## A102 An Examination of the Relationship Between Intrinsic Properties of Bone and Skeletal Element Recovery

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After attending this presentation, attendees will better understand which intrinsic skeletal factors have the greatest influence on the likelihood of skeletal recovery and how the relative importance of such factors varies across different taphonomic environments.

This presentation will impact the forensic science community by contributing to the development of methods for skeletal quantification and by informing field recovery of skeletal remains.

Skeletal assemblage recovery rates are important for estimating the number of individuals present and assessing the amount of skeletal attrition that has occurred, both for individual cases and larger assemblages. This presentation will examine the relationship between intrinsic skeletal properties and variation in skeletal element recovery rates.

A better understanding of the factors that influence recovery rates will assist the forensic science community in continuing to develop methods for skeletal quantification. Furthermore, evaluating the interaction between intrinsic skeletal properties and external taphonomic processes can assist in anticipating challenges in recovering certain elements in the field, as well as aid in selecting appropriate samples in research design.

This project addresses the hypothesis that skeletal attrition is non-random with respect to intrinsic properties of skeletal elements. Furthermore, the relationships between these intrinsic properties and skeletal recovery may be affected by variations in taphonomic processes.

Skeletal inventories were collected from the Forensic Data Bank (University of Tennessee), New York City Office of the Chief Medical Examiner forensic anthropology (NYC OCME) cases, and a subset of carnivore-scavenged cases from the California State University, Chico Human Identification Laboratory (CSUC HIL). Bone mass and length data were collected from the CSUC HIL skeletal teaching and donated cases collections and NYC OCME cases. Bone mineral density data for the six major long bones were obtained from the literature.[1] Inventories and bone mass and length data included 12 major appendicular skeletal elements.

Mass, length, and mineral densities were converted to ratios to account for inter-skeletal differences and to facilitate comparison. In cases in which a single element was bilaterally absent, imputation was performed using regression on the element with the highest correlation to the element missing. Mass and length data were not collected from cases with more than one element bilaterally absent. Counts for each element were converted to recovery rates using Perl; Pearson's correlations between recovery rates and property ratios were computed in R.

Comparison of mineral density, mass, and length for the long bone subset revealed significant correlation ($p < 0.05$) of recovery probability with mineral density and mass for all three datasets. Correlations were higher for mass than mineral density for the CSUC HIL ($r^2=0.95$ vs. 0.93) and NYC OCME ($r^2=0.92$ vs. 0.88) datasets, while mineral density revealed the highest correlation for the Forensic Data Bank ($r^2=0.95$ vs. 0.86). Comparison of mass and length for all 12 elements demonstrated a significant correlation of recovery probability with mass for the NYC OCME dataset ($p=0.046$, $r^2=0.58$) and recovery probability with length for the Forensic Data Bank ($p=0.0024$, $r^2=0.79$). All other correlations were not significant.

The hypothesis that intrinsic properties of skeletal elements affect skeletal attrition in a non-random fashion was supported. The secondary hypothesis that variations in taphonomic environment will influence the relative impacts of these properties was not well supported. Bone mass was the predominant factor for both the NYC OCME and CSUC HIL datasets, which were affected by very different taphonomic processes. The results of this study suggest that durability may affect element attrition more than size, even when taphonomic processes are widely varied.

**Reference(s):**

1. Kendell A., Willey P. Crow Creek Bone Bed Commingling: Relationship Between Bone Mineral Density and Minimum Number of Individuals and Its Effect on Paleodemographic Analyses. In: Osterholtz A., Baustian K.M., Martin D., editors. *Commingled and Disarticulated Human Remains: Working Toward Improved Theory, Method, and Data.* New York: Springer, 2014: 85-104.

**Skeletal Quantification, Taphonomy, Commingled Remains**