

Available normative references of [cranial bone](#) development and [suture fusion](#) are incomplete or based on simplified assumptions due to the lack of large [datasets](#). Liu et al. presented a fully data-driven normative model that represents the age- and sex-specific variability of [bone shape](#), [bone thickness](#), and [bone density](#) between birth and 10 years of age at every location of the [calvaria](#).

The model was built using a cross-sectional and multi-institutional pediatric computed tomography image dataset with 2068 subjects without cranial pathology (age 0-10 years). They combined principal component analysis and temporal regression to build a statistical model of cranial bone development at every location of the calvaria. They studied the influences of sex on [cranial bone growth](#), and the bone density model allowed quantifying for the first time [suture fusion](#) as a continuous temporal process. They evaluated the predictive accuracy of our model using an independent longitudinal image dataset of 51 subjects.

The model achieved temporal predictive errors of 2.98 ± 0.69 mm, 0.27 ± 0.29 mm, and 76.72 ± 91.50 HU in cranial bone shape, thickness, and mineral density changes, respectively. Significant sex differences were found in [intracranial volume](#) and bone surface areas ($P < 0.01$). No significant differences were found in the [cephalic index](#), [bone thickness](#), [mineral density](#), or [suture fusion](#).

Liu et al. presented the first pediatric age- and sex-specific statistical reference for local cranial bone [shape](#), [thickness](#), and [mineral density](#) changes. They showed its predictive accuracy using an independent longitudinal dataset, they studied developmental differences associated with sex, and quantified suture fusion as a continuous process ¹⁾.

¹⁾

Liu J, Elkhil C, LeBeau S, French B, Lepore N, Linguraru MG, Porras AR. Data-driven Normative Reference of Pediatric Cranial Bone Development. *Plast Reconstr Surg Glob Open*. 2022 Aug 10;10(8):e4457. doi: 10.1097/GOX.0000000000004457. PMID: 35983543; PMCID: PMC9377678.

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