Source of the Data and Accuracy of the Household Pulse Survey (HPS) Data Collection of December 2024

SOURCE OF THE DATA

The Household Pulse Survey (HPS), an experimental data product, measures how emergent social and economic issues impact U.S. households. The HPS is conducted by the United States Census Bureau in partnership with other Federal agencies and offices including:

- Bureau of Labor Statistics (BLS)
- Bureau of Transportation Statistics (BTS)
- Centers for Disease Control and Prevention (CDC)
- Consumer Financial Protection Bureau (CFPB)
- Department of Defense (DOD)
- Energy Information Administration (EIA)
- Department of Housing and Urban Development (HUD)
- Food and Drug Administration (FDA)
- HHS Administration for Community Living (HHS/ACL)
- HHS Office of the Assistant Secretary for Planning and Evaluation (HHS/ASPE)
- HHS Office of the Surgeon General (OSG)
- HHS Office of the Assistant Secretary for Health (HHS/OASH)
- Maternal and Child Health Bureau (MCHB)
- National Center for Education Statistics (NCES)
- National Center for Health Statistics (NCHS)
- National Center for Immunization and Respiratory Diseases (NCIRD)
- National Endowment for the Arts (NEA)
- National Institute for Occupational Safety and Health (NIOSH)
- USDA Economic Research Service (ERS)
- USDA Food and Nutrition Service (FNS)
- The White House Council of Economic Advisers (CEA)
- The White House Domestic Policy Council (DPC)

These agencies collaborated on the design and provided content for the December 2024 data collection.

As part of the Census Bureau's efforts to ensure these vital data are produced in an efficient, less burdensome manner that enhances their richness for informing policy, the Census Bureau introduced new methods for conducting the HPS. Since early October 2024, HPS content was incorporated into a longitudinal design with data being collected every other month and released at the national level. The longitudinal design benefits the HPS data by allowing direct measurement of change over a much longer period of time in critical elements like spending, inflation, and other social and economic indicators of well-being.

The goal of this longitudinal design is to ensure readily available sample cases for frequent data collections on a variety of topics for a variety of population subgroups, producing estimates that meet quality standards of the Federal Statistical Agencies and the Office of Management and Budget (OMB).

The sample for this survey is selected from the Census Bureau's Master Address File (MAF). This ensures that the survey is rooted in a rigorously developed and maintained frame, and available for linkage to administrative records securely maintained and curated by the Census Bureau. Initial invitations to enroll in this survey were sent by mail and post-recruitment panel questionnaires were collected mainly by internet self-response. The survey maintains representativeness by allowing respondents who choose not to respond via the internet to respond via in-bound computer-assisted telephone interviewing (CATI). All survey respondents received an incentive for completing the questionnaire.

The Census Bureau has reviewed this data product to ensure appropriate access, use, and disclosure avoidance protection of the confidential source data (Project No. P-7532382, Disclosure Review Board (DRB) approval number: CBDRB-FY25-0309).

The Household Pulse Survey measures how emergent social and economic issues are impacting households across the country.

The HPS asks about core demographic household characteristics, as well as the following topics:

- Access to infant formula
- Children's mental health treatment
- COVID-19 vaccinations and long COVID symptoms and impact
- Education, specifically K-12 enrollment
- Childcare arrangements
- Employment
- Food sufficiency
- Housing security
- Household spending, including energy expenditures and consumption
- Inflation concerns and changes in behavior due to increasing prices
- Physical and mental health
- Feelings of pressure to move from rental home
- Transportation, including behavioral changes related to the cost of gas
- Health insurance coverage (including Medicaid)
- Social isolation
- Shortage of critical items
- Participation with the arts
- Internet access
- Impact of living through natural disasters

Table 1 provides the start and end dates for the December 2024 data collection.

Table 1. Data Collection Periods for the December Household Pulse Survey

Data Collection Period Start Date	Data Collection Period Finish Date
December 17, 2024	January 3, 2025

Sample Design

The HPS utilizes the Census Bureau's MAF as the universe for the sampled housing units (HUs). HUs on the July 2023 MAF were stratified based on information obtained from the Demographic Frame[1] and the 2022 Block-Group Level Planning Database (PDB)[2].

The Demographic Frame is a comprehensive database of person-level data that contains demographic characteristics and addresses associated with each person. It is derived from administrative, third-party, census, and survey data sources. The Demographic Frame includes unique person-level identifiers used to link individuals across datasets. Extracts from the Demographic Frame are available only to approved, internal users in a secured computing environment.

The 2022 Block-Group Level Planning Database (also called the PDB) is a dataset that contains a range of housing, demographic, socioeconomic, and census operational data. The estimates in the PDB are derived from 2020 Census counts and 2016-2020 American Community Survey (ACS) 5-year estimates. Data are summarized for all block groups in the country and the territory of Puerto Rico.

The MAF HUs were first matched to the Demographic Frame. Matching records were stratified into one of six strata based on the racial and Hispanic origin characteristics of the matching records. Non-matching records to the Demo Frame were then matched to the PDB. Information on the PDB of where the housing unit is located was used to stratify the housing units into one of four strata based on the racial and Hispanic origin characteristics of the most likely race and Hispanic origin based of the block group. Non-matches to both the Demographic Frame and the PDB were put into their own stratum. Table 2 provides the resulting strata.

[1] More information on the Demographic Frame is available on the Frames Program (census.gov) website.

[2] More information of the PDB is available on the 2022 Planning Database (census.gov) website.

Table 2. Stratum Definitions and Size of Stratum from the July 2023 MAF

Stratum	Characteristics	Stratum Size+
DHPBK	Demo Frame Match -Hispanic Black	934,000
DHPOT	Demo Frame Match -Hispanic Other Race	8,151,000
DHPWH	Demo Frame Match -Hispanic White	7,175,000
DNHBK	Demo Frame Match - Non-Hispanic Black	14,318,000
DNHOT	Demo Frame Match - Non-Hispanic Other Race	12,465,000
DNHWH	Demo Frame Match - Non-Hispanic White	69,461,000
MHPHP	PDB Match – Hispanic – All Races	5,037,000
MNHBK	PDB Match – Non-Hispanic Black	3,401,000
MNHOT	PDB Match – Non-Hispanic Other Race	1,282,000
MNHWH	PDB Match – Non-Hispanic White	23,083,000
MZZZZ	Non-matches to the Demo Frame and PDB	2,352,000
All	Total Household on MAF	147,659,000

Source: U.S. Census Bureau
+Stratum sizes are rounded to the thousands.

The sample was then selected systematically within strata, with adjustments applied to the sampling intervals to enable estimates for the four Census regions[3]. Sample sizes were determined such that a 2.2 percent coefficient of variation (CV) for an estimate of 40 percent of the population would be achieved for each Census region. The sample size calculation assumed a 20 percent response rate, which yielded a national sample size requirement of 75,000 HUs. The initial sample size selected was 75,001 HUs. Oversampling occurred in all strata except the two non-Hispanic white population strata to ensure reliable estimates of minority subgroups.

In March of 2024, a supplementary sample, referred to as a "replenishment sample," was introduced to the baseline sample. These households received the baseline questionnaire in March 2024, and started receiving the topical questionnaires in May 2024. An additional 30,000 sampled households were introduced increasing the total sample size to 105,001 households. Base weights for all sampled households were adjusted to account for the additional sampled households.

Data Collection

Development of the longitudinal sample began with an initial recruitment operation, during which participants responded to a baseline survey. Following the initial Baseline survey, respondents were enrolled and can receive invitations to monthly topical surveys for up to three years. Data for the survey are collected online via self-response using the Qualtrics data collection platform.

Initial baseline survey invitations were distributed via postal letter that included a visible $5 pre-paid incentive to encourage participation. Outbound telephone follow-up and

[3] Go to census.gov for a map of the Census regions.

inbound call operations were employed to encourage participation, answer any respondent questions, and assist respondents in completing the questionnaire. Recruitment operations were conducted from September 12, 2023 through October 10, 2023, and the first replenishment operations were conducted from March 05, 2024 through April 09, 2024. Responding households received a $20 cash incentive for completing the initial baseline questionnaire.

Once the Baseline data were reviewed and respondents were confirmed as enrolled, monthly topical survey invitations were distributed via emails and/or texts, based on the contact information provided by the respondent in the baseline survey. For cases where no email or cell phone number was provided, an outbound telephone operation was conducted to inform respondents of the available monthly survey. Topical survey respondents received a $10 incentive for each completed survey.

The Census Bureau conducted the survey online using Qualtrics as the data collection platform. Qualtrics is currently used at the Census Bureau for research and development surveys and provides the necessary agility to deploy the survey quickly and securely. It operates in the Gov Cloud, is FedRAMP[4] authorized at the moderate level, and has an Authority to Operate from the Census Bureau to collect personally identifiable and Title-protected data.

Approximately 18,500 respondents answered the baseline questionnaire and agreed to participant in the topical follow-on surveys. Table 3 shows the sample sizes and the number of responses for data collection.

Table 3. Sample Size and Number of Respondents at the National Level

Data Collection	Sample Size	Number of Respondents
Baseline Sample	105,001	18,501
December HPS	18,501	9,355

Source: U.S. Census Bureau, Baseline and December Household Pulse Survey.

Estimation Procedure

The weighting procedures for both the baseline sample and topical samples apply the same general methods for adjustments. However, the topical surveys start with the baseline nonresponse adjusted weight.

The final HPS weights are designed to produce national and region-level estimates for the total population aged 18 and older living within HUs. These weights are created by adjusting the HU-level sampling base weights by various factors to account for nonresponse, adults per household, and coverage.

The sampling base weights in each of the four sample regions are calculated as the total eligible HUs in the sampling frame divided by the number of eligible HUs selected for

[4] For more information on FedRAMP see FedRAMP.gov

interviews. Therefore, the base weights for all sampled HUs sum to the total number eligible HUs on the MAF within each region.

The final HPS person weights are created by applying the following adjustments to the sampling base weights:

1. Nonresponse adjustment – the weight of all sample units that did not respond to the HPS are evenly allocated to the units that did respond within each stratum and sample region. After this step, the weights of all respondents sum to the total HUs on the MAF.
2. Occupied HU ratio adjustment – this adjustment corrects for undercoverage in the sampling frame by inflating the HU weights after the nonresponse adjustment to match independent controls for the number of occupied HUs within each region. For this adjustment, the independent controls are from the 2022 American Community Survey (ACS) one-year, region-level estimates available at www.census.gov[5].
3. Person adjustment – this adjustment converts the HU weights into person weights by multiplying them by the number of persons aged 18 and older that are reported to live within the household. The number of adults is based on subtracting the number of children under 18 in the household from the number of total persons in the household. This number is capped at 10 adults.
4. Iterative raking ratio to population estimates – this procedure controls the person weights to independent population controls by various demographics within each region. The ratio adjustment is done through an iterative raking procedure to simultaneously control the sample estimates to two sets of population: educational attainment estimates from the 2022 1-year ACS estimates (Table B15001)[6] by age and sex, and the July 1, 2024 Hispanic origin/race by age and sex estimates from the Census Bureau's Population Estimates Program (PEP). PEP provided July 1, 2024 household population estimates by single year of age (0-84, 85+), sex, race (31 groups), and Hispanic origin for regions from the Vintage 2024 estimates series[7]. The ACS 2022 estimates are adjusted to match the 2024 pop controls within region by sex, and the five age categories in the ACS educational attainment estimates. Tables 4 and 5 show the demographic groups formed. The raking procedure runs until convergence or a maximum of 10 iterations.

Before the raking procedure is applied, cells containing too few responses are collapsed to ensure all cells met the minimum response count requirement of 30 cases. The cells after collapsing remained the same throughout the raking. These collapsed cells are also used in

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[5] The one-year estimates are at this URL: B25002: Occupancy Status - Census Bureau Table
[6] The1-year state-level detailed table B15001 is located at this URL: B15001 - Census Bureau Tables.
[7] The Vintage 2023 estimates methodology statement is available at this URL: methods-statement-v2023.pdf (census.gov). Note: The Vintage 2024 methodology has not yet been released therefore the Vintage 2023 methodology has been provided for reference.
The Modified Race Summary File methodology statement is available at this URL: https://www2.census.gov/programs-surveys/popest/technical-documentation/methodology/modified-race-summary-file-method/mrsf2010.pdf

the calculation of replicate weights for variance estimation. Collapsing occurred only before raking; there is no collapsing during the first three steps of weighting.

Table 4: Educational Attainment Population Adjustment Cells within Region

Age	No HS diploma Male	No HS diploma Female	HS diploma Male	HS diploma Female	Some college or associate's degree Male	Some college or associate's degree Female	Bachelor's degree or higher Male	Bachelor's degree or higher Female
18-24								
25-34								
35-44								
45-64								
65+								

Table 5: Race/Ethnicity Population Adjustment Cells within Region

Age	Hispanic Any Race Male	Hispanic Any Race Female	Non-Hispanic White-Alone Male	Non-Hispanic White-Alone Female	Non-Hispanic Black-Alone Male	Non-Hispanic Black-Alone Female	Non-Hispanic Other Races Male	Non-Hispanic Other Races Female
18-24								
25-29								
30-34								
35-39								
40-44								
45-49								
50-54								
55-64								
65+								

The final HPS HU weights are created by applying the following adjustments to the final HPS person weights:

1. HU adjustment – this adjustment converts the person level weight back into a HU weight by dividing the person level weight by the number of persons aged 18 and older that are reported to live within the household. The number of adults is the same value used to create the person adjustment in Step 3 above.
2. Occupied HU ratio adjustment – this adjustment ensures that the final HPS HU weights will sum to the 2022 American Community Survey (ACS) one-year, region-level estimates available at www.census.gov[5]. This ratio adjustment is the same adjustment applied to the person weights in Step 2 above but is needed again because region totals may have changed as a result of the iterative raking adjustment in the final step of the person weight creation.

The detailed tables released for this experimental HPS show frequency counts rather than percentages. Showing the frequency counts allows data users to see the count of cases for each topic and variable that are in each response category and in the 'Did Not Report' category. This 'Did Not Report' category is not a commonly used data category in U.S.

Census Bureau tables. Most survey programs review these missing data and statistically assign them to one of the other response categories based on other characteristics.

In these tables, the Census Bureau recommends choosing the numerators and denominators for percentages carefully, so that missing data are deliberately included or excluded in these calculations. In the absence of external information, the percentage based on only the responding cases will most closely match a percentage that would result from statistical imputation. Including the missing data in the denominator for percentages will lower the percentages that are calculated.

Users may develop statistical imputations for the missing data but should ensure that they continue to be deliberate and transparent with their handling of these data.

ACCURACY OF THE ESTIMATES

A sample survey estimate has two types of error: sampling and nonsampling. The accuracy of an estimate depends on both types of error. The nature of the sampling error is known given the survey design; the full extent of the nonsampling error is unknown.

Sampling Error

Since the HPS estimates come from a sample, they may differ from figures from an enumeration of the entire population using the same questionnaires, instructions, and enumeration methods. For a given estimator, the difference between an estimate based on a sample and the estimate that would result if the sample were to include the entire population is known as sampling error. Standard errors, as calculated by methods described below in "Standard Errors and Their Use," are primarily measures of the magnitude of sampling error. However, the estimation of standard errors may include some nonsampling error.

Nonsampling Error

For a given estimator, the difference between the estimate that would result if the sample were to include the entire population and the true population value being estimated is known as nonsampling error. There are several sources of nonsampling error that may occur during the development or execution of the survey. It can occur because of circumstances created by the respondent, the survey instrument, or the way the data are collected and processed. Some nonsampling errors, and examples of each, include:

- Measurement error: The respondent provides incorrect information, the respondent estimates the requested information, or an unclear survey question is misunderstood by the respondent. The interviewer may also be a source of measurement error.
- Coverage error: Some individuals who should have been included in the survey frame were missed.
- Nonresponse error: Responses are not collected from all those in the sample or the respondent is unwilling to provide information.
- Imputation error: Values are estimated imprecisely for missing data.

To minimize these errors, the Census Bureau applies quality control procedures during all stages of the production process including the design of the survey, the wording of questions, and the statistical review of reports.

Two types of nonsampling error that can be examined to a limited extent are nonresponse and undercoverage.

Nonresponse

The effect of nonresponse bias cannot be measured directly, but one indication of its potential effect is the nonresponse rate. Tables 6 and 7 show the unit response rates by collection period. The expected baseline response rate, including the supplemental sample, and the current data collection response rate was lower than we anticipated.

Table 6. Unweighted National Level Response Rates by Collection Period for the Household Pulse Survey

Data Collection	Response Rate (Percent) of Data Collection	Overall Response Rate (Percent)
Baseline Invitation	17.6	17.6
December HPS	50.8	9.0

Source: U.S. Census Bureau, Baseline and December Household Pulse Survey.

Table 7. Weighted National Level Response Rates by Collection Period for the Household Pulse Survey

Data Collection	Response Rate (Percent) of Data Collection	Overall Response Rate (Percent)
Baseline Invitation	18.3	18.3
December HPS	52.7	9.7

Source: U.S. Census Bureau, Baseline and December Household Pulse Survey.

Responses are made up of complete interviews and sufficient partial interviews. A sufficient partial interview is an interview in which the household or person answered enough of the questionnaire to be considered a complete interview. Some remaining questions may have been edited or imputed to fill in missing values. Insufficient partial interviews are considered nonrespondents.

In accordance with Census Bureau and OMB Quality Standards, the Census Bureau will conduct a nonresponse bias analysis to assess nonresponse bias in the HPS.

Undercoverage

The concept of coverage with a survey sampling process is defined as the extent to which the total population that could be selected for sample "covers" the survey's target population. Missed housing units and missed people within sample households create undercoverage in the HPS. A common measure of survey coverage is the coverage ratio, calculated as the estimated population before poststratification divided by the independent population control.

HPS person coverage varies with age, sex, Hispanic origin/race, and educational attainment. Generally, coverage is higher for females than for males and higher for the non-black population than for the black population. This differential coverage is a general issue for most household-based surveys. The HPS weighting procedure tries to mitigate the bias from undercoverage within the raking procedure. However, due to small sample sizes, some demographic cells need collapsing to increase sample counts within the raking cells. In this case convergence to both sets of the population controls was not attained. Therefore, the final coverage ratios are not perfect for some demographic groups. Table 8 shows the coverage ratios for the person demographics of age, sex, Hispanic origin/race, and educational attainment before and after the raking procedure is run.

Table 8. Person-Level Coverage Ratios at the National Level for Household Pulse Survey Before and After Raking

Demographic Characteristic	Before Raking	After Raking
Total Population	0.96	1.00
Male	0.87	1.00
Female	1.05	1.00
Age 18-24	0.16	0.50
Age 25-29	0.52	1.10
Age 30-34	0.72	1.25
Age 35-39	0.92	1.08
Age 40-44	1.07	1.05
Age 45-49	1.04	0.99
Age 50-54	1.09	1.03
Age 55-64	1.19	1.08
Age 65+	1.36	1.00
Hispanic	0.71	1.00
Non-Hispanic White-only	1.07	1.00
Non-Hispanic Black-only	0.78	1.00
Non-Hispanic other races	0.97	1.00
No high-school diploma	0.29	0.85
High-school diploma	0.47	1.06
Some college or associate's degree	0.89	1.00
Bachelor's degree or higher	1.64	1.00

Source: U.S. Census Bureau, Baseline and December Household Pulse Survey.

Biases may also be present when people who are missed by the survey differ from those interviewed in ways other than age, sex, Hispanic origin/race, and educational attainment. How this weighting procedure affects other variables in the survey is not precisely known. All these considerations affect comparisons across different surveys or data sources.

Comparability of Data

Data obtained from the HPS and other sources are not entirely comparable. This is due to differences in data collection processes, as well as different editing procedures of the data, within this survey and others. These differences are examples of nonsampling variability not reflected in the standard errors. Therefore, caution should be used when comparing results from different sources.

A Nonsampling Error Warning

Since the full extent of the nonsampling error is unknown, one should be particularly careful when interpreting results based on small differences between estimates. The Census Bureau recommends that data users incorporate information about nonsampling errors into their analyses, as nonsampling error could impact the conclusions drawn from the results. Caution should also be used when interpreting results based on a relatively small number of cases.

Standard Errors and Their Use

A sample estimate and its standard error enable one to construct a confidence interval. A confidence interval is a range about a given estimate that has a specified probability of containing the true value. For example, if all possible samples were surveyed under essentially the same general conditions and using the same sample design, and if an estimate and its standard error were calculated from each sample, then approximately 90 percent of the intervals from 1.645 standard errors below the estimate to 1.645 standard errors above the estimate would include the true value.

A particular confidence interval may or may not contain the average estimate derived from all possible samples, but one can say with the specified confidence that the interval includes the average estimate calculated from all possible samples.

The context and meaning of the estimate must be kept in mind when creating the confidence intervals. Users should be aware of any "natural" limits on the bounds of the confidence interval for a characteristic of the population when the estimate is near zero – the calculated value of the lower bound of the confidence interval may be negative. For some estimates, a negative lower bound for the confidence interval does not make sense, for example, an estimate of the number of people with a certain characteristic. In this case, the lower confidence bound should be reported as zero. For other estimates such as income, negative confidence bounds can make sense; in these cases, the lower confidence interval should not be adjusted. Another example of a natural limit is 100 percent as the upper bound of a percent estimate.

Standard errors may also be used to perform hypothesis testing, a procedure for distinguishing between population parameters using sample estimates. The most common type of hypothesis is that the population parameters are different.

Tests may be performed at various levels of significance. A significance level is the probability of concluding that the characteristics are different when, in fact, they are the same. For example, to conclude that two characteristics are different at the 0.10 level of significance, the absolute value of the estimated difference between characteristics must be greater than or equal to 1.645 times the standard error of the difference.

The Census Bureau uses 90-percent confidence intervals and 0.10 levels of significance to determine statistical validity. Consult standard statistical textbooks for alternative criteria.

Estimating Standard Errors

The Census Bureau uses successive difference replication to estimate the standard errors of HPS estimates. These methods primarily measure not only the magnitude of sampling error but some effects of nonsampling error as well. They do not, however, measure systematic biases in the data associated with nonsampling error. Bias is the average over all possible samples of the differences between the sample estimates and the true value.

Eighty replicate weights were created for the HPS. Using these replicate weights, the variance of an estimate (the standard error is the square root of the variance) can be calculated as follows:

$$Var(\hat{\theta}) = \frac{4}{80}\sum_{i=1}^{80}(\theta_i - \hat{\theta})^2 \quad (1)$$

where $\hat{\theta}$ is the estimate of the statistic of interest, such as a point estimate, ratio of domain means, regression coefficient, or log-odds ratio, using the weight for the full sample and θ_i are the replicate estimates of the same statistic using the replicate weights. See reference Judkins (1990).

Creating Replicate Estimates

Replicate estimates are created using each of the 80 weights independently to create 80 replicate estimates. For point estimates, multiply the replicate weights by the item of interest to create the 80 replicate estimates. You will use these replicate estimates in the formula (1) to calculate the total variance for the item of interest. For example, say that the item you are interested in is the difference in the number of people with a loss in employment income in one time frame compared to the number of people with a loss in employment income in another. You would create the difference of the two estimates using the sample weight, $\hat{x}_0$, and the 80 replicate differences, x_i, using the 80 replicate weights. You would then use these estimates in formula (1) to calculate the total variance for the difference in the number of people with a loss in employment income from the first time frame to the second time frame.

$$Var(\hat{x}_0) = \frac{4}{80}\sum_{i=1}^{80}(x_i - \hat{x}_0)^2$$

Where x_i is the ith replicate estimate of the difference and $\hat{x}_0$ is the full estimate of the difference using the sample weight.

Example for Variance of Regression Coefficients

Variances for regression coefficients β_0 can be calculated using formula (1) as well. By calculating the 80 replicate regression coefficients $\beta_i's$ for each replicate and plugging in the replicate β_i estimates and the β_0 estimate into formula (1),

$$Var(\hat{\beta}_0) = \frac{4}{80}\sum_{i=1}^{80}(\beta_i - \hat{\beta}_0)^2$$

gives the variance estimate for the regression coefficient β_0.

TECHNICAL ASSISTANCE

If you require assistance or additional information, please contact the Demographic Statistical Methods Division via e-mail at dsmd.source.and.accuracy@census.gov.

REFERENCES

Judkins, D. (1990) "Fay's Method for Variance Estimation," Journal of Official Statistics, Vol. 6, No. 3, 1990, pp.223-239.

All links were verified as correct on February 3, 2025.