A14 Testing the Reliability of Ancestry-Specific Juvenile Age Estimation Methods Using the Diaphyseal Length of the Humerus

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After attending this presentation, attendees will have a better understanding of population variation in long bone length and how ancestry-specific age estimation methods based on humerus length do not necessarily improve the accuracy over other methods, particularly when the ontogenetic environment is not considered.

This presentation will impact the forensic science community by demonstrating that size is not ancestry specific, and that the reliability of juvenile age estimation methods based on long bone length is not necessarily conferred by matching the ancestry of the individual under investigation with the ancestry of the individuals in the sample used to develop the method.

Little work has been conducted on whether juvenile age estimation methods perform well beyond the population that was used as a reference. The accuracy of juvenile skeletal age-at-death estimation methods is known to be tied to the similarity between the method's reference sample and the target population. This similarity has been most often described in terms of "biological/genetic proximity" or ancestry and is the basis for advocating population-specific methods; however, similarity of growth environments has been less considered. The purpose of this presentation is to test two recently published juvenile skeletal age estimation methods (Stull et al., based on modern South African children; and Cardoso et al., based on 18th- to early 20th-century children from Portugal and England) on a diverse sample of known-age juvenile remains.[1,2]

Humerus diaphyseal length was collected from a sample of 81 known-age juvenile skeletons, aged between birth and 12 years. The data combines archaeological, anatomical, and forensic reference collections in the United States, Canada, and South Africa. Ages were estimated using Stull and colleagues and Cardoso and colleagues prediction models.[1,2] Mean residuals and mean absolute residuals were calculated to evaluate method accuracy and precision. To further evaluate reliability, 95% range inclusion frequencies were calculated as the percentage of individuals whose real age fell within the estimated 95% confidence interval.

Results do not lend support to the argument that ancestry-specific methods are more accurate, but seem more consistent with the ontogenetic environment hypothesis. Stull and co-worker's method is based largely on modern South African children, both "Black" and "Colored." It consistently performs best in the Forensic Data Bank sample, which is comprised largely of "Whites." Cardoso and co-workers' method is based on significantly stunted European children and consistently performs best in the Dart collection, which is comprised entirely of "Blacks." These findings have important implications for age estimation of juvenile skeletons in forensic contexts.

Reference(s):

1. Stull, Kyra E., Ericka N. L'Abbé, and Stephen D. Ousley. Using multivariate adaptive regression splines to estimate subadult age from diaphyseal dimensions. *American Journal of Physical Anthropology.* 154, no. 3 (2014): 376-386.
2. Cardoso, Hugo F.V., Joana Abrantes, and Louise T. Humphrey. Age estimation of immature human skeletal remains from the diaphyseal length of the long bones in the postnatal period. *International Journal of Legal Medicine.* 128, no. 5 (2014): 809-824.

Juvenile Skeletal Age, Inter-Population Variation, Ancestry