H16 Stature Estimation in Modern Thais: Are Population-Specific Estimation Equations Necessary?

Ani N. Hatza, BA, Mercyhurst Univ, Dept of Applied Forensic Sciences, 501 E 38th St, Erie, PA 16546; Stephen D. Ousley, PhD, Mercyhurst Univ, Dept of Applied Forensic Sciences, Dept of Anthropology, 501 E 38th St, Erie, PA 16546; and Panya Tuamsuk, MD, Khon Kaen Univ, Dept of Anatomy, Faculty of Medicine, Khon Kaen, 40002, THAILAND*

After attending this presentation, attendees will understand why the development and use of separate stature estimation equations for different ancestral groups are necessary in forensic anthropology.

This presentation will impact the forensic science community by demonstrating that the stature estimation accuracy of linear regression equations developed for a given population declines when applied to a different population, in this case the Thai. Additionally, this presentation provides new stature estimation equations developed specifically for modern Thai individuals, a group that until recently has been largely overlooked with respect to stature estimation studies.

Stature estimation is one aspect of a biological profile utilized by forensic anthropologists to assist law enforcement with the identification of unknown human remains. The use of population-specific stature estimation equations by forensic anthropologists increases the precision and accuracy of stature estimations and of identifying an unknown individual who is thought to come from a particular population. The *Daubert* standard requires forensic anthropologists to demonstrate the scientific validity of their methodologies through empirical testing, peer review and publication, and calculating error rates. External validity must be tested and is a requirement when procedures based on one population are applied to another population. Modern Thai males and females exhibit average statures that are considerably smaller than those of American Blacks and Whites, and Hispanic males. Mean stature for Thai males is approximately 165cm, while that of American Black males is 175cm, American White males is 176cm, and Hispanic males is 170cm; Thai females have a mean stature of approximately 155cm, whereas the mean stature for American Black and White females is 164cm.[1] For this reason, the development of population-specific stature estimation linear regression equations appears necessary.

To date, two stature estimation studies have been published for the modern Thai.[2,3] The Mahakkanukrauh study was performed on a sample from Chiang Mai, Thailand, in the northwestern region of the country. The authors noted that their linear regression equations produced unusually high standard errors, particularly with respect to the female equations. The Pureepatpong study was based on a sample population from Bangkok, located in southern Thailand. The linear regressions proposed in the Bangkok study had lower standard errors and higher R^2 values than the Chiang Mai regressions; however, the Bangkok sample population exhibited lower mean statures and limb lengths than both the Chiang Mai sample and the current study's sample population.

The lengths of five long bones (femur, tibia, humerus, radius, and ulna) were collected from 106 modern Thai at the Khon Kaen University Hospital, Thailand. Outliers were removed and linear regression formula and prediction intervals for stature were calculated using *R*.[4] Additionally, regression equations in FORDISC 3.1 based on American White, American Black, and Hispanic populations were applied to the Thai sample.[1] Results showed that the femur is most highly correlated with stature in both males and females, as in other studies, and therefore provides the best single bone stature estimation equations. Compared to the results of the previous Thai stature studies, the results of the current study produced the lowest standard errors and highest R^2 values. 90% prediction intervals at the mean using bicondylar femur length and maximum femur length, respectively, were 160.3cm to 168.9cm for Khon Kaen males and 150.3cm to 161.1cm for Khon Kaen females.

Upon comparison, estimation of Thai stature using the FORDISC 3.1 linear regressions resulted in lower R^2 values, higher standard errors, and wider prediction intervals across the board. Black equations for males and females underestimated Thai stature overall, whereas the White and Hispanic equations tended to overestimate Thai stature. Larger prediction intervals sacrifice precision for greater accuracy; however, in a forensic context, accurate but imprecise stature estimations are not as useful to law enforcement officials. These findings indicate that although stature prediction equations that were intended for use on a different population will work, these estimates will contain greater error, especially when moving farther away from the sample mean.

References:

1. Jantz RL, Ousley SD. FORDISC 3.1: personal computer forensic discriminant functions. Knoxville (TN): The University of Tennessee, 2010.
2. Mahakkanukrauh P, Khanpetch P, Prasitwattanseree S, Vichairat K, Case DT. Stature estimation from long bone lengths in a Thai population. Forensic Sci Int 2011 May;210:279.e1-279.e7.
3. Pureepatpong N, Sangiampongsa A, Lerdpipatworakul T, Sangvichien S. Stature estimation of modern Thais from long bones: a cadaveric study. Siriraj Medical Journal 2012;64(Suppl 1):S22-S25.
4. R Development Core Team. R: a language and environment for statistical computing. R Foundation for Statistical Computing. Retrieved from: http://www.R-project.org, 2012.

Stature Estimation, Linear Regression, Southeast Asians

 ** Presenting Author*