A51 The Application of Standardized Skeletal Inventory Methods to Fragmented Subadult Cranial Remains

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Learning Overview: After attending this presentation, attendees will have gained awareness of the importance of critically assessing standardized adult-based skeletal inventory methods when applied to subadult cranial remains.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by: (1) considering the utility of methods developed for mature skeletal remains when applied to subadults, and (2) recommending modifications to existing skeletal inventory methods when applied to subadult cranial remains.

Standardized inventories are integral for accurate skeletal assessments, including estimation of the Minimum Number of Individuals (MNI) for an assemblage. While previous research suggests that standardized methods perform nominally for mature skeletal remains, they have not yet been tested on subadult remains. Because subadult remains are less developed, it is expected that morphological traits may not be easily discerned; therefore, subadult remains will be more difficult to quantify.

Because subadult skeletal development progresses in predictable stages, this research assesses standardized inventory methods for different age classes of fragmented, subadult cranial remains. Skeletal remains were examined from previously analyzed bioarchaeological collections housed at the Carnegie Museum of Natural History. The remains are associated with Early–Middle Woodland and Monongahela sites in Western Pennsylvania. They were recovered from various burial contexts in fragmented and sometimes commingled conditions. The remains were segregated and MNI was established by previous analysts using traditional techniques, including burial context, dental formation and eruption, and epiphyseal union.

For the current study, the cranial remains from 33 subadult burial features were assessed using the landmark and zonation methods. The individuals were categorized as infant (0–1 years, n=17), young child (1–6 years, n=9), older child (7–12 years, n=3), and adolescent (13–16 years, n=4). Each set of cranial remains was assessed for the presence of zones (cranial zones 1–15; mandibular zones 1–14) and landmarks (cranial landmarks #1–#52; mandibular landmarks #53–#65). The zones represent individual cranial bones (e.g., cranial zone 3, right parietal) and portions of the mandible (e.g., mandibular zone 1, left horizontal ramus), while landmarks refer to specific features on a bone (e.g., #14, right parietal eminence or #56, left mental foramen).

Among infants, the zonation method (n=16) outperformed the landmark method (n=15), but neither method identified all 17 infants. Duplicate left petrous portions (#45) were identified in one set of remains, suggesting inaccurate segregation or a higher MNI than previously determined. Some elements, such as parietal bones, could not be identified by zones or landmarks due to the absence of developed morphology. Additionally, small elements, such as nasal bones, palatines, and vomers, were not identified. Among all other age classes, both the zonation and landmark methods resulted in the expected MNI. Among young children, parietal bones displayed diagnostic morphology consistent with zones and some landmarks, but small elements were still not easily identified. Among older children and adolescents, developed features were identifiable, and the expected individuals were represented by multiple zones and landmarks.

While both methods can be used to inventory fragmented subadult cranial remains accurately and assist in the resolution of commingling, the zonation method permits more flexibility using criteria that may not be represented by the landmark method. However, the zonation method is more subjective and does not provide a clear way to account for overlapping portions of fragments within the same zone. The landmark method relies on bone features that may be unidentifiable or underdeveloped in subadult skeletal remains. For example, while an analyst may recognize a parietal fragment by the presence of meningeal grooves and striae, these features are not part of the landmark system. If the parietal eminence, inferior temporal line, and squamosal suture are underdeveloped, parietal fragments risk being unidentified. Additionally, several landmarks are foramen (e.g., #39, foramen magnum), which may be difficult to identify among subadults due to the absence of fusion (e.g., between the occipital condyles, #40/41 and basicranium). Therefore, several modifications are recommended for the landmark method when applied to subadult remains.

Subadult Skeletal Remains, Zonation, Landmarks