H103 A Statistical Assessment of Cranial and Mandibular Morphoscopic Traits Used in the Determination of Ancestry

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After attending this presentation, attendees will learn the importance of utilizing a combination of both cranial and mandibular morphoscopic traits for ancestry determination.

This presentation will impact the forensic community by demonstrating the advantages of using statistical modeling and multivariate statistics for the determination of ancestry.

The determination of ancestry from the human skeleton is one of the most difficult and least precise aspects of the biological profile. However, an assignment of ancestry is of utmost importance for limiting the number of antemortem records used to compare with a postmortem profile and establish a positive identification. Ancestry is determined using a combination of craniometric analysis and an anthroposcopic assessment of a suite of morphological characteristics (morphoscopic traits) of the skull. Traditionally, emphasis has been placed on the cranium as the most diagnostic area of the skull, however, researchers have recently also turned to the mandible as a valid indicator of ancestry. This study looks at morphoscopic traits from the cranium and the mandible to see if, when used in combination, these traits increase accuracies in ancestry prediction. A second goal was to provide insight into the distribution of these traits among groups, with a careful consideration of the clinal distribution of morphological characters. Finally, several multivariate classification statistics were used to explore these distributions and select the methods and variables with the lowest classification errors.

A total of 11 cranial traits and 12 mandibular traits were examined for 94 individuals (European Americans, n=48; African Americans=46) from the Terry Anatomical Collection housed at the National Museum of Natural History, Smithsonian Institution. Data were collected following standard descriptions and illustrations of each trait. Several statistical methods were used to verify the applicability of these traits for ancestry determination. Ordinal regression was used to determine the effect, if any, of ancestry, sex, and the interaction between ancestry and sex on each trait. The ordinal regression analysis suggests that ancestry has a significant effect on 8 cranial traits and 5 mandibular traits. Following the ordinal regression analysis, quadratic discriminant function analysis, CAP, logistic regression, and *k*-nearest neighbor statistics were generated to determine the classification accuracies of the combined cranial and mandibular traits. Cross-validated, stepwise classification accuracies ranged between 73% and 91%, depending on the variables used and the selected method of analysis. Logistic regression had the highest classification rate using these variables. A stepwise logistic regression analysis selected 5 cranial traits (IOB, MT, NAW, NO, and PBD) and three mandibular traits (torus development, chin prominence, and chin shape) and misclassified only 8% of the total sample (ρ=0.805, df=18, p>0.001). This level of accuracy is higher than previous studies using only cranial or mandibular traits, suggesting that the combination of these two regions of the skull should be considered during ancestry determination.

The error rates generated using these methods greatly enhance our ability to predict ancestry from the skull. Added benefits of using statistical modeling to predict ancestry from the skull include the removal of subjectivity from the analysis (i.e., the experience-as- evidence process) and the proper selection and weighting of the variables most useful for ancestry prediction.

Ancestry, Nonmetric Traits, Multivariate Statistics

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