1999 NATIONAL HOUSEHOLD SURVEY ON DRUG ABUSE

SAMPLING ERROR REPORT

Contract No. 283-98-9008
RTI Project No. 7190
Deliverable No. 19

Authors:

Sara C. Wheeless
Harper Gordek
Avinash C. Singh

Project Director: Thomas G. Virag

Prepared for:

Substance Abuse and Mental Health Services Administration
Rockville, Maryland 20857

Prepared by:

Research Triangle Institute
RTP, North Carolina 27709

July 2, 2001

1999 NATIONAL HOUSEHOLD SURVEY ON DRUG ABUSE

SAMPLING ERROR REPORT

Contract No. 283-98-9008
RTI Project No. 7190
Deliverable No. 19

Authors:

Sara C. Wheeless
Harper Gordek
Avinash C. Singh

Project Director: Thomas G. Virag

Prepared for:

Substance Abuse and Mental Health Services Administration
Rockville, Maryland 20857

Prepared by:

Research Triangle Institute
RTP, North Carolina 27709

July 2, 2001

Acknowledgments

This report was prepared for the Office of Applied Studies, SAMHSA under Contract No. 283-98-9008. The authors are grateful to Joe Gfroerer, Doug Wright, and Art Hughes of SAMHSA, and Ralph Folsom and Jim Chromy of RTI for helpful discussions.

Table of Contents

List of Tables

1. Introduction

As part of any survey data analysis, a good understanding of the resulting standard errors (SEs) and design effects corresponding to a key set of outcome variables and other variables, is important for a number of reasons: (i) to evaluate how well the sample was designed in light of the target and realized precisions and design effects, (ii) for obtaining confidence intervals (CIs) for cross-sectional estimates (and for change estimates in the case of repeated surveys), (iii) to obtain quick estimates of SEs for any user-specified outcome variable through generalized variance function (GVF) modeling based on a set of key outcome variables, and (iv) to be able to incorporate realized design effects for future survey redesign.

This report compares the estimated (or realized) precision of two designs for the 1999 National Household Survey on Drug Abuse (NHSDA): (i) the computer-assisted interviewing (CAI) design and (ii) the paper-and-pencil interviewing (PAPI) design. The comparison was made with targets specified by the sponsor, the Substance Abuse and Mental Health Services Administration (SAMHSA) and with the predicted precision that statisticians from the Research Triangle Institute (RTI) anticipated during the design of the survey. In addition, tables of realized design effects are given. Also the report contains SE tables based on GVF that can be used for estimating the SEs of estimates (prevalences of drug recency of use in various domains, bounded between 0 and 1) from the 1999 NHSDA CAI. For the 1999 PAPI data, however, only limited results are given because of the questionable reliability of the information (see Office of Applied Studies (OAS) 2000). Briefly speaking, field problems arose due to low production rates of field interviewers (FIs); many of them were newly recruited to meet the high demands for the two surveys (CAI and PAPI).

This report is organized as follows. Section 2 summarizes the 1999 CAI and PAPI sample designs. Section 3 describes the calculation of relative standard errors (RSEs) and design effects. Section 4 presents tables that compare the observed precision with the expected precision. Section 5 compares median and mean design effects and gives the percentage of times each of three types of SEs was selected.[1] Section 6 presents median and mean design effects for

[1]This report, like reports produced for previous NHSDAs, uses the maximum-of-three rule for computing design-based SEs under the premise that the precision loss anticipated due to clustering and unequal probability sampling offsets any gain due to stratification (i.e., the design effect should be at least 1.) The three SEs correspond to the SUrvey DAta ANalysis (SUDAAN) assumption of (PSUs), stratified simple random sample (SRS), and SRS. Note that in future analyses, it is planned to use only the standard SUDAAN (with replacement) WR-based SE for the sake of simpler interpretation, as well for easier computation of the SE of functions of estimates, such as differences and ratios.

specific analysis domains. Section 7 gives tables of generalized SEs that can be used for estimating the SEs when direct estimates are unavailable. Finally, concluding remarks are given in Section 8.

2. Overview of the 1999 Sample Designs

2.1 Target Population

The respondent universe for the 1999 National Household Survey on Drug Abuse (NHSDA) was the civilian, noninstitutionalized population 12 years of age or older residing within the 50 United States and the District of Columbia (DC)[2]. Consistent with the NHSDA designs since 1991, the 1999 NHSDA 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. Prior to the 1991 NHSDA, survey coverage was limited to residents of the coterminous 48 States and excluded residents of group quarters and all persons (including civilians) living on military bases. Persons excluded from the 1999 universe included those with no fixed household address (e.g., homeless transients *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 the NHSDA was conducted in 1999 and is to be conducted in subsequent years. The 1999 survey was the first conducted using computer-assisted interviewing (CAI) methods. The 1999 survey also marked the first year in a transition to improved State estimates based on minimum sample sizes per State. In addition, it was the first year in which cigarette brand information was obtained for the Centers for Disease Control and Prevention (CDC). To obtain the required precision at the state level and to improve the precision of cigarette brand data for youths at the national level, the total targeted sample size was increased by 2,500 youths aged 12 to 17 to a total of 70,000 persons. This large sample size allowed SAMHSA to continue to report demographic subgroups at the national level with adequate precision without the need to oversample specially targeted demographics as was required in the past. This large sample is referred to as the "Main Sample" or the "CAI sample."

To maintain estimates of trend over time on a comparable survey mode basis, a nationally allocated sample supplement was also fielded in 1999. For this sample, paper-and-pencil interviewing (PAPI) was employed to maintain comparability with previous years for trend

[2]Material in this section was extracted from the 1999 NHSDA Sample Design Report (Bowman, Chromy, Odom, & Penne, 2000).

estimation purposes. This sample was used to adjust prior years' estimates to make them comparable with estimates obtained using the CAI methodology. This sample is referred to as the "supplemental sample" or the "PAPI sample." A sample size of 20,000 persons comparable to recent years' national samples was planned for the supplemental sample.

2.2.1 5-Year Design

A coordinated 5-year sample design was developed. Both the 1999 main sample and the 1999 supplemental sample are subsamples of the 5-year sample. Although there is no overlap with the 1998 sample, a coordinated design for 1999 to 2003 will facilitate 50% overlap in first-stage units (area segments) between each two successive years from 1999 through 2003. This design will increase the precision of estimates in year-to-year trend analyses because of the expected positive correlation resulting from the overlapping sample between successive NHSDA years.

The 1999 to 2003 design provides for estimates by state in all 50 States plus DC.[3] States may therefore be viewed as the first level of stratification as well as a reporting variable. Eight States, referred to as here the "big" States,[4] had a sample designed to yield 3,600 to 4,630 respondents per State for the 1999 survey. The remaining 43 States, had a sample designed to yield 900 to 1,030 respondents per State in the 1999 survey. The youth supplement was allocated to the larger population States in order to increase precision of smoking-related estimates for youths at the national level.

Within each State, field interviewer (FI) regions were formed. Based on a composited size measure, States were geographically partitioned into roughly equally sized regions. In other words, regions were formed such that each area would yield, in expectation, roughly the same number of interviews during each data collection period, thus distributing the workload equally among NHSDA interviewers. The smaller States were partitioned into 12 FI regions, whereas the eight "big" States were divided into 48 regions. Therefore, the partitioning of the United States resulted in the formation of a total of 900 FI regions.

---

[3]For reporting and stratification purposes, the DC is treated the same as a State, and no distinction is made in the discussion.

[4]For the 1999 to 2003 NHSDAs, the "big" States are California, Florida, Illinois, Michigan, New York, Ohio, Pennsylvania, and Texas.

For the first stage of sampling, each of the FI regions was partitioned into noncompact clusters of dwelling units by aggregating adjacent Census blocks. Consistent with the terminology used in previous NHSDAs, these geographic clusters of blocks are referred to as *segments*. A sample *dwelling unit* in the NHSDA refers to either a housing unit or a group quarters listing unit, such as a dormitory room or a shelter bed. To support the overlapping sample design and any special supplemental samples or field tests that SAMHSA may wish to conduct, segments were formed to contain a minimum of 150 dwelling units[5] on average. In prior years, this average minimum segment dwelling unit size was only 90.

Before selecting sample segments, additional implicit stratification was achieved by sorting the first-stage sampling units by socioeconomic status indicator[6] and by the percentage of the population that is non-Hispanic and white. From this well-ordered sample frame, 96 segments per FI region were selected with probabilities proportionate to a composite size measure and with minimum replacement.[7] The selected segments were then randomly assigned to a survey year and quarter of data collection. A total of 24 of these segments were designated for the coordinated 5-year sample, while the other 72 were designated as "reserve" segments.

2.2.2 Main Sample (Computer-Assisted Interviewing)

Once sample segments for the 1999 NHSDA were selected, specially trained field household listers visited the areas and obtained complete and accurate lists of all eligible dwelling units within the sample segment boundaries. These lists served as the frames for the second stage of sample selection.

The primary objective of the second stage of sample selection (listing units) was to determine the minimum number of dwelling units 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 we refer to as the "driving" age group. Using 1990 Census data adjusted to more recent data from Claritas, State-and age-specific sampling rates were computed. These rates were then adjusted by the segment's probability of

---

[5]Dwelling unit counts were obtained from the 1990 Decennial Census data supplemented with revised population counts from Claritas.

[6]Four categories are defined using metropolitan statistical area (MSA) and socioeconomic status (SES) information: (1) MSA/low SES, (2) MSA/high SES, (3) Non-MSA/low SES, and (4) Non-MSA/high SES.

[7]The 1999 to 2003 sample was planned such that 48 segments per FI region would be selected. In the implementation, however, an additional 48 segments were added to support any supplemental or field test samples.

selection, the subsegmentation inflation factor,[8] if any, the probability of selecting a person in the age group (equal to the maximum or 0.99 for the driving age group), and an adjustment for the "Max of 2" Rule.[9] In addition to these factors, historical data from the 1997 NHSDA were used to compute predicted screening and interviewing response rate adjustments. The final adjusted sampling rate was then multiplied by the actual number of dwelling units 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. For example, to ensure adequate sample for the overlapping design and/or for supplemental studies, the listing unit sample size could not exceed 100 or half of the actual listing unit count. Similarly, beginning in quarter 3, a minimum of five listing units per segment was required for cost efficiency.

Using a random start point and interval-based (systematic) selection, the actual listing units were selected from the segment frame. After dwelling unit selections were made, an interviewer visited each selected dwelling unit to obtain a roster of all persons residing in the dwelling unit. As in previous years, during the data collection period, if an interviewer encountered any new dwelling unit in a segment or found a dwelling unit that was missed during the original counting and listing activities, then the new/missed dwellings were selected into the 1999 NHSDA using the half-open interval selection technique.[10] The selection technique eliminates any frame bias that might be introduced because of errors and/or omissions in the counting and listing activities and also eliminates any bias that might be associated with using "old" segment listings.

Using the roster information obtained from an eligible member of the selected dwelling unit, zero, one, or two 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

---

[8]Segments found to be very large in the field were partitioned into equally representative *subsegments*. Then, one subsegment was chosen at random to be fielded. The subsegmentation inflation factor accounts for the narrowing down of the segment.

[9]Brewer's Selection Algorithm never allows for greater than a two-person per household to be chosen. Thus, sampling rates were adjusted to satisfy this constraint.

[10]In summary, this technique states that if a dwelling unit is selected for the 1999 study and an interviewer observes any new or missed dwelling units between the selected dwelling unit and the dwelling unit appearing immediately after the selection on the counting and listing form, then all new/missed dwellings falling in this interval will be selected. If a large number of new/missed dwelling units are encountered (generally greater than six), then a sample of the missing dwelling units will be selected.

which automatically implemented this third stage of selection based on the state and age group sampling parameters.

One exciting consequence of using an electronic screening instrument in the NHSDA is the ability to impose a more complicated person-level selection algorithm on the third stage of the NHSDA design. In 1999, one unique feature included in the design was that *any* two survey-eligible people within a dwelling unit had some chance of being selected (i.e., all survey-eligible pairs of people had some nonzero chance of being selected). This feature of the 1999 design was of interest to NHSDA 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 other family members residing in the same dwelling unit (e.g., the relationship of drug use between a parent and his/her child).

2.2.3 Supplemental Sample (Paper-and-Pencil Interviewing)

To maximize precision between the main study sample's CAI estimates and estimates generated from the PAPI supplemental sample, the design of the supplemental sample closely mirrored that of the main study with an additional level of clustering imposed at the first stage of selection. This additional clustering was introduced to minimize the costs associated with collecting the supplemental data by minimizing the number of interviewers that needed to be trained on the PAPI instrument. Unlike the main study, the supplemental sample's effort was designed to oversample Hispanics and blacks (as well as younger individuals) in order to maximize contrast estimates for these important subpopulations of interest. Finally, the 1999 supplemental sample allocation to age groups was matched to prior year allocations to facilitate efficient trend estimation.

The initial stage of selection entailed subselecting 250 FI regions from among the 900 FI regions defined for the main study. These FI regions were selected randomly within strata that were defined to isolate relatively high concentrated Hispanic areas, high concentrated black areas, high concentrated white areas, and the remainder areas. This racial.ethnic stratification was imposed to optimally sample Hispanics and blacks at the last stage of selection.

After the 250 FI regions were subselected, at the second stage of selection all those segments that were selected for the main study sample within these regions were also selected for the supplemental sample. The main study probabilities of selection apply here because segments were randomly selected from within the main study FI region strata. This complete segment

overlap between the main study and supplemental sample within the 250 FI regions provides for the maximal amount of precision when contrasting estimates between the two samples.

Within each segment, at the third stage of selection a sample of dwelling units was selected from among those not selected for the main study. The line sample size determination for the supplemental sample closely resembled that of the main study. In the supplemental sample, however, design stratum, age group, and race were considered instead of State and age.

Similar to the main study, at the fourth stage of selection for the supplemental sample, either zero, one or two persons were selected from within each successfully screened dwelling unit. As with the main study, any pair of survey-eligible residents within the dwelling unit had some known, nonzero chance of being selected for the survey.

3. Computing Relative Standard Errors and Design Effects

As mentioned in Section 1, there are several objectives for calculating relative standard errors (RSEs) and design effects for the 1999 NHSDA. One is to provide a mechanism for comparing the expected precision of the 1999 design with the precision actually obtained. A second objective is to provide government analysts and other users of the NHSDA data with a methodology for determining a quick approximation of the precision of estimates obtained from the 1999 survey. The third objective is to build confidence intervals (CIs) of estimates of level and change. Finally, magnitudes of design effects are useful for future redesign of the survey.

The RSE of a domain-d prevalence estimate is the SE of the estimate divided by the estimate; that is,.

$$RSE(\hat{P}_d) = SE(\hat{P}_d)/\hat{P}_d \quad . \tag{1}$$

The design effect for a prevalence estimate is its variance divided by the variance that would be observed if simple random sampling (SRS) had been used. Hence, the SE of the estimated prevalence can be written as follows:

$$SE(\hat{P}_d) = [DEFF(d)\hat{P}_d[1-\hat{P}]/n_d]^{1/2} \quad , \tag{2}$$

where DEFF(d) and n_d are the median (or mean as the case may be) design effect and sample size of domain-d respectively.

By substituting a prevalence rate of 0.10 into formulas (1) and (2), the RSE becomes

$$RSE(\hat{P} = .10) = [(DEFF(d) * 9/n_d)]^{1/2} \quad . \tag{3}$$

This shows that for the specified prevalence rate of 0.10, the RSE is purely a function of the design effect and sample size. In the tables given in this report, RSEs are expressed as percentages; that is, the right-hand side of equation (3) is multiplied by 100.

Mean and median design effects were used for many of the calculations in this report. Design effects were calculated based on estimates displayed in the sample design plan (Chromy, Bowman, & Penne, 1999), the report (Bowman et al., 2000), and the summary tables in the *Summary of Findings* reports, (Office of Applied Studies [OAS], 2000).

As noted previously, the design effect 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 design effect 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, the design effect should virtually always be greater than 1.

However, design effects were sometimes less than 1 for prevalence rates near 0. Because these values were considered spurious, another design effect estimate based only on stratification and unequal weighting effects was substituted if it was greater than the total design effect. Moreover, if both design effect estimates were less than 1, a value of 1 was substituted.

For each estimate, the maximum of three variances was calculated. The three variances were calculated using three designs referred to as (1) sampling with replacement at the first stage, (2) stratified random sampling with replacement, and (3) SRS. The with-replacement variance estimate properly accounts for clustering, stratification, and unequal weighting. The stratified with-replacement variance estimate is proper for a single-stage, stratified, probability proportionate to size (PPS) with-replacement sample, and as such reflects only the stratification and unequal weighting effects. The third variance estimate reflects SRS. The maximum of these three variance estimates was used to conservatively estimate the variance because such variance estimates are themselves subject to variability.

Design effects associated with prevalence estimates below 0.00005 or above 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, design effects or the corresponding prevalence estimates were not included if the corresponding RSE of -ln(p) satisfies

$$RSE[-\ln(p)] > 0.175 \quad \text{when } p \leq .5$$

or

$$RSE[-\ln(1-p)] > 0.175 \quad \text{when } p > .5.$$

A rationale for this rule is that for a prevalence estimate of 0.10, the minimum required effective sample size (or the sample size under SRS) is around 50 (55.43 to be exact) when the maximum tolerable value of RSE (-ln(p)) = 0.175. This can be derived as follows: under SRS, RSE(p) is equal to the square root of p(1-p)/np, and using Taylor series, SE (-ln(p)) is approximately SE(p)/p, i.e., RSE(p). Therefore, under SRS, RSE(-ln(p)) is approximately RSE(p)/(-ln(p)). Then substituting p = 0.1, and RSE(-ln(p)) = 0.175, gives n = 55.43 under SRS. For complex designs, this can be interpreted as the minimum required effective sample size. In other words, if deff(p) is 2, the minimum required sample size is the design effect times the effective sample size (i.e., 110).

It may be remarked that for a given sample size, the RSE increases as p decreases, and for a given p, it increases as the sample size decreases. The above discussion pertains to p< .5. For p >.5, RSE(p) is not symmetric about p = .5 although SE (p) is. Clearly, precision requirements should be identical for p or 1-p. Therefore, it is convenient to use the convention that the suppression rule for p < .5 is also applied for p > .5 by replacing p by 1-p.

This page intentionally left blank.

4. Comparing Observed Precision with Expected Precision

The sample design optimization for the 1999 NHSDA's computer-assisted and paper-and-pencil interviewing (CAI and PAPI) versions used the revised 9 key classes of NHSDA outcomes unlike the 56 classes used in the 1998 PAPI. These outcomes included recency-of-use estimates, treatment received for alcohol and illicit drug use, and dependency on alcohol and illicit drug use. Specifically, the outcomes used for 1999 were

- cigarette use in the past month,
- alcohol use in the past month,
- any illicit drug use in the past month,
- any illicit drug use other than marijuana in the past month,
- cocaine use in the past month,
- dependent on illicit drugs in the past year,
- dependent on alcohol and not illicit drugs in the past year,
- received treatment for illicit drug use in the past year, and
- received treatment for alcohol, but not illicit drugs, in the past year.

The 56 outcomes used in 1998 correspond to three recency-of-use categories for 15 illicit and 3 licit drug use categories plus two outcomes corresponding to past month heavy drinking and binge drinking (see Section 5.1). Precision requirements for the 1999 designs were specified in terms of targeted relative standard errors (RSEs) on a prevalence of 10% for age, race/ethnicity, and total domains and in terms of minimum sample sizes. The estimates and standard errors for the above outcomes were scaled to a prevalence of 10% as given by formula (3) in Section 3.

In this section, two benchmarks in the 1999 NHSDA are compared to the estimated achieved precision of important outcome measures. One is the derived from requirements specified by the Substance Abuse and Mental Health Services Administration (SAMHSA), and the other is the predicted precision that statisticians at Research Triangle Institute (RTI) anticipated during the design of the survey.

4.1 1999 Computer-Assisted Interviewing Design

4.1.1 Precision Requirements

Initial requirements for the CAI were defined in terms of the following:

- minimum sample sizes of 3,600 persons per state in eight large States and 900 persons in the remaining 43 States.
- Equal allocation of the sample across the three age groups: 12-17, 18-25, and 26+ within each state.

In addition, for national estimates, the SAMHSA-specified, precision requirements were that the expected relative standard error on a prevalence of 10% not exceed:

- 3.0% for total population statistics,
- 5.0% for statistics in four age group domains: 12 to 17, 18 to 25, 26 to 34, and 35+years old;
- 11.0% for statistics computed among Hispanics in four age group domains: 12 to 17, 18 to 25, 26 to 34, and 35+ years old;
- 11.0% for statistics computed among non-Hispanic blacks in four age group domains: 12 to 17, 18 to 25, 26 to 34, and 35+ years old; and
- 5.0% for statistics computed among non-Hispanic, non-blacks in four age group domains: 12 to 17, 18 to 25, 26 to 34, and 35+ years old.

A tobacco brand interview supplement and an additional national sample of 2,500 youths aged 12 to 17 were added to the NHSDA sample to allow for estimation of tobacco brand usage by youths.

The 1999 sample is the first sample to reflect SAMHSA's objective to develop more reliable State-level estimates using small area estimation procedures. To achieve this objective, the targeted sample size by State was set be at least 900 completed interviews; in eight States, the target was set at 3,600 completed interviews.[11] The larger overall sample makes it possible to get

[11]Due to a supplement of 2,500 cases at the national level for persons aged 12 to 17, the actual targets in the more populous States were increased to absorb this additional sample in the most effective way to improve the precision of national estimates for the 12- to 17-year-old age group.

adequate precision for Hispanic and non-Hispanic black populations without any targeted oversampling of areas of high concentration of these populations or any oversampling through screening for these target populations

4.1.2 Observed Versus Expected Precision

Table 4.1 presents observed results compared with projections for sample sizes, design effects, and associated RSEs, by race/ethnicity and age group for the CAI. The projected RSEs are averages over the nine outcome variables as given in the 1999 sample design report (Bowman et al. 2000). Note that using formula (3), the RSEs for all the outcome variables are scaled to the generic prevalence of 0.10. The projected design effect was derived as average of the design effects corresponding to the projected RSEs via formula (3) for various domains. For the observed RSE, mean design effects for the nine outcomes listed above were substituted into formula (3) to obtain mean RSEs for a prevalence of 0.10. We use the mean here for comparison purposes instead of the median since the mean was used for the purpose of sample allocation. Also, because the design effect is proportional to RSE^2 or relative variance, it is probably more meaningful to compute projected RSE over all nine outcomes as root mean relative variance rather than mean RSE. However, the difference between the two is only marginal. All of the nine prevalence estimates contributed to the means in Table 4.1; none was suppressed because of low precision. Although the observed design effects and RSEs are generally higher than the projected, the targeted RSEs were met most of the time in 13 of the 17 domains. Targeted RSEs were, however, not met for the four domains, namely, Hispanics 35+ years old, blacks 26-34 years old, blacks 35+ years old, and whites 26 to 34 years old. In all these domains except for Hispanic 35+, RSE was only skightly over the target. Also observe that the projected sample sizes were reasonably met under the CAI design.

4.2 1999 Paper-and Pencil Interviewing Design

4.2.1 Precision Requirements

Sample size requirements were set to meet these precision levels:

- 3.4% for total population statistics;
- 6.7% for statistics in four age group domains: 12 to 17, 18 to 25, 26 to 34, and 35+ years old;

- 11.2% for statistics computed among Hispanics in four age group domains: 12 to 17, 18 to 25, 26 to 34 and 35+;

- 11.2% for statistics computed among non-Hispanic blacks in four age group domains: 12 to 17, 18 to 25, 26 to 34, 35+ years old;

- 7.5% for statistics computed among non-Hispanic, non-blacks in four age group domains: 12 to 17, 18 to 25, 26 to 34, and 35+ years old.

4.2.2 Observed Versus Expected Precision

Table 4.2 presents observed results compared with projections for sample sizes and RSEs, by race/ethnicity and age group for the PAPI. Mean design effects for the five recency-of-use estimates were substituted into formula (3) to obtain mean RSEs for a prevalence of 0.10. The four treatment and dependency outcomes were not used because they were not created for the PAPI analysis data file.

Projected sample sizes were not achieved in the PAPI due to field problems, and a decision was made to reduce the overall PAPI sample from 20000 to 15000. The field problems arose due to relatively lower production rates of completed interviews by field interviewers (FI); many of them were newly recruited to meet high demands for both the CAI and PAPI surveys and therefore lacked experience. CAI, being the main survey, was given priority in terms of achieving required sample sizes for each quarter. It may be noted that the PAPI weights were adjusted by a modification to the final poststratification step by adding controls reflecting the 1998 respondent distribution associated with the FI experience. This adjustment for FI experience was desirable for removing bias in the trend estimates due to the unusual distribution (of respondents produced by interviewers) among different FI experience categories. However, it led to higher overall unequal weighting effect (UWE) from 3.05 to 5.77, and for various domains of Table 4.2, the increase in UWE varied from about 1.2 to 2. This explains to some extent why there is considerable increase in the observed mean design effect in comparison to the projected one. Now, as a result of this increase in UWE as well as reduction in sample size, the target precision, as expected, was not achieved.

Table 4.1 Estimated Precision Compared with Targeted and Projected Precision, by Race/Ethnicity and Age Group: 1999 NHSDA CAI

Race/ Ethnicity	Age Group	Sample Size			Mean Design Effect			Mean Relative Standard Error at p=10%			
		Projected	Observed	% Off	Projected	Observed	% Off	Projected	Target	Observed[1]	% Off[2]
Total	Total	70,000	66,706	-4.7	3.10	3.49	12.58	1.98	3.00	2.16	-28.1
	12-17	25,000	25,357	1.4	1.62	1.66	2.47	2.41	5.00	2.42	-51.5
	18-25	22,500	21,933	-2.5	1.68	2.11	25.60	2.59	5.00	2.94	-41.2
	26-34	9,352	7,878	-15.8	1.50	1.69	12.67	3.79	5.00	4.39	-12.2
	35+	13,148	11,538	-12.3	1.42	1.79	26.06	3.10	5.00	3.74	-25.2
Hispanic	Total	7,493	8,481	13.2	2.73	4.00	46.52	5.69	.	6.46	.
	12-17	3,049	3,516	15.3	1.42	1.98	39.44	6.47	11.00	7.10	-35.4
	18-25	2,410	3,000	24.5	1.44	1.90	31.94	7.34	11.00	7.53	-31.6
	26-34	1,086	1,175	8.2	1.30	1.42	9.23	10.39	11.00	10.36	-5.9
	35+	947	790	-16.6	1.28	1.76	37.50	11.00	11.00	14.11	28.3
Black	Total	8,853	8,171	-7.7	3.38	4.78	41.42	5.85	.	7.15	.
	12-17	3,335	3,384	1.5	1.46	1.61	10.27	6.27	11.00	6.51	-40.9
	18-25	2,997	2,802	-6.5	1.60	1.87	16.88	6.92	11.00	7.74	-29.7
	26-34	1,306	901	-31.0	1.46	1.38	-5.48	10.02	11.00	11.70	6.4
	35+	1,210	1,084	-10.4	1.23	1.84	49.59	9.58	11.00	12.31	11.9
White	Total	53,662	50,054	-6.7	2.91	3.14	7.90	2.18	.	2.36	.
	12-17	18,620	18,457	-0.9	1.59	1.59	0.00	2.78	5.00	2.78	-44.4
	18-25	17,093	16,131	-5.6	1.74	2.07	18.97	3.03	5.00	3.39	-32.3
	26-34	6,959	5,802	-16.6	1.39	1.79	28.78	4.24	5.00	5.26	5.2
	35+	10,991	9,664	-12.1	1.36	1.73	27.21	3.33	5.00	4.01	-19.7

[1]Calculated using equation (2) with the observed sample size and the mean observed design effect.
[2]Percent relative difference from the target relative standard error.

Source: SAMHSA, Office of Applied Studies, National Household Survey on Drug Abuse, 1999 CAI.

Table 4.2 Estimated Precision Compared with Targeted Projected Precision, by Race/Ethnicity and Age Group: 1999 NHSDA PAPI

Race/ Ethnicity	Age Group	Sample Size			Mean Design Effect			Mean Relative Standard Error at p=10%			
		Projected	Observed	% Off	Projected	Observed	% Off	Projected	Target	Observed[1]	% Off[2]
Total	Total	20,000	13,809	-31.0	1.66	4.93	196.99	2.71	3.40	5.55	63.3
	12-17	4,749	3,449	-27.4	1.69	3.29	94.67	5.65	6.75	9.21	36.4
	18-25	5,042	3,648	-27.7	1.80	4.47	148.33	5.66	6.75	10.42	54.3
	26-34	4,624	2,965	-35.9	1.69	3.54	109.47	5.71	6.75	10.19	51.0
	35+	5,585	3,747	-32.9	.98	2.95	201.02	3.95	6.75	8.32	23.3
Hispanic	Total	4,443	3,048	-31.4	1.76	5.09	189.20	5.96	.	12.18	.
	12-17	1,205	845	-29.9	1.48	2.51	69.59	10.50	11.25	16.16	43.7
	18-25	1,108	824	-25.6	1.48	4.81	225.00	10.94	11.25	22.75	102.2
	26-34	1,080	680	-37.0	1.44	2.30	59.72	10.97	11.25	17.14	52.3
	35+	1,050	699	-33.4	1.22	3.72	204.92	10.22	11.25	21.22	88.7
Black	Total	4,457	3,304	-25.9	2.21	5.57	152.04	6.67	.	12.24	.
	12-17	1,126	874	-22.4	1.44	2.71	88.19	10.71	11.25	16.65	48.0
	18-25	1,266	941	-25.7	1.62	3.22	98.77	10.74	11.25	17.46	55.2
	26-34	1,142	775	-32.1	1.55	3.42	120.65	11.04	11.25	19.91	76.9
	35+	923	714	-22.6	1.12	3.20	185.71	10.45	11.25	20.03	78.0
White	Tota1	11,100	7,457	-32.8	1.36	3.75	175.74	3.29	.	6.56	.
	12-17	2,418	1,730	-28.5	1.41	2.67	89.36	7.25	7.50	11.72	56.3
	18-25	2,668	1,883	-29.4	1.53	3.93	156.86	7.19	7.50	13.50	80.0
	26-34	2,402	1,510	-37.1	1.35	2.74	102.96	7.10	7.50	12.51	66.8
	35+	3,612	2,334	-35.4	.87	2.62	201.15	4.63	7.50	9.93	32.4

[1]Calculated using equation (2) with the observed sample size and the mean observed design effect.
[2]Percent relative difference from the target relative standard error.

Source: SAMHSA, Office of Applied Studies, National Household Survey on Drug Abuse, 1999 PAPI.

5. Comparison of Median and Mean Design Effects

5.1 Mean Versus Median

The mean is more sensitive to outliers and is generally larger than the median. **Table 5.1** compares the median and mean of 56 design effects for three age groups and the total in the 1999 computer-assisted interviewing (CAI) design. Comparison is also given for the four race/Hispanicity categories although they were not used as stratification variables when selecting persons within households as was done during the 1998 paper-and-pencil interviewing survey. In this section, the corresponding comparison results for PAPI are not presented because PAPI data were subject to only very limited analysis (see discussion in Section 4.2.2).

The median and design effect estimates were based on estimates from the following:

- ***15 illicit drug use categories:*** any illicit drug use, marijuana/hashish, cocaine, crack, inhalants, hallucinogens, LSD, PCP, heroin, nonmedical use of any psychotherapeutic, nonmedical use of stimulants, nonmedical use of sedatives, nonmedical use of tranquilizers, nonmedical use of analgesics, any illicit drug except marijuana, and

- ***3 licit drug use categories:*** cigarettes, alcohol, and smokeless tobacco;

These were applied for each of ***three recency-of-use categories:*** ever used, used in past year, and used in past month.

The estimates of past month heavy drinking and binge drinking were also included in the licit drug use category, bringing the total number of estimates used for the mean versus median comparisons to 56. The median and the mean design effects were calculated from the above estimates for the total population, by age and by race/ethnicity. As seen from Table 5.1, t the mean design effect is larger than the median design effect in only four out of the eight domains, but in one of the domains (other race/ethnicity), it is substantially larger.

5.2 Maximum-of-Three Rule for Selecting Standard Error

As mentioned in Section 3, the standard errors (SEs) presented for estimates used in this report are computed as the maximum of the SE under three designs: simple random sampling (SRS) with replacement, stratified random sampling, and sampling with replacement at the first stage.

Tables 5.2 and **5.3** give the percentage of times each of the three SEs was selected for the estimates used in **Tables 6.1, 6.2, and 6.3.** Table 5.2 shows that there seems to have been an increasing trend in the use of the SRS's SE as one moved from the lower to the older age group (26+), although the SE under the primary sampling unit (PSU) with-replacement assumption was used most of the time. To get a better understanding using the size of the prevalence estimates, **Table 5.3** shows that for smaller prevalences (0.5% or less), the SRS's SE was most likely to be used. This is probably due to the fact that for low prevalences, clustering has negligible effect on the drug use. However, for prevalences greater than 5%, the with-replacement SE was used about two thirds of the time and the stratified with-replacement SE was used about one third of the time.

Table 5.1 Comparison of Median and Mean Design Effects of 56 Outcomes

Outcome	Median Design Effect	Mean Design Effect	Difference (Mean-Median)	Percent Difference[1]
Total	3.71	3.51	-0.20	-5.39
Age				
12-17	1.65	1.66	0.01	0.41
18-25	2.07	2.15	0.07	3.43
26+	2.03	1.99	-0.05	-2.30
Race/Ethnicity				
White	3.50	3.15	-0.36	-10.14
Black	3.94	3.93	-0.01	-0.38
Hispanic	3.85	4.10	0.25	6.44
Other	2.90	3.48	0.59	20.25

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

Source: SAMHSA, Office of Applied Studies, National Household Survey on Drug Abuse, 1999 CAI.

Table 5.2 Percentage of Times Each Type of Standard Error Was Selected for the CAI Estimates, by Age Group

Age Group	Type of Standard Error			Number of Estimates
	With Replacement	Stratified With Replacement	Simple Random Sample	
Total U.S.	53.1	30.9	16.0	4,509
12-17	53.5	40.2	6.5	3,797
18-25	66.9	29.3	3.8	4,314
26+	51.4	38.3	10.3	3,705

Standard error estimates are those that go into the medians for the "Age" and "Total" columns in Tables 6.1, 6.2, and 6.3.

Source: SAMHSA, Office of Applied Studies, National Household Survey on Drug Abuse, 1999 CAI.

Table 5.3 Percentage of Times Each Type of Standard Error Was Selected for the CAI Estimates, by Size of the Estimate

Size of Percentage Estimate	Percentage of Times Each Type of Standard Error Was Selected			Number of Estimates
	With Replacement	Stratified With Replacement	Simple Random Sample	
<0.5%	33.2	24.2	42.6	1,947
0.5-1.0%	47.8	28.3	24.9	1,309
1.0-5.0%	55.7	37.0	7.3	4,771
5.0-10.0%	61.1	38.0	0.9	2,656
10.0-15.0%	64.6	35.4	0.0	1,366
15.0-30.0%	62.9	37.1	0.0	2,058
30.0-50.0%	66.9	33.1	0.0	1,198
50.0-75.0%	66.9	33.1	0.0	683
≥75%	65.9	33.8	0.3	346
All Estimates	56.4	34.3	9.3	16,634

Standard error estimates are those that go into the medians for the "Age" and "Total" columns in Tables 6.1, 6.2, and 6.3.

Source: SAMHSA, Office of Applied Studies, National Household Survey on Drug Abuse, 1999 CAI.

6. Use of Domain-Specific Design Effects for Approximating Standard Error

This section presents one of the two approaches considered for approximating standard error (SE) estimates when published estimates or computer software are un available. The first approach is based on median domain design effects considered in this section while Section 7 presents SE estimates based on a prediction equation obtained from modeling design effects.

6.1 Computer-Assisted Interviewing

Domains were defined by cross-classifications of age and gender, by race/ethnicity, population density, geographic division of residence, adult education, current employment, and state. The 56 types of drug and recency categories given in Section 5 were used for the estimates on which the medians were computed. Design effects associated with percentage estimates exhibiting low precision as defined in Section 3 were not used. The median design effects were computed separately for the three classifications: lifetime illicit drug use (**Table 6.1**), past year and past month illicit drug use (**Table 6.2**), and licit drug use (**Table 6.3**). Note that design effects for lifetime are expected to be quite different from those for past year and past month; therefore, it is desirable to keep the two separate. However, for licit drugs, this was not done because of the small number of drug use variables available for computing median for each domain (a total of only 11). This is a limitation of this method based on medians, unlike the generalized variance function (GVF) method used in Section 7. These tables can be used to calculate an approximate variance estimate for a particular domain as follows:

$$var(p_d)_{appx} = DEFF_{d,MED} * [p_d(1-p_d)/n_d] \ , \qquad \textbf{(4)}$$

where

p_d = estimated proportion for domain d,

n_d = sample size for domain d, and

$DEFF_{d,MED}$ = median design effect for domain d.

The approximate SE estimate for p_d, $SE(p_d)_{appx}$, is the square root of $var(p_d)_{appx}$. These tables give the median design effects for the 8 large states, and the median of the 43-State medians for the

remaining States. Results for the smaller States are given for reference only. Although design effects are of the same order as that for the larger States (because the sample design is the same for all States), the above approximate formula is not recommended for use with smaller States because of the instability of the prevalence estimates. Instead the small area estimation methodology should be used (see Office of Applied Studies [OAS], 2000). To get an idea of the magnitude of drug-specific design effects used in computing the median design effect over the drugs, **Table 6.4** lists the 56 individual design effects for each of the age groups and the national total.

6.2 Paper-and-Pencil Interviewing

As discussed in OAS (2000), we consider design effects for a limited set of paper-and-pencil interviewing (PAPI) estimates corresponding to past month drug use by age; the race/ethnicity domain was not considered. **Table 6.5** gives the median design effects separately for past month illicit and past month licit drug use. **Table 6.6** presents the individual design effects by drug classified by age. It lists only 20 drugs instead of 56 of Table 6.4 because only past month recency was included. Note that as in 1998 PAPI, the PCP drug use estimate for those aged 26 years or older was excluded due to low precision. Equation (4) can be used as before to calculate approximate variance estimates.

Table 6.1 Median Design Effects of Lifetime Illicit Drug Use, by Age Group, Gender, and Demographic Characteristics: 1999 NHSDA, CAI

Demographic Characteristics	Age Group			Gender		Total
	12 to 17	18 to 25	26+	Male	Female	
Total	1.63	2.25	2.06	4.55	4.05	4.59
Gender						
Male	1.58	1.99	2.05	NA	NA	4.57
Female	1.62	1.89	1.96	NA	NA	4.05
Age						
12 to 17 years	NA	NA	NA	1.58	1.62	1.63
18 to 25 years	NA	NA	NA	1.99	1.89	2.25
26+	NA	NA	NA	2.05	1.96	2.06
Race/Ethnicity						
White	1.61	2.29	1.96	4.22	3.87	4.09
Black	1.60	1.89	2.14	5.73	3.97	5.19
Hispanic	1.76	1.76	2.29	5.01	3.46	5.13
Other	1.67	2.39	1.56	2.92	3.81	3.44
Population Density						
Large metropolitan	1.45	1.95	1.90	4.28	3.55	4.18
Small metropolitan	1.75	2.29	2.08	4.43	4.28	4.46
Nonmetropolitan	1.68	2.34	1.88	3.87	4.00	4.11
Census Division						
New England	2.71	3.85	3.68	8.01	6.68	7.39
Middle Atlantic	1.57	2.13	1.77	3.49	3.22	3.64
East North Central	1.31	2.01	1.45	3.09	2.43	2.86
West North Central	2.08	2.49	1.99	4.58	3.81	4.22
South Atlantic	1.62	2.02	2.38	4.84	4.98	5.42
East South Central	1.36	1.71	1.87	4.78	3.56	3.94
West South Central	1.36	1.85	1.60	3.14	2.87	3.18
Mountain	1.94	2.31	2.12	4.35	4.97	4.63
Pacific	1.69	1.58	1.96	4.91	4.71	4.72
County Type						
Large Metropolitan	1.47	1.90	1.89	4.23	3.70	4.24
Small Metropolitan >250,000	1.72	1.87	2.15	4.26	3.88	4.56
Small Metropolitan <250,000	1.98	3.48	2.07	4.41	4.81	4.74
Nonmetropolitan >20,000	1.62	2.31	1.85	3.16	4.37	4.00
Nonmetropolitan 2,500-19,999	1.58	2.22	1.88	3.80	3.27	3.93
Nonmetropolitan <2,500	2.01	2.46	1.80	3.22	3.95	4.06
Adult Education[1]						
Less than high school	NA	1.78	1.70	3.07	2.13	2.70
High school graduate	NA	1.88	1.89	3.23	2.78	3.05
Some college	NA	2.22	2.09	3.32	3.62	3.55
College graduate	NA	2.05	2.35	2.82	2.93	3.09
Current Employment[2]						
Full-time	NA	1.90	2.14	3.19	3.03	3.20
Part-time	NA	2.15	2.01	4.51	3.80	3.74
Unemployed	NA	1.72	2.13	4.31	4.22	4.26
Other[3]	NA	2.06	1.64	2.66	2.01	2.37

See notes at end of table. (continued)

Table 6.1 (continued)

Demographic Characteristics	Age Group			Gender		Total
	12 to 17	18 to 25	26+	Male	Female	
State						
California	1.45	1.23	1.54	4.09	4.09	3.99
Florida	1.56	1.52	1.61	3.97	2.78	3.41
Illinois	1.28	1.55	1.63	3.64	2.66	3.13
Michigan	1.26	1.59	1.52	3.00	2.54	2.99
New York	1.52	1.59	1.62	3.01	3.08	3.42
Ohio	1.18	1.85	1.33	2.67	2.45	2.65
Pennsylvania	1.39	1.71	2.15	2.97	3.65	4.37
Texas	1.28	1.79	1.58	3.09	2.67	3.21
All Other[4]	1.36	1.52	1.45	3.23	2.68	3.20

Note: These design effects apply to the following drugs: any illicit drug use; marijuana/hashish; cocaine; crack; inhalants; hallucinogens; LSD; PCP; heroin; nonmedical use of any psychotherapeutics; nonmedical use of sedatives; nonmedical use of tranquilizers; nonmedical use of pain relievers; and any illicit drug except marijuana.

NA = not applicable

[1]Data on adult education are not applicable for 12 to 17 year olds.
[2]Data on current employment are not applicable for 12 to 17 year olds.
[3]Retired, disabled, homemaker, student or "other."
[4]Median of the median design effects for the 43 States.

Source: SAMHSA, Office of Applied Studies, CAI, National Household Survey on Drug Abuse, 1999, CAI.

Table 6.2 Median Design Effects of Past Year and Past Month Illicit Drug Use, by Age Group, Gender, and Demographic Characteristics: 1999 NHSDA, CAI

Demographic Characteristics	Age Group			Gender		Total
	12 to 17	18 to 25	26+	Male	Female	
Total	1.64	1.98	1.82	3.04	2.50	2.89
Gender						
Male	1.60	1.89	1.88	NA	NA	3.04
Female	1.57	1.83	1.67	NA	NA	2.50
Age						
12 to 17	NA	NA	NA	1.60	1.57	1.64
18 to 25	NA	NA	NA	1.89	1.83	1.98
26+	NA	NA	NA	1.88	1.67	1.82
Race/Ethnicity						
White	1.57	2.01	1.79	2.58	2.37	2.53
Black	1.53	1.70	1.58	2.70	2.38	3.21
Hispanic	1.74	1.85	2.18	4.00	1.07	3.38
Other	1.73	2.25	1.68	1.33	1.31	1.36
Population Density						
Large metropolitan	1.46	1.82	1.72	2.77	1.82	2.79
Small metropolitan	1.71	1.95	1.74	2.03	2.52	2.47
Nonmetropolitan	1.65	2.01	1.51	2.35	1.76	2.27
Census Division						
New England	2.57	2.47	4.06	4.12	2.71	5.57
Middle Atlantic	1.51	1.80	1.57	1.98	1.71	2.36
East North Central	1.30	1.74	1.22	1.92	1.59	1.76
West North Central	1.86	2.79	1.61	1.88	2.23	2.13
South Atlantic	1.55	1.98	1.78	2.49	1.99	2.42
East South Central	1.41	1.59	1.75	2.26	1.73	1.90
West South Central	1.27	1.54	1.38	1.43	1.25	1.62
Mountain	2.05	2.54	2.04	3.12	1.65	3.23
Pacific	1.66	1.68	1.78	2.28	2.65	3.11
County Type						
Large Metropolitan	1.46	1.79	1.69	2.81	1.82	2.81
Small Metropolitan >250,000	1.63	1.85	1.78	2.23	2.70	2.52
Small Metropolitan <250,000	1.82	2.42	1.14	1.51	1.23	1.42
Nonmetropolitan >20,000	1.58	2.12	1.46	1.11	2.43	1.82
Nonmetropolitan 2,500-19,999	1.56	1.84	1.54	2.43	1.00	2.18
Nonmetropolitan <2,500	2.01	2.14	1.76	1.58	1.02	1.35
Adult Education[1]						
Less than high school	NA	1.75	1.66	2.33	1.45	2.15
High school graduate	NA	1.92	1.52	1.75	1.70	1.88
Some college	NA	2.00	2.04	2.27	2.27	2.62
College graduate	NA	2.01	1.71	1.59	2.31	1.86

See notes at end of table.

(continued)

Table 6.2 (continued)

Demographic Characteristics	Age Group			Gender		Total
	12 to 17	18 to 25	26+	Male	Female	
Current Employment[2]						
Full-time	NA	1.86	2.01	2.38	1.97	2.31
Part-time	NA	1.88	1.69	1.29	2.27	2.02
Unemployed	NA	1.69	2.03	3.68	2.29	3.33
Other[3]	NA	2.11	1.28	1.70	1.31	1.52
State						
California	1.41	1.38	1.38	2.42	2.24	2.76
Florida	1.53	1.46	1.40	2.55	1.60	2.30
Illinois	1.35	1.41	1.17	1.21	2.02	1.77
Michigan	1.26	1.70	1.56	2.15	1.86	2.18
New York	1.38	1.54	1.01	1.00	1.41	1.27
Ohio	1.26	1.28	1.26	1.83	1.00	1.43
Pennsylvania	1.45	1.58	1.72	2.31	1.00	2.31
Texas	1.25	1.45	1.44	1.25	1.00	1.63
All Other[4]	1.38	1.52	1.28	1.33	1.13	1.30

Note: These design effects apply to the following drugs: any illicit drug use; marijuana/hashish; cocaine; crack; inhalants; hallucinogens; LSD; PCP; heroin; nonmedical use of any psychotherapeutics; nonmedical use of sedatives; nonmedical use of tranquilizers; nonmedical use of pain relievers; and any illicit drug except marijuana.

NA = Not applicable

[1]Data on adult education are not applicable for 12 to 17 year olds.
[2]Data on current employment are not applicable for 12 to 17 year olds.
[3]Retired, disabled, homemaker, student or "other."
[4]Median of the median design effects for the 43 States.

Source: SAMHSA, Office of Applied Studies, National Household Survey on Drug Abuse, 1999, CAI.

Table 6.3 Median Design Effects of Licit Drug Use Estimates, by Age Group, Gender, and Demographic Characteristics: 1999 NHSDA, CAI

Demographic Characteristics	Age Group			Gender		Total
	12 to 17	18 to 25	26 to 34	Male	Female	
Total	1.77	2.38	2.09	4.34	4.64	4.35
Gender	1.64	2.04	2.12	NA	NA	4.34
Male	1.65	2.17	2.17	NA	NA	4.64
Female						
Age in Years						
12 to 17	NA	NA	NA	1.64	1.65	1.77
18 to 25	NA	NA	NA	2.04	2.17	2.38
26+	NA	NA	NA	2.12	2.17	2.09
Race/Ethnicity[1]						
White	1.62	2.13	1.98	4.10	3.96	3.94
Black	1.85	1.94	2.27	5.17	5.19	5.28
Hispanic	1.79	1.90	2.36	5.38	4.37	4.57
Other	2.16	2.42	3.16	6.18	7.82	6.81
Population Density						
Large metropolitan	1.71	1.97	2.08	4.10	3.87	4.13
Small metropolitan	1.89	2.51	2.02	4.36	4.07	4.19
Nonmetropolitan	1.80	2.22	2.19	4.42	4.53	4.35
Census Division						
New England	3.16	4.65	3.08	5.90	5.26	5.89
Middle Atlantic	1.87	1.96	2.33	4.10	3.84	4.81
East North Central	1.29	2.24	1.72	3.35	2.99	3.28
West North Central	2.30	2.70	2.01	4.36	3.72	4.06
South Atlantic	1.92	2.40	2.02	4.50	4.34	4.16
East South Central	1.45	1.91	1.78	3.52	4.03	3.73
West South Central	1.27	1.92	1.74	3.32	3.41	3.42
Mountain	1.98	2.32	2.66	4.59	4.44	5.81
Pacific	1.55	1.75	2.18	5.29	4.72	4.94
County Type						
Large Metropolitan	1.74	1.96	1.97	4.02	3.82	4.15
Small Metropolitan >250,000	1.85	2.01	2.04	4.14	3.90	4.01
Small Metropolitan <250,000	2.01	2.89	2.25	5.92	4.77	4.95
Nonmetropolitan >20,000	2.06	2.20	2.33	4.99	4.52	4.85
Nonmetropolitan 2,500-19,999	1.80	2.36	2.13	4.28	4.38	4.59
Nonmetropolitan <2,500	2.37	2.85	2.78	5.57	5.62	5.59

See notes at end of table.

(continued)

Table 6.3 (continued)

Demographic Characteristics	Age Group			Gender		Total
	12 to 17	18 to 25	26 to 34	Male	Female	
Adult Education[2]						
Less than high school	NA	1.87	2.05	3.74	3.33	3.51
High school graduate	NA	1.93	2.15	3.44	3.25	3.54
Some college	NA	2.26	2.23	3.65	3.52	3.67
College graduate	NA	2.02	1.89	2.36	2.32	2.34
Current Employment[3]						
Full-time	NA	2.12	2.26	3.17	3.37	3.25
Part-time	NA	2.02	2.02	3.87	3.78	3.50
Unemployed	NA	1.81	2.19	4.39	4.23	4.20
Other[4]	NA	2.06	1.89	3.07	2.64	2.81
State						
California	1.30	1.41	1.66	4.39	3.62	4.15
Florida	1.69	1.56	1.49	3.28	3.07	3.18
Illinois	1.44	1.29	2.10	3.07	2.85	3.57
Michigan	1.32	1.48	1.62	2.70	3.08	2.95
New York	2.05	1.60	2.13	3.83	3.47	4.38
Ohio	1.35	2.40	1.44	3.05	2.73	2.78
Pennsylvania	1.49	2.18	1.74	3.05	4.01	3.59
Texas	1.22	1.85	1.74	3.28	3.32	3.32
All Other[4]	1.48	1.50	1.53	3.14	2.92	3.04

Note: These design effects apply to the following drugs: cigarettes; alcohol; smokeless tobacco; binge drinking; and heavy drinking.

NA = Not applicable

[1]Data on adult education are not applicable for 12 to 17 year olds.
[2]Data on current employment are not applicable for 12 to 17 year olds.
[3]Retired, disabled, homemaker, student or "other."
[4]Median of the median design effects for the 43 States.

Source: SAMHSA, Office of Applied Studies, National Household Survey on Drug Abuse, 1999.

Table 6.4 Design Effects, by Age for the Outcomes Used in the Medians in Tables 6.1, 6.2, and 6.3: 1999 NHSDA, CAI

Outcome	Age Group			Total
	12 to 17	18 to 25	26+	
Illicit Drugs, Lifetime Recency				
Any illicit drug	1.63	2.56	2.29	5.05
Marijuana	1.69	2.42	2.11	4.59
Cocaine	1.74	2.24	2.05	4.76
Crack	1.58	1.91	2.06	4.49
Inhalants	1.64	2.14	1.92	3.75
Hallucinogens	1.77	2.44	1.94	4.21
LSD	1.60	2.37	1.84	3.95
PCP	1.48	1.71	2.15	4.84
Heroin	1.86	2.27	2.39	5.27
Nonmedical use of psychotherapeutics	1.61	2.25	2.03	4.36
Nonmedical use of stimulants	1.66	2.04	2.03	4.43
Nonmedical use of sedatives	1.46	1.90	2.09	5.06
Any illicit except marijuana	1.66	2.36	2.10	4.62
Nonmedical use of tranquilizers	1.56	2.08	2.26	4.91
Nonmedical use of pain relievers	1.55	2.38	2.00	4.00
Illicit Drugs, Past Year Recency				
Any illicit drug	1.69	2.49	2.04	3.53
Marijuana	1.69	2.57	1.97	3.20
Cocaine	1.66	1.93	1.79	2.86
Crack	1.74	1.97	2.26	4.16
Inhalants	1.66	2.18	1.56	1.46
Hallucinogens	1.64	1.94	1.08	1.00
LSD	1.65	2.02	1.26	1.05
PCP	1.47	1.75	1.79	1.00
Heroin	2.12	1.86	1.76	2.52
Nonmedical use of psychotherapeutics	1.53	2.25	1.87	3.09
Nonmedical use of stimulants	1.70	2.49	1.54	2.17
Nonmedical use of sedatives	1.47	1.72	2.18	3.39
Any Illicit except marijuana	1.66	2.21	1.81	2.85
Nonmedical use of tranquilizers	1.71	2.00	1.70	2.75
Nonmedical use of pain relievers	1.53	2.31	2.22	3.38

See notes at end of table.

(continued)

Table 6.4 (continued)

Outcome	Age Group			Total
	12 to 17	18 to 25	26+	
Illicit Drugs, Past Month Recency				
Any illicit drug	1.64	2.56	1.91	3.14
Marijuana	1.62	2.60	1.71	2.65
Cocaine	1.66	1.98	1.86	3.20
Crack	1.10	1.57	2.13	4.51
Inhalants	1.62	1.94	1.32	1.48
Hallucinogens	1.66	1.85	1.58	1.13
LSD	1.82	1.93	1.82	1.18
PCP	1.38	2.33	*	1.00
Heroin	2.38	1.53	1.43	2.22
Nonmedical use of psychotherapeutics	1.51	1.99	2.26	3.63
Nonmedical use of stimulants	1.47	1.97	1.81	2.91
Nonmedical use of sedatives	1.42	1.67	3.13	4.79
Any Illicit except marijuana	1.58	1.88	2.04	3.11
Nonmedical use of tranquilizers	1.62	1.70	2.04	3.71
Nonmedical use of pain relievers	1.50	2.03	2.49	3.70
Licit Drugs, Lifetime Recency				
Alcohol	1.85	2.33	2.85	4.80
Cigarettes	1.74	2.39	2.24	4.35
Smokeless tobacco	1.84	1.95	2.08	4.49
Licit Drugs, Past Year Recency				
Alcohol	1.91	2.68	2.45	5.13
Cigarettes	1.92	2.38	2.09	4.42
Smokeless tobacco	1.68	2.01	1.84	3.40
Licit Drugs, Past Month Recency				
Alcohol	1.77	2.64	2.20	4.58
Cigarettes	1.93	2.07	2.02	4.27
Smokeless tobacco	1.58	1.80	1.76	3.47
Binge Drinking	1.75	2.64	2.05	4.30
Heavy Drinking	1.48	2.99	2.10	4.11

*Low precision
Source: SAMHSA, Office of Applied Studies, National Household Study on Drug Abuse, 1999: CAI.

Table 6.5 Median Design Effects of Past Month Illicit Drug Use and Licit Drug Use, by Age Group: 1999 NHSDA, PAPI

Outcome	Age Group			Total
	12 to 17	18 to 25	26+	
Past Month Illicit Drug Use	2.49	3.31	2.58	3.50
Past Month Licit Drug Use	3.90	4.52	3.37	4.70

Source: SAMHSA, Office of Applied Studies, National Household Study on Drug Abuse, 1999 CAI.

Note: The design effects in the first row apply to the following illicit drugs: any illicit drug use; marijuana/hashish; cocaine; crack; inhalants; hallucinogens; LSD; PCP; heroin; nonmedical use of any psychotherapeutics; nonmedical use of sedatives; nonmedical use of tranquilizers; nonmedical use of pain relievers; and any illicit drug except marijuana. The design effects in the second row apply to the following licit drugs: cigarettes; alcohol; smokeless tobacco; binge drinking; and heavy drinking.

Table 6.6 Design Effects, by Age, for the Outcomes Used in the Medians in Table 6.5: 1999 NHSDA, PAPI

Outcome	Age Group			Total
	12 to 17	18 to 25	26+	
Illicit Drugs				
Any illicit drug	2.88	4.72	5.93	5.01
Marijuana	2.49	4.69	6.79	5.01
Cocaine	2.22	3.31	1.84	3.24
Crack	1.95	1.94	1.14	2.26
Inhalants	1.92	2.66	2.93	2.40
Hallucinogens	2.31	4.82	5.76	4.21
LSD	2.54	5.94	1.98	4.00
PCP	2.22	1.34	*	1.65
Heroin	3.10	1.00	1.42	1.81
Nonmedical use of psychotherapeutics	4.15	4.20	3.15	3.70
Nonmedical use of stimulants	2.49	2.47	5.15	4.07
Nonmedical use of sedatives	2.10	1.00	1.00	1.28
Any illicit except marijuana	3.30	3.74	3.19	3.50
Tranquilizers	5.25	5.62	2.04	3.92
Nonmedical use of pain relievers	3.43	3.28	2.24	2.93
Licit Drugs				
Alcohol	3.90	6.60	3.37	6.58
Cigarettes	4.16	3.96	3.37	4.70
Smokeless tobacco	3.24	3.44	2.81	3.63
Binge drinking	3.54	4.85	3.64	5.08
Heavy drinking	4.52	4.52	3.14	4.27

*Low precision.

Source: SAMHSA, Office of Applied Studies, National Household Study on Drug Abuse, 1999 CAI.

7. Generalized Variance Functions (Model-Based Prediction) for Computer-Assisted Interviewing

This section deals only with the computer-assisted interviewing (CAI) version of the 1999 National Household Survey on Drug Abuse (NHSDA). For a drug recency-of-use variable, when a median design effect for a domain under investigation for CAI is not listed in **Tables 6.1**, **6.2, or 6.3**, an alternative standard error (SE) approximation based on generalized variance function (GVF) is recommended. This approximation uses a prediction equation obtained from modeling the estimated Ln(RSE) or ln (CV). Here, ln (CV) is treated as the dependent variable in a linear regression model, and the model parameters are estimated using ordinary least squares. In previous years, logs of estimated design effects, ln(deff), were modeled. It turns out with the same set of predictors, ln (RSE) that a transformed log design effect gives a much higher R^2 although the predicted values, rather curiously, do not change. It happens because the transformed dependent variable continues to be a linear function of the original variable and the predictor variables. This provides a good justification of the previously used model. Note that Wolter (1985) also suggested modeling ln (CV) for obtaining a GVF.

The definition of the design effect is the basis for the regression model that was used for obtaining estimates of the design-based SEs in 1998 and previous years:

$$deff(p) = var(p) / [p(1-p)/n] ,$$

where

var(p) = design-based variance estimate of p, and
[p(1-p)/n] = simple random sample (SRS) variance estimate of p .

The above equation can be rewritten as

$$CV^2(p) = deff(p)\,[(1-p)/np] .$$

Taking the log of both sides of the above equation leads to the following log-linear model:

$$\ln[CV^2(p)] = \beta_0 + \beta_1 \ln(p) + \beta_2 \ln(1-p) + \beta_3 \ln(n) , \qquad (5)$$

where

$\beta_0, \beta_1, \beta_2, \beta_3$ = regression coefficients for the intercept, ln(p), ln(1-p), and ln(n), respectively.

Here, β_0 corresponds to the ln design effect, which is treated approximately as constant. However, other terms in the model help to pick up departures from this assumption. Notice that the previously used model is given by

$$\ln[deff(p)] = \beta_0' + \beta_1' \ln(p) + \beta_2' \ln(1-p) + \beta_3' \ln(n) . \quad (6)$$

Because the dependent variable given by the realized values of the left-hand side of equation (6) is a linear function of the left-hand side of equation (5) and the covariates, it gives predicted variances identical to model equation (5). However, it has a much lower R^2 (.15 vs. .97 for both illicit and licit). Besides much higher R^2, use of equation (5) instead of (6) led to an alternative model given by the following:

$$\log[CV^2(p) - (1-p)/np] = \beta_0'' + \beta_1'' \log(p) + \beta_2'' \log(1-p) + \beta_3'' \log(n) . \quad (7)$$

The model in equation (7) has the property that predicted design effects are always greater than 1 although R^2 is somewhat lower, .86 for illicit, and .81 for licit. This alternative model would be desirable if it is believed that the design is such that effects of clustering and unequal weighting outweigh effects of stratification. In our experience with the NHSDA data, in terms of the closeness to the design-based SEs, there is no clear preference between the predicted SEs based on equations (5) and (7). However, equation (5) tends to be conservative relative to equation (7).

Using the models given in equations (5) and (7), separate models were fit for the illicit and licit drug recency outcome variables for the 1999 CAI. Models were not fit for the paper-and pencil interviewing (PAPI) data. The input data for the simple regression model fitting consists of (n, p, and $CV^2(p)$), where n denotes the total number of data points (i.e., the number of estimates p) corresponding to various drug use by domains. For our application, a total of 29,222 (23,485 for illicit, and 5,737 for licit) estimates were used. From these, 3,886 estimates were dropped because of low precision, and 3,083 were omitted as the SRS variance was used for finding CV (i.e., the design effect was 1), resulting in a total of 22,263 estimates overall. The total of 29,222 can be obtained from Table 6.2 as 56 drugs times 87 domains including the 51 States times the 6 columns corresponding to age and gender minus 10 empty cells (5 for each illicit and licit) to avoid double counting.

For 99 CAI all-State estimates along with the national estimates were included in model fitting because it would be of interest to see how the GVF model-predicted SEs compare for large and small States. This differs from the GVF modeling for the 1998 PAPI where the national but not the State estimates (using the supplementary sample for Arizona and California)

were used. The possible influence of unstable State estimates on estimated model parameters was avoided by using the suppression rule for low precision estimates. It may be comforting to note that the model parameter estimates with or without the use of State estimates were found to be similar. The CVs (based on the design effects used to calculate the medians in **Tables 6.1, 6.2, and 6.3)** were used as part of the input data for model fitting. In the interest of obtaining unique predicted SE, values of p<0.5 in the input data were converted to 1-p when the model was fit. The estimated regression coefficients for the models (5) and (7) are shown in the following table.

	Illicit		Licit	
Beta Coeff	**Model 5**	**Model 7**	**Model 5**	**Model 7**
b_0	0.3811	-0.9337	0.2108	-1.0804
b_1	-0.9744	-0.5757	-1.0638	-0.8730
b_2	1.1058	1.2977	1.0879	1.2399
b_3	-0.9025	-0.7525	-0.8836	-0.7539

A prediction equation for the approximate SE is obtained from equation (5) as follows:

$$SE_i(p)_{appx} = \left\{ e^{(b_{0i}/2)} * p^{(2+b_{1i})/2} * (1-p)^{(b_{2i}/2)} * n^{(b_{3i}/2)} \right\},$$

where

b_{0i}, b_{1i}, b_{2i}, b_{3i} = estimates of regression coefficients for the intercept, ln(p), ln(1-p), and ln(n), respectively in equation (5).

The index-i indicates whether the SE approximation is for a licit drug or illicit drug prevalence estimate.

After solving for the regression coefficients, the above approximation reduces to the following two prediction equations:

$$SE(p_{illicit})_{appx} = [e^{0.3811} * p^{1.0256} * (1-p)^{1.1058} * n^{-0.9025}]^{1/2} \quad \textbf{(8)}$$

and

$$SE(p_{licit})_{appx} = [e^{0.2108} * p^{0.9363} * (1-p)^{1.0879} * n^{-0.8836}]^{1/2} . \quad \textbf{(9)}$$

The corresponding formulas for model (7) can be similarly obtained. **Tables 7.1** and **7.2** present generalized SEs for various percentages (from 1% to 99%) and sample sizes (from 100 to 66,706) for the 1999 CAI, predicted using equations (5) and (7).

Tables 7.3 and **7.4** give an example of the results of the SE estimates using SRS formulas, (SRS), SUrvey DAta ANalysis (SUDAAN), the mean and median design effects using equation (4) and **Tables 6.2** for illicit and **6.3** for licit, and the two GVF models. In this example, the estimates used are the percentage of persons with any illicit drug use in the past year and the percentage using cigarettes in the past year. Results are given for the total, by age, and by race/ethnicity. Observe that in these examples median and model-based SEs both overestimating and underestimating the design-based SEs obtained from SUDAAN. Overall among the two models (based on equations 5, and 7), model (5) seems to perform reasonably well. Note that GVF results for small States confirm that the direct estimates may be quite unstable because of high SE, and alternative methods based on small area estimation techniques for point and interval estimation should be used (see Section 6.1).

In summary, the user may obtain SE estimates for the 1999 CAI NHSDA for drug recency outcomes from the following recommended order of sources:

1. commercially available variance estimation software packages, such as SUDAAN; otherwise,

2. published SEs from reports using data from the 1999 NHSDA (obtainable upon request from the OAS at SAMHSA); otherwise,

3. median domain design effects appearing in **Tables 6.1, 6.2, and 6.3** and application of equation (4) for drug recency of use; otherwise,

4. model-based prediction for national and the eight large State estimates for drug recency of use, using equation (5).

Table 7.1 Generalized Standard Errors for Estimated Percentages of Illicit Drug Use Estimates: 1999

Sample Size for Base of Percentage, n	Estimated Percent (Proportion p, Multiplied by 100)								
	1, 99	2, 98	3, 97	5, 95	10, 90	20, 80	30, 70	40, 60	50, 50
100	1.42	2.01	2.47	3.17	4.39	5.86	6.71	7.14	7.24
300	0.86	1.23	1.50	1.93	2.67	3.57	4.09	4.35	4.41
500	0.69	0.97	1.19	1.53	2.12	2.84	3.24	3.45	3.50
700	0.59	0.84	1.02	1.32	1.82	2.44	2.79	2.97	3.01
900	0.53	0.75	0.92	1.18	1.63	2.18	2.49	2.65	2.68
1,000	0.50	0.71	0.87	1.12	1.55	2.08	2.37	2.53	2.56
1,250	0.45	0.64	0.79	1.01	1.40	1.88	2.15	2.28	2.31
1,500	0.42	0.59	0.73	0.93	1.29	1.73	1.98	2.10	2.13
2,000	0.37	0.52	0.64	0.82	1.14	1.52	1.74	1.85	1.87
2,500	0.33	0.47	0.58	0.74	1.03	1.37	1.57	1.67	1.69
5,000	0.24	0.34	0.42	0.54	0.75	1.00	1.15	1.22	1.24
7,500	0.20	0.29	0.35	0.45	0.63	0.84	0.96	1.02	1.03
10,000	0.18	0.25	0.31	0.40	0.55	0.73	0.84	0.89	0.91
20,000	0.13	0.18	0.23	0.29	0.40	0.54	0.61	0.65	0.66
30,000	0.11	0.15	0.19	0.24	0.33	0.45	0.51	0.54	0.55
40,000	0.10	0.13	0.17	0.21	0.29	0.39	0.45	0.48	0.48
50,000	0.09	0.12	0.15	0.19	0.27	0.36	0.41	0.43	0.44
66,706[1]	0.08	0.11	0.13	0.17	0.23	0.31	0.36	0.38	0.38

Note: Obtained using the model given in equation (5) for illicit drug recency of use.

[1]The total sample size for the 1999 CAI is 66,706.

Source: SAMHSA, Office of Applied Studies, National Household Survey on Drug Abuse, 1999 CAI.

Table 7.2 Generalized Standard Errors for Estimated Percentages of Licit Drug Use Estimates: 1999

Sample Size for Base of Percentage, n	Estimated Percent (Proportion p, Multiplied by 100)								
	1, 99	2, 98	3, 97	5, 95	10, 90	20, 80	30, 70	40, 60	50, 50
100	1.67	2.30	2.77	3.48	4.67	6.06	6.81	7.17	7.20
300	1.03	1.42	1.70	2.14	2.87	3.73	4.19	4.41	4.43
500	0.82	1.13	1.36	1.71	2.29	2.98	3.35	3.52	3.54
700	0.71	0.97	1.17	1.47	1.98	2.56	2.88	3.03	3.05
900	0.63	0.87	1.05	1.32	1.77	2.29	2.58	2.71	2.73
1,000	0.61	0.83	1.00	1.26	1.69	2.19	2.46	2.59	2.60
1,250	0.55	0.75	0.91	1.14	1.53	1.98	2.23	2.35	2.36
1,500	0.51	0.70	0.84	1.05	1.41	1.83	2.06	2.17	2.18
2,000	0.45	0.61	0.74	0.93	1.24	1.61	1.81	1.91	1.92
2,500	0.40	0.56	0.67	0.84	1.13	1.46	1.64	1.73	1.74
5,000	0.30	0.41	0.49	0.62	0.83	1.08	1.21	1.27	1.28
7,500	0.25	0.34	0.41	0.52	0.69	0.90	1.01	1.06	1.07
10,000	0.22	0.30	0.36	0.45	0.61	0.79	0.89	0.94	0.94
20,000	0.16	0.22	0.27	0.33	0.45	0.58	0.66	0.69	0.69
30,000	0.13	0.19	0.22	0.28	0.38	0.49	0.55	0.58	0.58
40,000	0.12	0.16	0.20	0.25	0.33	0.43	0.48	0.51	0.51
50,000	0.11	0.15	0.18	0.22	0.30	0.39	0.44	0.46	0.46
66,706[1]	0.09	0.13	0.16	0.20	0.26	0.34	0.39	0.41	0.41

Note: Obtained using the model given by equation (5) for licit drug recency of use.

[1]The total sample size for the 1999 CAI is 66,706.

Source: SAMHSA, Office of Applied Studies, National Household Survey on Drug Abuse, 1999 CAI.

Table 7.3 Comparison of Simple Random Sample (SRS), Design-Based (SUDAAN), Medians, and Generalized Variance Functions (GVF) for Estimating the Standard Errors for Percentages Using Any Illicit Drug in the Past Year, by Age and Race/Ethnicity: 1999 NHSDA

Characteristics	Sample Size	Prevalence Percentage	Standard Error Estimates					
			SRS	Design Based[1]	Median[2]	Mean[3]	GVF[4]	GVF[5]
Total	66,706	11.86	0.13	0.24	0.23	0.23	0.23	0.22
Age in Years								
12-17	25,357	20.35	0.25	0.33	0.32	0.32	0..46	0.42
18-25	21,933	29.55	0.31	0.49	0.44	0.45	0.57	0.52
26+	19,416	7.72	0.19	0.27	0.27	0.27	0.33	0.27
Race/Ethnicity								
White	46,571	11.84	0.15	0.27	0.26	0.26	0.27	0.25
Black	8,171	13.50	0.38	0.71	0.71	0.71	0.64	0.52
Hispanic	8,481	11.42	0.35	0.65	0.67	0.69	0.58	0.47
Other	3,483	8.91	0.48	0.93	0.76	0.78	0.76	0.57
States								
California	4,681	13.17	0.49	1.13	0.89	0.87	0.81	0.63
Florida	3,096	10.87	0.56	0.87	0.89	0.89	0.89	0.67
Illinois	3,201	12.27	0.58	0.99	0.90	0.91	0.93	0.70
Michigan	3,109	12.90	0.60	0.90	0.95	0.94	0.96	0.73
New York	2,669	11.39	0.62	0.95	0.90	0.92	0.97	0.72
Ohio	3,234	11.17	0.55	0.72	0.78	0.78	0.88	0.66
Pennsylvania	3,460	10.62	0.52	0.85	0.93	0.93	0.84	0.63
Texas	3,951	9.62	0.47	0.69	0.68	0.70	0.75	0.57
Remainder of States[6]	903	12.11	1.07	1.67	1.58	1.69	1.59	1.08

[1]Calculated using SUDAAN, and then using the maximum of three standard errors.
[2]Calculated using equation (4) and the domain-specific median design effects of Table 6.2.
[3]Calculated using equation (4) and domain-specific mean design effects.
[4]Calculated as predicted standard errors from the GVF function based on ln ($CV^2(p)$) (equation 5).
[5]Calculated as predicted standard errors from the GVF function based on ln [$CV^2(p)$-(1-p)/np] (equation 7).
[6]Calculated as median of the 43 State estimates.

Source: SAMHSA, Office of Applied Studies, National Household Survey on Drug Abuse, 1999 CAI.

Table 7.4 Comparison of Simple Random Sample (SRS), Design-Based (SUDAAN), Medians, and Generalized Variance Functions (GVF) for Estimating the Standard Errors for Percent Using Cigarettes in the Past Year, by Age and Race/Ethnicity: 1998 NHSDA

Characteristics	Standard Error Estimates							
	Sample Size	Percentage	SRS	Design Based[1]	Median[2]	Mean[3]	GVF[4]	GVF[5]
Total	66,706	30.14	0.18	0.37	0.37	0.37	0.36	0.34
Age in Years								
12-17	25,357	23.47	0.27	0.37	0.35	0.35	0.51	0.45
18-25	21,933	47.48	0.34	0.52	0.52	0.52	0.66	0.59
26+	19,416	28.14	0.32	0.47	0.47	0.47	0.61	0.53
Race/Ethnicity								
White	46,571	31.46	0.22	0.43	0.43	0.42	0.43	0.40
Black	8,171	25.98	0.49	1.09	1.11	1.13	0.87	0.71
Hispanic	8,481	28.14	0.49	1.10	1.04	1.04	0.88	0.73
Other	3,483	23.56	0.72	1.71	1.88	1.93	1.22	0.94
States								
California	4,681	25.16	0.63	1.29	1.29	1.29	1.10	0.87
Florida	3,096	28.70	0.81	1.44	1.45	1.49	1.38	1.07
Illinois	3,201	30.91	0.82	1.61	1.54	1.47	1.40	1.09
Michigan	3,109	32.79	0.84	1.38	1.45	1.48	1.44	1.13
New York	2,669	30.11	0.89	1.63	1.86	1.87	1.50	1.16
Ohio	3,234	34.65	0.84	1.45	1.39	1.35	1.44	1.13
Pennsylvania	3,460	31.09	0.79	1.70	1.49	1.51	1.35	1.06
Texas	3,951	28.53	0.72	1.46	1.31	1.36	1.24	0.98
Remainder of States[6]	903	30.85	1.54	2.64	2.68	2.82	2.45	1.76

[1]Calculated using SUDAAN, and then using the maximum of three standard errors.
[2]Calculated using equation (4) and the domain-specific median design effects of Table 6.3.
[3]Calculated using equation (4) and domain-specific mean design effects.
[4]Calculated as predicted standard errors from the GVF function based on ln ($CV^2(p)$) (equation 5).
[5]Calculated as predicted standard errors from the GVF function based on ln [$CV^2(p)$-(1-p)/np] (equation 7).
[6]Calculated as median of the 43 State estimates.

Source: SAMHSA, Office of Applied Studies, National Household Survey on Drug Abuse, 1999 CAI.

8. Conclusion

The 1999 CAI met its precision goals for 13 of the 17 target domains defined by five age groups (12 to 17, 18 to 25, 26-34, 35+, and combined age, i.e., 12+) crossed by four race/Hispanicity groups (Hispanic, black, white, and combined race/Hispanicity). However, three domains corresponding to combined age group for Hispanic, black, and white were excluded because the corresponding target SEs were not specified.

Only for Hispanics aged 35 years old or older, the relative standard error (RSE) was off substantially. Reasons for not meeting the precision are partly due to smaller sample sizes and partly due to larger design effects relative to the values projected in the sample design. For the 1999 paper-and-pencil interviewing (PAPI) version, however, precision goals were not met because the effective sample size was not achieved due to field problems, reduction in overall sample size, and higher unequal weighting effects due to an adjustment for field interviewer experience.

This report also presented tabulations giving the percentage of times each of the three types of standard errors (SEs) for estimated recency of drug use was used, which indicate that smaller prevalence estimates (under 1%) are generally more likely to have the stratified with-replacement or simple random sample SE estimates selected. It may be noted that for future analyses of the NHSDA data, it is planned to drop the maximum-of-three rule (although having the desirable feature of ensuring design effect to be at least one) because its impact was found to be marginal compared to the complexity it introduces in the interpretation of SE and its calculation for functions of estimates. This report also compared mean and median design effects for each age and race/ethnicity domain. The differences were generally small.

Finally, this report presented two approaches (median design effect and generalized variance function model-based) for approximating SE estimates for drug recency use when published estimates or computer software are not available.

This page intentionally left blank.

References

Bowman, K.R., Chromy, J.R., Odom, D.M. & Penne, M.A. (2000). *The 1999 National Household Survey on Drug Abuse: Sample design report* (Draft, Deliverable 10; prepared for the Substance Abuse and Mental Health Services Administration under Contract No. 283-98-9008). Research Triangle Park, NC: Research Triangle Institute.

Chromy, J.R., Bowman, K.R. & Penne, M.A. (1999). *The 1999 Household Survey on Drug Abuse: Sample design plan* (Deliverable 9, prepared for the Substance Abuse and Mental Health Services Administration under Contract No. 283-98-9008). Research Triangle Park, NC: Research Triangle Institute.

Office of Applied Studies (2000). *Summary of findings from the 1999 National Household Survey on Drug Abuse* (DHHS Publication No. SMA 00-3466, SAMHSA Series H-12). Rockville, MD: Substance Abuse and Mental Health Services Administration.

Wolter, K.M. (1985). *Introduction to variance estimation*. New York: Springer-Verlag.