# Clinical standards for growth assessment and referral criteria for children with a suspected growth disorder

The **BSPED Growth Disorders Special Interest Group (SIG)** has produced these Clinical Standards for assessment of growth and referral of children with a suspected growth disorder. These collate established evidence-based standards with current best practice guidance with input from relevant stakeholders, including the Child growth Foundation (CGF) and the BSPED nurses' group. Future iterations will be reviewed regularly to include new evidence.

## Aim: To optimise the clinical outcome of children with growth disorders by:

- Improving the recognition and diagnosis of growth disorders in children
- Standardising current clinical practice
- Promote early diagnosis and timely referral of growth disorders
- Enhance the use of opportunistic growth measurements

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## Introduction

Accurate evaluation of growth is a key assessment of child health. The UK 'Coventry consensus', recommended a single height measurement for all children at primary school entry with referral if height is <0.4$^{th}$ centile (-2.67 SDS) at 5 years of age (1). However, abnormalities of growth (short stature, tall stature, growth failure, growth acceleration) are often identified before or after this time and may require investigation. Opportunistic growth assessment should be undertaken when a child is seen for any reason whether in primary or secondary care (2).

Early and precise identification of growth problems is important for timely access to secondary and tertiary services. This enables appropriate investigation and earlier therapeutic interventions to achieve optimal outcomes.

This document provides recommendations for UK children (0-18 years) and encompasses the clinical standards for 1. Growth measurement and equipment, 2. Growth references and 3. Referral recommendations.

## Clinical standards

### 1) Standards for measurement and equipment

| No. | Standard | Reference / source |
|---|---|---|
| 1.1 | Every child should have height and weight assessment at every visit to a children's outpatient department / secondary care | (3-6) |
| 1.2 | Measurements should be performed by an appropriately trained individual as detailed in the RCN Endocrine Nurse Specialist competency framework | (7) |
| 1.3 | In addition to height and weight, the initial growth assessment should include a head circumference measurement plotted on a growth chart (for categorisation of normo-, macro- and micro-cephalic short stature) | (3,4,8-12) |
| 1.4 | Length should be measured until aged 2 yr using an infantometer or purpose-built calibrated infant measuring device* and standing height measured after age 2 yr (see 1.5) | (13) |
| 1.5 | Every hospital department in which children are medically reviewed should have a calibrated manual or electronic stadiometer, wall-mounted stadiometer or other validated stadiometer | (13) |
| 1.6 | Correct position should be adopted for standing height measurements‡ (Frankfort horizontal plane) | (14,15) Figure 1 (Appendix) |
| 1.7 | Every children's outpatient should have a mobile hoist with a weighing scale attachment, age-appropriate slings, a growth mat or tape to assess recumbent length in non-ambulatory patients. Use of ulnar/foot-knee measurements are recommended when recumbent length is likely to be inaccurate | (13,16-18) See Table 1 (Appendix) |
| 1.8 | All height/length measurements should be plotted on an appropriate growth chart to the nearest 0.1cm (1mm) | (13,19) Section B |
| 1.9 | Every tertiary paediatric endocrine unit should have a validated sitting height table. Sitting height should be assessed in all children with suspected growth disorders at tertiary centres | (8) Table 1 (Appendix) |
| 1.10 | Every out-patient department where children are seen should have accurate electronic class 3 scales for weight assessment: infant scale (children aged <24 mths or <20kg), standing beam balance (children and adolescents 2-19 years) and sit down or wheelchair scale (larger children who cannot stand unaided) ¶. | (13) Table 1 (Appendix) |
| 1.11 | Weight should be recorded to the first decimal place (nearest 0.1kg)† | (19) Section B |
| 1.12 | All measurement equipment should be calibrated at least once a year and regularly cleaned/maintained according to the specific manufacturer recommendations | (13) Table 1 (Appendix) |
| 1.13 | Every children's outpatient department should have a validated orchidometer | (13) Table 1 (Appendix) |

*The infant should be placed in the centre of the length board with their head against the fixed headboard compressing the hair. The parent should hold the head gently in the neutral position i.e. looking vertically upwards with neck neither flexed nor extended. The infant's heels and feet should lie firmly against footboard with toes pointed upwards, ensuring trunk and legs are aligned. The infant's knees should be gently depressed to maintain full leg extension.

¶All scales should be calibrated annually and whenever there is reason to doubt accuracy. Suspect weighing equipment should be taken out of service, checked, and verified by recognised Weighing Federation members or by electro-biomedical engineering (EBME) technicians.

†Infants (birth to 8 weeks) should be weighed nude and 2-24 months old infants should be weighed wearing a clean dry nappy. Children/adolescents aged 2-19 years should be weighed wearing lightweight outer clothing with shoes/hats/bulky items removed.

‡The patient should stand upright, with their back against the wall and head erect (Frankfort horizontal plane; Appendix Fig. 1), facing forward, and looking straight ahead. Shoes, socks, and bulky clothing should be removed. Hair accessories and hairstyles that may interfere with measurement should be removed. The patient should be encouraged to assume a fully erect posture with heels together and buttocks and shoulders in contact with the wall or measuring device. The moveable headboard is lowered gently until it touches the top of the head with enough pressure to compress the hair.

## 2) Growth Charts

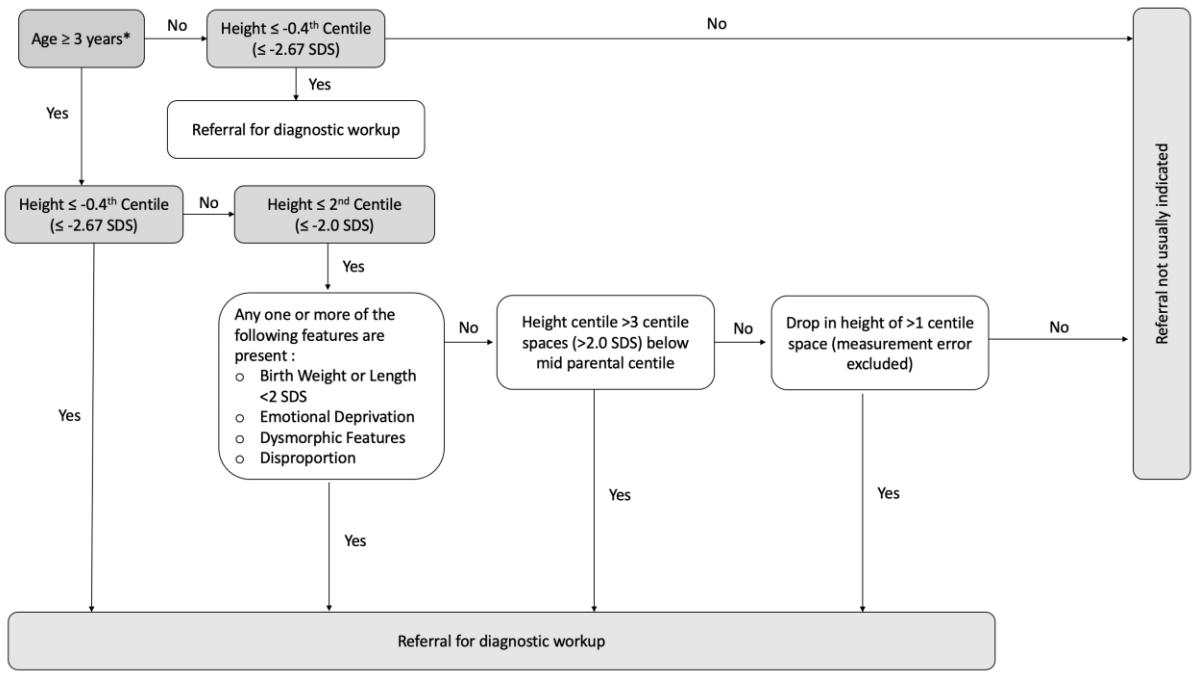
| No. | Standard | Reference / source |
|---|---|---|
| 2.1 | Recommended growth charts: UK-WHO 0-4 yr and UK-WHO (updated UK90) from 2-18 yrs† | (3-6) (Appendix) |
| 2.2 | Head circumference charts should be available 0-18 years of age† | (3,4,8-10) |
| 2.2 | Weight and BMI should be assessed at each clinic visit to monitor for nutritional influences on height† | (11,19,20) |
| 2.3 | Measurements should be converted to centiles using growth charts. SDS can calculated by a growth calculator using the recommended UK-WHO source/reference data (important for those at the extremes of height and weight) (2.1) | (15,21) Table 2 (Appendix) |
| 2.4 | Electronic growth charts should be available and must use the recommended UK-WHO source/reference data (2.1) ‡ | (13) |
| 2.5 | Gestational correction should be used for infants born <37 weeks and should continue until 1 year for infants born 32-36 weeks and 2 years for infants born before 32 weeks if manually plotting* | (22) |
| 2.6 | Small for gestational age (SGA) is defined as birth weight [BW] (and/or birth length [BL]) < -2.0 SDS or <2$^{nd}$ percentile | (23) |
| 2.7 | Record manual measurements immediately after taking. Dots should be plotted on the chart and not joined up. Record measurement and date in ink and age in weeks for the first 6-12 months and then calendar months thereafter | (15) |
| 2.8 | Bone age(s) (left hand/wrist radiographs using validated e bone age assessment tool (BoneXpert) or Greulich-Pyle or Tanner-Whitehouse methods) should be taken on the same day as the height measurement, and both recorded on the growth chart | (24) |
| 2.9 | Specialist charts should be used where appropriate (Downs, Turner, Noonan, sitting height, height velocity) | (12,25-27) |

†Age banded charts will not be necessary when using the electronic RCPCH API
‡ The gestational age correction method may vary between electronic growth chart software packages and may impact SDS calculations
* RCPCH API can correct at any age and will correct for any gestation <40 weeks

## 3) Referral recommendations (see algorithm)

| No. | Standard | Reference / source |
|---|---|---|
| **Short stature and/or growth failure** | | |
| 3.1 | UK guidance recommends referral for children with height below the 0.4$^{th}$ centile (<-2.67 standard deviations (SDS) from the mean) | (2,5,6) |
| 3.2 | We recommend the following additional criteria for a growth assessment in secondary care: Height centile more than 3 centile spaces (>2.0 SDS) below the mid-parental height centile and/or drop in height of >1 centile spaces | (5,6) |
| 3.3 | Presence of 'red flags': weight loss, constipation/diarrhoea, headaches, vomiting, abnormal fat stores, disproportion, dysmorphic features, anaemia, delayed puberty, clinical features of hypothyroidism or other chronic illness | (8) |
| **Tall stature and/or accelerated growth** | | |
| 3.4 | We recommend the following growth criteria for a growth assessment in secondary care: Height >98$^{th}$ centile (>+2.0 SDS), height-target height +2SDS and/or increase in height or 1 centile space over >1 year before the onset of puberty | (28,29) |
| 3.5 | Presence of 'red flags': dysmorphic features, developmental delay (motor, cognitive, speech etc), behavioural problems, cardiac or eye conditions, delayed or precocious puberty, signs or symptoms of hyperthyroidism or GH excess | (28,29) |

## Algorithm for referral of short stature




*Referral recommended for all girls with no signs of puberty (>Tanner stage 2 breast development) by age 13 and boys with no signs of puberty (>Genitalia Tanner stage 2 or testicular volumes >4 ml) by age 14.

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# Appendices

## Table 1. Recommended equipment

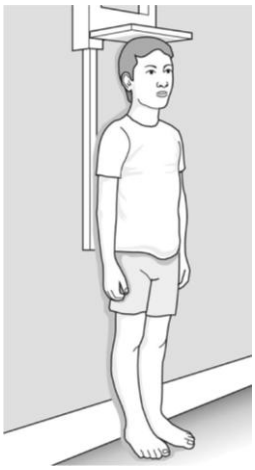
| | Height | | | Length | | | Weight | | | | Other | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***Stadiometer*** | ***Wall-mounted*** | ***Sitting height*** | ***Measuring Board*** | ***Measuring Tape*** | ***Growth Mat*** | ***Weighing scale*** | | ***Sitting Scale*** | ***Hoist Scale*** | ***Ulnar length*** | | ***Head Circumference*** | ***Orchidometer*** |
| **Brand** | Secca Leicester | Harpenden Wall Mounted Stadiometer | Holtain Sitting Height Table | Harpenden Infantometer | Seca 201 | Rollameter 100 | Seca 384 Class III | Seca 875 Class III | Seca 955 Class III | Marsden M-600 Class III | Harpenden Anthropometer | Standard vernier caliper | Lasso-o™ | Prader |
| **Calibration** | Annual | Daily check with calibration rod | | | Annual | | | | | | | | Check before use | |
| **Decontamination** | Cleaned and wiped between each patient | | | | | | | | | | | | | |
| **Range** | 75cm - 205cm | 60cm - 210cm | 32 cm - 109 cm | 30cm - 91cm | 0 - 205cm | 0 - 100cm | 20kg capacity 10g < 10kg > 20g graduation | 200kg capacity 200g graduation | 200kg capacity 100g graduation | 200kg capacity 100g graduation | 5cm - 57cm | 0 - 60cm | 5 - 59cm | 12 numbered beads (1-25ml) |

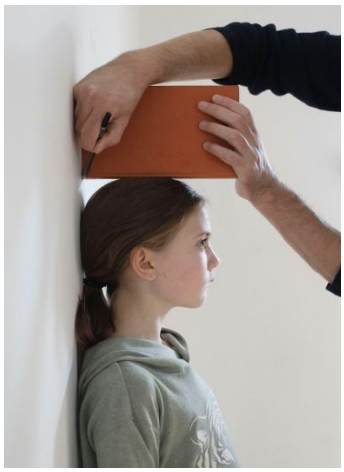
**Note:** Equipment brands are examples of suitable equipment. Any validated measuring equipment can be used.

Table 2. SDS scores and their equivalent centiles on the UK-WHO growth charts

| Standard Deviation Score (SDS) | Equivalent growth chart percentile |
|---|---|
| -2.68 | 0.4th |
| -2.01 | 2nd |
| -1.34 | 9th |
| -0.67 | 25th |
| 0 (mean or average) | 50th |
| +0.67 | 75th |
| +1.34 | 91st |
| +2.01 | 98th |
| +2.68 | 99.6th |

Figure 1. Frankfort plane





Total standing height is the distance from the highest point of the head to the sole of the foot in the midsagittal plane with the individual standing in an upright position. The head should be held erect with the eyes looking straight forward, so that the lower margin of the bony orbit and upper margin of the external auditory canal opening are in the same horizontal plane (Frankfort plane)(14).

## A) Growth charts

*WHO Growth Charts* (2006) multi-ethnic charts (based on longitudinal data from Brazil, Ghana, India, Norway, Oman and USA). Aim to represent the best description of physiological growth for all children from birth to 5 years of age and establish the breastfed infant as the normative model for growth and development. These are 'growth standards' as they are based on longitudinal rather than cross-sectional data.

*UK-World Health Organization (WHO) 0–4 years growth charts* (2009) Developed for the Department of Health by the RCPCH, based on the growth of breastfed infants replacing previous charts that were based on the growth of predominantly formula-fed babies. Constructed using the WHO standards for infants aged 2 weeks to 4 years and birth data for

gestations 23 to 42 weeks from the UK 1990 growth reference (the WHO dataset did not include preterm infants).

UK90 Growth Charts (1995) Data for UK90 came from various sources across the UK with non-white children excluded from the final dataset. These are growth 'reference' charts as they are based on cross-sectional data.

## B) Plotting standards

- UK-WHO growth charts start from 2 weeks. There are no centile lines between birth and two weeks of age to allow for weight loss/regain during this period. All term infants (37+ weeks) are plotted at zero weeks.
- The preterm section of the chart should be used for infants born 32-36 weeks' gestation until term. Following term plus two weeks, the 0-4 year section is used with gestation age correction.

## C) Normal weight

- Weight normally tracks within one centile. A weight loss of 10% needs assessment. In acute illness the weight centile is expected to fall but usually returns to its normal centile within 2-3 weeks.