A11 A Comparative Analysis of Stature Estimation Methods for Application in Forensic Anthropology

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Learning Overview: After attending this presentation, attendees will better understand the accuracy of various stature estimation methods and their implications on the biological profile for identifying unknown individuals.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing a comprehensive analysis of stature estimation methods and will identify the most accurate method for estimating stature for use in forensic contexts.

Forensic anthropologists use either anatomical or mathematical methods to estimate stature in unknown individuals. Anatomical methods use all bones contributing to stature and have been considered the most accurate approach. The popular mathematical methods use correlations of long bones to estimate overall stature and are not reliant on complete skeletal remains and are less time consuming. The ease of the computer program FORDISC® has likely contributed to the increased use of mathematical methods over anatomical methods, even with complete remains.

The first goal of this research is to validate each method type (anatomical vs. mathematical) and to determine if anatomical methods are in fact more accurate. The second goal of this research is to compare the accuracy of available methods and to determine if the methods derived from modern samples are more accurate for use with modern forensic cases. Skeletal measurements were collected for 72 White males and females of known stature from the William M. Bass Donated collection. A total of 41 measurements were collected from 36 bones by one expert observer, a practicing forensic anthropologist, using sliding calipers and an osteometric board to take the measurements of the individual. The left side was measured for each individual unless the bone was damaged or exhibited a pathology, in which case, the right side was substituted. The collected measurements were added together for the anatomical methods (n=2), and the appropriate soft tissue correction factor was applied or entered into the sex and bone specific regression equations to estimate overall stature using the mathematical methods (n=4). Age-correction factors (n=2) were also applied and tested for accuracy. Lastly, estimated stature, with and without age correction factors, was compared to the known stature to determine the overall accuracy of each method.

Stature was more accurately predicted for females using both method types, despite having sex-specific equations in the mathematical methods, and male stature was typically underestimated in most methods. Overall, the revised methods for both the anatomical and mathematical methods provided more accurate estimates than the older methods, likely due to secular changes in body proportions. Raxter et al.'s revision of the Fully method provided a stature estimate closer to known height in 80.9% of individuals.[1,2] Newer mathematical methods (Ousley, Wilson et al.) produced higher accuracy rates per individually tested bones (76.4%-93.0%) than the older mathematical methods (Trotter and Gleser) with accuracy rates of only 50.7%-63.4%.[3-6] FORDISC® had a total accuracy rate of 91.7%, but with wide prediction interval ranges (average of 7.8 inches when using known sex and ancestry; 95%). Overall, the age correction factors did not improve accuracy and generally resulted in lower accuracy than the uncorrected estimates.

The results of this research suggest that the Wilson et al. method should be applied in forensic casework as it has the highest total accuracy, even outperforming anatomical methods, and small prediction interval ranges.[4] Generally, anatomical methods tended to underestimate reported stature, which may suggest that self-reported stature was likely overestimated, as first reported by Willey and Falsetti.[7] Overall, the tibia equations provided the best estimates of stature (93%) using Wilson et al.'s equations, followed by the humerus at 91.5%.[4] Wilson et al.'s tibia equation provided the most accurate estimates of actual stature overall (93.0%) and suggests that when possible, the tibia equation from Wilson et al. should be utilized for forensic casework over other stature methods.[4]

Reference(s):

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Stature Estimation, FORDISC®, Wilson Method