2016 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

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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).[1] The multiyear design consists of a deeply stratified, multistage area probability design. The 2016 sample design is thoroughly documented in the 2016 NSDUH sample design report (Center for Behavioral Health Statistics and Quality, 2017a). The goal of this report is to further document the 2016 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 (RSEs), and documentation of any issues encountered during sample implementation (none in 2016).

This report is organized as follows. Chapter 2 summarizes the 2016 sample design. Chapters 3, 4, and 5 document the sample experiences at the third, fourth, and fifth stages of sample selection, respectively. Finally, Chapter 6 includes a comparison of the observed precisions with the expected precisions and a comparison of median design effects (DEFFs) and mean DEFFs.

[1] This report presents information from the 2016 NSDUH. Prior to 2002, the survey was called the National Household Survey on Drug Abuse (NHSDA).

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2. Overview of the 2016 Sample Design

2.1 Target Population

The respondent universe for the 2016 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 2016 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 2016 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 (CAI) 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. This large sample is referred to as the "main sample." The achieved sample for the 2016 NSDUH was 67,942 persons.

Beginning with the 2002 NSDUH and continuing through the 2016 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 slowly declining, which has required the number of selected households to increase. Beginning in 2014 and continuing through 2016, 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.

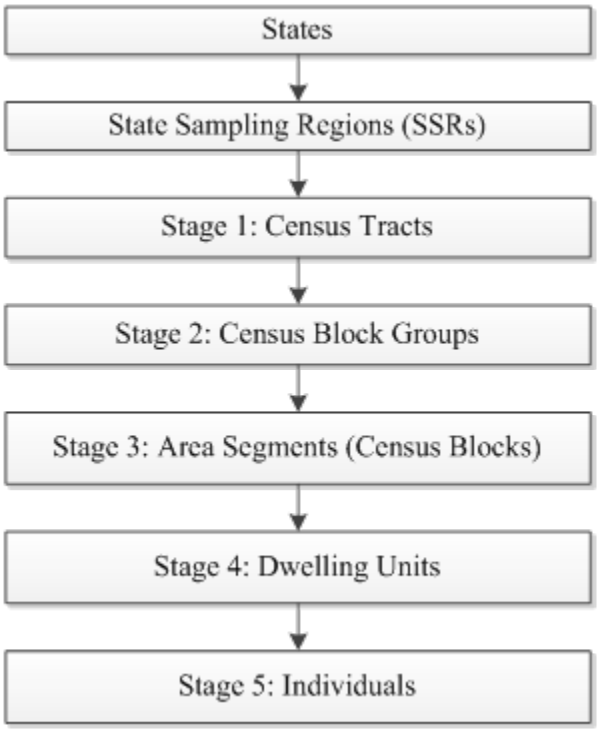
An additional design change was made in 2002 and continued through 2013. A new pair sampling strategy was implemented that increased the number of pairs selected in dwelling units (DUs) with older persons on the roster (Chromy & Penne, 2002). With the increase in the number of pairs came a moderate decrease in the response rate for older persons. Changes to the 2014 through 2017 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, 2015, and 2016 NSDUHs.

2.2.1 4-Year Coordinated Design

A coordinated sample design was developed for the 2014 through 2017 NSDUHs. Exhibit 1 summarizes the multistage design. The coordinated design facilitates 50 percent overlap in third-stage units (area segments) within each successive 2-year period from 2014 through 2017. 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 2017 surveys.

Exhibit 1. Summary of the 2014 through 2017 NSDUH Design



The 2016 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 2016, 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 direct estimates or estimates based on the SAE methodology for selected outcomes while maintaining efficiency for national estimates. All state estimates are typically produced by pooling multiple years of data to increase precision, especially for estimates of change over time. For example, to measure short-term change in past month marijuana use by state, 2013-2014 data and 2014-2015 data are pooled and the two resulting small area estimates are compared. To measure long-term change in the same estimate, 2008-2009 data and 2014-2015 data are pooled and compared (Center for Behavioral Health Statistics and Quality [CBHSQ], 2016-2017).

Within each state, state sampling regions (SSRs) were formed. Based on a composite size measure, 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 2017 NSDUHs was census tracts.[2] This stage was included to contain sample segments within a single census tract to the extent possible.[3] 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 aggregated within SSRs until each first-stage sampling unit met the minimum size requirement. In California, Florida, Georgia, Illinois, Michigan, New Jersey, New York, North Carolina,

[2] 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).

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

Ohio, Pennsylvania, Texas, and Virginia, this minimum size requirement was 250 DUs[4] in urban areas and 200 DUs in rural areas.[5] 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 census tracts,[6] 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 census tracts per SSR were sequentially selected with probabilities proportionate to a composite size measure and with minimum replacement (Chromy, 1979).

For the second stage of selection, adjacent census block groups were aggregated within selected census tracts 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 were formed, they were sorted in the order they were formed (i.e., geographically), and one census block group[10] was selected per sampled census tract 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 2017 NSDUH samples to facilitate possible transitioning to an address-based sampling (ABS) design in the future.

The census block groups were generally larger than practical for building frames of housing units through field enumeration. Therefore, one smaller geographic region was selected within each sampled census block group. For this third stage of sampling, each selected census

[4] 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/). Claritas was formerly affiliated with Nielsen Holdings and became independent in January 2017.

[5] 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.

[6] For the remainder of the discussion, first-stage sampling units are referred to as "census tracts" even though each first-stage sampling unit contains one or more census tracts.

[7] CBSAs include metropolitan and micropolitan statistical areas as defined by the Office of Management and Budget (2009).

[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 lower sampling error by reducing the selection of neighboring and possibly similar segments than if the selection was done completely at random.

[10] For the remainder of the discussion, second-stage sampling units are referred to as "census block groups" even though each second-stage sampling unit contains one or more census block groups.

block group 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 census tracts and census block groups, 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 census block group using Chromy's method of sequential random sampling (with probability proportionate to size and minimum replacement) (Chromy, 1979). The 48 selected segments within each SSR were randomly assigned to a survey year and quarter of data collection. Although 48 segments were selected, only 20 were needed to field the main survey across the 4-year period. The remaining segments are available to accommodate supplemental studies and other uses.

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 2016, the first panel segments (panel C) were used for the 2015 and 2016 surveys. The second panel segments (panel D) were used for the 2016 survey and will be used again for the 2017 survey, constituting the overlap sample.

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 2017 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 (census tracts). This change was confirmed to improve coverage and therefore require smaller poststratification adjustments in weighting (CBHSQ, 2015c).

Next, the number and distribution of SSRs was revised in 2014. In the 2005 through 2013 design, the 8 large states were partitioned into 48 SSRs and the small states were partitioned into 12 SSRs, for a total of 900 SSRs. Beginning in 2014, the sampling frame was stratified into

[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 4 for information about Claritas.

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 the states of 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 not only gained due to increased yield and clustering, but also in 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 sending them 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.

The issues related to the new SSR distribution continued into 2016. In response to these issues, management of the FI case assignments and staffing levels was modified based on the

2014 and 2015 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 16 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 2015 fieldwork.

The third change, which was mentioned previously, was the addition of a sample selection stage by selecting census block groups from selected census tracts. The purpose of this change was to facilitate the possible transition to ABS. The introduction of census blocks 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 2016 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 2014, 2015, and 2016 NSDUHs were used to compute predicted screening and interviewing response rate adjustments. 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

[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. Thus, sampling rates are adjusted to satisfy this constraint.

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 2017 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 2016 NSDUHs (see the 2016 NSDUH sample design report; CBHSQ, 2017a).

As in previous years, during the data collection period, if an interviewer encountered any new or missed DU on the premises of a sampled DU (e.g., a garage apartment), the new or missed dwelling was selected into the 2016 NSDUH. However, unlike the 2005 through 2013 NSDUHs, the half-open interval (HOI) procedure[16] 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

[16] In summary, the HOI technique states 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.

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 2016 NSDUH sample design report; CBHSQ, 2017a).

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 2017 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 2017 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.

Census tracts, 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 census tract and block group, 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 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, 2017a; RTI International, 2013).

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3. Segment (Third-Stage) Sample Experience

As mentioned in Chapter 2, the third stage of selection for the 2014 through 2017 National Surveys on Drug Use and Health (NSDUHs) was area segments. To form segments within sampled census block groups, 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 census block groups), and one segment was selected per sampled census block group using the probability proportional to size with minimal replacement sequential sampling method. As a result, 48 census tracts/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 4-year study from 2014 through 2017, an additional 28 segments were selected to serve as replacements when segment DUs are depleted and/or to support any supplemental studies embedded within NSDUH.

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. The fourth subsample of segments was assigned to the 2016 NSDUH and will be used again in the 2017 survey. Finally, the fifth subsample of segments will be used for the 2017 NSDUH only. 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 15,000 segments selected for the 4-year study, 14,605 (97.4 percent) were unique. Table 3.1 lists the duplicated segments in the 2016 NSDUH sample. Panel A and B segments in Table 3.1 are not in the 2016 sample, but are duplicates of segments in the 2016 sample. Because segments are randomly assigned to panels, duplicates may exist within or across panels. For example, AK02B3 and AK02D4 are in different panels, while DC05D3 and DC05D4 are in the same panel. The original segment (e.g., AK02B3) is field enumerated, and the resulting DU frame is used each time the segment is fielded (e.g., for

AK02B3 and AK02D4). 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 (e.g., ND02C2 and ND02D2), a double sample is selected from the first segment, then randomly split for analysis purposes.

Table 3.1 Duplicated Segments in the 2016 NSDUH Sample

Original Segment	2016 NSDUH Duplicate Segment
AK02B3*	AK02D4
AK09A1*	AK09D1
CO07B1*	CO07C1
DC03A4*	DC03D2
DC05D3	DC05D4
DC06A4*	DC06C4
DC12C2[a]	DC12D3
DE02A3*	DE02C2
DE05A2*	DE05C1
ME09A2*,[a]	ME09C2
ND02C2	ND02D2
ND03A2*	ND03D2
ND11A3*	ND11C4
SD02A1*	SD02C2
SD04B2*	SD04D1
SD12B4*	SD12D2
WY03C2[a]	WY03D2
WY07C2	WY07D2

*Segment is not in the 2016 NSDUH sample but is a duplicate of a segment in the 2016 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 2016 NSDUH sample.

Table 3.2 2016 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**
AK01C1	AK01C2	AK01C3	AK01C4
AK02C1	AK02C2	AK03C3	AK03C4
AK02D1	AK02D2	AK11C3	AK11C4
AK05C1	AK05C2	CA34C3	CA34C4
AK10C1	AK10C2	CO11C3	CO11C4
AK11C1	AK11C2	CO11D3	CO11D4
AK11D1	AK11D2	CO12C3	CO12C4
ID02D1	ID02D2	CO12D3	CO12D4
ID03D1	ID03D2	GA15C3	GA15C4
ID10D1	ID10D2	ID07C3	ID07C4
ID11C1	ID11C2	ID11C3	ID11C4
ID12C1	ID12C2	MO01C3	MO01C4
ME09C1	ME09C2	MO09C3	MO09C4
MT01C1	MT01C2	MT05D3	MT05D4
MT02D1	MT02D2	MT09C3	MT09C4
MT04C1	MT04C2	MT09D3	MT09D4
MT04D1	MT04D2	MT10C3	MT10C4
MT07C1	MT07C2	MT11D3	MT11D4
MT10C1	MT10C2	MT12D3	MT12D4
NM02C1	NM02C2	ND06D3	ND06D4
VT01D1	VT01D2	ND09D3	ND09D4
VT10D1	VT10D2	SD06D3	SD06D4
VT11D1	VT11D2	SD08D3	SD08D4
WV04C1	WV04C2	TN11C3	TN11C4
WV05C1	WV05C2	TX28D3	TX28D4
WV07C1	WV07C2	TX29D3	TX29D4
WY04C1	WY04C2	TX30D3	TX30D4
WY05C1	WY05C2	WY06C3	WY06C4
WY06D1	WY06D2	WY07C3	WY07C4
WY08C1	WY08C2	WY12D3	WY12D4
WY09C1	WY09C2		

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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. The list of DUs constructed during counting and listing is entered into a database and serves 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 34.10 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	1,508,299	204,610	34.10	979	0.48	205,589
Alabama	96	21,757	2,988	31.13	8	0.27	2,996
Alaska	96	23,351	3,224	33.58	48	1.49	3,272
Arizona	96	23,088	2,919	30.41	2	0.07	2,921
Arkansas	96	19,889	3,035	31.61	1	0.03	3,036
California	288	81,538	12,152	42.19	40	0.33	12,192
Colorado	96	23,966	2,564	26.71	6	0.23	2,570
Connecticut	96	21,350	2,969	30.93	11	0.37	2,980
Delaware	96	24,349	2,941	30.64	12	0.41	2,953
District of Columbia	96	26,472	5,934	61.81	6	0.10	5,940
Florida	240	70,064	11,264	46.93	18	0.16	11,282
Georgia	120	31,782	3,615	30.13	4	0.11	3,619
Hawaii	96	25,569	3,909	40.72	40	1.02	3,949
Idaho	96	20,951	2,643	27.53	10	0.38	2,653
Illinois	192	58,150	7,196	37.48	26	0.36	7,222
Indiana	96	21,871	2,554	26.60	6	0.23	2,560
Iowa	96	21,736	2,882	30.02	11	0.38	2,893
Kansas	96	20,717	2,519	26.24	3	0.12	2,522
Kentucky	96	22,586	3,144	32.75	18	0.57	3,162
Louisiana	96	23,211	2,942	30.65	4	0.14	2,946
Maine	96	21,143	3,914	40.77	27	0.69	3,941

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	25,809	2,399	24.99	19	0.79	2,418
Massachusetts	96	21,000	3,659	38.11	41	1.12	3,700
Michigan	192	53,721	7,068	36.81	22	0.31	7,090
Minnesota	96	21,204	2,590	26.98	6	0.23	2,596
Mississippi	96	20,667	2,379	24.78	3	0.13	2,382
Missouri	96	22,922	2,599	27.07	13	0.50	2,612
Montana	96	20,634	3,199	33.32	18	0.56	3,217
Nebraska	96	20,075	2,684	27.96	12	0.45	2,696
Nevada	96	25,070	2,378	24.77	1	0.04	2,379
New Hampshire	96	23,726	3,206	33.40	38	1.19	3,244
New Jersey	120	36,013	4,355	36.29	15	0.34	4,370
New Mexico	96	21,117	2,903	30.24	4	0.14	2,907
New York	240	69,141	12,223	50.93	175	1.43	12,398
North Carolina	120	34,704	4,108	34.23	14	0.34	4,122
North Dakota	96	20,566	3,495	36.41	16	0.46	3,511
Ohio	192	53,832	6,781	35.32	23	0.34	6,804
Oklahoma	96	21,440	2,652	27.63	2	0.08	2,654
Oregon	96	20,587	3,134	32.65	26	0.83	3,160
Pennsylvania	192	52,762	7,771	40.47	54	0.69	7,825
Rhode Island	96	22,181	3,059	31.86	13	0.42	3,072
South Carolina	96	23,256	2,827	29.45	5	0.18	2,832
South Dakota	96	19,663	2,796	29.13	17	0.61	2,813
Tennessee	96	21,417	3,026	31.52	8	0.26	3,034
Texas	240	70,068	6,781	28.25	12	0.18	6,793
Utah	96	20,987	1,476	15.38	7	0.47	1,483
Vermont	96	20,683	3,815	39.74	43	1.13	3,858
Virginia	120	36,459	3,900	32.50	20	0.51	3,920
Washington	96	20,202	2,764	28.79	15	0.54	2,779
West Virginia	96	22,414	3,166	32.98	6	0.19	3,172
Wisconsin	96	22,551	3,513	36.59	18	0.51	3,531
Wyoming	96	19,888	2,596	27.04	12	0.46	2,608

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 2016 NSDUH sample design report (Center for Behavioral Health Statistics and Quality [CBHSQ], 2017a), 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 most 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.[17] 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, the FI was instructed to consider these DUs as part of his or her assignment. If either of these limits was exceeded, special subsampling procedures were implemented (see the 2016 NSDUH sample design report; CBHSQ, 2017a).

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 the 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 interview's assignment; these procedures are described in more detail in the 2016 NSDUH sample design report (CBHSQ, 2017a). 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 0.48 percent increase in sample was realized through the check for missed DUs. Larger increases in sample were realized in the states of Alaska, Hawaii, Massachusetts, New Hampshire, New York, and Vermont. In Alaska and Hawaii, properties that were listed by mailbox may have had only one mailbox for several units. Also, in general, Hawaii had a large number of DUs on the property of other DUs that were difficult to see. 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.

[17] 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	57,200	47,670	83.34	62,359	52,931	84.88
Northeast	12,707	10,578	83.25	13,996	11,985	85.63
Connecticut	826	684	82.81	874	802	91.76
Maine	1,258	1,050	83.47	1,255	996	79.36
Massachusetts	926	771	83.26	1,102	966	87.66
New Hampshire	921	770	83.60	1,041	869	83.48
New Jersey	1,175	976	83.06	1,208	1,161	96.11
New York	3,609	3,003	83.21	4,134	3,456	83.60
Pennsylvania	2,197	1,826	83.11	2,401	2,003	83.42
Rhode Island	783	653	83.40	946	867	91.65
Vermont	1,012	845	83.50	1,035	865	83.57
Midwest	13,189	10,986	83.30	14,468	12,022	83.09
Illinois	2,021	1,676	82.93	2,121	1,767	83.31
Indiana	710	591	83.24	800	631	78.88
Iowa	806	675	83.75	901	828	91.90
Kansas	738	614	83.20	763	638	83.62
Michigan	2,061	1,719	83.41	2,205	1,835	83.22
Minnesota	697	581	83.36	779	687	88.19
Missouri	804	670	83.33	764	608	79.58
Nebraska	746	621	83.24	827	623	75.33
North Dakota	992	832	83.87	1,093	1,048	95.88
Ohio	1,969	1,638	83.19	2,199	1,739	79.08
South Dakota	654	544	83.18	781	745	95.39
Wisconsin	991	825	83.25	1,235	873	70.69
South	18,697	15,593	83.40	20,040	16,715	83.41
Alabama	867	722	83.28	964	681	70.64
Arkansas	761	631	82.92	818	715	87.41
Delaware	825	682	82.67	872	767	87.96
District of Columbia	1,728	1,442	83.45	1,815	1,439	79.28
Florida	3,241	2,707	83.52	3,469	2,455	70.77
Georgia	1,029	858	83.38	1,106	968	87.52
Kentucky	763	637	83.49	843	767	90.98
Louisiana	762	633	83.07	768	768	100.00
Maryland	633	531	83.89	710	652	91.83
Mississippi	734	615	83.79	792	628	79.29
North Carolina	1,134	945	83.33	1,130	1,040	92.04
Oklahoma	761	636	83.57	847	774	91.38
South Carolina	765	635	83.01	777	713	91.76
Tennessee	794	669	84.26	851	781	91.77
Texas	1,927	1,602	83.13	2,097	1,749	83.40
Virginia	1,070	891	83.27	1,209	1,008	83.37
West Virginia	903	757	83.83	972	810	83.33
West	12,607	10,513	83.39	13,855	12,209	88.12
Alaska	994	828	83.30	1,191	1,040	87.32
Arizona	839	700	83.43	969	764	78.84
California	3,182	2,651	83.31	3,469	3,038	87.58
Colorado	721	605	83.91	774	640	82.69
Hawaii	1,021	851	83.35	1,106	1,011	91.41
Idaho	588	491	83.50	706	706	100.00
Montana	905	750	82.87	1,012	842	83.20
Nevada	781	651	83.35	745	628	84.30
New Mexico	807	673	83.40	912	874	95.83
Oregon	726	606	83.47	890	813	91.35
Utah	393	331	84.22	408	392	96.08
Washington	768	639	83.20	849	813	95.76
Wyoming	882	737	83.56	824	648	78.64

(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	62,109	53,421	86.01	59,058	50,588	85.66
Northeast	14,070	11,738	83.43	12,794	10,670	83.40
Connecticut	1,002	917	91.52	749	566	75.57
Maine	1,104	1,013	91.76	1,202	855	71.13
Massachusetts	1,285	1,019	79.30	1,032	903	87.50
New Hampshire	1,059	794	74.98	806	773	95.91
New Jersey	1,362	1,250	91.78	1,162	968	83.30
New York	3,555	2,814	79.16	3,725	2,950	79.19
Pennsylvania	2,419	2,021	83.55	2,191	1,921	87.68
Rhode Island	1,041	821	78.87	820	718	87.56
Vermont	1,243	1,089	87.61	1,107	1,016	91.78
Midwest	14,490	12,429	85.78	13,538	11,240	83.03
Illinois	2,193	1,913	87.23	2,099	1,840	87.66
Indiana	779	716	91.91	738	616	83.47
Iowa	867	725	83.62	826	654	79.18
Kansas	709	653	92.10	668	614	91.92
Michigan	2,161	1,896	87.74	2,043	1,618	79.20
Minnesota	779	646	82.93	768	676	88.02
Missouri	825	692	83.88	791	629	79.52
Nebraska	890	738	82.92	800	702	87.75
North Dakota	896	778	86.83	1,010	837	82.87
Ohio	2,213	1,842	83.24	1,880	1,562	83.09
South Dakota	798	798	100.00	742	709	95.55
Wisconsin	1,380	1,032	74.78	1,173	783	66.75
South	20,386	17,299	84.86	19,727	17,494	88.68
Alabama	916	800	87.34	895	785	87.71
Arkansas	830	796	95.90	893	893	100.00
Delaware	938	706	75.27	860	786	91.40
District of Columbia	1,609	1,542	95.84	1,648	1,511	91.69
Florida	3,710	2,942	79.30	3,299	3,160	95.79
Georgia	1,155	863	74.72	1,111	926	83.35
Kentucky	936	856	91.45	967	884	91.42
Louisiana	861	794	92.22	846	747	88.30
Maryland	701	642	91.58	725	574	79.17
Mississippi	699	557	79.69	696	579	83.19
North Carolina	1,147	997	86.92	1,226	1,126	91.84
Oklahoma	832	657	78.97	783	585	74.71
South Carolina	953	794	83.32	782	685	87.60
Tennessee	823	792	96.23	940	784	83.40
Texas	2,113	1,848	87.46	1,997	1,582	79.22
Virginia	1,249	990	79.26	1,103	1,011	91.66
West Virginia	914	723	79.10	956	876	91.63
West	13,163	11,955	90.82	12,999	11,184	86.04
Alaska	904	603	66.70	855	753	88.07
Arizona	828	795	96.01	932	660	70.82
California	3,457	3,457	100.00	3,275	3,006	91.79
Colorado	746	685	91.82	661	634	95.92
Hawaii	1,144	1,053	92.05	1,175	994	84.60
Idaho	694	693	99.86	951	753	79.18
Montana	1,001	916	91.51	875	691	78.97
Nevada	645	509	78.91	671	590	87.93
New Mexico	931	811	87.11	813	545	67.04
Oregon	890	890	100.00	903	825	91.36
Utah	375	375	100.00	378	378	100.00
Washington	875	693	79.20	742	619	83.42
Wyoming	673	475	70.58	768	736	95.83

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5. Person (Fifth-Stage) Sample Experience

Compared with previous designs, the 2014 through 2017 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	67,942	0.64
12-17	16,877	17,109	1.37
18-25	16,877	16,573	-1.80
26-34	10,126	10,423	2.93
35-49	13,501	13,596	0.70
50+	10,126	10,241	1.14
Alabama	960	983	2.40
Alaska	960	960	0.00
Arizona	960	982	2.29
Arkansas	960	992	3.33
California	4,560	4,619	1.29
Colorado	960	920	-4.17
Connecticut	960	937	-2.40
Delaware	960	928	-3.33
District of Columbia	960	967	0.73
Florida	3,300	3,435	4.09
Georgia	1,500	1,508	0.53
Hawaii	967	1,004	3.83
Idaho	960	1,088	13.33
Illinois	2,400	2,467	2.79
Indiana	960	933	-2.81
Iowa	960	1,028	7.08
Kansas	960	996	3.75
Kentucky	960	953	-0.73
Louisiana	960	959	-0.10
Maine	960	992	3.33
Maryland	960	990	3.13
Massachusetts	960	988	2.92
Michigan	2,400	2,420	0.83
Minnesota	960	962	0.21

(continued)

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

Age Group and State	Targeted	Achieved	Percent Difference
Mississippi	960	934	-2.71
Missouri	960	938	-2.29
Montana	960	1,018	6.04
Nebraska	960	964	0.42
Nevada	960	966	0.63
New Hampshire	960	936	-2.50
New Jersey	1,500	1,433	-4.47
New Mexico	960	980	2.08
New York	3,300	3,232	-2.06
North Carolina	1,500	1,508	0.53
North Dakota	960	960	0.00
Ohio	2,400	2,377	-0.96
Oklahoma	960	965	0.52
Oregon	960	1,004	4.58
Pennsylvania	2,400	2,360	-1.67
Rhode Island	960	937	-2.40
South Carolina	960	970	1.04
South Dakota	960	960	0.00
Tennessee	960	993	3.44
Texas	3,300	3,293	-0.21
Utah	960	936	-2.50
Vermont	960	896	-6.67
Virginia	1,500	1,493	-0.47
Washington	960	934	-2.71
West Virginia	960	962	0.21
Wisconsin	960	1,018	6.04
Wyoming	960	964	0.42

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 2016, the unweighted interview response rate was 76.64 percent for individuals aged 12 to 17, 72.57 percent for individuals aged 18 to 25, and 67.91 percent for individuals aged 26 or older (Center for Behavioral Health Statistics and Quality [CBHSQ], 2017b). Within the 26 or older age group, individuals aged 50 or older had the lowest unweighted interview response rate (66.34 percent). The higher percentage of respondents in the older age groups 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 2017 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 2017 NSDUHs, simulation analyses based on the 2012 screening data, modified to reflect the 2014 through 2017 age group sample proportions, were conducted, and $\lambda = 0.25$ was selected (CBHSQ, 2015b). As a result, fewer pairs were projected to be selected in the 2014 through 2017 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 2017 when compared with earlier years.

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 2016 were considerably 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 67,942 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. Finally, the projection models may require updating.

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	2014-2017 Projected Count ($\lambda = 0.25$)	2016 Observed Count ($\lambda = 0.25$)
12+, 12+	22,752	28,033
12-17, 12-17	3,041	3,199
12-17, 18-25	2,326	2,548
12-17, 26+	6,208	8,233
18-25, 18-25	3,185	3,958
18-25, 26+	3,833	4,725
26+, 26+	4,160	5,370

Source: SAMHSA, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2012 and 2016.

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	2014-2017 Projected Response Rate ($\lambda = 0.25$)	2016 Observed Response Rate ($\lambda = 0.25$)
12+, 12+	71.4	63.7
12-17, 12-17	81.4	74.6
12-17, 18-25	76.1	69.6
12-17, 26+	74.8	67.3
18-25, 18-25	71.2	63.5
18-25, 26+	67.1	58.0
26+, 26+	60.7	53.9

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, 2012 and 2016.

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 2016 NSDUH. These rates will be used to fine-tune the sample size calculations for the 2017 NSDUH.

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	205,589	173,149	84.12	135,188	77.88	95,607	67,942	68.44	53.30
Alabama	2,996	2,478	82.63	2,026	82.04	1,392	983	66.70	54.72
Alaska	3,272	2,386	69.10	1,901	79.52	1,325	960	69.03	54.90
Arizona	2,921	2,203	74.18	1,835	83.43	1,313	982	74.79	62.39
Arkansas	3,036	2,503	82.33	2,041	81.73	1,381	992	69.49	56.80
California	12,192	11,070	88.81	7,993	72.01	6,720	4,619	65.40	47.10
Colorado	2,570	2,163	83.72	1,757	80.69	1,324	920	67.04	54.10
Connecticut	2,980	2,559	85.54	1,931	75.41	1,392	937	65.01	49.03
Delaware	2,953	2,459	80.94	1,880	76.98	1,330	928	67.70	52.12
District of Columbia	5,940	5,119	86.42	3,401	65.20	1,260	967	74.11	48.32
Florida	11,282	9,267	79.20	7,135	77.11	4,794	3,435	68.22	52.60
Georgia	3,619	3,139	86.80	2,443	77.88	1,998	1,508	71.10	55.37
Hawaii	3,949	3,329	83.75	2,478	73.74	1,458	1,004	66.33	48.91
Idaho	2,653	2,151	75.40	1,842	85.77	1,429	1,088	74.13	63.59
Illinois	7,222	6,310	87.35	4,501	71.35	3,789	2,467	61.81	44.10
Indiana	2,560	2,149	83.53	1,665	77.38	1,286	933	69.65	53.90
Iowa	2,893	2,461	85.12	2,076	84.27	1,414	1,028	71.71	60.43
Kansas	2,522	2,204	87.46	1,848	83.82	1,363	996	71.16	59.64
Kentucky	3,162	2,586	81.87	2,104	81.27	1,445	953	62.76	51.00
Louisiana	2,946	2,381	80.97	1,934	81.24	1,328	959	70.61	57.37
Maine	3,941	3,022	75.47	2,473	82.01	1,394	992	71.53	58.66
Maryland	2,418	2,120	87.69	1,550	72.57	1,317	990	73.23	53.14
Massachusetts	3,700	3,252	86.38	2,365	72.42	1,596	988	61.77	44.73
Michigan	7,090	5,893	83.03	4,809	81.40	3,311	2,420	70.59	57.46
Minnesota	2,596	2,278	87.71	1,855	81.33	1,375	962	68.58	55.78
Mississippi	2,382	1,949	81.75	1,617	83.00	1,283	934	71.09	59.00
Missouri	2,612	2,247	86.18	1,926	85.56	1,334	938	66.20	56.65
Montana	3,217	2,602	80.92	2,247	86.51	1,433	1,018	71.23	61.62
Nebraska	2,696	2,350	87.22	1,881	80.01	1,364	964	68.95	55.16

(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	2,379	2,095	87.95	1,526	72.71	1,268	966	72.48	52.70
New Hampshire	3,244	2,763	84.44	2,148	77.51	1,355	936	67.19	52.08
New Jersey	4,370	3,866	88.52	2,791	71.09	2,149	1,433	63.19	44.92
New Mexico	2,907	2,023	70.06	1,720	84.86	1,215	980	79.43	67.41
New York	12,398	10,716	86.06	6,932	63.92	4,934	3,232	61.44	39.27
North Carolina	4,122	3,470	82.89	2,832	81.56	2,089	1,508	71.49	58.31
North Dakota	3,511	2,882	81.76	2,521	87.70	1,344	960	69.08	60.58
Ohio	6,804	5,933	87.19	4,700	79.21	3,363	2,377	67.60	53.55
Oklahoma	2,654	2,198	83.30	1,794	81.39	1,374	965	68.24	55.54
Oregon	3,160	2,765	87.13	2,224	80.46	1,391	1,004	71.05	57.17
Pennsylvania	7,825	6,665	83.94	5,277	79.17	3,308	2,360	70.48	55.80
Rhode Island	3,072	2,653	86.38	2,043	77.12	1,356	937	67.37	51.96
South Carolina	2,832	2,251	78.76	1,849	81.99	1,326	970	72.46	59.41
South Dakota	2,813	2,338	83.21	2,037	86.96	1,338	960	70.92	61.67
Tennessee	3,034	2,416	79.27	2,002	82.87	1,373	993	70.57	58.48
Texas	6,793	5,725	83.08	4,877	84.53	4,255	3,293	74.68	63.13
Utah	1,483	1,331	89.76	1,138	85.78	1,215	936	74.82	64.18
Vermont	3,858	2,992	77.13	2,315	77.15	1,298	896	71.09	54.85
Virginia	3,920	3,376	86.15	2,743	81.20	2,077	1,493	68.86	55.91
Washington	2,779	2,421	86.82	1,911	78.99	1,362	934	66.41	52.45
West Virginia	3,172	2,630	82.76	2,125	80.79	1,440	962	63.87	51.60
Wisconsin	3,531	2,927	76.56	2,412	82.32	1,368	1,018	73.22	60.27
Wyoming	2,608	2,083	79.16	1,757	84.46	1,261	964	75.14	63.46

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 2016 National Survey on Drug Use and Health (NSDUH). One objective was to provide a mechanism for comparing the expected precision of the 2016 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 B.2.1 of Section B in the 2016 NSDUH's methodological summary and definitions report (Center for Behavioral Health Statistics and Quality [CBHSQ], 2017c).

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 2016 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 $RSE[-\ln(\hat{p})]$ Approximation

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

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

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 2016 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.

Predicted precision requirements for the 2016 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 2016 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 2016 (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 past year (TXYRSPILAL),
- serious mental illness (SMI) in past year (SMIYR), 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 2016 sample design report's specified domain breakdowns (CBHSQ, 2017a).

6.3.1 Sample and Precision Requirements

Initial sample requirements for the 2016 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 2016, 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	2016 Prevalence	Projected RSE (2014-2017)	2016 RSE	Relative Change in RSE[1]	Expected Sample Size (2014-2017)	2016 Sample Size	Relative Change in Sample Size[2]
ALCMON	Past Month Alcohol Use	12+	0.5070	0.0069	0.0061	-0.1192	67,507	67,942	0.0064
ALCMON	Past Month Alcohol Use	12-20	0.1930	0.0238	0.0233	-0.0216	23,261	22,955	-0.0132
ALCMON	Past Month Alcohol Use	50+	0.4880	0.0127	0.0124	-0.0224	10,126	10,326	0.0198
ALCMON	Past Month Alcohol Use	API, 12+	0.3570	0.0472	0.0380	-0.1940	3,506	3,098	-0.1164
ALCMON	Past Month Alcohol Use	AIAN, 12+	0.3440	0.0752	0.0877	0.1658	736	939	0.2758
ALCMON	Past Month Alcohol Use	Pregnant, 12-44	0.0820	0.1341	0.1507	0.1237	814	854	0.0491
BNGDRKMON	Past Month Binge Alcohol Use	18-25	0.3840	0.0135	0.0142	0.0521	16,877	16,435	-0.0262
BNGDRKMON	Past Month Binge Alcohol Use	12+	0.2420	0.0116	0.0106	-0.0822	67,507	67,942	0.0064
MRJMON	Past Month Marijuana Use	12+	0.0890	0.0205	0.0184	-0.1013	67,507	67,942	0.0064
MRJMON	Past Month Marijuana Use	12-17	0.0650	0.0384	0.0377	-0.0193	16,877	17,081	0.0121
MRJMON	Past Month Marijuana Use	18-25	0.2080	0.0221	0.0201	-0.0901	16,877	16,435	-0.0262
MRJMON	Past Month Marijuana Use	50+	0.0430	0.0722	0.0577	-0.2015	10,126	10,326	0.0198
MRJMON	Past Month Marijuana Use	API, 12+	0.0370	0.1458	0.1100	-0.2454	3,506	3,098	-0.1164
MRJMON	Past Month Marijuana Use	AIAN, 12+	0.1360	0.1633	0.1289	-0.2106	736	939	0.2758
MRJMON	Past Month Marijuana Use	Pregnant, 12-44	0.0490	0.1453	0.1757	0.2093	814	854	0.0491
CIGMON	Past Month Cigarette Use	12-17	0.0340	0.0446	0.0511	0.1457	16,877	17,081	0.0121
CIGMON	Past Month Cigarette Use	12+	0.1910	0.0136	0.0132	-0.0259	67,507	67,942	0.0064
PNRNMMON	Past Month Pain Reliever Misuse	18-25	0.0180	0.0559	0.0735	0.3141	16,877	16,435	-0.0262
PNRNMMON	Past Month Pain Reliever Misuse	12+	0.0120	0.0423	0.0473	0.1194	67,507	67,942	0.0064
ABODALC	Past Year Alcohol Use Disorder	12+	0.0560	0.0219	0.0229	0.0475	67,507	67,942	0.0064
UDPYILL	Past Year Illicit Drug Use Disorder	12+	0.0270	0.0305	0.0307	0.0057	67,507	67,942	0.0064
UDPYILAL	Past Year Substance Use Disorder	50+	0.0410	0.0646	0.0565	-0.1248	10,126	10,326	0.0198
TXYRSPILAL	Past Year Specialty Substance Use Treatment	12+	0.0080	0.0616	0.0589	-0.0432	67,507	67,942	0.0064
SMIYR	Past Year SMI	18+	0.0420	0.0305	0.0287	-0.0586	50,630	50,861	0.0046
AMDEYR	Past Year MDE	18+	0.0670	0.0244	0.0227	-0.0700	50,630	50,291	-0.0067

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 2017 state and age sample allocations in a variance component model.

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

[2] *Relative Change in Sample Size* = {[*2016 Sample Size – Expected Sample Size*] / (*Expected Sample Size*)}.

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

Unlike previous NSDUHs, no specific precision requirements were set for the 2016 NSDUH. Instead, it was 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 outcomes 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 outcomes and measures and the RSEs and sample sizes that were observed for the 2016 NSDUH. All but one of the observed RSEs differed by no more than roughly 25 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, 16 were less than the expected precisions that were described in the 2016 sample design plan (CBHSQ, 2015b).

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 2016 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 2014 through 2016 NSDUHs. In a continuation of what was seen for the 2014 NSDUH, the current design used in 2016 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: 2016

Outcome	Median Design Effect	Mean Design Effect	Difference (Mean – Median)	Percentage Difference[1]
Total	2.20	2.24	0.04	1.78
Age (Years)				
12 to 17	1.54	1.52	-0.02	-1.35
18 to 25	1.79	1.79	0.00	0.24
26+	1.72	1.74	0.02	1.29
Race/Ethnicity				
White, Not Hispanic or Latino	2.03	2.04	0.01	0.59
Black or African American, Not Hispanic or Latino	2.06	2.10	0.04	1.92
Hispanic or Latino	2.64	2.61	-0.03	-1.11
Other or Multiple, Not Hispanic or Latino	2.38	2.44	0.06	2.57

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

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

Table 6.3 Median and Mean Design Effects of 53 Outcomes: 2014 through 2016

Outcome	Median Design Effect			Mean Design Effect		
	2014	2015	2016	2014	2015	2016
Total	2.26	2.24	2.20	2.28	2.29	2.24
Age (Years)						
12 to 17	1.70	1.62	1.54	1.70	1.62	1.52
18 to 25	1.82	1.75	1.79	1.82	1.77	1.79
26+	1.76	1.74	1.72	1.76	1.79	1.74
Race/Ethnicity						
White, Not Hispanic or Latino	1.94	2.01	2.03	2.07	2.04	2.04
Black or African American, Not Hispanic or Latino	2.32	2.34	2.06	2.25	2.37	2.10
Hispanic or Latino	2.37	2.40	2.64	2.39	2.36	2.61
Other or Multiple, Not Hispanic or Latino	2.46	2.66	2.38	2.67	2.50	2.44

Note: A total of 26 of the 53 outcomes for 2015 were similar but not directly comparable with the variables from the 2014 NSDUH. Results based on the 27 comparable outcomes were very similar to results based on the full 53 outcomes.

Source: SAMHSA, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health, 2014-2016.

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/hashish, 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, treatment or counseling for mental illness, 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 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 2.6 percent for all the comparison groups with the largest difference being 2.57 for the non-Hispanic or Latino other races.

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7. Issues Encountered

This chapter is typically used to document any issues with the sample implementation. In the 2016 National Survey on Drug Use and Health (NSDUH), no such problems were encountered.

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