# THE PRECISION OF THE NORMATIVE DATA AND THEIR COMPARISONS

A common question asked about sample surveys relates to the precision of the data, which is typically reported as the accuracy of a percentage "plus or minus x percentage points." This figure, which is known as a confidence interval, can be estimated for items of interest if one knows the response percentage and its standard error.

Given the CIRP's large normative sample, the calculated standard error associated with any particular response percentage will be small (as will its confidence interval). It is important to note, however, that traditional methods of calculating standard error assume conditions which, (as is the case with most real sample survey data), do not apply here. Moreover, there are other possible sources of error which should be considered in comparing data across normative groups, across related item categories, and over time. In reference to the precision of the CIRP data, these concerns include:

1) Traditional methods of calculating standard error assume that the <u>individuals</u> were selected through simple random sampling. Given the complex stratified design of the CIRP, where whole institutions participate, it is likely that the actual standard errors will be somewhat larger than the standard error estimates produced through traditional computational methods. In addition, while every effort has been made to maximize the comparability of the institutional sample from year to year (repeat participation runs

about 90 percent), comparability is reduced by non-repeat participation and year-to-year variation in the quality of data collected by continuing institutional participants. While the CIRP stratification and weighting procedures are designed to minimize this institutional form of "response bias," an unknown amount of non-random variation is introduced into the results.

2) The wording of some questions in the survey instrument, the text and number of response options, and their order of presentation have changed over the years. We have found that even small changes can produce large order and context effects. Given this, the *exact* wording and order of items on the survey instrument (see Appendix B) should be examined carefully prior to making comparisons across survey years.

3) Substantial changes in the institutional stratification scheme were made in 1968, 1971, 1975, 2001, and 2008. These changes resulted in a revision of the weights applied to individual institutions. Stratification cell assignments of a few institutions may also change from time to time, but the scale of these changes and their effect on the national normative results are likely to be small in comparison to other sources of bias.

Since it is impractical to report statistical indicators for every percentage in every CIRP comparison group, it is important for those who

are interested to be able to estimate the precision of the data. Toward this end, Table D1 provides estimates of standard errors for comparison groups of various sizes and for different percentages[1] which can be used to derive confidence interval estimates.

For example, suppose the item we are interested in has a response percentage of 15.7 percent among students at all nonsectarian four-year colleges (a normative group that is 39,525 in size). First, we choose the column that is closest to the observed percentage 15.7—in this case "15%."[2] Next, we select the row closest to the unweighted sample size of 39,525—in this case "40,000." Consulting Table D1, we find the estimated standard error would be .179.

To calculate the confidence interval at the 95% probability level, we multiply the estimated standard error by the critical value of t for the unweighted sample size (which, for all CIRP comparison groups, will be equal to 1.96 at the .05 level of probability).[3] In this example, we would multiply the estimated standard error of .179 by 1.96, which yields .350. If we round this figure to a single decimal point we would then estimate our confidence interval to be 15.7 ± .4. In practical terms, this confidence interval means that if we were to replicate this survey using the same size sample, we would expect that the resulting percentage would fall between 15.3 percent and 16.1 percent 95 times out of 100.

### Table D1. Estimated Standard Errors of Percentages for Comparison Groups of Various Sizes

| Unweighted size of comparison groups | Percentage | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1% | 5% | 10% | 15% | 20% | 25% | 30% | 35% | 40% | 45% | 50% |
| 500 | .445 | .975 | 1.342 | 1.597 | 1.789 | 1.936 | 2.049 | 2.133 | 2.191 | 2.225 | 2.236 |
| 1,000 | .315 | .689 | .949 | 1.129 | 1.265 | 1.369 | 1.449 | 1.508 | 1.549 | 1.573 | 1.581 |
| 5,000 | .141 | .308 | .424 | .505 | .566 | .612 | .648 | .675 | .693 | .704 | .707 |
| 10,000 | .099 | .218 | .300 | .357 | .400 | .433 | .458 | .477 | .490 | .497 | .500 |
| 20,000 | .070 | .154 | .212 | .252 | .283 | .306 | .324 | .337 | .346 | .352 | .354 |
| 40,000 | .050 | .109 | .150 | .179 | .200 | .217 | .229 | .238 | .245 | .249 | .250 |
| 55,000 | .042 | .093 | .128 | .152 | .171 | .185 | .195 | .203 | .209 | .212 | .213 |
| 70,000 | .038 | .082 | .113 | .135 | .151 | .164 | .173 | .180 | .185 | .188 | .189 |
| 90,000 | .033 | .073 | .100 | .119 | .133 | .144 | .153 | .159 | .163 | .166 | .167 |
| 110,000 | .030 | .066 | .090 | .108 | .121 | .131 | .138 | .144 | .148 | .150 | .151 |
| 130,000 | .028 | .060 | .083 | .099 | .111 | .120 | .127 | .132 | .136 | .138 | .139 |
| 240,000 | .020 | .044 | .061 | .073 | .082 | .088 | .094 | .097 | .100 | .102 | .102 |

Note: Assumes simple random sampling.

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[1] Calculated by $\sqrt{\dfrac{x\%(100-x\%)}{N}}$ where x is the percentage of interest and N is the population count from Table A1.

[2] Since the distribution of the standard errors is symmetrical around the 50 percent mid-point, for percentages over 50 simply subtract the percentage from 100 and use the result to select the appropriate column. For example, if the percentage we were interested in was 59, 100 – 59 percent yields 41, so we would use the column labeled '40%.'

[3] To calculate the confidence interval at the 99% probability level the critical t value is 2.56.