## A81 A Test of the Transition Analysis Method for Estimating Adult Age-at-Death

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After attending this presentation, attendees will better understand the effectiveness of Transition Analysis (TA) and ADBOU software compared to other well-known age estimation methods for skeletonized remains.

This presentation will impact the forensic science community by providing a rigorous validation test of TA and by identifying the limitations and advantages of various age estimation methods.

Several problems inherent to most age estimation methods include the tendency to overestimate the ages of younger individuals and to underestimate the ages of older individuals, to lump the elderly into an umbrella category of ">50 years," and "age mimicry," or the tendency of a method to produce age estimates that mirror the age distribution of the collection on which the method was developed. Milner's and Boldsen's TA was developed to address and resolve these problems.[1] The method uses Bayesian statistics in tandem with a modified "component" scoring system to produce an age estimate that reflects a decedent's age at transition. The method's software interface, ADBOU, draws from one of two known prior population distributions (forensic and historic hazards) that are preloaded and unalterable. TA scores a number of different components for three skeletal indicators: the Pubic Symphysis (PS), the Auricular Surface (AS), and the Cranial Sutures (CS). TA can therefore be used with incomplete or fragmented remains.

The present study's primary goal is to test the accuracy of TA and ADBOU against traditional "phase" methods commonly used for the same three skeletal indicators: Suchey-Brooks' (PS), Osborne et al. (AS), and Nawrocki (CS). The hypothesis that TA is more effective in older age ranges than traditional methods was evaluated by calculating inaccuracy and bias by decade; Spearman's rho evaluated whether component scores are correlated with actual age better than phase scores; and the effects of continent of origin and ancestry on prediction error were evaluated with Analysis of Covariance (ANCOVA).

This study sample consisted of 147 modern adult males with documented ages at death, drawn from the Pretoria Bone Collection in South Africa ($n$=72) and the Bass Donated Collection in Tennessee ($n$=75). Scoring was conducted blind without reference to the actual age of the decedent. Each skeleton was scored using the three traditional phase methods as well as with the three TA component methods. Target age estimates and 95% prediction intervals were obtained for each male using the traditional method's published tables and ADBOU's algorithms for the TA data. Furthermore, summary age estimates were calculated by averaging the results of the three traditional methods, to compare with the corrected age calculated by ADBOU.

Mean prediction error (inaccuracy) is always significantly lower for the three traditional methods than for the three TA component methods, and averaging the three traditional methods produces the lowest mean error in the study (12.5 years, compared to 17.1 years for TA). While average bias was always significantly lower for the three TA component methods, the summary age provided by ADBOU suffers from considerable bias, indicating there may be a problem with the software's algorithm. Evaluation of the older age categories indicates that TA does not provide any clear advantage over traditional methods, although TA does seem to produce slightly more accurate estimates for younger individuals. Spearman's rho shows that component scores, taken individually or summed, are not more highly correlated with age than traditional phase scores. ANCOVA results indicate that residuals from the traditional methods were not influenced by ancestry or continent of origin, while the TA residuals were. These results indicate that: (1) while TA does display lower prediction bias, it does not perform as well as traditional methods with respect to inaccuracy, and therefore, in forensic settings, the traditional methods are preferred; (2) age estimation is more accurate when multiple indicators are averaged; and, (3) despite their lower accuracy, the cranial sutures seem to stabilize the other indicators, offsetting the tendency for the pubic symphysis and auricular surface to underestimate age.

**Reference(s):**

1. Boldsen J.L., Milner G.R., Konigsberg L.W., Wood J.W. Transition analysis: a new method for estimating age from skeletons. In: Hoppa R.D., Vaupel J.W., editors. *Paleodemography: age distributions from skeletal samples*. Cambridge: Cambridge University Press, 2002;73–106.

**Age Estimation, Transition Analysis, Biological Profile**





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