PC PAL
Spring 2024

Child growth evaluation and charting – congress and news update

This series of newsletters draws on research presented during 2023 highlighting the value that accurate growth charts provide in the diagnosis and management of growth failure. PC PAL continues to work with specialists to provide a large number of specialised charts in a convenient digital format.

Defining optimal growth – translation into growth charts

Paediatricians rely heavily on growth charts as an accurate representation of optimal growth and tempo. However, the concept of optimal growth is problematic as discussed in a narrative review by Babette Zemel (1). Caution is needed in the interpretation of a growth chart based on the methodology behind its development. The distinction is made between 'descriptive' (or 'reference') charts which show the growth of children with little or no inclusion/exclusion criteria applied, and 'prescriptive' (or 'standard') charts where criteria are applied with the aim of describing 'optimal' growth.

Charting child growth is also problematic in cases of rare genetic conditions: statural height, body proportions, body composition and pubertal tempo can significantly vary from the 'healthy' population. Constructing representative growth charts is complicated by the uncertainty of whether the cause of abnormal growth is the genetic condition itself or associated problems. The data available for rare conditions are also limited and charts are only available for a few conditions.

Recently, improvements in medical care, and new treatments, for many conditions have led to improved childhood growth, questioning the relevance of existing disease-specific growth charts.

Down syndrome (trisomy 21) illustrates some of the difficulties in the construction and interpretation of disease-specific growth charts. Zemel describes the history of Down syndrome charts from the 1980s with later charts showing significant improvements in some growth parameters (see Figure 1). The use of BMI charts for this group of children has caused concern: the curves do not necessarily describe growth which might be achievable using optimal guidelines for Down syndrome patients. There is a danger of 'institutionalising' obesity in this group of children. The author recommends using normal population charts for weight and BMI in Down syndrome.

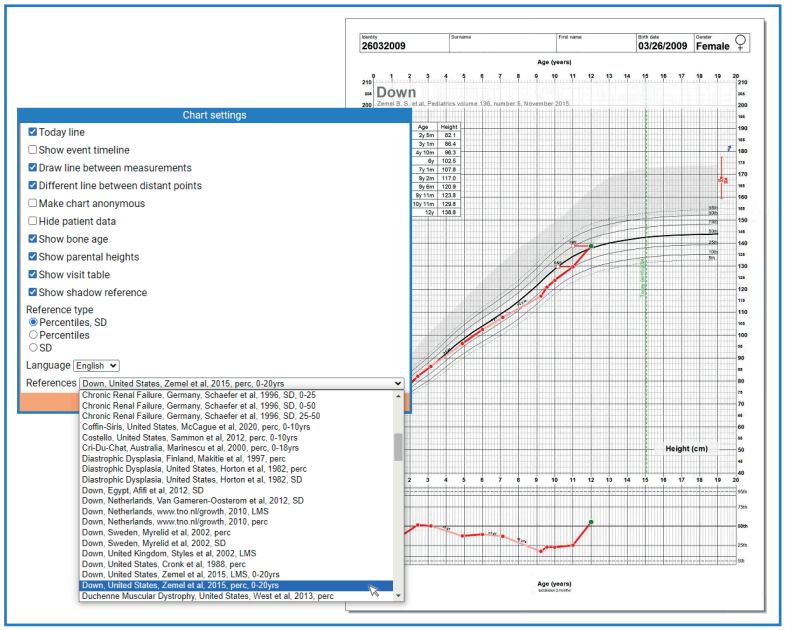

Figure 1. Down syndrome chart in the growth charting application, GrowthXP, showing the national reference options which allow users to find a growth reference relevant to their patient.

Congenital Adrenal Hyperplasia (CAH): disease-specific charts in the era of newborn screening

A previous newsletter in this series (Spring 2023) reported on the construction and value of CAH-specific growth charts in providing curves that describe the pattern and reduced final height of affected children. The growth observed assumed that children do not benefit from early treatment for CAH, which might be facilitated by newborn screening (NBS).

Hoyer-Kuhn *et al* report on a review of the German CAH registry which looked at the growth of children in relation to newborn screening (2). Of 600 patients with data on near-adult height (NAH) and target height, NBS was performed in 17% of the patients. In males, NAH was significantly better in those who received NBS than in the non-NBS cohort, but the benefit was not found in females.

The digital growth charting application, GrowthXP, includes the option of specific growth charts for over 50 rare disorders, including CAH. The application allows users to see a shadow plot of the unaffected, 'normal' population and this may be of particular value when plotting the growth of children with a condition which is treatable, such as CAH, where more appropriate forms of cortisol treatment may allow better growth compared to older treatments.

Disproportionate short stature

Children with skeletal dysplasia are commonly referred to paediatric endocrinologists due to associated short stature. Although each condition is rare, they have an overall prevalence of 1:4000. For the several hundred skeletal dysplasias, specific pharmacological treatments have been available for only a relatively small number with a metabolic lysosomal storage disorder. However, the number of treatable dysplasias is increasing. In recent years new treatments have been licensed for several conditions, including achondroplasia, hypophosphatasia and X-linked hypophosphatemia. In the light of these developments, the overview of the subject, intended for the practicing paediatric endocrinologist, by Legare and Basel is timely (3).

The authors provide a detailed description of the disproportions at different ages in affected children. They also advise a range of physical features which should trigger investigation of possible skeletal dysplasia. In the case of body disproportion, either elevated or decreased sitting height: total height ratio or a greater than 2cm difference between wing space and height (age 10 or later) are highlighted.

Relative sitting height (sitting height: standing height ratio) charts are available (see Figure 2). Relative sitting height is a valuable calculation to help identify body disproportion in short children affected by skeletal dysplasia.

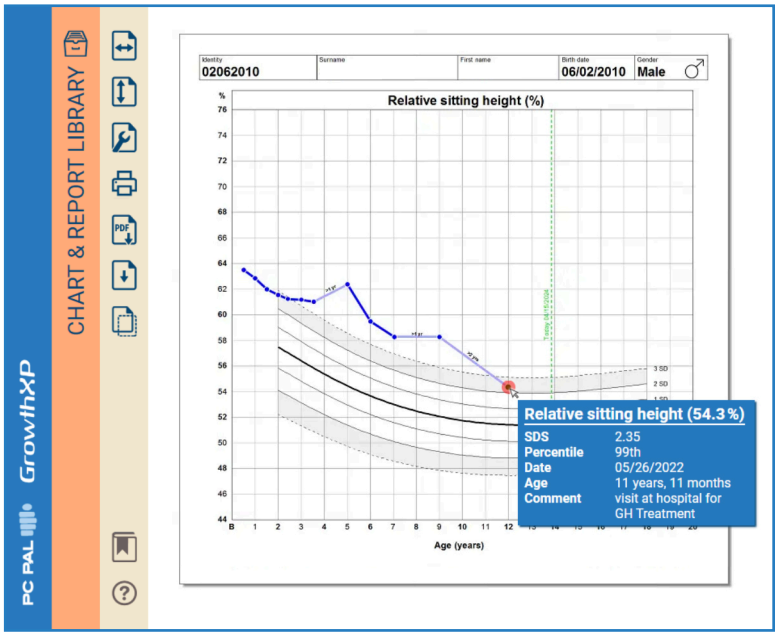

Figure 2. Relative sitting height chart based on Hawkes *et al*, 2020 (from the application GrowthXP). The tooltip automatically displays visit date, age, as well as the derived percentile and SDS.

Skeletal defects in specific RASopathies

A description of the features of Noonan syndrome was published in 1963. Since then, the complex molecular defects underlying this and phenotypically similar syndromes has led to the term 'RASopathies' being used to describe a group of related conditions. In their review, Papadopoulou and Bountouvi describe the molecular genetics and phenotypes of Noonan (NS), Costello (CS) and cardio-facio-cutaneous syndromes (4).

A common feature of the group is short stature with growth failure becoming evident postnatally. The low mean height is further exacerbated by delayed puberty and reduced growth spurt. The causes of growth impairment are several.
To support management of patients with this disordered growth pattern, disease-specific charts have been developed for NS and CS (see Figure 3).

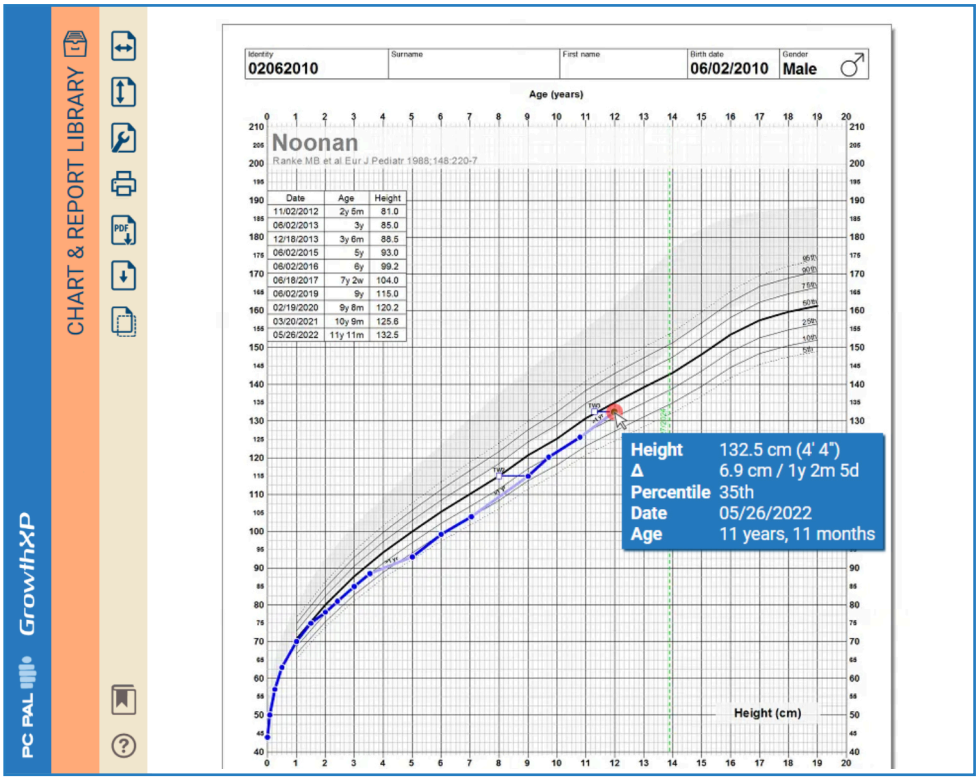

Figure 3. Noonan-specific growth chart showing curves based on Ranke MB *et al*, 1988. This chart is included in GrowthXP: the tooltip shows visit data and change in height since the previous visit. The shadow range is the reference population (CDC).

Impact of obesity on growth and final height

The increase in severe obesity in children and adolescents has raised interest on the possible effect on statural growth. In a prospective obesity treatment study, researchers at the Karolinska Institute, Stockholm, Sweden, have found that the severity of obesity is positively correlated with prepubertal growth (5).

Prepubertal children with differing obesity severity (class I and II corresponding to adult BMI of 30 and 35 respectively) were separately analysed and compared to the reference for the normal Swedish population. Class II obesity prepubertal children were taller on average compared to those with class I obesity, with both being taller than the normal reference. The degree of obesity was inversely associated with the pubertal growth spurt, which was absent in boys with class II obesity. The overall effect was that the final height attained was in the normal range for both groups.

A new charting approach to better management of extrauterine growth restriction (EUGR)

Depending on the growth assessment tool used, premature infants with EUGR could be overtreated, according to a study presented at the Pediatric Academy of Sciences congress. Traditional charts used to assess growth of premature infants assumed that extrauterine growth should mimic intrauterine growth of the fetus (notably, Fenton charts).

In their single centre study, Olgun *et al* assessed the growth of premature infants in the neonatal clinic against both the Fenton and Intergrowth-21 charts, which are based on longitudinal growth assessment of preterm infants (6). The use of Intergrowth charts identified fewer infants with EUGR (19%) compared to using Fenton charts (61%). The authors cited other research indicating that using Intergrowth charts vs Fenton better predicted morbidity in the infants identified with EUGR. Lowering the number of EUGR infants may reduce overfeeding, which may be harmful.

References

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6. Olgun L *et al.* Extrauterine growth restriction trajectory by Intergrowth-21 vs Fenton growth charts. Poster presentation, PAS, 2023.

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