



A22 The Impact of Error in Femur Subtrochanteric Measurements on the Assessment of Population Affinity

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Learning Overview: After attending this presentation, attendees will understand the implications of intra- and inter-observer measurement variability on the calculation of Platymeric Index (PI) and resulting ancestry classifications. This presentation focuses on the reliability of the required measurements and the consistency of index classifications.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating the effect of measurement error on a commonly utilized method for assessing population affinity from postcranial skeletal remains.

When skeletonized remains are incomplete and/or fragmentary, the PI has been identified as a possible method for population differentiation.^{1,2} This method serves as a part of the forensic toolkit for the estimation of ancestry and is most commonly utilized when cranial elements are missing or fragmented. However, previous research on data accuracy and reliability indicates that measurements utilized to calculate the PI, the subtrochanteric Anterior-Posterior Diameter (APD), and Medial-Lateral Diameters (MLD) of the femur have greater-than-acceptable error rates.³ Despite reported error rates exceeding that of the published thresholds, the measurements remain necessary for assessing population affinity in forensic casework. Thus, it is important to understand the role of intra- and inter-observer error in the data collection process and how that variability may impact method application and classification results.

In this study, three observers independently collected three rounds of APD and MLD measurements on 53 left and right femora. The femora are part of a commingled assemblage of Vietnamese males derived from a C-130 aircraft that crashed in 1974. In an effort to emphasize replicability of the measurements across time and ensure that each round was performed independently with no relation to past rounds, a minimum of one week passed between each round.

Absolute and relative Technical Errors of Measurement (TEM) were calculated to assess measurement error within and between observers. APD and MLD measurements were then utilized to calculate the PI (APD/MLD x 100). Indices were classified as platymeric, eurymeric, and stenomic following sectioning points recommended in previous studies to demonstrate the role of inter-observer measurement variability on classifications, and as a result, the potential effect in ancestry estimation application.^{1,2} Comprehensive Kruskal-Wallis and chi-square tests of significance were conducted to determine the degree of intra- and inter-observer error throughout the analyses.

Results mirror previously reported observer errors with absolute TEM ranging from 0.50mm to 0.77mm and relative TEMs ranging from 2.10% to 3.17% for intra-observer error. Inter-observer absolute TEM ranges from 0.88mm to 1.14mm and relative ranges from 2.98% to 4.65%. Despite greater-than-acceptable error in the raw measurements, no significant differences were found between measurement rounds or index calculations. Likewise, no significant differences were observed in the classification data for each observer.

These results highlight both the reliability and validity of subtrochanteric femur measurements when applied to PI classifications. While intra- and inter-observer error remains high in the raw measurements, it is not enough to significantly alter the platymeric classification results for this dataset. Thus, the present analysis argues that variation in how the PI of individuals or groups classify is not likely a result of measurement error, but rather a reflection of method application and the specific groups included in the given analyses.

Reference(s):

1. Wescott, D. Population Variation in Femur Subtrochanteric Shape. *Journal of Forensic Science*, vol. 50, No. 2, 2005, pp. 286-293.
2. Tallman, S., Winburn, A. Forensic Applicability of Femur Subtrochanteric Shape to Ancestry Assessment in Thai and White American Males. *Journal of Forensic Science*, vol. 60, No. 5, 2015, pp. 1283-1289.
3. Langley, N., Jantz, L., McNulty, S., Maijanen, H., Ousley, S., Jantz, R. Error quantification of osteometric data in forensic anthropology. *Forensic Science International*, vol. 287, 2018, pp. 183-189.

Platymeric Index, Subtrochanteric Measurements, Data Validation