H19 Sternal Rib Standards for Age Estimation in Balkan Populations: An Evaluation of U.S. Standards Using Alternative Statistical Methods

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The goals of this presentation are: 1) to evaluate the accuracy of US sternal rib standards of age estimation used in the Balkans, and 2) to present cumulative probit regression and Bayes' methodology as alternative statistical methods for the estimation of age at death.

This presentation will impact the forensic community and/or humanity by evaluating the accuracy of existing US sternal rib standards for age estimation used in the Balkans; and presenting to the forensic community an alternative statistical approach for the estimation of age-at-death using a cumulative probit regression model and Bayes' methodology.

Presently, US aging standards are used to generate ages at death for victims of the Balkan war. However, the accuracy of Balkan estimates derived from US standards has not yet been systematically evaluated. This presentation addresses this issue. Further, alternative statistical procedures are used to estimate the ages at death of the US and Balkan samples used in this study.

The US sample contains 156 sternal ribs of known individuals from the William M. Bass Donated (WMB) and Forensic Skeletal Collections (FC) at the Department of Anthropology at the University of Tennessee. Sternal rib data for an additional 32 individuals of known age, sex, and ancestry were obtained from the Forensic Data Bank (FDB) and included in the US sample. Both sexes are represented, and ages at death range from 18 to 94 for white males (with a mean age of 51.22 yrs.) and 20 to 89 for white females (with a mean age of 49.35). The presenter (JS) classified rib ends from the WMB and FC into one of nine phases (0-8) using the rib end phase descriptions developed by Iscan et al. (1984, 1985) for white males and white females. Data obtained from the FDB had been previously collected by various observers from around the country. The Balkan sample contains 529 male and 78 female sternal rib ends of known individuals from the Baraybar Forensic Skeletal Collection. Ages at death range from 17 to 90 years for males (with a mean age of 49.17 yrs.) and 17 to 96 for females (with a mean age of
53.67 yrs.) Four observers (GB, EK, DP, and JS) classified rib ends from the Baraybar Collection into one of nine phases (0-8) using the rib end phase descriptions developed by Iscan et al. (1984, 1985), for white males and white females. Data collected by the observer who produced the highest correlation between rib phase and chronological age (EK) were used in this study.

Traditionally, physical and forensic anthropologists estimate age by assigning a mean age and age range to an unknown individual based on the distribution of the age indicator in a known age reference collection. With the cumulative probit and Bayesian approaches, however, probabilities are assigned to each possible age in the age at death distribution of an unknown individual and the single age assigned the highest probability is the most likely age at death for that individual. While these approaches involve several computational steps and are mathematically more complex they provide certain advantages over traditional methodology, including: 1) assignment of probability to age-at-death estimates, 2) less subjective age estimates, 3) more realistic error estimates, and 4) practitioners are not forced to use truncated age ranges when estimating the ages-at-death of older adult individuals (i.e., 50+ years).

The US data were analyzed using cumulative probit and Bayesian methods in order to find the highest posterior density of age (i.e. most likely age) for each rib phase. Ages at death were then calculated for a sub-sample of the Balkan data using the "standards" derived from the US sample. If US standards do not provide accurate age at death estimates for the Balkan sub-sample, population-specific standards are warranted.

Iscan, M., Loth, Susan R., and Wright, Ronald K. (1984) Age estimation from the rib by phase analysis: white males. *Journal of Forensic Sciences* 29(4):1094-1104.

Iscan, M., Loth, Susan R., and Wright, Ronald K. (1985) Age estimation from the rib by phase analysis: White females. *Journal of Forensic Sciences* 30(3):853-863.

Estimation of Age-at-Death, Population-Specific Standards, Bayesian Approach

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