



A119 A Validation of the 2014 Hefner and Ousley Decision Tree Model for Ancestry in a Mexican Population

Bersal C. Villegas-Camposeco, *Escuela Nacional de Antropología e Historia, Mexico City 14030, MEXICO*; Mackenzie Walls*, *Forensic Anthropology Program, Topeka, KS 66621*; Antinea Menéndez Garmendia, *MS, Universidad Nacional Autónoma de México, Mexico City 04510, MEXICO*; Gabriela Sánchez-Mejorada, *PhD, Universidad Nacional Autónoma de México, Ciudad de México 04510, MEXICO*; Alexandra R. Klales, *PhD, Washburn University, Topeka, KS 66621*; Jorge A. Gómez-Valdés, *PhD, Instituto Nacional de Antropología e Historia, Ciudad de Mexico 14030, MEXICO*

Learning Overview: After attending this presentation, attendees will understand the decision tree method of ancestry estimation performed in a distinct Hispanic sample from outside the United States.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by reaffirming the need of greater population-specific samples to develop and validate ancestry estimation methods currently used in forensic casework.

Accurate estimation of ancestry plays an important role for human identification and is the most complex parameter of the biological profile to assess. As the Hispanic population of the United States increases, so must our methods so that we may accurately estimate ancestry of the different populations encompassed as “Hispanic.” This study examines the validity and reliability of the decision tree model of ancestry estimation proposed by Hefner and Ousley to determine if it works in an independent sample of Mexican individuals.¹ The decision tree method addresses issues of standardization and uses trait frequencies of the Anterior Nasal Spine (ANS), interorbital breadth, Inferior Nasal Aperture (INA), nasal aperture width, and nasal bone contour to differentiate between White, Black, and Hispanic individuals.

For this research, these five morphoscopic traits, utilized in the Hefner and Ousley decision tree, were scored and utilized to estimate group membership by the decision tree model in a sample of 75 individuals from the Universidad Nacional Autónoma de México Collection, housed at the Departamento de Anatomía, Facultad de Medicina collected previously in research by Villegas-Camposeco.^{1,2} The collection is comprised of contemporary mestizo individuals from Mexico City (1990–2010 date of death) that are unclaimed bodies from forensic, public hospitals, psychiatric institutions, and shelters. A subsample of 20 individuals was scored by the first observer, with six months between scoring events, to test intra-observer error, then by a second observer to test inter-observer error using the Intraclass Correlation Coefficient (ICC) and weighted Kappa (*wK*).

Classification accuracy using the decision tree was low at 18.7%. Within the decision tree, INA must always be a score of 2 (moderate sloped) or 3 (straight), and the ANS must be 3 (pronounced) to classify as Hispanic; however, in this sample, most individuals only showed a slight (score 1) or intermediate (score 2) ANS, and the INA scores varied from a pronounced slope (score 1) up to a pronounced sill (score 5). The variation in the degrees of expression of the features relies on greater frequencies for classification in the decision tree, which would not be considered a misclassification, but rather that it corresponds to the biological diversity of the population. Intra-observer agreement was moderate for all traits except the interorbital breadth (*wK*=.23), with scores typically increasing to a higher (wider) score when scored in the second observation (*n*=8). The inter-observer error was comparable with all agreements being good or excellent, again with the exception of the interorbital breadth (ICC=.27). In 75% of cases, the second observer scored the interorbital breadth as lower (more narrow) than the first observer.

In conclusion, the reliability results indicate general consistency on trait scoring among observers and is consistent with previous research, while the validity results suggest that the decision tree method developed by Hefner and Ousley using a Hispanic sample from the PIMA County Medical Examiner’s Office is not very accurate when applied to this Mexican sample and fails to encompass the range of variation in trait frequencies in this sample.¹ Despite the low classification accuracy with this sample, the trait frequencies are highly concordant with those reported in Hefner.³ These findings also corroborate previous findings by Hefner and colleagues concerning the “unique population histories” of Hispanic populations.⁴ Refinement of the decision nodes and a larger sample of Hispanic individuals may increase accuracy of the decision tree model in Mexican populations.

Reference(s):

1. Hefner J.T. and Ousley S.D. Statistical Classification Methods for Estimating Ancestry Using Morphoscopic Traits. *J Forensic Sci.* 2014; 59: 883-890.
2. Villegas-Camposeco B. *¿Tu origen, es mi origen? Frecuencia y variación de rasgos no-métricos craneales en población mexicana contemporánea.* Tesis de Maestría. Escuela Nacional de Antropología e Historia 2018.
3. Hefner J.T. Cranial Nonmetric Variation and Estimating Ancestry. *J Forensic Sci.* 2009; 54: 985-995.
4. Hefner J.T., Pilloud M.A., Black C.J., Anderson B.E. Morphoscopic Trait Expression in “Hispanic” Populations. *J Forensic Sci.* 2015; 60: 1135-1139.

Mexican Population, Ancestry Estimation, Hefner Decision Tree