

Could z-scores replace the target limits in EQA schemes?



Ulla Tiikkainen¹, Päivi Rauvo¹, Jari Leinonen², Marko Laine³

¹ Labquality, Helsinki, Finland, ² HUSLAB, Helsinki, Finland, ³ Finnish Meteorological Institute, Helsinki, Finland

Introduction

In laboratory medicine the participants' performance in the external quality assurance (EQA) schemes is traditionally assessed using the total error approach. The criteria used in setting the analyte-specific total error % are within- and between-subject biological variation, clinical needs and analytical performance.

The other possibility of assessing participant performance, commonly used in the analytical chemistry proficiency testing (PT) schemes, is the z-score approach.

We examined and compared the usage of total error approach and z-score approach in the Labquality's Prostate specific antigen (PSA) schemes using pooled human sera spiked with PSA. PSA is an important plasma marker

of prostate cancer and is used both in diagnosis and in follow-up of the disease. Several commercially available immunoassays are used for total PSA measurements.

Methods

The total error of ±20 % has been set for the target limits of the PSA results. Participants' performance was expressed as Diff% where X is the assigned value and x represents a laboratory result. For the z-score calculations we used the robust standard deviation (ISO 13528) of all results of each sample as the target standard deviation (s). Table 1.

$$\text{Diff\%} = \frac{(x-X) * 100}{X}$$

$$\text{z-score} = (x-X) / s$$

Results

The laboratory results from two EQA rounds organized in 2014 were evaluated. Table 2. The correlation between the total error performance assessment compared to z-scoring was good (r=0.997). Fig. 1.

Conclusion

The correlation between Diff% and z-score values show good agreement and these two approaches for assessing participants' performance give quite similar interpretations. However, one has to keep in mind that in the total error approach the pre-set quality specification describes the desired performance whereas the z-score is a measure of observed performance.

Table 1. Performance interpretation

Performance interpretation	Total error	z-score
satisfactory	Diff% within analyte-specific target limits	z ≤ 2.0
questionable	not determined	2.0 < z < 3.0
unsatisfactory	Diff% outside analyte-specific target limits	z ≥ 3.0

Figure 1. Correlation of Diff% and z-score

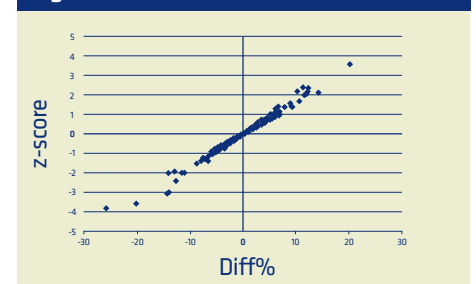


Table 2. Performance summary from two first EQA rounds in 2014

Sample-Round	Assigned value (µg/L)	s (µg/L)	n	Diff% over ± 10 %	2.0 < z < 3.0	Diff% over ± 20 %	z ≥ 3.0
1-0114	3.1	0.17	47	4.3 %	4.3 %	0 %	0 %
2-0114	7.1	0.44	47	2.1 %	0 %	6.4 %	6.4 %
1-0214	18.0	1.19	79	7.6 %	5.1 %	3.8 %	3.8 %
2-0214	8.0	0.44	80	7.5 %	3.8 %	2.5 %	5.0 %
All			253	5.9 %	3.6 %	3.2 %	3.9 %