H18 A New Method for Estimating Age-at-Death From the First Rib

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After attending this presentation, attendees will understand that the first rib can be used as an effective age-at-death indicator. In addition, attendees will learn that a Bayesian approach utilizing transition analysis can be used for developing robust aging methodologies.

This presentation will impact the forensic community and/or humanity by demonstrating that forensic anthropologists working in numerous contexts can improve their efforts by refining methods used to estimate age-at-death. Results from this research indicate that the first rib can be used to estimate age-at-death as an isolated element or as a component in a multifactorial approach.

Forensic anthropologists working both internationally and domestically are often faced with the problem of developing a biological profile from incomplete skeletal remains. Elements commonly used for establishing age-at-death are sometimes absent and frequently damaged. Such occurrences are unfortunate; however, they underscore the importance of developing aging methodologies from a broader range of skeletal elements. The purpose of this study was to determine whether a modification of the Kunos *et al.* (1999) method for estimating age-at-death from the first rib could be developed. While the fourth rib has been used for some time in age-at-death estimation, Kunos and coworkers (1999) indicate several limitations with the element. Oftentimes, the fourth rib is misidentified in unarticulated skeletons or damage to the sternal aspect precludes its use as an age indicator. Moreover, Kunos *et al.* indicate methods that rely solely on morphological changes of the costal face do not utilize other aspects of the rib that change throughout life, particularly the head and tubercle. These authors argue that the first rib is unambiguously identifiable in addition to its prolonged span of remodeling into the eighth decade.

The purpose of this study was to determine whether the method devised by Kunos and co-workers can be reproduced and successfully applied as a workable model for the estimation of age-at-death. Data were collected on three aspects of the first rib (rib head, tubercle facet, and costal facet) for 549 known-aged males and for 74 known-aged females. The data come from Balkan materials collected as evidence during the investigation of violations to international humanitarian law conducted by the ICTY. The ages-at-death for this sample range from 15-90 years for males (with a mean age of 48.2 years) and 15-96 for females (with a mean age of 51.1).

First, a list of variables was extracted from the original study utilizing all three skeletal aspects of the first rib. This list was subsequently modified as preliminary tests based on serrations of the samples occurred during this investigation and resulted in a total of eleven possible variables. Morphological changes of costal face, rib head, and tubercle facet were coded with regard to numerous features that include shape, surface topography and texture, and marginal morphology. These variables were each scored using a coding system ranging from 1-4 to 1-7 depending on the variable in question. Second, two observers independently scored the three rib components using all eleven variables. The eleven variables were first analyzed separately. To calculate the mean, standard deviation, log-likelihood, and standard error of the ages-of-transition for each component, the *unrestrictive cumulative probit model* is performed. These statistics are further used to calculate the *highest posterior density region*s for estimating individual ages-at-death. Additionally, a multivariate analysis of the three components is performed. A principal component analysis (PCA) of the covariance matrix is conducted for the regions of the first rib to reduce variables with a high degree of correlation. The correlation matrix demonstrates that the inter-correlations of the eleven variables are low (0.4960.768 for the costal facet, 0.181-0.444 for the rib head, and 0.146-0.521 for the tubercle facet). Findings are consistent with those of Kunos and coworkers, in that the morphological changes of all three components of the first rib are useful indicators of age-at-death.

Age-at-Death, First Rib, Transition Analysis

 ** Presenting Author*