



A42 Developmental Validation of ArmedXpert™ : Forensic Mixture Deconvolution Software for Short Tandem Repeat Data

Rhonda K. Roby, PhD, UNT Health Science Center, Forensic & Investigative Genetics, 3500 Camp Bowie Boulevard, Fort Worth, TX 76107; and Dennis J. Reeder, PhD, Reeder Analytical Consulting, 7094 Glen Abbey Ct, Frisco, TX 75034*

After attending this presentation, attendees will learn of the advances made in software algorithms for deconvolution of STR data generation from forensic casework.

This presentation will impact the forensic science community by introducing changes to mixture analyses of DNA samples.

With the major advances made in capillary electrophoresis instrumentation, more precise color separation, and improved chemistries, it is even more apparent today that mixture data from forensic casework have a significant amount of information that are not fully evaluated and summarized. ArmedXpert™, a software mixture deconvolution program, is designed to automate the tedious and numerous calculations required to thoroughly review a mixed STR DNA result. ArmedXpert™ not only aids the forensic DNA analyst in these routine, time-consuming computations, but it also provides an array of significant other functions. ArmedXpert™ was subjected to a rigorous validation study where it was evaluated with known mixed data sets of two- and even three-person mixtures. At the end of the study, actual casework data files from adjudicated cases were evaluated and compared to the submitted final case reports.

ArmedXpert™ allows the user to check ladders, to check controls, to detect possible stutter, to perform matching between evidence samples and references, and to evaluate possible contamination with staff profiles. The software is designed to perform CODIS functions, conduct mixture interpretation with two to three contributor mixtures, view simulated electropherograms, chart data, perform various biostatistical analyses for single and multiple source samples, and print and save data. The stated functionality of each of these features was confirmed during the developmental validation process.

The developmental validation study of ArmedXpert™ entailed testing of three main software specifications: compatibility, QC checks and matching, and interpretation. For compatibility, different operating systems were subjected to the software to verify the ability of the software to perform as expected. All menus and functions were subjected to verification testing. In addition, different data files were imported to verify successful upload and functionality. The control checks, formatting of output files, and comparisons demonstrated full utility. Mixture interpretation tools were evaluated for display features, accurate and reproducible calculations, and application of defined thresholds. In addition, all statistical calculations were confirmed by manual testing and comparison to other software programs. The output reporting and CODIS CMF files were also verified.

Lastly, the software was evaluated for applying the appropriate thresholds and stutter and color-coding features as described. Significant studies were conducted to confirm the correct reporting of all allele calls. The Mixture Interpretation section of ArmedXpert™ produces a list all possible combinations for each locus based on the user-defined thresholds. This list provides the proportion of DNA of the minor and major contributors of the mixed sample. The graphical visualization tool provides the user with an easy visual assessment of the proportions identified per locus for the mixed result. The combinations, thresholds, proportions, and bar chart tool were all tested with known mixtures at varying concentrations.

ArmedXpert™ is a software program that can be easily adapted and implemented into the forensic analyst's toolbox. This program has many features that will assist forensic analysts to fully evaluate and summarize their data. ArmedXpert™ can be used as a stand-alone program or can support DNA analysts in the arduous task of mixture interpretation, and seamlessly import data for statistical evaluations. This developmental validation study demonstrates that the software meets the defined specifications and performs as expected.

ArmedXpert, Deconvolution, Mixture