

thermo scientific



How to interpret your excellence

Interpretation guidance for Quality Club
within Phadia™ Laboratory Systems

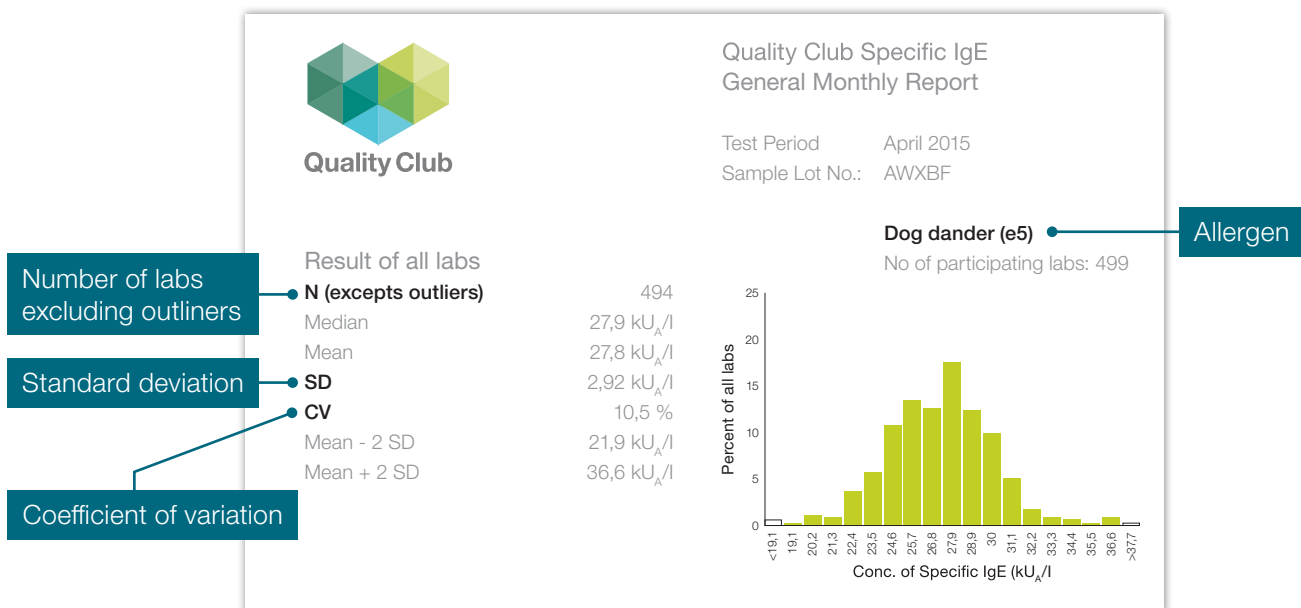
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Performance of all labs

General Monthly Report

The General Monthly Report gives an overview of aggregated results from all participating labs. These results include measurements of three allergens

(i.e. Specific IgE) and characteristics of these measurement distributions across the participating labs. A description of the included distribution characteristics on the left side of the distribution histograms is given in the appendix.



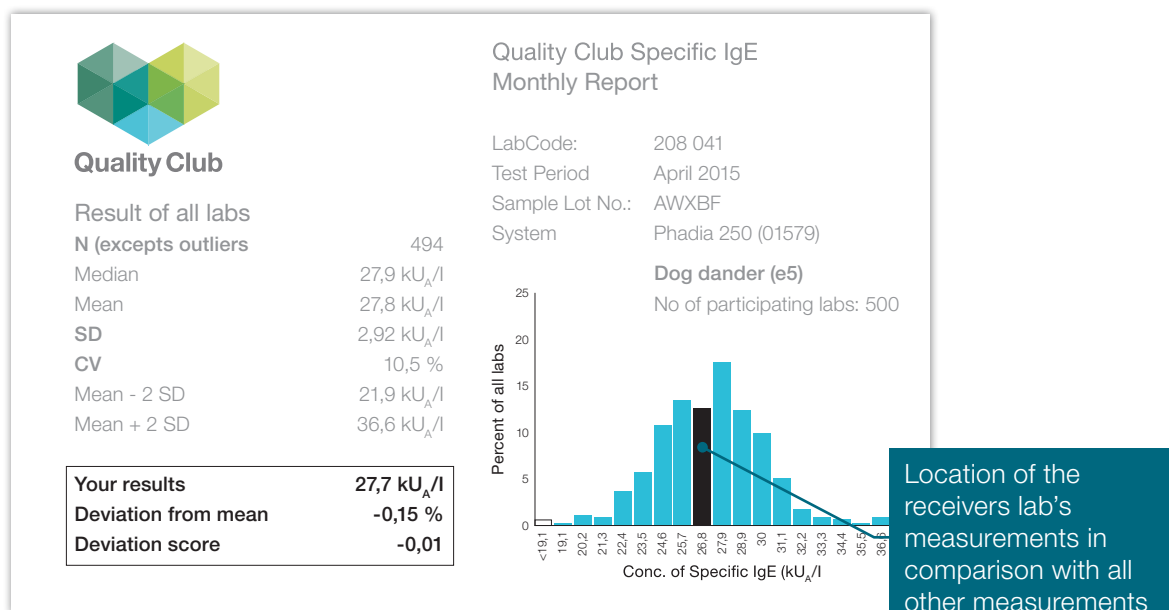
An overview of the General Monthly Report. The histogram displays the distribution of all measurements. Outliers are marked as blank bars. The distribution characteristics are provided on the left side of the histogram.

Performance of your lab

Monthly Report

The Monthly Report builds on the information from the preceding page and overlays the individual results of your lab (the receiver lab). These individual results are displayed in the distribution histogram as well as beneath the distribution characteristics. The Monthly Report can be utilized to deduce the performance of your lab in regards with the general distribution across all labs.

More specifically, optimal performances are those located closely to the center of the distribution and therefore scoring relatively small values for “deviation from mean” and “deviation score”. Although, single deviation scores exceeding ± 2 or even ± 3 need not cause any alarm, instrument and procedure check-up is recommended in case of repeated instances of deviation scores exceeding the limits above.



The information from the Monthly Report of the Quality Club report overlaid with your (the receiver lab) results. The black bar in the histogram displays the location of your lab's measurement in comparison with all other measurements. The exact result and its relative deviation from the distribution mean is presented in the solid box on the left side of the histogram.

Your labs performance over time

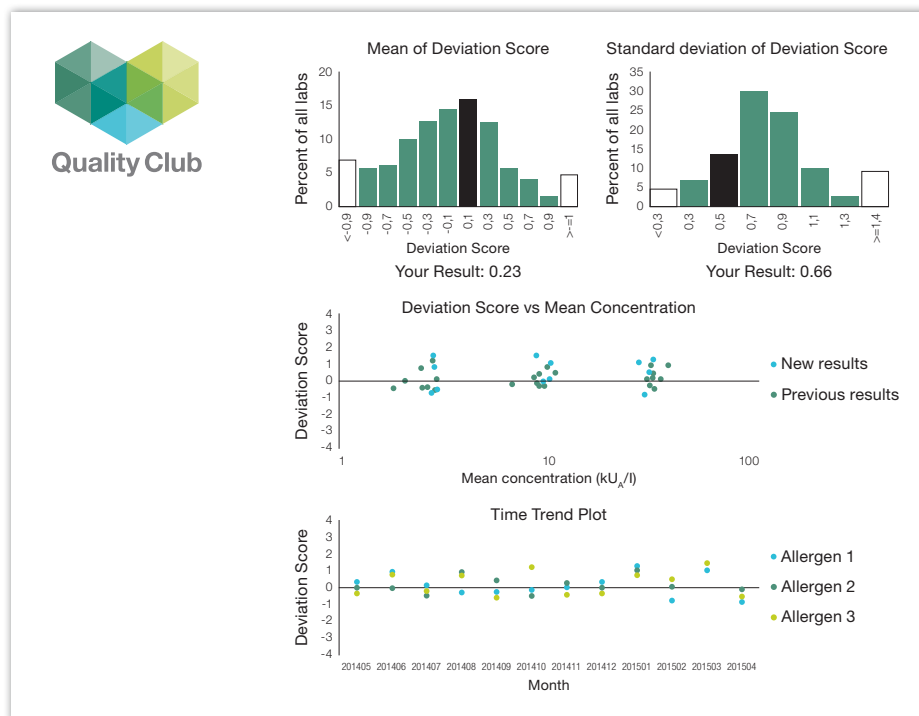
Summary Report

The Summary Report represents historical results of your lab using the deviation score. The top left panel displays a distribution of means of deviation scores from all participating labs during the preceding year. The individual result of your lab is marked in the histogram and annotated below the panel.

Similarly, the top right panel displays the standard deviation (dispersion) of deviation scores from all participating labs, along with the individual result of your

lab. The middle panel of the page depicts a plot of mean concentrations (kU_A/l) against deviation scores. The plotted values are grouped into “previous” and “new” measurements. Ideally, measurements should be aligned around the solid horizontal line, where deviation score is equal to zero.

Finally, the bottom panel of the page displays the distribution of deviation scores across the preceding year for the included allergens. Typically, there are three allergen measurements per month (i.e. Specific IgE).



Summary of retrospective results presented using the deviation score's mean and standard deviation. The top panels demonstrate the properties of the preceding year's deviation scores in comparison with deviation scores from all other labs across the world. Ideally, the deviation score should be close to zero and distributed symmetrically around the solid horizontal line in the middle and bottom panel.

How to interpret your scores

The optimal outcome for a participating lab is to yield results with low bias and low variance. In practical terms, this translates to measurements of allergens that are located closely to the center of distributions in the Member Monthly Report. Generally, the aim is to obtain deviation scores that are symmetrically distributed around zero and low in value. The former property guarantees low bias and the latter low variance.

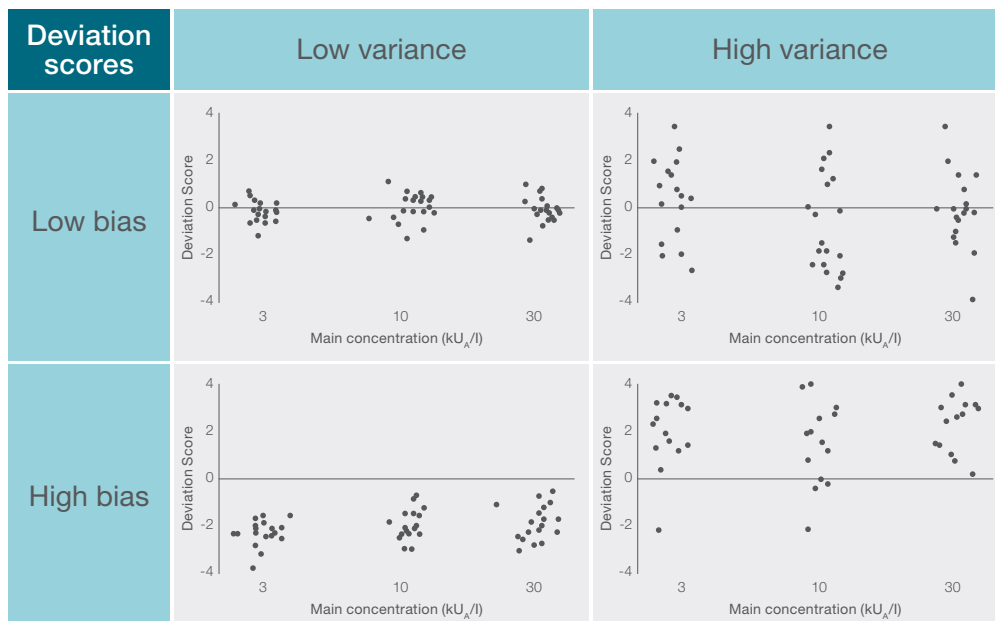
The following examples demonstrate the effects of bias and variance on deviation scores:

Deviation scores	Low variance	High variance
Low bias	0,2 0,1 -0,15	2,5 -2,9 -0,5
High bias	1,7 1,65 1,8	2,1 2,7 1,3

A more in-depth illustration and concrete evidence of this phenomenon can be shown using the historical data provided in the Summary Report, the mean of the deviation score in the preceding year should be close to zero here (top left panel). In the top right panel, the standard deviation (dispersion) of the deviation score should be in the vicinity of the center of the distribution.

deviations (of deviation scores) is consistently larger than zero. Although desirable, a standard deviation close to zero could be a hint of outstanding but improbable performance, and in some cases signal a systematic bias with very low variance. Moreover, the distribution in the top right panel is based on hundreds of measurements and reflects a natural “innate” variation, which should be regarded as well representative of measurements performed across a large number of labs.

The latter remark might seem slightly counter-intuitive in the sense that the center of the distribution of standard



Appendix

Presented below, there is a brief description of statistics used to characterize the distribution of measurements, as well as how single measurements stand in comparison with the general distribution. A single measurement is denoted as x or x_i and the mean of measurements is denoted as \bar{x} .

Parameter	Description
N	Number of values included in the statistical calculation
Median	The value which separates sorted data into two halves, i.e. the middle of sorted data
Mean	Arithmetic mean of data, i.e. \bar{x}
SD	Standard deviation, estimated according to: $SD_x = \sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N - 1}}$
CV	Coefficient of variation, estimated as the standard deviation divided by the mean (multiplied by 100 in order to be presented in % units)
Deviation from mean	Deviation of receiver lab's results from the mean in percentage, calculated according to: $Deviation\ from\ mean = \frac{(x - \bar{x}) \cdot 100}{\bar{x}}$
Deviation score	Represents the number of standard deviations the receiver lab's results differ from the mean. Calculated according to: $Deviation\ score = \frac{x - \bar{x}}{SD_x}$

Outliers

Outliers are excluded from the statistical calculations by use of robust estimators of mean and standard deviation.

More specifically, the median (Med) is used as a robust estimator of the mean. For each measurement, the absolute distance from the median (Med) is evaluated and the median of these distances (Dis) is determined.

This median of distances (Dis) is multiplied by 1.483 to obtain a robust estimator of the standard deviation(s). Measurements falling outside of $(Med) \pm 3.5 \times s$ are considered outliers and thus excluded. The remaining measurements are used for the calculation of the distribution characteristics such as mean, coefficient of variation, and deviation scores.

Reference

Rousseuw PJ. Tutorial to robust statistics. *Journal of Chemometrics*. 1990;5:1-20.

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