A46 Testing Computational Age Estimation Methods Using Laser Scans of the Adult Pubic Symphysis on Modern Hispanic Populations

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After attending this presentation, attendees will have a better understanding of the applicability and effectiveness of three newly published computational methods that focus on 3D laser scans of the pubic symphysis to estimate age at death for individuals of Hispanic identity.[1-3]

This presentation will impact the forensic science community by demonstrating how age at death can be estimated in a more accurate, precise, and objective manner by utilizing fully computational methods and 3D scans of the pubic symphysis on populations of Mexican and Puerto Rican descent. This presentation will also provide recommendations and best practice applications of these standards for forensic casework.

Age-at-death estimation techniques have received considerable attention within the anthropological community, especially among forensic anthropologists, as knowing age can narrow the list of potential missing persons in a forensic investigation. Even though the estimation of age is a crucial parameter of a biological profile, it is also one of the most challenging to attain as it greatly depends on the practitioner's ability to associate age changes with a set of population-specific criteria, usually represented by a series of pre-defined age phases. Along with this issue is the lack of population-specific standards for underrepresented populations in the United States, as the most established of the age-at-death techniques are based on individuals of European and, to a lesser degree, African ancestries from late 19th- and mid-20th-century anatomical collections. In order to address the lack of population-specific methods in age-at-death estimation for contemporary Hispanic casework, this study sourced data from individuals of Mexican and Puerto Rican origin with the goal of testing the newly published framework for age-at-death estimation of Slice and Algee-Hewitt and Stoyanova et al.[1-3]

Slice and Algee-Hewitt and Stoyanova et al. have recently developed objective, fully computational, and statistically robust techniques that offer several advantages over the conventional bone-to-phase matching methods.[1-3] These new techniques utilize coordinates obtained from 3D scans of the pubic symphysis. These data are subjected to numerical shape algorithms and multivariate regression analysis to produce age-at-death estimates. The goals of this study are: (1) to expand these new standards so they can be utilized in populations of Mexican and Puerto Rican origin; and, (2) to produce more accurate and precise estimates of age at death for these populations with reduced error and subjectivity than currently possible using the traditional macroscopic assessment methods.

Data for this study consists of laser scans for both sides of the pubic symphysis from skeletal collections with known age at death housed at the Universidad Nacional Autónoma de Mexico, Institute of Forensic Science in Puerto Rico, and Pima County Office of the Medical Examiner's in Arizona. For each pubic symphysis, 3D scans were created using the NextEngine® 3D Desktop Scanner, 2020i. The resulting scans were aligned and fused in order to generate a multidimensional model of the pubic symphysis. The 3D coordinates representing the

symphyseal surface were extracted from each scan and subjected to the Slice Algee-Hewitt (SAH) -Score method, the thin plate splines/bending energy-based method, and the ventral curvature method.[1-3] Multivariate regression models were used to combine the resulting measures and obtain the final age estimate for each individual.

Preliminary results of match-paired *t*-tests find no significant differences between known age at death and inferred age when utilizing a combination of all three methods and when both left and right sides were pooled, such that $0.03 \leq p \leq 0.71$. Furthermore, when left and right sides of the pubic symphysis were tested separately, non-significant results are produced: SAH+curvature for left, p=0.28; BE+curvature for left, p=0.80; BE+curvature for right, p=0.47. Bonferroni corrections were imposed on α=0.05 for multiple comparisons. Pearson correlations between true and inferred ages for all methods and side configurations appeared consistently high (r >0.91), indicating good agreement among values. Results do suggest a tendency, though not significant, to overestimate known age notably with the SAH+curvature method, generating the greatest mean difference, 9.3 years, for the right side. This study has confirmed that objective and reliable age-at-death estimation can be obtained for populations of Mexican and Puerto Rican descent by the use of computational methods and 3D laser scans of the pubic symphysis.

Reference(s):

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2. Stoyanova D., Algee-Hewitt B.F., Slice D.E. An enhanced computational method for age-at-death estimation based on the pubic symphysis using 3D laser scans and thin plate splines. *American Journal Of Physical Anthropology.* 2015;158(3):431-40.
3. Stoyanova D., Algee-Hewitt B.F., Kim J., Slice D.E. A Fully Computational Framework for Age-at-Death Estimation from the Adult Skeleton: Surface and Outline Analysis of Three-Dimensional Laser Scans of the Pubic Symphysis. *Journal of Forensic Sciences.* 2016, in review.

Age Estimation, 3D Scans, Hispanic Populations