B208 Quality Assurance of the Biostatistical Workflow in Forensic Genetic Casework

Andreas Tillmar, PhD, National Board of Forensic Medicine, Artillerigatan 12, Linkoping SE-58758, SWEDEN; and Gunilla Holmlund, PhD, Rättsmedicinalverket, Artillerigatan 12, 58758, Linköping, AL 58758, SWEDEN*

After attending this presentation, attendees will understand the different components of a biostatistical workflow in forensic genetic casework. Attendees will also gain insight into different aspects of the quality assurance of such a workflow as well as become aware of the challenges in the validation process and the maintenance of personnel competence.

This presentation will impact the forensic science community by contributing to ideas for the design and quality assurance of a complete biostatistical workflow to be used in forensic genetic casework. This presentation will also illustrate how validation of this workflow can be carried out within an accredited laboratory.

Quality assurance is a key element in an accredited forensic laboratory. Quality involves several components such as: (1) validation of methods, instruments, and software; (2) documented maintenance; (3) secured chain of custody; (4) documented operating procedures; (5) traceability; and, (6) proven competence of the staff. The general goal is to produce test reports of forensic investigations with legal certainty.

DNA is a powerful tool in forensic analysis for linking a suspect to a crime scene, resolving biological relationships, and identifying disaster victims. Traditionally, DNA investigations can be divided into two parts: (1) the establishment of DNA profiles; and, (2) the evaluation of the evidential weight of these DNA profiles, given some hypotheses about the true circumstances. There are well-documented standards for quality assurance of the first part (for example, DNA extraction and DNA typing methods), but for the second part, guidelines have not yet been established within the community.

The evaluation of the weight of evidence, using a biostatistical workflow, includes several components such as different computational methods, reference data, secured transfer of case data, and expert opinions made by reporting officers.

Sophisticated biostatistical computation models are implemented in dedicated software packages making up the basis of the biostatistical workflow. To assure the quality of this workflow requires not only validation of software packages per se, but also validation of population reference databases and reference parameter settings. It also requires thresholds to be set for different verbal conclusions that are used in the final report, and it embraces qualification demands for the authorization of competence of expert practitioners. It also includes proficiency testing of the workflow as a whole.

A biostatistical workflow for use in forensic genetic casework has been designed, validated, and implemented. The workflow contains four different software packages and population reference data for more than 50 autosomal, X-chromosomal, and Y-chromosomal DNA markers from three different populations. Competence requirements specific for each software and type of casework have been implemented. The requirements also include maintenance of competence through annual exercises. In addition, parameters for validation of any changes in the workflow, such as a new version of a software, have been established to maintain continuity.

Quality Assurance, Statistics, Forensic Genetics

*Presenting Author