L. Detailed Sampling and Weighting Plan for the Student Survey

SAMPLING AND WEIGHTING PLAN
NATIONAL YOUTH PHYSICAL ACTIVITY AND NUTRITION SURVEY

The objective of the sampling design is to support estimation of the physical activity and nutrition characteristics of students in a nationally representative population of 9th through 12th graders, by gender and by age or grade. National estimates of all high school students are specifically required as well as estimates by grade, by gender, and by race/ethnicity for white, black, and Hispanic youth. The survey will emulate the sampling design of the Youth Risk Behavior Survey (YRBS).

The sampling universe for the national survey will consist of public, Catholic, and other private school students in grades 9 through 12 in the 50 states and the District of Columbia.

L.1 ESTIMATION AND JUSTIFICATION OF SAMPLE SIZE

L.1.1 Overview

As in the regular YRBS, the study will be designed to produce most estimates accurate to within ±5 percent at 95 percent confidence. The YRBS estimates meet this standard for overall estimates and estimates by grade or gender or race/ethnicity, and meet a looser design target of ±5 percent at 90 percent confidence for estimates by grade and race/ethnicity. For the NYPANS, the tighter precision levels are required for the key racial group estimates overall but not by grade. Because some of the precision requirements are not as tight for the NYPANS as for the YRBS, we can consider sample sizes that are smaller than the typical YRBS. Nevertheless, we propose to replicate in most respects the sampling parameters used in the 2009 YRBS because they met the levels of precision required for CDC's purposes.

The proposed sample consists of 75 primary sampling units (PSUs), defined as a county or a group of counties. In each PSU, two different schools will contribute classes at each grade in the 9 through 12 range. The actual number of sampled schools will be greater than 75 x 2 = 150 because (1) some schools contain only some of the targeted grades (e.g., schools with grades 7^{th} – 9^{th}) and (2) small schools are selected in a subset of the 75 PSUs over and above those initially selected. A small school has an enrollment that is insufficient to generate the equivalent of one full class section at each targeted grade contained in the school. We expect that approximately 159 sample schools will be selected to generate about 8,000 respondents. We anticipate that approximately 127 schools will participate in the study (for a projected 80% school participation rate).

We will select one class per school per eligible grade. We expect that a final sample of approximately 8,000 respondents will be obtained on the NYPANS.

L.1.2 Expected Confidence Intervals for the NYPANS

Confidence intervals vary depending upon whether the prevalence estimate is for the full population or for a subset, such as a particular grade or gender. They also vary from one variable to another. Within a grouping, they also vary depending on the level of the estimate and the design effect associated with the measure.

Precision for Subgroup Estimates. For the design of the 2010 study, we considered two scenarios defined according to whether or not we would implement the double sampling of sections in high-minority schools. The selection of two sections per grade in these schools leads to larger numbers of students in the two minority groups and overall. On the other hand, the double sampling of sections is not only more costly but also leads to higher design effects due to clustering.

We used the 2005 YRBS sample schools to simulate and compare the two scenarios, with and without double sampling of sections in high-minority schools. Table L-2 presents a summary comparison of the two scenarios in terms of expected yields in the two key minority groups, blacks and Hispanics.

Table L-2. Expected number of participating students in the two minority groups for the two sampling scenarios

Ethnic Minority Group	With double sampling	Without double sampling
Blacks	3524	2359
Hispanics	3278	2420

To evaluate the precision expected for these groups under the two scenarios, we considered a range of design effects. For the first scenario, the average design effect is expected to mirror the DEFFs estimated from the YRBS for these key variables. Table L-3 provides empirical estimates of standard errors and DEFFs computed for the 2005 YRBS survey. While we use the average DEFF of 2.5 to estimate the precision expected for the first scenario (typical YRBS design), we assume a lower DEFF=2.0 for the second scenario.

With these realistic parameters, the effective sample sizes for blacks and Hispanics are shown in Table L-4. Effective sample sizes, computed as actual sample sizes divided by the design effect, are not only simple summary sample sizes but also provide a direct link to the precision results discussed next.

Table L-5 provides the precision expected for these different scenarios. The table shows the expected standard error and confidence intervals for estimated percentages (or proportions). The exhibit shows the precision expected for subgroup estimates based on the two scenarios: a) n=1400, the approximate subgroup size anticipated under the first scenario, and b) n=1200, the approximate subgroup size anticipated under the second scenario.

Table L-3. Design Effect (DEFF) for Physical Activity and Nutrition Variables for the 2005 YRBS

	Estimated Proportion	Std Error	DEFF
qn83	0.828	0.0229	4.8413
qn84	0.5622	0.0121	2.7881
qn85	0.8823	0.0094	3.2658
qn86	0.1693	0.004	1.2058
qn87	0.1419	0.0043	1.4127
qn88	0.103	0.008	2.8481
qn89	0.0643	0.0049	2.1743
qn90	0.0846	0.0058	2.3834
qn76	0.8208	0.0046	1.3611
qn77	0.15	0.0108	3.6611
qn78	0.6371	0.0075	1.7862
qn79	0.2626	0.0078	2.0714
qn80	0.3565	0.0113	2.7994
qn81	0.3757	0.0133	3.1474

AVERAGE DEFF: 2.553293

Table L-4. Effective sample sizes expected for blacks and Hispanics for the two sampling scenarios

Ethnic Minority Group	With double sampling	Without double sampling
Blacks	1409.6	1179.5
Hispanics	1311.2	1210

Table L-5 Precision expected for racial subgroup estimates: standard error of estimated percentages and associated 95% confidence intervals

a) First scenario: double sampling

Estimated Percentage	Standard Error	95% Confidence Interval
5%	0.58%	1.14%
10%	0.80%	1.57%
15%	0.95%	1.87%
20%	1.07%	2.10%
50%	1.34%	2.62%

a) Second scenario: no double sampling

Estimated Percentage	Standard Error	95% Confidence Interval
5%	0.63%	1.23%
10%	0.87%	1.70%
15%	1.03%	2.02%
20%	1.15%	2.26%
50%	1.44%	2.83%

The precision results shown in Table L-5 demonstrate that subgroup estimates will be within plus or minus 3 percentage points (95% confidence intervals) under either scenario. This discussion demonstrates that the planned design, which does not include double sampling of sections, will ensure the precision for subgroup estimates as well as for overall study estimates.

In the 2005 YRBS, the school sample included 159 participating schools. Using the 2005 YRBS school sample sizes (n=159 participants), the projected total number of participating students goes down from 12,231 with double sampling to 10,255 without double sampling.

For the target 8,000 participating students, and under the no double sampling scenario, we deflate the number of participating schools so that the projected number of participating schools becomes 127.

It may be useful to examine also the precision expected for grade-level estimates under the planned scenario without double sampling. For the planned sample of 8,000 students over 127 participating schools, the per-grade sample size would be approximately 2,000. Table L-6 shows the expected precision for grade-level estimates, again assuming DEFF=2 for scenario#2 (no double sampling).

Table L-6. Precision expected for grade-level subgroup estimates: standard error of estimated percentages and associated 95% confidence intervals

Estimated Percentage	Standard Error	95% Confidence Interval
5%	0.69%	1.35%
10%	0.95%	1.86%
15%	1.13%	2.21%
20%	1.26%	2.48%
50%	1.58%	3.10%

Also for grade-level estimates confidence intervals will be within +/- 3 percentage points.
In summary, the planned sample sizes are the minimal necessary to ensure that all key estimates will achieve the required levels of precision for the NYPANS. The anticipated n=160 school selections will generate 127 participating schools (79% participation rate) and approximately 8,000 participating students

L.1.3 School and Student Non-response

The school participation rate over the prior 10 YRBS studies has been between 75 and 80 percent; the average student participation rate has been 86 percent. To be conservative, we will assume response rate values for the NYPANS similar to average YRBS values, subject to future re-evaluation.

L.2 SAMPLING METHODS

L.2.1 Overview

The sampling universe for the NYPANS will consist of all public, Catholic and other private school students in grades 9 through 12 in the 50 states and the District of Columbia. The sample will be a stratified, three-stage cluster sample stratified by racial/ethnic status and urban versus rural. PSUs are classified as "urban" if they are in one of the 54 largest MSAs in the U.S.; otherwise, they were classified as "rural". Additional, implicit stratification will be imposed by geography by sorting the PSU frame by state and by 5-digit Zip Code (within state). Within each stratum, a primary sampling unit (PSU), defined as a county or a group of counties, will be chosen without replacement at the first stage. In subsequent sampling stages, a probabilistic selection of schools and students will be made from the sample PSUs. Table L-7 presents a summary of the sampling design features.

Two strategies will be employed to achieve over-sampling of blacks and Hispanics: (1) larger sampling rates will be used in high-Hispanic and high-black strata; and (2) a modified measure of size will be employed that increases the probability of selection of schools with high minority enrollments.

Table L-7 Key Sampling Design Features

Sampling Stage	Sampling Units	Sample Size (Approximate)	Stratification	Measure of Size
1	Counties or groups of counties	75 PSUs	Urban vs. non-urban (2 strata) Minority concentration (8 strata)	Aggregate school size in target grades
2	Schools	159 selections (2 large schools per PSU plus 10 small schools)	Small vs. other	Weighted enrollment (increased for black, Hispanic groups)
3	Classes/ students	1 class per grade per school: 8,000 participating students (expected)		

L.2.2 Measure of Size

The sampling approach will utilize Probability Proportional to Size (PPS) sampling methods to achieve over-sampling of blacks and Hispanics. In PPS sampling, when the measure of size is defined as the count of final-stage sampling units, and a fixed number of units are selected in the final stage, the result is an equal probability of selection for all members of the universe. For the NYPANS, we approximate these conditions, and thus obtain a roughly self-weighting sample. This section describes the type of measure of size to be employed for selecting PSUs and schools with over-sampling of blacks and Hispanics.

A function of the form $r_hH + r_bB + r_oO$ is used where the r's are the weighting factors for the Hispanic, black, and Other racial/ethnic groups and the corresponding high school per-grade enrollment totals are denoted by H, B, and O, respectively. This function will increase the chances of schools with relatively large minority enrollments entering the sample, and will also increase the probability of selection for high-minority PSUs.

The effectiveness of a weighted measure of size in achieving oversampling is dependent upon the distributions of blacks and Hispanics in schools. For example, if U.S. schools had identical percentages of minorities in every school, then the sample of students from any sample of schools would mirror the national percentages and use of a weighted measure of size would fail to oversample blacks and Hispanics. We know this is not the case, however, as the distribution of high school students with respect to race and ethnicity follows that of the general population, and here we find a great deal of clustering by race and ethnicity. This observation is further born out by the success of the use of a weighted measure of size in prior studies as an effective means of oversampling blacks and Hispanics.

In 1990, Macro conducted a series of simulation studies that investigated the relationship of various weighting functions to the resulting numbers and percentages of minority students in the obtained samples.[1] These simulation studies have been regularly re-examined, and the parameters adjusted to fit the changing picture of minority concentrations. In the 2007 and 2009 YRBS cycles, the following weighting function was used for the measure of size:

2 H + 2 B + O

We will perform a new simulation study during the NYPANS design for similar purposes, i.e., fine-tuning the measure of size coefficients.

The measure of size will be used to compute stratum and PSU sizes as well. This will have the effect of increasing the allocation of the sample to the strata with higher concentrations of the two key minority groups. At the same time, PSUs with high minority concentrations will have a higher likelihood of being included in the sample.

L.2.3 Definition of Primary Sampling Units

In defining PSUs, several issues are considered:

- Each PSU should be large enough to contain the requisite numbers of schools and students by grade.
- Each PSU should be compact geographically so that field staff can go from school to school easily.
- There should be recent data available to characterize the PSUs.
- PSUs definitions should be consistent with secondary sampling unit (school) definitions.

Generally, counties will be equivalent to PSUs, except where low population counties are combined to provide sufficient numbers of schools and students. Also, very large counties are divided into multiple PSUs so that no one county will be certain of selection. The variance estimation process is more efficient without the need to account for certainty PSUs. The method of dividing large PSUs will ensure that each sub-county PSU meets all of the criteria for a PSU.

County population figures will be aggregated from school enrollment data for the grades of interest. Enrollment data are being obtained from the most recent Common Core of Data from the National Center for Education Statistics, which are merged on a rolling basis into the current school and school district data files of Quality Education Data, Inc.
Geographically, the 2010 NYPANS PSU sampling frame will be the same PSUs constructed from counties for the 2009 YRBS. The schools constituting each PSU, as well as the PSU measures of size and stratification, will be updated using current QED data.

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[1] Errecart, M.T., Issues in Sampling African-Americans and Hispanics in School-Based Surveys. Centers for Disease Control, October 5, 1990.

L.2.4 Stratification and Selection of PSUs

L.2.4.1 Definition of strata

The PSUs will be organized into 16 strata, based on urban/rural location (as defined above) and minority enrollment. The approach involves the computation of optimum stratum boundaries using the cumulative square root of “f” method developed by Dalenius and Hodges. The boundaries or cutoffs change as the frequency distribution (“f”) for the racial groupings change from one survey cycle to the next. These rules are summarized below, and the boundaries computed for the 2007 YRBS are shown in Table L-8.

- If the percentage of Hispanic students in the PSU exceeds the percentage of black students, then the PSU is classified as Hispanic. Otherwise it is classified as black. (Table L-8, column (a)).
- If the PSU is within one of the 54 largest MSA in the U.S. it is classified as 'Urban', otherwise it is classified as 'Rural' (Table L-8, column (b)).
- Hispanic Urban and Hispanic Rural PSUs are classified into four density groupings (Table L-8, column (c)) depending upon the percentages of Hispanics in the PSU. (Table L-8, column (d)).
- Black Urban and black Rural PSUs are also classified into four density groupings (Table L-8, column (c)) depending upon the percentages of blacks in the PSU (Table L-8, column (d)),

L.2.4.2 Allocation of the PSU sample

The 2010 NYPANS will be based on a larger number of sample PSUs than the typical YRBS samples; specifically, 75 PSUs rather than a number between 55 and 60. A larger number of PSUs has the greatest impact on variance reduction. In order to stay as close as possible to maximum sample efficiency in terms of precision, the initial allocation will be made proportional to student enrollment. Then, so as to meet design requirements in terms of minority student yields, we will make adjustments to the initial allocation. These adjustments will be evaluated and fine tuned using sample simulations. Response rates from prior cycles will be used to inform the yield computations in the simulations.

Table L-8 First-Stage Strata and Frame PSU Distribution

Predominant Minority (a)	Urban/Rural (b)	Density Group Number (c)	Boundaries (d)	Stratum Code (e)	Total Number PSU (f)
Black	Urban	1	0% - 22%	BU1	91
		2	22% - 34%	BU2	25
		3	34% - 56%	BU3	12
		4	56% - 100%	BU4	8
	Rural	1	0% - 18%	BR1	373
		2	18% - 34%	BR2	100
		3	34% - 58%	BR3	94
		4	58% - 100%	BR4	26
Hispanic	Urban	1	0% - 22%	HU1	60
		2	22% - 34%	HU2	13
		3	34% - 45%	HU3	10
		4	45% - 100%	HU4	4
	Rural	1	0% - 22%	HR1	373
		2	22% - 44%	HR2	44
		3	44% - 66%	HR3	19
		4	66 - 100%	HR4	13

L.2.4.3 Selection of PSUs

Primary sampling units (PSUs) will be selected with the following sequence of steps.

- Within each first-stage stratum, the PSUs will be sorted by five-digit zip code to attain a form of implicit geographic stratification. Implicit stratification, coupled with the probability proportional to size (PPS) sampling method described below, will ensure geographic sample representation. With PPS sampling, the selection probability for each PSU is proportional to the PSU's measure of size. The following systematic sampling procedures, similar to those adopted in previous YRBS cycles, will be applied to the stratified frame to select a PPS sample of PSUs.

- Select 75 PSUs with a systematic random sampling method within each stratum. The method applies within each stratum a sampling interval computed as the sum of the measures of size for the PSUs in the stratum divided by the number of PSUs to be selected in the stratum.

- Subsample at random 10 of the 75 sample PSUs for the small school sampling.

L.2.5 Selection of Schools

Schools in selected PSUs will be classified as “large” if they have 25 or more students per grade in all eligible grades, otherwise they will be classified as small. The following procedures, similar to those used in successive cycles of the YRBS, will be used to select large schools in each stratum:

- Schools will be classified as "whole" if they have all high-school grades 9-12. Otherwise, they will be considered a "fragment" school. Fragment schools will be linked with other schools (fragment or whole) to form a cluster school that has all four grades. We will link schools before sampling using an algorithm that links geographically proximate schools. Cluster schools are treated as a single school during sampling with selection performed at the grade level as described below.

- The weighted high school per-grade average enrollment will be computed for each school, to be used as the measure of size. The estimate of enrollment will be developed by averaging the enrollment at each eligible grade in the school. When enrollment by grade is not available, we will divide total school enrollment by the number of grades taught in the school.

- Two large schools, or linked school clusters, will be selected in each PSU with probability proportional to their measures of size.

Small schools will also be selected with an approach that resembles the YRBS methods yet with modified sample sizes. Specifically, ten small schools will be drawn in the 2010 NYPANS to represent the small percent of students attending small schools (less than six percent nationwide). The sample of small schools will be selected in subsample PSUs, with one school selected per PSU (in this case, n=10 subsample PSUs). All students in eligible grades will be selected per school. Within each sub-sampled PSU, small schools will be selected with PPS sampling using the same weighted measure of size used in selecting large schools. This approach minimizes the linking of schools to create linked sampling units that span all grades and have a required minimum grade size for selection.

L.2.6 Grade Selection

Except for school clusters, all eligible grades (i.e., 9-12) are included in the class selection in each school. In school clusters, grade samples are selected independently with one component school being selected for each grade.

L.2.7 Selection of Classes

The method of selecting students will vary from school to school, depending upon the organization of that school and whether a school cluster is involved. The key element of the school sampling strategy is to identify a structure that partitions the students into mutually exclusive, collectively exhaustive groupings that are of approximately equal sizes and that are accessible. Beyond that basic requirement, we will do the partitioning to result in groups in which both genders and students of all ability levels are represented. In selecting classes, we will generally give preference to selecting from mandatory courses, such as English. Another option is to select from all classes that meet during a particular time of day such as all second or third period classes.

We will not use special procedures to sample for minorities at the school building level for two reasons:

- Schools do not maintain student rosters that identify students by racial/ethnic affiliation.
- We feel this would be viewed by many schools as an offensive practice.

We plan to select one class at each grade level from each participating school. In the case of school clusters, we will conduct our sampling on a grade by grade basis. At each grade we will determine the identity of all schools in the cluster with students in that grade. If each school has enough students in the grade, then we will pick randomly one of the schools with probability proportional to grade enrollment and then select one class per grade from that school. If one of the schools does not have enough students in a grade, then its students will be combined with a class of another school in the cluster. If that class is picked, then students are surveyed in both schools.

A "class" will be defined by our sampling team so that it meets size and composition requirements before the sampling is done. For example, two small classes may be combined and treated as one for sampling purposes. Or, boys and girls physical education classes may be combined. This approach is an efficient method of data collection in schools that also has the advantage of using the classroom teacher to distribute consent forms and to "leverage" student participation; hence, it tends to yield higher student participation rates. The disadvantage of this approach is its tendency to make the sampling design less efficient because students within a class section tend to be more homogeneous than the student population at large within a school. The effect of this inefficiency has been accounted for in our estimates of the design effect of the study.

L.2.8 Replacement of Schools/School Systems

We will not replace refusing school districts, schools, classes, or students. We have allowed for school and student non-response by inflating the number of selections to account for the expected levels of non-response.

L.2.9 Selection of Students

All students in a selected classroom will be surveyed.

L.3 Weighting and Variance Estimation

This section describes the procedures used to weight the data including:

- Sampling weights
- Non-response adjustments and weight trimming
- Post-stratification to national estimates by race and grade

This section also provides a brief discussion of the estimators and variance estimators that may be computed from the NYPANS survey data.

L.3.1 Weighting

Although the sample was designed to be self-weighting under certain idealized conditions, it will be necessary to compute weights to produce unbiased estimates. The basic weights, or sampling weights, will be computed on a case-by-case basis as the reciprocal of the probability of selection of that case. Below is a simple presentation of the basic steps in weighting including a) sampling weight computation, b) non-response adjustments, and c) post-stratification adjustments.

L.3.1.1 Sampling Weights

If k is the number of PSUs to be selected from a stratum, N_i is the size of stratum i and N_{ij} is the size of PSU j in stratum i (in all cases "size" refers to our proposed measure of size), then the probability of selection of PSU j is kN_{ij}/N_i. Assuming two large schools are to be selected in PSU j in stratum i, and with the notation that N_{ijk} is the size of school k in PSU j in stratum i, then the conditional probability of selection of the school given the selection of the PSU is $2\,N_{ijk}/N_{ij}$. The derivation is similar for small schools with an extra factor to account for PSU subsampling probability.

If C_{ijk} is the number of classes in school ijk then the conditional probability of selection of a class is just $1/C_{ijk}$. Since all students are selected, the conditional probability of selection of a student given the selection of the class is unity.

The overall probability of selection of a student in stratum i is the product of the conditional probabilities of selection:

$$\left(\frac{k\,N_{ij}}{N_i}\right)\left(\frac{2\,N_{ijk}}{N_{ij}}\right)\left(\frac{1}{C_{ijk}}\right) = 2k\left(\frac{N_{ijk}}{N_i\,C_{ijk}}\right) \qquad \textbf{(1)}$$

The probabilities of selection will be the same for all students in a given school, regardless of their ethnicity, but will vary among schools depending upon the racial/ethnic mix of the schools and their surrounding regions.

Sampling weights assigned to each student record are the reciprocal of the overall probabilities of selection for each student.

L.3.1.2 Non-response Adjustments and Weight Trimming

Several adjustments are planned to account for student and school non-response patterns. An adjustment for student non-response will be made using gender and grade within school. With this adjustment, the sum of the student weights over participating students within a school matches the total enrollment by grade in the school. This adjustment factor will be capped in extreme situations, such as when only one or two students respond in a school, to limit the potential effects of extreme weights (i.e., unequal weighting effects on survey variances).

The weights of students in participating schools will be adjusted to account for nonparticipation by other schools. The adjustment uses the ratio of the weighted sum of measures of size over all selected schools in the stratum (numerator of adjustment factor), and over the subset of participating schools in a stratum (denominator of adjustment factor). The adjustment factor will be computed and applied to small and large schools separately.

Extreme variation in sampling weights can inflate sampling variances, and offset the precision gained from a well-designed sampling plan. One strategy to compensate for these potential effects is to trim extreme weights and distribute the trimmed weight among the untrimmed weights. The trimming method that we will use, outlined in Potter[2,3] , for example, is based on procedures first developed for the National Assessment of Educational Progress (NAEP).
The trimming is an iterative procedure. In each iteration, an optimal weight, W_o is calculated from the sum of the squared weights in the sample. Then, each weight W_i is marked and trimmed if it exceeds that optimal weight. The trimmed weight is summed within grade and spread out proportionally over the unmarked cases in the grade. This process is repeated until little or no weight is being trimmed. Weight trimming is done within stratum.

Typically, 3 to 4 percent of the total sample weight is trimmed and redistributed under the weight trimming procedure.

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2 Potter F. "Survey of Procedures to Control Extreme Sampling Weights" in Proceedings of the Section on Survey Research Methods, American Statistical Association, pp 453-458. 1988.

3 Potter F. "A Study of Procedures to Identify and Trim Extreme Sampling Weights," in Proceedings of the Section on Survey Research Methods of the American Statistical Association, pp 225-230, 1990.

L.3.1.3 Post-stratification to National Estimates of Racial Percentages and Student Enrollment by Grade

National estimates of racial/ethnic percentages were obtained from two sources. Private schools enrollments by grade and five racial/ethnic groups were obtained from the Private School Universe Survey (PSS), and public school enrollments by grade, gender, and five racial/ethnic categories were obtained from the Common Core of Data (CCD), both produced by the National Center for Education Statistics (NCES). These databases were combined to produce the enrollments for all schools and to develop population percentages to use as controls in the post-stratification step. For post-stratification purposes, a unique race/ethnicity is assigned to respondents with missing data on race/ethnicity, those with an "Other" classification, and those reporting multiple races.

Given a national estimate of R_a and a weighted population estimate of P_a for race category a in some grade, the simple post-stratification factor would be the ratio of R_a to P_a for each race and grade.

L.3.2 Estimators and Variance Estimators

If w_i is the weight of case i (the inverse of the probability of selection adjusted for non-response and post-stratification adjustments) and x_i is a characteristic of case i (e.g., $x_i=1$ if student i smokes, but is zero otherwise), then the mean of characteristic x will be $(\Sigma\ w_i x_i)/(\Sigma\ w_i)$. A population total would be computed similarly as $(\Sigma\ w_i x_i)$. The weighted population estimates will be computed with the Statistical Analysis System (SAS) and SUDAAN software.

These estimates will be accompanied by measures of sampling variability, or sampling error, such as variances and standard errors, that account for the complex sampling design. These measures will support the construction of confidence intervals and other statistical inference such as statistical testing (e.g., subgroup comparisons or trends over successive YRBS cycles).

Sampling variances will be estimated using the method of general linearized estimators[4] as implemented in the SUDAAN[5] or SAS survey procedures. These software packages must be used since they permit estimation of sampling variances for multistage stratified sampling designs, and account for unequal weighting, and for sample clustering and stratification.

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[4] Skinner CJ, Holt D, and Smith TMF, Analysis of Complex Surveys, John Wiley & Sons, New York, 1989, pp. 50.

[5] Shah BV, Barnwell GG, Bieler GS. SUDAAN: software for the statistical analysis of correlated data, release 7.5, 1997 [user's manual]. Research Triangle Park, NC: Research Triangle Institute; 1997.