H86 Sex Estimation From the Calcaneus Using Discriminant Function Analysis

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After attending this presentation, attendees will be better informed of the importance of the uses that the calcaneus can serve in estimating sex during the creation of the biological profile.

The presentation will impact the forensic science community by showing the importance the calcaneus can serve in providing an additional reliable method for sex estimation via discriminant functions based on an American forensic population.

Reliable methods for sex estimation during the creation of a biological profile are important to the forensic community in instances when the common skeletal elements used to assess sex are absent or damaged. Sex estimation from the calcaneus has potentially significant importance for the forensic community. Specifically, measurements of the calcaneus provide an additional reliable method for sex estimation via discriminant function analysis based on a North American forensic population.

The calcaneus was chosen for study because of its size and the durability, which permit it to withstand postmortem alteration (Drechsler et al 1996; Bidmos and Asala 2003, 2004; Introna et al 1997). Previous studies have estimated sex using the calcaneus and other tarsal bones (Bidmos and Asala 2003, 2004; Gualdi-Russo 2007, Introna et al 1997, Murphy 2002, Steele 1976; Wilbur 1998), However, these studies use populations from an older American sample (birth years from late 19th- early 20th century), Italy, South Africa, prehistoric Polynesian, and prehistoric Native American and thus are not applicable a modern North American population. It is important to take into account demographics, secular change and regional origin of the collection being used (Komar and Grivas 2008). Due to secular change and regional origin, previous studies must be revised and existing methods evaluated for populations of differing geographic origin.

Research on a modern American sample was chosen in order to develop up-to-date population specific discriminant functions for sex estimation. The current study addresses this matter, building upon previous research (Bidmos and Asala 2003, 2004; Gualdi-Russo 2007, Introna et al 1997, Murphy 2002, Steele 1976; Wilbur 1998) and introduces a new measurement, posterior circumference that promises to advance the accuracy of use of this single, highly resistant bone in future instances of sex determination from partial skeletal remains.

Data was collected from The William Bass Skeletal Collection, housed at the University of Tennessee. Sample size includes 260 adult American White individuals born between the years 1900 and 1985. The sample was comprised of 131 females and 129 males. Skeletons used for measurements were confined to those with fused diaphyses showing no signs of pathology or damage that may have altered measurements, and that also had accompanying records that included information on ancestry, age, and sex. Measurements collected and analyzed include maximum length, load-arm length, load-arm width, and posterior circumference. Posterior circumference was obtained by measuring the minimum circumference of the area between the dorsal articular facet and the most posterior point on the calcaneus avoiding the calcaneal tuberosity.

The sample was used to compute a discriminant function, based on all four variables, and was performed in SAS 9.1.2. The discriminant function obtained an overall cross-validated classification rate of 86.90%. Females were classified correctly in 90.08% of the cases and males were correctly classified in 83.72% of the cases.

Due to the increasing heterogeneity of current populations, further discussion on this topic will include the importance that the re-evaluation of past studies has on modern forensic populations. Additionally due to secular and micro evolutionary changes among populations, future research must include additional methods being updated, and new methods being examined, both which should cover a wide population spectrum.

Calcaneus, Sex Estimation, Discriminant Function