A17 Stature Estimation Using Measurements of the Cranium for Populations in the United States

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After attending this presentation, attendees will understand the accuracy and limitations of estimating stature for populations in the United States using only cranial measurements.

This presentation will impact the forensic science community by providing a method of estimating the stature of an unknown individual using cranial measurements if no other skeletal elements are present.

Stature estimation is part of the process of developing a biological profile for an unidentified individual. This is usually accomplished by measuring the lengths of the available long bones and calculating a stature range for the unidentified individual using published sex- and ancestry-specific regression equations. Stature can be estimated using measurements from other bones if long bone measurements are not available for an individual, but the estimated stature ranges generated from these equations are typically larger than those utilizing long bone measurements. Human crania are easily recognizable even to the untrained observer and are sometimes recovered in the absence of other skeletal material. The height of the cranium from points basion to bregma directly relates to stature, suggesting that this measurement and other cranial measurements could be used to estimate stature when no other skeletal elements are present.[1] Although stature estimation equations using various cranial measurements have been developed for several regional populations in various countries, no stature estimation equations utilizing standard cranial measurements exist for common populations in the United States. The purpose of this study is to develop and test stature estimation equations for four populations in the United States.

Seventeen standard cranial measurements were obtained from both a cranial Computed Tomography (CT) dataset and the Forensic Data Bank for Black, White, and Asian males and females and Hispanic males, for a total of 513 individuals.[2-4] Only individuals with either self-reported stature or stature measured at the time of the CT scan were included in this study, and all individuals were between the ages of 18 years and 60 years. Correlation coefficients and both simple and multiple linear regression equations were calculated for each of the 17 cranial measurements. Weak-to-moderate correlations with stature were observed for several cranial measurements in each population group, but none of the cranial measurements for any population demonstrated a strong correlation with stature.

The simple regression equations were tested using a separate dataset consisting of 94 individuals from the William M. Bass Donated Collection for which both cranial measurements and stature information (either self-reported or measured) are available. Stature ranges were developed from 95% confidence intervals calculated using the method by Giles and Klepinger.[5] Actual stature for these individuals fell within the calculated stature range for their respective regression equations 91%-97% of the time, but the calculated stature ranges for all individuals were very broad (±14-20cm). When individuals were tested using equations from groups other than their own, method accuracy dropped dramatically (41%-60%). The results of this study indicate that stature can be estimated using cranial measurements as long as the sex of the individual has been correctly assessed; however, this method produces broad stature ranges and should only be used if no other suitable skeletal elements are present.

Reference(s):

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Stature Estimation, Cranial Measurements, Linear Regression

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