

FEASIBILITY EVALUATION OF A FAMILIAL SEARCH MODEL USING LIKELIHOOD RATIOS

Urfan Mukhtar, New York State Police Forensic Investigation Center

An indirect model was used to determine the feasibility of incorporating a familial search procedure, as an additional avenue of developing investigative leads for instances in which the direct model is deemed fruitless.

The familial search study was conducted using a total of 1,100 New York State DNA Index System (NY SDIS) offender seed profiles. These profiles were divided into two groups with 550 seed profiles used for a 13 locus study and 550 seed profiles used for a 15 locus study. The seed profiles were used to develop a total of 1,100 familial units consisting of a simulated pair of parents and a simulated full sibling for a total of 3,300 simulated family members.

The simulated family members were treated as the profiles of interest and compared against the entire NY SDIS offender database consisting of over 620,000 offender profiles. All comparisons, which were calculated as LR values, were conducted outside of CODIS using standalone software provided by the Denver Police Department referred to as Denver Familial Search (DFS) software version 2.1N. The LR output for each of the 3,300 comparisons calculated by the DFS software were then sorted according to the maximum LR.

Sensitivity and specificity calculations were calculated for the 13 and 15 locus studies in order to determine the appropriate LR limits for familial searches. The LR at which a balance between sensitivity and specificity was observed in the study, was used as the main criteria to determine these limits. The LR limit for the 13 and 15 locus systems were determined to be 5,000 and 10,000 respectfully, and were generally associated with candidate list sizes of approximately 150-200 individuals.

The LR limits were then tested using samples collected from two separate sets of real life familial units. The primary focus of this test was to determine the percentage of first order relatives captured using the suggested LR limits, characterized using the 3,300 simulated family members. For the first set of family samples approximately 95.2% and 92.9% of first order relatives were captured at a LR = 5,000 and 10,000 respectfully. For the second set of family samples approximately 92.2% and 96.1% of first order relatives were captured at a LR = 5,000 and 10,000 respectfully.

Based on the high degree of success in capturing familial links demonstrated in this study, a familial search model using likelihood ratios is a feasible approach to develop investigative leads.