A57 Comparing Socio-Economic and Population-Level Differences and Quantifying Their Impact on Subadult Age Estimations

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The goal of this presentation is to inform attendees on the impacts of socio-economic and population differences on growth and development markers and, subsequently, subadult age estimation. A comparison of diaphyseal dimensions and dental formation from individuals between birth and ten years of age from two economically and genetically diverse countries will advise forensic practitioners on the potential utility of global, rather than population-specific, models.

This presentation will impact the forensic science community by providing insight into the developmental onset of economic and population differences and at what age the differences need to be considered prior to estimating a subadult biological profile.

Subadult age estimation is usually the sole contribution to the subadult biological profile. It is regularly stated that there need to be population-specific methods; however, it is not known at what age the population differences become apparent, or at least influential, to age estimations. Similar to population differences, another concern is the socio-economic status of reference groups. Growth data is recognized as being heteroscedastic, meaning that as individuals increase in age, the variation also increases. Based on the nature of heteroscedastic data, if there are minimal differences in the first few years of life, it should be possible to build global models, or apply models derived from one population and to others. The purpose of this study is to compare the skeletal and dental formation of two economically and genetically diverse populations as a means to determine if differences in growth and development exist and, if so, to quantify their magnitude.

Long bone lengths and dental formation stages for the maxillary and mandibular first and second molar were collected from a modern sample of subadults from South Africa and the United States. Individuals were between the ages of birth and ten years of age. First, simple visualizations were used to display the growth and development trends for each age indicator and variable per population. Second, point estimates were created for each individual variable using multivariate adaptive regression splines and age as the response variable. Ranges and means of the differences between the fitted values and true chronological age provided insight into the accuracy of each variable. By visualizing the discrepancies between the estimated ages based on dental formation and long bone length, we can also obtain an idea of which variable is more or less sensitive to the environment and/or population differences.

Visual comparisons confirmed very similar trends for long bone lengths and molar development, especially in the youngest individuals (<5 years). Differences between the groups increase as age increases. In the youngest ages, South African subadults have longer diaphyseal dimensions than their United States counterparts. As age increases (~3-4 years) of age), the median values become more similar and eventually the United States subadults (>6 years) exceed the South African children. Mean differences for the estimated and true chronological age in the regression models is close to zero for both South African children and United States children for the femur diaphyseal lengths (-0.02, -0.003, respectively) and the first molar (-0.04, -0.03, respectively). No differences were found when dental age and skeletal age were visualized to explore differential sensitivities; there was an even spread of predicted age both below and above the ideal fit line.

The findings of this study prove that minimal skeletal and dental differences are expressed in economically and genetically diverse young, modern subadults, which suggests anthropologists could apply methods developed on one population to other populations. The results will substantially impact the field, considering the paucity of modern skeletal remains around the world from which to derive population-specific methods. Furthermore, by increasing the application of scientifically and statistically sound techniques, we can also increase the number of positive identifications.

Diaphyseal Dimensions, Dental Formation, MARS

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