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Equipping State Agency Staff to Analyze Nonresponse Bias in Federal Survey Programs

Ben Schneider
Tamara Nimkoff
Anthony Fucci
Andy Cruse

WESTAT @ FCSM 2024

Nonresponse Bias Analyses (NRBAs) in Federal Surveys

- Response rates for federal surveys continue to decline each year, even those with expensive in-person data collection
- The impacts on data quality are not obvious: lower response rates don't imply greater nonresponse bias
- NRBA is thus an increasingly routine part of survey data quality reporting in the federal principal statistical agencies
  - OMB standards and guidelines requiring NRBAs
  - Hundreds of published studies since OMB guidelines went into effect

Challenges Making NRBAs Routine in State Data Collections

- Many federal statistical data collection programs happen outside of the core federal statistical agencies, often relying on state partnerships for data collection
- Some key challenges faced by state partners in these programs:
  - State agencies can vary widely in terms of the available staffing and training
  - Staff are often expected to "wear multiple hats" (e.g., survey programmer, data collections coordinator, data analyst, tech support)
  - Best-practice methods for NRBAs require statistical programming (R, SAS, Stata) that often cannot be done by agency staff

State Data Collections for the Individuals with Disabilities in Education Act (IDEA)

OSEP and Requirements of IDEA Reporting

- U.S. Department of Education evaluates states' performance in fulfilling the requirements of the Individuals with Disabilities Education Act (IDEA) through its Office of Special Education Programs (OSEP)
- OSEP established specific, enumerated performance indicators that measure states' fulfillment of IDEA's requirements
  - Example: "The percent of parents of school-aged students with disabilities who report that the school facilitated parent involvement as a means of improving services and results for children with disabilities"

State Data Collection and Analysis

- States are generally responsible for:
  - Producing these indicators by collecting, analyzing, and reporting data through surveys or other means
  - Adhering to OSEP requirements for data quality
  - Submitting the indicators and accompanying data quality summaries to OSEP in annual reports
- Beginning in 2022, OSEP requires states to report a nonresponse bias analysis accompanying certain indicators

Technical Assistance Funded by OSEP

- OSEP indirectly provides technical assistance to states and builds their capacity through its funding of national technical assistance centers
- The IDEA Data Center (IDC) helps states collect, report, analyze, and use accurate IDEA data
- As part of this broader mission, IDC provides training and resources to states to help address new NRBA requirements from OSEP:
  - Guidance documents disseminating best practices
  - Access to methodologists and statisticians
  - In-person and virtual training sessions for state agency staff
  - Specialized software for conducting NRBAs

Key Training Subjects for NRBAs

- Definitions and pre-requisite concepts:
  - Response rates
  - Representativeness*
  - Nonresponse bias
- Establishing basic factors driving nonresponse bias:
  1. Overrepresentation/underrepresentation of population subgroups
  2. Differences in key survey outcomes across these subgroups
- Statistical analyses that can assess each factor
- Identifying and preparing data for these analyses
- Reporting findings from an NRBA

Guiding Analysts Through a Basic NRBA with the IDC *NRBA App*

Overview of the IDC *NRBA App*

- An interactive point-and-click application to analyze survey response rates, representativeness, and nonresponse bias to address OSEP data quality requirements
- Users access the app within their preferred web browser—Google Chrome, for example—while the R application runs the computations in the background
  - Run through freely-available R software, keeping users' data only on their local computer
  - Uses best-practice R packages for complex survey data analysis
- Published as free, open-source software

Guiding the User through Key Analysis Questions

1. What are our response rates, and do they differ across subgroups?
2. Are some subgroups in the population overrepresented or underrepresented in our respondent data?
3. How do survey outcomes differ across subgroups?
4. Can statistical adjustments reduce nonresponse bias in our data?

Structure of the IDC *NRBA App*

- Three modules:
  - **Setup:** Import a dataset to use for analysis and describe the data collection design (census vs. sample, stratification, etc.)
  - **Analysis:** Select analyses for the app to run to answer questions about response rate, representativeness, and nonresponse bias and choose which analysis results statistics to save in a report
  - **Report:** Export output tables summarizing the analyses to an Excel file for later use
- Documentation is available through in-application text, tooltips, and a link to a detailed user guide

Overview

Welcome to the IDEA Data Center's (IDC's) Nonresponse Bias Analysis Application, or *NRBA App*, an interactive application that you can use to analyze survey data response rates, representativeness, and nonresponse bias.

Use the *NRBA App* to answer questions such as

- What are our response rates, and do they differ across subgroups?
- Are some subgroups in the population overrepresented or underrepresented in our respondent data?
- How do survey outcomes differ across subgroups?
- Can statistical adjustments reduce nonresponse bias in our data?

The tool consists of three modules–Setup, Analysis, and Report. Before using the *NRBA App*, IDC highly recommends that states leverage the technical assistance IDC provides to make the most of this tool. Contact your IDC State Liaison or email IDEAdata@westat.com to connect with a TA specialist. The sections below provide a broad overview of the functionality of each module.

Setup: Load a Prepared Dataset into the Application

First, select and import a dataset to use for analysis (Step 1: Import). IDC recommends that your dataset has certain elements to ensure optimal use of the *NRBA App*. Refer to the Preparing Your Dataset section of the *NRBA App Reference Guide* for more information and a list of these elements. Once you have imported your dataset, the app will provide a summary of the contents of the dataset along with a preview of the first few rows and columns of the dataset.

Next, to properly analyze the data, indicate how you collected the data (Step 2: Identify the Data Collection Method). This includes identifying whether the data come from an attempted census or represent a survey sample, which variable indicates response and eligibility status for the survey, and other variables in the data related to the method of data collection. Once you have described the data in the Setup module, you can move to the Analysis module.

Note: The app will check for errors in the Setup options that you selected before proceeding.

Analysis: Select and Configure Specific Analyses to Run, and View the Results

This module allows you to select from a variety of analysis types to answer questions about response rate, representativeness, and nonresponse bias. When you select an analysis type from the menu, a new Specify Analysis tab will appear with options for conducting the specific analysis. The application will recommend some of these selections as defaults. When you submit your options, a pop-up window will appear, showing a table with the resulting statistics for the analysis.

Once complete, you can add the analysis output to the Report module. You can then repeat the same analysis with a variety of options (e.g., calculating response rates separately by race, disability category, or other demographic variable) or select a different analysis type and then add each type of analysis to

Step 1: Import Data

Choose File

Browse... No file selected

Data Preview

Step 2: Identify Data Collection Method

Select the option which best describes the way in which the data were collected:

(•) Attempted Census ( ) Survey Sample

Select the variable in your dataset that indicates each individual's eligibility/response status:

For each category of response and eligibility status, select the appropriate value. These fields cannot be blank.

Eligible Respondents

Cases known to be ineligible

Eligible Nonrespondents

Cases whose eligibility status is unknown

Should cases with unknown eligibility be grouped with nonrespondents for all analysis types other than response rates?

( ) Yes (•) No

Proceed to Analysis

Step 1: Import Data

Choose File

Browse... Involvement-Survey-Data.xl

Upload complete

Filename	Rows	Columns	Column Names
Involvement-Survey-Data.xlsx	7057	16	UNIQUE_ID, RESPONSE_STATUS, SCHOOL_DISTRICT, SCHOOL_ID, N_SCHOOL_DISTRICTS, SAMPLING_WEIGHT, STUDENT_GRADE, STUDENT_AGE, STUDENT_DISABILITY_CODE, STUDENT_DISABILITY_CATEGORY, STUDENT_SEX, STUDENT_RACE, WHETHER_PARENT_AGREES, CONTACT_ATTEMPTS, STUDENT_RACE_BENCHMARK, STUDENT_DISABILITY_CATEGORY_BENCHMARK

Data Preview

UNIQUE_ID	RESPONSE_STATUS	SCHOOL_DISTRICT	SCHOOL_ID	N_SCHOOL_DISTRICTS	SAMPLING_W
ID_03305	Respondent	District 30	30-H-007	100	
ID_19006	Respondent	District 46	46-E-012	100	
ID_05110	Respondent	District 58	58-E-009	100	
ID_13753	Respondent	District 83	83-E-012	100	
ID_07077	Respondent	District 83	83-E-012	100	
ID_01791	Respondent	District 73	73-E-012	100	
ID_00396	Respondent	District 63	63-E-020	100	
ID_08095	Nonrespondent	District 73	73-E-027	100	
ID_09070	Respondent	District 97	97-E-010	100	

Step 2: Identify Data Collection Method

Select the option which best describes the way in which the data were collected:

(●) Attempted Census ( ) Survey Sample

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For each category of response and eligibility status, select the appropriate value. These fields cannot be blank.

Eligible Respondents

Cases known to be ineligible

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Cases whose eligibility status is unknown

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Filename	Rows	Columns	Column Names
Involvement-Survey-Data.xlsx	7057	16	UNIQUE_ID, RESPONSE_STATUS, SCHOOL_DISTRICT, SCHOOL_ID, N_SCHOOL_DISTRICTS, SAMPLING_WEIGHT, STUDENT_GRADE, STUDENT_AGE, STUDENT_DISABILITY_CODE, STUDENT_DISABILITY_CATEGORY, STUDENT_SEX, STUDENT_RACE, WHETHER_PARENT_AGREES, CONTACT_ATTEMPTS, STUDENT_RACE_BENCHMARK, STUDENT_DISABILITY_CATEGORY_BENCHMARK

Data Preview

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ID_07077	Respondent	District 83	83-E-012	100	
ID_01791	Respondent	District 73	73-E-012	100	
ID_00396	Respondent	District 63	63-E-020	100	
ID_08095	Nonrespondent	District 73	73-E-027	100	

Step 2: Identify Data Collection Method

Select the option which best describes the way in which the data were collected:

○ Attempted Census ◉ Survey Sample

Select the variable in your dataset that indicates each individual's eligibility/response status:

RESPONSE_STATUS

For each category of response and eligibility status, select the appropriate value. These fields cannot be blank.

Eligible Respondents: Respondent

Cases known to be ineligible: Ineligible

Eligible Nonrespondents: Nonrespondent

Cases whose eligibility status is unknown: Unknown

Should cases with unknown eligibility be grouped with nonrespondents for all analysis types other than response rates?

○ Yes ◉ No

Select the variables in your dataset, if any, giving the population size. Use one variable for each stage of sampling.

[No Population Size Variables]

Select the variable in your dataset, if any, that indicates the sampling weight for each case.

SAMPLING_WEIGHT

N_SCHOOL_DISTRICTS
SAMPLING_WEIGHT
STUDENT_GRADE
STUDENT_AGE

Select one or more analyses to run based on the question(s) you want to answer.

What are our response rates and do they differ across subgroups?

- Calculate response rates by subgroup
- Test whether subgroups differ in likelihood of responding
- Identify variables that predict likelihood of responding

Are some subgroups in the population overrepresented or underrepresented in our respondent data?

- Compare subgroup percentages in respondent data to data from respondents and nonrespondents
- Compare subgroup percentages in respondent data to external data

How do survey outcomes differ across subgroups?

- Compare outcomes across subgroups
- Identify variables that are predictive of survey outcomes
- Assess how outcomes change as level-of-effort increases

Can statistical adjustments reduce nonresponse bias?

Specify Analysis

Select one or more analyses to run based on the question(s) you want to answer.

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Calculate response rates by subgroup

This analysis assesses whether different subgroups are more or less likely to respond to the survey, by comparing their response rates.

In the fields below, select one more grouping variable(s) to calculate response rates for different subgroups, the response rate formula to be used, and the method for classifying nonrespondents with unknown eligibility. To calculate an overall response rate for your survey, leave the grouping variable field empty.

Choose grouping variable(s):

STUDENT_RACE

Choose the response rate formula:

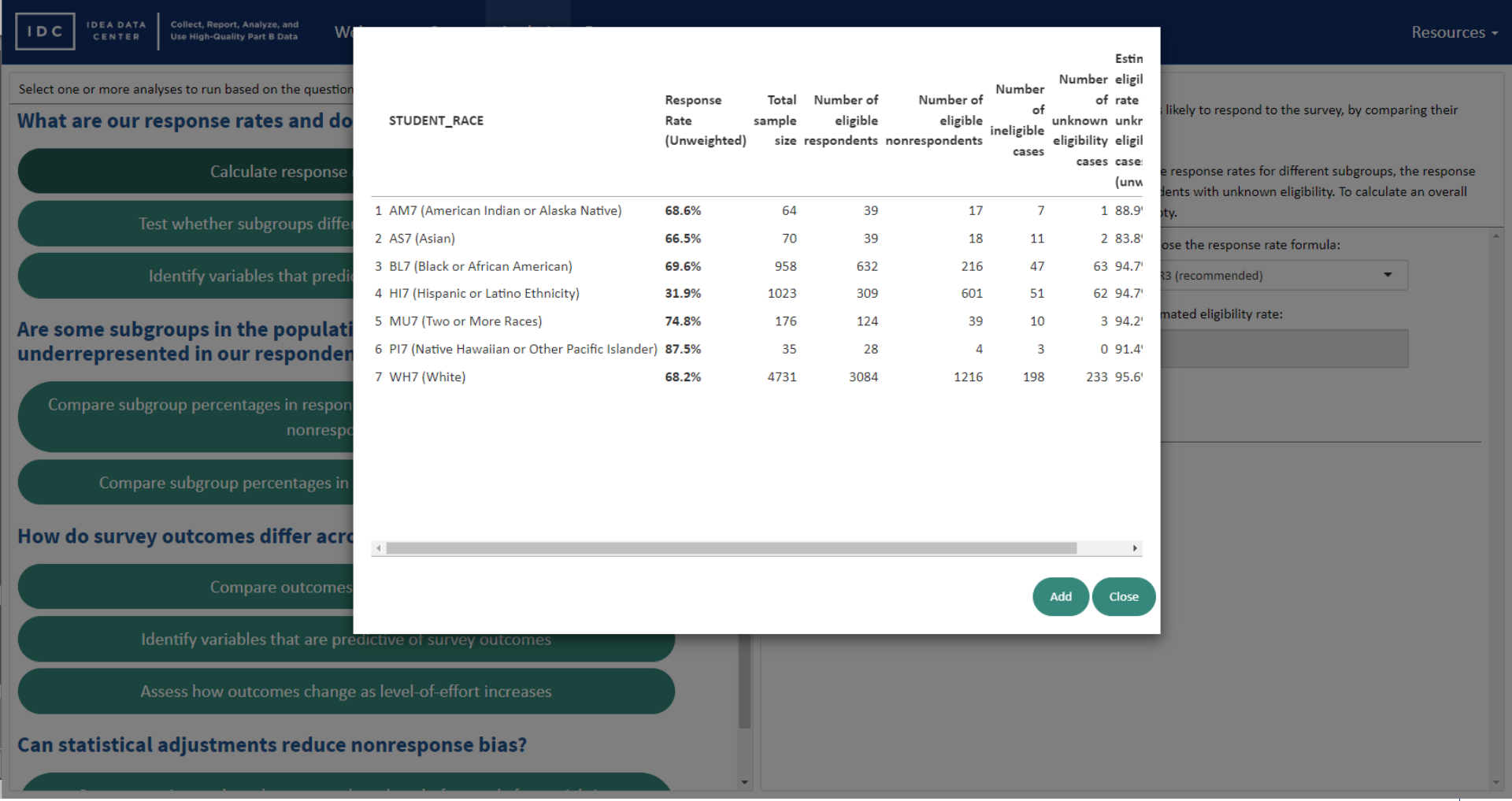
RR3 (recommended)

Choose method for estimating eligibility rate for unknown eligibility cases:

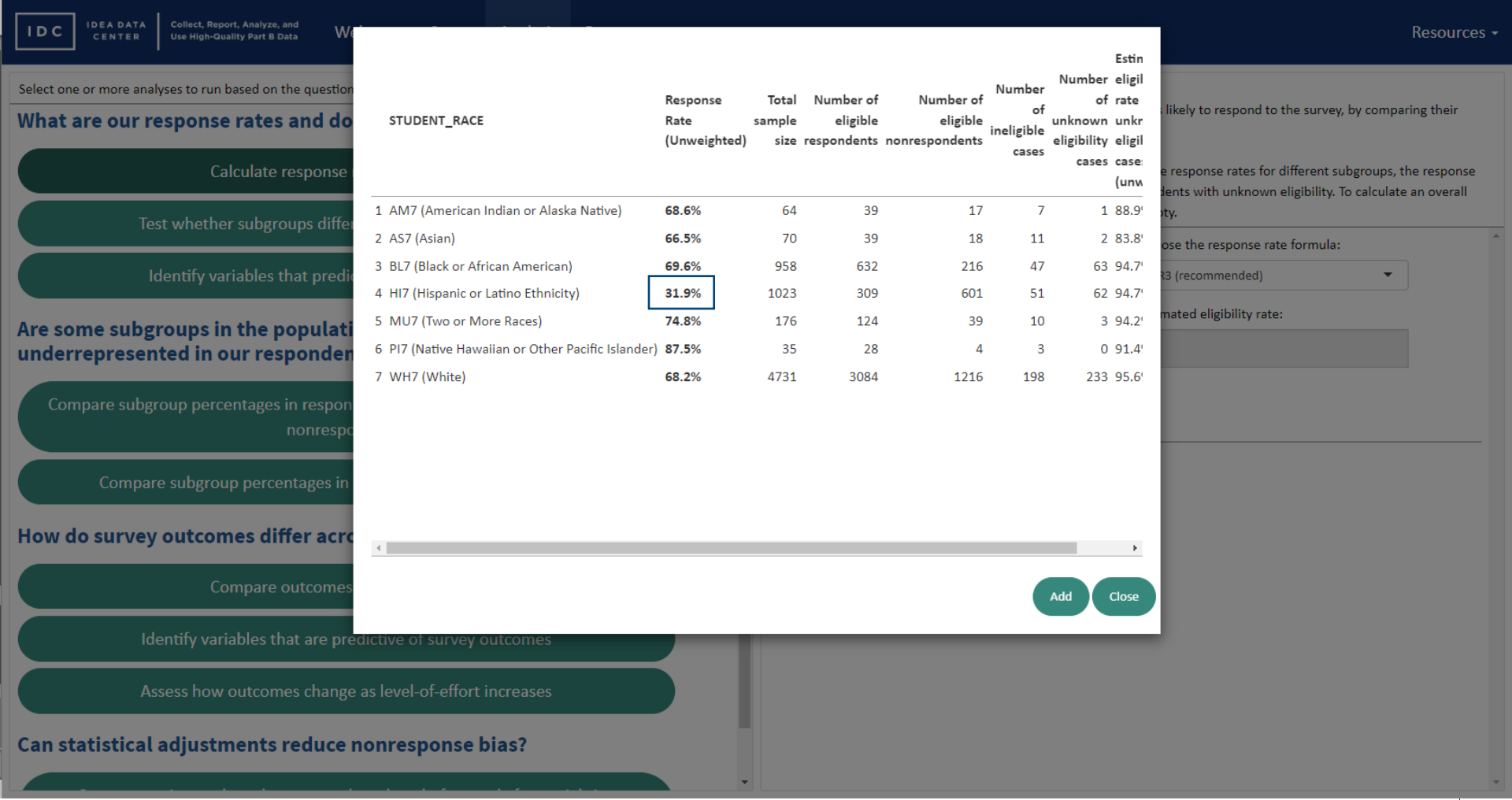
CASRO subgroup (recommended)

Estimated eligibility rate:

Submit



	STUDENT_RACE	Response Rate (Unweighted)	Total sample size	Number of eligible respondents	Number of eligible nonrespondents	Number of ineligible cases	Number of unknown eligibility cases	Estin eligil rate unkr eligil case (unw
1	AM7 (American Indian or Alaska Native)	**68.6%**	64	39	17	7	1	88.9
2	AS7 (Asian)	**66.5%**	70	39	18	11	2	83.8
3	BL7 (Black or African American)	**69.6%**	958	632	216	47	63	94.7
4	HI7 (Hispanic or Latino Ethnicity)	**31.9%**	1023	309	601	51	62	94.7
5	MU7 (Two or More Races)	**74.8%**	176	124	39	10	3	94.2
6	PI7 (Native Hawaiian or Other Pacific Islander)	**87.5%**	35	28	4	3	0	91.4
7	WH7 (White)	**68.2%**	4731	3084	1216	198	233	95.6



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Can statistical adjustments reduce nonresponse bias?

Compare outcomes across subgroups

This analysis type compares outcomes across subgroups by calculating percentages for each category of an outcome variable, separately for each subgroup. The application uses a Chi-squared test to assess whether observed differences among subgroups in outcome percentages are simply due to randomness rather than actual population differences. Nonresponse bias will occur if subgroups systematically differ in likelihood of responding to the survey, and they also differ in outcomes the survey measures.

Choose grouping variable:

STUDENT_RACE

Choose outcome variable:

WHETHER_PARENT_AGREES

Submit

Select one or more analyses to run based on the question

What are our response rates and do

Calculate response

Test whether subgroups diffe

Identify variables that predi

Are some subgroups in the populati underrepresented in our responden

Compare subgroup percentages in respon nonresp

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Can statistical adjustments reduce nonresponse bias?

ing percentages for each category of an outcome
quared test to assess whether observed differences
mness rather than actual population differences.
elihood of responding to the survey, and they also differ

	STUDENT_RACE	WHETHER_PARENT_AGREES	Percent	Lower bound of 95% confidence interval	Upper bound of 95% confidence interval	Weighted Count	Unwe
1	AM7 (American Indian or Alaska Native)	AGREE	53.8%	38.3%	68.7%	21	
2	AS7 (Asian)	AGREE	87.2%	72.7%	94.6%	34	
3	BL7 (Black or African American)	AGREE	45.9%	42.0%	49.8%	290	
4	HI7 (Hispanic or Latino Ethnicity)	AGREE	25.2%	20.7%	30.4%	78	
5	MU7 (Two or More Races)	AGREE	45.2%	36.6%	54.0%	56	
6	PI7 (Native Hawaiian or Other Pacific Islander)	AGREE	71.4%	52.4%	85.0%	20	
7	WH7 (White)	AGREE	56.8%	55.1%	58.6%	1753	
8	AM7 (American Indian or Alaska Native)	DISAGREE	46.2%	31.3%	61.7%	18	
9	AS7 (Asian)	DISAGREE	12.8%	5.4%	27.3%	5	
10	BL7 (Black or African American)	DISAGREE	54.1%	50.2%	58.0%	342	
11	HI7 (Hispanic or Latino Ethnicity)	DISAGREE	74.8%	69.6%	79.3%	231	
12	MU7 (Two or More Races)	DISAGREE	54.8%	46.0%	63.4%	68	
13	PI7 (Native Hawaiian or Other Pacific Islander)	DISAGREE	28.6%	15.0%	47.6%	8	
14	WH7 (White)	DISAGREE	43.2%	41.4%	44.9%	1331	

The test of whether the survey outcome, WHETHER_PARENT_AGREES, differs among subgroups defined by STUDENT_RACE has a p-value of < 0.001, based on a Chi-squared test of independence.

Add Close

Select one or more analyses to run based on the question

What are our response rates and do

Calculate response

Test whether subgroups diffe

Identify variables that predi

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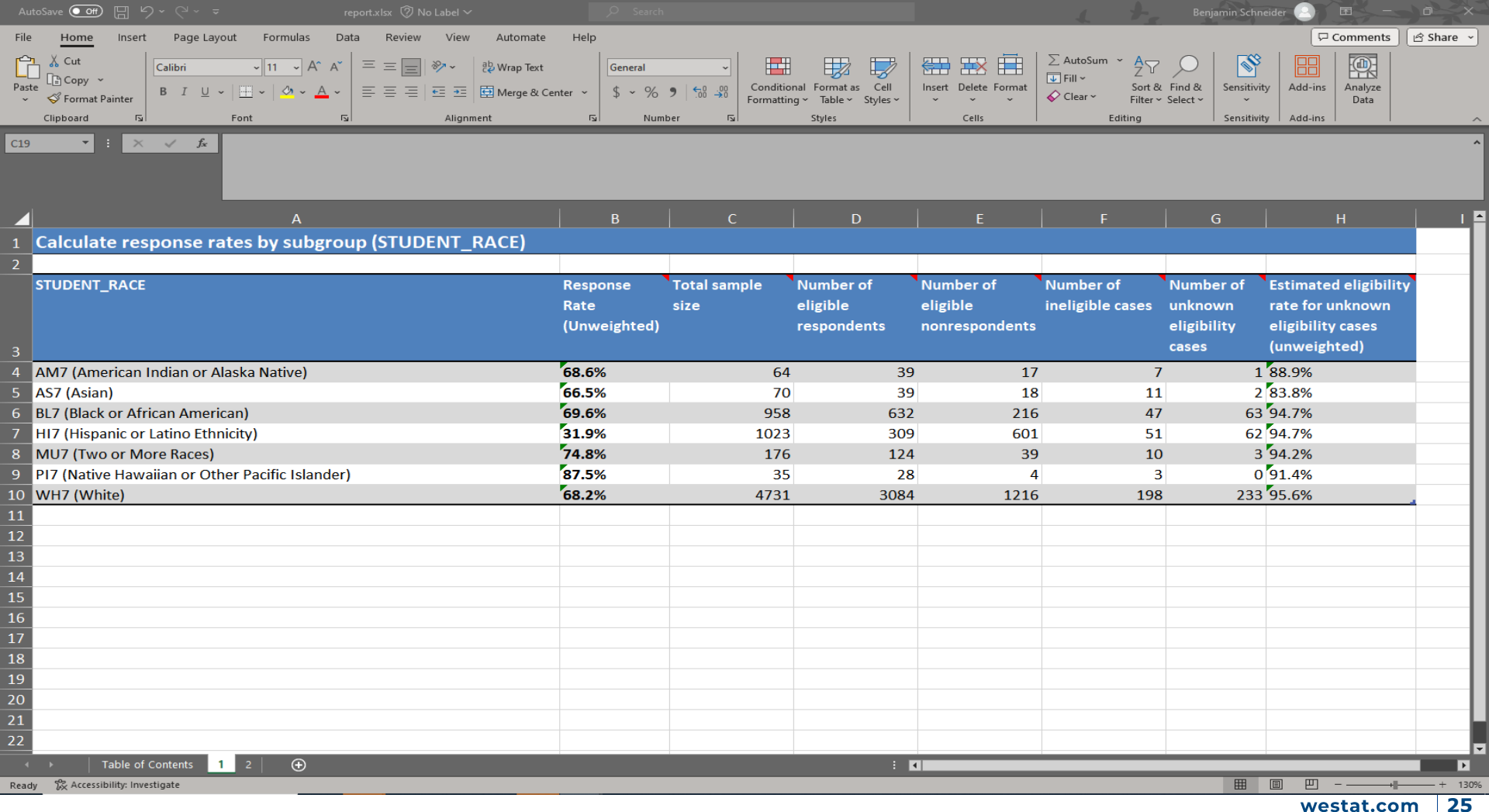
Add Close

Download Report

Save to Excel

Items in Report

Created On	Title	Include in Report
4/9/2024, 12:39:10 PM	Calculate response rates by subgroup (STUDENT_RACE)	☑
4/9/2024, 1:01:01 PM	Compare subgroup percentages in respondent data to data from respondents and nonrespondents (STUDENT_RACE)	☑
4/9/2024, 12:47:28 PM	Compare outcomes across subgroups (STUDENT_RACE, WHETHER_PARENT_AGREES)	☑



Calculate response rates by subgroup (STUDENT_RACE)

STUDENT_RACE	Response Rate (Unweighted)	Total sample size	Number of eligible respondents	Number of eligible nonrespondents	Number of ineligible cases	Number of unknown eligibility cases	Estimated eligibility rate for unknown eligibility cases (unweighted)
AM7 (American Indian or Alaska Native)	68.6%	64	39	17	7	1	88.9%
AS7 (Asian)	66.5%	70	39	18	11	2	83.8%
BL7 (Black or African American)	69.6%	958	632	216	47	63	94.7%
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PI7 (Native Hawaiian or Other Pacific Islander)	87.5%	35	28	4	3	0	91.4%
WH7 (White)	68.2%	4731	3084	1216	198	233	95.6%

Reporting Results

- Summary of findings:
  - "The analysis found evidence of nonresponse bias in base-weighted estimates, attributable to lower response rates among parents of Hispanic or Latino students and key differences in survey outcomes compared to parents of other race/ethnicity groups."
  - "Parents of Hispanic students have substantially lower response rates than other parents, and—among respondents—substantially differ from other groups in their responses to key survey items."
- Using analysis results for future improvement:
  - Including Spanish in survey invitation and follow-up contact attempts
  - Identify interventions to improve involvement of Hispanic or Latino parents

Key lessons learned in supporting states

- Training is needed in underlying concepts:
  - Essential to establish that nonresponse bias isn't just about response rates: crucial to consider variation in key survey outcomes
  - Need to provide refreshers or introductions for related statistical concepts (e.g., interpretation of significance tests)
- Specialized software can provide a clear path through this complex process
  - Open-source tools like R and Shiny can provide access to best practices without requiring the analyst to do any statistical programming
  - Users can rely on reasonable defaults and clear recommendations (e.g., "use AAPOR RR3 as your response rate formula")

Next steps

- Version 2.0 of the application:
  - Incorporating user feedback to further simplify choices
  - Moving to a 100% in-browser application (no need to install software)
- Training:
  - More guidance on summarizing NRBA results
  - Providing short video tutorials (<5 minutes) for each analysis type

References

- The IDC NRBA App:
  - Schneider, B., Nimkoff, T., Fucci, A., Cruse, A., Cates, A., and Green, J. (2023, July). NRBA App. IDEA Data Center. Rockville, MD: Westat. https://ideadata.org/resources/resource/2799/nonresponse-bias-analysis-application
  - Nimkoff, T., & Schneider, B. (2023, July). NRBA App Reference Guide. IDEA Data Center. Rockville, MD: Westat. https://ideadata.org/sites/default/files/media/documents/2023-10/NRBA-AppReferenceGuide.pdf
- FCSM Nonresponse Bias Subcommittee Reports:
  - "A Systematic Review of Nonresponse Bias Studies in Federally Sponsored Surveys" FCSM 20-02
  - "Best Practices for Nonresponse Bias Reporting" FCSM-23-01

Thanks!

Comments and suggestions welcome:

BenjaminSchneider@westat.com