A20 The Influence of Stature on Sex Estimation

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After attending this presentation, attendees will better understand whether body size influences the expression of traits used in forensic sex estimation.

This presentation will impact the forensic science community by illustrating the importance of understanding human variation when looking at skeletal traits in forensic anthropology.

Sex estimation of the adult skeleton is a key part of the biological profile in forensic anthropology due to its utility in feasibly eliminating half of the missing persons pool and enhancing the accuracy of other aspects of the biological profile, such as stature and ancestry; however, sexual dimorphism in the human skeleton is relatively small, and sex estimation can be further complicated by aspects of the individual's life or genetic background. The degree of sexual dimorphism is known to vary between populations, and while global patterns have been well-studied, the underlying causes of this variation are still unclear. Previous studies have established a secular pattern of increasing sexual dimorphism with increasing stature, a reduced accuracy of sex estimation methods on short-bodied populations, and have shown that body size affects morphological trait expression used for age estimation.[1-3] These findings give support to the present study, which seeks to establish whether body size also influences expression of traits useful in forensic sex estimation. The hypotheses for this study are: (1) variation in expression of sexually dimorphic traits covary with stature; and, (2) taller individuals are more accurately sexed due to a greater expression of dimorphic traits.

Sex estimation has been known to achieve 95% accuracy when a complete set of skeletal remains is present, though forensic contexts often produce incomplete remains.[4] In an effort to account for this potential limitation, this study employs three widely-used non-metric sex estimation methods, as metric methods depend on significant skeletal preservation. The three methods selected for this study (Walker, Klales et al., and Rogers) rely on the cranium, pelvis, and humerus, respectively.[5-7] Should differences in sexual trait expression in individuals of varying stature be observed, the use of three different sex estimation methods will illustrate whether this pattern is observable in multiple regions of the skeleton. This research was conducted at the William M. Bass Donated Skeletal Collection curated at the University of Tennessee, Knoxville, one of the most comprehensive modern skeletal collections of known demography. The derived sample of 127 individuals (63 males and 64 females) was controlled for ancestry and age by consisting strictly of White adult males and females. Stature is used as a proxy for body size and is treated as a continuous variable. Body mass is not considered since skeletal growth (height) is more tightly canalized than storage of fat.[8]

Preliminary statistical analyses were conducted. Overall, the methods show a higher misclassification rate than has been previously reported for reference collections (Walker: 24% misclassified; Klales: 17% misclassified; Rogers: 22% misclassified). Logistic regressions were used to test whether stature can explain the probability of individuals being assigned male or female for each method. Regression results reveal that stature is significantly correlated ($p < 0.001$ for all cases) with all the sex estimation methods used in this study; however, this is expected due to the fact that there is sexual dimorphism in human stature and that forensic sex estimation methods are explicitly designed to detect other sex-related differences. Therefore, to remove the impact of sex on stature variation, new binary regressions were conducted for each method within sex groups to determine if the misclassified individuals can be explained by body size. The results indicate that within each sex, incorrect sex estimations were not related to individual stature (Walker: p = .080 for males/p = .250 for females; Klales: p = .058 for males/no females were misclassified using this method; Rogers: p = .447 for males/p = .808 for females). In conclusion, the misclassifications are not the result of stature, and future studies will pursue other sources of biological variation, such as donor weight or Body Mass Index (BMI), to test the hypothesis that body-size dimorphism is associated with sexual dimorphism in the skeleton.

Reference(s):

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Sexual Dimorphism, Stature, Non-Metric Method