

# Prediction of adult height using Bone Age

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The commonly used methods of prediction of adult height in clinical practice are the Tanner-Whitehouse 2 (TW2) recently superseded by the TW3 method, and the Bayley-Pinneau (BP) method based on estimating the bone age using the Greulich and Pyle standards of skeletal maturation.

## Short stature (CDGP and GH deficiency)

Maes et al have suggested that the Bayley-Pinneau method may be preferable in boys with short stature with a small underestimate of 0.4 +/- 3.5 cm, whereas for girls the TW2 performed better again with a slight underestimate of 0.7 +/- 3.5 cm. In boys with constitutional growth delay of growth and puberty best results were found using the BP method where predicted adult height was within 5 cm of actual measured height in 67% of patients [Sperlich et al], although advocates for the TW2 method using single observers of bone age estimation claim that this method may predict adult height accurately to within +/- 2 cm in both untreated CDGP boys and also those receiving short courses (3 months) of low dose i.m. testosterone [Kelly et al]. The BP method may also be the most accurate for children with growth hormone deficiency performing better in boys [Cacciari et al]. However, national preferences often decide which height prediction method is employed.

## Tall Stature

Similar discussions have taken place in final height prediction in constitutionally tall children in the decision process as to whether growth limiting therapy should be considered. Generally height prediction is less accurate for tall compared with short children and even more inaccurate in boys. The BP method seems to give a reasonably accurate prediction in girls (mean error 2.3 cm or less) although the actual final height is over estimated in both sexes [de Waal et al]. TW2 and Index of Potential Height methods (where height SD score for bone age is assumed to be constant up to final height) systematically underestimated final height by 2.3-5.3 cm. All methods became more accurate in predicting adult height with increasing age.

The errors found in the prediction of adult height for children with short and tall stature suggests that as yet there is no single ideal method.

## Turner syndrome

Bone age predictions have also been applied to girls with Turner syndrome who have received growth hormone treatment. Again reports of outcomes using the different methods vary, citing predicted mean gains of 3.3 cm, range -4.7 to +12.1 cm [van den Broeck et al] and 7.7 cm, range 1.6 to 12.3 cm [Sas et al], but prediction of the long term response to growth hormone treatment seems best achieved using treatment parameters, most notably the first year growth response and the weekly growth hormone dose [Ranke et al].

## **Precocious puberty**

As most children with precocious puberty receive GnRHa treatment, controlled trials are not available. Evaluation of the performance of the BP method modified for Japanese children overestimated adult height achieved in CPP children unless an appropriate correction for children with advanced bone ages was applied (Tanaka et al).

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