



Growth Measurements & Vital Signs Booklet for Nursing Students



Children's Wisconsin Approaches for Accurate Growth Measurements and Vital Signs

- Inpatient & Clinic specific approach for accurate measurements
 - Weight
 - Height/length
 - Head circumference (OFC)
- Inpatient & Clinic specific approach for accurate vital signs
 - Temperature
 - Respiratory rate
 - Heart rate/pulse
 - Manual blood pressure
 - Growth & Development
 - Fluid Maintenance
 - Pulse oximetry/oxygenation
 - Pain Assessments

Growth Measurements

Accurate growth measurements are required for the safe administration of medication, calculation of fluid needs, nutrition screening, and patient assessment. Obtain weight at every clinic visit.

Growth measurements can be upsetting to young children. Do these after vital signs when you need the child to be calm.

Weight in kilograms (kg)

Infant weight to nearest 0.01kg

- Calibrated beam or electronic infant scale.
- Newborns lose heat quickly. Keep as warm as possible to prevent hypothermia.
- Weigh naked (CMG) or in dry diaper (CSG).
- Use 2 people, if needed.



Child or adolescent weight to nearest 0.1kg

- Calibrated beam or electronic stand-up scale.
- Shoes off, pockets empty (cell phones, keys, etc.), minimal clothing.

Wheelchair scale (available in some areas)

- Remove shoes and any extra items.
- Weigh child in chair.
- Lift child from chair to weigh chair and subtract chair's weight from total to get weight of child.
- Some charts may have the wheelchair weight documented. Verify with the parent.

Scales on Units:

- Each unit has scales numbered, make sure you are using the correct scale for that patient.

How often do I obtain patient height, weight and head circumference (OFC)?

	Inpatient Policy Guidelines			Outpatient Policy Guidelines	
Age	Weight	Height	OFC	Weight and Height	OFC
Preterm	Daily	Weekly	Weekly	Every visit	Monthly
Term - 2 years	Weekly	Monthly	Monthly	Every visit	Every visit
2-10 years	Weekly	Monthly	As indicated	Every visit	As indicated
10-18 years	Weekly	Every 3 months	As indicated	Every visit	As indicated

Note: Use electronic health record flowsheets to determine when last measurement was taken.

Length/height in centimeters (cm)

Recumbent length (0-23 months or non-ambulatory patients)

- Use hard or soft length board (not a tape measure).
- Measure to nearest 0.1cm.
- Head positioned using Frankfort Horizontal Plane (looking to ceiling)
- Remove barrettes, hair bands, hats, etc.
- Shoes off.
- Use 2 people, one to hold head in position, the other to stretch out legs.



Measuring Knee Height

The knee height is the distance from the top of the patella to the bottom of the foot. It is measured using a knee height caliper.

- The subject lies on his/her back with their left knee and ankle bent at 90 degree angles
- The caliper is placed under the heel and against the thigh
- The measurement is read to the nearest 0.1 cm

Equation for Predicting Stature for Children from 3 to 12 years

$$\text{Stature (cm)} = (2.69 \times \text{knee ht}) + 24.2$$

Reference: Stevenson RD. Use of segmental measures to estimate stature in children with cerebral palsy. Archives of Pediatrics & Adolescent Medicine. 1995.

Equation for Predicting Stature in Children 13 to 18 Years of Age

Caucasian Boys

$$\text{Stature (cm)} = 40.54 + (2.22 \times \text{knee height})$$

African American boys

$$\text{Stature (cm)} = 39.6 + (2.18 \times \text{knee height})$$

Caucasian Girls

$$\text{Stature (cm)} = 43.21 + (2.15 \times \text{knee height})$$

African American girls

$$\text{Stature (cm)} = 46.59 + (2.02 \times \text{knee height})$$

Reference: Chumlea, WM. Prediction of stature from knee height for black and white adults and children with application to mobility-impaired or handicapped persons. JADA. 1994

Equations

The Stevenson equation will be used for patients 3 – 12 years old and the Chumlea equations for 13 – 18 year olds.

Equations are in spreadsheet form on the shared Q drive.

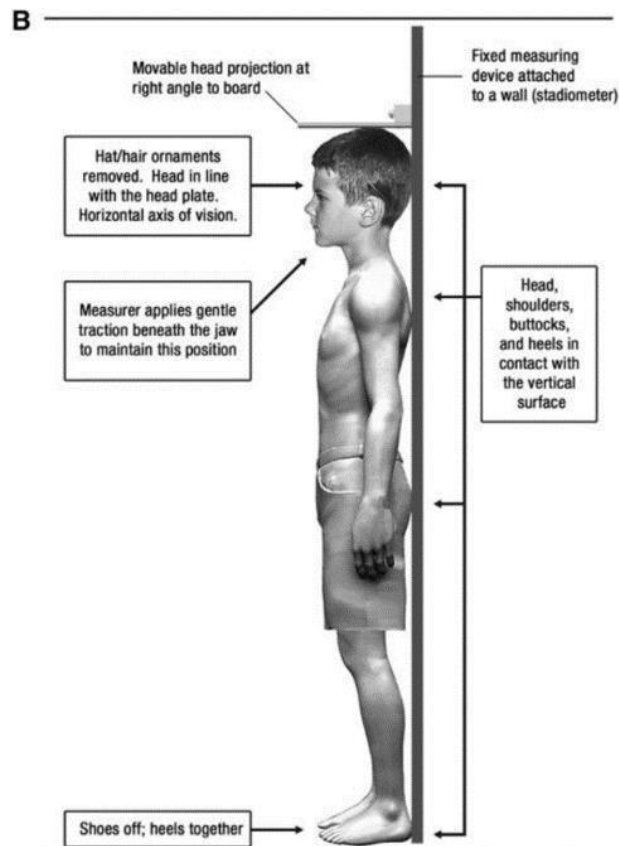
Knee Height Value

This value should be plotted on the standard growth chart but noted that it is derived from knee height measurement.

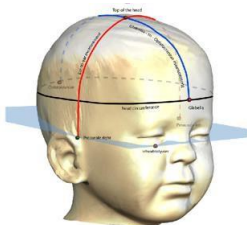
This value should not be used to calculate the BMI

Standing Height

- Use vertical stadiometer.
- Shoes off.
- Remove barrettes, hair bands, hats, etc.
- Heels of feet touching stadiometer.
- Buttocks and shoulders touching stadiometer.
- Head positioned using Frankfort Horizontal Plane (straight ahead).



Occipital-Frontal Circumference (OFC) or head circumference



- Measured in children 0 – 24 months of age to nearest 0.1 cm.
- Use measuring tape that does not stretch or a measuring device.
- Around head, above eyebrows, above ears, at most prominent part of back of head.

Head circumference measurement device (available in some areas)



Sample CMG clinic vitals chart (Specialty & Urgent Care clinics will vary)

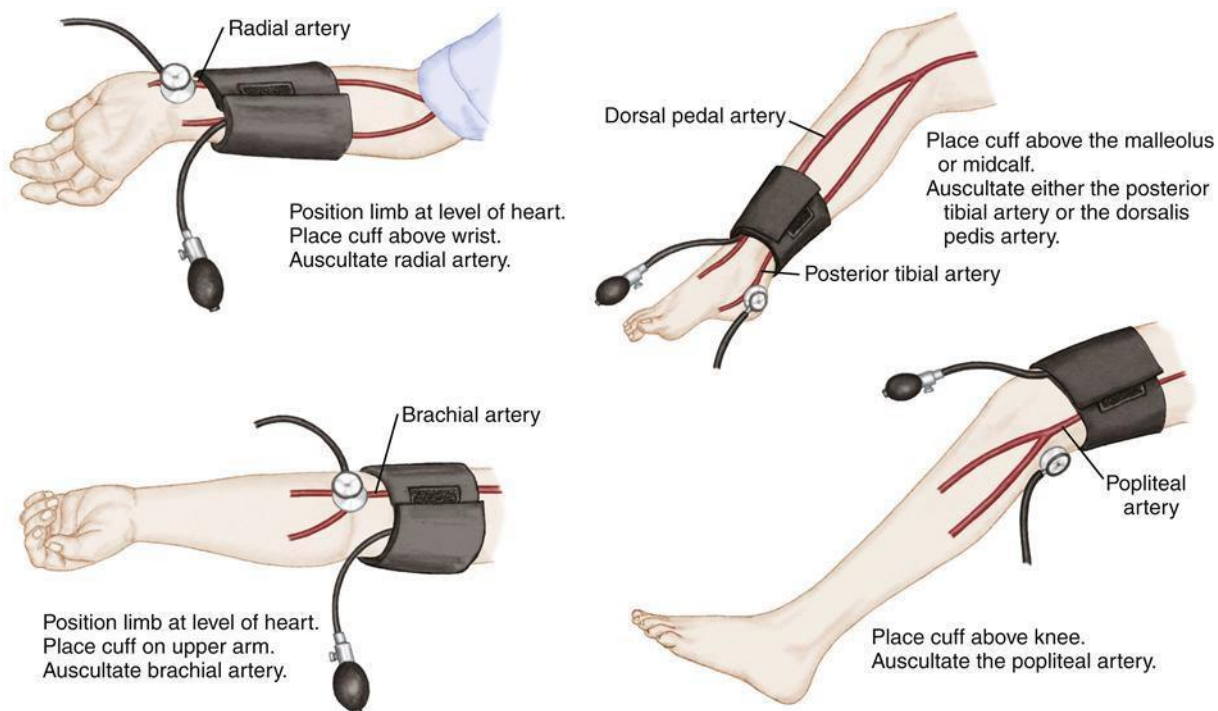
- Be aware that clinics have different requirements for each visit type.
- Complete all vitals as required per clinic & visit type.

<u>Chief Complaint</u>	<u>Weight</u>	<u>Height</u>	<u>Length</u>	<u>OFC</u>	<u>Temp</u>	<u>Apical Pulse</u> (30 sec x2)	<u>Respirations</u> (30 sec x2)	<u>Blood Pressure</u>	<u>Pulse Ox</u>
Weight Check Bilirubin	X				X				
General Sick	X				X	X	X		
Headache Dizziness	X	X			X	X	X	X	
Cough Wheezing Chest Pain Breathing Difficulty	X				X	X	X		X
Abdominal Pain	X				X	X	X		
Injury Muscle pain	X				X	X	X		
Medication Check	X	X			X	X	X	X	
Contraception	X	X			X	X	X	X	
Pre-op Visit	X	X (if over 24 months)	X (if under 24 months)		X	X	X	X	
WCC (0-24 months)	X		X	X (For 0-24 months)	X (only 0-2 months)				

Vital Signs & Blood Pressure Measurement

- High blood pressure in adults is above 120/80. Hypertension is $\geq 130/80$.
- In children, high blood pressure is ≥ 90 th percentile, hypertension ≥ 95 % for age.

Sites for taking blood pressure



Blood pressure cuffs sizes

- Correct cuff size: bladder 80 – 100% of mid-arm circumference
 - If too small $\rightarrow$ higher BP
 - If too large $\rightarrow$ lower BP
- During infancy, BP is often performed on lower legs, but sometimes on the arm.



Manual Blood Pressure Process



In Pediatrics, the focus is getting a blood pressure while the patient is content.

You may not be able to have feet on the floor or back supported. They may want to sit in a parent's lap or keep their legs crossed. If they are crying or fussy, you will not get an accurate reading.

- Sitting for at least 3- 5 minutes.
- Feet flat on floor, legs uncrossed, sitting in chair with back against backrest (OR) sitting with legs uncrossed on exam table and back against wall.
- Arm supported at heart level.
- No talking, consider distraction such as a picture book or quiet toy.
- Bladder empty.
- Bare arm.
- Correct cuff size, bladder 80 – 100% of mid-arm circumference.
- Align middle of bladder about 2 finger widths above brachial artery.
- Right arm preferred unless contraindicated, try to use same arm for comparison.
- Inflate pressure to 20-30 mmHg above expected systolic reading (about 120 in infants, 140 in children, 180-200 in teens or adults).
- Systolic first Korotkoff sounds (tapping or thumping) starts.
- Diastolic when sound stops.

How to Check Manual Blood Pressure 7 min.

- <https://www.youtube.com/watch?v=kudh6uo5ITg>



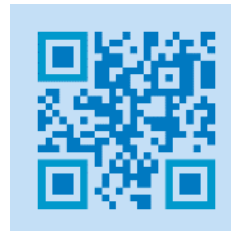
Listening for Korotkoff Sounds 8 min.

- <https://www.youtube.com/watch?v=bHXvhOQ0hYc>



Finding Correct Cuff Size 2 min.

- https://www.youtube.com/watch?v=beuN_WI2Aqk



Factors that can affect blood pressure

Preparation and positioning are key. When you add the factors in the below chart up, they can lead to a blood pressure reading as much as 50 mmHG above actual.

- The focus is getting a blood pressure while the patient is content and calm.
- You may not be able to have feet on the floor or back supported.
- They may want to sit in a parents lap or keep their legs crossed.
- If they are crying or fussy, you will not get an accurate reading.
- The most important factor is using the correct size cuff for you patient.

Performing manual blood pressure checklist

Blood Pressure (BP) Compliance Audit Tool		
Task	Yes	No
Sat and relaxed comfortably for at least 3 minutes before BP measurement		
Feet flat on floor		
Back supported		
Legs were uncrossed		
Made attempt to determine that the cuff was the correct size for the patient (visual inspection of cuff prior to placement, width encircles at least 40% of mid-arm circumference and cuff length at least 80-100%)		
BP cuff placed over bare arm		
Mid-BP cuff placed at heart level		
No smartphones during BP measurement		
No talking during BP measurement		
Both the systolic and diastolic BP recorded in EHR		

Developmental Stages & Fluid Maintenance Formulas

DEVELOPMENTAL STAGES

Erikson (Psychosocial)	Kohlberg (Moral)	Piaget (Cognitive)	Fowler (Spiritual)
Infancy (Birth-1 Yr)	Trust VS Mistrust	Sensorimotor (birth to 2 Yrs)	Un-differentiated
Toddlerhood (1-3 Yrs)	Autonomy VS Shame & Doubt	Preconventional (Premoral): Punishment & Obedience	Intuitive
Early Childhood (3-6 Yrs)	Initiative VS Guilt	Preconventional (Premoral): Naive Instrumental Orientation	Mythical-Literal
Middle Childhood (6-12 Yrs)	Industry VS Inferiority	Conventional: Good boy, Nice Girl; Law & Order Orientation	Synthesis
Adolescence (12-18 Yrs)	Identity/repudiation VS Identity/confusion	Post Conventional (Principled): Social Contract Orientation; Universal Ethical	Formal Operational (11-18 Yrs)

F	C	F	C	F	C	F	C
96.8	36.0	98.6	37.0	100.4	38.0	102.2	39.0
97.0	36.1	98.8	37.1	100.6	38.1	102.4	39.1
97.2	36.2	99.0	37.2	100.8	38.2	102.6	39.2
97.4	36.3	99.2	37.3	101.0	38.3	102.8	39.3
97.6	36.4	99.4	37.4	101.2	38.4	103.0	39.4
97.8	36.5	99.6	37.5	101.4	38.5	103.2	39.5
98.0	36.6	99.8	37.6	101.6	38.6	103.4	39.6
98.2	36.7	100.0	37.7	101.8	38.7	103.6	39.7
98.4	36.8	100.2	37.8	102.0	38.8	103.8	39.8
98.6	36.9	100.4	37.9	102.2	38.9	104.0	39.9

FLUID MAINTENANCE	HR	RR	B/P
<10 KG = 100 x kg = day OR 4 x kg (rounded) = hr	Newborns	80-160	30-60
10-20 KG = 1000 ml + (wt-10) x 50 = day OR 40 ml + (wt-10) x 2 = hr	Infants	80-130	20-40
> 20 KG = 1500 ml + (wt-20) x 20 = day OR 60 ml + (wt-20) x 1 = hr	1- 6 yrs	80-120	20-30
URINE OUTPUT	6-10 yrs	75-115	16-22
1 - 2ml/kg/hr	> 10 yr	60-100	16-20

Heart rate/Apical pulse



- You will use a stethoscope for finding the heart rate/pulse of all patients.
- Listen for a heartbeat and count for a minimum of 30-60 seconds while listening to a patient's heart sounds.
- It is never wrong to listen for a full 60 seconds.

Age Stage	Heart rate	Margin of error when practicing (+ or -)
Infant	90-180	8
Toddler	80-140	7
Preschooler	65-120	6
School age child	58-118	6
Adolescent	50-100	5

Respiratory rate



- You will use a stethoscope to listen to your patient's lung sounds and count the **respiratory rate**.
- We do not count "shoulder shrugs" or chest rise at Children's Wisconsin.
- Listen for a complete respiration (inhale and exhale) and count for a minimum of 30-60 seconds.
- It is never wrong to listen for a full 60 seconds.

Age Stage	Respiratory rate	Margin of error when practicing (+ or -)
Infant	30-53	6
Toddler	22-37	6
Preschooler	20-28	5
School age child	18-25	5
Adolescent	12-20	4

Temperature

Rectal temperatures – Only for infants 1 year and younger

- In **CMG**, rectal temps are only taken in infants up to 2 months of age.
- In **Ambulatory/Specialty (CSG)**, the maximum age for rectal temps varies per clinic, but usually up to 12 months of age.
- In **Inpatient & Urgent Care**, rectal temps are taken up to 12 months of age. Depending on the situation, some inpatients may need a more accurate temp, so they may have a rectal temp taken. Some inpatients may have a Foley temp present.



A rectal temperature can be taken in either of these positions.

Oral temperatures

- Generally, for children ages 4 and up. Depends on if child can follow directions to place thermometer in mouth correctly.

Axillary temperatures

- For infants and children if other methods are not appropriate.
- The axillary temperature may be lower than patient's core temperature.

Pulse oximetry/oxygenation



- Types of probes will vary. Generally, clinics use reusable probes. Disposable probes are typically used in inpatient units. Be sure you know which type of probe you use on your patient.
- Check that the HR/pulse on the handheld oximeter correlates to a manual HR to verify correct reading.
- Correct placement on clean skin/nail without nail polish):
- Edge of hand or foot for infants.
- Middle or ring fingers best, avoid dominant hand or digit used for self - soothing.
- Big toe or 2nd toe.
- Align light source and photo sensor across from each other.
- Protect from ambient light sources such as heat lamps and phototherapy.
- Change site at least every 4 hours to prevent skin breakdown.

Pain Assessments:

There are three different ways we assess pain at Children's Wisconsin. There is the FLACC scale for infants and special needs children. Bieri Faces Pain Scale (for ages 4 to 10), and 0-10 scale for older children able to self-report their pain.

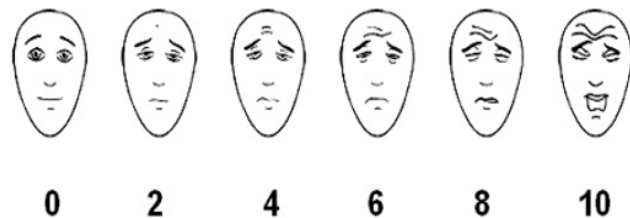
Nurses can then make a decision of using non-pharmacologic or pharmacologic methods to control their patient's pain.

Non Pharmacologic: Parent, Comfort (Animal/Blanket), Holding/Swaddling, Distraction, PO Feeds, Music, Dim Lights, Ice/Heat area of injury, Reposition/Elevation, Warm Blankets, Massage, and Pacifier (sweet ease)

Pharmacologic: Morphine, Hydrocortisone, Toradol, Dilaudid, Benadryl, PCA vs Bolus, Epidurals & Blocks, Tylenol, Ativan, Zofran, and Valium.

FLACC Revised			
Category	0	1	2
Face	No Particular expression or smile	Occasional grimace or frown, withdrawn or disinterested; <i>appears sad or worried</i>	Constant grimace or frown; frequent or constant quivering chin, clenched jaw; <i>distressed looking face, expression of fright or panic</i>
Legs	Normal position or relaxed; <i>usual tone & motion to limbs</i>	Uneasy, restless, tense; <i>occasional tremors</i>	Kicking or legs drawn up; <i>marked increase in spasticity; constant tremors or jerking</i>
Activity	Lying quietly, normal position, moves easily; <i>regular rhythmic respirations</i>	Squirming, shifting back and forth, tense; <i>tense or guarded movements; mildly agitated (head back & forth, aggression); shallow splinting respirations, intermittent sighs</i>	Arched, rigid or jerking; <i>severe agitation; head banging; shivering (not rigors); breath holding, gasping or sharp intake of breaths, severe splinting</i>
Cry	No cry or verbalization (awake or asleep)	Moans or whimpers, occasional complaint; <i>occasional verbal outburst or grunt</i>	Crying steadily, screams or sobs, frequent complaints; <i>repeated outbursts, constant grunting</i>
Consol-ability	Content and relaxed	Reassured by occasional touching, hugging, or being talked to. Distractible	Difficult to console or comfort; <i>pushing away caregiver, resisting care or comfort measures</i>
Each category is scored from 0-2 resulting in a total score of 0 - 10.			
<i>Italicized cues are intended to capture unique characteristics of children with developmental delays. Ask parents if there are any individualized characteristics their child displays when in pain</i>			

Bieri Faces Pain Scale



References

Children's Wisconsin Policy and Procedure: *Measurement and Documentation of Physical Growth* Children's Wisconsin Policy and Procedure: *Assessment, Reassessment, Documentation of a Patient* CMG Preventive Services Core Team - Visit Grids A & B https://www.cdc.gov/growthcharts/clinical_charts.htm
<https://kidshealth.org/en/parents/rectal-temperature.html>