A94 Postcraniometric Assessment of Sexual Dimorphism Among Modern South Africans

Gabriele C. Kruger, BSc*, 6 Casa Bari, 574 Jacobs Street, Gezina, Pretoria, Gauteng 0084, SOUTH AFRICA; Ericka N. L'Abbe, PhD, PO Box 5023, Pretoria 0001, SOUTH AFRICA; and Kyra E. Stull, PhD, Idaho State University, Dept of Anthropology, 921 S 8th Avenue, Stop 8005, Pocatello, ID 83209

After attending this presentation, attendees will better understand the pattern expression of sexual dimorphism in the postcranial skeleton of modern South Africans and the effect this variation has on correct classification. Different multivariate statistical methods to estimate sex, namely Linear Discriminant Analysis (LDA), Flexible Discriminant Analysis (FDA), and logistic regression, are highlighted.

This presentation will impact the forensic science community by contributing to knowledge on variation in sexual dimorphism in the postcranial skeleton, the types of statistical analyses available to assess sexual dimorphism, and to the improvement of postcraniometric sex estimations.

Recently, a multivariate approach using the postcrania to estimate sex achieved higher accuracies than the commonly used cranium, thereby recommending postcraniometric sex estimation in forensic case analysis.[1] In South Africa, sex-estimation techniques using long bones only include univariate or bone-by-bone models, which do not acknowledge sexual dimorphism in other elements and, as expected, represent an outdated statistical approach. The purpose of this study was to evaluate accuracies of sex estimation in the postcrania of modern South Africans using multivariate statistics and to compare pattern expression of sexual dimorphism in Black, White, and Colored groups. Additionally, FDA, a fairly new method to physical anthropology, was compared to two commonly used statistical techniques (LDA and logistic regression).

A total of 360 South African Black, White, and Colored individuals (equal sex and ancestry) were assessed. Colored South Africans are a peer-reported group unique to South Africa that received genetic contributions from a number of different populations from around the world.[2] All skeletal material was obtained from the Pretoria Bone Collection, University of Pretoria and the Kirsten Collection, University of Stellenbosch, in South Africa. Both collections are cadaveric in origin and are mainly comprised of donated or unclaimed, albeit known, individuals.[3]

Symmetric percentage differences (sympercents) expressed sexual dimorphism and were compared in the three South African groups.[4] Three classification methods assessed the 39 standard measurements taken from 11 postcranial bones. The creation of different bone models and a variety of multivariate models revealed the potential of a multivariate technique. Comparisons of LDA, FDA, and logistic regression indicated which model provided the greatest discriminatory power between sex and sex-ancestry groups.

All measurement means, except sacral breadth, were larger in males than females. South African Coloreds showed the greatest differences between the sexes for the most measurement (20 of 39). Black males and females presented with the highest levels of sexual dimorphism for 13 of 39 measurements. South African Whites only showed the highest degree of sexual dimorphism for six of 39 measurements. Overall, the most sexually dimorphic skeletal elements included the anterior-posterior and vertical diameters of the clavicle, the anterior-posterior diameter of the radius, the humeral minimum midshaft diameter, and the dorso-volar and transverse diameters of the ulna.

Multivariate classification accuracies ranged from 75%-90% (LDA) to 75%-91% (FDA and logistic regression) for individual bone models. Overall, the clavicle model classified best for FDA and logistic regression, whereas the radius classified best for LDA. Multivariate subsets (various combinations of measurements) achieved correct classifications that ranged from 85%-98% (LDA) to 88%-97% (FDA and logistic regression). For both FDA and logistic regression the "all-variable" model achieved the highest correct classifications, whereas for LDA, the subset of breadth measurements achieved the highest accuracies. When classifying into sex and ancestry, a multivariate subset using eight measurements achieved classification accuracies of 79% (FDA) and 80% (LDA).

While LDA and logistic regression produced better results for some subsets and bone models, overall FDA achieved greater accuracies. Colored males and females and Black females misclassified most often as the same sex but different ancestry groups, whereas Black males and White males and females misclassified equally into different sex and ancestry groups. Overall, White males and females had the highest correct classification rates for both sex and ancestry. Postcranial bones achieved comparable classification accuracies to morphological analysis of the pelvis and higher accuracies than metric or morphological techniques using the cranium in South Africa. The high correct classifications obtained for LDA also indicate that a custom database of postcranial data can be used with FORDISC® 3.0 to improve classification into sex and sex-ancestry groups in forensic case analyses in South Africa.[5]

References:

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* Presenting Author