H46 Quantification of Commingled Human Skeletal Remains: Determining the Most Likely Number of Individuals (MLNI)

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Attendees will learn about a new technique (MLNI) that can be used to estimate the actual number of individuals represented by a commingled assemblage of human skeletal remains. This technique may be more useful to forensic anthropologists than methods currently employed.

This presentation will impact the forensic community and/or humanity by describing a new technique for the quantification of commingled human skeletal remains. Case examples will be used to demonstrate the utility of the technique.

Most anthropologists rely on the Minimum Number of Individuals (MNI) for the quantification of commingled human remains. In its most common application, the MNI is derived by simply counting the most frequently observed element or element portion (e.g., proximal right femur). As the name indicates, this estimate represents the *minimum* number of individuals necessary to be represented by the skeletal assemblage. In cases where the recovery of major skeletal elements is near 100%, this estimate will be reasonably accurate. In situations where element recovery is not complete due to various taphonomic forces, the MNI may present misleading estimates regarding the *actual* number of individuals. As an alternative, a technique is described which can provide more realistic values of the true number of dead.

The Lincoln Index (LI) is a method that will provide more accurate estimates of the *original* number of individuals represented by a commingled osteological assemblage, especially when random loss of skeletal elements has occurred. A critical step in the use of the LI is pair matching of homologous bones (e.g., right and left femora) to determine if they come from the same individual. For calculation of the LI, the total number of rights (R), the total number of lefts (L), and the total number of pairs (P) are used for any paired element. In its most basic format, the LI is calculated as N = L*R/P.

A minor modification by Chapman (1951) was recommended to account for potential bias with the LI. The modified equation is simply N = [(L+1)(R+1)/(P+1)]-1. The integer value produced by this equation is referred to as the Most Likely Number of Individuals (MLNI). By using the hypergeometric distribution (available in such programs as Excel™ spreadsheets) it is possible to provide confidence intervals around this value. (See http://konig.la.utk.edu/MLNI.html for more information.) As long as accurate pair matching of elements can be accomplished, the MLNI provides unbiased number estimates that reflect the actual population represented by the commingled skeletal assemblage. The MLNI can be calculated from a single element type (e.g., femur), or multiple paired elements (e.g., femur, humerus, and tibia) can be used together to derive an estimate of population size.

An example is provided using a protohistoric massacre site (Larson Village). Numerous lodge features at this site contained well-preserved commingled remains. Analysis of one of the lodges revealed that there were 43 left femora and 36 right femora, of which 31 femur pairs could be found. The MLNI estimate based solely on these femora is 49 individuals, with an approximate 95% confidence interval ("highest density region") of 48-54 individuals. A combined estimate using the pair-matching results for the tibia, os coxa, humerus, and femur is an MLNI value of 50, with an approximate 95% confidence interval of 48-52 individuals. The MNI for this example is only 43.

The MLNI technique could be easily applied to modern forensic contexts and these figures will provide number estimates that are of much greater interpretive value than the MNI counts.

Lincoln Index, Commingling, Statistics

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