A2 Improving Non-Metric Sex Classification for Hispanic Individuals

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After attending this presentation, attendees will understand how two commonly used non-metric sex estimation methods for the skull and pelvis perform when applied to Hispanic individuals.

This presentation will impact the forensic science community by providing new recalibrated equations that are population-specific and more appropriate than the original methods used with Hispanic individuals who are encountered in forensic contexts.

Forensic anthropologists are tasked with helping to identify Hispanic Undocumented Border Crossers (UBCs) that die during the journey into the United States; however, current techniques used by forensic anthropologists in the identification of unknown human skeletal remains have largely been created using United States Black and White samples. When applied to Hispanic individuals, these techniques often perform poorly.[1] The increase in migrant deaths at the United States-Mexico border in recent years has created the imperative need to validate methods using Hispanic samples or to create population-specific standards for Hispanic individuals. This research examines the classification accuracies obtained by the original Walker and Klales et al. methods using logistic regression equations for non-metric sex estimation and provides recalibrated population-specific equations.[2,3]

An experienced observer collected ordinal score data of the skull using the five Walker method traits and of the innominate using the three Klales et al. method traits. The sample consisted of 55 (28 females, 27 males) Hispanic individuals housed at the Forensic Anthropology Center at Texas State University. The majority of individuals are UBCs from the Center's on-going Operation Identification (OPID) project. The remaining individuals are from the Texas State University Donated Skeletal Collection. Individuals within the donated collection are positively identified and, therefore, have known demographic information. The demographic information from the OPID UBCs had to be inferred based on a number of variables, including DNA, FORDISC®, and associated artifacts.

Frequency distributions were calculated for each trait score by sex and a chi-square test was used to test for significant differences in score frequencies between the two sexes. The scores for each individual were then entered into the original logistic regression equations provided by the Walker and Klales et al. methods to test the validity of the original equations for this sample of modern Hispanic individuals. Next, the equations were recalibrated to generate population-specific regression formulas for Hispanics, as both original publications give equations developed using only White and Black individuals. Classification accuracies between the validation and recalibration tests were compared to determine if population-specific formulas are more appropriate for Hispanic individuals.

Males and females differed significantly in score frequencies for all traits at the $p > 0.05$ level. Using the fourth Walker method, combined classification accuracy was 81.8% (females 71.4%, males 92.6%). The disparity in classification between males and females regarding the skull indicates a high sex bias (21.2%) in favor of males. Overall accuracy for combined sexes using the Klales et al. method was 87.5% (females 91.7%, males 83.3%). The disparity in classification between males and females indicates a low sex bias in favor of females (-8.4%).

Recalibration of the Klales et al. equation improved accuracy (87.5% vs. 91.7%), while recalibration of the Walker method equation decreased accuracy (81.8% vs. 74.5%), but greatly reduced sex bias (21.2% vs. -8.2%).

In conclusion, classification accuracy and sex bias improved for the innominate when using the recalibrated regression equations specifically for Hispanic individuals. These results are not surprising given that similar results were obtained in another study using modern South African, Thai, and United States samples. Interestingly, the skull recalibration decreased overall accuracy in the current study; however, sex bias was reduced by 13%, thereby making the recalibrated equation more appropriate for use with modern Hispanics. Although the recalibrated equation performed worse, the original equation achieved a classification accuracy of only 81.8%, which is much lower than accuracy achieved by Walker in his original study. This study recommends placing greater emphasis on the results of the innominate rather than the skull due to the higher level of sexual dimorphism in this skeletal region for Hispanics.

Reference(s):

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2. Walker P.L. Sexing skulls using discriminant function analysis of visually assessed traits. *Am J Phys Anthropol.* 2008;136:39-50.
3. Klales A.R., Ousley S.D., Vollner J.M. A revised method of sexing the human innominate using Phenice's nonmetric traits and statistical methods. *Am J Phys Anthropol.* 2012;149:104-114.

Hispanic, Sex Estimation, Non-Metric