GUIDE TO NATA PROFICIENCY TESTING

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NATA AUSTRALIA, 7 LEEDS STREET, RHODES NSW 2138

B.4 Summary Statistics

Once the data preparation is complete, summary statistics are calculated to describe the data. NATA uses seven summary statistics - number of results, median, normalised interquartile range (IQR), robust coefficient of variation (CV), minimum, maximum and range. All of these are described in detail below.

The most important statistics used are the median and the normalised IQR - these are measures of the centre and spread of the data (respectively), similar to the mean and standard deviation. The median and normalised IQR are used because they are robust statistics, which means that they are not influenced by the presence of outliers in the data.

The no. of results is simply the total number of results received for a particular test/sample, and is denoted by N. Most of the other statistics are calculated from the sorted results, i.e. from lowest to highest, and in this appendix X[i] will be used to denote the ith sorted data value (e.g. X[1] is the lowest value and X[N] is the highest).

The median is the middle value of the group, i.e. half of the results are higher than it and half are lower. If N is an odd number the median is the single central value, i.e. X[(N+1)/2]. If N is even, the median is the average of the two central values, i.e. (X[N/2] + X[(N/2)+1])/2. For example if N is 9 the median is the 5th sorted value and if N is 10 the median is the average of the 5th and 6th values.

The normalised IQR is a measure of the variability of the results. It is equal to the interquartile range (IQR) multiplied by a factor[†] (0.7413), which makes it comparable to a standard deviation. The interquartile range is the difference between the lower and upper quartiles. The lower quartile (Q1) is the value below which, as near as possible, a quarter of the results lie. Similarly the upper quartile (Q3) is the value above which a quarter of the results lie. In most cases Q1 and Q3 are obtained by interpolating between the data values. The IQR = Q3–Q1 and the normalised IQR = IQR × 0.7413.

The robust CV is a coefficient of variation (which allows for the variability in different samples/tests to be compared) and is equal to the normalised IQR divided by the median, expressed as a percentage - i.e. robust CV = 100 × normalised IQR ÷ median.

The minimum is the lowest value (i.e. X[1]), the maximum is the highest value (X[N]) and the range is the difference between them (X[N]–X[1]).

Once the summary statistics have been calculated for each of the samples and tests in a program, the medians and normalised IQRs are tabulated and sent to each laboratory which has returned results as "early information". Following the issue of this information no further changes or additions (e.g. of late results) to the data are permitted.

On page 22 is an example of the summary statistics as they appear in a final report. For this program three samples were used and samples A and C were identical (i.e. a uniform pair), so the summary statistics for these two samples are very similar.

NOTE: [†] *The factor comes from the "standard" normal distribution (as described in Section B.2), which has a mean of zero and a standard deviation (SD) equal to one. The interquartile range of such a distribution is [–0.6745, +0.6745] and this is narrower than the familiar ±1 SD interval. So, to convert an IQR into a ±1 SD range, it must be scaled up by the ratio of the interval widths, namely 2/1.3490. To then convert this ±1 SD range (whose width is 2 standard deviations) into an amount equivalent to 1 SD, this range is then halved. Hence the IQR is divided by 1.3490 (or equivalently multiplied by 0.7413) to convert it into an estimate of the standard deviation.*