Demographic Statistical Methods Division
Sample Design and Estimation

Nonresponse Bias Report for the 2020 Household Pulse Survey

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Executive Summary

The 2020 Household Pulse Survey (HPS) was developed to measure the impacts of the coronavirus pandemic on households within all fifty states, the District of Columbia, and the fifteen largest metropolitan statistical areas. All data collection was done virtually, with sample units contacted by text message and/or email. Overall response rates were low, which raised concerns about nonresponse bias. This report used HPS response data and American Community Survey estimates to evaluate potential nonresponse bias in the HPS estimates.

The 2020 HPS produced estimates for 21 different data collection periods in three phases. Phase 1 produced weekly estimates (weeks 1-12, from April 23 to July 21) where respondents from one week were included in the following week sample for up to three weeks. Phase 2 introduced new questions and consisted of two-week data collection periods (weeks 13-17, from August 19 to October 26) where each sample was independent of the previous week. Phase 3 also consisted of two-week data collection periods (weeks 18-21, from October 28 to December 21), with the same sampling methods and questionnaire as Phase 2. Phase 3 continued into 2021, but this report only analyzes data from 2020 HPS.

The level of nonresponse bias varied across data collection periods, and all individual nonresponse bias measures are posted to the HPS technical documentation page (census.gov). This report provides average measures across a subset of weeks in the 2020 HPS data collection. It shows evidence that response patterns differ across demographic domains that are correlated with key estimates, which could result in biased estimates. This research also shows that weighting adjustments appear to mitigate some of this nonresponse bias by controlling weights to independent totals by domain.

This analysis was limited by the data available for all HPS sample units, so the results should be interpreted with caution. There is no way of knowing what the HPS estimates would be if all sampled cases responded to the survey. This report also does not address other sources of survey error such as frame coverage. This analysis shows that the weighting adjustments help mitigate nonresponse bias, but it does not prove that there was no bias, by nonresponse or coverage, in the HPS estimates.

1. Introduction

The 2020 Household Pulse Survey (HPS) was developed to measure the impacts of the coronavirus pandemic on households within all fifty states, the District of Columbia (DC), and the fifteen largest metropolitan statistical areas (metro areas). This survey was developed quickly in response to the pandemic and required data collection methods that have never been implemented before by the U.S. Census Bureau. The 2020 HPS was conducted completely by web, and all sampled addresses were contacted by email and/or text message.

This report presents discussion about, and analysis of, potential nonresponse bias in the 2020 HPS estimates. The Census Bureau plans to conduct more analysis than what is presented here, however this report is limited to the analysis that could be completed quickly using data already available to us.

The HPS produced 21 different collection cycles in three phases during 2020, all of which were approved for release to the public[1]. Each data release included tables of estimates, a source and accuracy statement, and a public use file so data users may produce their own estimates. This report was released with additional tables of nonresponse bias measures, labeled Tables A1-A8 and B1-B2, which are posted to the HPS technical documentation page (census.gov). This report analyzes measures of bias for a subset of weeks, as identified by each table. Any questions about these results may be sent to dsmd.source.and.accuracy@census.gov.

1.1 Overview of the 2020 Household Pulse Survey

The HPS sampling frame consisted of all housing units on the Master Address File (MAF) where at least one email address or cell phone number was known. Geocoded units on the MAF contain census block codes that identified the location of each address. Ungeocoded units on the MAF do not contain census block codes but do contain county codes and ZIP codes. The HPS sampling frame was divided into 66 different areas for the 51 states (including DC) and 15 metro areas. All sampling areas had the same sample sizes to ensure adequate estimate precision within all areas[2]. Variations in population across the different sampling areas led to different sampling base weights across the sampling areas.

The HPS selected a sample of housing units (HUs) from the MAF, as most other demographic surveys do. Most other demographic surveys then attempt to contact persons

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[1] Cycle 21 approval number was CBDRB-FY21-POP001-005.
[2] Some small states had smaller sample sizes because the sampling frame did not contain enough addresses to support all HPS samples.

at the sampled address through telephone and/or personal visits. Personal visits were not possible for the HPS, however, so we continued to follow-up with the emails and/or cell phones associated with the address until we received a response. Response was measured by how far into the questionnaire someone got before exiting the instrument. Phase 1 respondents were set at 30 percent of the questions, and Phase 2 and 3 respondents were set at 23 percent of the questions. The Phase 2 and 3 cutoff was around the same point in the questionnaire as Phase 1, but the percentage was different because more questions were added to the questionnaire.

Phase 1 included the first twelve weeks of HPS (April 23 – July 21), during which respondents from one week were included in the following week's sample for up to three weeks total. Therefore, we had more information about the nonrespondents among the sample cases on their second or third interviews. Phase 2 was conducted weeks 13 through 17 (August 19 – October 26) where samples were independent and each sample case was only interviewed once. The 2020 Phase 3 data collection periods included weeks 18 through 21 (October 28 – December 21) and continued the same sampling methods as Phase 2. Phase 2 and 3 data collection periods were two weeks long, but we continued to refer to them as weeks to be consistent with Phase 1. Due to the data collection and sampling methods, very little was known about the nonrespondents in the Phase 2 and Phase 3 HPS.

Key measures (and the HPS detailed tables that contain them[3]) were the percentages of respondents who reported:

1. Expected loss in employment income (Employment Table 1)
2. Food scarcity (Food Sufficiency and Food Security Table 2)
3. Housing insecurity for owners (Housing Table 2a)
4. Housing insecurity for renters (Housing Table 2b)
5. Likelihood of foreclosure for owners (Housing Table 3a)
6. Likelihood of eviction for renters (Housing Table 3b)
7. Difficulty paying for usual household expenses (Spending Table 1)

Key domains were:
- Race/ethnicity
- Household income

For more information about the HPS, refer to the Technical Documentation at census.gov (U.S. Census Bureau, 2020b).

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[3] Available on the HPS Data Tables page (census.gov).

1.2 Discussion of Nonresponse Bias in the HPS

Some degree of nonresponse bias and variance is a normal feature of almost all statistical surveys. The HPS produces pandemic impact estimates using the answers from responding persons. These estimates may be biased if answers from respondents differ from the potential answers of nonrespondents. The magnitude of nonresponse bias is a function of the response rate and differences between respondents and nonrespondents.

The HPS attempts to minimize nonresponse bias by adjusting weights for potential differences between respondents and nonrespondents. However, these weighting adjustments are limited by a lack of information about nonresponding units. Therefore, the nonresponse adjustment cells are defined only by the sampling area from the MAF. To account for population mobility, respondents are allocated to new sampling areas using address information provided in the response data. Then the weights are controlled to the American Community Survey (ACS) estimates of occupied HUs within those assigned sampling areas. Whenever address information is not provided, or does not match to a sampling area, the case is assigned to the sampling area in which they were sampled. During Phase 1, respondents who did not provide an address in their second or third interviews were assigned to the same sampling area as their first interview.

The HU-level sampling weights are converted to person weights by multiplying the HU-level weight by the number of adults within the household. This means the demographics (such as age, sex, Hispanic origin, and race) of the respondent are applied to all adults within the household even though it is possible -- in fact, probable -- that all persons within a household do not have identical demographic characteristics. The person weights are then controlled to independent population estimates from the Census Bureau's Population Division. The adjustment cells are initially defined within each state by age, sex, Hispanic origin, race, and educational attainment, and cells are collapsed together if there are not at least 30 respondents within a cell for a given state. These demographic characteristics are imputed for any respondents who fail to provide this information.

Despite the measures taken to reduce nonresponse bias, there is likely some amount of nonresponse bias that cannot be corrected without knowing the pandemic impacts of the nonrespondents. Additionally, the survey design limits our ability to measure nonresponse bias for multiple reasons:
1. Population mobility – it is possible for people to move to a different county, state, and country without changing their email address or cell phone number. This means

there is no guarantee that respondents and nonrespondents still live in the geographic areas where they were sampled.

2. Nonresponse reason – due to the method of data collection, we do not know whether a sample case failed to respond because the contact information is invalid or because they chose not to respond to the survey. This forces us to treat all noninterviews as valid units that did not respond.

3. Nonrespondent characteristics – without field representative observations we may obtain from personal visit attempts, we have no way of knowing the characteristics of nonresponding cases.

The nonresponse bias analysis in this report is not a perfect measure of the bias in the HPS estimates but is an early approximation of bias that may exist based on observations in response patterns across demographic groups that are correlated with pandemic impacts.

2. Methodology

This section describes the methods and data used for the analysis in this report. For analysis of domains that were collected in the HPS, the domain categories were determined by the response options and domain groupings used in weighting adjustments.

For domains that use ACS estimates from the block-group[4] the case was sampled within, the domain categories are four quartiles for each ACS estimate. We calculated the quartiles using all block-groups on the planning database (U.S. Census Bureau, 2020a), initially placing 25 percent of all block groups within each of four buckets. For some ACS estimates, like the percent of housing units that are mobile homes, more than 25 percent of the block-groups had a value of zero. In this case, we assigned all block-groups with a value of zero to the lowest quartile and evenly divided the remaining block-groups across the remaining three quartiles. Refer to Appendix B for the resulting quartile definitions.

After defining the quartiles using the planning database, we merged the HPS response data to the domain data by block-group code. Ungeocoded cases did not have a block-group code and were excluded from all analysis by ACS estimate domains.

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[4] Block-groups are a collection of census blocks within the same census tract. This is the lowest level for which the ACS creates estimates. More information is available at the Census Bureau Glossary (census.gov).

2.1   Correlation of Key Estimates and Key Domains

Most 2020 HPS measures have never been collected before, so there is no historical knowledge about what demographic characteristics are correlated to the key estimates. Therefore, before conducting nonresponse analysis, it seemed appropriate to identify which demographic groups show significant differences in the key HPS estimates.

This analysis used data from the HPS responses as well as ACS estimates of demographic properties of the census block-group that sampled addresses belong to. The ACS estimates were available on the Planning Database (U.S. Census Bureau, 2020a) and allowed us to analyze demographic characteristics for all geocoded sample cases in the HPS, even though this may not match the current location of the respondents (and nonrespondents) at the time of HPS data collection.

The HPS produced estimates of total persons and percent of all persons who experienced each specific pandemic impact. In order to compare estimates of populations of different sizes, all analysis in this report was based on the percent estimate. The key estimates were calculated as the sum of final person weights for all respondents who reported each pandemic impact divided by the sum of person weights for all respondents who answered the question about the pandemic impact. All key estimates excluded HPS respondents for which the key estimate did not apply or who did not provide a valid answer to the key question. The formula for HPS estimates was:

$$EST = \frac{\sum_{i \in s} w_i I_i}{\sum_{i \in s} w_i}$$

where *s* is the set of all respondents within the domain of interest who answered the key question, w_i is the final person weight for respondent *i*, and I_i is an indicator (0 or 1) for whether the respondent reported experiencing the pandemic impact (refer to Appendix A for criteria).

Variances were calculated using Fay's Balance Repeated Replication (BRR) method with 80 replicate weights (Fay, 1989). We used these variances to test the significance of estimate differences across subgroups within each demographic characteristic. Any characteristics that showed significant estimate differences are later analyzed for response differences to evaluate the potential nonresponse bias impacts.

Key estimates five, six, and seven were added to the HPS questionnaire in week 13 and could not be produced for any weeks before then. Some domain variables were also not available on early weekly data files and are, therefore, excluded from this analysis for those specific weeks.

2.2 Nonresponse Bias in First Interviews Based on Sampling Geography

The HPS sampling frame did not contain demographic information that could be used to classify nonrespondents. However, the geographical location of the sample address, when known, was used to determine demographic characteristics about the blocks containing the address. To accomplish this, we matched the HPS sample data to the ACS block-group level estimates by block-group codes.

This analysis measured levels of response within different demographic groups determined by the ACS estimates for the block-group that contained the sample address. Ungeocoded cases did not have block-group codes in the HPS sampling frame and were excluded from the analysis.

Weighted **response rates** showed the percent of each demographic subgroup that responded to the HPS and were calculated as:

$$RR = \frac{\sum_{i \in s} w_i R_i D_i}{\sum_{i \in s} w_i D_i}$$

where:

s = the set of all sample cases within the sampling area
w_i = the sampling base weight for sample case i
R_i = the response indicator (1 for respondents, 0 for nonrespondents) for sample case i
D_i = the domain indicator (1 if within the domain of interest, 0 otherwise) for sample case i

We used replicate weights to calculate a variance of the response rates and test the significance of response rate differences between all subgroups of a demographic characteristic, using a Tukey adjustment for multiple comparisons.

Weighted **respondent and nonrespondent distributions** showed the demographic distribution of respondents and nonrespondents separately, and respondent distributions were calculated as:

$$RD = \frac{\sum_{i \in s} w_i R_i D_i}{\sum_{i \in s} w_i R_i}$$

using the same eligibility criteria, weights, and indicators as the response rate calculation. Nonrespondent distributions used the same formula, but with the R_i variable indicating nonrespondents instead of respondents. We tested for differences between respondent and nonrespondent distributions within domain characteristics using Rao-Scott chi-square tests and replicate weights.

2.3 Nonresponse Bias in Second Interviews Based on First Interview Responses

This analysis used HPS response data to evaluate response patterns among demographic groups identified by the demographic data provided in the HPS. For Phase 1 interviews, first-time respondents for a given week were divided into those who also responded in the following week, and those who did not respond in the following week. For Phase 2 and 3 interviews, all respondents were divided into those who first accessed the on-line questionnaire in the first six days of the 13-day data collection period and those who did not. We used a six-day cutoff because the Phase 1 data collection period was six days, so any Phase 2 and 3 respondents who accessed the instrument after that point would have been nonrespondents in Phase 1. Some respondents started the interview in the first six days of data collection and finished the interview in the last seven days, but we could not determine when the interview was completed so we divided them by when the interview was started.

Weighted **response measures** showed the percent of HPS respondents within each demographic subgroup that belonged to the response status that indicated more cooperation. For Phase 1, this subgroup was respondents who provided responses in more than one week of data collection. For Phases 2 and 3, this subgroup was respondents who accessed the on-line instrument in the first six days of data collection. The response measures were calculated as:

$$RM = \frac{\sum_{i \in r} w_i R_i D_i}{\sum_{i \in r} w_i D_i}$$

where:

r = the set of all respondents
w_i = the final person weight for respondent i
R_i = indicator (0 or 1) for whether respondent i is in the response group of interest
D_i = indicator (0 or 1) for whether respondent i is within the domain of interest

We used replicate weights to calculate a variance of the response measures and test the significance of differences between all subgroups of a demographic characteristic, using a Tukey adjustment for multiple comparisons.

Weighted **domain distributions by response status** showed the demographic distributions within each subgroup of respondents, and were calculated as:

$$DDRS = \frac{\sum_{i \in r} w_i R_i D_i}{\sum_{i \in r} w_i R_i}$$

using the same eligibility criteria, weights, and indicators as the response measure calculation. We tested for domain distribution differences between response status subgroups using Rao-Scott chi-square tests and replicate weights.

The **key estimates by response status** showed how response differences among the different demographic groups potentially impacted the estimates. The formula was the same as the HPS estimates produced in Section 2.1, where the domain of interest was determined by response status. We calculated a 90 percent confidence interval around the full sample estimate to determine if the estimate from only respondents who responded at least twice (for Phase 1) or accessed the instrument in the first six days (for Phase 2 and 3) was outside that confidence interval.

3. Assumptions and Limitations

This report analyzes potential nonresponse bias in the HPS, but there are many other sources of error that are not examined. We presented HPS data observations that may indicate bias, but please keep in mind the assumptions made and the limitations of this analysis.

3.1 Assumptions

This report presents HPS estimates and response rates by ACS demographic estimates for the block-group containing the sample address. It is possible that HPS respondents no longer live at the address where they were sampled, so this analysis assumes that households who move away from the address where they were sampled would move to an area with similar characteristics to the area they left.

When calculating overall response rates by ACS estimates of the geographical area containing the address, we assumed that all sample cases were valid units within those geographical areas. In-person surveys typically locate new sample addresses and exclude all cases that no longer exist as occupied residences. The HPS data collection methods did not allow for this type of determination, so we must assume that all sample units were occupied residences and the contact information belonged to persons living within those residences. In reality, the unit may be vacant or demolished, and the contact information

may not be in use because the original contact person passed away or changed their phone and email. Therefore, the HPS response rates by geographic area were actually participation rates that are typically lower than response rates because they include invalid units as nonresponse.

Analysis of response patterns using HPS respondent data allowed us to analyze response based on known demographics of the potential HPS respondents. However, the universe of cases for this analysis consisted of only sample units that responded to the HPS at some point. For Phase 1 analysis, we assumed that HPS respondents who did not respond to a second interview request were similar to sample cases that did not respond to the first request. For Phase 2 and 3 analysis, we assumed that HPS respondents who first accessed the instrument in the second half of the two-week data collection period were similar to sample cases that did not respond at all.

3.2   Limitations

This analysis focused on nonresponse bias but with little knowledge of the nonrespondent characteristics. We had ACS demographic estimates for the block-group each address belongs to but did not know the demographic characteristics of the HPS sample cases that did not respond. We also did not know demographic characteristics for respondents who did not provide valid answers to the demographic questions, so they are excluded from this analysis.

This analysis also did not cover other sources of error in the HPS. For example:
- Frame coverage – the HPS sampling frame included only MAF units for which we had a cell phone number or email address. The MAF is a reliable source for all addresses in the United States, but around 19 percent of addresses on the MAF were excluded from the HPS sampling frame due to missing contact information.
- Population coverage – The HPS collected responses from one person within each household, and their answers represented all adults in the household. This assumed everyone in the household had the same demographics as the respondent, which potentially impacted the representation of different demographic subgroups. One example is the educational attainment demographic, because some parents with college degrees represented adult children living in the home who had not yet completed their education.
- Processing – During post-data collection processing, we assigned current geography codes (state and 15 largest metro areas) based on an address provided by the respondent. There was potential error in this process due to item nonresponse for

the address questions, typos in the address provided, and respondents who no longer lived in the United States.

We had limited time to complete this analysis, so there were some aspects that we did not have time to research. Some potential further research is:

- Analysis of estimates and response rates while controlling for demographic characteristics that were used in weighting adjustments. Many of the demographic characteristics presented in this report could be correlated with each other. If a demographic variable was correlated with a characteristic that was accounted for in the weighting, then the weighting adjustments could mitigate potential nonresponse bias for that demographic subgroup.
- Use of administrative records to identify characteristics of nonrespondents.
- Item nonresponse for key estimates and domains. Responses were considered sufficient partials based on how far into the questionnaire they got before exiting. This meant any questions after that cutoff were missing more often. Most demographic questions were in the first section of the questionnaire, but household income and address were the last section of the questionnaire. For key estimate items, any respondents that did not reach the question were simply excluded from the estimates. This likely resulted in downward bias of total estimates for these items, and the potential bias of rate estimates is unknown.
- State or metro area. This analysis does not evaluate potential nonresponse bias at those lower geographic levels. State-level coverage ratios and response rates are available in the weekly source and accuracy statements (U.S. Census Bureau, 2020b).

4. Results

This section presents overall results of the HPS nonresponse bias analysis. The HPS released weekly or biweekly (depending on survey phase) estimates on the HPS website (census.gov). Response rates and coverage ratios by key domain groups were also provided in the weekly/biweekly source and accuracy statement on the HPS technical documentation page (census.gov). Those estimates and quality measures used all HPS response data, including respondents for which some key domain questions were not answered. The analysis for this report, summarized in the following subsections, is limited to only respondents who provided all information needed for each measure. Therefore, the measures discussed in this report are different from the estimates reported for the survey and the response rates in the source and accuracy statement. Unless stated otherwise, all comparisons are significant at a ten percent significance level.

4.1 Correlation of Key Estimates and Key Domains

To analyze the correlation of key estimates and key domains, we calculated all key estimates by all key domains. The full estimates by week are in Table A1. Some observations from weeks 1, 4, 8, 11, 13, 15, 18, and 21 are:

- HPS respondent age – persons age 65 and older were economically affected by the pandemic less than younger age groups. The oldest age group had lower percentages of respondents with expected loss in employment income and difficulty paying for usual household expenses for all weeks. Other estimates and age groups showed significant differences but not in all weeks.
- HPS respondent educational attainment – all weeks showed that college graduates were least likely, and persons with no high-school diploma were most likely, to expect loss in employment and have difficulty paying for usual household expenses. College graduates were also least likely to have housing insecurity as owners in all weeks.
- HPS respondent race/ethnicity – Hispanic persons were impacted more than non-Hispanic white-only persons for almost all[5] weekly estimates of expected loss in employment income, food scarcity, housing insecurity, and difficulty paying for usual household expenses. When looking only at race (ignoring ethnicity), black-only and Asian-only persons both had higher rates of difficulty paying for usual household expenses than white-only and other races and were not significantly different from each other.
- HPS respondent household income – Significant comparisons across all groups and estimates differed by week, but all weeks had the lowest income group higher than the highest income group for estimates of expected loss in employment income, food scarcity, housing insecurity (owners and renters), and difficulty paying for usual household expenses.
- ACS estimates for sample unit block-group – Estimates 1 and 7 (expected loss in employment income and difficulty paying for usual household expenses) both had first quartile rates different from fourth quartile rates in all weeks for characteristics: median age, percent age 65 and older, percent below poverty, percent Hispanic, percent black-only, percent white-only, percent receiving public assistance, percent without health insurance, percent owner occupied, and percent renter occupied. Other characteristics had significant differences for some estimates in some weeks, as seen in Table A1.

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[5] Hispanic and non-Hispanic white-only rates were not significantly different for week food scarcity.

For each week of data collection, we also calculated the respondent distributions across the different domain variables for all respondents, only respondents who reported being impacted by each estimate, and only respondents who reported not being impacted by each estimate. The Rao-Scott Chi-Square test indicated whether the impacted respondent distributions were significantly different from the nonimpacted respondent distributions for each domain variable and estimate. Table 1 provides the percent of weeks where the correlation between the demographic group and each key estimate were significant (p-value below 0.1). Refer to Tables A2.1 and A2.2 for all weekly distributions and Chi-Squared results.

Key items 5 & 6 (likelihood of foreclosure/eviction) were not significant for 100 percent of weeks for any domain estimates. This was likely because the variances of those particular estimates tended to be higher than the other estimates. Across all weeks and domains, the average coefficients of variation for estimates 5 and 6 were 38.5 percent and 28.7 percent, respectively. The average coefficients of variation for all other estimates ranged from 2.7 percent to 14.2 percent.

Excluding key items 5 & 6, demographic variables that were significant for all weeks and key items were household income, highest educational attainment, race, race/ethnicity, and percent of population with no health insurance.

Key item 7 (difficulty paying for usual household expenses) was the only estimate significantly correlated with HPS respondent gender in all weeks. In all Phase 2 and 3 weeks, females reported higher rates for key item 7 than males.

All domains appeared to have some level of significant correlation with at least some key estimates, so we analyzed all domains for the analysis that follows.

Table 1: Percent of Weeks with Significant Correlation between Demographics and Household Pulse Survey Estimates

	Household Pulse Survey Key Estimate						
Domain	1 Loss Employ Income	2 Food Scarcity	3 Housing Insecure Owners	4 Housing Insecure Renters	5* Foreclosure Likely	6* Eviction Likely	7* Difficult to Pay Household Expenses
HPS respondent gender	50%	50%	0%	25%	75%	0%	100%
HPS respondent ethnicity	100%	75%	100%	100%	0%	0%	100%
HPS respondent household income	100%	100%	100%	100%	75%	67%	100%
HPS respondent age category	100%	88%	100%	100%	50%	0%	100%
HPS respondent highest educational attainment	100%	100%	100%	100%	25%	50%	100%
HPS respondent race/ethnicity	100%	100%	100%	100%	25%	25%	100%
HPS respondent race	100%	100%	100%	100%	67%	0%	100%
ACS Average persons per occupied household	100%	13%	63%	63%	25%	25%	100%
ACS Housing unit density	100%	38%	25%	25%	25%	50%	100%
ACS Median household income	88%	88%	100%	75%	25%	50%	100%
ACS Median house value	88%	88%	75%	63%	75%	25%	100%
ACS Median age	100%	38%	63%	50%	25%	25%	100%
ACS Percent of population that is female	38%	63%	13%	13%	25%	0%	75%
ACS Percent of population that is Hispanic	100%	50%	100%	75%	0%	0%	100%
ACS Percent of housing units within multi-unit structures of at least 10 units	100%	38%	38%	25%	0%	25%	75%
ACS Percent of housing units that are mobile homes	75%	25%	13%	13%	25%	0%	50%
ACS Percent of population that is non-Hispanic and black-only	100%	88%	100%	75%	50%	25%	100%
ACS Percent of population that is non-Hispanic and white-only	100%	75%	100%	88%	25%	25%	100%
ACS Percent of population with no health insurance	100%	100%	100%	100%	25%	0%	100%
ACS Percent of housing units that are owner occupied	100%	63%	63%	50%	25%	25%	100%
ACS Percent of population age 18-24	88%	25%	38%	13%	50%	50%	75%
ACS Percent of population age 65 and older	100%	0%	50%	63%	25%	25%	100%
ACS Percent of population below the poverty level	100%	88%	100%	75%	25%	50%	100%
ACS Percent of population receiving public assistance income	100%	38%	38%	38%	25%	0%	100%
ACS Percent of housing units that are renter occupied	100%	63%	63%	50%	25%	25%	100%
ACS Percent of housing units that are vacant	0%	88%	25%	13%	50%	50%	100%
ACS total housing units within block-group	63%	25%	38%	63%	50%	25%	100%

Source: U.S. Census Bureau Household Pulse Survey data from weeks 1, 4, 8, 11, 13, 15, 18, and 21

* Percentages do not include weeks 1, 4, 8, or 11 because key items 5-7 were added to the survey in week 13

4.2   Nonresponse Bias in First Interviews Based on Sampling Geography

The effect of nonresponse cannot be measured directly, but one indication of its potential effect is the nonresponse rate by domains that are correlated with key estimates. Table 2 presents the average weighted response rates for key domains across the weeks included in this analysis. See Table B1 for the complete set of response rates, standard errors, and significance groupings.

Table 2 shows the average response rates for the population in each quartile, with the last column of the table summarizing the magnitude of the difference in these response rates. Since there are four weeks included in this analysis and six comparisons within each domain, the percent of comparisons that are significant are calculated based on a total of 24 comparisons for each key item.

The most differences in response rates were observed in five domains, namely, median household income, median house value, percent of population with no health insurance, percent of population below the property level, and percent of housing units that are vacant. For these key items, the responses in the four quartiles were significantly different from each other every week. For the domains median household income and median house value, the population in the fourth quartile had significantly higher response rates than the rest of the population. For the domains percent of population with no health insurance, percent of population below the property level, and percent of housing units that are vacant, the population in the first quartile had significantly higher response rates than the rest of the population.

The least differences in response rates were seen in the domains percent of housing units within multi-unit structures of at least 10 units and percent of the population age 65 and older.

Table 2: 2020 Household Pulse Survey Average Weighted Response Rates by Domain

Domain	Average Response Rate				Percent of Comparisons that are Significant*
	Quartile 1	Quartile 2	Quartile 3	Quartile 4	
Average total persons in occupied households	6.5%	6.6%	6.8%	6.9%	50%
Housing unit density	6.0%	7.0%	7.1%	6.7%	79%
Median household income	5.0%	6.0%	6.9%	8.4%	100%
Median house value	5.0%	6.1%	7.2%	8.3%	100%
Median age	6.3%	6.9%	6.9%	6.7%	67%
Percent of population that is female	6.6%	6.9%	6.9%	6.4%	67%
Percent of population that is Hispanic	6.1%	7.0%	7.2%	6.3%	88%
Percent of housing units within multi-unit structures of at least 10 units	6.8%	6.6%	6.8%	6.6%	21%
Percent of housing units that are mobile homes	7.1%	6.7%	6.1%	5.4%	96%
Percent of population that is non-Hispanic and black-only	6.9%	7.1%	7.0%	5.8%	79%
Percent of population that is non-Hispanic and white-only	5.7%	7.1%	7.3%	6.5%	96%
Percent of population with no health insurance	7.6%	7.0%	6.4%	5.7%	100%
Percent of housing units that are owner occupied	6.0%	6.5%	6.7%	7.5%	96%
Percent of population age 18-24	7.1%	6.9%	6.6%	6.3%	88%
Percent of population age 65 and older	6.8%	6.8%	6.7%	6.6%	29%
Percent of population below the poverty level	7.9%	7.0%	6.2%	5.3%	100%
Percent of population receiving public assistance income	7.1%	6.8%	6.5%	5.8%	92%
Percent of housing units that are renter occupied	7.5%	6.7%	6.5%	6.0%	96%
Percent of housing units that are vacant	7.5%	7.0%	6.4%	5.7%	100%
Total housing units within block-group	6.4%	6.6%	6.6%	6.9%	63%

Source: U.S. Census Bureau Household Pulse Survey data from weeks 1, 8, 13, and 18

* How often response rates for one quartile were significantly different from response rates for the other three quartiles within the same variable and data collection period.

Table 3 presents the respondent and nonrespondent distributions averaged across the weeks for persons within the different domain quartiles. Respondent and nonrespondent distributions show the relative percent contribution of members of a domain subset to respondent and nonrespondent populations separately. This is different than the response rates, which are the relative percent of respondents within the different domain subsets. The last column of Table 3 shows the percent of weeks (out of a total of four weeks) where the respondent and nonrespondent distributions were significantly different for the given domain. See Table B2 for the weekly respondent/nonrespondent distributions and associated statistics.

Table 3:2020 Household Pulse Survey Average Weighted Respondent/Nonrespondent Distributions by Domain

Domain	Distribution Type	Quartiles				Percent of Weeks with Different Distributions
		1	2	3	4	
Average total persons in occupied households	Respondent	24.2%	24.2%	26.7%	24.9%	75%
	Nonrespondent	25.0%	24.7%	26.2%	24.1%	
Housing unit density	Respondent	20.5%	30.4%	26.5%	22.6%	100%
	Nonrespondent	23.1%	28.8%	25.2%	23.0%	
Median household income	Respondent	15.4%	21.6%	27.6%	35.5%	100%
	Nonrespondent	20.9%	24.4%	26.8%	27.9%	
Median house value	Respondent	14.5%	22.6%	31.5%	31.4%	100%
	Nonrespondent	20.1%	25.5%	29.2%	25.3%	
Median age	Respondent	23.3%	27.3%	25.7%	23.8%	100%
	Nonrespondent	25.1%	26.4%	24.9%	23.6%	
Percent of population that is female	Respondent	22.0%	27.2%	27.9%	22.9%	100%
	Nonrespondent	22.4%	26.5%	27.1%	24.0%	
Percent of population that is Hispanic	Respondent	20.5%	28.3%	29.9%	21.3%	100%
	Nonrespondent	22.5%	27.0%	27.5%	23.1%	
Percent of housing units within multi-unit structures of at least 10 units	Respondent	44.5%	17.6%	18.5%	19.4%	75%
	Nonrespondent	44.1%	17.8%	18.4%	19.8%	
Percent of housing units that are mobile homes	Respondent	63.5%	15.0%	11.6%	9.9%	100%
	Nonrespondent	59.8%	14.9%	12.9%	12.4%	
Percent of population that is non-Hispanic and black-only	Respondent	25.2%	27.1%	27.7%	19.9%	100%
	Nonrespondent	24.7%	25.4%	26.5%	23.4%	
Percent of population that is non-Hispanic and white-only	Respondent	18.0%	28.9%	30.0%	23.1%	100%
	Nonrespondent	21.7%	27.3%	27.3%	23.8%	
Percent of population with no health insurance	Respondent	28.3%	27.6%	24.4%	19.8%	100%
	Nonrespondent	24.6%	26.3%	25.6%	23.5%	
Percent of housing units that are owner occupied	Respondent	21.9%	23.6%	25.4%	29.1%	100%
	Nonrespondent	24.6%	24.5%	25.3%	25.6%	
Percent of population age 18-24	Respondent	25.4%	27.4%	25.5%	21.7%	100%
	Nonrespondent	24.0%	26.5%	26.0%	23.4%	
Percent of population age 65 and older	Respondent	26.4%	26.0%	24.1%	23.5%	50%
	Nonrespondent	26.1%	25.7%	24.4%	23.9%	
Percent of population below the poverty level	Respondent	31.7%	29.1%	23.2%	16.0%	100%
	Nonrespondent	26.5%	27.7%	25.1%	20.7%	
Percent of population receiving public assistance income	Respondent	43.1%	24.5%	18.8%	13.7%	100%
	Nonrespondent	40.7%	23.9%	19.4%	16.0%	
Percent of housing units that are renter occupied	Respondent	29.1%	25.4%	23.6%	21.9%	100%
	Nonrespondent	25.6%	25.3%	24.5%	24.6%	
Percent of housing units that are vacant	Respondent	27.9%	30.1%	24.4%	17.7%	100%
	Nonrespondent	24.6%	28.8%	25.6%	21.0%	
Total housing units within block-group	Respondent	12.6%	18.4%	24.8%	44.1%	100%
	Nonrespondent	13.3%	18.9%	25.3%	42.5%	

Source: U.S. Census Bureau Household Pulse Survey data from weeks 1, 8, 13, and 18

All domains except average total persons in occupied households, percent of housing units within multi-unit structures of at least 10 units, and percent of population age 65 and older had significantly different respondent/nonrespondent distributions every week.

There are significant differences in response rates and respondent distributions across most domains, and the amount of nonresponse bias depends on the pandemic impact differences between respondents and nonrespondents within each domain. Of course, we do not know the total degree of bias because we do not know the pandemic impacts for nonresponders. However, HPS reduces potential bias by applying nonresponse weighting adjustments and controlling to independent population controls by various demographics.

4.3 Nonresponse Bias Based on HPS Response data

The previous section presented measures of nonresponse bias for overall HPS response rates by ACS demographic estimates of the block-groups containing the sample addresses. The analysis in this section used only HPS response data to analyze potential nonresponse bias based on demographic data reported in the HPS. The universe for this analysis was a small portion of the overall HPS sample, but this was the only way to know the demographics of the nonresponders.

Table 4 presents the average response measures across a subset of weeks for Phase 1 and Phase 2 and 3 data collection separately. Refer to Tables A3 and A4 for the weekly Phase 1 and Phase 2 and 3 response measures, respectively. The Phase 1 response measures were the percent of all first-time respondents who also responded a second time. The Phase 2 and 3 response measures were the percent of all respondents who first accessed the instrument in the first six days of data collection. Phase 1 measures were generally lower than Phase 2 and 3 measures because they were defined differently. The Phase 2 and 3 measures were also high because the data only allowed us to determine the first time a respondent accessed the instrument and not necessarily when they completed their response.

The "Percent of comparisons significant" column in Table 4 indicates how often the response measure for each domain group is significantly different from another group within the same domain variable. The number of comparisons in the percent is determined by how many different groups are within the domain variable. For example, each individual age group was part of 32 comparisons for the eight other age groups and four weeks analyzed. Similarly, the domain variables with only two categories had only four comparisons across the four weeks analyzed.

In all weeks, Hispanic response measures were lower than non-Hispanic response measures. In Phase 1, average response measures were lowest for persons age 18-24 with 93.8 percent of all comparisons significant.

Table 4: Average Household Pulse Survey Response Measures by Domain

Domain	Phase 1		Phase 2 and 3	
	Average percent of response a second time	Percent of comparisons significant*	Average percent of early response	Percent of comparisons significant*
HPS respondent age group				
Age 18-25	10.2%	93.8%	64.8%	9.4%
Age 25-29	15.2%	56.3%	63.6%	12.5%
Age 30-34	16.6%	43.8%	63.7%	9.4%
Age 35-39	18.1%	37.5%	63.1%	12.5%
Age 40-44	18.3%	34.4%	63.3%	9.4%
Age 45-49	19.3%	37.5%	63.2%	9.4%
Age 50-54	20.1%	31.3%	64.5%	15.6%
Age 55-64	22.6%	53.1%	65.5%	12.5%
Age 65+	25.0%	81.3%	67.0%	46.9%
HPS respondent education				
No high school diploma	16.4%	33.3%	62.7%	16.7%
High school diploma	17.4%	33.3%	64.0%	16.7%
Some college	18.1%	41.7%	64.7%	16.7%
College degree	21.9%	91.7%	66.1%	50.0%
HPS respondent race/ethnicity				
Hispanic	15.5%	50.0%	60.9%	41.7%
Non-Hispanic white-only	20.4%	66.7%	67.1%	91.7%
Non-Hispanic black-only	15.7%	41.7%	59.1%	50.0%
Non-Hispanic other races	18.8%	41.7%	63.1%	50.0%
HPS respondent gender				
Male	18.4%	25.0%	65.6%	50.0%
Female	19.0%	25.0%	63.9%	50.0%
HPS respondent ethnicity				
Non-Hispanic	19.5%	100.0%	65.6%	100.0%
Hispanic	15.5%	100.0%	60.9%	100.0%
HPS respondent household income				
Income <$25K	19.1%	14.3%	64.0%	17.9%
Income $25K to <$35K	20.9%	7.1%	64.3%	0.0%
Income $35K to <$50K	18.8%	7.1%	64.6%	0.0%
Income $50K to <$75K	19.9%	7.1%	65.2%	10.7%
Income $75K to <$100K	21.1%	3.6%	67.2%	7.1%
Income $100K to <$150K	20.7%	0.0%	66.8%	3.6%
Income $150K to <$200K	22.1%	17.9%	65.9%	3.6%
Income $200K+	21.4%	21.4%	66.9%	7.1%
HPS respondent race				
White-only	19.8%	33.3%	66.3%	75.0%
Black-only	15.8%	33.3%	59.0%	50.0%
Asian-only	14.6%	16.7%	62.3%	25.0%
Other races	18.7%	16.7%	63.0%	50.0%

Source: U.S. Census Bureau Household Pulse Survey data from weeks 1, 4, 8, 11, 13, 15, 18, and 21

* How often response measures for a domain category were significantly different from response measures for other categories within the same variable and data collection period.

Table 5 shows the average domain distributions by response status from the weekly distributions and Chi-Square values in Tables A5.1, A5.2, A6.1, and A6.2.

Table 5: Household Pulse Survey Average Domain Distributions by Response Status

Domain	Phase 1		Phase 2 and 3	
	Two or more Responses	One response	Accessed Instrument Early	Accessed Instrument Later
HPS respondent age group	100% of weeks different		100% of weeks different	
Age 18-25	6.8%	13.7%	9.3%	9.3%
Age 25-29	9.1%	11.8%	8.4%	8.8%
Age 30-34	9.4%	10.9%	9.5%	10.0%
Age 35-39	8.7%	9.1%	8.7%	9.4%
Age 40-44	8.5%	8.8%	8.3%	8.8%
Age 45-49	8.1%	7.8%	7.8%	8.4%
Age 50-54	8.3%	7.7%	8.3%	8.4%
Age 55-64	18.2%	14.4%	17.6%	17.0%
Age 65+	22.9%	15.9%	22.1%	20.0%
HPS respondent education	75% of weeks different		50% of weeks different	
No high school diploma	8.8%	10.2%	8.1%	8.8%
High school diploma	31.1%	33.8%	30.4%	31.4%
Some college	29.3%	30.6%	30.5%	30.6%
College degree	30.8%	25.4%	31.0%	29.2%
HPS respondent race/ethnicity	100% of weeks different		100% of weeks different	
Hispanic	16.0%	20.1%	16.2%	19.2%
Non-Hispanic white-only	63.7%	57.1%	65.1%	58.8%
Non-Hispanic black-only	11.0%	13.5%	10.0%	12.8%
Non-Hispanic other races	9.4%	9.3%	8.6%	9.3%
HPS respondent gender	25% of weeks different		50% of weeks different	
Male	48.3%	49.3%	49.0%	47.2%
Female	51.7%	50.7%	51.0%	52.8%
HPS respondent ethnicity	100% of weeks different		100% of weeks different	
Non-Hispanic	84.1%	80.0%	83.8%	80.9%
Hispanic	15.9%	20.0%	16.2%	19.1%
HPS respondent household income	50% of weeks different		75% of weeks different	
Income <$25K	16.3%	17.4%	13.8%	14.8%
Income $25K to <$35K	12.7%	12.1%	10.8%	11.4%
Income $35K to <$50K	12.4%	13.6%	12.6%	13.1%
Income $50K to <$75K	17.7%	18.1%	17.7%	18.0%
Income $75K to <$100K	13.5%	12.7%	14.1%	13.1%
Income $100K to <$150K	14.3%	13.9%	15.8%	14.9%
Income $150K to <$200K	6.6%	5.9%	7.2%	7.1%
Income $200K+	6.6%	6.2%	8.1%	7.6%
HPS respondent race	75% of weeks different		100% of weeks different	
White-only	74.8%	70.9%	76.8%	72.4%
Black-only	12.7%	15.7%	11.5%	14.8%
Asian-only	1.5%	2.0%	1.7%	1.9%
Other races	11.0%	11.3%	10.0%	10.9%

Source: U.S. Census Bureau Household Pulse Survey data from weeks 1, 4, 8, 11, 13, 15, 18, and 21

The domain distributions in Table 5 tell a similar story as the response measures in Table 4. Age group distributions were different in all weeks, primarily due to the differences in response for the older age groups. Race/ethnicity distributions were also different in all weeks, likely because the non-Hispanic white-only group tended to respond more than the other race/ethnicities. Household income and gender groups were not consistently different across all weeks. This may be misleading, however, because the universe for this analysis was all cases that responded to the HPS at least once, which was not necessarily the same distribution as the total sample. For more information about respondent representation among these demographic groups, refer to the coverage ratios in the HPS source and accuracy statement (U.S. Census Bureau, 2020b).

The analysis has shown some significant correlations between estimates and domains as well as some significant correlation between response rates and domains. This leads to the conclusion that there was potential nonresponse bias in the overall estimates. To evaluate how the different response rates by domains might impact the key estimates, Table 6 presents overall estimates by response status for phase 1 and phase 2 and 3 separately. Refer to Tables A7 and A8 for the weekly Phase 1 and Phase 2 and 3 estimates, respectively.

Table 6: Household Pulse Survey Average Estimates by Response Status

Estimate	Phase 1			Phase 2 and 3		
	All Respondents	Two or More Responses	Percent of weeks different*	All Respondents	Accessed Instrument Early	Percent of weeks different*
1-Expected income loss	37%	36%	0%	27%	27%	0%
2-Food scarcity	2%	2%	0%	3%	3%	0%
3-Housing insecurity-owners	5%	6%	25%	4%	5%	0%
4-Housing insecurity-renters	13%	13%	25%	12%	13%	0%
5-Eviction-owners	n/a	n/a	n/a	4%	4%	0%
6-Eviction-renters	n/a	n/a	n/a	15%	17%	0%
7-Difficulty paying expenses	n/a	n/a	n/a	15%	15%	25%

Source: U.S. Census Bureau Household Pulse Survey data from weeks 1, 4, 8, 11, 13, 15, 18, and 21
* How many weeks, out of four total, the All Respondents estimate was significantly different from the Two or More Responses (for Phase 1) or Accessed Instrument Early (for Phase 2 and 3) estimate.

Only three weeks found any significant difference between the response subset estimate and the estimate with all respondents, and all three weeks were for different estimates. This indicates that the HPS weighting adjustments reduced nonresponse bias by controlling the weights for domains that are correlated with response. However, this could also simply be because this analysis was limited to only cases that responded to the HPS at least once.

5. Conclusions

The 2020 HPS data had many potential sources of error, including coverage, processing, unit nonresponse, and item nonresponse. The analysis in this report focused on the potential bias due to unit response and was not an evaluation of total survey error.

We found evidence that two specific key estimates, expected loss in employment income and difficulty paying for usual household expenses, were strongly correlated with respondent age, race/ethnicity, educational attainment, and household income. These same estimates were also correlated with neighborhood ACS rates by age, race/ethnicity, poverty-level, public assistance, health insurance, and owner/renter occupied.

Estimates of likelihood of foreclosure or eviction did not have many significant results because they are a relatively rare event with higher variances than the other key estimates. The remaining three estimates, food scarcity and housing insecurity for owners/renters, showed some correlation with domains but were not consistent across all HPS data collection periods.

The HPS sampling frame did not contain demographic information for nonrespondents, so our analysis of overall HPS response used the geographical location of the sample address to obtain demographic estimates from the ACS for respondents and nonrespondents participating in their first interview. This analysis found that response rates were significantly different every week for the domains median household income, median house value, percent of population with no health insurance, percent of population below the property level, and percent of housing units that are vacant. In addition, respondent and nonrespondent distributions were significantly different for almost all domains of interest.

To analyze response patterns based on person-specific demographics, we also produced domain response measures (how many times they responded in Phase 1, and how early they accessed the instrument in Phase 2 and 3), domain distributions by response status, and overall key estimates by response status that may provide insights into characteristics of the nonrespondents. This analysis found response measures were most correlated with respondent age, education, and race/ethnicity. However, the overall key estimates generally did not detect nonresponse bias, most likely because many of the most correlated domains (age, race/ethnicity, education) are accounted for in the HPS weighting adjustments.

Our results show evidence of potential nonresponse bias in the 2020 HPS. Our results also show evidence that the weighting adjustment methods help to mitigate that nonresponse bias in the final estimates. However, this does not mean there is no nonresponse bias in the HPS

estimates. The weighting adjustments do not incorporate any geographical ACS estimates, such as percent of population with no health insurance, that appear to be correlated with response and key estimates.

All results in this analysis should be interpreted with caution. We found many domains that appear to be correlated with response and the HPS estimates, and domains that are not accounted for in the weighting adjustments indicate potential nonresponse bias. However, the weighting adjustments may still mitigate this bias if these domains are correlated with other domains that are accounted for in the weights. Further research is needed to determine if there are any sources of nonresponse bias that are not currently accounted for in the final HPS weights and estimates.

6. References

Fay, Robert E. (1989). Theory and Application of Replicate Weighting for Variance Calculations. In Proceedings of the Survey Research Methods Section, American Statistical Association, 212-217

U.S. Census Bureau. (2020a). 2020 Planning database, released on June 22, 2020. https://www.census.gov/topics/research/guidance/planning-databases.2020.html

U.S. Census Bureau. (2020b). Household Pulse Survey Technical Documentation (census.gov)

Appendix A   HPS Key Estimate Definitions

Table 7: Household Pulse Survey Key Estimate Definitions

Estimate Description	Criteria	Universe
Key estimate 1: expected loss in employment income	EXPCTLOSS=1	EXPCTLOSS=1 or 2
Key estimate 2: food scarcity	CURFOODSUF=4	CURFOODSUF=1,2,3, or 4
Key estimate 3: housing insecurity for owners	TENURE=2 and MORTCONF=1	TENURE=2 and MORTCONF=1,2,3,4, or 5
Key estimate 4: housing insecurity for renters	TENURE=3 and MORTCONF=1	TENURE=3 and MORTCONF=1,2,3,4, or 5
Key estimate 5: likelihood of foreclosure for owners (week 13 and later only)	TENURE=2 and MORTCUR=2 and FORCLOSE=1	TENURE=2 and MORTCUR=2 and FORCLOSE=1,2,3, or 4
Key estimate 6: likelihood of eviction for renters (week 13 and later only)	TENURE=3 and RENTCUR=2 and FORCLOSE=1	TENURE=3 and RENTCUR =2 and EVICT=1,2,3, or 4
Key estimate 7: difficulty paying for usual household expenses (week 13 and later only)	EXPNS_DIF=4	EXPNS_DIF=1,2,3, or 4

Source: U.S. Census Bureau 2020 Household Pulse Survey response data

Appendix B   Planning Database Quartile Definitions

Table 8: Planning Database Quartile Definitions

Variable Description	Quartile	Number of block-groups	Value range		
Average total persons in occupied households	1	54,523	1.00	-	2.25
	2	54,232	2.26	-	2.57
	3	55,728	2.58	-	2.95
	4	54,279	2.96	-	20.76
Housing unit density	1	55,620	0	-	188.02
	2	54,704	188.03	-	1,129.10
	3	54,703	1,129.11	-	2,574.38
	4	54,705	2,574.47	-	487,500.00
Median household income	1	53,170	0	-	41,135
	2	53,170	41,136	-	57,373
	3	53,175	57,375	-	80,956
	4	53,165	80,957	-	250,001
Median house value	1	51,552	0	-	111,200
	2	51,571	111,300	-	176,500
	3	51,558	176,600	-	315,600
	4	51,560	315,700	-	2,000,001
Median age	1	55,327	0	-	33.6
	2	54,428	33.7	-	39.6
	3	54,518	39.7	-	46.3
	4	54,877	46.4	-	89.5
Percent of population that is female	1	55,043	0	-	47.52
	2	54,704	47.53	-	50.91
	3	54,711	50.92	-	54.45
	4	54,756	54.46	-	100.00
Percent of population that is Hispanic	1	54,684	0	-	1.38
	2	54,822	1.39	-	6.47
	3	54,895	6.48	-	21.36
	4	54,813	21.37	-	100.00
Percent of housing units within multi-unit structures of at least 10 units	1	108,050	0	-	0
	2	36,920	0.03	-	6.43
	3	36,928	6.44	-	22.98
	4	36,920	22.99	-	100.00
Percent of housing units that are mobile homes	1	134,374	0	-	0
	2	28,138	0.05	-	4.98
	3	28,159	4.99	-	17.34
	4	28,147	17.35	-	100.00
Percent of population that is non-Hispanic and black-only	1	65,478	0	-	0
	2	51,154	0.01	-	3.20
	3	51,237	3.21	-	15.23
	4	51,345	15.24	-	100.00
Percent of population that is non-Hispanic and white-only	1	54,845	0	-	37.43
	2	54,895	37.44	-	72.02
	3	54,767	72.03	-	89.94
	4	54,707	89.95	-	100.00

Variable Description	Quartile	Number of block-groups	Value range		
Percent of population with no health insurance	1	55,097	0	-	3.00
	2	54,745	3.01	-	6.79
	3	54,685	6.80	-	12.86
	4	54,687	12.87	-	100.00
Percent of housing units that are owner occupied	1	54,695	0	-	47.44
	2	54,682	47.45	-	70.26
	3	54,688	70.27	-	85.12
	4	54,697	85.13	-	100.00
Percent of population age 18-24	1	54,794	0	-	4.81
	2	54,673	4.82	-	7.63
	3	54,743	7.64	-	11.09
	4	55,004	11.10	-	100.00
Percent of population age 65 and older	1	55,067	0	-	9.88
	2	54,747	9.89	-	15.08
	3	54,699	15.09	-	21.14
	4	54,701	21.15	-	100.00
Percent of population below the poverty level	1	54,730	0	-	4.83
	2	54,676	4.84	-	11.06
	3	54,670	11.07	-	21.73
	4	54,726	21.74	-	100.00
Percent of population receiving public assistance income	1	94,310	0	-	0
	2	41,405	0.05	-	2.24
	3	41,594	2.25	-	4.83
	4	41,424	4.84	-	100.00
Percent of housing units that are renter occupied	1	54,696	0	-	14.87
	2	54,689	14.88	-	29.73
	3	54,682	29.74	-	52.55
	4	54,695	52.56	-	100.00
Percent of housing units that are vacant	1	54,718	0	-	3.14
	2	54,686	3.15	-	8.69
	3	54,726	8.70	-	16.37
	4	54,688	16.38	-	100.00
Total housing units within block-group	1	56,070	0	-	394
	2	54,985	395	-	546
	3	54,544	547	-	766
	4	54,734	767	-	26,436

Source: U.S. Census Bureau 2014-2018 American Community Survey Estimates