

## **KINSHIP INDEX VARIATIONS AMONG POPULATIONS AND THRESHOLDS FOR FAMILIAL SEARCHING**

Jianye Ge, Bruce Budowle

Institute of Applied Genetics, Department of Forensic and Investigative Genetics, University of North Texas Health Science Center, Fort Worth, TX, USA

Current familial searching strategies are developed primarily based on autosomal STR loci, since most of the offender profiles in the forensic DNA databases do not contain Y-STR or mitochondrial DNA data. Here are generally two familial searching methods, Identity-by-State (IBS) based methods or kinship index (KI) based methods. The KI based method is an analytically superior method because the allele frequency information is considered as opposed to solely allele counting. However, multiple KIs should be calculated if the unknown forensic profile may be attributed to multiple possible relevant populations. An important practical issue is the KI threshold to select for limiting the list of candidates from a search. There are generally three strategies of setting the KI threshold for familial searching: (1) SWGDAM recommendation 6; (2) minimum  $KI \geq KI \text{ threshold}$ ; and (3) maximum  $KI \geq KI \text{ threshold}$ . These strategies were evaluated and compared by using both simulation data and empirical data. The minimum KI will tend to be closer to the KI appropriate for the population of which the forensic profile belongs. The minimum  $KI \geq KI \text{ threshold}$  performs better than the maximum  $KI \geq KI \text{ threshold}$ . The SWGDAM strategy may be too stringent for familial searching with large databases (e.g., 1 million or more profiles), because its KI thresholds depend on the database size and the KI thresholds of large databases have a higher probability to exclude true relatives than smaller databases. Minimum  $KI \geq KI \text{ threshold}$  strategy is a better option, as it provides the flexibility to adjust the KI threshold according to a pre-determined number of candidates or false positive/negative rates. Joint use of both IBS and KI does not significantly reduce the chance of including true relatives in a candidate list, but does provide a higher efficiency of familial searching. ☞