

# Criteria for age estimation in living individuals

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**Abstract** This paper presents updated recommendations of the Study Group on Forensic Age Diagnostics for age estimations in living individuals in criminal proceedings. In order to increase the diagnostic accuracy and to improve the identification of age-relevant developmental disorders, a physical examination, an X-ray examination of the left hand, as well as a dental examination including the determination of the dental status and an X-ray of the

dentition should be performed in each case. If the skeletal development of the hand is completed, an additional radiological examination of the clavicles should be carried out. Minimum requirements for reference studies are defined and recommendable studies are listed. Instructions for the examination and the preparation of expert reports are presented. The committee of the study group organizes annual proficiency tests for quality assurance.

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## Introduction

In many European countries, the growing migration into Europe and between European countries has led to an increase in the number of foreigners who cannot present documentary evidence for their date of birth. As a result of this development, age diagnostics of living individuals in criminal proceedings has become an essential part of forensic practice [3]. In many countries, the age limits of relevance in criminal proceedings are between 7 and 21 years [2].

A transregional analysis of the current state of forensic age estimation in living individuals in the German-speaking countries was conducted on the occasion of the “Xth Lübeck Meeting of German Forensic Physicians” in December 1999. At this meeting, it was suggested to set up a study group composed of forensic physicians, dentists, radiologists, and anthropologists. The aim was to develop recommendations for age estimations in order to standardize the, as yet rather, heterogeneous procedure in setting up expert reports and to implement quality assurance in this area. The interdisciplinary “Study Group on Forensic Age Diagnostics” was constituted in Berlin on March 10, 2000.

The present recommendations apply to age estimations in criminal proceedings for determining whether an individual is of criminally responsible age or whether adult criminal law is applicable. The first version of these recommendations was passed by the members of the Study Group on Forensic Age Diagnostics on September 15, 2000 [24]. The updated recommendations were adopted on March 14, 2008.

## Examination methods

The scientific basis of age estimation is the genetic control of ontogenesis, which delimits the temporal variation of developmental stages [8, 17]. The growth curves of monozygotic twins show a high degree of correspondence. Although a range of diagnostic procedures for age estimation is available [10, 18, 19, 27], only few of these appear to be suitable for forensic application in living individuals regarding the above-mentioned relevant age limits, if one takes ethical and medicolegal aspects into account.

There is a wide agreement about the most suitable methods currently available. They involve:

- physical examination with determination of anthropometric measures (body height and weight, constitution-
- al type), inspection of signs of sexual maturation as well as identification of any age-relevant developmental disorders
- X-ray examination of the left hand
- dental examination with determination of the dental status and X-ray examination of the dentition
- if the skeletal development of the hand is completed, an additional examination of the clavicles should be carried out, preferably by means of a conventional X-ray examination and/or a computed tomography scan [9, 28]

The methods should be used together to increase the diagnostic accuracy and to improve the identification of age-relevant developmental disorders. The legitimization of the X-ray examinations is to be checked in accordance with the regulations applicable in the respective country. Further radiological features for determining the individual maturation should only be considered, if the relevant radiographs and scans are already available [6, 23].

## Reference studies

A reference study evaluates data in a random sample using a specific method. A method in this context is the conversion of an ontogenetic process into a chronological scale.

Reference studies used for forensic age estimation should meet the following requirements:

- adequate sample size, considering the number of age groups and population groups included in the study
- proven age of the subjects
- even age distribution
- analysis separately for both sexes
- information on the time of examination
- clear definition of the examined features
- detailed description of the methods
- data on the reference population regarding genetic/geographic origin, socioeconomic status, state of health
- data on the sample size, mean value, and range of scatter for each examined feature

Examples of reference studies are [4, 5, 7, 12, 13, 15, 16, 21, 25, 29, 30].

## Examination

Before taking on an expert evaluation in an individual case, one should check whether the question(s) can be answered with a sufficiently high degree of reliability by using sound scientific methods. The examinations to be performed must be justified by a court order.

The individuals to be examined must be informed about the type of examination and its purpose. The court ordering the report must be notified that an interpreter may be required. Each part of the examination should be performed by a specialist experienced in setting up expert reports and participating in regular proficiency tests for quality assurance (see below).

When ionizing radiation is applied, the national regulations must be observed. From a scientific point of view, the so-called minimization principle is valid without restrictions. It requires to perform each examination as dose saving as possible and to dispense any exposition that is not mandatory. The coordinating expert has to give a comprehensive assessment on the basis of the different parts of the evaluation performed by the respective specialists.

### Expert reports

The central forensic aspect of an expert report is to give the most probable age of the examined individual and/or the degree of probability that the stated age is the actual age or that the individual's age is above the relevant penal age limit. The expert report has to quote the methods and reference studies the age estimation is based on. For each examined feature, the report must indicate the most probable age and the range of scatter of the reference population [20]. Furthermore, it should be noted that the range of tolerance may be increased by an empirical observer error. The age-relevant variations resulting from the application of the reference studies in an individual case such as deviating genetic/geographic origin, different socioeconomic status, and with that a possibly different degree of acceleration, developmental disorders of the individual, have to be discussed in the report including their effect on the estimated age and, if possible, a quantitative assessment of any such effect should be given [1, 11, 14, 22, 26].

The individual's most likely age is estimated on the basis of all partial diagnoses and a critical discussion of the individual case. When the age estimations based on the used methods are summarized, it can generally be assumed that the range of scatter is reduced. So far, however, this reduction could only be estimated. Depending on what is requested, it may be necessary to assess the legally relevant age limits and/or the probability of the age given in the court order verbally.

### Quality assurance

The committee of the study group organizes annual proficiency tests for continuing quality assurance. An

expert may also request an evaluation of an age estimation before the report is written.

The present recommendations are revised annually by the committee of the study group with regards to new scientific and practical results and updated if required. The updated version of the recommendations is available on the website of the study group (<http://rechtsmedizin.klinikum.uni-muenster.de/agfad/index.htm>).

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