A42 The Application of the Optimized Summed Scored Attributes (OSSA) Method to Sex Estimation in Whites and Blacks

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Learning Overview: After attending this presentation, attendees will understand the practicality of the OSSA method for sex estimation in unidentified individuals.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by validating a new method of sex estimation and demonstrating how this method can be incorporated into the biological profile aspect of casework.

Recently, Tallman and Go applied the OSSA method, originally developed for ancestry estimation, to the five cranial traits of Walker in order to estimate sex.[1,2] While possessing great potential as a new sex estimation method, this approach has only been tested in Asian samples, which had a high sex bias (>24.5%) despite high classification accuracy (83.7% calibration; 81.9% validation). This research tests the applicability of the OSSA sex estimation method in United States Black and White populations. A random sex/ancestry balanced sample of 700 individuals from the MorphoPASSE Database Databank (MDD) was utilized to calibrate the OSSA method dichotomized scores and sex classification sectioning points. Everyone in the MDD had been previously scored for the five Walker traits by an experienced observer from the Terry Anatomical, William Bass Forensic Skeletal, and the Hamann-Todd Human Osteological Collections.[1] A second random validation sample of 200 individuals from the MDD was used to test the validity of the OSSA method.

First, trait frequencies of the nuchal crest, glabella, mastoid, supraorbital margin, and mental eminence were calculated in the calibration sample by sex/ancestry group for each score (from one to five). The trait scores were then dichotomized based on the frequency distributions and score mean, median, and modes. Trait scores that were more frequent in females were dichotomized to a zero, while trait scores more frequent in males were dichotomized to one. The scores for all five cranial traits were summed to obtain a combined OSSA score from zero to five. From these totals, the sectioning point for sex classification was determined based on classification accuracy rates in the calibration sample. Finally, the validity of the OSSA sex method was tested in the holdout sample.

In Blacks, the nuchal crest, glabella, mastoid, and orbital scores of 1–2 were dichotomized to an OSSA score of 0, while scores 3–5 were dichotomized to an OSSA score of 1. For the mental eminence, scores 1–3 were designated as a 0 and scores of 4–5 were designated as a 1. A summed OSSA score of ≤2 classified as female, while ≥3 classified as male. Classification accuracy in the calibration sample was 77.4% with 15.4% sex bias in favor of males, while validation accuracy in the holdout sample was 78.0% with 8.0% sex bias in favor of males. In Whites, the nuchal crest, glabella, mastoid, and mental eminence scores of 1–2 were dichotomized to an OSSA score 0, while scores 3–5 were dichotomized to an OSSA score 1. For the orbital margin, scores 1–3 were designated as a 0 and scores 4–5 were designated as a 1. A summed OSSA score of ≤3 classified as female, while ≥4 classified as male. Classification accuracy in the calibration sample was 77.1% with 20.6% sex bias in favor of females, while validation accuracy in the holdout sample was 70% with a 56% sex bias in favor of females.

Walker's method using these five traits and logistic regression produced 87.9% correct classification and 0.1% sex bias in his sample and logistic regression analysis in this sample produced 83.0% accuracy and 0.2% sex bias, which suggests that employing his trait scores in logistic regression far outperforms the OSSA sex estimation method and had considerably less sex bias[2]. One option to improve classification accuracy and the utility of OSSA for sex would be the inclusion of an indeterminate category as proposed by Tallman and Go, and then only utilize the method for individuals that do not have an indeterminate summed OSSA score.[1] In conclusion, this research suggests that the OSSA method can be applied to sex estimation in United States forensic casework; however, the results are less accurate and have a higher sex bias than using the original Walker traits in regression analyses.[2]

Reference(s):

1. Tallman, S.D., and Go, M.C. (2018). Application of the Optimized Summed Scored Attributes Method to Sex Estimation in Asian Crania. *Journal of Forensic Sciences, 63(3),* 809-814.
2. Walker, P.L. (2008). Sexing Skulls Using Discriminant Function Analysis of Virtually Assessed Traits. *American Journal of Physical Anthropology, 136,* 39-50.

Walker Traits, Sex Estimation, OSSA Method