A93 Estimating Ancestry From the Postcrania of Modern South Africans

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After attending this presentation, attendees will understand postcraniometric variation among modern peer-reported Black, White, and Colored South Africans and the statistical techniques employed to identify differences and similarities within and among South African groups.

This presentation will impact the forensic science community by contributing to the knowledge of human variation within a modern South African population and by evaluating the potential of the postcranial skeleton for the estimation of ancestry.

Several successful craniometric approaches have been developed to facilitate the estimation of ancestry; however, the cranium is not always available for analysis, emphasizing the need for postcranial alternatives. The postcranial skeleton is frequently labeled as too variable and unreliable to provide an accurate assessment of ancestry. Yet numerous studies utilize the postcrania for sex and stature estimation, where the a priori knowledge of population affinity results in higher accuracy. Thus, the presence of postcranial differences observed among populations when investigating other biological parameters inherently demonstrates the potential for the estimation of ancestry. The purpose of this study was to quantify postcranial variation among modern, peer-reported Black, White and Colored South Africans. A series of 39 standard measurements were taken from 11 postcranial bones, namely the clavicle, scapula, humerus, radius, ulna, sacrum, pelvis, femur, tibia, fibula, and calcaneus. The sample consisted of 360 modern South African individuals (120 Black, 120 White, and 120 Colored) from the Pretoria Bone and Kirsten Collections housed at the University of Pretoria and the University of Stellenbosch, respectively. Group differences were explored with Analysis of Variance (ANOVA) and Tukey's Honestly Significant Difference (HSD) test. The group means were used to create univariate sectioning points for each variable indicated as significant ($p<0.05$) with ANOVA. Where two of the three groups had similar mean values, the groups were pooled for the creation of the sectioning points. Multivariate classification models were employed using Linear and Flexible Discriminant Analysis (LDA and FDA, respectively). Classification accuracies were compared to evaluate which model yielded the best results.

The results demonstrated variable patterns of group overlap. Black and Colored South Africans displayed similar means for breadth measurements, and Black and White South Africans showed similar means for the maximum length of distal limb elements. The majority of group variation is attributed to differences in size and robusticity, where White South Africans are overall larger and more robust than Black and Colored South Africans. Classification accuracies for the univariate sectioning points ranged from 43% to 87%, with iliac breadth performing the best; however, as groups were pooled when overlap was observed between two of the three groups, the majority of the sectioning points can only classify individuals into two groups rather than three. Multivariate bone models created using all measurements taken per bone resulted in accuracies ranging from 46% to 62% (LDA) and 41% to 66% (FDA). Multivariate subsets consisting of numerous different measurement combinations from several skeletal elements achieved accuracies as high as 85% (LDA) and 87% (FDA).

Ultimately, the best results were achieved using combinations of different variables from several skeletal elements. Although both Black and Colored South Africans present with narrow diaphyses and pelvii, the longer limbs of Black South Africans distinguish them from the Colored group. Both the Black and Colored groups can be discerned from White South Africans, who have a combination of long limbs, robust diaphyses, and large pelvii. The multivariate models yielded overall better results than the univariate approach, as the inclusion of more variables is generally better for maximizing group differences. Furthermore, FDA achieved higher accuracies than the more traditional approach of LDA. Despite the significant overlap among the groups, the postcranial skeleton has proven to be proficient in distinguishing the three groups. Thus, even in a heterogeneous population, a multivariate postcraniometric approach can be used to estimate ancestry with high accuracy.

Postcraniometric, Discriminant Analysis, Human Variation