# Alternate Height Measurements for Non-Ambulatory Patients

Methodology to Obtain Height Proxies

Knee Height[1]

Equipment required: knee caliper

1. Patient must be able to dangle legs freely
2. Bend the knee and ankle to a 90° angle
3. Place the fixed blade of the large sliding caliper under the heel of the right leg
4. Place the adjustable blade of the caliper on the anterior surface of the right thigh (approximately 2 inches above the patella)
5. Hold the caliper shaft parallel to the tibia shaft (lateral malleolus of fibula to posterior head of fibula)
6. Take 2 measurements, calculate and record the average
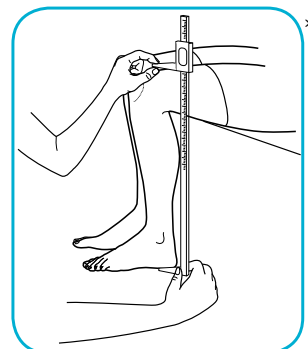
Equations for Height Proxies

Equations for Males:

- White male 6-18 years: Stature (cm) = [Knee Height (cm) x 2.22] + 40.54; SEI: 4.21 cm
- Black male 6-18 years: Stature (cm) = [Knee Height (cm) x 2.18] + 39.60; SEI: 4.58 cm
- White male 18-60 years: Stature (cm) = [Knee Height (cm) x 1.88] + 71.85; SEI: 3.97 cm
- Black male 18-60 years: Stature (cm) = [Knee Height (cm) x 1.79] + 73.42; SEI: 3.60 cm

Equations for Females:

- White female 6-18 years: Stature (cm) = [Knee Height (cm) x 2.15] + 43.21; SEI: 3.90 cm
- Black female 6-18 years: Stature (cm) = [Knee Height (cm) x 2.02] 46.59; SEI: 4.39 cm
- White female 18-60 years: Stature (cm) = [Knee Height (cm) x 1.87] – [Age (years) x 0.06] + 70.25; SEI: 3.60 cm
- Black female 18-60 years: Stature (cm) = [Knee Height (cm) x 1.86] – [Age (years) x 0.06] + 68.10; SEI: 3.80 cm

Key: SEI = standard error of the individual

Methodology to Obtain Height Proxies

Arm Span[2]

Equipment required: tape measure

1. Must ensure the patient is contracture-free and able to freely move arms
2. Ask patient to abduct shoulders to 90 degrees with fully extended elbows, wrists, and fingers
3. Measurer should measure from tip of middle finger on right hand to tip of middle finger on left hand
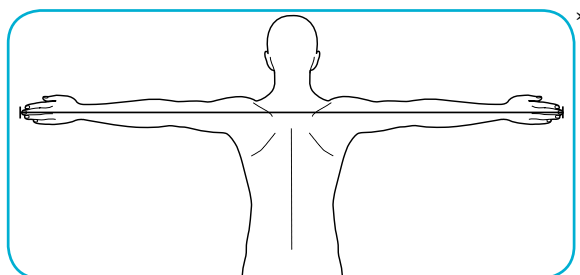
All readings to be taken to the nearest 0.5cm

Equations for Height Proxies

Equation for Boys ≤ 20 Years:

- H = 0.825*AS+0.5*A+16.737; SEE: 3.17 cm

Equation for Men ≥ 21 Years :

- H = 0.677*AS+50.235

Equation for Girls ≤ 20 Years:

- H= 0.847*AS+20.43; SEE: 3.52 cm

Equation for Women ≥ 21 Years :

- H = 0.681*AS+45.882

Key: H = height in cm; AS = arm span in cm; A = age in years; SEE = standard error of the estimate

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Methodology to Obtain Height Proxies

Upper Arm[3]

Equipment required: tape measure

1. Patient should flex arm to 90° angle at the elbow with palm facing up
2. Measurer should position himself/herself behind the patient
3. Measure and mark the upper edge of the posterior border of the acromion process of the scapula
4. Measure from the mark down to the posterior surface of the arm to the tip of the olecranon process (bony part of mid-elbow)
5. Take 2 measurements, calculate and record the average
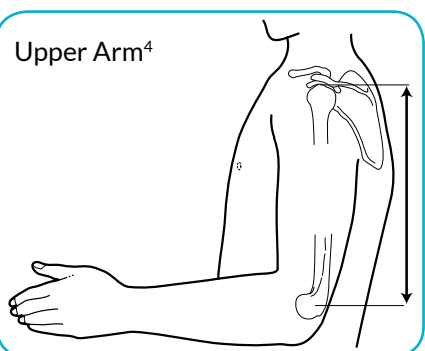
Upper Arm[4] *

Equations for Height Proxies

Equation for Patients with Cerebral Palsy from Birth to 12 Years:

- $S = (4.35 \times UAL) + 21.8$; SE: 1.7

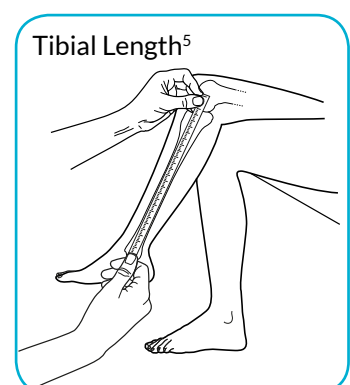**Key:** S = estimated stature in cm; SE = standard error; UAL = upper arm length

Methodology to Obtain Height Proxies

Tibial Length[3]

Equipment required: tape measure

1. Have patient sit
2. Cross right leg over left leg above the knee
3. Measure from the medial joint line of the knee to the distal edge of the medial malleolus
4. Take 2 measurements, calculate and record the average

Please note: it may not be possible for certain patients to adopt this posture

Tibial Length[5] *

Equations for Height Proxies

Equation for Patients with Cerebral Palsy from Birth to 12 Years:

- $S = (3.26 \times TL) + 30.8$; SE: 1.4

Key: S = estimated stature in cm; SE= standard error; TL = tibial length

The anthropometric measurements shown here are to be used as a guide. The equations and measurements are best practice examples from Jodi Wolff, (Paediatric Dietitian - University Hospitals, Rainbow Babies and Children's Hospital, Ohio, USA). These may be used as a guide for practice in the UK.

* All pictures are for illustration purposes and reflect both the right and left side. In general, the right or least affected side can be measured and documented to ensure future measurements are repeated on the chosen side

References: 1. Chumlea WC, Guo SG, Steinbaugh ML. Prediction of stature from knee height for black and white adults and children with application to mobility-impaired or handicapped persons. J Am Diet Assoc. 1994;94(12):1385-1391. **2.** Golshan M, Amra B., Hoghoghi MA. Is arm span an accurate measure of height to predict pulmonary function parameters? Monaldi Arch Chest Dis. 2003;59(3):189-192. **3.** Stevenson RD. Use of Segmental Measures to Estimate Stature in Children With Cerebal Palsy. Arch Pediatr Adolesc Med. 1995;149:658-662. **4.** Jarzem PF, Gledhill RB. Predicting Height from Arm Meausurements. J Pediatr Orthop. 1993;13(6):761-765. **5.** Stevenson RD. Measurement of Growth in Children with Developmental Disabilities. Dev Med Child Neurol. 1996;38(9):855-860.

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