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Measurement Uncertainty and Its Application in Clinical Examination

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Abstract

Measurement uncertainty is an important parameter in clinical laboratories. By definition, measurement uncertainty is a parameter that characterizes the dispersion that is reasonably assigned to the measured value in relation to the measurement. Therefore, in clinical laboratories, we can use the results of indoor quality control to assess the measurement uncertainty.

Keywords: measurement uncertainty, application, clinical examination

1 Introduction

Clinical testing is a process of assigning various characteristics to the human body. The accuracy of assignment can play an important role in the diagnosis of clinical disease and in the later course of treatment. Therefore, how to improve the quality of clinical testing has become an important issue in clinical testing. The current clinical biochemical test task is to assign the characteristics of the human specimen, the assignment of the reliability, accuracy and dispersion of clinical disease diagnosis and treatment of prognosis have a significant impact. Therefore improve the accuracy of clinical testing and the reliability and quality of its test. Currently, the accuracy of clinical evaluation is often used to determine the uncertainty of measurement. In clinical biochemical tests, the application of measurement uncertainty, not only can improve the accuracy of biochemical test results, but also can effectively reduce the error, with the practical value.

2 The measurement uncertainty and its related basic terms

2.1 The measurement uncertainty

Characterize the dispersion that is reasonably assigned to the measured value, and the parameters associated with the measurement. Reasonable refers to the measurement under the state of statistical control. The so-called statistical control state is a random state, that is, repeatability conditions or reproducibility of the measurement conditions. Dispersion refers to the dispersion of measurement results, that is, a range of values, can be a probability that contains the possible measurement results.

2.2 The classification of uncertainty

(1) Standard Uncertainty: The uncertainty given by the standard deviation. (2) Category A standard uncertainty: the uncertainty of statistical methods used to assess. The assessment method is called Class A assessment. (3) Class B Standard Uncertainty: Uncertainty that is assessed by non-statistical methods. The assessment method is called Class B assessment. (4) Composite uncertainty: when the measurement results are obtained by a number of other values, the other by the variance and covariance calculated standard uncertainty. When the standard uncertainty of the measurement results is composed of several standard uncertainty components, the standard uncertainty obtained by the square root (if necessary, the covariance).

2.3 Uncertainty of synthetic standard

The standard uncertainty, calculated as the variance and covariance of the other quantities, is obtained when the measurement result is obtained from the values of several other quantities. In the case where the measurement result is obtained from several other quantities, the standard uncertainty of the measurement result is equal to the square root of the sum of these other quantities, which is called the composite standard uncertainty. The combined standard uncertainty is an estimate of the standard deviation of the measured results.

2.4 Expanding uncertainty and inclusion factor

The extended uncertainty is the amount of the measurement result interval, and most of the distribution of the measured value is expected to be included in this interval. In practice, the extended uncertainty is a measurement uncertainty expressed as a multiple of the composite standard uncertainty. In order to obtain extended uncertainty, the standard uncertainty of the composite factor by the number, called the inclusion factor. The value of the inclusion factor determines the confidence level of the extended uncertainty.

3 Error and Uncertainty

It is important to distinguish between errors and uncertainties because the error is defined as the difference between the unit result and the true value of the unit being measured. Since true values are often unknown, error is an ideal concept and can not be known exactly. However, the uncertainty can be expressed as an interval, which can be applied to all of the measurements described for an analysis process and for a defined sample type. Therefore, the measurement error and measurement uncertainty in terms of definition, evaluation methods, synthesis methods, forms of expression, component classification are different. According to the definition of uncertainty, a measurement of the results obtained are also uncertain, although according to a result itself does not see its dispersion, but under repeated conditions in the given conditions can be repeated the results of any one assessment of the results dispersion, which applies to any one result.

Whether the measurement uncertainty is the error limit of the measurement result? Because the uncertainty gives the interval in which the measurement result can be measured, the different error that may exist in each measurement result constitutes the dispersion interval. Therefore, measurement uncertainty has been defined in the past as a measure of the possible error in the measured estimates from the measurements. Since the measurement result is the algebraic sum of the measured true value and the error of the measured result, the measurement uncertainty actually indicates the interval in which the true value may appear. The measurement uncertainty is the range of the measured true value. The definition of uncertainty in 1984 is: characterization of the measured value of the range of the assessment.

4 The evaluation process of measurement uncertainty

Uncertainty in the evaluation of the principle is very simple, generally divided into the following three steps:

1. To be measured: the relationship between the measurement and the input dependent on which the measurement is to be measured is clearly stated.

2. Identify the sources of uncertainty: List the complete list of possible sources of uncertainty. Typical sources of uncertainty include sampling, storage conditions, instrumentation, reagents of chemical reactions, measurement conditions, sample mass, computational effects, blank revisions, operator influence, and stochastic effects.

3. Quantification of Uncertainty Components: Each potential uncertainty component of measurement or estimation shall be expressed as a standard deviation and shall be synthesized according to the rules of the square root to obtain the composite standard uncertainty, The extended uncertainty is given using the appropriate inclusion factor.

5 The application of uncertainty assessment in clinical test

Clinical testing is one of the most complex and influential factors in the analytical field. Over the years in clinical laboratory quality control work carried out to assess the degree of uncertainty to bring great convenience. Because the uncertainty is given in the statistical control of the state under the measured value of the dispersion, and indoor quality control work to achieve precisely the purpose is to make the entire clinical specimen measurement work in a state of statistical control, indoor control the resulting dispersion can represent the dispersion of the clinical specimen under statistical control. Since the measurement of the indoor quality control is done every day and several times a day, the standard deviation and the coefficient of variation (CV) calculated from the large amount of measured data obtained can reflect the measurement accurately and reliably Data dispersion, can be used for the project's measurement uncertainty evaluation.

When estimating the total uncertainty of the measurement, the analyst is familiar with the analysis process and the various influencing factors and considers their contribution to the total uncertainty. The pre-analysis factors are usually complex or can not be estimated. In many cases, however, the impact of their total uncertainty is reduced to one-third of the maximum component by appropriate measures.

Uncertainty in measurement is actually digital information, which complements the results of the measurements and indicates the degree of doubt about the results. Ideally, this information should be appended to the patient's results as in the example above. Depending on the field of application, the uncertainty can be attributed to a different set of factors. In general, the factors contributing to the uncertainty of a given measurement system in clinical test science are the imperfect definition of the measurement being measured, the fact that the sample (sample) being measured can not represent the defined measure, the effect of the additive. Storage conditions, day (or batch) imprecision, systematic errors, lack of specificity, assignment of calibrators, and the like.

The estimated synthetic uncertainty is expressed as the variance, which is the sum of the variances of the above factors. In some laboratories the variance of these factors is easier to estimate, but for some other evaluations it is not so easy to obtain, as it can be seen from the following: (a) The manufacturer does not give a calibration Uncertainty of assignment. (b) The vast majority of the methods used in clinical testing, the standard deviation of which varies according to the value being measured; this phenomenon is called "heterogeneity" and should be considered when estimating the uncertainty. Even if the current detection process seems to be well standardized, pre-analysis variability should not be considered negligible. Measurement of uncertainty is actually digital information, to the results of the measurement of a reasonable supplement, showing that the degree of doubt on this result. Uncertainty is generally attributed to a collection of different factors, depending on the application area. In most cases, the contribution of clinical uncertainty to the known measurement system uncertainty is that the definition of measurement is inadequate and that the

sample being measured can not be represented by a defined measure, obvious additive effect, and the existence of storage conditions "centrifugal conditions" day imprecision and system error and other factors, the lack of specificity and calibration of the assignment.

The prerequisite for the assessment of uncertainty is that the laboratory must have an effective quality assurance and control measures that can provide stability to the process and protection on the control. These measures generally include the availability of qualified personnel, proper maintenance and calibration of equipment and reagents, use of validated analytical methods, and appropriate and appropriate reference "documented procedures for the determination of internal quality control procedures to be reasonable application, and to participate in the level of test items to pay attention. In the above state, the laboratory room, indoor method validation data to be reasonable use of the impact of the determination of the components to expand the analysis to assess the uncertainty. A measure of the overall method performance parameters of the dispersion obtained can be on the day of the measurement of a test results to be covered.

6 Conclusions

It will take us enormous energy to do the potential assess of the contribution of some relevant factors to the uncertainty in clinical laboratories. And the use of uncertainty in the outcome of the patient will be difficult. Only making effective prevention of the impact of uncertainty factors in the measurement, can the uncertainty of measurement for clinical detection can provide an effective detection basis, and it has very important significance in the clinical application process

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