95 | 2.85 |
| Hispanic HH | 13 | 4,413 | 29.84 | 1.30 | 4.34 | 3.56 |
| | 14 | 4,852 | 32.20 | 1.52 | 4.73 | 5.13 |
| | 15 | 4,628 | 31.22 | 1.23 | 3.93 | 3.26 |
| | 16 | 6,090 | 30.98 | 1.29 | 4.17 | 4.74 |
| Black HH | 13 | 2,838 | 19.24 | 1.01 | 5.27 | 1.86 |
| | 14 | 3,230 | 19.16 | 1.07 | 5.57 | 2.39 |
| | 15 | 3,090 | 20.41 | 0.99 | 4.82 | 1.86 |
| | 16 | 3,662 | 21.11 | 0.94 | 4.44 | 1.94 |
| Other HH -Complete | 13 | 6,017 | 13.97 | 0.67 | 4.81 | 2.25 |
| | 14 | 7,713 | 13.47 | 0.64 | 4.77 | 2.71 |
| | 15 | 5,850 | 13.41 | 0.67 | 4.97 | 2.26 |
| | 16 | 5,373 | 12.97 | 0.67 | 5.15 | 2.14 |
| All HH | 13 | 18,786 | 18.59 | 0.54 | 2.92 | 3.67 |
| | 14 | 16,725 | 17.59 | 0.63 | 3.56 | 4.53 |
| | 15 | 15,048 | 17.78 | 0.53 | 3.00 | 2.92 |
| | 16 | 19,051 | 17.17 | 0.55 | 3.19 | 4.01 |

[1]Poor/Cancer and Other-partial domains are excluded.
[2]Panel 17 FY weight is not available at the time of producing this table.

The estimate of healthcare expenditures is an important and widely used estimate from MEPS. Table 7 presents similar comparison for the mean of individual total healthcare expenditures estimated from new panels in FY files with panel-specific FY weights. A comparison of design effects among pre- and post-PPS panels do not show any improvement in the precision of the estimate of healthcare expenditure in the post-PPS panels. The SEs, CVs, and design effects are all higher in the post-PPS panels than those in the pre-PPS panels.

**Table 7.** Estimates of Mean Total Healthcare Expenditures and accuracy measures by sampling domain from FY files with panel-specific FY weights

| Sampling Domain[1] | Panel | Sample Size | Mean Total Expenditure ($) | SE ($) | CV% | DEFF |
|---|---|---|---|---|---|---|
| Asian HH | 13 | 1,436 | 2,329 | 223 | 9.57 | 1.52 |
| | 14 | 1,475 | 2,275 | 191 | 8.40 | 1.90 |
| | 15 | 1,497 | 2,638 | 288 | 10.92 | 1.31 |
| | 16 | 1,511[2] | 2,688 | 310 | 8.67 | 1.87 |
| Hispanic HH | 13 | 4,437 | 2,220 | 146 | 6.58 | 1.52 |
| | 14 | 4,881 | 2,201 | 112 | 5.09 | 1.38 |
| | 15 | 4,657 | 2,403 | 185 | 7.70 | 1.24 |
| | 16 | 6,131 | 2,141 | 147 | 6.87 | 1.63 |
| Black HH | 13 | 2,861 | 3,192 | 243 | 7.61 | 1.35 |
| | 14 | 3,255 | 3,372 | 207 | 6.14 | 1.36 |
| | 15 | 3,110 | 3,777 | 222 | 5.88 | 0.99 |
| | 16 | 3,681 | 3,327 | 219 | 6.58 | 1.37 |
| Other HH - Complete | 13 | 6,076 | 4,325 | 144 | 3.33 | 1.35 |
| | 14 | 7,234 | 4,852 | 154 | 3.17 | 1.13 |
| | 15 | 5,909 | 4,495 | 168 | 3.74 | 1.26 |
| | 16 | 5,401 | 4,210 | 167 | 3.97 | 1.53 |
| All HH | 13 | 1,8948 | 3,788 | 100 | 2.64 | 2.06 |
| | 14 | 1,6845 | 3,372 | 207 | 6.14 | 1.36 |
| | 15 | 1,5173 | 3,910 | 118 | 3.02 | 1.57 |
| | 16 | 1,9252 | 3,963 | 144 | 3.63 | 1.37 |

[1]Poor/Cancer and Other-partial domains are excluded. [2]Excludes an outlier.

## 6. Conclusion

The MEPS sample from NHIS used to be selected using a stratified systematic equal probability sampling scheme up to 2009 (Panel 14). A PPS sampling scheme was introduced from 2010 (Panel 15) to reduce the variation in MEPS base weight. The PPS sampling is mainly targeted for the sampling domain of other households because sampling rates in the domains of minority households are usually close to 100%. The analysis presented in this report show that the PPS sampling has some initial impact on the variation of base weight. The CVs of weights in the Other-complete domain reduced by about 2 to 7 percentage points in different post-PPS panels depending on the sampling rate for a panel. However, as subsequent weighting adjustments are made on the base weight by combining different domains, the lower CVs in the post-PPS panels disappeared and became similar to those in the pre-PPS panels. At the stage of person-level weight derived immediately after the household-level weight, there was no noticeable difference in CVs of weights between the pre- and the post-PPS panels. Therefore, in the main public use files (i.e., PIT or FY), there was no difference in the CVs of weights between the pre- and the post-PPS panels.

Precisions of health insurance and expenditure estimates were also compared between the pre- and the post-PPS panels. The precisions of estimates of insurance rates computed from both PIT and FY files do not show any noticeable difference between the pre- and the post-PPS panels. The precision of healthcare expenditure estimates produced from the FY files also did not show any improvement in the post-PPS panels.

The high sampling rate from the frame is probably the main reason for no detectable ultimate impact of the PPS sampling. As the conditional sampling rate from the MEPS frame is high even in the Other-complete domain, many cases are selected with certainty from NHIS to MEPS under the PPS sampling, making it less effective for reducing the variation in the MEPS weight. If the sampling rates were lower (say <50%) in most domains, the PPS sampling would probably make an impact at the overall level.

The other issue that contributes to the poor performance of the PPS sampling is the use of predicted or proxy measure of size. As the NHIS interim (or predicted interim) weight is used as the measure of size it introduces a noise in the process of reducing variation in the MEPS weight. Due to the lack of perfect correlation between the NHIS final weight and the measure of size used in the PPS sampling, the variation in the NHIS final weight does not fully cancel out, thereby failing to completely control the within-domain variation in the MEPS base weight.

Although the PPS sampling is not making any detectable impact on the precision of estimates, the evaluation does not indicate any negative impact other than adding some complexity in the selection process which is already incorporated in the programming codes. Moreover, the PPS sampling at the second phase is theoretically more appealing where the weight from the first phase varies widely. So there is no immediate need for dropping the PPS sampling and going back to the previous scheme at this stage. If the sampling rate in MEPS is reduced in some years, the PPS sampling may be useful.

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