K27 A Statistical Analysis of Urine:Blood Data, and Oxycodone Redistribution: A Simple Ratio Will Not Suffice

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After attending this presentation, attendees will understand concept of a meta-analysis and the importance of statistical analyses in general. Attendees will gain an appreciation of the mathematical and statistical implications of simple ratios and what they imply.

This presentation will impact the forensic science community by introducing the concept of a quantitative review of literature rather than a qualitative review, and the importance of a rigorous statistical and mathematical analysis.

Meta-analysis, odds ratios, confidence intervals, prediction intervals, tolerance intervals, and bounds are demonstrated and these concepts are applied to several alcohol data sets including both blood and first- and second-void urine data and another meta-analysis on oxycodone redistribution will be demonstrated. A meta-analysis is a mathematical summary of previously done studies that address the same research hypothesis. The first meta-analysis, usually credited to Karl Pearson, a noted statistician, was done in 1904 to overcome the problem of small sample sizes and their reduced statistical power. A prediction interval is used to predict a value from a calibration curve while a confidence interval is used to express the uncertainties in the parameter estimates. Tolerance intervals are meant to contain a proportion of the population with a specified probability. Subject-level data available from urine-alcohol studies in the medical literature was extracted. Using multivariate regression techniques, the limits for urine-alcohol levels were critically examined from a statistical viewpoint taking into account whether first- or second-void urine samples were used, the assay method, and whether the subject was alive or dead. Oxycodone redistribution and, again, the improper use of only a simple ratio was also reviewed. The difficulties of modeling such data via regression strategies were examined.

Based upon an analysis of the data and pharmacokinetic, mathematical, and statistical principles, this presentation will show why the use of only a simple ratio is incorrect and misleading. Using the methodology described, it is easy to see that the per se values some state legislatures have incorporated into their laws and statutes allow innocent people to be convicted of a crime. Also, simple ratios and/or linear regressions will not always solve the data analysis problem, and more complicated models will be required. This will require collaboration with a statistician and other specialists. It is concluded that the levels of urine alcohol specified by some states are set statistically improperly. Experts must incorporate statistical methods to properly summarize their data and report error intervals.

Meta-Analysis, Alcohol, Oxycodone

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