

# Anthropometric measurements guide in disproportionate short stature

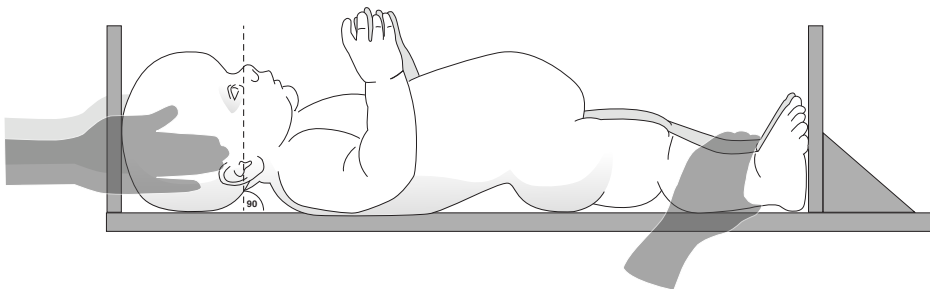
This booklet provides guidance for key anthropometric measurements in children and adults with disproportionate short stature

Material from Hoover-Fong J *et al.* Considerations for Anthropometry Specific to People with Disproportionate Short Stature. *Adv Ther* 2025;42:1291–311. Reproduced with permission of Springer Nature Customer Service Center (SNCSC)

The BioMarin logo consists of the word "BIO" in a large, white, sans-serif font, followed by a vertical stack of four small white dots, and then the word "MARIN" in a smaller, white, sans-serif font. A registered trademark symbol (®) is located at the top right of the word "MARIN".

Developed and funded by BioMarin  
MED-SC-0183 | October 2025

# Infants: Body length



## Equipment:

An infant measuring board.



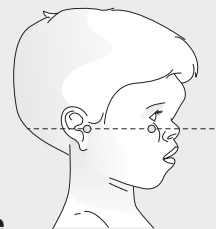
## Personnel:

Two people for positioning (one to hold the infant's head in position, and the other to flatten knees and hold feet against the foot plate).



## Method:

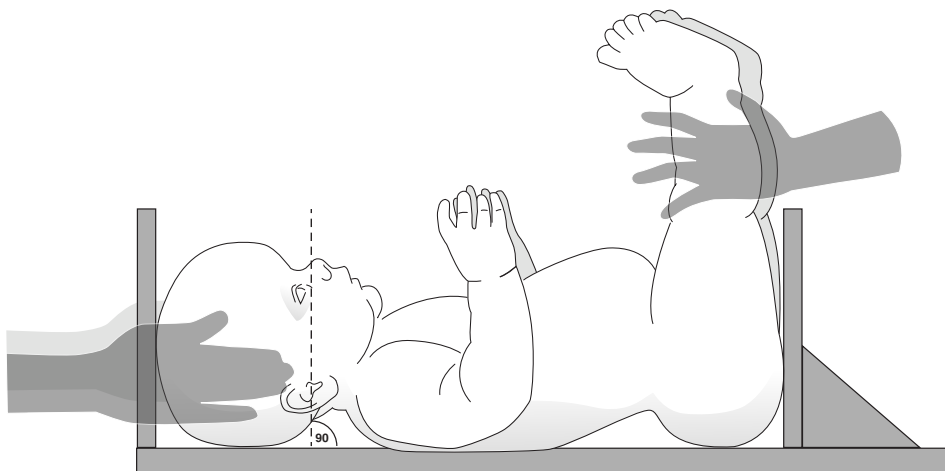
- Lay the infant on their back on the measuring board, with their head at the fixed end.
- The infant's head needs to be facing upwards, with the Frankfurt plane aligned at  $90^\circ$  to the board.
- Flatten knees to fully extend the legs; feet should be flexed such that the soles of the feet are flat against the foot plate.
- Glide the foot plate to establish full heel contact, and measure to nearest 0.1 cm.
- Reposition the infant before repeating the measurement.



## Frankfurt plane

The Frankfurt plane is an imaginary line from the upper margin of the auditory meatus to the lower margin of the orbit of the eye.

## Infants: Crown-rump length



### Method:

- Lay the infant on their back on the measuring board, with their head at the fixed end, facing upwards, with the Frankfurt plane aligned at 90° to the board.
- Hold the legs straight and perpendicular to the floor.
- Support the legs while moving the foot plate to touch the posterior distal thigh, and measure to nearest 0.1 cm.
- Reposition the infant before repeating the measurement.



### Equipment:

An infant measuring board.



### Personnel:

Two people to position the infant.

# Infants: Head circumference



## Equipment:

Insertion tape or tape measure.  
If using an insertion tape,  
prepare it before you begin.



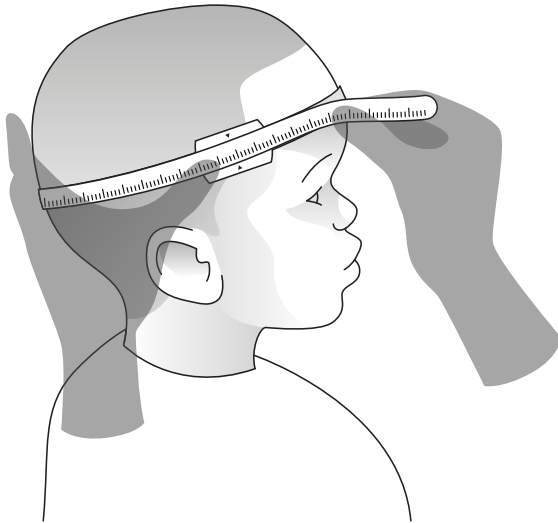
## Personnel:

A parent/caregiver to hold  
the child and at least one  
person to measure.



## Method:

- The infant should be seated in the lap of a parent/caregiver, looking straight ahead (this may require their head to be held gently in place).
- Active infants/toddlers may need two individuals to measure (one to stabilize the head and one to measure).
- Remove any hair accessories, braids, etc. from the surface of the head where the tape measure will lie.
- Move the tape up and down to find the largest circumference (occipitofrontal circumference), without including the ears in the measurement.
- Pull insertion tape/tape measure taut to minimize contribution of hair to the circumference measurement.
- Record measurement to nearest 0.1 cm.
- Reposition the tape and repeat.



# Children: Standing height



## Equipment:

Stadiometer or wall-mounted tape measure with head plate.



## Method:

- Where possible, feet should be placed shoulder width apart, with heels against the vertical surface/wall.
- Ideally, the heels, buttocks, shoulder blades, and back of the head should all touch the wall/vertical surface of the stadiometer. If all four contact points are not possible, we recommend a minimum of two contact points (head and buttocks).
- The head should be positioned so that the Frankfurt plane is horizontal, at 90° to the wall.
- Adjust hairstyles or remove hair accessories that interfere with measurement.
- Decide on a standard operating procedure for measuring with breath held (just before exhalation) or after exhalation. Young children do best without any breathing instruction.
- Lower the measurement plate/paddle gently to the top of the head with one hand while supporting the child's head with the other hand, being careful to maintain the Frankfurt plane.
- Measure to nearest 0.1 cm.
- Reposition the child before repeating the measurement.



# Children: Sitting height



## Equipment:

Stadiometer/wall-mounted tape measure and a stool; additional blocks may also be required to elevate the child to 90°/90° position.



## Calculation:

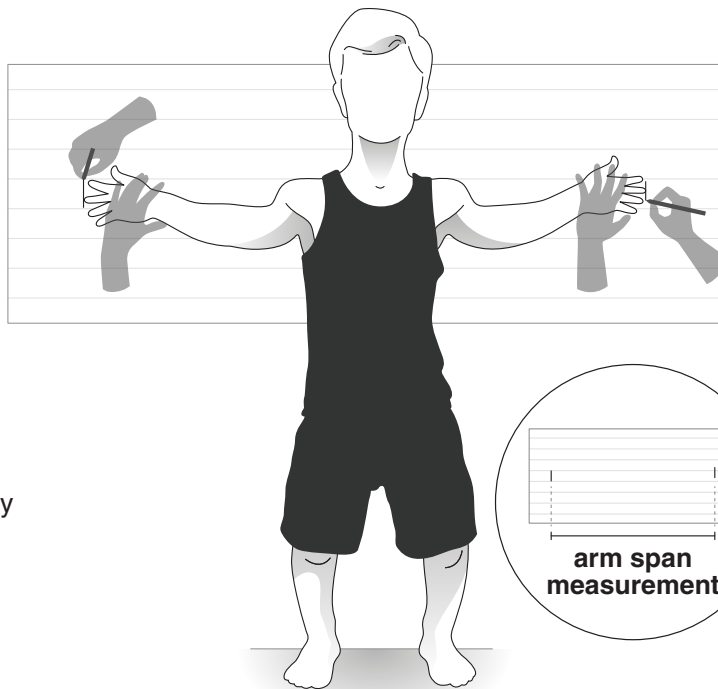
Sitting height = Measurement – (stool height + height of any objects sat upon)



## Method:

- The child should be sitting comfortably on the stool with a 90° angle at both hips and knees and feet supported.
- Adjust the foot support or seat height and the seat depth to create a 90° angle at the hips and knees. It is best to use yoga blocks or books, etc. to adjust feet height, so as not to affect the sitting height. If needed to adjust hips to achieve the 90° angle, use hard flat objects for sitting on.
- Ideally, buttocks, shoulders, and back of the head should be touching the wall/vertical surface of the stadiometer.
- The head should be positioned so that the Frankfurt plane is horizontal, at 90° to the wall.
- Decide on a standard operating procedure for measuring with breath held (just before exhalation) or after exhalation.
- Lower the measurement plate/paddle gently to the top of the head with one hand while supporting the child's head with the other hand.
- Measure to nearest 0.1 cm.
- Also record the height of the stool and any yoga blocks that the child is sitting on.
- Reposition the child before repeating the measurement.

## Children: Arm span (1/2)



### Equipment:

Flat wall, washable markers, tape measure.

To keep the wall clean and ready for subsequent measurements, exam paper (lined or grid) can be attached to the wall.



### Personnel:

Two people are required or this measurement.

### Notes:

- Use of a grid makes it easier to achieve consistent measurements of arm span.
- Repeatability may be easier to achieve with supine than standing measurement.

## Children: Arm span (2/2)



### Method:

- Measurement is made against a flat wall with exam paper attached.
- The child's back is flat against the wall in a comfortable stance with weight even on both feet.
- Position head so that the child is looking straight ahead.
- Arms are outstretched sideways with palms facing away from the wall (in the local standard operating procedure, specify if arms are to be stretched out by the measurers or not).
- Each measurer makes a mark (one on each side) on the paper at the tip of the middle finger at the same time.
- Repeat the positioning on a blank space on the paper.
- The child steps away from the wall.
- The arm span is measured using a tape measure between the two marks on the paper.
- Record measurement to nearest 0.1 cm.

### Alternative method – Supine arm span

- The child lies on the exam paper/floor mat.
- The child's back is flat against the floor, legs stretched out and straight, and the head is positioned so that the child is looking straight up at the ceiling.
- Arms are outstretched sideways with palms facing up (in the local standard operating procedure, specify if arms are to be stretched out by the measurers or not).
- Each measurer makes a mark (one on each side) on the paper/floor mat at the tip of the middle finger at the same time. Number the marks.
- Move the child down to another grid line or blank space and repeat.
- Remove the child from the paper/floor mat.
- The arm span is measured using a tape measure between the two marks on the paper/floor mat.
- Record measurements to nearest 0.1 cm.



## Adults: Upper arm length (1/2)

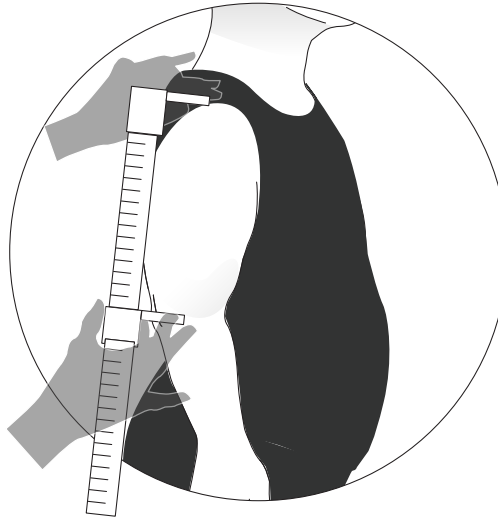


### Equipment:

Segmometer, washable marker.

### Alternative equipment:

Tape measure, washable marker.



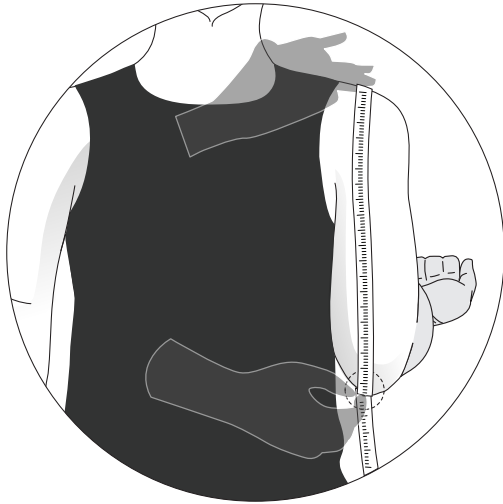
### Method:

- The local standard operating procedure should dictate which method (segmometer or tape measure) is used.
- The patient sits or stands (determine which in local standard operating procedure) with their arms relaxed at their sides. The patient should remove their shirt or roll up their sleeve if possible.

### Segmometer method:

- One end of the segmometer (the inside edge of the caliper) is placed at the acromion process mark.
- The other end of the segmometer (the inside edge of the caliper) is placed at the border of the lateral humeral epicondyle.
- Make sure the shaft of the segmometer is parallel to the long axis of the arm and apply slight pressure.
- Record measurement to nearest 0.1 cm.

## Adults: Upper arm length (2/2)



### Tape measure method:

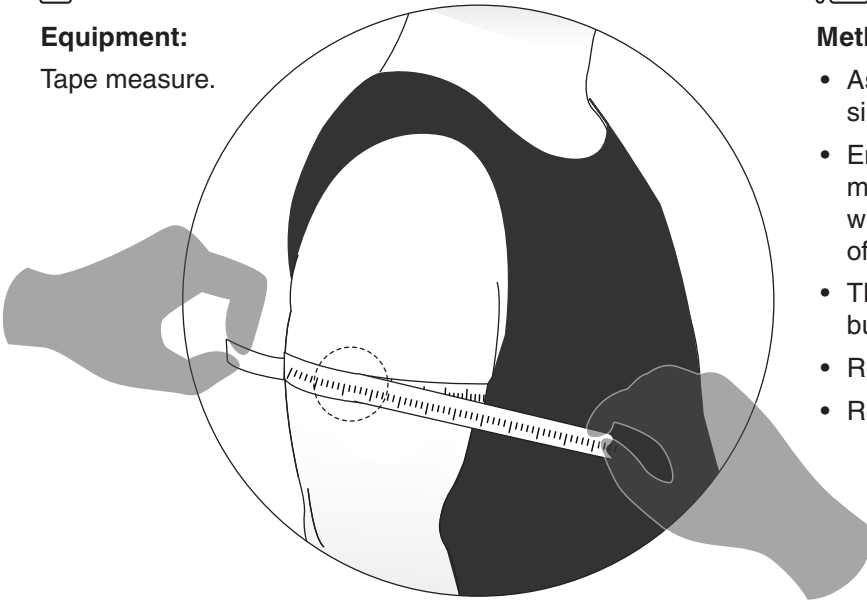
- Locate and mark the tip of the acromion process of the scapula with the marker.
- Instruct patient to bend right arm to 90° with elbow close to the body and palm facing upwards.
- Locate and mark the tip of the olecranon process of the ulna (multiple palpations may be required to establish positions of these landmarks).
- Place the zero end of the tape measure on the first landmark and extend the tape down the posterior surface of the arm to the second landmark.
- Record measurement to nearest 0.1 cm.
- If also measuring the upper arm circumference, mark the arm on either side of the tape at the halfway point (upper arm length divided by 2).
- Reposition before repeating the measurement.

## Adults: Upper arm circumference



### Equipment:

Tape measure.



### Method:

- Ask the patient to stand with arms relaxed by their sides with muscles loose and relaxed (not flexed).
- Encircle the upper arm at the halfway point previously marked (see upper arm length, tape measure method), with the tape horizontal (perpendicular to the long axis of the arm).
- The tape measure should fit snugly around the arm but not compress the skin.
- Record measurement to nearest 0.1 cm.
- Reposition before repeating the measurement.

## Adults: Neck circumference



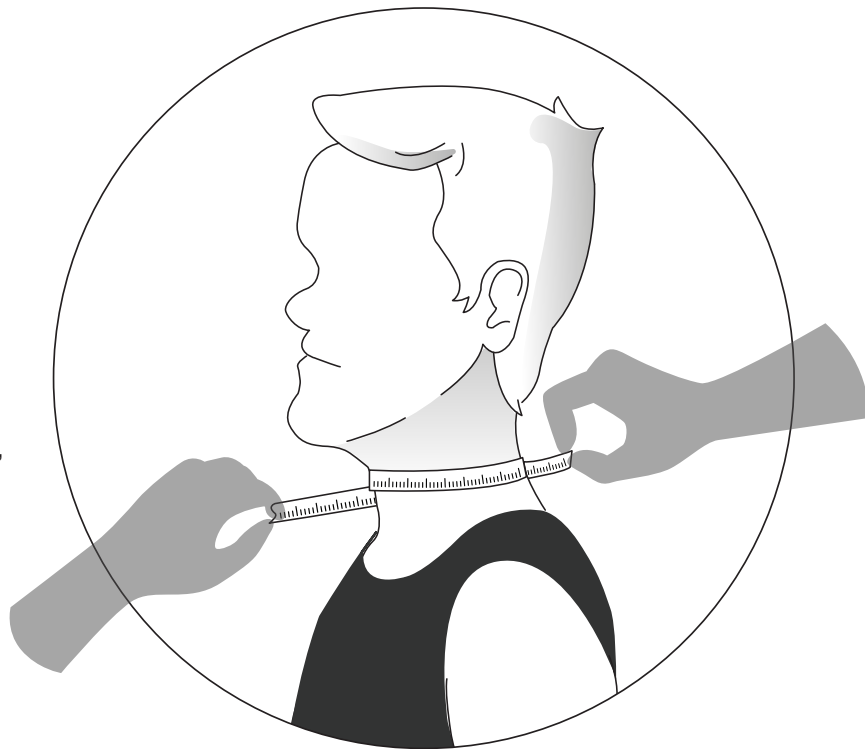
### Equipment:

Tape measure.

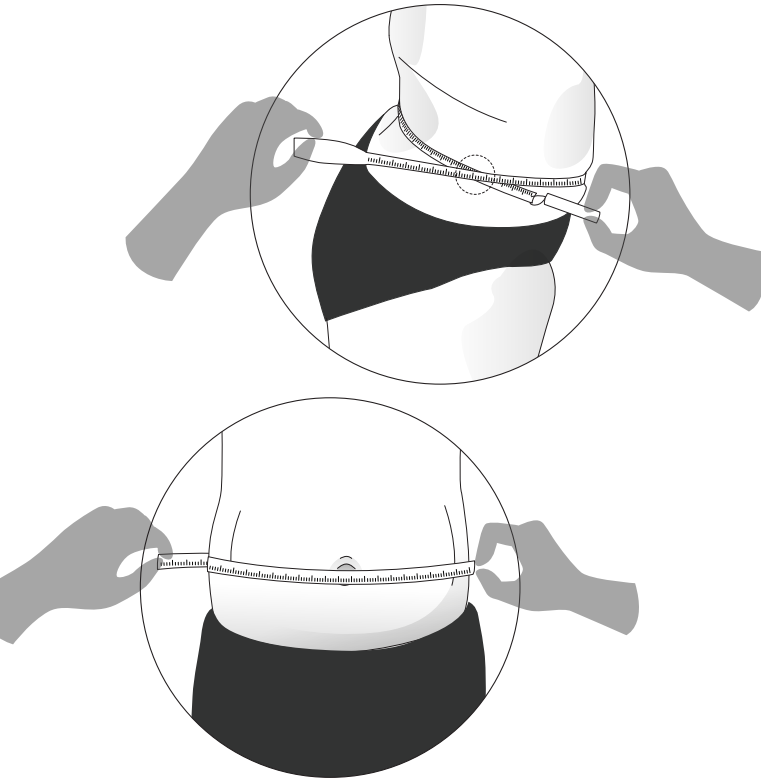


### Method:

- The patient stands with shoulders relaxed (not hunched) and looking straight ahead.
- Locate the tape measure on the thyroid cartilage, perpendicular to the long axis of the body.
- Record measurement to nearest 0.1 cm.
- Reposition before repeating the measurement.



## Adults: Umbilical waist circumference



### Equipment:

Tape measure.



### Method:

- Ideally, this measurement should be made directly on skin, not over clothing.
- The patient should stand with both feet on the floor, arms crossed over the chest with hands on opposite shoulders.
- Locate the tape measure at the umbilicus and extend around the waist, perpendicular to the long axis of the body.
- While the anthropometrist remains on one side of the patient, the recorder should go to the other side to ensure the tape is horizontally aligned.
- The tape should lie snugly but not compress the skin.
- The anthropometrist should have their eye level with the tape.
- Take the measurement at the end of an exhalation.
- Record measurement to nearest 0.1 cm.
- Reposition before repeating the measurement.

# Adults: Maximal hip circumference



## Equipment:

Tape measure.



## Method:

- The patient should stand with feet together (as much as possible), with arms folded across the chest.
- The patient should be wearing very light (not especially tight- or loose-fitting) clothing, or a hospital gown.
- Locate the tape measure at the widest point (viewed from the side) across the buttocks, under the abdominal pannus, perpendicular to the long axis of the body and level on both sides.
- The anthropometrist should have their eye level with the tape.
- The tape should fit snugly but not compress the skin.
- As inhalation does not affect the accuracy of this measure, breathing instructions are not necessary.
- Record measurement to nearest 0.1 cm.
- Reposition before repeating the measurement.

