A81 Trotter and Gleser's (1958) Equations Outperform Trotter and Gleser's (1952) Equations in Estimating Living Statures of White Males

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Learning Overview: After attending this presentation, attendees will understand that Trotter and Gleser's (1958) equations perform better than those of Trotter and Gleser (1952) in estimating living statures of White males.[1,2] Additionally, attendees will learn that the Bayes factor is a useful tool to compare the performance of stature estimation equations quantitatively.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by reassessing the utility of Trotter and Gleser's (1958) White male equations, which have long been underestimated and rarely used. It is also expected that the Bayes factor, which is used for comparison of equations in this study, will be widely utilized for a similar purpose in the forensic science community.

Trotter and Gleser presented two sets of stature estimation equations for White and Black males in 1952 and 1958. The 1952 and 1958 equations were based on World War II and Korean War casualties, respectively. Between the two sets of White/Black male equations, Trotter (1970) preferred the 1952 ones since their associated standard errors were smaller than those of the 1958 ones.[3] Since then, Trotter and Gleser's (1958) White/Black male equations have rarely been used, with no systematic validation tests. This research aims to re-evaluate the performance of the 1958 White male equations in comparison with the 1952 equations using quantitative measures.

Living stature and left long bone length data of 55 White male casualties, who were identified by the Defense POW/MIA Accounting Agency (DPAA), were used. Stature estimates of the individuals were produced using the 1952 equations, 1958 equations, and FORDISC®. When the "Trotter M Stats" option is selected, FORDISC® provides stature estimates based on Trotter's original data used for the 1952 study. The performance of the three methods was evaluated by three quantitative measures—bias ($\sum$(estimated – actual)/n), inaccuracy ($\sum$|estimated – actual|/n), and Bayes factors. Good performance of a method is indicated by small bias and inaccuracy and large value of the Bayes factor. The 1958 equations mark the lowest bias of the three methods, except when the "femur+tibia" was used (0.32cm, 0.02cm, and -1.33cm for the 1958 equation, 1952 equation, and FORDISC®, respectively). As to the inaccuracy, the 1958 equations mark the lowest values in seven out of ten comparisons. Yet, in the comparisons where the 1958 equations did not mark the lowest ("tibia," "femur+tibia," and "femur+fibula" equations), the difference in the inaccuracy among the methods was minimal (<0.2cm). The greatest Bayes factors were obtained from the 1958 equations in all comparisons.

The Bayes factors allow for an objective comparison of performance among different equations by quantifying the similarity/dissimilarity of the distributions between the actual statures and estimated statures.[4] The fact that the greatest Bayes factors were obtained from the 1958 equations indicates that the distributions of the estimates by the 1958 equations are closer to those of actual statures compared to the other methods. Among the 1958 equations, those using the "tibia," "femur+tibia," and "ulna" yielded the greatest Bayes factors (BF's=7.0, 6.6, and 6.2, respectively); and those using the "humerus+ulna," "humerus," and "radius" yielded the lowest Bayes factors (BF's=1.5, 2.5, and 3.0, respectively). In general, the Bayes factor of 3 through 10 is interpreted as a "positive" or "substantial" evidence that the estimated statures by the equation follow the distribution of the actual statures.

The results of this study clearly show that the 1958 equations outperform the 1952 equations or FORDISC® in estimating statures of the White males. Also, it is necessary that researchers choose the best-performing equation based on an objective and quantitative measure such as the Bayes factor.

Reference(s):

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4. Jeong Y., Harris A.P., Ali O., Jung Y. 2020. Bayes factor: A useful tool to quantitatively evaluate and compare performance of multiple stature estimation equations. *Forensic Sci Int*. 312:110299. DOI: 10.1016/j.forsciint.2020.110299.

Stature Estimation, Equation, Bayes Factor

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