How to interpret response rates

Response rates are an indicator of the proportion of students or teachers who participated, but they should be interpreted with caution.

What are response rates?

This survey is a snapshot of the conditions in your school at the time of survey administration, for the individuals who responded. It can give you a good idea of what is going on in your school in order to help you and your community with school improvement. Response rates can help you understand the quality of the data provided by teachers and students at your school.

One indicator of data quality that is commonly used is the response rate. The student response rate is calculated as follows:

$$Response\ rate = \frac{\#\ respondents}{\#students - ineligible\ students}$$[1]

Why are response rates important?

For every aspect of school climate in the 5 Essentials, the sample size has an effect on the results. For example, if we're trying to measure students' perception of safety, we'll get more reliable information in a large school than in a smaller school—simply because there are more students, and therefore more measurements, in the larger schools. Similarly, when response rates increase, the number of measurements increases.

Do low response rates mean the results are wrong?

Low response rates *may* indicate the *potential* for bias in the results but they do not necessarily mean that bias exists. When bias occurs, there are substantial differences between the responses coming from those who responded to the survey and the way non-responders would have responded had they taken the survey. When those differences are substantial, the survey results do not accurately represent what everyone in the school thinks or feels.

For example, news organizations often survey citizens to determine presidential job approval ratings. Rather than ask every citizen how they feel, they take a sample that is representative of the entire population. As long as those who respond to the survey accurately reflect the population of citizens as a whole, the results will not be biased. Thus, even though less than a one hundredth of 1% of the population respond, the results reflect the feelings of the population overall.

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[1] Ineligible students include those who are unable to take the survey. These students may have severe cognitive difficulties, are in the hospital or are ill for the entire survey period, have withdrawn from school, or have been expelled.

Mathematically, bias occurs when the values of some statistic (like an average) is different between those who responded and the full sample[2]. If we divide by the average of the full sample, we can compare bias values across variables:

$$Relative\ bias = \frac{avg(y_r) - avg(y_n)}{avg(y_n)}$$

A little bit of algebra reveals that the relative bias is related to the response rate:

$$Relative\ bias = (1 - response\ rate) * \frac{avg(y_r) - avg(y_m)}{avg(y_n)}$$

where $avg(y_m)$ is the nonrespondent average of *y*. If the response rate is 100%, then the relative bias of *y* is 0. But if the response rate is less than 100% **and** there are substantial differences between respondents and nonrespondents, then *y* has some bias associated with it.

Table 1 presents an example of what happens to the bias when response rates are low or high and what happens when there is a large or small difference in an outcome, in this case the average GPA. Each cell is the relative bias as calculated from the formula. Notice how the response rate and $avg(y_r) - avg(y_m)$ affect each other—When there is a small difference between respondents and nonrespondents, the bias can be lower at a 50% response rate than at a 75% response rate.

Table 1. Example of relative bias under different conditions[3].

	Response rate = 99%*	Response rate=75%	Response rate=50%
SMALL DIFFERENCE between respondents and non-respondents: $avg(y_r) = 2.45$ $avg(y_m) = 2.35$	$(1 - 99\%) * \frac{2.45 - 2.35}{2.449} = .0004$	$(1 - 75\%) * \frac{2.45 - 2.35}{2.425} = .0103$	$(1 - 50\%) * \frac{2.45 - 2.35}{2.4} = .0208$
LARGE DIFFERENCE between respondents and non-respondents $avg(y_r) = 2.52$ $avg(y_m) = 2.0$	$(1 - 99\%) * \frac{2.52 - 2.0}{2.515} = .0021$	$(1 - 75\%) * \frac{2.52 - 2.0}{2.39} = .0544$	$(1 - 50\%) * \frac{2.52 - 2.0}{2.26} = .1150$

*If the response rate is 100%, there are no nonrespondents.

[2] Groves, R.M., & Couper, M.P. (1998). *Nonresponse in Household Interview Surveys.* New York: Wiley.
[3] The average of the full sample ($avg(y_n)$) is derived from $avg(y_n)$.

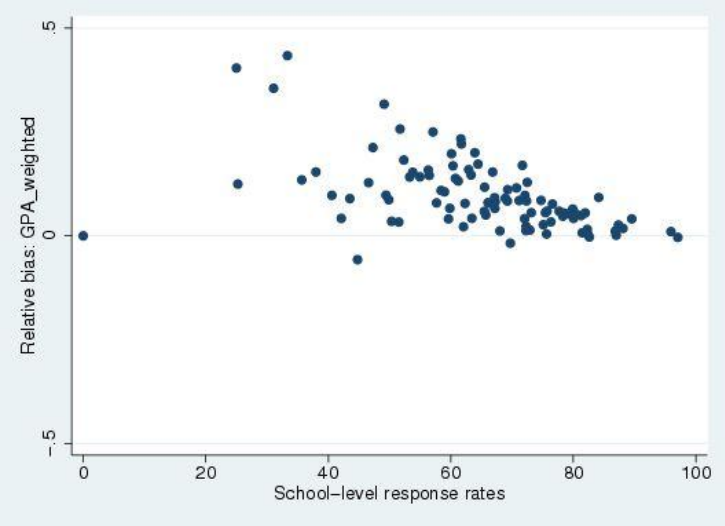
Are the survey measures reported for my school biased?

We cannot calculate the relative bias for our survey measures because we do not have information on students who do not respond. But we can look at the bias for some variables that are available for all students. If biased variables are related to our measures, then our measures are likely biased.

Example 1: Higher response rates → Less bias

After the 2007 Chicago Public Schools survey, we calculated standardized estimates of the bias of weighted GPA and test scores within each school. In Figure 1, the school-level response rates are plotted along the horizontal axis. The vertical axis shows the standardized bias of GPA – a measure of the difference between respondents and non-respondents. If this difference is equal to zero, there is no difference in the GPAs of students who did or did not take the survey. Figure 1 shows that, as the response rates for CPS schools increase, the bias decreases. Specifically, in schools with lower response rates, the students who responded to the survey had higher GPAs than students who did not respond.

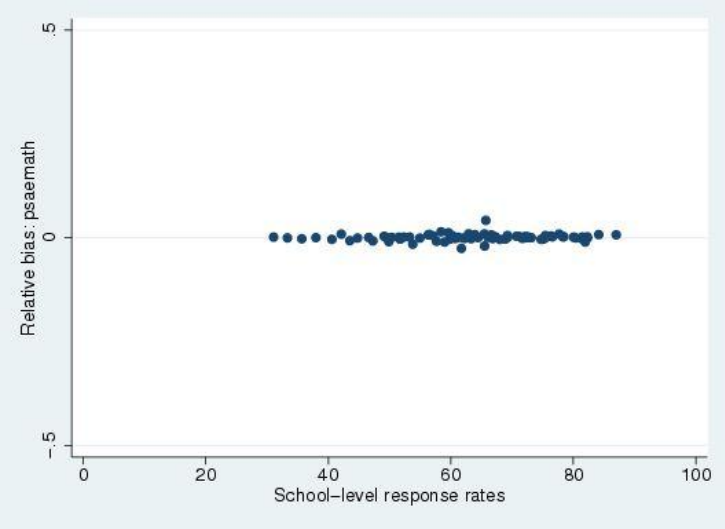
Figure 1. Response rates and standardized bias of weighted GPA in CPS schools in 2007.



Example 2: Higher response rates are unrelated to bias

But let's contrast this with test scores (PSAE math scores in high schools). In Figure 2, we see a different situation. As response rates increase, the bias of this variable does not change—it stays around zero in schools with 35% response rates as well as in schools with 90% response rates.

Figure 2. Response rates and standardized bias of PSAE math scores in CPS high schools in 2007.



What do I do with this information?

We require a minimum 50% response rate to receive reports. But whether your response rate is 51% or 91%, is less important than whether the respondents reflect the population in your school.. High response rates yield more *certainty* in our measures, but high response rates do not always yield less *bias*. Keep in mind the over- or under-representation of certain groups when you interpret the findings.