

**American Indian and Alaska Native
Pediatric Height and Weight Study
2001-2002**

Anthropometric Protocols

*Selecting Equipment
Weighing Infants and Children
Measuring Infants and Children*

July 2002

Table of Contents

Equipment.....	3
Measuring Infants.....	7
Weighing Infants	10
Measuring Children.....	12
Weighing Children.....	16
Reading and Recording Measurements	18
Resources	21

Selecting and Using Equipment

The accuracy and reliability of measurements are dependent on the quality of the equipment used for the measurements. Quality, easily calibrated and well-maintained equipment will be utilized.

Length Boards for Measuring Infants

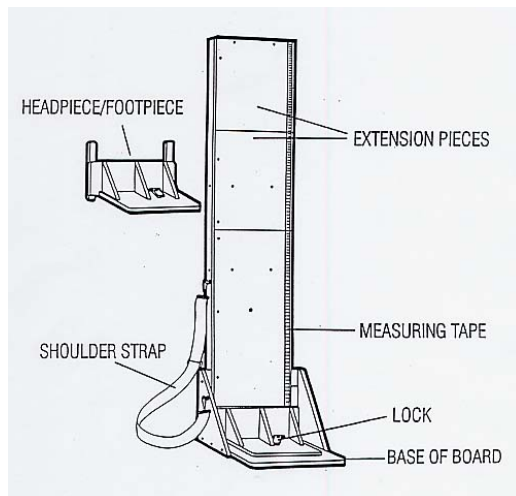
A recumbent measuring board should have a firm, flat base with an attached measuring tape, a fixed perpendicular headpiece and a smoothly sliding foot piece constructed of a durable material like wood or plexiglass that is easy to clean. The foot piece must form a 90° angle with the measurement surface. All edges must be smooth and finished. Measurements should be readable to the nearest 1/8 inch. The board should be placed on a secure table with enough room for the Assistant to be able to stand behind the back of the head of the child.



Stadiometers for Measuring Children and Adolescents

Two types of stadiometers are acceptable for measuring older children and adults. One type is a measuring board mounted to the wall with an attached measuring tape and moveable right angle headpiece. It is

important to ensure that the measuring board has been accurately mounted. A portable measuring board with a base for standing upon and a right angle headpiece may also be used. Portable measuring boards should be on a stable surface. It is also useful to have a step stool or short stepladder for the staff to stand on to read the height of a person who is taller than the measurer.



Selecting and Using Equipment

Unacceptable Measuring Equipment

The following equipment is unacceptable for measuring an infant:

- A measuring tape or yardstick alone or attached to a table top
- Measuring between two pencil marks on an exam table
- Length measuring device attached to an infant scale
- Movable measuring rod on platform scales
- Tape measures, yard sticks or paper “growth charts” mounted on the wall
- Books, tissue boxes, etc. should not be used as headpieces.

Selecting and Using Equipment

Scales for Weighing Infants

Infant beam balance or digital scales are appropriate to use for weighing infants. Beam balance scales should be marked in increments of 1 ounce or less. They should have a screw-type zeroing adjustment. There should be two sliding weights on a beam balance scale, one for whole pound increments and a second for ounces. Digital scales should read to one ounce or less. Both types should have features that allow for calibration. The scale must rest on a firm, stable table.

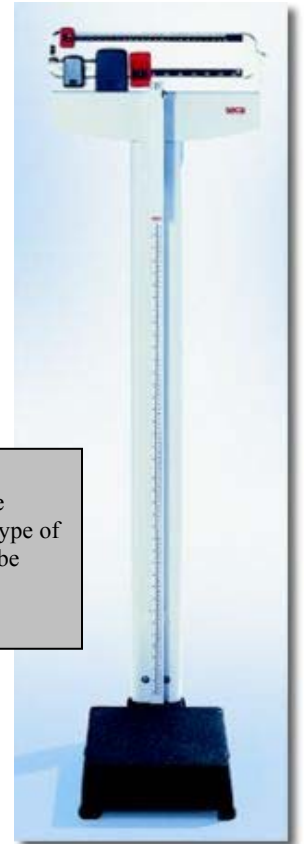


Scales for Weighing Children and Adolescents

A digital scale or an adult beam balance scale with a step-on platform and attached sliding weights are appropriate to use to weigh children and adults. The scales should measure in increments of 1/4 pound or less. Beam scales should have a screw-type zeroing adjustment. The scale should rest on firm, uncarpeted floors. The scale should have features that allow for calibration.



Note that the measuring device pictured on this type of scale should not be used to measure height



Selecting and Using Equipment

Zeroing and Standardization

Daily

Scales should be zeroed daily.

Zeroing means that the scale reads zero when no weight is placed on it.

Monthly

Scales and stadiometers should be standardized monthly.

Scales should be tested with standard weights.

Stadiometers should be checked with a standard length rod.

Measuring Infants and Young Children

Recumbent length refers to stature taken while lying down. Recumbent length is used to measure infants and children less than two years of age. Recumbent length can also be used for children two to three years of age who have great difficulty standing on their own; these children must be measured lying down and the measurement should be recorded as recumbent length.

Two people must be used to measure recumbent length. The infant should be wearing only a clean disposable diaper and undershirt. A child over the age of one should be wearing only light clothing. Shoes, sweaters, coats, etc. should be removed.

Procedure for Taking Recumbent Length*

1. **Measurer:** Cover the board with table paper.
2. **Assistant:** Ask the Assistant to remove hats, barrettes, shoes and socks. "Big" hairstyles will need to be flattened as much as possible. If hair or barrettes interfere with placing the child's head directly against the measuring board, make a note of this on the questionnaire. (Do not attempt to adjust the measurement.)
3. **Measurer:** Provide a brief training to the Assistant on how to hold the child's head.
4. **Measurer:** Place the sliding foot piece at the end of the measuring board and check to see that it is sliding freely.
5. **Assistant:** Ask the Assistant to lay the child down on his/her back on the measuring board and stand directly behind the child's head (Arrow 2). If it is not possible for the Assistant to stand behind the child's head, he/she may stand beside it.
6. **Measurer:** Position yourself on the right side of the child so you can hold the foot piece with your right hand (Arrow 3).

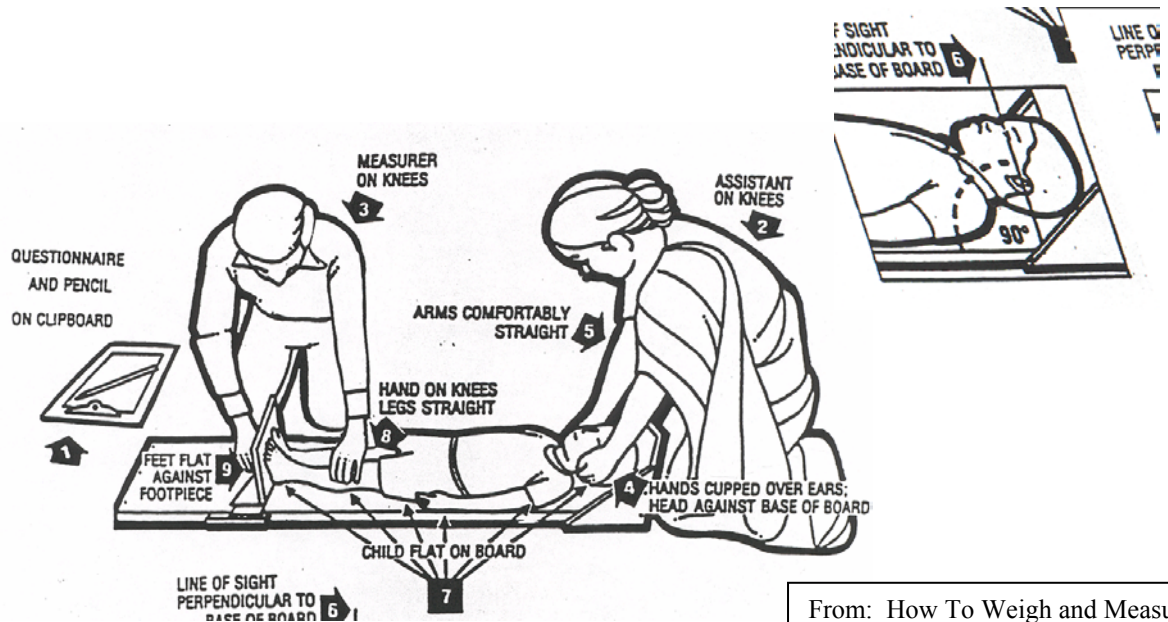
Note: While the infant is on the measuring board, you must hold and control the child so that he/she will not roll off or hit his/her head on the board.

7. **Measurer:** Hold the child securely at the waist while the Assistant positions the head.

* Adapted from *How To Weigh and Measure Children*, I.J. Shorr, UN, New York, 1986

Measuring Infants and Young Children

8. **Assistant:** Ask the Assistant to cup her hands over the child's ears. The Assistant's arms should be straight if possible and she should hold the child securely yet comfortably (Arrow 5). Make sure that the Assistant is cupping her hands. Her hands should not be flat against the child's head and her thumbs should not be touching the child's shoulders (Arrow 4).



From: How To Weigh and Measure Children, I.J. Shorr, UN, New York, 1986

8. **Measurer:** Ask the Assistant to place the child's head against the headpiece (Arrow 4).
9. **Measurer:** If the head is not against the headpiece, hold the child at the waist and lift or slide the child towards the headpiece. The Assistant should hold the child's head at all times and guide the head into position.
10. **Measurer:** Check to be sure that the child's head is in the correct position. The line from the hole in the ear to the bottom of the eye socket (Frankfort Plane) should be perpendicular to the board or table (Arrow 6).
11. **Assistant:** Ask the Assistant to place her head directly above the child's head and watch the position of the child's during the entire measurement. Ask her to make certain that the child's chin is not tucked in against his/her chest or stretched too far back.
12. **Measurer:** Position the child's body so that the shoulders, back and buttocks are flat

Measuring Infants and Young Children

along the center of the board (Arrow 7).

13. **Measurer:** Place your left hand on the child's knees (Arrow 8). Hold the movable foot piece (Arrow 9) with your right hand and firmly place it against the child's heels. A child's legs and feet can be very strong. You may have to straighten them with your hands.
14. **Measurer:** Check the child's position: head against the headpiece with eyes looking straight up, body and legs straight and flat in the center of the measuring board, heels and feet firmly against the foot piece.
15. **Measurer:** When the child's position is correct, read and call out the length measurement to the nearest 1/8". Continue to call out the measurement until the measurement is recorded.
16. **Measurer:** Record the measurement on the data collection sheet under "Recumbent Length". Check to make sure it is accurate and legible.

Note: It is acceptable to take two measurements that agree within 1/8" and use either one of those measurements.

Common Errors in Measuring Recumbent Length

- g Improper equipment used.
- g Hat, hair barrettes or big hairdos not removed.
- g Shoes, sandals, socks are not removed.
- g Child's head is not in correct position.
- g Child's head is not against headpiece.
- g Legs are not straightened or properly positioned.
- g Heels are not flat against the footboard.
- g Heels or legs are not flat against the recumbent board.
- g Only one leg is extended rather than both legs.

Weighing Infants and Young Children

Procedure for Weighing Infants/Children using the Beam Balance Scale*

1. Cover scale with paper.
2. Place both the pound and the ounce sliding beam weights directly over their respective zeroes.
3. Loosen the screw on the adjustable zeroing weight or counter weight. Move it until the beam balances, then tighten the screw on the counter-weight.
4. Ask the Assistant to remove the infant's clothing to a dry diaper. A child over one year of age should have shoes and heavy outer garments such as sweaters and coats removed.
5. Ask the Assistant to place the child on his/her back or sitting on the tray of the scale. Make sure the child is centered in the tray and is not touching anything off of the scale tray including other parts of the scale.
6. Move the pound weight until you find the first notch where the beam falls, then move the weight back one notch.
7. Slowly push the ounce weight across the beam until it is balanced. You may need to move it back and forth in small increments several times to reach balance.
8. If the beam continues to move (e.g. when the child moves), steady the beam with your hand. It may be difficult to get the beam as steady as you would like; be patient and as careful as possible.
9. Read and call out the measurement to the nearest 1 ounce or 1/16 pound. Call out the weight repeatedly until it is recorded.
10. Record the weight on the data collection sheet. Make sure it is accurate and legible.
11. Have the Assistant remove the child from the tray of the scale and return the weights on the beam to zero in preparation for the next measurement.

Note: It is acceptable to take two measurements that agree within 4 oz and use either one of those measurements.

* Adapted from the *Training Manual for the New York State Child Growth Monitoring Project*; I.J. Shorr, 1994-96.

Weighing Infants and Young Children

Procedure for Weighing Infants/Children using a Digital Infant Scale*

1. Cover scale with paper.
2. Activate the scale by turning it on. Zeroes will appear on the display panel. Make sure the scale is on “lb” rather than “kg”.
3. Ask the Assistant to remove the child’s clothing to undergarments.
4. Ask the Assistant to place the child on his/her back or sitting on the tray of the scale.
5. Make sure that the infant or child is not touching anything off of the scale.
6. The weight will appear on the display panel. If the weight changes (e.g. from 15lb 4oz to 15lb 5oz), record either number. Read and call out the weight to the nearest 1 ounce repeatedly until it is recorded.
7. Record the weight on the data collection sheet. Check it for accuracy and legibility.

Note: It is acceptable to take two measurements that agree within 4 oz and use either one of those measurements.

Common Errors in Measuring Weight of Infants/Children

- g Improper equipment is being used.
- g The scale is not properly zeroed or balanced.
- g Necessary clothing is not removed.
- g Child is not placed in center of scale tray.
- g Assistant is touching infant/child.
- g Infant/child is touching something off the scale or the scale itself.

*From I.J. Shorr, 1997



Measuring Height in Children and Adolescents

Standing height is used to measure children who are more than two years old and can stand without assistance.

Procedures for Taking Standing Height*

Two people are required to take the standing height of a child under the age of six. The directions below can also be followed for older children except that the child can be instructed on how to position the body and head and does not require anyone to hold the knees and ankles. Children should be measured without shoes and heavy outer clothing such as sweaters and coats.

1. **Assistant:** Ask the Assistant to remove socks and shoes on the child and remove or push aside any barrettes, braids, or hairstyles that might interfere with the measurement. Big hairstyles will need to be flattened as much as possible.
2. **Measurer:** Provide a brief training to the Assistant on how to hold the child's knees and feet.
3. **Assistant:** Ask the Assistant to walk the child to the board and kneel on the right side of the child. (Arrow 2)
4. **Measurer:** Place the data collection sheet and pen/pencil on the floor near you and kneel on the left side of the child. (Arrow 3)
5. **Measurer:** Place the child's feet flat and *either* the knees or feet together in the center of the measuring board.
6. **Assistant:** Ask the Assistant to place her/his right hand just above the child's ankles on the shins (Arrow 4) and place her left hand on the child's knees (Arrow 5) and push against the board. Make sure that the child's legs are straight.

The position of the legs is important. The line that bisects the body from the side is called the "mid-axillary line." Make sure the mid-axillary line is perpendicular to the base of the board (Arrow 16). This may mean that the child's feet may not touch the back of the measuring board, particularly in overweight or obese children.

* Adapted from *How To Weigh and Measure Children*, I.J. Shorr, UN, New York, 1986

Measuring Height in Children and Adolescents

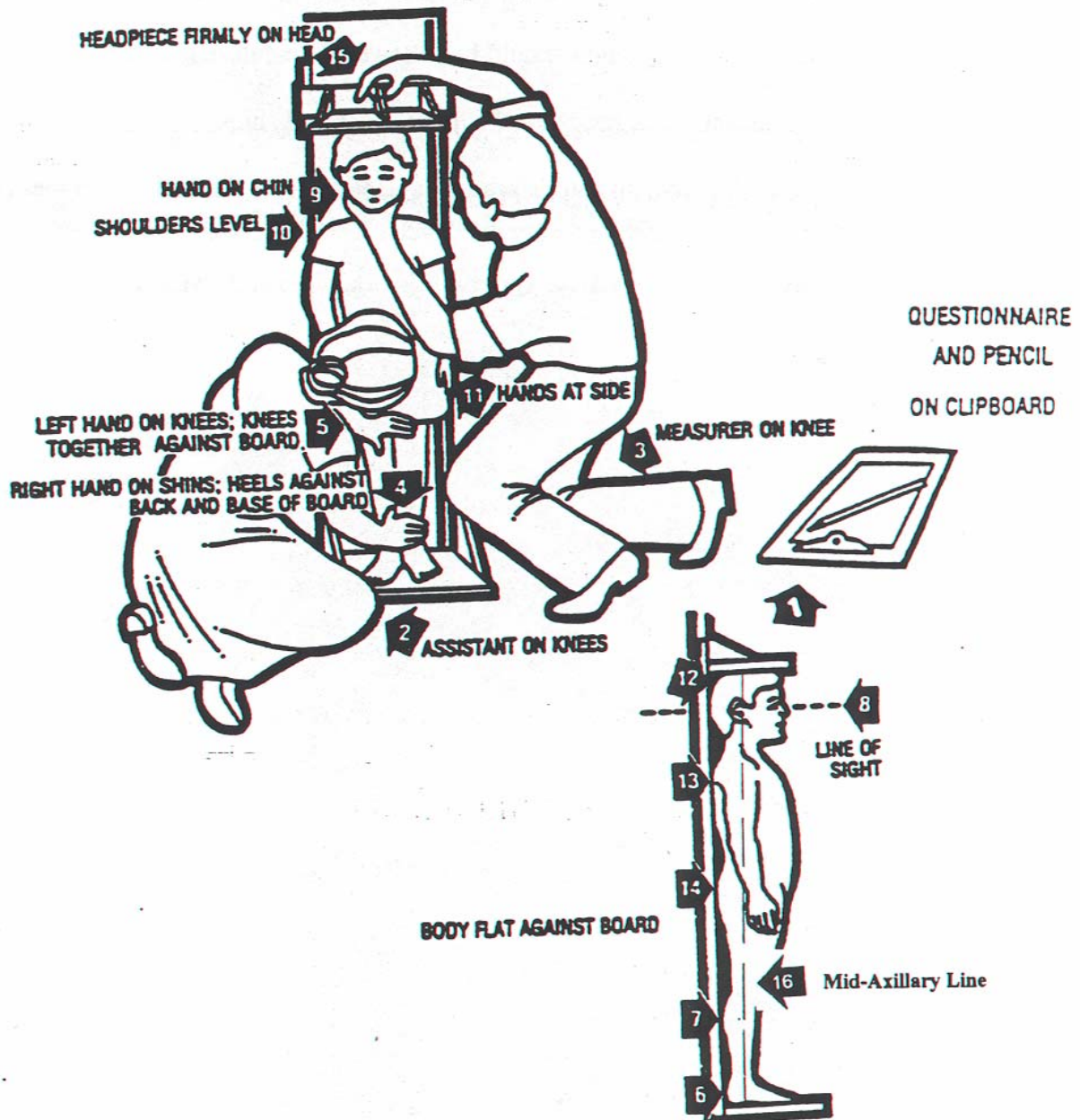
7. **Measurer:** Tell the child to look straight ahead. Make sure the child's line of sight (Frankfort Plane) is level with the floor (Arrow 8). The line from the hole in the ear to the bottom of the eye socket (Frankfort Plane) should be perpendicular to the board or table. In overweight, obese and older children, when the head is placed in proper position, according to the Frankfort Plane, there will be a space between the back of the child's head and the back of the measuring board. Do not judge the position of the child's head by looking at the top of the head, use the Frankfort Plane. Place your open left hand on the child's chin. Gradually close your hand (Arrow 9). Do not cover the child's mouth or ears. Do not rest your left hand on the child's chest. Make sure that the shoulders are level (Arrow 10), the hands are at the child's side (Arrow 11) and the head, shoulder blades and buttocks are against the board, if appropriate (Arrows 12, 13 and 14). With your right hand, lower the headpiece on top of the child's head. Make sure that you push through the child's hair (Arrow 15).
8. **Measurer:** When the child's position is correct, read and call out the measurement to 1/8 inch. Continue calling out the measurement.
9. **Measurer:** Record the measurement on the data collection sheet under "Standing Height". Check to make sure it is accurate and legible.
10. **Measurer:** If there were any unusual problems such as braids in the way or difficulty measuring the child, record this next to the measurement on the sheet.

Note: It is acceptable to take two measurements that agree within 1/4" and use either one of those measurements.

Measuring Height in Children and Adolescents

From: How To Weigh and Measure Children, I.J. Shorr, UN, New York, 1986

ILLUSTRATION #2 *
Standing Height



Measuring Height in Children and Adolescents

Common Measurement Errors



- g Improper equipment used.
- g Equipment is not properly installed.
- g Footwear, heavy outer clothing, hats or hair barrettes are not removed.
- g Feet are not flat on floor.
- g Knees are bent.
- g Head is not in proper position.
- g Measurement is not read at eye level.

Weighing Children and Adolescents

Procedure for Taking the Weight of Children and Adolescents Using a Beam Balance Scale*

1. Place both the sliding beam weights directly over their respective zeroes.
2. Loosen the screw on the adjustable zeroing weight or counter weight. Move it until the beam balances, then tighten the screw on the counter-weight.
3. Ask the child or Assistant to remove shoes and any heavy clothing such as jackets, sweatshirts, sweaters, etc.
4. Ask the child to step onto the scale. Make sure the child is centered on the platform and the arms are at his/her side.
5. Move the large 50-pound weight until you find the first notch where the beam falls, then move the weight back one notch.
6. Slowly push the small pound weight across the beam until it is balanced. You may need to move it back and forth in small increments several times to reach balance.
7. Read and call out the measurement to the nearest 1/4 pound. Call out the weight⁺ repeatedly until it is recorded.
8. Record the weight on the data collection sheet. Make sure it is accurate and legible.
9. Have the child step off of the scale and return the weights on the beam to zero in preparation for the next measurement.

Note: It is acceptable to take two measurements that agree within ¼ lb and use either one of those measurements.

*Adapted from *Training Manual for the New York State Child Growth Monitoring Project*, I.J. Shorr, 1994-96.

⁺ Out of respect for children's privacy, call out weight so other children are not able to hear.

Weighing Children and Adolescents

Procedure for Taking the Weight of Children and Adolescents Using a Digital Scale*

1. Activate the scale by turning it on. Zeroes will appear on the display panel. Make sure the scale is on “lb” rather than “kg”.
2. Ask the Assistant or child to remove shoes and any heavy clothing such as jackets, sweatshirts, sweaters, etc.
3. Ask the child to step onto the scale. Make sure the child is centered on the platform and the arms are at his/her side.
4. The weight will appear on the display panel. If the weight changes (e.g. from 22.1 lb to 22.2 lb), record either number. Call out the weight⁺ to the nearest ¼ lb repeatedly until it is recorded.
5. Record the weight on the data collection sheet. Make sure it is accurate and legible.

Note: It is acceptable to take two measurements that agree within ¼ lb and use either one of those measurements.

Common Errors



- g Improper equipment is used.
- g Scale is not properly zeroed or balanced.
- g Footwear and heavy outer clothing are not removed.
- g Individual is not properly centered on scale platform.
- g Child is holding onto Assistant or scale.
- g Child is not remaining still on the scale.

*From I.J. Shorr, 1997

⁺Out of respect for children’s privacy, call out weight so other children are not able to hear.

Reading and Recording Measurements*

Taking accurate measurements does not stop with following the correct procedures for weighing or measuring an infant or child. One of the greatest sources of error in taking anthropometric measurements takes place during the reading and recording of a measurement. If the height or weight is read incorrectly or an error is made when recording the measurement, the result will be inaccurate. Therefore, it is important to use care in reading and recording measurements.

Reading the Stature Measurement

Measurements can be difficult to read. The reading area of the measuring tape on most height measuring boards is usually in English units (inches and feet). Some measuring instruments may have both English and metric units. Read the English units only. Be sure to read the measurement in the correct area on your board. Find out where measurements should be read on your board.

1. Each inch on the measuring board is divided into sixteenths ($1/16$) or eighths ($1/8$) using small vertical lines (Arrow 1 or Arrow 2). There are slightly longer lines at $1/4$ inch (Arrow 3). There is an even longer line at $1/2$ inch (Arrow 4). There is a large number at each inch (Arrow 5).



2. Be careful to read the tape from the left to the right for recumbent (lying down) measurements and in an upward direction for standing height. For example, the reading of the tape below is $74 \frac{3}{4}$, not $75 \frac{1}{4}$.



* Adapted from: I.J. Shorr, 1997 and Training Manual for the New York State Child Growth Monitoring Project, I.J. Shorr, 1994-96.

Reading and Recording Measurements*

3. When measuring, you need to measure to the nearest 1/8 inch for recumbent (lying down) lengths and to the nearest 1/8 inch for standing heights. Count the number of 1/8 inch lines when you read the tape. The reading of the tape above is 74 6/8.
4. If the measurement falls between two 1/8 inch lines, record the nearest 1/8 inch number.
5. If the reading falls exactly between two of the 1/8 inch lines, randomly select either the higher or lower 1/8 inch number.
6. Use the 1/2 inch line to help identify a reading. For example, the reading on the tape below is 44 3/4 inches, since the arrow is a little more than 1/4 (2/8) inch above the 1/2 inch line. Be careful not to read this measurement as 44 1/4.



Reading and Recording Measurements*

Recording Measurements on the Data Collection Sheet

1. Immediately record the measurement after it is read. Call out the measurement* continuously until you have recorded the measurement. It helps to have your pen or pencil and collection sheet near you.
2. Record the measurement directly onto the data collection sheet. The more times the measurement is copied, the more chances of error there are.
3. Record measurements clearly and neatly, the same way every time. Check to make sure it is accurate and legible. The chart below shows how to write numbers that are easy to read.

Number	Comments
	A single vertical line. Do not slant the 1(/). Do not put a hat or base on the 1 (,).
	Make 2 and 3 with no loops (,).
	Make open 4. Closed 4 can look like a 9 ().
	Be careful not to connect the 5 which can look like a 6 ().
	Be careful with the loop of the 6 which can look like a zero ().
	Be careful that the 7 does not look like a 1 ().
	Be careful that the 8 does not look like a zero ().
	Make sure to close the loop of the 9 which could look like a 4 ().
	Be careful the 0 does not look like the number 6 ().

*Out of respect for children's privacy, call out weight so other children are not able to hear.

Resources

Resources for obtaining measuring boards and scales

Medical Supply Company, Inc.

18 Tanwood Court
Bethpage, NY 11714
Phone: 888-633-8282
www.medsupplyco.com

Perspective Enterprises

7829 Sprinkle Road
Portage, MI 49002
Phone: 800-323-7452
www.perspectiveent.com

QuickMedical

8300 Railroad Ave SE
Snoqualmie, WA 98065
Phone: 888.345.4858
Fax: 425.831.6032
sales@stadiometer.com

Shorr Productions

Irwin J. Shorr
17802 Shotley Bridge Place
Olney, MD
Phone: 877- 900-9007
ijshorr@shorrproductions.com
Website:www.shorrproductions.com