

# Age estimation on pelvis x-rays

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Viola Bartolini <sup>1</sup>  
Vilma Pinchi <sup>1</sup>  
Barbara Gualco <sup>1</sup>  
Stefano Vanin <sup>2</sup>  
Giusto Chiaracane <sup>3</sup>  
Giovanni D'Elia <sup>4</sup>  
Gian-Aristide Norelli <sup>1</sup>  
Martina Focardi <sup>1</sup>

<sup>1</sup> Department of Health Sciences,  
Section of Medical Forensic  
Sciences, University of Florence,  
Italy

<sup>2</sup> Department of Biological  
Sciences, School of Applied  
Sciences, University of  
Huddersfield, UK

<sup>3</sup> Orthopedic Department, Azienda  
Ospedaliero-Universitaria Careggi,  
Florence, Italy

<sup>4</sup> Radiology Department, Azienda  
Ospedaliero-Universitaria Careggi,  
Florence, Italy.

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**Corresponding author:**  
[viola.bartolini@gmail.com](mailto:viola.bartolini@gmail.com)

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## ABSTRACT

**Introduction:** Age assessment in children and young adults is a relevant forensic issue. It is requested not only in evaluating criminal responsibility in youths without proper identification documents, often in relation to age thresholds, but also for release of a residency permit, and asylum seekers of minors. The pelvis, with focus on the iliac crest ossification, has been proposed as a useful tool for forensic age estimation. In the present study the Authors verified the utility and applicability in an Italian sample of three estimation methods based on the radiographic study of the pelvis.

**Materials and methods:** The Authors tested the Risser method in the two FR and US variants, and a staging system inspired by Kreitner and Kellinghaus methods (KK-MS); the applicability of an area measurement method (AM) based on Cameriere's approach was also evaluated. The three methods were applied on a sample of 497 AP pelvic radiographs taken from the Orthopedic Trauma Center of Careggi (Florence, Italy), and belonging to Italian individuals aged between 10 and 25 years.

**Results:** Each method showed high reliability for both reproducibility and repeatability. The KK-MS staging technique proposed by Kreitner and Kellinghaus is easier than the Risser method in applicability, as it is not affected by the variations of ossification. All subjects attained stage 3c of KK-MS and 5 of Risser Fr were > 14 years, suggesting the benefits of these methods for that age threshold. The applicability of the AM method ranged between 12 and 20 years, but the statistical analysis showed only a moderate correlation with age. In order to evaluate the possible use of this method is therefore necessary to clarify and exclude external factors influencing the parameter.

**Conclusions:** The iliac crest ossification is of interest in age estimation for forensic purposes. The methods tested may find a useful application in addition to the other common dental and skeletal methods for the fourteen year threshold. Given the ethical limits of radiographic exposition of the pelvis, radiographic methods are applicable whenever a pelvic x-ray is available. Other studies, with a wider and more standardized sample, are needed to verify the fulfillment of forensic requirements and to develop future methods based on radiation-free technics.