

Chapter 8

Blood Pressure, Heart Rate, Standing Height, Body Weight and Abdominal Circumference

BACKGROUND

This chapter addresses blood pressure and heart rate, which are cardiovascular measures and height, weight and waist circumference which are used to assess body size and fatness.

Blood pressure is a key indicator of healthy aging. Systolic blood pressure is the maximal blood pressure with each heartbeat and is recorded as the first or upper number in a blood pressure recording. With aging, the vessels stiffen and the maximal pressure is augmented. This stiffening of the vessels also results in a greater drop in blood pressure with each heartbeat, thus the diastolic blood pressure (the second number), goes down. In combination, the difference between the systolic and diastolic blood pressure, called the pulse pressure, increases with age. Even if blood pressure does not rise to a level requiring treatment with antihypertensives, an increase in systolic blood pressure alone or pulse pressure is a useful measure of the degree of vascular aging.

- Key change variables for blood pressure will include:
 - the difference between the average of the baseline systolic blood pressure and the average of the follow-up systolic blood pressure.
 - the difference between the average of the baseline diastolic blood pressure and the average of the follow-up diastolic blood pressure
 - the difference between the baseline pulse pressure and the follow-up pulse pressure

Change in blood pressure can be examined in those on and those not on blood pressure treatment separately or combined with adjustment for use of blood pressure medication.

Heart rate is a measure of cardiovascular fitness or can reflect abnormal heart rhythm. Heart rate goes up with exercise and illness, including cardiac arrhythmias. A low resting heart rate of about 60 beats per minutes is found in fit individuals but lower than 60 can reflect a block in the heart rhythm.

- Change in heart rate will be defined as the simple difference. Adjustment for heart slowing medications may be required for some analyses.

Height, weight and waist circumference are basic measures of anthropometry or body size and can reflect the body composition as well. The metric of weight adjusted for height squared is well correlated with percent body fat and is called body mass index or BMI. Waist circumference is used to assess central fat deposition.

Standing height also reflects bone mineral density and osteoporotic fracture of the spine. Height loss occurs with aging and is accelerated in osteoporosis.

- Change in height, weight, waist circumference and BMI will be taken as the simple difference between the baseline and the follow-up values.
- For understand maximal height or for measurements that need to be adjusted for maximal adult height, the baseline leg length should be used.
- If a participant cannot stand to measure standing height at visit 2, height will be set to missing.

Definitions:

Blood Pressure: Level of blood pressure is subject to biologic and observer variations, the latter being due to errors in measurement. The purpose of a specific protocol for the measurement of BP, a stringent certification procedure for technicians who measure BP, and a standard automated blood pressure measurement device in LLFS is to minimize error in measurement.

The seated BP reading for LLFS is an average of three systolic and diastolic BP's calculated by computer. When any of the blood pressure readings are out of range, it will trigger an "alert" and subsequent participant/ physician notification. Please see Chapter 6 – Alerts for out of range values, specific instructions and template notification letters.

The 8th Report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure defines categories of BP and recommends follow-up according to the following criteria:

Table 8.1: Classification of BP in Adults Aged 18 Years or Older¹:

BP Range, mm Hg	Category
Diastolic BP:	
< 80	Normal BP
80-89	Pre-hypertension
90-99	Stage 1 Hypertension
≥ 100	Stage 2 Hypertension
Systolic BP (when Diastolic BP < 80 mm Hg):	
< 120	Normal BP
120-139	Pre-hypertension
140-159	Stage 1 Hypertension ²
≥ 160	Stage 2 Hypertension ²

¹ Classification based on the average of two or more readings on two or more occasions. BP indicates blood pressure; DBP diastolic blood pressure; and SBP, systolic blood pressure.

² A classification of borderline isolated systolic hypertension (SBP, 140 to 159 mm Hg) or isolated systolic hypertension (SBP, ≥ 160 mm Hg) takes precedence over high-normal BP (DBP 85 to 89 mm Hg) when both occur in the same person. High-normal BP (DBP, 85 to 89 mm Hg) takes precedence over a classification of normal BP (SBP, < 140 mm Hg) when both occur in the same person.

Table 8.2: Follow-up Criteria for Initial BP Measurement for Adults Aged 18 Years or Older³:

BP Range, mm Hg	Recommended Follow-up
Diastolic BP:	
< 80	Have your blood pressure rechecked within 2 years
80-89	Have your blood pressure rechecked within 1 year
90-99	See your doctor about your blood pressure within 2 months
100-109	See your doctor about your blood pressure within 1 month
110- 119	See your doctor about your blood pressure within 2 weeks
≥120	See your doctor about your blood pressure immediately
Systolic BP, when DBP < 90 mm Hg:	
< 120	Have your blood pressure rechecked within 2 years
120-139	Have your blood pressure rechecked within 1 year
140-159	See your doctor about your blood pressure within 2 months
160-179	See your doctor about your blood pressure within 1 month
180-209	See your doctor about your blood pressure within 2 weeks
≥210	See your doctor about your blood pressure immediately

³ When recommendations for follow-up of DBP and SBP are different, the shorter recommended time for recheck and referral should take precedence.

Standing Height: Height with no shoes on a flat, uncarpeted floor.

Body Weight: Weight with no shoes.

Waist circumference: Circumference at the level of the umbilicus with the participant standing erect.

EQUIPMENT

- Omron HBP-1300 Professional Blood Pressure Monitor
- Handi-stat stature measuring tool, painter's tape, pencil and measuring tape.
- SECA Integra 840 or 841 or 803 digital scale
- Steel/fiberglass tape calibrated in centimeters
- BP cuffs in five sizes:
 - o 1 large adult cuff
 - o 1 regular adult cuff
 - o 1 extra-large (thigh) cuff
 - o 1 small cuff
 - o 1 extra small cuff

**Do not use the measurements provided on the cuffs. Refer to Chapter 8 and/or Panel 9 for appropriate cuff sizes.

MEASURE: BLOOD PRESSURE MEASUREMENTS

1. If possible, make sure that the device is plugged in. The device can operate on battery power for up to two hours. Insure that the device readouts are pointing away from the participant so that the participant cannot see the results.
2. Record the last four digits of the serial number, located on the back side of the Omron HBP-1300 machine, on the form in Question 1a.
3. Measure right arm circumference and record it to the nearest cm in Q1b. (See instructions below for measuring left arm if there is a medical reason to avoid using the left arm.)

Arm circumference is measured by having the participant stand facing away from the observer with the right arm bent 90 degrees at the elbow, with the hand on the mid-section. The tip of the acromion process (shoulder bone) is located and the length of the upper arm from the acromion process to the olecranon process (tip of the elbow) is measured with a tape. The midpoint is marked and the participant is asked to relax the arm at the side. The tape measure is then wrapped around the arm over the midpoint mark, making sure that the tape is level.

Mark cuff size used for the blood pressure measurement with the Omron HBP-1300 device in Question 1c. Cuff size is determined by the arm circumference measured in Question 1b. The appropriate size cuff for a given arm circumference appears below and on the form. Proper size of the cuff is essential for accurate blood pressure measurement.

Medical Reason to Measure Left Arm - If there is a medical reason (e.g., chronic pain, paralysis, amputation) to avoid using the right arm, measure left arm. Document which arm was measured in Q2a, select the appropriate response for cuff placement in Q2b and, if right arm was not used, document reason right arm was not used in Question 2c.

Table 8.3: Arm Circumference Chart for Determining Correct Cuff Size

Arm Circumference	Cuff Size
12-17.9 cm	Extra-Small/Child
18-21.9 cm	Small
22-31.9 cm	Regular
32-41.9 cm	Large
42-50 cm	Extra-Large

4. Place the cuff on the participant, and record in Question 2b whether the cuff was placed on the forearm or the upper arm. If possible, the cuff should be placed on the upper arm. However, in obese individuals, the cuff may be placed on the forearm to allow for measurement of blood pressure with the Omron HBP-1300 device.
5. Palpate and mark the brachial artery with an X. Connect the cuff tubing to the Omron HBP-1300 by twisting the female adaptor into the male connection on the machine.
6. During the five minute waiting period, the participant should remain sitting in a chair and not read, with feet flat on the floor. Conversation should be kept to a minimum during the subsequent blood pressure measurements.

7. The Omron HBP-1300 inflates the cuff automatically once the machine is turned on by pressing the blue “START/STOP” button on the lower, right-hand side of the screen. Turn on the machine AFTER the five minute waiting period and when the first measurement is ready to be taken. Record the systolic, diastolic, and pulse values at the first set of blood pressure measurements onto the form in Questions 3a and 3b. If the participant wants to know what the measurement is, do not tell him or her. Instead, give them all 3 readings after the final reading.
8. Wait one minute after the first measurement has concluded before obtaining the next set of measurements. Record the systolic, diastolic, and heart rate values onto the form in Questions 4a and 4b after the second set of blood pressure measurements. If the participant wants to know what the measurement is, do not tell him or her. Instead, give them all 3 readings after the final reading.
9. Wait one minute after the first measurement has concluded before obtaining the next set of measurements. Record the systolic, diastolic, and heart rate on the form after the third set of blood pressure measurements in Questions 5a and 5b. If participant would like to know their blood pressure, give them all 3 recordings.
10. Turn off the Omron HBP-1300 by holding the blue “START/STOP” button for approximately 3 seconds and the screen powers off.

MEASURE: STANDING HEIGHT

Standing Height Measurement: Record the standing height in Questions 6a-6f after measurement by the following procedure outlined below. If participant is unable to complete standing height, mark the form with a "N" for not applicable, subject is unable to perform the procedure. However, if the participant is unable to complete the procedure because they were unable to sufficiently follow instructions to complete the measurement, then enter "U" for measurement 1 (Q6a) and then proceed to Q7.

Home Visit Protocol:

1. Use a hard, flat floor which is even and without carpet. Measurement may be inside a doorway, against a closed door, or in a hallway. Use an area that does not have a baseboard, threshold, or other protrusion.
2. Explain the procedure to the participant. Ask him/her to remove shoes or slippers. Ask him/her to stand with feet flat on the floor, heels together, with heels, hips, shoulders directly against the wall. Keep the head in a Frankfort plane (Figure 1) as close to the wall as possible. [Note: if the participant has a kyphotic posture, measure the height with the participant standing in a sideways position, preferably in a doorway.]

Script: *Now I am going to measure your standing height. Please remove your shoes. Stand with your feet flat on the floor, heels together, with heels, hips, shoulders directly against the wall."*

3. Ask the participant to tilt the head forward so you can place a piece of adhesive tape vertically on the wall in the area where the height will be measured. Place the tape loosely, with one end folded over so that it will be easy to remove without damaging the wall. Now ask the participant to look straight ahead.
4. Rest the wooden base of the set square against the wall above the participant's head with the right angle toward the floor. Slide down slowly until it touches the top of the participant's scalp, carefully centered with their nose. Make sure one wooden edge is flat and held steadily against the wall. Mark the tape exactly where the corner of the right angle touches the tape. Be sure to mark the tape from underneath the set square with the pencil angled upward.
5. Remove the square and ask the participant to step away from the wall. Open the metal measuring tape and make sure it is straight. Secure it against the wall by pressing it with your foot at the "0" end, or by taping it. Keeping the tape flat against the wall, and vertical read the measurement closest to the mark

on the tape and record to the nearest 0.1 cm. If necessary, stand on the folding stool to be at eye level with the mark. It may be necessary to solicit assistance from the second technician or the participant if you use a stool.

6. Record the height measurement. If the two measurements differ by ≥ 0.4 cm, two additional measurements should be taken. After the result has been recorded, convert the height to feet and inches for the participant.
7. Remove the tape carefully from the wall and discard.

Clinic Protocol: If the visit is done in the clinic, follow the procedures above, but use a stadiometer in lieu of the handi-stat set square. See sitting height below for stadiometer instructions. If participant is unable to complete standing height, mark the form with an "N" for not applicable, subject is unable to perform the procedure. However, if the participant is unable to complete the procedure because they were unable to sufficiently follow instructions to complete the measurement, then enter "U" for measurement 1 (Q6a) and then proceed to Q7.

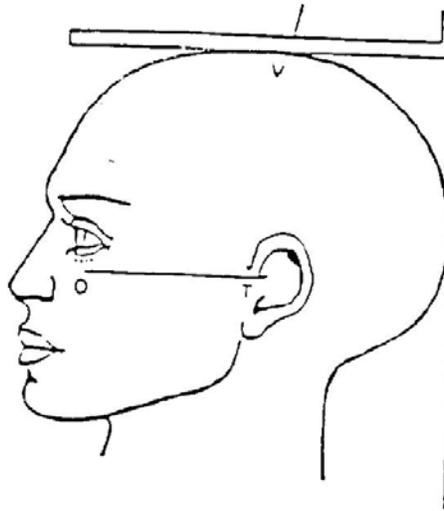


Figure 1

MEASURE: BODY WEIGHT MEASUREMENT

Scale Weight: The SECA Integra 840 or 841 digital scale is to be brought to the home visit for weighing the participant.

Record the weight in Question 7 after measurement, using the following guidelines outlined below. If participant is unable to complete the weight measurement, mark the form with a "N" for not applicable, subject is unable to perform the procedure. However, if the participant is unable to complete the procedure because they were unable to sufficiently follow instructions to complete the measurement, then enter "U" for this measurement (Q7) and then proceed to Q8a.

Note: If the measured body weight is over 300 lbs, the scale will not register. If the individual has a home scale and they are weighed on it, please enter the weight from the non-LLFS approved equipment. If they do not have a home scale, you can ask them for their self-reported body weight. If the scale malfunctions and you are unable to get a measurement, you can ask for their self-reported body weight. For all situations, flag this form for data entry as this value should be marked in the DES as an estimated value. There is an associated comment field for this questionnaire item where you can make the notation.

1. Check the scale prior to the visit to verify that the batteries are operational. If necessary, remove the digital display head from the base to open the battery compartment underneath, and replace with a new standard 9 volt alkaline battery. After connecting the battery terminals, insert the battery and close the cover. Replace the head on the base of the scale.
2. After carrying the scale into the home, place it on a hard floor surface rather than on a carpet.
3. The participant should be wearing light indoor clothing. Remove shoes as well as any heavy sweater, coat, etc. prior to the weigh-in.

Script: In order to measure your weight, please remove your shoes and heavy jewelry, and empty your pockets. Please step forward onto the center of the scale.

4. To weigh the participant:
 - Select "kg" measurement using the switch on the underside of the digital display.
 - Turn the scale "on" by stepping one foot on the scale for 0.5 seconds. The number 0.0 will appear on the digital display.
 - The participant may step onto the scale as soon as the number 0.0 appears on the display.
 - Wait about four seconds for the numbers to stabilize. Record the weight viewed on the digital display onto the anthropometry form or data-enter into the computer. This scale is accurate to 1 kg over the entire weighing range.
 - If two values are displayed alternately in the 1 kg range, then the exact weight is between these values. Round to the nearest whole number.
 - The scale switches off automatically after 30 seconds.
5. Problems:
 - If no weight display appears under the load - Remove the person from the scale, press the ON button and wait for the display to read 0.0.
 - If "----" appears in the display - Press the ON button and wait for the display to read 0.0.
 - If "ERR" appears on the display - Remove the person from the scale, press the ON button and wait for the display to read 0.0.
 - IF "BAT" appears on the display - Change the battery.

MEASURE: ABDOMINAL (WAIST) CIRCUMFERENCE

Measured waist circumference should be recorded in Questions 8a-8c. If participant is unable to complete abdominal circumference, mark the form with a "N" for not applicable, subject is unable to perform the procedure. However, if the participant is unable to complete the procedure because they were unable to sufficiently follow instructions to complete the measurement, then enter "U" for measurement 1 (Q8a) and then this form is completed.

1. The measurements will be taken over bare skin. Participants should be dressed in a clinic gown (or ask them to lower their underwear to below hip level to allow measurement on bare skin) so that appropriate landmark can be located and should be instructed prior to the visit not to wear restricting or compressing undergarments, such as girdles or panty hose, which could interfere with the measurement.
2. Detailed Measurement Procedures:
 - Ask the participant to stand with their weight equally distributed on both feet, arms hanging at their side, and head facing straight ahead. They should relax their abdomen and breathe normally. The examiner should be sitting or squatting at the side of the participant so that their eyes are at the level of the waist.

- Measure the abdominal circumference directly over bare skin. If necessary, lower pants so that waist bands do not produce a bulge in tissue.
- Pull the tape around the participant's middle at the level of the umbilicus with the tape in a horizontal plane.
- Use a wall mirror hanging at waist level to be sure the tape is in the same horizontal plane all around. An assistant may sometimes be needed to help position the tape behind the participant. Alternately, have the participant help hold the tape in position. Bending their arm slightly should not affect the measurement as long as they maintain an erect posture.
- Hold the tape snug against the skin, without compressing the tissue, and with its zero end below the value to be recorded.
- Make the measurement at the end of a normal expiration to the nearest 0.1 cm.
- Script: *"I'd like to take a measurement around your middle at your bellybutton. I may need to move some of your clothing out of the way. Breathe normally. Don't hold your stomach in. Just relax."*
- Remove and reposition the tape. Repeat the measurement. If the difference between the measurements is > 1 cm, a third and fourth measurement should be obtained. Record all the measurements in Q8d-e. The computed value will be the mean of the two or four recorded values.
- If circumference at the umbilicus was obstructed (e.g., ostomy bag, bandages, hernia, etc.) during measurement, then mark 'yes' in Question 8f and explain in Question 8g.

Study Documents Referred to in this Chapter:

- Blood Pressure, Height, Weight and Waist Circumference Data Collection Form