eQA

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[Open Forum]

Rethinking the feasibility of using quality control materials with metrological traceability for internal quality control purposes

Recently, it was proposed that trueness materials with metrological traceability can be used for internal quality control (IQC) purposes to confirm that the measuring system performance is properly unbiased, and that they should be supplied by the system's manufacturer and commutability is not required. But the challenge for the medical laboratory is to find a suitable trueness control material and how to incorporate it into its IQC plan. The concept of using control materials with metrological traceability is advocated to supplement (not substitute) for IQC purposes.

Such an emerging issue has raised some concerns and discussions on the internet by professional colleagues in the region:

Westgard QC

Metrologists are Rethinking IQC - Wrongly

January 2021

James O. Westgard, Sten A. Westgard

https://www.westgard.com/2021-end-of-qc.htm

accessed 02/04/2021

QuaLab QC Forum

佳文引薦—— 室內質控品的溯源時代？

https://mp.weixin.qq.com/s?__biz=MzA5NzIOMjUxOA==&mid=2649509755&idx=1&sn=be2497d5e8a1633c666adac7f8f3a6da&chksm=88bb3382bfccba9432d47a43b6814523cab22523d535cc4f39811e92cfd744ee8ec6ba25f7f5&xtrack=1&scene=90&subscene=93&sessionid=1617327012&clicktime=1617327159&enterid=1617327159&ascene=56&devicetype=android-27&version=2700153b&nettype=WIFI&abtest_cookie=AAACAA%3D%3D&lang=zh_HK&exportkey=AowmJWrvyZRr3lUxJPKl5Xs%3D&pass_ticket=M1WI%2BTsl3g583bQuwlGZBHai94okMMl739GNrvZCWfHST%2BeLzSFjg2K9DJMZ9w4J&wx_header=1

accessed 02/04/2021

Important concepts of metrological traceability and the estimation of measurement uncertainty (MU) are required for medical laboratories accredited by ISO 15189:2012 (1). According to ISO 15189 accreditation standard requirements, the laboratory shall design internal quality control (IQC) procedures that verify the attainment of the intended quality of results. The medical laboratories have the responsibility to report comparable results among different measuring systems and should confirm the metrological traceability of the measuring systems they used (2). Statistical quality control (SQC) is still the best technique available for managing IQC in medical laboratories. The right IQC system in the laboratory practice is to apply SQC procedures carefully, implement them properly, and perform them correctly.

Generally, IQC is designed for monitoring precision, and external quality assessment (EQA) and/ or proficiency testing (PT) are used to assess bias. The basic requirement of SQC is to calculate the laboratory's own mean and standard deviation (SD) values. Unfortunately, there are lots of inappropriate modifications and implementations of SQC(3). One common nonconformity is that individual laboratories might use assayed IQC materials and replace the calculated mean and SD values with the assigned target value and a range of acceptable limits provided by the manufacturer. This breaks the principles of SQC. So that laboratories cannot detect and monitor the assay performance based on the SQC i.e., probability of error detection and/or false rejection.

A recent article published online in the Clinical Chemistry and Laboratory

Medicine (CCLM)：The internal quality control in the traceability era by Braga et al (4) has proposed that IQC materials should be divided into two categories, one devoted to checking the alignment of the measuring system (IQC component I), and the other structured for estimating MU due to random effects (IQC component II). It is not uncommon that many laboratories found no accuracy claims regarding the assigned values and that the mean values were just derived from independent laboratories without any trueness check, confirming the high vulnerability of this approach adopted to assign QC values in terms of metrological traceability for routine IQC plotting. There were examples of using the assigned values and acceptability range supplied by the manufacturer on the IQC charts and, as the criteria for out-of-control judgment. The Clinical and Laboratory Standards Institute (CLSI) describes the assigned values range should be used only as guides and not as a replacement for target value and SD established by the laboratory (5). Many laboratories, however, have adapted incorrect SQC parameters leading to erroneous out-of-control judgements, and the troubleshooting procedures performed thereafter to correct the problems would be inappropriate.

According to CLSI guideline C24, there are different types of control materials available to clinical laboratories. One is control materials made and supplied by the manufacturer accompanied with the measurement system, the other is control materials that are made by a third-party for the manufacturer of the

measurement procedure. As shown in the TABLE 1, most manufacturers provide in-kit control materials. These controls are generally designed only for use on their analyzer systems. More importantly, they are often manufactured from the same materials as their calibrators with the same traceability for individual analytes. These controls can be considered as Component I IQC materials. Unless the source of the quality control product is different from the calibration material, otherwise it will defeat its purpose as a third-party quality control for IQC.

TABLE 1. In-kit control materials information of different Chemistry Analyzer Systems*

Chemistry Analyzer Systems	Whether to provide in-kit control materials
Abbott ARCHITECT	No
Abbott Alinity	No
Beckman Coulter AU	Yes
Ortho VITROS	Yes
Roche Cobas	Yes
Siemens Atellica	No
Siemens Dimension	No

*Taken from package inserts of individual instrument manufacturers

Until recently, it was proposed that the trueness IQC materials (component I) with metrological traceability can be used to confirm that the measuring system performance is properly unbiased, and that it should be supplied by the

system’s manufacturer and commutability is not required. The ISO 17511:2020 provides guidelines to the control materials according to their intended use, one is used for IQC purpose to assess the imprecision (precision control materials), the other is to evaluate the measurement bias of a specified measurand in a specified measuring system (trueness control materials). The IQC component I looks like trueness control materials mentioned in the ISO 17511:2020. Although IFCC Working Group on Commutability recommends that the bias caused by non-commutability of a certified reference material (CRM) could be corrected (6), it also indicates that development of a correction factor or function for non-commutability bias is the responsibility of the manufacturer, not the medical laboratories except for the laboratory developed test (LDT).

The challenge for the medical laboratory is to find a suitable trueness control material and how to incorporate it into its QC plan. The ideal approach is to use available certified reference materials for the calibration of individual assays, and then the patient results are comparable to a reference through documented metrological traceability. CLSI EP15 proposes that bias can be evaluated by analyzing materials with known concentrations and results for the measurement procedure under evaluation can be compared to the target value provided by the EQA/PT organizations or other reference standard institutions. But the reference material must be commutable for validation or verification of trueness.

The application of CRMs for QC purposes is well recognized and recommended by a wide range of international, national and professional organizations. EQA/PT programs offer commutable samples with target values assigned by reference methods. But unfortunately, CRMs and trueness control materials or the range of concentrations are not available for the wide spectrum of analytes measured in the medical laboratories. For certain matrix types, such as urine and other body fluids, the analytes needed might not be available or certified. Irrespective of the geographical region or the global economic situations, current practice of metrological traceability application in many EQA/PT programs is also not adequate.

In summary, there are situations emerging that require special attention and when preparation of the IQC materials might be considered viz., the reference materials for the appropriate matrix types are not available at all, too precious to be used for routine quality control of a larger number of analytical test runs, and not stable for longer time in sense of matrix or measurand of interest, particularly for component I materials with multi-constituents. The concept of metrological traceability is advocated to supplement (not substitute) for IQC purposes. As noted previously, the limited ready availability of the trueness control materials, and the cost of such materials likely makes this unfeasible for the medical laboratories, there needs to be a balance. However, testing of

available trueness control materials on a routine basis, perhaps weekly or monthly, would be much more practical. We must acknowledge the limitations and restrictions that manufacturers and laboratories need to face before it can be applied in routine practices.

References

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3. *Westgard S, Bayat H, Westgard JO. Mistaken assumptions drive new Six Sigma model off the road. Biochem Med (Zagreb) 2019;29(1):010903. https://doi.org/10.11613/BM.2019.010903*
4. *Braga F, Pasqualetti S, Aloisio E, Panteghini M. The internal quality control in the traceability era.Clin Chem Lab Med 2021;59(2):291-300.*
5. *CLSI.Statistical quality control for quantitative measurement procedures: principles and definitions. 4th ed. CLSI guideline C24. Wayne, PA:Clinical and Laboratory Standards Institute, 2016.*
6. *Budd JR, Weykamp C, Rej R, MacKenzie F, Ceriotti F, Greenberg N, et al. IFCC Working Group Recommendations for Assessing Commutability Part 3: Using the Calibration Effectiveness of a Reference Material. Clin Chem 2018;64:465–74.*