A84 Evaluation and Reformation of Osteometric Data in Forensic Anthropology: The Foundations of DCP 2.0

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After attending this presentation, attendees will be aware of "problem" skeletal measurements and informed about error rates associated with measurements that interface with the FORDISC® program. This presentation will also introduce a new version of a popular laboratory manual: *Data Collection Procedures for Forensic Skeletal Material 2.0.*

This presentation will impact the forensic science community by addressing recommendations of the 2009 National Academy of Sciences (NAS) Report, Strengthening Forensic Science in the United States: A Path Forward. Specifically, the NAS Report stressed the need for "rigorous systematic research to validate the discipline's basic premises and techniques." This foundational research investigates the reliability, accuracy, and validity of forensic methods (Recommendation 3) and seeks to assist in the effort to establish valid and reliable methods and protocols that will serve as proficiency testing, training, and certification (Recommendation 6).

Many methods and techniques in forensic anthropology employ osteometric data as their basis, but little work has been done to investigate the error rates associated with these measurements. Metric data form the basis of the FORDISC® program used to develop a biological profile of unknown remains. Metric data also provide a straightforward means to quantify error; therefore, their use in forensic casework is increasingly common, particularly in light of the judicial atmosphere since *Daubert* (1993). Many components of a forensic anthropology case report are derived from osteometric data (i.e., sex, ancestry, stature). As such, error associated with any method that employs these data is compounded by the error that is inherent in the measurement(s), whether a function of the observer, the instrumentation, or both. Documented error rates will provide a foundation from which to proceed with metric estimations of the biological profile components, as well as method development.

Data collection was done on William M. Bass Donated Collection skeletons at the University of Tennessee. Four observers took 78 standard (34 cranial and 44 postcranial) and 20 less commonly used measurements on a sample of 50 skeletons using sliding calipers, spreading calipers, an osteometric board, and a mandibulometer; one observer repeated the measurements on the 50 skeletons three times with a two-month time lapse between sessions. Instruments were calibrated daily with a calibration rod. Absolute and relative Technical Error of Measurement (TEM), Scaled Error Index (SEI), percent error, and one-way and repeated measures Analysis of Variances (ANOVAs) were used to assess the degree of inter-observer and intra-observer error for each measurement.

Results indicate that maximum lengths and breadths have the lowest inter- and intra-observer values across the board (SEI values <2.0, relative TEM values <4.0, percent error <2%, and non-significant ANOVAs at α=.05). The ten most reliable measurements are maximum femur length, bicondylar femur length, maximum humerus length, maximum fibula length, bizygomatic breadth, maximum ulna length, maximum clavicle length, maximum radius length, biauricular breadth, and scapula height. The 12 most unreliable measurements are ischium length, mastoid height, breadth of mandibular body, pubis length, interorbital breadth, vertical diameter of clavicle, proximal epiphyseal breadth of tibia, sagittal diameter of clavicle, transverse diameter of first sacral segment, transverse subtrochanteric diameter of femur, anterior sacral breadth, and A-P subtrochanteric diameter of femur (SEI values >2.0, relative TEM values >4.0, percent error >2%, and significant ANOVAs at α=.05). Alternative maximum/minimum midshaft diameters were assessed as options to positionally dependent measurements such as sagittal and vertical clavicle diameters, dorso-volar and transverse ulna diameters, diameters at the nutrient foramen of the tibia, and sagittal and transverse radius diameters. The alternatives for the clavicle and ulna were found to be considerably more reliable than their aforementioned counterparts.

These results support an earlier report on inter-observer error of 22 postcranial measurements (Adams and Byrd) and have implications for forensic anthropology practice and research.[1] At the extreme, this study suggests that some measurements should be abandoned or replaced with more reliable alternatives if they are to be used in case analyses and method development. Others must be clearly explained and accurately translated in the available laboratory manuals. *Data Collection Procedures 2.0* will provide error rates for all measurements that interface with the FORDISC® software and include more reliable options for "problem measurements." In addition, the new manual will clarify problematic definitions, include updated images, and interface with upcoming versions of the Forensic Data Bank and FORDISC® software.

Reference:

1. Adams, B.J. and J.E. Byrd 2002 Interobserver variation of selected postcranial measurements. *J. Forensic Sci.* 47(6):1193–1202.

Osteometric Data, Observer Error, FORDISC®