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Standard for Stature Estimation in Forensic Anthropology

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Academy Standards Board
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Foreword

This standard was developed to provide guidance to practitioners for estimating stature from skeletal remains. Stature estimation is a component of the biological profile typically developed for comparison to the physical description of a missing person.

This standard was revised, prepared and finalized as a standard by the Anthropology Consensus Body of the AAFS ASB. This document is intended to assist forensic anthropologists when estimating stature from complete or partial skeletal remains. All hyperlinks and web addresses shown in this document are current as of the publication date of this standard.

Keywords: *stature estimation; biological profile; personal identification*

Table of Contents

Standard for Stature Estimation in Forensic Anthropology

1 Scope

Stature is one of several biological parameters that can be estimated from skeletal remains or radiographic images of skeletal remains. This standard describes methods for estimating stature from skeletal elements when disarticulation has occurred, rendering measured cadaver length unreliable. The methods in this standard are intended to provide a mathematically-based systematic manner of estimating stature and documenting the stature estimation process.

2 Normative Reference

There are no normative reference documents. Annex B, Bibliography, contains informative references.

3 Terms and Definitions

For purpose of this document, the following definitions apply.

3.2
anatomical method
A method of estimating stature that involves measuring all bones constituting the components of stature, summing those measurements, and correcting for the missing soft tissue.

3.3
biological profile
The description of an individual's estimated age, sex, ancestry, and living stature derived from an anthropological (skeletal) analysis.

3.4
cadaver length
The measured "stature" of a body after death.

3.5
linear regression method
Method of estimating stature based on a statistical procedure for describing a relationship between stature and bone dimension that can be used to predict the former from the latter.

3.6
living stature
A person's recorded height, which may be derived from various sources including self-reported stature, family remembrance, or direct measurement**.**

4 Requirements

4.1 General

Stature estimation shall follow methods that are published in peer-reviewed sources and validated. Stature estimates shall be reported as a prediction interval. Appreciation of the statistical foundations of the methods used provides an understanding of their advantages and limitations.

If one or more of the bones needed to apply a specific method are absent or in poor condition, the method shall not be used. Maximum length should not be estimated from fragmented bones.

Practitioners of forensic anthropology should implement this standard to the extent applicable, practical, and appropriate.

4.2 Procedure

4.2.1 General

Stature shall be estimated from the skeleton using one of two methods: anatomical or linear regression.

When more than one method is appropriate for the condition and representation of skeletal elements, the method with the smallest standard error should be used. Consideration should be given to the individual's known or estimated population of origin, sex, and temporal cohort.

Measurements shall be taken following method-specific definitions and/or measurement guidelines[1, 6, 7].

4.2.2 **Anatomical Method** (also known as Complete Skeletal Method)

The anatomical method involves estimating stature based on the sum of the vertical measurements of all bones that contribute to stature, along with a correction factor for soft tissue[3,9].

The anatomical method usually provides the most accurate estimate of an individual's living height. This method is recommended when the required skeletal elements are present and in good condition, ancestry and sex of the individual cannot be estimated, there is an anomalous number of vertebrae, or the individual's limb bones appear to be atypical in length.

4.2.3 Linear Regression Method

The linear regression method involves estimating stature based on the mathematical relationship between stature and bone dimensions[5,10].

Regression coefficients vary across ancestral population groups and by sex. If sex and ancestry are known, the equation for that population shall be used; otherwise, general formulae based on pooled data may be utilized.

Most linear regression methods are based on measurements of complete limb bones. Formulae also exist for fleshed body parts and non-limb bones, these methods may be used when validated.

4.2.4 Considerations and Adjustments

Stature may decrease with advancing adult age (often due to compression of vertebral bodies and/or disks, or changes in spine curvature). If age correction factors are utilized, both the corrected and uncorrected stature estimates shall be reported.

The source of the data used to develop the method (i.e., antemortem measured statures, cadaver lengths, or living statures) as well as the source of the reported height of the missing person should be considered to understand the inherent error of the method as well as potential bias.[2,8]

Pathological conditions, trauma, or other skeletal alterations may adversely affect stature estimation.

This standard is primarily applicable to adult skeletal remains; however, methods also exist for subadults.[8]

Exclusion of a positive match between an unidentified decedent and missing person should not be made solely based on a discrepancy between an estimated and living stature.

4.2.5 Reporting

To accommodate the range of normal variation between bone length and stature, a 90% (or greater) prediction interval should be reported. Reporting only a point estimate is unacceptable.

The results from multiple stature estimations shall not be combined into a single estimate unless explicitly outlined for the particular method.

NOTE Raw measurements shall be recorded and maintained.

Annex A
(informative)

Foundational Principles

Stature is one of several biological parameters that can be estimated from skeletal remains or radiographic images of skeletal remains. Stature estimation is based on a mathematical relationship between skeletal dimensions and stature (or height). An accurate stature estimate is dependent on using the appropriate model and accurate measurement of skeletal elements.

In the forensic setting, the estimated stature of an unidentified decedent often is compared to the height listed in a missing persons report, and used as a basis to either include or exclude the individual from further consideration. Stature alone should not be used as the basis for exclusion; possible matches with individuals of statures other than those reported should not be excluded without further investigation.

Annex B
(informative)

Bibliography

The literature presenting method development, method validation and case studies of stature estimation in forensic anthropology is extensive. The following bibliography is not intended to be an all-inclusive list or a robust literature review. The goal of the bibliography is to provide the full reference of any work cited in the standard and to provide one or two examples of publications focused on points addressed in the standard. Additionally, any mention of a particular software tool or vendor as part of this bibliography is purely incidental, and any inclusion does not imply endorsement.

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[1] Free to download at http://fac.utk.edu/wp-content/uploads/2016/03/DCP20_webversion.pdf

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