

Child growth evaluation and charting – research update

This newsletter summarises key neonatology research with direct relevance to clinical practice published during 2025. The studies explore how early growth shapes later development, how growth charts compare in identifying at-risk infants, and how categorisation and screening tools can be improved for safer, more consistent neonatal care. Together, these findings reinforce the importance of accurate auxology and the use of appropriate reference standards across the neonatal period. Digital growth-charting systems can support transparent reference selection and consistent longitudinal plotting.

Early growth and long-term effects

A recurring question in paediatrics is how strongly early growth patterns influence later development. Three publications from 2025 show how size and growth in foetal life, infancy, and early childhood relate to

pubertal timing and pubertal growth. Although the studies differ in design and population, they share a common clinical message: early growth matters, and its effects can persist into adolescence.

Preterm birth and low birth weight: association with height and BMI at age 12

The relationship between prematurity and birth size, and growth patterns up to age 12 was presented by Morkuniene *et al*.

Their retrospective longitudinal study examined how preterm birth (early: <34 weeks or late: 34–37 weeks) and birth weight (low: <2500g or low to normal: 2500 – 3000g) related to size at 12 years (height, weight and BMI) in comparison with term and normal birth weight infants.

The authors conclude that intrauterine growth restriction indicated by low birth weight is a more powerful determinant of long-term growth outcomes than preterm birth itself, emphasising the need for targeted follow-up of low-birth-weight infants well into childhood. Early preterm birth predisposes to a higher BMI suggesting a higher risk of later obesity.

The key findings are directly relevant to clinicians following infants born early or small:

- Early preterm birth (<34 weeks) was associated with slightly shorter stature at age 12 (around 1 cm shorter than term peers).
- Low birth weight (<2500 g) had a stronger and more persistent effect on later size than gestational age alone.
- Low-birth-weight children were 1.4 cm shorter at age 12 and also weighed less than normal-birth-weight peers.
- Adiposity rebound occurred earlier in preterm children, especially those born early preterm.
- By age 9–9.5 years, BMI in the early-preterm group surpassed that of term children.

Foetal and infant growth impact pubertal timing

There has been a secular trend for earlier pubertal onset, particularly for girls: early puberty can result in long term, adverse health outcomes. It has been suggested that altered early life growth might account for this trend, acting through the hormonal axes.

The hypogonadal (HPG) axis develops through gestation and early infancy, remaining dormant until puberty. Therefore, any alteration in the HPG axis activity and puberty timing resulting from slower or faster foetal/infancy growth may have long-term consequences.

In a population-based study of 5830 mother-child pairs, Blaauwendraad *et al* explored how foetal and infant growth patterns relate to markers of pubertal development, including skeletal age, ovarian and testicular volumes at age 10, age at menarche and Tanner stages at 13 years².

The findings highlight infancy as a sensitive period for hormonal axis development:

- Girls with faster growth in the first two years of infancy had a more advanced skeletal age at 10 years, earlier menarche, and more advanced breast and pubic hair development at 13 years.
- Boys with higher infant growth also showed more advanced skeletal age, as well as larger testicular volume, and more pubic hair development at age 10.

The study reveals infancy as a critical window for endocrine and developmental programming, and that deviations in early growth, whether slow or rapid, may have long-term consequences for pubertal development.

Further evidence for the importance of early growth patterns for future growth is confirmed by Skogastierna *et al* in their Swedish, retrospective, longitudinal study of 4700 children (50% males)³. Early life growth strongly predicts both pubertal height gain and adult height. Summarising the impact of this study, the authors conclude: “*early life growth is strongly associated with and explains specific pubertal height gain and adult height but less so the timing of pubertal growth*”. The relationship is robust for growth magnitude but less strong for the timing of the pubertal growth spurt.

Clinical takeaway

Across these three studies, a consistent message emerges: early growth, particularly in the neonatal period and first two years, sets the trajectory for later childhood size, pubertal development, and adult height. This underscores the importance of precise measurement, appropriate growth references, and early identification of infants at risk of suboptimal growth. Follow up of early growth depends on the selection of relevant growth charts.

Growth chart selection: from measurement to meaning

Growth charts are fundamental tools in neonatal and paediatric care, yet their performance depends heavily on how well they reflect the population and clinical context in which they are used.

Different charts can classify the same individual in

very different ways. Two studies published in 2025 examined how different growth references perform in newborn and early infant populations, with implications for screening, classification, and clinical decision-making.

INTERGROWTH-21 vs WHO and national references: classification of SGA neonates

The INTERGROWTH-21 (IG-21) foetal growth chart has previously been compared with different references. Rahim *et al* studied how IG-21 performed in relation to WHO foetal growth charts in the detection of term, small for gestational age (SGA) newborns and in predicting adverse outcomes in a Pakistani population⁴. In Pakistan, 27% of live infants are born SGA, a proportion in line with the findings across low and middle-

income countries. SGA accounts for 26% of neonatal mortalities in Pakistan, therefore, the performance of foetal growth charts that are used has important healthcare implications.

The study revealed that the WHO chart was more sensitive in predicting SGA neonates than IG-21. Both charts performed similarly in predicting short-term adverse perinatal outcomes.

Outcome	WHO	IG-21
Sensitivity	70.2 (60.4 to 78.8)	45.2 (35.4 to 55.3)
Specificity	80.7 (76.4 to 84.6)	80.5 (76.1 to 84.4)
Accuracy	75.5 (70.1 to 80.3)	70.3 (66.5 to 73.8)

Tejón-Fernández also assessed the relative performance of IG-21 charts, with national (Carrascosa 2008) charts as the comparator for a cohort of very low birth weight babies in Spain in a single centre⁵. A significantly higher proportion of neonates were classified as SGA based on the Carrascosa chart (40.8%) compared to the IG-21 chart (31.6%).

The authors note that the Carrascosa reference is based purely on Caucasian newborns with parents born in Spain and excluding preterm births from multiple gestations.

Mortality and morbidity were not significantly different between SGA neonates classified by either growth reference.

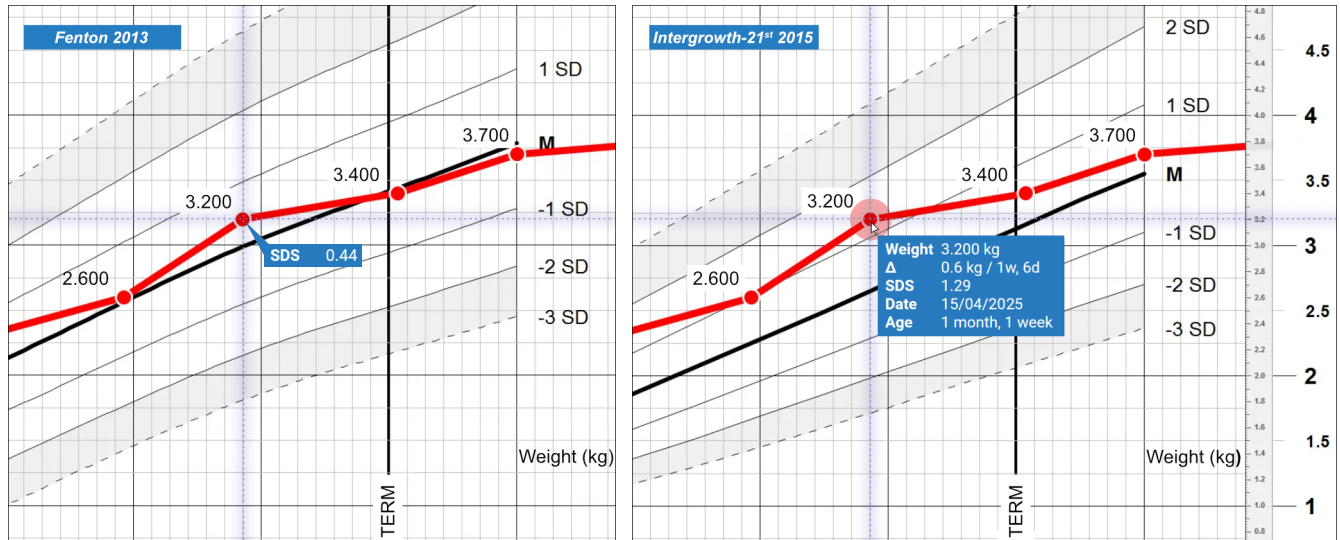


Figure 1. Plotting growth (weight) of the same foetus on different charts. These two charts have been prepared in the growth charting application, GrowthXP. The highlighted measurement (3.2kg) is 1.29 SDS on the Intergrowth-21 chart but 0.44 on the Fenton chart.

Twin-specific birth weight percentiles improve classification of newborns as SGA/LGA

Singleton-based charts can over diagnose twins as SGA or LGA. Zong et al addressed the problem by developing twin-specific birth weight percentiles for Chinese infants⁶. They conducted a systematic literature review based on a broad range of sources. Five studies met the inclusion criteria allowing the generation of P3, P10, P25, P50, P75, P90 and P97 reference values for male and female

neonates in the gestational age range 22 - 42 weeks. This work supports the growing recognition that twins require their own growth standards, not simply adjusted singleton charts. The new charts may reduce the misdiagnosis of intra-uterine growth restriction and help identify twin newborns at risk of adverse outcomes in the Chinese population.

Fenton v WHO: which chart best identifies term infants at risk for hypoglycaemia?

Being born small, or large for gestational age (SGA [weight <10th percentile for gestational age and sex] or LGA [weight >90th centile]) is a risk factor for neonatal complications, including hypoglycaemia. The Fenton (FGC) and WHO (WGC) growth charts are commonly used to assess birth weight but their relative sensitivity and specificity in identifying infants at risk of hypoglycaemia is unclear. Each reference is based on diverse and different populations which leads to differences in SGA/LGA classification. In a retrospective study, Khalil *et al* compared the performance of these charts in identifying term, well neonates at risk of hypoglycaemia⁷.

Within a total study cohort of 970 newborns, 283 (29.2%) developed hypoglycaemia. Agreement between the charts in SGA/LGA categorisation was only 47.7% with 53.7% of infants being identified with hypoglycaemia on both charts. The authors note that this level of disagreement could result in neonates with hypoglycaemia not being detected, and others undergoing unnecessary screening. WGC was more sensitive than FGC in detecting infants at risk of all levels of hypoglycaemia, whereas FGC was more specific for each category. The authors recommend WGC as a better option to identify at risk infants due to being classified as SGA/LGA.

Clinical takeaway

Accurate categorisation and appropriate reference standards are essential for selecting appropriate neonatal care. Whether assessing twins, preterm infants, or term infants at risk of hypoglycaemia, the choice of chart and categorisation method directly affects clinical decision-making.

References

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