

## Reader's Guide

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*The Condition of Education* is available in two forms: this print volume for 2003 and a web version on the NCES web site (<http://nces.ed.gov/programs/coe>). The web version includes special analyses, essays, and indicators from this and earlier print volumes of *The Condition of Education*. (See page xxii for a list of all the indicators that appear on *The Condition of Education* web site.)

Each section of the print volume of *The Condition of Education* begins with a summary that presents the key points in the indicators to follow. All indicators contain a discussion, a single graph or table on the main indicator page, and one or more supplemental tables. All use the most recent national data available from the National Center for Education Statistics (NCES) or other sources serving the purposes of the indicator. The icon to the side of the graph or table directs readers to supplemental notes, supplemental tables, or another source for more information.

When the source is an NCES publication, such as *The Digest of Education Statistics 2002* (NCES 2003–060), that publication can be viewed at the NCES web site (<http://nces.ed.gov>).

Supplemental notes provide information on the sources of data used, describe how analyses were conducted, or provide explanations of categories used in an indicator. Supplemental tables provide more detailed breakouts for an indicator, such as household income, students' race/ethnicity, or parents' education. Tables of standard errors (see below) are also included for applicable indicators. A glossary of terms and a comprehensive bibliography of items cited in *The Condition of Education* appear at the end of the volume.

### DATA SOURCES AND ESTIMATES

The information presented in this report was obtained from many sources, including federal and state agencies, private research organizations, and

professional associations. The data were collected using many research methods, including surveys, compilations of administrative records, and statistical projections. Users of *The Condition of Education* should be cautious when comparing data from different sources. Differences in procedures, timing, phrasing of questions, interviewer training, and so forth mean that the results are not strictly comparable.

Data reported in this volume are primarily from two types of sources. Some indicators report data from entire populations, such as *indicator 39* (public elementary and secondary expenditures per student). With these kinds of data, information is collected from every member of the population surveyed. This “universe” could be all colleges and universities or every school district in the country. Other indicators report data from a statistical sample of the entire population. When a sample is used, the statistical uncertainty introduced from having data from only a portion of the entire population must be considered in reporting estimates and making comparisons.

In contrast, when data on an entire population are available, estimates of the size of the total population or a subpopulation are made simply by counting, or summing, the units in the population or subpopulation. In the case of subpopulations, the size is usually reported as a percentage of the total population. In addition, estimates of the average (or mean) values of some characteristic of the population or subpopulation may be reported. The mean is obtained by summing the values for all members of the subpopulation and dividing the sum by the size of the subpopulation. Examples include the annual mean salaries of professors at 4-year colleges and universities.

Although estimates derived from universe surveys are not affected by sampling, they are affected by a wide range of potential data collection errors such as coverage errors, response errors, coding errors, and data entry errors. These errors may be larger than the error due to collecting data on

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a sample rather than the entire population. Estimates of the size of these errors are typically not available.

A universe survey is usually expensive and time consuming, so researchers often collect data from a small sample of the population of interest. Through (stratified) random sampling and other methods, researchers seek to ensure that this sample accurately represents the larger population to which they wish to generalize. As an illustration, the National Education Longitudinal Study of 1988, upon which *indicator 22* is based, surveyed a representative sample of nearly 25,000 8th-graders from among all 8th-graders across the country. Based on this sample, conclusions can be drawn about all 8th-graders, such as their family background, characteristics of the schools they attend, their mathematical achievement (as measured with a test administered as part of the survey), and their activities outside of school (NCES 90-458).

Estimating the size of the total population or subpopulations from a data source based on a sample of the entire population requires consideration of several factors before the estimates become meaningful. However conscientious an organization may be in collecting data from a sample of a population, there will always be some margin of error in estimating the size of the actual total population or subpopulation because the data are available from only a portion of the total population. Consequently, data from samples can provide only an estimate of the true or actual value. The margin of error or the range of the estimate depends on several factors, such as the amount of variation in the responses, the size and representativeness of the sample, and the size of the subgroup for which the estimate is computed.<sup>1</sup> The magnitude of this margin of error is measured by what statisticians call the “standard error” of an estimate.

Most indicators in *The Condition of Education* summarize data from sample surveys conducted

by NCES or the Bureau of the Census with support from NCES. Detailed explanations of NCES surveys can be obtained at the web site noted above, under “Survey and Program Areas.” Information about the Current Population Survey, another frequent source of survey data used in *The Condition of Education*, can be obtained at <http://www.bls.census.gov/cps/cpsmain.htm> (and also in *supplemental note 2*).

### STANDARD ERRORS

When data from samples are reported, as is the case with most of the indicators in *The Condition of Education*, the standard error is calculated for each estimate provided in order to determine the “margin of error” for these estimates. The standard errors for all the estimated means, medians, or percentages reported in the graphs and text tables of *The Condition of Education* can be found in appendix 3, Standard Error Tables. The corresponding standard errors for the supplemental tables can be viewed at the NCES web site at <http://nces.ed.gov/programs/coe>.

The standard errors of the estimates for different subpopulations in an indicator can vary considerably. As an illustration, *indicator 11* reports on the mathematics performance of students in 8th grade in 2000. For Hispanic students, the average scale score was 253; for American Indian/Alaska Native students, the average scale score was 255 (see supplemental table 11-2). In contrast to the similarity in these scale scores, the standard errors were 1.5 for Hispanics and 8.3 for American Indians/Alaska Natives.

The percentage or mean score with the smaller standard error provides a more reliable estimate of the true value than does the percentage or mean score with a higher standard error. Standard errors tend to diminish in size as the size of the sample (or subsample) increases. Consequently, for the same kinds of data, such as enrollment rates in postsecondary education sample surveys (like the National Postsecondary Student Aid

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Study) or scores on the National Assessment of Educational Progress, standard errors will almost always be larger for Blacks and Hispanics than for Whites, who represent a larger proportion of the population.

#### DATA ANALYSIS AND INTERPRETATION

Due to standard errors, caution is warranted when drawing conclusions about the size of one population estimate in comparison to another or whether a time series of population means is increasing, decreasing, or staying about the same. Although one mean or percentage may be larger than another, a statistical test may find that there is no discernable difference between estimates due to the uncertainty of the estimates.

Whether differences in means or percentages are statistically significant can be determined using the standard errors of the estimates. When differences are statistically significant, the probability that the difference occurred by chance is usually small; for example, it might be about 5 times out of 100. Some details about the method primarily used in *The Condition of Education* for determining whether the difference between two means is statistically significant are presented in the introduction to appendix 3, Standard Error Tables.

For all indicators in *The Condition of Education* based on samples, differences between means or percentages (including increases or decreases) are stated only when they are statistically significant. To determine whether differences reported are statistically significant, two-tailed *t*-tests, at the .05 level, are typically used. The *t*-test formula for determining statistical significance is adjusted when the samples being compared are dependent. When the variables to be tested are postulated to form a trend, the relationship may be tested using linear regression, logistic regression, or ANOVA trend analysis instead of a series of *t*-tests. These other

methods of analysis test for specific relationships (e.g., linear, quadratic, or cubic) among variables.

Discussion of several indicators illustrates the consequences of these considerations. *Indicator 2* reports that a smaller percentage of White children lived in poor families in 2001 (9.7 percent) than in 1976 (11.1 percent). Although the difference of less than 2 percentage points is relatively small, as are the standard errors associated with each estimate (0.28 and 0.57 for 2001 and 1976, respectively), the difference is statistically significant and supports the statement. In contrast, *indicator 37* discusses the frequency with which children and their families engaged in certain literacy activities in 2001. The data in supplemental table 37-1 indicate that 58 percent of Asian children and 42 percent of Hispanic children were told a story three or more times a week according to their parents or guardians. The difference of 16 percentage points is larger than in the previous example, but the standard errors are also larger (6.85 and 2.06, respectively). The difference is not statistically significant; the data do not support a conclusion that Asian children were more likely than Hispanic children to be told a story three or more times a week. *Indicator 25* provides a similar example. The introduction to appendix 3 explains in some detail how the statistical significance of the difference between two estimates is determined.

#### VARIATION IN POPULATIONS

In considering the estimated means in the tables and figures shown in this volume and on the web site, it is important to keep in mind that there may be considerable variation among the members of a population in the characteristic or variable represented by the population mean. For example, the estimated average mathematics score of children who entered kindergarten in the fall of 1998 was 20 score points (see table 9-1). In reality, many students

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scored above 20 points and many scored lower than 20 points. Likewise, not all community colleges have the same rate of transfer to a 4-year institution as the national average rate of transfer.

Because of this variation, there may be considerable overlap among the members of two populations that are being compared. Although the difference in the estimated means of the two populations may be statistically significant, many members of the population with the lower estimated mean may be above the estimated mean of the other population and vice versa. For example, it is possible that some percentage of the students in, say, the highest poverty schools score higher than the average student, or even the top quartile of students, in the lowest poverty schools (see *indicator 12*). The extent of such overlap is not generally considered in the indicators in this volume.

Estimates of the extent of variation in such population characteristics can be computed from the NCES survey data sets or are available in published reports. For example, estimates of the variation in students' assessment scores can be found using the NAEP Data Tool at <http://nces.ed.gov/nationsreportcard/naepdata/> or in the appendices to most NAEP reports.

### ROUNDING AND OTHER CONSIDERATIONS

Although values reported in the supplemental tables are generally rounded to one decimal place (e.g., 76.5 percent), values reported in

each indicator are rounded to whole numbers (with any value of 0.5 or above rounded to the next highest whole number). Due to rounding, cumulative percentages may sometimes equal 99 or 101 percent, rather than 100.

In accordance with the recently revised NCES Statistical Standards, many tables in this volume use a series of symbols to alert the reader to special statistical notes. These symbols, and their meaning, are as follows:

- Not available.  
Data were not collected or not reported.
- † Not applicable.  
Category does not exist.
- # Rounds to zero.  
The estimate rounds to zero.
- ! Interpret data with caution.  
Estimates are unstable (because standard errors are large compared with the estimate).
- ‡ Reporting standards not met.  
Did not meet reporting standards.
- \*  $p < 0.05$  Significance level.<sup>2</sup>

### NOTES

<sup>1</sup>If there are five racial/ethnic groups in a sample of 1,500, the researcher would have less confidence in the results for each group individually than in the results for the entire sample because there are fewer people in the subgroup than in the population.

<sup>2</sup>The chance that the difference found between two estimates when no real difference exists is less than 5 out of 100.