The Subadult Virtual Anthropology Database and KidStats:
Improving the Subadult Biological Profile

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SUMMARY
The Subadult Virtual Anthropology Database (SVAD) is comprised of metric and morphological data collected from computed tomography (CT) scans of ~5,000 individuals from eight countries. The data source facilitated the development of graphical user interfaces (GUIs) that translate novel methods into easy applications. KidStats currently houses three freely available GUIs. Virtual anthropology, open science initiatives, and free software have collectively advanced our knowledge of the subadult skeletal system and increased the ability to investigate immature remains.

Keywords: age estimation, sex estimation, stature estimation

Introduction
Subadults are an under-represented group in modern cadaveric and donated skeletal collections. Subsequently, method development and validation has been limited, which impacts the ability of the forensic anthropologist to facilitate a positive identification. Virtual anthropology provides an avenue to mitigate limitations with skeletal collections. The SVAD is comprised of metric and morphological data collected from CT scans of ~5,000 individuals between the ages of birth and 22 years and eight countries (Brazil, United States, Colombia, Taiwan, Netherlands, France, Angola, South Africa).

Objectives
The current study will introduce SVAD, KidStats, and the three GUIs that estimate subadult age, sex, and stature.

Methods
Three GUIs have been developed to estimate components of the subadult biological profile and are freely available in KidStats. The MCP-S-Age estimates age for individuals from birth to 22 years using diaphyseal dimensions, epiphyseal fusion, and dental development. KidStats: Stature estimates stature for individuals between birth and 21 years of age using diaphyseal lengths and breadths. OnSEt: The Ontogenetic Subadult Sex Estimation System estimates subadult sex using epiphyseal fusion and morphological indicators of the innominate and cranium.

Results and Discussion
Testing of these GUIs and their underlying methods demonstrate high accuracy (>90%) and precision for estimates of the subadult biological profile. KidStats, and specifically GUIs utilizing data from SVAD, facilitates estimation of subadult age, sex, and stature. The SVAD enables subadult research that was previously impossible. Ultimately, leading to increased understanding of human variation in growth, which in turn leads to improved methods, and the potential for an increased number of positive identifications.

Conclusion
Virtual anthropology has advanced the field of biological anthropology broadly, and SVAD has impacted our ability to develop new methods for the subadult biological profile. However, the application of the new methods is still dependent on ease of use. GUIs facilitate application of methods, and KidStats acts as a hub for subadult methods developed using SVAD.