1. Introduction

When blood samples are drawn for medical purposes, subsequent medical records often have ethanol concentration values listed as serum ethanol concentration instead of a whole-blood ethanol concentration. Since legal statutes are worded to reflect whole-blood ethanol concentrations, not serum ethanol concentrations, a mathematical conversion is needed for the ethanol value to be useful within the judicial system.

2. Scope

The quantitative value indicating a serum ethanol concentration found within a medical record will be mathematically converted to an equivalent whole-blood ethanol concentration using a currently accepted method within the forensic toxicology discipline. No chemical analyses of specimens will be conducted within this procedure. Numerical values used for conversions will be solely based on blood-serum values; urine values will not be converted.

Serum alcohol to blood alcohol conversion can be performed either using a range on conversion factors or using a single conversion factor. The conversion factor used within this procedure (1.16) is an average of the low (1.12) and high (1.18) conversion values found reported within reference articles with an administrative addition of 0.01 (e.g.,, (1.12 + 1.18)/2 = 1.15 + 0.01 = 1.16).

3. Procedure

Ethanol conversions are electronic. No paper forms or documentation (including, but not limited to, a technical and administrative review checklist) will be generated.

3.1 Valid documentation

The page of the medical record which contains the value to be converted should be from a medical facility. The medical record must contain the patient's name. The complete medical record does not need to be submitted for a conversion to be performed.

3.2 Case Demographic Verification

Ensure that the information listed on the RFA has been entered correctly into the Laboratory Information Management System (LIMS) and that the name within the medical record concurs with LIMS data.

4. Conversion

Find the value to be converted within the medical record. Ensure that the value is for ethanol and the units are present. Units are typically in milligrams (mg) per deciliter (dL) or grams (g) per deciliter (L).

The ethanol value listed on the medical records is entered into the LIMS system and the serum ethanol concentration value is converted to a whole-blood ethanol concentration value in gram percent (g%) units.

The following are examples of how LIMS performs the necessary conversion calculation:

- If the serum ethanol concentration is reported in milligrams per deciliter (mg/dL), the conversion is performed by either multiplying the serum ethanol value by 0.000862 or dividing the serum ethanol value by 1.16, then again by 1000. This will give a resulting whole-blood ethanol value in units of gram per 100 milliliters (g/100mL), which is equivalent to the unit of gram percent (g%).

$$\frac{28\ \text{mg}}{\text{dL}} \times 0.000862 = \frac{0.02\ \text{g}}{100\ \text{mL}} = 0.02\ \text{g\%}$$

- If the serum ethanol value is reported in units of grams per deciliter (g/dL), the conversion is performed by dividing the serum ethanol value by 1.16. This will give a resulting whole-blood ethanol value in units of gram per 100 milliliters (g/100mL), which is equivalent to the unit of gram percent (g%).

$$\frac{0.333\text{g}}{\text{dL}} \div 1.16 = \frac{0.28\text{g}}{100\text{mL}} = 0.28\ \text{g\%}$$

All final ethanol concentration values will be truncated to the second decimal place. The number of significant digits is not the same as the number of decimal places. If a serum ethanol value consists of a number with more than three decimal places, then the converted value will still only be to two decimal places.

For any value within the submitted medical documentation which has a range associated with it (e.g., <), the converted value will carry the same range (e.g., < 10 mg/dL converts to < 0.01 g%).

5. Uncertainty of Measurement

A single point conversion is used within this procedure, therefore no uncertainty will be reported.

The report will have the following statement: "The conversion from serum ethanol to blood ethanol concentration found within this report is based on a single point conversion factor, as opposed to a conversion factor range."

6. References

M.T. Barnhill, Jr., D. Herbert, D.J. Wells, Journal of Analytical Toxicology, Vol. 31, January/February, 2007

P.M. Rainey, Relation Between Serum and Whole-Blood Ethanol Concentrations, Clin. Chem., 39/11, 2288-2292, 1993

R.C. Charlebois, M.R. Corbett, J.G. Wigmore, Comparison of Ethanol Concentrations in Blood, Serum, and Blood Cells for Forensic Application, J. of Anal. Toxicology, Vol. 20, May/June, 1996.