



Physical Anthropology Section - 2012

H85 Metric and Non-Metric Assessments of Sex: Accuracy, Correlation, and Corroboration

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After attending this presentation, attendees will understand the reliability of non-metric methods, as well as their correlation with metric methods, which are commonly employed in biological profile estimation for unknown individuals.

This study will impact the forensic science and anthropology community by demonstrating the relationship between both types of methods, as well as their relative accuracies, in sex estimation from a forensic context.

Sex estimation is a vital component of the biological profile estimation in forensic identification of skeletonized or badly decomposed unknown individuals. While the forensic anthropological community is moving toward the increased use of metric methods, non-metric methods continue to be routinely employed because of their relative ease of use, their perceived reliability, and because they are frequently “passed-down-knowledge.” Because of these factors, non-metric methods are often still utilized for biological profile estimation, in conjunction with metric assessments, particularly with the human skull and pelvis. The skull has historically been the most studied portion of the skeleton for both ancestral and sex related differences, while the pelvis, specifically the innominates, is widely regarded as the greatest indicator of sex due to the dimorphism related to childbirth in females.

Non-metric and metric data were collected from all forensic cases conducted from 2009 to present at the Department of Applied Forensic Sciences at Mercyhurst College in Erie, PA. The non-metric methods utilized for sex estimation include: (1) the Walker method for sex estimation of the crania using the expressions of the supra-orbital ridge, the mastoid processes, the mental eminence, the nuchal crest, and the supra-orbital margin of the orbits; and, (2) the Klales *et al.* (in press) method for estimating sex using ordinal scoring and expressions of the subpubic concavity, the medial aspect of the ischio-pubic ramus, and the ventral arc in the pubic bone as modified from the Phenice method.¹⁻³ In addition to non-metric techniques, standard osteometric measurements of the skull and pelvis were also collected for each for individual or case based on the parameters outlined in Buikstra and Ubelaker and were analyzed using FORDISC 3.1 (Jantz and Ousley).^{4,5} Graduate students with extensive training in each of the methods collected all measures.

Cases were separated into two groups, those that were positively identified and those that were unidentified at the time of this research. Classification accuracies were calculated for each of the non-metric methods and also for the osteometric measures. This was undertaken in order to evaluate how well the metric assessment corroborates with the results obtained using non-metric methods and vice versa. Additionally, with the positively identified cases, each non-metric method and the osteometrics were examined for accuracy in sex estimation. Lastly, correlation matrices were then used to examine the relationship between standard osteometric measures and non-metric trait expressions.

Preliminary results using the positively identified individuals indicate that metric methods had slightly higher classification accuracies of sex (100% using FORDISC 3.1) than the non-metric methods employed (92.9% combined accuracy for the Walker and Klales *et al.* methods). However, the non-metric methods and metric methods for sex estimation were found to be highly correlated using the entire sample. Finally, metric methods showed high correlation with the Walker non-metric traits: nuchal crest with nasion-occipital length (NOL), and the expression of the mastoids with mastoid height (MDH).² As expected, metric methods failed to show a high correlation with the Klales *et al.* (in press) and Phenice traits.^{2,3} This suggests that metric measures of the pelvis fail to capture these visual sex differences in the pubic bone which may best explain why these non-metric methods are still frequently employed for sex estimation.

Evaluating the correlation between metric and non-metric methods will aid in the understanding of non-metric traits and will also increase the confidence in their use and reliability for sex estimation in forensic cases. Furthermore, this understanding will improve the practitioner’s ability to assuredly utilize both types of methods by revealing the factors contributing to each of the non-metric traits and thus result in more accurate estimates.

References:

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3. Phenice TW. A newly developed visual method of sexing the os pubis. *Am J Phys Anthropol* 1969;30:297-301.
4. Buikstra JE, Ubelaker DH, editors. Standards for data collection from human skeletal remains. Fayetteville: Arkansas Archeological Survey Research Series, 1994.
5. Jantz RL, Ousley SD. FORDISC 3.0: personal computer forensic discriminant functions. University of Tennessee, 2005.

Sex Estimation, Osteometrics, Non-Metric Methods