A81 Estimating Stature When Ancestry is Unknown: What Statistical Methods Work Best?

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After attending this presentation, attendees will gain an in-depth understanding of key sampling and hypothesis testing issues that arise when estimating new equations to assess stature from skeletal elements. In particular, it will demonstrate the convenience of incorporating outgroup comparisons in the development of stature equations, including the appropriate hypothesis tests to assess whether the regression lines differ significantly from those for other samples or groups. This strategy serves to prevent overfitting to the reference sample, which is not addressed by goodness-of-fit measurements such as correct classification percentages or error rates.

This presentation will impact the forensic science community by demonstrating that, contrary to traditional assumptions, pooled-ancestry stature equations can be more appropriate than population-specific equations obtained from a single sample.[1-3] This implies that in many instances stature can be accurately and precisely estimated from the femur and tibia even when the decedent's ancestry is unknown.

The study examines this hypothesis and proposes new methods and criteria to assess whether it is necessary to subdivide samples from the same or different populations to create new, specific stature equations. Equations for five modern adult skeletal samples separated by different levels of genetic distance are compared using Analyses of Covariance (ANCOVA) to test whether regression lines actually differ across groups.[4,5] In the absence of such differences, a single, common regression line is appropriate to estimate stature for those groups. ANCOVA also provides weighted estimates for the slope and intercept, accounting for the slopes and range of variables in all sample groups. This method provides a criterion to decide if separate equations should be calculated for new "populations" and compares the regressions obtained from several samples to address the issue of sample bias.

Results demonstrate that despite differences in mean height, the relationship between female stature and lower limb bone length is constant across several populations, indicating that specific stature equations are not always required for each ancestral group. More precisely, in the present example, the ANCOVA approach serves to reduce the total number of female equations from twelve to five, since no significant differences were observed between several of the groups. The observed differences across male groups were slightly greater than those of their female counterparts, but the total number of equations for male groups could still be reduced significantly.

By presuming that populations are significantly different, forensic anthropologists sometimes create a false need to calculate new stature equations.[6-8] The results of this study indicate that it is more beneficial to first compare different sample populations using ANCOVA to determine whether or not the groups are truly significantly different, thus requiring new, population-specific stature regressions.

References:

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