Graphical Description of Performance Characteristics of Laboratories and Assays using data from the UK NEQAS for Haematinics

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Introduction

Clinicians may be aware that different Diagnostic Manufacturers' assays can differ, but may not be aware of the scale of these differences, nor the changes that can and do occur over time.

The UK NEQAS for Haematinics has been assessing the performance of participating laboratories for decades. In the last few years when the scheme operation came under the auspices of Birmingham Quality, part of University Hospitals Birmingham Trust, participants have had their data expressed in the easy to assimilate, graphical rich format that has been used in the Clinical Chemistry EQA domain for some time.

Aim

The use of graphical representation of data puts into stark images the findings from the probing EQA exercises which we hope will generate more of a sense of priority compared to being hidden in sea of tabulated data. We want Participants to be in no doubt as to when their performance or that of their method is a cause for concern.

Method

The scheme operates on the usual UK NEQAS Chemistry model whereby participants receive three specimens every month which they analyse and interpret. The data is entered into a web portal and at the end of the monthly Distribution cycle a personalised report is produced. Statistics are calculated at the Specimen level as well as an accumulated Rolling Time-Window level synthesising data on a six-monthly moving average.

The use of long term trend statistics allows us to show a Laboratory's individual history, colour coded by analytical performance; the so-called Bias B score vs time 'Seismograph Plot' is a game changer in letting participants see their performance within their group.
The complementary method-specific Bias B vs Consistency of Bias C 'Penalty Box Plots' show a snapshot of relative method characteristics which allows, with little statistical uncertainty, the true performance of the assay systems. Concentration-dependent bias is also assessed.

Results

We present here data for Serum Folate which has seen some radical shifts in assay performance, some planned and some less so, which impact on both the numerical values obtained and how that value is interpreted by the laboratory. The scheme operates on the usual UK NEQAS Chemistry model whereby participants receive three specimens every month which they analyse and interpret. The data is entered into a web portal and at the end of the monthly Distribution cycle a personalised report is produced. Data is calculated at the Specimen level as well as an accumulated Rolling Time-Window level synthesising data on a six-monthly moving average.

Conclusions

We continue to have strong statistical data which underpins the graphs, but the immediacy of the displays direct the Participant to focus on those areas which need addressing. Diagnostic Manufacturers, too, benefit from having data from a high frequency, multi-specimen EQA Scheme which provides data that they cannot get from any other source.

Figure 1a Folate results on a Specimen with low Serum Folate levels

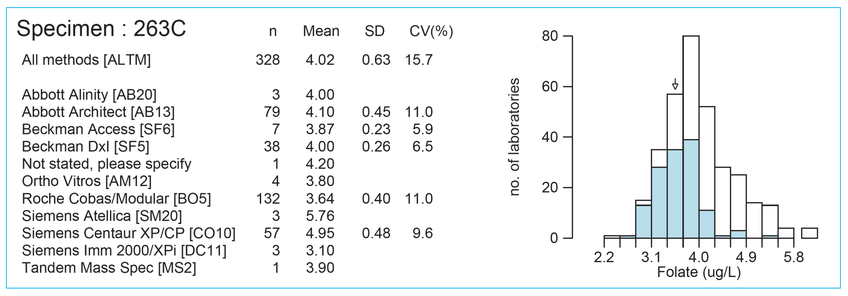

Figure 1b Participants Interpretations, by method, on a Specimen with low Serum Folate levels

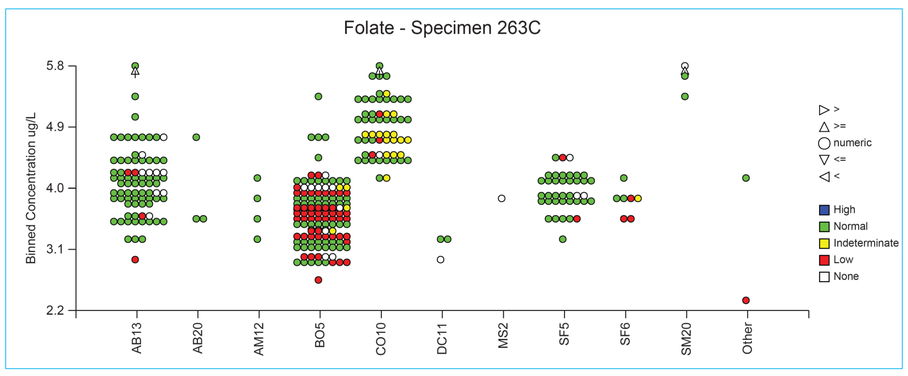

Figure 1c Participants Interpretations on a Specimen with low Serum Folate levels displayed as a Pie a Chart and as Bar Charts of number of responses and as a % of the method responses

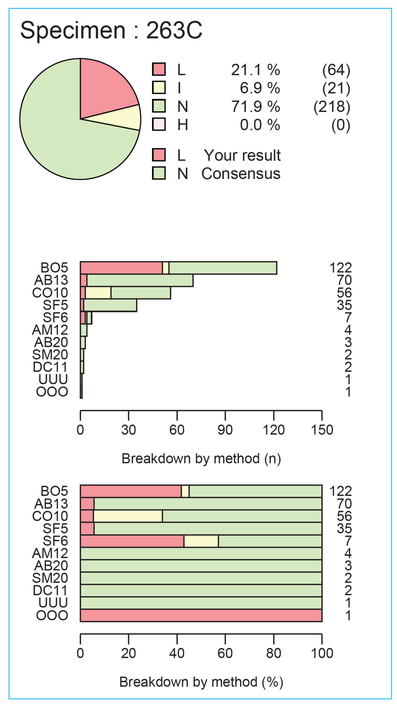

Figure 1a has a standard histogram with a table of means, SDs and CVs of the major methods.
Figure 1b is the so called 'Rainbow Trout Plot' which displays Laboratories' own interpretations against their numerical values, again broken down by method. This shows that both within- and between-methods different interpretation cut-offs are being used.
Figure 1c shows the proportions of users of each method that categorise the results in each of the interpretation categories.

Figure 2a and 2b An individual Participant's Bias and Consistency of Bias scores at the current time point (the Penalty Box Plot) with their B score (colour coded by performance) over the last 5 years which has been superimposed on their method performance (the Seismograph Plot).

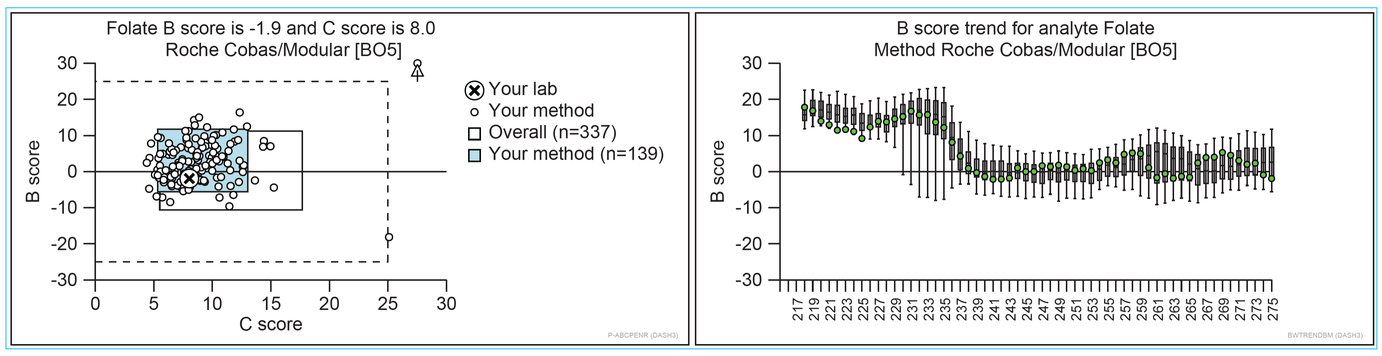

Figure 2a shows that this Participant is in consensus but currently at the 25th Centile of B score for their method.
Figure 2b shows the change in performance over the last 5 years for the method that this Participant uses.

Figure 3a and 3b The Bias and Consistency of Bias plots of all the major method at the current time points and the trend of method performance for the last 5 years. The dotted lines on the Penalty Box Plot are the Acceptable Limits of Performance. On the Seismograph Plots, the Box and Whiskers at the individual Distributions are the 5th, 25th, 50th 75th and 95th Centiles of performance.

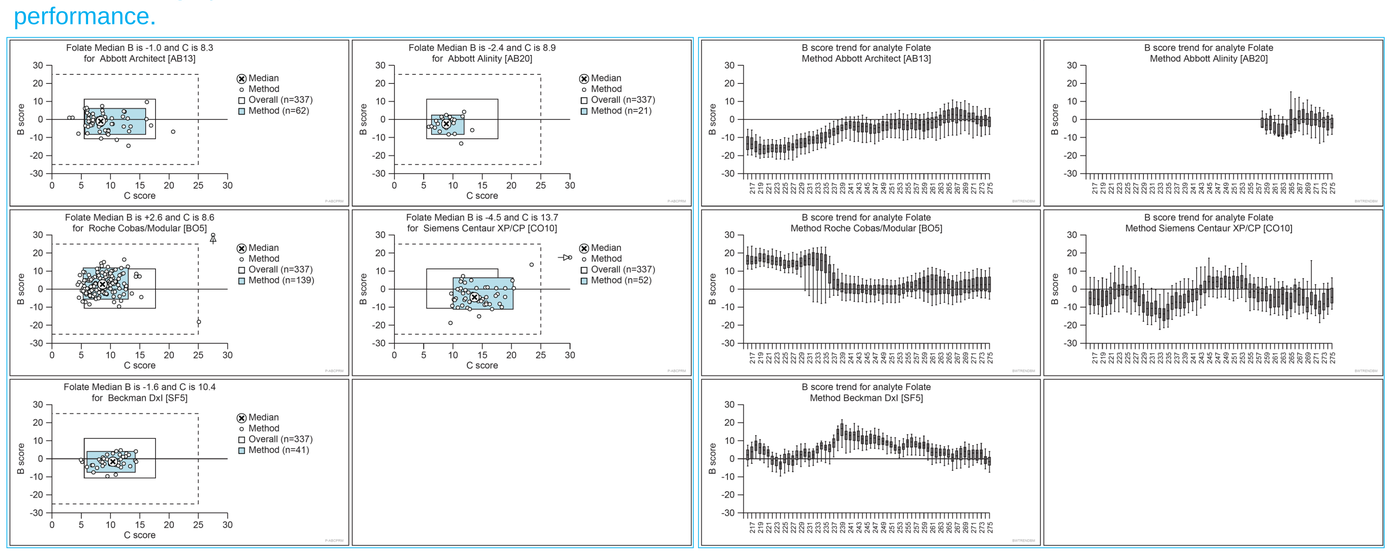

Figure 3a shows that currently the major methods are all in broad agreement.
Figure 3b shows that the state-of-the-art around 4 years ago was far inferior than what we now see. At that time we had differences between methods of almost 30%. The reason for this improved situation is that Roche, after many years of petitioning by UK NEQAS among others, changed both their calibration and antibody.

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