**YHS 2023 SURVEY METHODOLOGY**

**I. Overview**

The MYHS and MYRBS were administered concurrently in a representative sample of high schools, and the MYHS was conducted in a representative sample of middle schools. The 2023 MYHS was conducted among 6th-12th grade students in a representative sample of public and charter schools across Massachusetts during the spring semester. The MYHS used two instruments, one for high school students and one for middle school students. Both instruments were administered primarily by web, with a paper and pencil (PAPI) back up option should a school experience technology issues or express a strong preference for using paper. The survey took one class period to complete. Survey procedures were designed to protect student privacy and allow for anonymous participation.

The universe for the MYHS is all students attending public schools, containing any of the grades 6 through 12, in Massachusetts. Students were selected first by selecting schools, then by selecting intact classes within sampled schools. All students in selected classes were invited to participate.

District and school recruitment for a spring administration began in November 2022. The fielding window for survey administration was January 17th to June 9th, 2023.

**II. Sample Design**

**A. Middle School Sample**

Middle schools were selected from the sampling frame with probability proportional to the number of students in grades 6-8 attending the school. Based on an expected middle school response rate of 68%, 117 schools were selected with a target of 79 responding schools. The school selection probability for school i was calculated as $P\_{i}=\frac{N\_{i}}{N}n\_{i}$ , where Ni is the number of enrolled students in the eligible grades in school i, N is the total number of students enrolled in eligible schools in grades 6-8 in the state, and ni is the number of schools to be selected.

During recruitment, responding schools were asked to provide a complete list of classes covering all students in eligible grade levels in a required class, (e.g., English) or a fixed period of the day (e.g., 2nd period) for class selection. ICF reviewed the list to remove any classes that did not meet eligibility criteria (e.g., classes meeting off campus, intact classes of low-literacy readers or physically/cognitively impaired students unable to complete the survey independently). Approximately two classes in each selected middle school were sampled. Classes were selected by calculating a sampling interval equal to the total number of classes meeting the selection criteria (a required course or period of the day) expected to be offered based on the school’s enrollment on the frame, divided by the desired number of classes to be selected (two). Classes on the list provided by responding schools were assigned an ID number sequentially. A random starting point was assigned to each school, and the classes with ID numbers equal to a multiple of the sampling interval plus the starting point were selected. The selection probability for class c within school i was calculated as $P\left(c\_{i}\right)=\frac{2}{C\_{i}}$ where Ci is the expected number of eligible classes in school i.

**B. High School Sample**

By design, the MYHS high school sample had 100% overlap with schools selected for the YRBS by CDC's TA Contractor. MYHS class interval numbers were drawn by CDC’s TA Contractor at the time that YRBS class intervals were drawn. Based on an expected high school response rate of 76%, 79 schools were selected with a target of 60 responding schools. High school class selection followed the same procedures described above for middle schools, however classes for both the YRBS and MYHS were selected concurrently from the same class list using interval numbers unique to each study. That is, a high school class could be selected for the MYHS or the YRBS, but not both. For the MYHS administration in high schools, approximately three classes consisting of an average of 58 total students were selected per participating school.

The final MYHS sample included 139 school districts, 116 eligible middle schools, and 79 high schools. At the middle school level, the two-stage sampling strategy had a design effect (DEFF) of 1.98, resulting in a margin of error of +/- 2.5%. At the high school level, the DEFF was 2.14 with a margin of error of +/-2.6%.

**C. Sample Validation**

Prior to the initiation of study recruitment, the MYHS sample was validated by ICF staff to ensure school eligibility and confirm district and school leadership. Districts and schools were asked to verify the name and title of the superintendent and principal respectively, as well as their physical address. Schools were asked to confirm school enrollment and grade levels. During validation, one middle school was found to be ineligible and was replaced with an eligible school.

**III. Sample Recruitment and Response**

At the school level, 196 schools were selected across Massachusetts to participate in the MYHS, 117 middle schools and 79 high schools. In total, 77.78% (n= 91) of selected middle schools and 77.22% (n=61) of selected high schools participated in the study. The remaining 22.78% (n=18) of selected high schools and 22.22% (n=26) of selected middle schools were considered refusals. Of those refusals, 11.36% (n=5) of them at the high school level and 6.81% (n=3) at the middle school level were due to district-level refusals to allow contact with schools to discuss participation and 22.72% (n=10) at the high school level and 38.63% (n=17) at the middle school level were school level refusals.

**Table 1: School Participation Rates, by School Level and Mode**

|  |  |  |  |
| --- | --- | --- | --- |
| School Level | Sampled Schools | Participating Schools | Mode |
| **Web** | **Paper** |
|  | **#** | **#** | **%** | **#** | **%** | **#** | **%** |
| Middle Schools | 117 | 91 | 77.78% | 90 | 98.90% | 1 | 1.10% |
| High Schools | 79 | 61 | 77.22% | 60 | 98.37% | 1 | 1.63% |

At the high school level, 2,910 eligible students were selected across 61 participating schools, and 2,423 participated for a high school student response rate of 83.26%. When combined with the high school response rate of 77.22%, the overall response rate (school x student) is 64.29%.

At the middle school level, 3,803 eligible students were selected across 91 participating schools, and 3,304 participated for a middle school response rate of 86.88%. When combined with the middle school response rate of 77.78%, the overall response rate is (school x student) is 67.58%. Table 4.2 below shows the number of eligible students, participants, and participation rates for the MYHS.

Of the 2,423 high school students that participated, 1.07% (n=26) of them completed the paper-based survey. The remaining 98.93% (n=2,397) were captured by the web-based survey. Of the 3,304 middle school students that participated, 1.48% (n=49) of them completed the paper-based survey. The remaining 98.52% (n=3,255) were captured by the web-based survey. Table 4.2 below shows the number of schools and participants by mode for the MYHS.

##### **Table 2: Student Participation Rates, by School Level and Mode**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **# Eligible** | **# Web Completes** | **# PAPI Completes** | **Total Completes** | **Student Participation %** | **Overall Participation %** |
| **Middle School students** | 3,803 | 3,255 | 49 | 3,304 | 86.88% | 67.58 |
| **High School Students** | 2,910 | 2,397 | 26 | 2,423 | 83.26% | 64.29 |

**IV. Weighting and Variance Estimation Issues**

**A. Weighting**

The MYHS sample design was a probability sample, which allowed for the calculation of sampling weights. The multistage sample was designed so that each student at a given level had the same overall probability of selection. The design yielded unbiased population estimates because the probability of selection was known for every student.

Similar to CDC’s weighting plan for the YRBS, the weighting plan for the MYHS followed the sample design with adjustments for nonresponse at each stage of sampling and a final adjustment to known middle school and high school population totals by grade, race/ethnicity, and sex provided by DESE. We adjusted for nonresponse at each stage of weighting to minimize nonresponse bias. Nonresponse bias occurred with the presence of both of the following conditions:

1. Nonrespondents differed from respondents along key survey characteristics and

2. Nonrespondents accounted for a large enough proportion of the sample (i.e., substantial nonresponse rates).

While nonresponse adjustments reduce bias, they usually introduce added variation to the weights. A balance between bias reduction and the increase in variance were considered when implementing a nonresponse adjustment. Nonresponse adjustments use the information available for the sampled cases. In general, the adjustment distributes the base weights of the nonrespondents to the responding sampled cases so that the sum of the adjusted weights equals the sum of the base weights.

The weighting plan for both the middle school and high school surveys replicated the methodology used by CDC on the national YRBS. The overall weights were decomposed as the products of successive stage weights and weight adjustments (the latter adjustments are denoted by a hat symbol). The middle school and high school MYHS data were weighted separately but followed the same weighting process. The middle school weights were computed using the sampling probabilities developed by ICF. The high school weights used the school and class probabilities provided by CDC from the coordinated sample draw with the YRBS.

**School Sampling Weight (W1)**

The weighting process began with W1 computed as the inverse of the school probability of selection ($p\_{i}$).

$$W1= \frac{1}{p\_{i}}$$

**School Nonresponse-Adjusted Weight (W2)**

We then adjusted for school nonresponse within weight adjustment cells defined by school level and school size. Schools were categorized according to enrollment as small, medium, or large with an approximately equal number of schools per category.

The nonresponse adjustment factor ($\hat{W}1$) was calculated as as the ratio of two weight sums: the sum of W1 for all sampled schools (A) divided by the sum of W1 for participating schools (P). The formula for the school nonresponse adjustment factor $\hat{W}1$ is:

$$\hat{W}1= \frac{\sum\_{A}^{}W1}{\sum\_{P}^{}W1}$$

W2 was computed as the product of the school weight and the school nonresponse adjustment factor:

$$W2= W1∙\hat{W1}$$

**Class Weight (W3)**

The class weight was calculated as the product of two factors: (1) the nonresponse-adjusted school weight and (2) the class sampling weight, computed as the inverse of the probability of selecting a class J within a responding school. Specifically,

$$W3= W2\frac{1}{p\_{J}}$$

**Class Nonresponse-Adjusted Weight (W4)**

Within a school, a class nonresponse adjustment factor ($\hat{W}3$) was calculated as the number of selected classes (n) over the number of participating classes in the survey (k).

$$\hat{W}3= \frac{n}{k}$$

We expressed W4 as follows:

$$W4= W3∙\hat{W3}$$

Student Weight (W5)

Within each classroom, W5 approximately accounted for student nonresponse within a class. We calculated a student factor by dividing the class enrollment (a), obtained during the data collection process, by the number of responding students ($b$).

$$\hat{W}4= \frac{a}{b}$$

We expressed W5 as follows:

$$W5= W4∙\hat{W4}$$

**Final State Sample Student Weight (W6)**

The student weights were post-stratified to population totals on the sampling frame by grade (x), gender (y), and race/ethnicity (z) to ensure the weighted population estimates match known state population totals. Within each grade by gender and by race combination, the post-stratification adjustment factor was defined as follows:

$$\hat{W}5= \frac{N\_{xyz}}{\sum\_{xyz}^{}W5}$$

The post-stratum cell totals are the population totals $N\_{xyz}$ known for each cell defined by grade (x), gender (y), and race/ethnicity (z) categories.

W6 was computed as the product of the student weight and the post-stratification adjustment:

$$W6= W5∙\hat{W5}$$

**B. Variance Estimation**

The sample for this study is a complex sample design due to the clustering of students within randomly selected schools. Therefore, an assumption of simple random sampling for data analysis will almost certainly lead to estimated variances and standard errors of sample statistics that are too small. This could lead to false results for any hypothesis testing performed or estimated 95% confidence intervals that are too narrow.

On the YHS data files, a variable is included named “schoolID”. This variable identifies students clustered within each school using a numeric code which cannot be used to identify any individual school. Use of this variable in statistical packages that can handle complex samples will allow for the accurate estimation of sample variances and standard errors. Statistical packages such as SUDAAN, WESTVARS, STATA, SPSS (with the Complex Samples module), and SAS (with the callable SUDAAN PROC) can all handle such designs. It is highly recommended that such packages be used for analysis purposes.