H89 Applicability of Common Age-at-Death Estimation Methods in Cold Case Analysis

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The goal of this presentation is to explain the statistical comparison of six age-at-death estimation methods commonly used by practicing forensic anthropologists. Additionally, the applicability of these methods to cold case work is explored.

This presentation will impact the forensic science community by highlighting the limitations of these methods and posit modifications of their use when developing a biological profile.

The most commonly employed methods for forensic age-at-death estimation from adult skeletal remains utilize gross morphological changes of the auricular surface of the ilium, the pubic symphysis, and the sternal end of the fourth rib. Due to their frequency of use, age estimation methods should be subject to continued accuracy of use assessments. As such, this research utilized three standard methods of skeletal age estimation (Lovejoy et al., Brooks and Suchey, and Işcan et al.,) as well as, three recently published methods, which modify these standard methods (Osborne et al., Hartnett) to identify the differences in error and accuracy of each method using known aged individuals.[1-7] Additionally, the limitations and applicability of each method for populations with known and unknown age-at-death was assessed. The research was completed with two goals in mind: first, to determine if the more recent methods more accurate assessed the age of a known-age individuals than the older standard methods, and second, to examine the statistical properties of each of these methods to ascertain the practical application of each with regards to an unknown sample.

Forty individuals from the William M. Bass Donated Skeletal Collection were examined using these six aging methods. The data were analyzed for accuracy and error across all six methods. Using the McNemar statistical test, the researcher found that the Osborne et al. method provided correct age ranges significantly more often than the Lovejoy method (*p-value* < 0.0001); neither the Hartnett nor the Brooks and Suchey method provided correct age ranges significantly more often (*p-value* 0.4142); and the Işcan method provided correct age ranges significantly more often than the Harnett method (2010b) (*p-value* < 0.0001). It was determined that the accuracy of some methods was due to the large prediction intervals for a given phase.[5,1,6,2,7]

For this sample, the linear regression results were not associated with age using the Osborne et al. and Lovejoy et al. methods (Root MSE 8.58, R-square 0.13, Root MSE 8.65, R-square 0.12, respectively).[2] Results also show that the age phases using Hartnett (2010a; Root MSE 8.63, R-square 0.12) are more closely associated to actual age than Brooks and Suchey (Root MSE 8.99, R-square 0.05).[6,2] Overall, the Hartnett (2010b) method proved to have the closest relationship between phase and age.

These results suggest that when the Işcan et al. method is used to predict age, the inclusion of either the Lovejoy et al. or the Brooks and Suchey methods will not significantly improve the estimated age of the individual in this sample. The same is true for the newer methods; the estimated age cannot be significantly improved by including estimations from the Osborne et al. method or the Hartnett pubic symphysis or rib methods. Finally, the statistical relationship between phase and age for each method was used to develop six regression formulas that could be utilized to calculate age intervals based upon the user's determination of phase for that individual.

Following this analysis, thirty sets of unidentified skeletal remains from the Georgia Bureau of Investigation (GBI) were examined. After sex, ancestry, and stature had been determined, the regression formulas from this study were applied to calculate skeletal age estimation for each individual.

While this research does not ultimately point to a single of the six methods studied as superior to others, it provides a validation for these methods using a modern sample and applies the conclusions to a contemporary morgue sample in order to observe the shortcomings of each of the methods.

References:

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