H73 Testing the Accuracy of North American Growth Standards to Estimate Age-at- Death in Modern South African Subadults

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After attending this presentation, attendees will have knowledge of population variation in subadult growth. Long bone lengths of modern South African children are compared to North American children as a means to address validity and reliability of current methods.

This presentation will impact the forensic science community by demonstrating a need for population-specific age-at-death estimation methods from long bone lengths and the need for appropriate predictive statistical models.

The longitudinal growth study of Maresh has been adopted into anthropological literature and has been influential in estimating age-at-death from long bone lengths of modern subadults.[1] While this data has been reprinted in several research texts, the original purpose was to evaluate normal growth, not to estimate age. Though accuracy is low when used to evaluate age-at-death of modern North Americans, the accuracy of the data to estimate age-at-death is not known when applied to geographically distinct groups from North America.[2] The purpose of this study is to compare the maximum and relative diaphyseal lengths of Maresh charts to modern South African groups as a means to explore the applicability of the Maresh charts and to advocate for population-specific research.[1]

Maximum diaphyseal lengths of six long bones were recorded on 640 South African children (male and female) between birth and twelve years of age. A 21st-century sample was obtained from Lodox Statscan images from the Forensic Pathology Services in Salt River and the Red Cross War Memorial Children's Hospital in Cape Town, South Africa (n=600).[3] The 20th-century sample, which is temporally similar to Maresh, was acquired from the Raymond A. Dart Human Skeletal Collection (n=40).[1] A separate study validated the radiographic measurements were similar to dry bone measurements.[4]

Percent correct was done for both the 20th- and 21st-century South African data in order to gauge the accuracy of Maresh (1970). Results were higher for the Dart sample, with 41% correct while the 21st-century sample demonstrated 22% correct classification. The mean and relative long bone lengths of the Maresh (1970) and Lodox samples were sorted by age and bone and were compared using Student's t-tests. Using the mean values of each age group, statistically significant differences were demonstrated ($p < 0.05$) for most ages above seven years and for all long bones, except the radius. Mean differences between North Americans and South Africans revealed differences in growth. At birth, South Africans are larger than North Americans for all bones. A transition in size between groups was noted from three to seven years. At 12 years of age, South Africans were significantly smaller than North Americans for all bones. No statistically significant differences ($p > 0.05$) were noted in relative long bone lengths. Similar results to mean maximum lengths were obtained when mean relative lengths were explored through graphical parameters. The mean relative lengths of all bones for the South African sample are larger than North Americans at birth, only to lag between four and nine years. By 10 years, the relative lengths begin to increase and by age 12 the proportions are similar to North Americans.

The South African and North American samples are of different socioeconomic status and genetic background, both of which contribute to differential growth. Mean adult stature in South Africans is smaller than the mean adult stature of North Americans in the 1970s. This difference in size mimics differences found in long bone lengths seen in the current study at age 12 years.

The problems with data used to estimate age-at-death are highlighted when applied to South African subadults. Due to a lack of modern skeletal material and a void of appropriate predictive methods, validation of current subadult age-at-death techniques is difficult. Full-body Lodox Statscan images are an invaluable tool for addressing the dearth of subadult skeletal material. Data is continually being collected with the goal of developing population-specific age-at-death tables for South Africans.

Referneces:

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2. Stull K, Frazee K, Cabo L. 2008. Accuracy of Metric Infant Age Estimation Methods. Proceedings of thr 75th Annual Meeting of the American Association of Physical Anthropologists; 2008 Apr 9-12; Columbus, OH: 202.
3. http://www.lodox.com
4. Stull KE, L'Abbé EN, Steiner S. Measuring distortion in Lodox generated images. Clin Anat. Submitted.

Long Bone Lengths, Relative Lengths, Radiographs

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