A41 Craniometric Variation and Sexual Dimorphism in a Chilean Population

Rachel M. Kreher, BS, University of Indianapolis Biology Department, Indianapolis, IN 46227; Krista E. Latham, PhD, University of Indianapolis, Indianapolis, IN 46227; Stephen P. Nawrocki, PhD, University of Indianapolis, Indianapolis, IN 46227-3697*

Learning Overview: After attending this presentation, attendees will better understand the strengths and weaknesses of using FORDISC® to analyze Chilean crania. The learning objectives include better understanding of human biological variation in a Latin American subgroup and how the accuracy of sex determination can be improved in forensic contexts.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by illustrating that not all Hispanic populations in the New World are skeletally identical, so existing analytical methods must be carefully assessed prior to application.

This research tests the following null hypotheses: (1) there are no significant differences between Chilean males and females in standard cranial measurements; (2) these measurements are not affected by age at death; and (3) Chileans do not differ from other Hispanic reference samples in FORDISC®v.3.1.

In the United States, many sex and ancestry determination methods used by forensic anthropologists are based on White and Black reference populations, but these methods may not work well on other populations. "Hispanic" individuals of Spanish (Iberian) and Latin American descent are especially underrepresented. In Chile, accurate sex determination is crucial in forensic investigations as the country continues to address prior genocides and experiences a recent influx of migrants from surrounding countries. This research examines whether currently available methods can accurately determine sex of Chilean crania, specifically investigating the application of discriminant analysis via FORDISC® to determine whether the program's Hispanic reference sample adequately represents modern Chileans.

A total of 27 standard cranial measurements were taken for 250 specimens from the Cementerio General Collection located at the Universidad de Chile and the Servicio Médico Legal in Santiago, Chile. The modern sample includes known adult males and females aged ~16–80+ years who died in the 1950s–1990s. All measurements were first analyzed with Analysis of Covariance (ANCOVA) to determine which vary significantly by sex and/or age. Subgroup means were generated for each sex for comparison to the reference samples. The Bonferroni correction was applied to reduce the probability of Type I (false positive) errors in the ANCOVAs. Each specimen was then entered into FORDISC® and subjected to a 9-subgroup discriminant analysis using the White, Black, American Indian, Hispanic, and Guatemalan reference samples. A stepwise selection of 15 variables was employed to ensure that a sufficient number of measurements were included without over-fitting the model. Primary ancestry/sex classification was recorded in addition to relevant distance values and classification probabilities. For the purposes of this study, "Hispanic" and "Guatemalan" classifications were both considered to be "correct."

Of the 27 cranial measurements, 20 differed significantly between the sexes, with males being larger in all cases. Age at death was significant for only four measurements, but, in each case, the effects of age were much less important than the effects of sex. Therefore, discriminant equations for determining sex can reasonably disregard the age of the decedent.

Only 32% of the Chileans were classified correctly by FORDISC® into their proper ancestry/sex subgroup; 39% of Chilean females were classified as Hispanic females, while 26% of Chilean males were classified as Hispanic or Guatemalan males. The most common ancestry groups assigned to Chilean females were Hispanic (41%), White (29%), and Black (25%); for Chilean males, Hispanic/Guatemalan (36%), White (26%), and Black (24%) were the most common assignments. Ignoring ancestry, 97% of Chilean females were classified as female, while only 55% of Chilean males were classified as male. This disparity suggests that the entire Chilean sample is systematically smaller than FORDISC's® Hispanic reference sample. Comparisons of the Chilean means by sex with those of Hispanics in FORDISC® indicate that Chilean females are smaller than their FORDISC® counterparts in 24 measurements and Chilean males are smaller than their FORDISC® counterparts in 22 measurements. These differences explain the high and low classification rates for Chilean females and males, respectively: because *all* Chileans are smaller than the reference samples, they are disproportionately classified as female.

In sum, despite their overall smaller size, modern Chileans display enough sexual dimorphism that tailored discriminant equations should work well for forensic anthropologists. These findings reinforce the need for a population-specific understanding of body size and sexual dimorphism prior to applying sex and ancestry determination methods, especially given the wide range of geographical and biological variation collected under the umbrella designation of "Hispanic."

FORDISC®, Chilean Craniometrics, Sex Determination