2018 NATIONAL SURVEY ON DRUG USE AND HEALTH METHODOLOGICAL RESOURCE BOOK

SECTION 14: SAMPLE EXPERIENCE REPORT

Substance Abuse and Mental Health Services Administration
Center for Behavioral Health Statistics and Quality
Rockville, Maryland

July 2019

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SECTION 14: SAMPLE EXPERIENCE REPORT

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1. Introduction

A coordinated sample design was developed for the 2014 through 2017 National Surveys on Drug Use and Health (NSDUHs) and was extended to the 2018 through 2022 NSDUHs.[1] The multiyear design consists of a deeply stratified, multistage area probability design. The 2018 sample design is thoroughly documented in the 2018 NSDUH sample design report (Center for Behavioral Health Statistics and Quality, 2019a). The goal of this report is to further document the 2018 NSDUH sample experiences, including a comparison of actual sample yields to state and quarter targets, a comparison of achieved and expected design effects (DEFFs) and relative standard errors, and documentation of any issue encountered during sample implementation.

This report is organized as follows. Chapter 2 summarizes the 2018 sample design. Chapters 3, 4, and 5 document the sample experiences at the third, fourth, and fifth stages of sample selection, respectively. Chapter 6 includes a comparison of the observed precisions with the expected precisions and a comparison of median and mean DEFFs. Finally, any issues encountered during sample implementation are described in Chapter 7.

[1] This report presents information from the 2018 NSDUH. Prior to 2002, the survey was called the National Household Survey on Drug Abuse (NHSDA).

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2. Overview of the 2018 Sample Design

2.1 Target Population

The respondent universe for the 2018 National Survey on Drug Use and Health (NSDUH) was the civilian, noninstitutionalized population aged 12 years or older residing in the United States. Consistent with the NSDUH designs since 1991, the 2018 NSDUH universe included residents of noninstitutional group quarters (e.g., shelters, rooming houses, dormitories, and group homes), residents of Alaska and Hawaii, and civilians residing on military bases in the United States. Persons excluded from the 2018 universe included those with no fixed household address (e.g., homeless or transient persons not in shelters) and residents of institutional group quarters, such as jails and hospitals.

2.2 Design Overview

The Substance Abuse and Mental Health Services Administration (SAMHSA) implemented major changes in the way that NSDUH would be conducted beginning in 1999 and continuing through subsequent years. The survey is conducted using computer-assisted interviewing methods and provides state estimates based on minimum sample sizes per state. Furthermore, the NSDUH sample was redesigned in 2014 to allow for a more cost-efficient sample allocation to the largest states while maintaining adequate sample sizes in smaller states to support reliable state and substate estimates based on the small area estimation (SAE) methodology. Reliable direct state estimates are also possible (in any state) by pooling multiple years of data. The target national sample size of 67,507 is distributed across five age groups as follows: 25 percent for youths aged 12 to 17, 25 percent for young adults aged 18 to 25, 15 percent for adults aged 26 to 34, 20 percent for adults aged 35 to 49, and 15 percent for adults aged 50 or older. This large sample size allows SAMHSA to continue reporting precise estimates for demographic subgroups at the national level without needing to oversample specially targeted demographics, as was required prior to 1999. The achieved sample for the 2018 NSDUH was 67,791 persons.

Beginning with the 2002 NSDUH and continuing through the 2018 NSDUH, survey respondents were given a $30 incentive for participation. As expected, the incentive had the effect of increasing response rates, thereby requiring fewer selected households than previous surveys. In recent years, however, response rates have been declining, which has required the number of selected households to increase. Beginning in 2014 and continuing through 2018, this increase was partially offset by selecting fewer youths aged 12 to 17, requiring fewer selected households per completed interview. That is, with more proportional sampling by age group, fewer households are needed to support the oversample of youths aged 12 to 17.

An additional design change was made in 2002 and continued through 2013. A new pair sampling strategy was implemented that increased the number of pairs selected in dwelling units (DUs) with older persons on the roster (Chromy & Penne, 2002). With the increase in the number of pairs came a moderate decrease in the response rate for older persons. In 2014, changes to the sample design with respect to age group and state necessitated a review of the pair

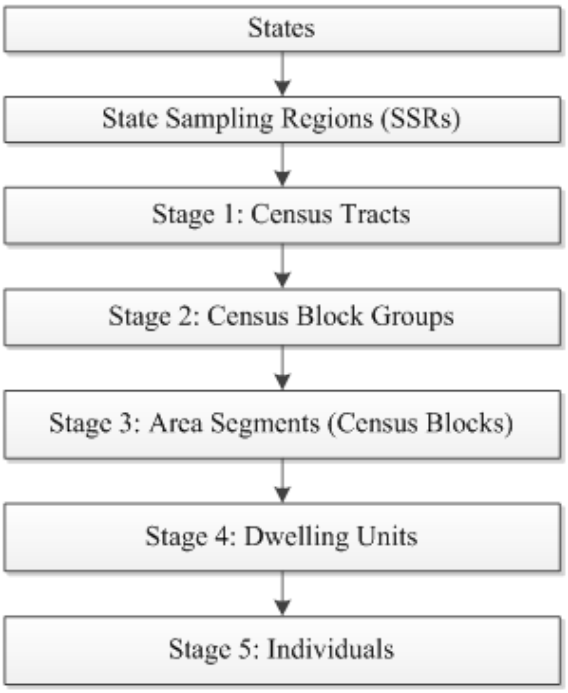
sampling strategy. As a result, slightly fewer pairs were selected for the 2014 through 2018 NSDUHs.

2.2.1 Multiyear Coordinated Design

A coordinated sample design was developed for the 2014 through 2017 NSDUHs. A large reserve sample of area clusters or segments was selected at the time the 2014 through 2017 NSDUH sample was selected. This reserve sample is being used to field the 2018 through 2022 NSDUHs. Thus, the 2018 through 2022 NSDUH designs simply continue the coordinated design.

Exhibit 1 summarizes the 2014 through 2022 NSDUH multistage design. The coordinated design facilitates 50 percent overlap in third-stage units (area segments) within each successive 2-year period from 2014 through 2022. This designed sample overlap slightly increases the precision of estimates of year-to-year trends because of the expected small but positive correlation resulting from the overlapping sample between successive survey years. The 50 percent overlap of segments significantly reduces segment listing costs because only one half of the segments need to be listed for the 2015 through 2022 surveys.

Exhibit 1. Summary of the 2014 through 2022 NSDUH Design



The 2018 design provides for estimates by state in all 50 states plus the District of Columbia. States may therefore be viewed as the first level of stratification and as a reporting variable. In the 2005 through 2013 NSDUH design, the sample was divided into 8 "large" states and 43 "small" states (including the District of Columbia), with the large and small sample states designed to yield 3,600 and 900 respondents per state, respectively. Beginning in 2014 and continuing through 2018, the survey's sample was designed to yield the following:

- 4,560 completed interviews in California;
- 3,300 completed interviews each in Florida, New York, and Texas;
- 2,400 completed interviews each in Illinois, Michigan, Ohio, and Pennsylvania;
- 1,500 completed interviews each in Georgia, New Jersey, North Carolina, and Virginia;
- 967 completed interviews in Hawaii; and
- 960 completed interviews in each of the remaining 37 states and the District of Columbia.

To accommodate state and local policymakers' need for substate estimates in Kauai County, Hawaii, the sample was designed to yield a minimum of 200 completed interviews in this county over a 3-year period. This allows for Kauai County to be included as a separate entity in the production of substate estimates that are produced biennially and typically based on 3 years of data. To achieve this goal while maintaining precision at the state level, Kauai County was treated separately from the remainder of Hawaii for sample allocation and sample size management purposes. The target annual sample in Hawaii consisted of 67 completed interviews in Kauai County and 900 completed interviews in the remainder of the state, for an expected total of approximately 967 completed interviews each year.

In all states, the sample sizes were sufficient to support reliable estimates based on the SAE methodology while maintaining efficiency for national estimates. Direct estimates and estimates of change are typically produced by pooling multiple years of data to increase precision. For example, 2008-2009 data are pooled, 2016-2017 data are pooled, then the two pooled estimates are compared for an estimate of long-term change (Center for Behavioral Health Statistics and Quality [CBHSQ], 2018-2019).

Prior to selecting the sample for the 2014 through 2022 NSDUHs, state sampling regions (SSRs) were formed within each state. These SSRs will be used for the duration of the 2014 through 2022 NSDUHs. Based on a composite size measure,[2] each state was geographically partitioned into roughly equal-sized regions according to population. In other words, regions were formed such that each area yielded, in expectation, roughly the same number of interviews within each state during each quarterly data collection period. This partitioning divided the United States into 750 SSRs.

Similar to the 2005 through 2013 NSDUHs, the first stage of selection for the 2014 through 2022 NSDUHs was census tracts.[3] This stage was included to contain sample segments within a single census tract to the extent possible.[4] Segments that cross census tract boundaries make merging to external data sources difficult.

The first stage of selection began with the construction of an area sample frame that contained one record for each census tract in the United States. If necessary, census tracts were

[2] The composite size measure is defined as the population weighted by the state sampling rate in each age group.

[3] A census tract is a small, relatively permanent statistical subdivision of a county or equivalent entity that contains between 1,200 and 8,000 people, with an optimum size of 4,000 people (U.S. Census Bureau, Redistricting Data Office, 2009).

[4] Some census tracts had to be aggregated in order to meet the minimum DU requirement.

aggregated within SSRs until each primary sampling unit (PSU; one or more census tracts) met the minimum size requirement. In California, Florida, Georgia, Illinois, Michigan, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Texas, and Virginia, this minimum size requirement was 250 DUs[5] in urban areas and 200 DUs in rural areas.[6] In the remaining states and the District of Columbia, the minimum requirement was 150 DUs in urban areas and 100 DUs in rural areas.

Before selecting PSUs, additional implicit stratification was achieved by sorting the first-stage sampling units by a CBSA/SES[7] (core-based statistical area/socioeconomic status) indicator[8] and by the percentage of the population that is non-Hispanic and white.[9] From this well-ordered sample frame, 48 PSUs per SSR were sequentially selected with probabilities proportionate to a composite size measure and with minimum replacement[10] (Chromy, 1979).

For the second stage of selection, adjacent census block groups were aggregated within selected PSUs as necessary to meet the minimum DU requirements (150 or 250 DUs in urban areas and 100 or 200 DUs in rural areas according to state). After the resulting second-stage sampling units (SSUs) were formed, they were sorted in the order they were formed (i.e., geographically), and one SSU was selected per sampled PSU with probability proportionate to a composite size measure and with minimum replacement (Chromy, 1979). Compared with 2013 and prior years, the selection of census block groups is an additional stage of selection that was included in the 2014 through 2022 NSDUH samples to facilitate possible transitioning to an address-based sampling (ABS) design in the future.

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[5] DU counts were obtained from the 2010 census data supplemented with revised population counts from Claritas, which is a market research firm headquartered in Ithaca, New York (see https://www.claritas.com/).

[6] The basis for the differing minimum DU requirement in urban and rural areas is that it is more difficult to meet the requirement in rural areas, 100 DUs are sufficient to support one field test and two main study samples in the smaller states, and 200 DUs are sufficient to support three samples in the larger sample states.

[7] CBSAs include metropolitan and micropolitan statistical areas as defined by the Office of Management and Budget (2009). Metropolitan statistical areas contain at least one urbanized area with 50,000 or more people and may include adjacent territory with a high degree of social and economic integration with the core as measured by commuting. Micropolitan statistical areas have an urban core with at least 10,000 but fewer than 50,000 people, plus adjacent territory that is socioeconomically tied to the core by commuting. Both metropolitan and micropolitan statistical areas are defined in terms of whole counties (or equivalent entities).

[8] Four categories are defined as (1) CBSA/low SES, (2) CBSA/high SES, (3) non-CBSA/low SES, and (4) non-CBSA/high SES. To define SES, census tract-level median rents and property values obtained from the 2006 to 2010 American Community Survey (ACS) data were given a rank (1,…,5) based on state and CBSA quintiles. The rent and value ranks then were averaged, weighted by the percentages of renter- and owner-occupied DUs, respectively. If the resulting score fell in the lower 25th percentile by state and CBSA, the area was considered "low SES"; otherwise, it was considered "high SES."

[9] Although the large sample size eliminates the need for the oversampling of specially targeted demographic subgroups as was required prior to the 1999 National Household Survey on Drug Abuse (NHSDA), sorting by a CBSA/SES indicator and by the percentage of the population that is non-Hispanic and white ensures dispersion of the sample with respect to SES and race/ethnicity. Implicit stratification also has the potential to make sampling error lower by reducing the selection of neighboring and possibly similar segments than if the selection was done completely at random.

[10] Probability minimum replacement sampling is a type of probability proportional to size sampling that allows for a sampling unit with a relatively large measure of size to be selected more than once. More importantly, neighboring units on the sorted sampling frame are unlikely to be jointly selected for the sample. This reduces the potential for variance when neighboring units are similar with respect to the outcomes being measured.

The SSUs were generally larger than practical for building frames of housing units through field enumeration. Therefore, one smaller geographic region was selected within each sampled SSU. For this third stage of sampling, each selected SSU was partitioned into compact clusters[11] of DUs by aggregating adjacent census blocks.[12] Consistent with the terminology used in previous NSDUHs, these geographic clusters of blocks are referred to as "segments." A sample DU in NSDUH refers to either a housing unit or a group quarters listing unit, such as a dormitory room or a shelter bed. Similar to PSUs and SSUs, segments were formed to contain a minimum of 150 or 250 DUs in urban areas and 100 or 200 DUs in rural areas according to state. This minimum DU requirement will support the overlapping sample design and any special supplemental samples or field tests that SAMHSA may wish to conduct.

Prior to selection, the segments were sorted in the order they were formed (i.e., geographically), and one segment was selected within each sampled SSU using Chromy's method of sequential random sampling (with probability proportionate to a composite size measure and with minimum replacement) (Chromy, 1979). The 48 selected segments within each SSR were randomly assigned to a survey year and quarter of data collection. Although only 20 segments per SSR were needed to support the 2014 through 2017 NSDUHs, an additional 28 segments were selected to serve as replacements when segment DUs are depleted, to support any supplemental studies embedded within NSDUH, and to extend the sample to the next decennial census, if desired. These 28 segments constitute the "reserve" sample and are being used to support the 2018 through 2022 NSDUHs.

An equal probability subsample of eight segments per SSR is used for each NSDUH year. These eight segments are randomly assigned to quarters and to two panels within each quarter. For 2018, the first panel segments (panel E) were used for the 2017 and 2018 surveys, constituting the overlap sample. The second panel segments (panel F) were used for the 2018 survey and will be used again for the 2019 survey.

2.2.2 Sample Frame

Beginning in 2014, three changes related to the sample frame were implemented. First, whereas the sampling frame for the 2005 through 2013 NSDUHs was constructed using 2000 census data, the 2014 through 2022 sample frame was built using 2010 census data supplemented with 2013 population projections from Claritas.[13] Furthermore, because the Census Bureau's long-form data were no longer available, census tract-level median rents and property values were obtained from the 2006 to 2010 ACS. These data were used to form the CBSA/SES indicator that was used in the implicit stratification of the first-stage sampling units

[11] Although the entire cluster is compact, the final sample of DUs represents a noncompact cluster. Noncompact clusters (selection from a list) differ from compact clusters in that not all units within the cluster are included in the sample. Although compact cluster designs are less costly, a noncompact cluster design was used because it provides for greater heterogeneity of dwellings within the sample. Also, social interaction (contagion) among neighboring dwellings is sometimes introduced with compact clusters (Kish, 1965).

[12] A census block is a small statistical area bounded by visible features (streets, roads, streams, railroad tracks, etc.) and nonvisible boundaries (e.g., city, town, and county limits). A block group is a cluster of census blocks within the same census tract and generally contains between 300 and 6,000 people (U.S. Census Bureau, Redistricting Data Office, 2009).

[13] See footnote 5 for information about Claritas.

(census tracts or PSUs). This change was confirmed to improve coverage and therefore require smaller poststratification adjustments in weighting (CBHSQ, 2015b).

Next, the number and distribution of SSRs were revised in 2014. In the 2005 through 2013 design, the 8 large states were each partitioned into 48 SSRs and the 43 small states were each partitioned into 12 SSRs, for a total of 900 SSRs. Beginning in 2014, the sampling frame was stratified into 750 SSRs with the number of SSRs varying by state. In each of the eight large states (California, Florida, Illinois, Michigan, New York, Ohio, Pennsylvania, and Texas), the total number of SSRs was reduced. In four of the small states (Georgia, New Jersey, North Carolina, and Virginia), the total number of SSRs was increased, while there was no change in the number of SSRs in the remaining small states. Thus, the change in the number and distribution of SSRs affected only 12 states.

In general, the new SSR distribution in the affected states resulted in increased efficiency in the highly populated areas and efficiency losses in the less populated areas. In the highly populated areas, some efficiency was gained because the SSRs and segment locations were more compact and the work could be completed by fewer field interviewers (FIs). The concentrated locations reduced travel for the FIs, provided sufficient options for case assignments, and provided the option for FIs to work more hours, if desired. In some less populated areas, the decrease in SSRs created some inefficiencies because the SSRs were larger and the segment locations were not as central. In these areas, it was often challenging for an FI to cover all of the work in an SSR due to the varying locations of segments and the location of an FI's home. Depending on the quarter, some SSRs experienced inefficiencies due to increased FI travel for the initial assignments and reduced FI options for conducting cleanup. Not all of the FIs were willing or available to travel longer distances, creating some inefficiencies in case assignments. In these areas, the use of borrowed FIs (BFIs) and sometimes traveling FIs (TFIs) was required.

In Illinois, Michigan, Ohio, and Pennsylvania, the total number of SSRs was cut in half, and the average segment size was increased. As a result, these states experienced both gains and losses in efficiency. In the highly populated areas, these states experienced gains due not only to increased yield and clustering, but also to staffing selection. Field management for 2014 was able to reduce the number of field staff members in the highly populated areas of these states. With location being equal, the best, most proficient, more efficient, and dedicated field staff members were retained. In the less populated areas of these states, increased SSR sizes and varying segment locations caused inefficiencies. Some segments had no nearby FI and had to be worked by a BFI or TFI, thus increasing travel costs. Overall, the greater yields in these states resulted in gains in efficiency, but also kept the field staff members working in their local segments longer while waiting for that assignment to be finished and before going to another area to work or clean up.

Overall, the new SSR distribution resulted in a reduction of hours and miles per interview; however, miscellaneous travel expenses increased. The SSR distribution also affected scheduling because it was initially not known what the yield would be in an area or when an FI would be available to move on to another assignment. With the higher yield, FIs took longer to work their initial assignments and were delayed while working a travel assignment. Compared with previous designs when field staff members completed their assignments several weeks

before the end of the quarter, FIs were working late into each quarter. Without a short break at the end of the quarter, getting off to a strong start at the beginning of the following quarter was more challenging. That is, without the downtime at the end of the quarter that they were accustomed to, field staff were not as motivated when working their new assignments during the following quarter.

The issues related to the new SSR distribution continued into 2018. In response to these issues, management of the FI case assignments and staffing levels was modified based on the 2014 through 2017 field experience. Staffing levels were increased in many states, and new local staff were hired with the expectation of fewer hours per week and required travel in rural areas to accommodate quarterly fluctuations in location assignments. Because management of the new SSR distribution required more travel to cover remote areas, a team of 11 dedicated TFIs was maintained, and field supervisors increased the utilization of FIs who could travel from adjacent states. Field supervisors proactively made quarterly assignments to account for working cases later into the quarter, and weekly production benchmarks were adjusted to reflect realistic expectations based on the 2017 fieldwork.

The third change, which was mentioned previously, was the addition of a sample selection stage by selecting census block groups from selected PSUs. The purpose of this change was to facilitate the possible transition to ABS. The introduction of census block groups as a sampling stage was transparent in the area sampling results and was expected to have little impact on the person-level analysis weight.

2.2.3 Sample Selection at Fourth and Fifth Stages

After sample segments for the 2018 NSDUH were selected, specially trained field household listers visited the areas and compiled complete lists of all eligible DUs within the sample segment boundaries. These lists served as the frames for the fourth stage of sample selection.

The primary objective of the fourth stage of sample selection (listing units) was to select the minimum number of DUs needed in each segment to meet the targeted sample sizes for all age groups. Thus, listing unit sample sizes for the segment were determined using the age group with the largest sampling rate, which is referred to as the "driving" age group. Using 2010 census data adjusted to more recent data from Claritas, state- and age-specific sampling rates were computed. These rates then were adjusted by (a) the segment's probability of selection; (b) the subsegmentation inflation factor,[14] if any; (c) the probability of selecting a person in the age group (equal to the maximum, or 0.99, for the driving age group); and (d) an adjustment for the "maximum of two" rule.[15] In addition to these factors, historical data from the 2016, 2017, and 2018 NSDUHs were used to compute predicted screening and interviewing response rate

[14] Segments found to be very large in the field were partitioned into *subsegments*. Then one subsegment was chosen at random with probability proportional to the size to be fielded. In some cases, a second-level subsegmenting was required if the census totals used in the initial subsegmenting were off and the selected subsegment was still too large for listing. The subsegmentation inflation factor accounts for reducing the size of the segment.

[15] Brewer's Selection Algorithm never allows for greater than two persons per household to be chosen (Brewer, 1963, 1975; Cochran, 1977, pp. 261-263). Thus, sampling rates are adjusted to satisfy this constraint.

adjustments.[16] The final adjusted sampling rate then was multiplied by the actual number of DUs found in the field during counting and listing activities. The product represents the segment's listing unit sample size.

Some constraints were put on the listing unit sample sizes. First, to ensure adequate samples for supplemental studies, the listing unit sample size could not exceed 100 per segment or half of the actual listing unit count. Next, for cost-efficiency (i.e., to make traveling to and from the segment worth the expense), a minimum of five listing units were selected if five unused listing units remained in the segment.

Using a random start point and interval-based (systematic) selection, the actual listing units were selected from the segment frame. In 2015 and beyond, DUs that are selected from the overlap segments in the prior year are flagged as "used" and are not eligible for selection in the "current" year (i.e., two separate samples are selected with the complement of the prior year's sample serving as the DU frame in the "current" year). Individuals may be selected in consecutive years if they move and their new residence is selected the year after their original DU was sampled. No mechanism is currently in place for identifying duplicate persons in a given year, but this number should be small given the restriction on DUs that were sampled in the previous year.

After DU selections were made, an interviewer visited each selected DU to obtain a roster of all persons residing in the DU. Using the roster information obtained from an eligible member of the selected DU, 0, 1, or 2 persons were selected for the survey. Sampling rates were preset by age group and state. Roster information was entered directly into the electronic screening instrument, which automatically implemented this fifth stage of selection based on the state and age group sampling parameters.

One advantage of using an electronic screening instrument in NSDUH is the ability to impose a more complicated person-level selection algorithm on the fifth stage of the NSDUH design. Similar to the 1999 through 2013 designs, one feature that was included in the 2014 through 2018 design is that any two survey-eligible persons within a DU have some chance of being selected (i.e., all survey-eligible pairs of persons had some nonzero chance of being selected). This design feature is of interest to NSDUH researchers because, for example, it allows analysts to examine how the drug use propensity of one individual in a family relates to the drug use propensity of another family member residing in the same DU (e.g., the relationship of drug use between a parent and his or her child). The pair sampling algorithm in NSDUH is based on the Chromy and Penne (2002) adaptation of the Brewer (1963, 1975) method for selecting samples of size two. Chromy and Penne (2002) also introduced a pair sampling parameter λ that governs the number of pairs selected. A simulation analysis was conducted to select the pair sampling parameter for the 2014 through 2022 NSDUHs (see the 2018 NSDUH sample design report; CBHSQ, 2019a).

As in previous years, during the 2018 data collection period, if an interviewer encountered any new or missed DU on the premises of a sampled DU (e.g., a garage apartment),

[16] Data from quarters 1 and 2 of the 2018 NSDUH were used to compute screening and interview response rate adjustments for the quarter 3 and 4 samples.

the new or missed dwelling was selected into the 2018 NSDUH. However, unlike the 2005 through 2013 NSDUHs, the half-open interval (HOI) procedure[17] was not implemented. An evaluation of 2010 NSDUH data found that the HOI procedure accounted for only 0.2 percent of the total DUs on the supplemented NSDUH frame (Iannacchione, McMichael, Shook-Sa, & Morton, 2012). Further, an analysis of cases added to the sample through the HOI procedure found that these respondents did not have an appreciable impact on the estimates (Cunningham et al., 2009). Excluding the HOI procedure decreases the burden on FIs and simplifies the screening process. This decrease in burden outweighs the small increase in coverage resulting from implementation of the HOI procedure. To minimize bias associated with large numbers of missed DUs, interviewers were instructed to call their supervisors if they noticed large differences in the segment listing and what they encountered in the field. Then special "bust" procedures were implemented (see the 2018 NSDUH sample design report; CBHSQ, 2019a).

2.2.4 Creation of Variance Estimation Strata and Replicates

The nature of the stratified, clustered sampling design requires that the design structure be taken into consideration when computing variances of survey estimates. Key nesting variables representing the variance estimation strata and replicates were created to capture explicit stratification and to identify clustering. For the 2014 through 2022 NSDUHs, variance estimation strata are defined at the SSR level, and each SSR is assigned to a different stratum every quarter in a pseudorandom fashion. Similar to the 2005 through 2013 definition of variance estimation strata, the 2014 through 2022 definition also has the effect of increasing the number of degrees of freedom (*df*) for state-level estimates while preserving the number of degrees of freedom for national estimates (750). Each of the smallest sample states is in 48 different strata (12 SSRs × 4 quarters); therefore, 48 degrees of freedom are available for state estimates in these states. At the other extreme, the largest sample state, California, is in 144 strata (36 SSRs × 4 quarters) and therefore has 144 degrees of freedom for estimation. Two replicates per year were defined within each variance stratum. Each variance replicate consists of four segments, one for each quarter of data collection. The first replicate consists of those segments that are "phasing out" or will not be used in the next survey year. The second replicate consists of those segments that are "phasing in" or will be fielded again the following year, thus constituting the 50 percent overlap between survey years.

PSUs (census tracts), SSUs (block groups), and segments are nested within variance replicates, so the nesting variables cover the variance contributions of all three sampling units. Also, because one segment is selected per sampled PSU and SSU, the selection of census tracts and block groups at the first stages of selection may reduce variance by controlling the sample distribution and minimizing the chance of selecting neighboring and possibly similar segments within the same census tract or block group. All weighted statistical analyses for which variance estimates are needed should use the stratum and replicate variables to identify nesting. Stratification reduces variances, while clustering increases them. Ignoring these design elements

[17] In summary, the rules for the HOI technique state that, if a DU is selected and an interviewer observes any new or missed DUs between the selected DU and the DU appearing immediately after the selection on the counting and listing form, all new or missed dwellings falling in this interval will be selected. If a large number of new or missed DUs are encountered (greater than 10), a sample of the new or missing DUs is selected, and the sample weight is adjusted accordingly.

may produce standard errors that lead to false-positive or false-negative test outcomes. Variance estimates can be computed using a clustered data analysis software package such as SUDAAN® (CBHSQ, 2019a; RTI International, 2013).

3. Segment (Third-Stage) Sample Experience

As mentioned in Chapter 2, the third stage of selection for the 2014 through 2022 National Surveys on Drug Use and Health (NSDUHs) was area segments. To form segments within sampled second-stage sampling units (SSUs), adjacent census blocks were collapsed until the total number of dwelling units (DUs) within the area met the minimum requirement. In California, Florida, Georgia, Illinois, Michigan, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Texas, and Virginia, this minimum size requirement was 250 DUs in urban areas and 200 DUs in rural areas. In the remaining states and the District of Columbia, the minimum requirement was 150 DUs in urban areas and 100 DUs in rural areas.

To control the geographic distribution of the sample, segments were sorted in the order they were formed (geographically within SSUs), and one segment was selected per sampled SSU using the probability proportional to composite size with minimal replacement sequential sampling method. As a result, 48 segments per state sampling region (SSR) were chosen for a total of 36,000 segments. Although only 20 segments per SSR or 15,000 segments total were needed to support the 2014 through 2017 NSDUHs, an additional 28 "reserve" segments were selected to serve as replacements when segment DUs are depleted, to support any supplemental studies embedded within NSDUH, or to extend the sample to the next decennial census. Out of the reserve sample, 20 segments per SSR are being used to support the 2018 through 2022 NSDUHs.

The 48 sampled segments per SSR were randomly assigned to survey years by drawing equal probability subsamples of four segments. The first subsample of segments was assigned to the 2014 NSDUH and constituted the panel of segments to be used for 2014 only. The second subsample of segments was assigned to the 2014 NSDUH and was used again in the 2015 survey. The third subsample of segments was assigned to the 2015 NSDUH and was used again in the 2016 survey. This process continued for the remaining 36 sampled segments. Within each subsample, segments were assigned to survey quarters 1 through 4 in the order that they were selected.

Using the survey year and quarter assignments, a segment identification number (SEGID) then was assigned. The first two digits of the SEGID are the state abbreviation, the second two digits are for the SSR within the state, and the last two digits are called the "segment suffix," with the next-to-last digit being the panel identifier and the last digit being the original quarter assignment.

Because segments were selected with minimal replacement, some segments may have been selected more than once. Among the 30,000 segments selected for the 9-year study, 28,608 (95.4 percent) were unique. Table 3.1 lists the duplicated segments in the 2018 NSDUH sample. Panels B, C, and D segments in Table 3.1 are not in the 2018 sample but are duplicates of segments in the 2018 sample. Because segments are randomly assigned to panels, duplicates may exist within or across panels. For example, AK01B1 and AK01F1 are in different panels, while DC05F3 and DC05F4 are in the same panel. The original segment (e.g., AK01B1 or DC05F3) is

field enumerated, and the resulting DU frame is used each time the segment is fielded (e.g., for AK01B1 and AK01F1 and for DC05F3 and DC05F4). DUs that were selected in previous fieldings are ineligible for selection in subsequent fieldings. Within survey years, duplicate segments may be assigned to the same or different quarters. If a segment is used twice in the same quarter, a double sample is selected from the first segment, then randomly split for analysis purposes.

Table 3.1 Duplicated Segments in the 2018 NSDUH Sample

Original Segment	2018 NSDUH Duplicate Segment
AK01B1*	AK01F1
DC05F3	DC05F4
DC06B2*	DC06F1
DC06E4[a]	DC06F3
DC06E4[a]	DC06F4
DC07E4	DC07F4
DC08C4*	DC08E4
HI01C2*	HI01E3
HI01F2	HI01F3
HI02B2*	HI02F3
IL01D2*	IL01E3
ND09E1	ND09F1
ND09B4*	ND09F4
RI07D3*	RI07F2
SC05C3*	SC05F4
SD02F2	SD02F3
VT04F2	VT04F3
VT07D2*	VT07F2
VT07D2*	VT07F3
WY03E1	WY03E2

*Segment is not in the 2018 NSDUH sample but is a duplicate of a segment in the 2018 NSDUH sample.

[a] Original segment is also a duplicate of an earlier segment.

During field enumeration, a small number of segments are switched with another segment in the same SSR and panel due to difficult conditions during the winter months. In general, quarter 1 segments are switched with quarter 2 segments, and quarter 3 segments are switched with quarter 4 segments. Table 3.2 lists the quarter switches in the 2018 NSDUH sample.

Table 3.2 2018 NSDUH Segment Quarter Switches in the Field

Quarters 1 and 2		Quarters 3 and 4	
Original Segment in Quarter 1	**Switched Segment from Quarter 2**	**Original Segment in Quarter 3**	**Switched Segment from Quarter 4**
AK05E1	AK05E2	AK03F3	AK03F4
AK11E1	AK11E2	AK10F3	AK10F4
AK11F1	AK11F2	CO11F3	CO11F4
ID05F1	ID05F2	CO12E3	CO12E4
MT01E1	MT01E2	CO12F3	CO12F4
MT01F1	MT01F2	ID02F3	ID02F4
MT04F1	MT04F2	ID05F3	ID05F4
MT07E1	MT07E2	MT02E3	MT02E4
MT08E1	MT08E2	MT02F3	MT02F4
MT09E1	MT09E2	MT07E3	MT07E4
MT09F1	MT09F2	MT09F3	MT09F4
MT11E1	MT11E2	MT12E3	MT12E4
ND03F1	ND03F2	MT12F3	MT12F4
ND06E1	ND06E2	ND01E3	ND01E4
ND07E1	ND07E2	ND07F3	ND07F4
ND10E1	ND10E2	ND11E3	ND11E4
ND10F1	ND10F2	ND11F3	ND11F4
ND11F1	ND11F2	NM01F3	NM01F4
ND12F1	ND12F2	NM03F3	NM03F4
NM06F1	NM06F2	NM05F3	NM05F4
NV01E1	NV01E2	NM10F3	NM10F4
NV03F1	NV03F2	NV04F3	NV04F4
NV05F1	NV05F2	SD01E3	SD01E4
OR02F1	OR02F2	SD01F3	SD01F4
OR03F1	OR03F2	SD02F3	SD02F4
SD10F1	SD10F2	SD07E3	SD07E4
TX02F1	TX02F2	SD08F3	SD08F4
TX03E1	TX03E2	SD09E3	SD09E4
TX29E1	TX29E2	UT10F3	UT10F4
UT09E1	UT09E2	WA12F3	WA12F4
VA10E1	VA10E2	WV02E3	WV02E4
WA11F1	WA11F2	WY03E3	WY03E4
WV04E1	WV04E2	WY04E3	WY04E4
WY04E1	WY04E2	WY04F3	WY04F4
WY05E1	WY05E2	WY05F3	WY05F4
WY05F1	WY05F2	WY12F3	WY12F4
WY07F1	WY07F2		
WY10F1	WY10F2		

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4. Dwelling Unit (Fourth-Stage) Sample Experience

The process by which the dwelling unit (DU) frame is constructed is called "counting and listing." In summary, a certified lister visits the selected area and lists a detailed and accurate address (or description, if no address is available) for each DU within the segment boundaries. Using a paper-based format, lists of DUs constructed during counting and listing are entered into a database and serve as the frame from which the fourth-stage sample is drawn.

As described in Section 2.2.3, after the DU frame was constructed, the next step was to determine the minimal number of DUs to select for each segment to meet the targeted sample sizes for all age groups. This sample size determination was performed on a quarterly basis to take advantage of both segment differences and, if necessary, make adjustments to design parameters (e.g., to use the most recent response rate experience). Table 4.1 provides the number of DUs that were enumerated during the counting and listing process and the number of DUs that were sampled. After accounting for anticipated screening and interview response rates using historical National Survey on Drug Use and Health (NSDUH) data, an average of 37.72 sample dwelling units (SDUs) were selected per segment. The number of SDUs per segment varied by state according to the state's sample size, number of segments, and anticipated response rates.

Table 4.1 Segment and Dwelling Unit Summary

State	Total Segments	Listed DUs	SDUs	SDUs per Segment	Added DUs	Percent Increase in DUs	Total Selected DUs
Total Population	6,000	1,483,753	226,316	37.72	936	0.41	227,252
Alabama	96	20,623	2,845	29.64	12	0.42	2,857
Alaska	96	19,320	3,256	33.92	37	1.14	3,293
Arizona	96	22,532	2,948	30.71	4	0.14	2,952
Arkansas	96	22,983	2,620	27.29	5	0.19	2,625
California	288	79,234	14,450	50.17	51	0.35	14,501
Colorado	96	21,686	2,932	30.54	8	0.27	2,940
Connecticut	96	21,935	3,430	35.73	12	0.35	3,442
Delaware	96	24,017	4,083	42.53	8	0.20	4,091
District of Columbia	96	30,726	6,907	71.95	34	0.49	6,941
Florida	240	68,788	11,552	48.13	49	0.42	11,601
Georgia	120	31,043	4,336	36.13	1	0.02	4,337
Hawaii	96	23,085	3,944	41.08	27	0.68	3,971
Idaho	96	20,375	2,482	25.85	9	0.36	2,491
Illinois	192	55,220	8,526	44.41	15	0.18	8,541
Indiana	96	21,023	3,258	33.94	17	0.52	3,275
Iowa	96	20,014	3,419	35.61	11	0.32	3,430
Kansas	96	23,730	2,782	28.98	4	0.14	2,786
Kentucky	96	23,478	2,696	28.08	11	0.41	2,707
Louisiana	96	23,042	2,783	28.99	6	0.22	2,789
Maine	96	20,712	3,625	37.76	43	1.19	3,668

See notes at end of table.

(continued)

Table 4.1 Segment and Dwelling Unit Summary (continued)

State	Total Segments	Listed DUs	SDUs	SDUs per Segment	Added DUs	Percent Increase in DUs	Total Selected DUs
Maryland	96	25,799	3,249	33.84	16	0.49	3,265
Massachusetts	96	23,645	3,304	34.42	20	0.61	3,324
Michigan	192	53,232	7,882	41.05	27	0.34	7,909
Minnesota	96	22,266	2,614	27.23	8	0.31	2,622
Mississippi	96	23,378	2,492	25.96	1	0.04	2,493
Missouri	96	21,223	3,054	31.81	3	0.10	3,057
Montana	96	19,841	4,114	42.85	55	1.34	4,169
Nebraska	96	21,322	2,593	27.01	12	0.46	2,605
Nevada	96	23,554	2,799	29.16	3	0.11	2,802
New Hampshire	96	20,776	3,555	37.03	35	0.98	3,590
New Jersey	120	34,148	5,542	46.18	21	0.38	5,563
New Mexico	96	20,425	3,025	31.51	0	0.00	3,025
New York	240	65,876	14,263	59.43	82	0.57	14,345
North Carolina	120	35,563	4,418	36.82	6	0.14	4,424
North Dakota	96	19,779	3,659	38.11	5	0.14	3,664
Ohio	192	52,201	7,972	41.52	21	0.26	7,993
Oklahoma	96	20,926	3,176	33.08	10	0.31	3,186
Oregon	96	22,016	3,575	37.24	30	0.84	3,605
Pennsylvania	192	53,309	9,137	47.59	45	0.49	9,182
Rhode Island	96	22,943	3,735	38.91	6	0.16	3,741
South Carolina	96	21,308	2,771	28.86	8	0.29	2,779
South Dakota	96	19,072	2,885	30.05	9	0.31	2,894
Tennessee	96	21,077	2,568	26.75	7	0.27	2,575
Texas	240	67,475	7,674	31.98	16	0.21	7,690
Utah	96	20,250	1,866	19.44	10	0.54	1,876
Vermont	96	21,861	3,990	41.56	55	1.38	4,045
Virginia	120	33,378	4,924	41.03	16	0.32	4,940
Washington	96	21,722	2,767	28.82	11	0.40	2,778
West Virginia	96	21,342	3,767	39.24	8	0.21	3,775
Wisconsin	96	20,618	3,195	33.28	10	0.31	3,205
Wyoming	96	19,862	2,877	29.97	16	0.56	2,893

DU = dwelling unit; SDU = sample dwelling unit.

To compensate for quarterly variations in response rates and yields, a sample partitioning procedure was implemented in all quarters. The entire sample of DUs still would be selected, but only certain percentages of the total would be released into the field. An initial percentage would be released in all segments at the beginning of the quarter. Based on interquarter work projections, additional percentages would be released 1 month into the quarter as needed and if field staff could handle the added workload. Each partitioning of the sample is a valid sample and helps manage the sample sizes by state without jeopardizing the validity of the study. Incidentally, a reserve DU sample of 20 percent also was selected within each selected segment, over and above the required quarterly sample, to allow for supplemental releases within each quarter. These releases usually occur as a result of lower than expected response rates, but are also released for other reasons, including a large percentage of sample in controlled access areas and in college dormitories that are vacant during the summer months. In previous years, additional sample has also been released to compensate for sample lost to natural disasters and other emergency situations (e.g., following Hurricanes Katrina and Rita). Sample releases are made at the state level and do not target any particular age group. In each quarter, the DU sample was allocated out to states in the following release percentages:

Release 1: 67 percent of entire sample (80/120, main sample + 20 percent reserve);
Release 2: 4 percent of entire sample (5/120, main sample + 20 percent reserve);
Release 3: 4 percent of entire sample (5/120, main sample + 20 percent reserve);
Release 4: 8 percent of entire sample (10/120, main sample + 20 percent reserve);
Release 5: 8 percent of entire sample (10/120, main sample + 20 percent reserve); and
Release 6: 8 percent of entire sample (10/120, main sample + 20 percent reserve).

As described in the 2018 NSDUH sample design report (Center for Behavioral Health Statistics and Quality [CBHSQ], 2019a), a weight adjustment is applied to all DUs within a segment to account for the partial release of sample. The DU release adjustment is equal to the inverse of the percentage of the sample that is released into the field. A summary of the quarterly sample sizes and percentages released is provided in Table 4.2. If the release plan was implemented with no changes, a percentage equal to 100/120 or 83.3 percent would be expected.

To ensure that nearly all DUs had a chance of selection and to minimize bias associated with incomplete frames, a check for missed DUs was implemented at most sampled DUs.[18] During the screening interview, the field interviewer (FI) asked the screening respondent about other units on the property of the sampled DU (e.g., a garage apartment). When found on the property of a sampled DU, the unlisted units became part of the sample (added DUs) and were considered "linked" to that DU. If the number of added DUs linked to any particular sample DU did not exceed 5, and if the number for the entire segment was less than or equal to 10, FIs were instructed to consider these DUs as part of their assignments. If either of these limits was exceeded, special subsampling procedures were implemented (see the 2018 NSDUH sample design report; CBHSQ, 2019a).

In addition to checking for missed DUs at each sampled DU, interviewers were instructed to call their supervisors if they noticed large differences in the segment listing and what they encountered in the field. If an FI identified 150 or more missed DUs in a segment or 50 or more missed DUs following any DU, special "bust" procedures were implemented to minimize bias associated with large numbers of missed DUs. The bust procedures involve selecting a subsample of the missed DUs and adding them to the interviewer's assignment; these procedures are described in more detail in the 2018 NSDUH sample design report (CBHSQ, 2019a). The total number of added DUs identified during the screening interview or added through the bust procedures is summarized in Table 4.1. Overall, a 0.41 percent increase in sample was realized through the check for missed DUs. Larger increases (more than 1 percent) in sample were realized in the states of Alaska, Maine, Montana, and Vermont. In Alaska, a large number of DUs were difficult or impossible to see during the listing stage (e.g., DUs on large properties or multiple units within a single structure). In rural Montana, several missed housing units were found on the land behind the main housing unit. The Northeast states typically had a large number of garage apartments and single-family homes converted into multiple units. The added DU information in Table 4.1 will be used in the sample size calculations for future NSDUHs.

[18] The screening respondent was not asked about other units on the property or within the sampled DU in apartment buildings and other multiunit structures.

Table 4.2 Quarterly Dwelling Unit Sample Sizes and Percentages Released

Region/State	Quarter 1			Quarter 2		
	# Selected	# Released	Percent	# Selected	# Released	Percent
Total Population	62,471	52,023	83.28	68,536	61,577	89.85
Northeast	14,406	12,002	83.31	15,218	13,753	90.37
Connecticut	924	777	84.09	984	900	91.46
Maine	950	795	83.68	997	916	91.88
Massachusetts	992	824	83.06	1,155	964	83.46
New Hampshire	1,102	914	82.94	1,080	1,080	100.00
New Jersey	1,604	1,336	83.29	1,705	1,495	87.68
New York	4,207	3,501	83.22	4,341	3,984	91.78
Pennsylvania	2,399	2,000	83.37	2,606	2,500	95.93
Rhode Island	965	808	83.73	1,096	868	79.20
Vermont	1,263	1,047	82.90	1,254	1,046	83.41
Midwest	13,686	11,387	83.20	15,183	14,551	95.84
Illinois	2,143	1,780	83.06	2,505	2,298	91.74
Indiana	847	707	83.47	1,007	966	95.93
Iowa	811	674	83.11	970	970	100.00
Kansas	656	545	83.08	758	758	100.00
Michigan	2,161	1,807	83.62	2,370	2,370	100.00
Minnesota	729	607	83.26	821	821	100.00
Missouri	863	719	83.31	921	883	95.87
Nebraska	728	602	82.69	804	736	91.54
North Dakota	965	802	83.11	976	815	83.50
Ohio	2,075	1,719	82.84	2,228	2,226	99.91
South Dakota	737	617	83.72	818	789	96.45
Wisconsin	971	808	83.21	1,005	919	91.44
South	20,608	17,166	83.30	22,673	19,448	85.78
Alabama	874	730	83.52	1,005	792	78.81
Arkansas	806	672	83.37	822	755	91.85
Delaware	1,072	892	83.21	1,244	1,089	87.54
District of Columbia	2,044	1,701	83.22	2,192	1,825	83.26
Florida	3,416	2,846	83.31	3,628	2,871	79.13
Georgia	1,240	1,035	83.47	1,423	1,186	83.35
Kentucky	775	642	82.84	810	706	87.16
Louisiana	758	642	84.70	895	671	74.97
Maryland	943	786	83.35	986	906	91.89
Mississippi	744	621	83.47	810	746	92.10
North Carolina	1,184	983	83.02	1,262	1,210	95.88
Oklahoma	841	700	83.23	1,042	998	95.78
South Carolina	715	594	83.08	838	698	83.29
Tennessee	789	654	82.89	817	579	70.87
Texas	2,129	1,773	83.28	2,342	2,045	87.32
Virginia	1,311	1,090	83.14	1,512	1,326	87.70
West Virginia	967	805	83.25	1,045	1,045	100.00
West	13,771	11,468	83.28	15,462	13,825	89.41
Alaska	973	813	83.56	1,008	880	87.30
Arizona	732	609	83.20	882	769	87.19
California	3,830	3,197	83.47	4,394	3,844	87.48
Colorado	807	672	83.27	920	766	83.26
Hawaii	1,030	855	83.01	1,146	1,128	98.43
Idaho	692	575	83.09	757	664	87.71
Montana	971	807	83.11	1,197	1,197	100.00
Nevada	752	625	83.11	865	865	100.00
New Mexico	909	755	83.06	1,015	802	79.01
Oregon	1,001	835	83.42	1,045	915	87.56
Utah	465	387	83.23	526	502	95.44
Washington	828	691	83.45	888	813	91.55
Wyoming	781	647	82.84	819	680	83.03

(continued)

Table 4.2 Quarterly Dwelling Unit Sample Sizes and Percentages Released (continued)

Region/State	Quarter 3			Quarter 4		
	# Selected	# Released	Percent	# Selected	# Released	Percent
Total Population	65,743	56,857	86.48	64,494	55,859	86.61
Northeast	14,756	12,836	86.99	14,310	11,990	83.79
Connecticut	1,078	1,034	95.92	954	719	75.37
Maine	1,046	960	91.78	1,039	954	91.82
Massachusetts	1,113	745	66.94	1,023	771	75.37
New Hampshire	1,103	870	78.88	879	691	78.61
New Jersey	1,658	1,315	79.31	1,680	1,396	83.10
New York	4,246	3,707	87.31	4,097	3,071	74.96
Pennsylvania	2,388	2,289	95.85	2,348	2,348	100.00
Rhode Island	1,117	1,073	96.06	1,190	986	82.86
Vermont	1,007	843	83.71	1,100	1,054	95.82
Midwest	14,892	12,833	86.17	15,119	13,068	86.43
Illinois	2,538	1,908	75.18	2,648	2,540	95.92
Indiana	959	834	86.97	1,003	751	74.88
Iowa	930	853	91.72	922	922	100.00
Kansas	808	808	100.00	700	671	95.86
Michigan	2,358	1,871	79.35	2,311	1,834	79.36
Minnesota	810	675	83.33	765	511	66.80
Missouri	895	818	91.40	804	634	78.86
Nebraska	655	493	75.27	796	762	95.73
North Dakota	925	925	100.00	1,221	1,117	91.48
Ohio	2,201	2,106	95.68	2,200	1,921	87.32
South Dakota	793	694	87.52	818	785	95.97
Wisconsin	1,020	848	83.14	931	620	66.60
South	21,653	18,516	85.51	20,699	17,731	85.66
Alabama	869	581	66.86	774	742	95.87
Arkansas	706	556	78.75	760	637	83.82
Delaware	1,353	1,298	95.93	1,207	804	66.61
District of Columbia	2,021	1,765	87.33	1,945	1,616	83.08
Florida	3,799	3,009	79.21	3,569	2,826	79.18
Georgia	1,263	945	74.82	1,272	1,170	91.98
Kentucky	781	584	74.78	833	764	91.72
Louisiana	828	689	83.21	888	781	87.95
Maryland	814	747	91.77	883	810	91.73
Mississippi	747	561	75.10	715	564	78.88
North Carolina	1,253	1,202	95.93	1,161	1,023	88.11
Oklahoma	1,029	895	86.98	823	583	70.84
South Carolina	817	643	78.70	870	836	96.09
Tennessee	754	722	95.76	702	613	87.32
Texas	2,178	2,000	91.83	2,024	1,856	91.70
Virginia	1,492	1,370	91.82	1,305	1,138	87.20
West Virginia	949	949	100.00	968	968	100.00
West	14,442	12,672	87.74	14,366	13,070	90.98
Alaska	958	754	78.71	809	809	100.00
Arizona	845	737	87.22	833	833	100.00
California	4,095	3,588	87.62	4,174	3,821	91.54
Colorado	779	746	95.76	782	748	95.65
Hawaii	1,110	1,011	91.08	1,015	950	93.60
Idaho	832	622	74.76	647	621	95.98
Montana	1,081	1,061	98.15	1,140	1,049	92.02
Nevada	792	726	91.67	825	583	70.67
New Mexico	833	664	79.71	804	804	100.00
Oregon	996	873	87.65	1,087	952	87.58
Utah	562	495	88.08	551	482	87.48
Washington	778	647	83.16	826	616	74.58
Wyoming	781	748	95.77	873	802	91.87

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5. Person (Fifth-Stage) Sample Experience

Compared with previous designs, the 2014 through 2022 National Survey on Drug Use and Health (NSDUH) design places more sample in the 26 or older age groups to estimate substance use and related mental health measures more accurately among the aging drug-using population. As noted previously, the target national sample size of 67,507 was distributed across five age groups as follows: 25 percent for youths aged 12 to 17, 25 percent for young adults aged 18 to 25, 15 percent for adults aged 26 to 34, 20 percent for adults aged 35 to 49, and 15 percent for adults aged 50 or older. Further, the sample was designed to yield minimum sample sizes in each state as described in Section 2.2.1. Table 5.1 displays the desired and achieved sample yields by age group and state. In general, the sample allocation and sample size management procedures were effective at achieving the numerous sample size targets.

Table 5.1 Yields, by Age Group and State

Age Group and State	Targeted	Achieved	Percent Difference
Total	67,507	67,791	0.42
12-17	16,877	16,852	-0.15
18-25	16,877	16,711	-0.98
26-34	10,126	10,092	-0.34
35-49	13,501	13,916	3.07
50+	10,126	10,220	0.93
Alabama	960	935	-2.60
Alaska	960	952	-0.83
Arizona	960	871	-9.27
Arkansas	960	999	4.06
California	4,560	4,540	-0.44
Colorado	960	955	-0.52
Connecticut	960	1,006	4.79
Delaware	960	985	2.60
District of Columbia	960	975	1.56
Florida	3,300	3,462	4.91
Georgia	1,500	1,488	-0.80
Hawaii	967	1,045	8.07
Kauai County	67	76	13.43
Remainder of Hawaii	900	969	7.67
Idaho	960	944	-1.67
Illinois	2,400	2,372	-1.17
Indiana	960	996	3.75
Iowa	960	959	-0.10
Kansas	960	960	0.00
Kentucky	960	972	1.25
Louisiana	960	1,006	4.79
Maine	960	967	0.73

(continued)

Table 5.1 Yields, by Age Group and State (continued)

Age Group and State	Targeted	Achieved	Percent Difference
Maryland	960	936	-2.50
Massachusetts	960	963	0.31
Michigan	2,400	2,431	1.29
Minnesota	960	928	-3.33
Mississippi	960	980	2.08
Missouri	960	980	2.08
Montana	960	972	1.25
Nebraska	960	966	0.63
Nevada	960	986	2.71
New Hampshire	960	956	-0.42
New Jersey	1,500	1,511	0.73
New Mexico	960	936	-2.50
New York	3,300	3,269	-0.94
North Carolina	1,500	1,451	-3.27
North Dakota	960	965	0.52
Ohio	2,400	2,465	2.71
Oklahoma	960	964	0.42
Oregon	960	994	3.54
Pennsylvania	2,400	2,383	-0.71
Rhode Island	960	937	-2.40
South Carolina	960	933	-2.81
South Dakota	960	941	-1.98
Tennessee	960	948	-1.25
Texas	3,300	3,307	0.21
Utah	960	1,001	4.27
Vermont	960	947	-1.35
Virginia	1,500	1,516	1.07
Washington	960	957	-0.31
West Virginia	960	960	0.00
Wisconsin	960	969	0.94
Wyoming	960	950	-1.04

Some unique challenges arose with the increase in sample allocated to the 26 or older age groups. Respondents in these age groups are more challenging to find at home and persuade to take the time to participate in the study. In 2018, the unweighted interview response rate was 73.39 percent for individuals aged 12 to 17, 68.59 percent for individuals aged 18 to 25, and 66.10 percent for individuals aged 26 or older (Center for Behavioral Health Statistics and Quality [CBHSQ], 2019b). Within the 26 or older age group, individuals aged 50 or older had the lowest unweighted interview response rate (65.57 percent). The higher percentage of respondents within the 26 or older age group required more visits to attempt completion of pending cases and for refusal conversion efforts. Anecdotally, individuals aged 50 or older are more likely to live in controlled access situations, making it more challenging to complete screening and interviewing for these cases.

In addition to the shift in sample to the older age groups, a new pair sampling parameter was selected for the 2014 through 2022 NSDUHs. The pair sampling algorithm in NSDUH is

based on the Chromy and Penne (2002) adaptation of the Brewer (1963, 1975) method for selecting samples of size 2 as a means of selecting samples of 0, 1, or 2 people within a selected dwelling unit (DU) containing at least 1 eligible person. Chromy and Penne's adaptation includes a pair sampling parameter, λ, that governs the number of pairs selected. Simulation analyses resulted in the selection of $\lambda = 0.50$ for the 2002 to 2013 NSDUH sample designs because this selection increased the number of pairs by about 20 percent (relative to the selection of $\lambda = 0.00$) with only a moderate impact on the response rates by age group.

For the 2014 through 2022 NSDUHs, simulation analyses based on the 2012 screening data, modified to reflect the 2014 through 2022 age group sample proportions, were conducted, and $\lambda = 0.25$ was selected (CBHSQ, 2017). As a result, fewer pairs were projected to be selected in the 2014 through 2022 NSDUHs than were selected in the 2002 through 2013 NSDUHs. However, as a result of increasing the older adult sample, a lambda value of 0.25 yielded a large projected number of adolescent-adult pairs in 2014 through 2022 when compared with earlier years.

Prior to the 2018 NSDUH, pair projection models were updated using 2016 screening data. Tables 5.2 and 5.3 provide projected and observed pair selection counts and response rates, respectively, by age group pairs for the three age groups: 12 to 17, 18 to 25, and 26 or older. Observed selection counts in 2018 were larger than their projected counterparts overall and in most age group pairs. This is partially because the observed counts are based on an overall sample of 67,791 interviews and the projected counts were normalized to yield 67,507 interviews. Further, response rates were lower than anticipated, requiring more selections to achieve the desired sample.

Table 5.2 Projected and Observed Pair Selection Counts, by Age Group Pairs (Three Age Groups: 12 to 17, 18 to 25, and 26 or Older)

Age Group Pair	2018 Projected Count ($\lambda = 0.25$)	2018 Observed Count ($\lambda = 0.25$)
12+, 12+	28,126	29,063
12-17, 12-17	3,233	3,296
12-17, 18-25	2,571	2,680
12-17, 26+	8,182	8,299
18-25, 18-25	3,930	4,381
18-25, 26+	4,844	5,026
26+, 26+	5,367	5,381

Note: Projected pair selection counts are based on 2016 NSDUH screening data.

Source: SAMHSA, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2016 and 2018.

Table 5.3 Projected and Observed Pair Response Rates, by Age Group Pairs (Three Age Groups: 12 to 17, 18 to 25, and 26 or Older)

Age Group Pair	2018 Projected Response Rate ($\lambda = 0.25$)	2018 Observed Response Rate ($\lambda = 0.25$)
12+, 12+	63.7	59.9
12-17, 12-17	74.6	71.3
12-17, 18-25	69.6	65.8
12-17, 26+	67.2	64.3
18-25, 18-25	63.5	58.2
18-25, 26+	58.1	53.4
26+, 26+	53.9	50.8

Note: Projected pair response rates are based on 2016 NSDUH screening data.
Note: Observed response rates are based on questionnaire age.
Note: A pair response requires both members of the age group pair to respond.
Source: SAMHSA, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2016 and 2018.

Departures from the planned sample sizes occur for several reasons, including sampling variability, access problems (e.g., in gated communities or college dormitories), and departures from expected response rates. Table 5.4 provides weighted screening and interview response rates by state for the 2018 NSDUH.[19] These rates will be used to fine-tune the sample size calculations for the 2019 NSDUH.

[19] The NSDUH screening response rate is calculated using the American Association for Public Opinion Research (AAPOR) Response Rate 1 (RR1), and the interview response rate is calculated using AAPOR's Response Rate 2 (RR2) (AAPOR, 2016, p. 61).

Table 5.4 Weighted Screening and Interview Response Rates, by State

State	Total Selected DUs	Total Eligible DUs	Weighted DU Eligibility Rate	Total Completed Screeners	Weighted DU Screening Response Rate	Total Selected	Total Respondents	Weighted Interview Response Rate	Weighted Overall Response Rate
Overall	227,252	193,456	85.08	141,879	73.30	99,111	67,791	66.56	48.79
Alabama	2,857	2,288	80.01	1,934	84.30	1,279	935	68.29	57.57
Alaska	3,293	2,483	72.22	1,841	73.06	1,357	952	69.79	50.99
Arizona	2,952	2,342	79.10	1,597	67.92	1,192	871	72.09	48.96
Arkansas	2,625	2,133	81.52	1,874	87.81	1,313	999	72.96	64.07
California	14,501	13,463	92.56	8,605	63.83	7,275	4,540	60.01	38.31
Colorado	2,940	2,476	83.66	1,894	76.09	1,376	955	66.22	50.39
Connecticut	3,442	3,095	90.04	2,129	68.72	1,639	1,006	58.45	40.17
Delaware	4,091	3,375	72.87	2,310	67.60	1,498	985	64.29	43.46
District of Columbia	6,941	5,945	85.01	3,555	56.25	1,301	975	71.25	40.08
Florida	11,601	9,609	78.02	6,989	71.78	4,839	3,462	69.51	49.89
Georgia	4,337	3,695	84.51	2,825	76.42	2,049	1,488	69.76	53.31
Hawaii	3,971	3,397	85.12	2,238	65.50	1,564	1,045	66.18	43.35
Idaho	2,491	2,169	85.09	1,744	80.50	1,300	944	72.87	58.66
Illinois	8,541	7,496	87.69	4,678	62.39	3,846	2,372	60.38	37.67
Indiana	3,275	2,846	86.95	1,986	69.91	1,401	996	69.94	48.90
Iowa	3,430	2,932	85.27	2,300	78.60	1,450	959	66.79	52.50
Kansas	2,786	2,283	81.76	1,769	77.42	1,355	960	69.24	53.60
Kentucky	2,707	2,225	81.96	1,806	81.13	1,433	972	65.55	53.18
Louisiana	2,789	2,243	80.32	1,943	86.64	1,338	1,006	72.27	62.61
Maine	3,668	2,800	74.71	2,280	81.43	1,430	967	69.04	56.22
Maryland	3,265	2,937	89.84	2,003	68.43	1,303	936	71.16	48.70
Massachusetts	3,324	3,053	91.69	2,175	71.18	1,536	963	62.81	44.71
Michigan	7,909	6,674	83.45	5,152	77.15	3,450	2,431	68.37	52.75
Minnesota	2,622	2,279	86.06	1,742	75.83	1,313	928	69.94	53.04
Mississippi	2,493	2,043	81.74	1,767	86.42	1,347	980	68.97	59.60
Missouri	3,057	2,494	79.37	2,079	83.33	1,316	980	73.23	61.03
Montana	4,169	3,404	81.22	2,702	79.37	1,468	972	66.79	53.01
Nebraska	2,605	2,310	88.77	1,818	79.04	1,377	966	71.76	56.72

(continued)

Table 5.4 Weighted Screening and Interview Response Rates by State (continued)

State	Total Selected DUs	Total Eligible DUs	Weighted DU Eligibility Rate	Total Completed Screeners	Weighted DU Screening Response Rate	Total Selected	Total Respondents	Weighted Interview Response Rate	Weighted Overall Response Rate
Nevada	2,802	2,527	89.08	1,713	67.09	1,394	986	69.80	46.83
New Hampshire	3,590	2,965	81.90	2,275	76.64	1,444	956	63.60	48.74
New Jersey	5,563	4,967	81.23	3,346	66.33	2,442	1,511	59.89	39.72
New Mexico	3,025	2,232	72.32	1,871	84.11	1,240	936	72.21	60.74
New York	14,345	12,675	88.13	7,485	57.98	5,187	3,269	59.54	34.53
North Carolina	4,424	3,748	84.79	2,814	75.08	2,076	1,451	67.96	51.02
North Dakota	3,664	2,954	79.53	2,442	82.88	1,499	965	64.20	53.21
Ohio	7,993	6,914	86.50	5,247	75.88	3,697	2,465	64.76	49.14
Oklahoma	3,186	2,627	83.14	2,015	76.27	1,461	964	65.72	50.12
Oregon	3,605	3,176	87.92	2,425	76.13	1,494	994	65.92	50.19
Pennsylvania	9,182	7,834	85.47	5,819	74.26	3,521	2,383	66.28	49.22
Rhode Island	3,741	3,274	87.34	2,239	68.40	1,417	937	66.92	45.77
South Carolina	2,779	2,336	84.10	1,764	75.57	1,227	933	76.25	57.62
South Dakota	2,894	2,391	81.58	1,943	81.71	1,336	941	71.30	58.27
Tennessee	2,575	2,185	84.70	1,829	83.76	1,327	948	67.85	56.83
Texas	7,690	6,471	84.07	5,270	81.44	4,459	3,307	71.72	58.41
Utah	1,876	1,679	89.53	1,445	86.06	1,341	1,001	73.68	63.41
Vermont	4,045	3,112	76.70	2,424	78.01	1,459	947	67.70	52.81
Virginia	4,940	4,279	86.31	3,328	77.74	2,146	1,516	70.04	54.45
Washington	2,778	2,477	89.34	1,950	78.63	1,431	957	65.26	51.32
West Virginia	3,775	3,052	80.90	2,341	76.78	1,533	960	61.22	47.01
Wisconsin	3,205	2,746	85.73	2,230	81.20	1,398	969	67.50	54.81
Wyoming	2,893	2,346	80.88	1,929	82.17	1,237	950	71.84	59.03

DU = dwelling unit.

6. Sampling Error

6.1 Computation of Relative Standard Errors and Design Effects

Several objectives were set for calculating relative standard errors (RSEs) and design effects (DEFFs) for the 2018 National Survey on Drug Use and Health (NSDUH). One objective was to provide a mechanism for comparing the expected precision of the 2018 design with the precision actually obtained. A second objective was to have a record of the magnitudes of the DEFFs for a future redesign of the survey.

The RSE of a domain *d* prevalence estimate $\hat{p}_d$ is the standard error (SE) of the estimate divided by the estimate, that is,

$$RSE(\hat{p}_d) = SE(\hat{p}_d) / \hat{p}_d \cdot \tag{1}$$

The DEFF for a prevalence estimate is its variance divided by the variance that would be observed if simple random sampling (SRS) had been used:

$$DEFF(d) = \frac{\mathrm{VAR}(\hat{p}_d)}{\mathrm{VAR}_{\mathrm{SRS}}(\hat{p}_d)}. \tag{2}$$

Hence, the SE of the estimated prevalence can be approximated as follows:

$$SE(\hat{p}_d) \cong [DEFF(d)\hat{p}_d(1-\hat{p}_d)/n_d]^{1/2}, \tag{3}$$

where $DEFF(d)$ and n_d are the median (or mean, as the case may be) DEFF and sample size of domain *d*, respectively.

As noted previously, the DEFF is the ratio of the design-based variance estimate divided by the variance estimate that would have been obtained from an SRS of the same size. Therefore, the DEFF summarizes the effects of stratification, clustering, and unequal weighting on the variance of a complex sample design. Because clustering and unequal weighting are expected to increase the variance and generally dominate the stratification effect, the DEFF is expected to be greater than 1 in most instances. However, DEFFs were sometimes less than 1 for prevalence rates near 0.

Note that the DEFF is based on the with-replacement (wr) variance estimate as obtained from SUDAAN, which properly accounts for clustering, stratification, and unequal weighting (RTI International, 2013). Prior to the 2000 survey, a more complex method of variance estimation was used; however, it was decided that only the standard SUDAAN wr SE, based on the primary sampling unit (PSU), would be used for the sake of simpler interpretation and for easier computation of the SE of functions of estimates, such as differences and ratios.
A description of the previous method of variance estimation can be found in the 1999 National

Household Survey on Drug Abuse (NHSDA) sampling error report (Wheeless, Gordek, & Singh, 2001).

Also note that, prior to 2004, the SEs were applied directly from SUDAAN to only a subset of tables. Since then, the process changed so that the decision about which method of calculation would be used for the SEs of estimated totals was made at the estimate level (e.g., the cell level) rather than at the marginal table level. In this way, the estimated totals would have consistent values for their variances throughout all of the reported tables. A specific set of domains used as covariates in the poststratification step of the NSDUH weighting process were designated as the "controlled" domains. The SEs reported for estimates from these domains would be based on the original method. Estimates from all other domains would include the SEs directly from the SUDAAN calculation. A more detailed discussion of the 2004 change in SE reporting can be found in Section 3.2.1 of Chapter 3 in the 2018 NSDUH's methodological summary and definitions report (Center for Behavioral Health Statistics and Quality [CBHSQ], 2019c).

DEFFs associated with prevalence estimates below 0.00005 or greater than or equal to 0.99995 (an ad hoc rule representing 0 or 1 in practice) or prevalence estimates exhibiting low precision were not used for determining the medians. To identify estimates with low precision, the suppression rule used in earlier years was applied. Specifically, DEFFs or the corresponding prevalence estimates were not included if the corresponding RSE of $-\ln(\hat{p})$ satisfies

$$RSE[-\ln(\hat{p})] > 0.175 \text{ when } \hat{p} \le 0.5$$

or

$$RSE[-\ln(1-\hat{p})] > 0.175 \text{ when } \hat{p} > 0.5.$$

Another way to identify estimates with potentially low precision is to find estimates where the nominal sample size is under 100 or the effective sample size is under 68. The effective sample size is defined as follows:

$$Effective\ n = \frac{n}{deff} = \frac{\hat{p}(1-\hat{p})}{[SE(\hat{p})]^2}.$$

This equation is part of the standard suppression rule that is used in the reporting of NSDUH estimates. See the 2018 NSDUH statistical inference report for more information (CBHSQ, in press).

It may be noted that, for a given sample size, the RSE increases as $\hat{p}$ decreases, and for a given $\hat{p}$, it increases as the sample size decreases. The above discussion pertains to $\hat{p} < 0.5$. Although the RSE of $\hat{p}$ is not symmetric about $\hat{p} = 0.5$, it makes logical sense for precision requirements to be identical for $\hat{p}$ and $1-\hat{p}$. Therefore, it is convenient to use the convention that the suppression rule for $\hat{p} < 0.5$ also applies for $\hat{p} > 0.5$ by replacing $\hat{p}$ with $1-\hat{p}$.

6.2 Derivation of the Approximation for the RSE of a Prevalence Estimate's Negative Natural Logarithm

Define the first-order Taylor series of a function, $f\left(\hat{\theta}\right)$, about a point, θ, as

$$f\left(\hat{\theta}\right) \cong f\left(\theta\right) + \left[df\left(\hat{\theta}\right) / d\hat{\theta} \right]_{\hat{\theta}=\theta} \left(\hat{\theta} - \theta\right),$$

then $\left[f\left(\hat{\theta}\right) - f\left(\theta\right) \right] \cong \left[df\left(\hat{\theta}\right) \Big/ d\hat{\theta} \right]_{\hat{\theta}=\theta} \left(\hat{\theta} - \theta\right)$. If $E\left(\hat{\theta}\right) = \theta$, then

$$Var\left[f\left(\hat{\theta}\right) \right] = E\left[f\left(\hat{\theta}\right) - f\left(\theta\right) \right]^2 \cong \left[df\left(\hat{\theta}\right) \Big/ d\hat{\theta} \right]^2_{\hat{\theta}-\theta} Var\left(\hat{\theta}\right),$$

where $Var\left(\hat{\theta}\right) = E\left(\hat{\theta} - \theta\right)^2$.

Let

$$\hat{\theta} = \hat{p} \quad f(\hat{\theta}) = -\ln(\hat{p}) \quad d\ln(\hat{p}) / d\hat{p} = -1 \Big/ \hat{p},$$

then the approximation of the variance would be

$$Var[-\ln(\hat{p})] \cong Var(\hat{p}) \div (-\hat{p})^2 = [RSE(\hat{p})]^2,$$

and the approximation of the relative variance could be shown as

$$Relvar[-\ln(\hat{p})] \cong [RSE(\hat{p})]^2 \div [-\ln(\hat{p})]^2.$$

Taking the square root of both sides of the equation leads to the approximation of $RSE[-\ln(\hat{p})]$ as

$$RSE[-\ln(\hat{p})] \cong RSE(\hat{p}) \div [-\ln(\hat{p})].$$

The derivation of $RSE[-\ln(1-\hat{p})]$ follows a similar set of steps.

6.3 Comparison of Observed Precision with Expected Precision

In this chapter, benchmarks from the 2018 NSDUH design process are compared with the estimated achieved precision of important outcome measures. These benchmarks are the predicted precision that the statisticians anticipated during the design of the survey.

Using 2016 NSDUH data, predicted precision requirements for the 2018 designs were specified in terms of targeted RSEs and minimum sample sizes. To obtain the targeted RSEs, RSEs were computed for 25 measures of interest for specific domains of interest. These 25 key NSDUH outcomes that the sample design optimization for the 2018 NSDUH was based on included recency-of-use estimates for both illicit and licit drugs, dependence on alcohol and illicit drug use, treatment for substance abuse, and mental health issues. Specifically, the

following outcomes were used for 2018 (variable names on the NSDUH data files are in parentheses):

- alcohol use in the past month (ALCMON),
- binge alcohol use in the past month (BNGDRKMON),
- marijuana use in the past month (MRJMON),
- cigarette use in the past month (CIGMON),
- misuse of a pain reliever in the past month (PNRNMMON),
- alcohol use disorder in the past year (ABODALC),
- illicit drug use disorder in the past year (UDPYILL),
- alcohol use disorder or illicit drug use disorder in the past year (UDPYILAL),
- specialty substance use treatment in the past year (TXYRSPILAL),
- serious mental illness (SMI) in the past year (SMIYR_U), and
- major depressive episode (MDE) in the past year (AMDEYR).

Table 6.1 shows a comparison of the projected and observed RSEs for the 25 outcomes from the 2018 sample design report's specified domain breakdowns (CBHSQ, 2019a).

6.3.1 Sample and Precision Requirements

Initial sample requirements for the 2018 NSDUH were defined in terms of the following:

- minimum sample sizes of 4,560 completed interviews in California; 3,300 completed interviews each in Florida, New York, and Texas; 2,400 completed interviews each in Illinois, Michigan, Ohio, and Pennsylvania; 1,500 completed interviews each in Georgia, New Jersey, North Carolina, and Virginia; 967 completed interviews in Hawaii; and 960 completed interviews in each of the remaining 37 states and the District of Columbia; and
- allocation to age groups as follows: 25 percent for youths aged 12 to 17, 25 percent for young adults aged 18 to 25, 15 percent for adults aged 26 to 34, 20 percent for adults aged 35 to 49, and 15 percent for adults aged 50 or older.

The 1999 sample was the first to reflect the objective of the Substance Abuse and Mental Health Services Administration (SAMHSA) to develop more reliable national estimates and representative state-level estimates using small area estimation (SAE) and direct estimation procedures. To achieve this objective in 2018, the targeted sample size by state was set to be at least 960 completed interviews. In 13 states, the target was set at greater than 960 completed interviews. The larger overall sample made it possible to get adequate precision for Hispanic and non-Hispanic black or African-American populations without any targeted oversampling of high concentration areas of these populations or any oversampling through screening for these populations.

Table 6.1 Comparisons of Projected and Observed Relative Standard Errors and Sample Sizes for Key Outcome Measures, by Demographic Domain

Data File Variable Name	Measure	Domain	2018 Prevalence	Projected RSE (2018)	2018 RSE	Relative Change in RSE[1]	Expected Sample Size (2018)	2018 Sample Size	Relative Change in Sample Size[2]
ALCMON	Past Month Alcohol Use	12+	0.5108	0.0069	0.0072	0.0419	67,507	67,791	0.0042
ALCMON	Past Month Alcohol Use	12-20	0.1883	0.0158	0.0222	0.4080	23,044	23,078	0.0015
ALCMON	Past Month Alcohol Use	50+	0.5017	0.0126	0.0135	0.0737	10,126	10,297	0.0169
ALCMON	Past Month Alcohol Use	API, 12+	0.3905	0.0428	0.0394	-0.0785	3,891	3,440	-0.1159
ALCMON	Past Month Alcohol Use	AIAN, 12+	0.3590	0.0801	0.1007	0.2576	763	835	0.0944
ALCMON	Past Month Alcohol Use	Pregnant, 12-44	0.0990	0.2241	0.1470	-0.3439	775	857	0.1058
BNGDRKMON	Past Month Binge Alcohol Use	18-25	0.3489	0.0129	0.0147	0.1415	16,877	16,561	-0.0187
BNGDRKMON	Past Month Binge Alcohol Use	12+	0.2450	0.0111	0.0105	-0.0557	67,507	67,791	0.0042
MRJMON	Past Month Marijuana Use	12+	0.1011	0.0184	0.0195	0.0573	67,507	67,791	0.0042
MRJMON	Past Month Marijuana Use	12-17	0.0666	0.0387	0.0379	-0.0219	16,877	16,820	-0.0034
MRJMON	Past Month Marijuana Use	18-25	0.2212	0.0199	0.0212	0.0649	16,877	16,561	-0.0187
MRJMON	Past Month Marijuana Use	50+	0.0489	0.0573	0.0630	0.0999	10,126	10,297	0.0169
MRJMON	Past Month Marijuana Use	API, 12+	0.0570	0.1080	0.1293	0.1976	3,891	3,440	-0.1159
MRJMON	Past Month Marijuana Use	AIAN, 12+	0.1458	0.1266	0.1656	0.3079	763	835	0.0944
MRJMON	Past Month Marijuana Use	Pregnant, 12-44	0.0473	0.2830	0.1754	-0.3802	775	857	0.1058
CIGMON	Past Month Cigarette Use	12-17	0.0270	0.0553	0.0584	0.0558	16,877	16,820	-0.0034
CIGMON	Past Month Cigarette Use	12+	0.1715	0.0144	0.0144	0.0009	67,507	67,791	0.0042
PNRNMMON	Past Month Pain Reliever Misuse	18-25	0.0139	0.0714	0.0770	0.0783	16,877	16,561	-0.0187
PNRNMMON	Past Month Pain Reliever Misuse	12+	0.0104	0.0492	0.0555	0.1277	67,507	67,791	0.0042
ABODALC	Past Year Alcohol Use Disorder	12+	0.0541	0.0237	0.0238	0.0040	67,507	67,791	0.0042
UDPYILL	Past Year Illicit Drug Use Disorder	12+	0.0296	0.0304	0.0329	0.0820	67,507	67,791	0.0042
UDPYILAL	Past Year Substance Use Disorder	50+	0.0394	0.0600	0.0612	0.0194	10,126	10,297	0.0169
TXYRSPILAL	Past Year Specialty Substance Use Treatment	12+	0.0086	0.0610	0.0627	0.0273	67,507	67,791	0.0042
SMIYR_U	Past Year SMI	18+	0.0457	0.0294	0.0264	-0.1017	50,630	50,971	0.0067
AMDEYR	Past Year MDE	18+	0.0720	0.0232	0.0214	-0.0781	50,630	50,335	-0.0058

AIAN = American Indian or Alaska Native (NEWRACE2 = 3); API = Asian or Other Pacific Islander (NEWRACE2 = 4 or 5); MDE = major depressive episode; Pregnant 12-44 = (PREG2=1); RSE = relative standard error; SMI = serious mental illness.

Note: Projected RSEs were determined using 2014 through 2022 state and age sample allocations in a variance component model. All model components were updated using 2016 NSDUH data.

[1] *Relative Change in RSE* = {[*RSE(observed) – RSE(projected)*] / *RSE(projected)*}.

[2] *Relative Change in Sample Size* = {[*2018 Sample Size – Expected Sample Size*] / (*Expected Sample Size*)}.

Source: SAMHSA, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2018.

Unlike previous NSDUHs, no specific precision requirements were set for the 2014 through 2022 NSDUHs. Instead, they were designed to achieve acceptable precision for various subpopulations of interest, which accounted for the allocation of persons per state and the requirement to support direct estimation in some large sample states and SAE in the remaining states. Using the state and age group distribution, estimates and RSEs were modeled for 25 key outcome measures and domains of interest.

6.3.2 Observed versus Expected Precision

In Table 6.1, the expected RSEs and sample sizes are presented for the 25 key outcome measures and the RSEs and sample sizes that were observed for the 2018 NSDUH. All but four of the observed RSEs differed by no more than roughly 26 percent. Although this might be considered quite a large difference in terms of percentages, the point changes from the expected RSEs were generally quite small. Also, the percentage changes followed no particular direction. Out of 25 observed precisions, 7 were less than the expected precisions described in the 2018 sample design plan, and out of the 4 observed RSEs greater than roughly 26 percent, 2 were less than the expected precisions (CBHSQ, 2017).

6.4 Comparison of Median and Mean Design Effects

The mean DEFF is more sensitive to outliers and is generally larger than the median DEFF. Table 6.2 compares the median and mean of 53 DEFFs for three age groups and over all ages in the 2018 NSDUH design. Comparisons are also provided for the four race/ethnicity categories, although they were not used as stratification variables when selecting individuals within households. Table 6.3 provides the same median and mean DEFFs for the 2016 through 2018 NSDUHs. In a continuation of what was seen for the 2014 NSDUH, the current design used in 2018 is more efficient overall and within all race/ethnicity groups when compared with the design used prior to 2014 (CBHSQ, 2015a).

Table 6.2 Comparison of Median and Mean Design Effects of 53 Outcomes: 2018

Outcome	Median Design Effect	Mean Design Effect	Difference (Mean – Median)	Percentage Difference[1]
Total	2.42	2.47	0.06	2.38
Age (Years)				
12 to 17	1.72	1.70	-0.02	-1.14
18 to 25	1.74	1.76	0.03	1.44
26+	1.78	1.88	0.11	5.96
Race/Ethnicity				
White, Not Hispanic or Latino	2.23	2.20	-0.03	-1.28
Black or African American, Not Hispanic or Latino	2.24	2.29	0.05	2.10
Hispanic or Latino	2.53	2.56	0.03	1.16
Other or Multiple, Not Hispanic or Latino	2.51	2.74	0.24	9.57

[1] Computed as 100 * (*Mean* – *Median*) / *Median*.

Source: SAMHSA, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2018.

Table 6.3 Median and Mean Design Effects of 53 Outcomes: 2016 through 2018

Outcome	Median Design Effect			Mean Design Effect		
	2016	2017	2018	2016	2017	2018
Total	2.20	2.25	2.42	2.24	2.31	2.47
Age (Years)						
12 to 17	1.54	1.59	1.72	1.52	1.56	1.70
18 to 25	1.79	1.80	1.74	1.79	1.83	1.76
26+	1.72	1.75	1.78	1.74	1.78	1.88
Race/Ethnicity						
White, Not Hispanic or Latino	2.03	2.22	2.23	2.04	2.13	2.20
Black or African American, Not Hispanic or Latino	2.06	2.11	2.24	2.10	2.26	2.29
Hispanic or Latino	2.64	2.39	2.53	2.61	2.40	2.56
Other or Multiple, Not Hispanic or Latino	2.38	2.29	2.51	2.44	2.43	2.74

Source: SAMHSA, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2016 to 2018.

The median and mean DEFF estimates were based on estimates from the following four types of substance use and mental health categories: (a) *eight illicit drug use categories:* any illicit drug use, marijuana, cocaine, crack, inhalants, hallucinogens, misuse of any psychotherapeutics, and misuse of pain relievers; (b) *seven licit drug use categories:* tobacco, cigarettes, smokeless tobacco, cigars, alcohol, heavy drinking, and binge drinking; (c) *six treatment or abuse categories:* abuse of drugs or alcohol, dependence on drugs or alcohol, treatment received for illicit drug use, treatment received for alcohol use, treatment received for either alcohol use or illicit drug use, and treatment received for both alcohol use and illicit drug use; and (d) *six mental health categories:* any mental illness (AMI), SMI, mental health services, MDE, suicidal thoughts, and serious psychological distress (SPD). Estimates used from the illicit and licit categories included one from each of three recency-of-use classes: ever used, used in past year, and used in past month. An exception was made for estimates of heavy drinking and binge drinking, which are past month variables. The treatment or abuse and mental health variables are for the past year.

The median and the mean DEFFs were calculated from the above estimates for the total population, by age and by race/ethnicity. As seen from Table 6.2, the mean DEFF turned out to be larger than the median DEFF in six of the eight domains. The differences between the mean and median DEFFs fell below 2.4 percent for six of the eight comparison groups with the largest differences being 5.96 percent for the 26 or older age group and 9.57 percent for the non-Hispanic or Latino other or multiple races.

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7. Issues Encountered

This chapter is typically used to document any issues with the sample implementation. In the 2018 National Survey on Drug Use and Health, no such problems were encountered.

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