



Centers for Disease
Control and Prevention
National Center for
Health Statistics

2021 Blood Pressure- Oscillometric Measurement Procedures Manual

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National Health and Nutrition Examination Survey

Table of Contents

<u>Chapter</u>		<u>Page</u>
1	Overview of Blood Pressure.....	1-1
1.1	Importance of Blood Pressure Measurement.....	1-1
1.2	Physiological/Anatomical Basis of BP Readings (Systolic and Diastolic).....	1-1
1.2.1	Non-Invasive Brachial Blood Pressure Assessment.....	1-2
1.2.2	Clinical vs. Standardized BP Readings.....	1-3
1.3	Training.....	1-4
1.3.1	Cleaning, Setting Up the Device, and Calibration for Accurate Standardized Readings (See Chapter 2 for More Detailed Information).....	1-5
1.3.2	Skills to Obtain Standardized Brachial BP Measurement (See Chapter 3 for More Detailed Information).....	1-5
1.3.3	Data Entry-Related Skills (See Chapter 4 for More Detailed Information).....	1-6
1.4	Risk.....	1-6
	References.....	1-7
2	Equipment and Supplies.....	2-1
2.1	List of Equipment and Supplies for Blood Pressure.....	2-1
2.1.1	List of Equipment.....	2-1
2.2	Description of Equipment for Blood Pressure.....	2-1
2.2.1	Omron IntelliSense Blood Pressure Monitor (HEM-907XL).....	2-1
2.2.2	Display Items on Omron BP Monitor.....	2-3
2.2.3	Accessories for the Omron BP Monitor (HEM-907XL).....	2-4
2.2.4	Supplies and Materials for Blood Pressure.....	2-5

<u>Chapter</u>		<u>Page</u>
	2.3 Equipment Care and Maintenance	2-7
	2.3.1 Procedure to Verify the Function Settings	2-9
	2.4 Annual Calibration Check.....	2-9
	2.5 Inventory	2-10
	2.6 Equipment Malfunctions	2-10
3	Protocol.....	3-1
	3.1 Introduction to the Blood Pressure Measurement	3-1
	3.2 Procedures for Blood Pressure Measurement	3-1
	3.2.1 SPs Excluded from Blood Pressure.....	3-2
	3.2.2 Steps to Obtain Blood Pressure	3-2
	3.3 Special Considerations.....	3-20
	3.3.1 SPs in Street Clothes	3-20
	3.3.2 Comprehension or Language Difficulties	3-20
	3.3.3 Interruptions.....	3-21
4	Data Entry Screens.....	4-1
	4.1 General Screen Information.....	4-1
	4.2 Arm Circumference Screen	4-3
	4.3 Data Capture Screens	4-6
	4.4 Error Code/Restart Screen	4-8
	4.5 Blood Pressure Statement Screen.....	4-11
	4.6 Blood Pressure Component Status Screen.....	4-16
5	Referrals and Report of Findings	5-1
	5.1 Blood Pressure Referrals.....	5-1
	5.1.1 Blood Pressure Referrals—Adults	5-1
	5.1.2 Blood Pressure Referrals—Children.....	5-4

<u>Chapter</u>		<u>Page</u>
6	Quality Control	6-1
6.1	Equipment and Room Setup Checks.....	6-1
6.1.1	Daily.....	6-2
6.1.2	Start of Stand.....	6-3
6.1.3	End of Stand	6-3
6.1.4	Incomplete QC Checks	6-4
6.2	Changing Set Values for the BP Monitor.....	6-4
6.2.1	Changing/Confirming the Number of Measurements (F1)	6-4
6.2.2	Waiting Time Until the Start of the First Measurement (F2).....	6-4
6.2.3	Measurement Interval (F3).....	6-5
6.3	Recording the Serial Number of the Monitor	6-5
6.4	Observations, Replication, and Review	6-6
 <u>Appendixes</u>		
A	Child Blood Pressure Values.....	A-1
B	Child Blood Pressure References	B-1
C	Adult Blood Pressure Reference Tables.....	C-1
D	Blood Pressure Quick Tips	D-1
E	Blood Pressure Talking Points	E-1
F	Blood Pressure Recording Form.....	F-1

<u>Tables</u>		<u>Page</u>
1-1	Factors affecting accurate BP readings.....	1-4
1-2	Skills matrix	1-5
2-1	Arm circumference and corresponding cuff size.....	2-5
2-2	Summary of key functions.....	2-8
3-1	Arm circumference and corresponding cuff size.....	3-11
3-2	List of error codes	3-17
5-1	Blood Pressure category (adults)	5-1
5-2	Blood pressure referral levels, category, and action guideline (adults).....	5-2
5-3	Adults' blood pressure referral letter comments.....	5-2
5-4	Table of blood pressure report of findings – comments (adults).....	5-3
5-5	Referral comments for blood pressure (children).....	5-4
5-6	Table of blood pressure report of findings – comments (children).....	5-4
 <u>Exhibits</u>		
1-1	Systolic and diastolic blood pressure	1-1
1-2	Brachial artery.....	1-2
1-3	Oscillometric blood pressure	1-3
2-1	Omron HEM-907XL BP monitor (Main Unit)	2-2
2-2	Display items and buttons on the Omron HEM-907XL BP monitor.....	2-3
2-3	Battery pack, AC adapter, and air tube.....	2-4
2-4	BP arm cuffs.....	2-5
2-5	Supplies for blood pressure.....	2-6

<u>Exhibits</u>		<u>Page</u>
2-6	Foam pads.....	2-7
2-7	Start of Stand QC Check screen.....	2-8
2-8	Function settings.....	2-9
3-1	Attaching the Omron to the AC adapter	3-4
3-2	P-SET and MODE selections	3-4
3-3	Connecting the air tube.....	3-5
3-4	Display of arm circumference measurement in blood pressure	3-6
3-5	Upper arm bony landmarks	3-7
3-6	Marking spine extending from acromion process	3-8
3-7	CORRECT tape placement for upper arm length.....	3-8
3-8	INCORRECT tape placement for upper arm length	3-8
3-9	Marking upper arm length midpoint.....	3-9
3-10	Measurement of mid arm circumference	3-9
3-11	Brachial artery.....	3-10
3-12	Locating the brachial artery.....	3-11
3-13	Marking the brachial pulse	3-11
3-14	Applying the blood pressure cuff.....	3-12
3-15	Wrapped blood pressure cuff	3-12
3-16	Blood pressure cuff fit	3-13
3-17	Correct position for blood pressure measurements	3-14
3-18	Foot and arm foam pads	3-15

<u>Exhibits</u>		<u>Page</u>
3-19	How to start the blood pressure measurement	3-16
3-20	How to deflate the blood pressure cuff	3-17
4-1	Login SP screen	4-1
4-2	ISIS screen characteristics	4-2
4-3	Arm Circumference screen	4-3
4-4	Intake and Arm Circumference screen.....	4-4
4-5	Cuff size	4-5
4-6	Out of range confirmation message.....	4-5
4-7	Intake question.....	4-5
4-8	Data Capture Screen 1 with values	4-6
4-9	Data Capture Screen 2 with inconsistent readings from Screen 1	4-7
4-10	Data Capture Screen 3	4-7
4-11	Data Capture Screen 3 with corrected values.....	4-8
4-12	Error code.....	4-9
4-13	Error code numbers	4-9
4-14	Rest period re-started	4-10
4-15	BP measures re-started	4-11
4-16	BP statement – Normal (adult).....	4-11
4-17	BP statement – Elevated (adult).....	4-12
4-18	BP statement – High (adult).....	4-12
4-19	BP statement – Very high (adult)	4-13
4-20	BP statement – Severely high (adult)	4-13

<u>Exhibits</u>		<u>Page</u>
4-21	BP statement – Normal (children)	4-14
4-22	BP statement – Elevated (children)	4-14
4-23	BP statement – High (children)	4-15
4-24	BP statement – Very high (children).....	4-15
4-25	BP statement – Children 8-12 missing height measurement	4-16
4-26	Blood Pressure Component Status screen—complete	4-17
4-27	Blood Pressure Component Status screen—partial	4-17
6-1	Quality control daily checks	6-2
6-2	Quality control start of stand checks	6-3
6-3	Quality control end of stand checks	6-3
6-4	Quality control equipment swap	6-5

1. Overview of Blood Pressure

Blood pressure (BP) will be monitored in the current National Health and Nutrition Examination Survey (NHANES) by the mobile examination center (MEC) health technicians (HT). HTs will obtain BP values using an oscillometric device (Omron HEM-907XL) on participants aged 8 years and older.

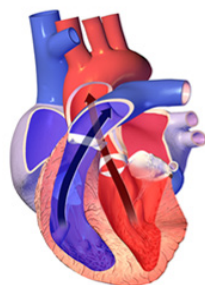
1.1 Importance of Blood Pressure Measurement

Recently, the Global Burden of Disease report identified elevated systolic blood pressure as one of the 10 largest contributors to disability-adjusted life years lost during 2015.¹ Effective BP management, resulting in a reduction in BP values, has been shown to decrease the incidence of mortality, stroke, heart attack, and heart failure.^{2,3} Accurate and reliable BP measurement is the key to providing valid national hypertension estimates, and hence, helping to reduce the burden of cardiovascular diseases in the U.S.

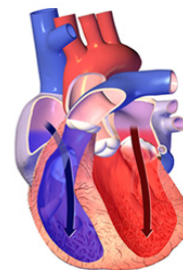
1.2 Physiological/Anatomical Basis of BP Readings (Systolic and Diastolic)

Blood pressure is measured using two numbers. The first number, defined as systolic, is the measurement exerted by the blood as it flows through the arteries as the result of contraction (pumping) of the ventricles. The second number, defined as diastolic, is the pressure exerted on the arteries when the ventricles are at rest and filling with blood (Exhibit 1-1).

Exhibit 1-1. Systolic and diastolic blood pressure



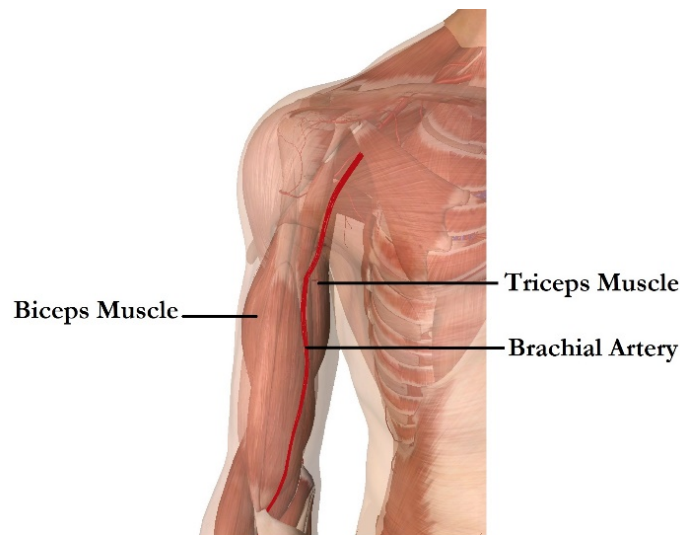
Systolic Blood Pressure
Systole (pumping)



Diastolic Blood Pressure
Diastole (filling)

Unless indicated otherwise, blood pressure refers to the pressure in the large arteries delivering blood to body parts other than the lungs, such as the brachial artery (in the arm). Arteries are mostly located inside our body, which makes them difficult to palpate. In contrast, the brachial artery is close to the surface of the skin, and easy to find and palpate with your fingers. When in a seated position it is approximately at the same height as the heart, and is located above a large muscle (the biceps muscle), which provides a hard surface to compress the brachial artery against (Exhibit 1-2).

Exhibit 1-2. Brachial artery



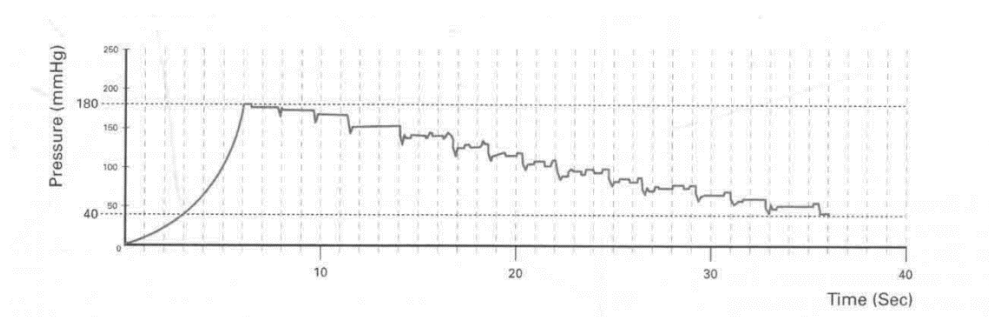
1.2.1 Non-Invasive Brachial Blood Pressure Assessment

Non-invasive brachial blood pressure assessment can be broadly categorized as using: a) auscultatory, which is listening to sounds using a stethoscope and manual technology (mercury column or aneroid sphygmomanometers) or b) oscillometric technology (automated devices) to obtain BP readings.⁴

Auscultatory device estimate systolic BP (SBP) and diastolic BP (DBP) from two Korotkoff sounds: Korotkoff 1, the beginning of at least two uninterrupted pulse sounds and Korotkoff 5, the point when pulse sounds stopped being audible, respectively. Auscultatory/manual BP devices have been phased out in recent years due to intensive training to accurately obtain BP, increased environmental concerns about the disposal of mercury-contaminated medical waste, and the risk of spills from mercury sphygmomanometers.⁵ Oscillometric BP devices estimate systolic BP (SBP) and diastolic BP (DBP) from the mean arterial pressure using a device-specific algorithm and the

oscillometric pulse waves detected in the BP cuff, typically during deflation, although some devices assess BP during inflation. Each manufacturer of oscillometric devices incorporates its own undisclosed proprietary algorithm(s) for estimating SBP and DBP.⁴ Exhibit 1-3 depicts an oscillometric blood pressure curve showing BP cuff inflation and deflation for a single BP measurement. The cuff is automatically inflated by the pump when the BP measurement is initiated. The cuff pressure increases to 180 millimeters of Mercury (mm Hg) over 10 seconds, the pump stops, and the electronic valves control the deflation from 180 mm Hg to a pressure below diastolic pressure. The total measurement time is approximately 36 seconds.⁴

Exhibit 1-3. Oscillometric blood pressure



1.2.2 Clinical vs. Standardized BP Readings

BP can be observed in a clinical setting such as in a health care providers' office or in a research setting such as the National Health and Nutrition Examination Survey. Because of the need to generalize to U.S. population, standardized reproducible training and procedures are absolutely essential for accurate BP observations. Stated differently, to extrapolate from the survey sample to the United States non- institutionalized population, all BP observations need to be done repeatedly in the same manner. Table 1-1 lists factors that can affect accurate systolic BP (SBP) and diastolic BP (DBP) readings.

Table 1-1. Factors affecting accurate BP readings

Before measurement		
Device	Validation	
Omron HEM-907XL	It is designed and used as a clinical BP monitor. It passed the AAMI validation criteria and was cleared by the FDA. ⁶⁻¹⁰ Also, it has been used in numerous adult CVD/epidemiological studies, including the following: (a) the action to control cardiovascular risk at diabetes (AACORD); (b) the systolic BP intervention trial (SPRINT); (c) the NHLBI Coronary Artery Risk Development in Young Adults (CARDIA); (d) the Arkansas Cardiovascular Health Examination Survey (ARCHES); (e) the Survey of the Health of Wisconsin (SHOW); and (f) the Oregon Health Study Group. ¹¹⁻¹⁵	
Obtaining BP	Effect on SBP, mm Hg	Effect on DBP, mm Hg
Individual positioning		
Standing versus sitting	-2.9 to +5.0	+7
Supine versus sitting	-10.7 to +9.5	-13.4 to +6.4
Legs crossed at the knee	+2.5 to +14.9	+1.4 to +10.8
Unsupported back	Not significant effects	+6.5
Unsupported arm	+4.9	+2.7 to +4.8
Arm lower than heart level	+3.7 to +23	+2.8 to +12
Attaching the device to the individual		
Too small cuff size	+2.1 to +11.2	+1.6 to +6.6
Too large cuff size	-3.7 to -1.5	-4.7 to -1.0
Talking during the measurement	+4 to +19	+5 to +14.3
Interpreting the measurement		
Reliance on a single measurement	+3.3 to +10.4	-2.4 to +0.6

1.3 Training

Training will be provided by NCHS personnel and Westat. This training will teach the health technicians (HT) the rationale and skills for taking standardized BP (Table 1-2). At the end of the training, HTs will be able to:

- Explain, briefly and simply, the physiological/anatomical basis of BP readings (systolic and diastolic);
- Explain the concept of clinical vs. standardized BP readings;
- Describe factors affecting accurate BP readings;
- Demonstrate and describe device-related skills, such as cleaning, setting up the device, and calibration, for accurate standardized readings;
- Demonstrate and describe procedure-related skills to obtain standardized brachial BP measurement; and
- Demonstrate and describe data entry-related skills.

Table 1-2. Skills matrix*

Skills	Yes	No
BP device is correctly set to obtain standardized BP		
Explains the procedure		
Correct cuff size is selected matching mid-upper arm circumference		
Cuff is placed over bare mid-upper arm with mid-cuff marker over the brachial artery		
SP is seated with back supported		
Feet flat on the floor		
Arm and mid-upper arm are supported at the level of the right atrium		
SP rests 5 minutes while sitting prior to measurements		
No talking, mobile phone usage, or reading during rest period		
No talking, mobile phone usage, or reading during BP readings		
Obtains three BP measurements (systolic and diastolic), waiting 1 minute between BP measurements		
Waits 1 minute between BP measurements		
Enters data correctly (double keys data)		
If asked, provides BP readings to SP with explanation		
If appropriate, refers the individual to see the MEC physician		

*Adapted from Rakotz MK, et. al. 2017.⁷

1.3.1 Cleaning, Setting Up the Device, and Calibration for Accurate Standardized Readings (See Chapter 2 for More Detailed Information)

- Cleaning;
- Device settings for obtaining BP; and
- Calibration.

1.3.2 Skills to Obtain Standardized Brachial BP Measurement (See Chapter 3 for More Detailed Information)

- Explain the procedure;
- Take BP on bare upper-right arm (or upper-left arm if cannot obtain BP on the upper-right arm);
- Obtain the individual's mid-arm circumference;
- Select correct BP cuff size, matching the mid-arm circumference range;
- Position the individual in the chair, back and arm supported, with legs uncrossed and both feet flat on the floor;
- Position the middle of the cuff on the individual's mid-upper arm at the level of the right atrium (the midpoint of the sternum);

- Complete rest period of at least 5 minutes with no talking, mobile phone usage, or reading; and
- Take three BP measurements 1 minute apart with no talking, mobile phone usage, or reading.

1.3.3 Data Entry-Related Skills (See Chapter 4 for More Detailed Information)

- Integrated Survey Information System (ISIS) data entry;
- Double key the BP data; and
- Inform the SP about the results, including the possibility for referral to the MEC physician.

1.4 Risk

There is minimal risk when performing blood pressure measurements; however, there can be transient discomfort when the blood pressure cuff inflates. Before taking blood pressure measurements, the HT will inform the participant that while the machine inflates the cuff, it may feel tight and the participant may feel some pressure. The oscillometric device has an instant deflation button and a stop button that can be used if a participant complains about uncomfortable pressure.

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2. Equipment and Supplies

2.1 List of Equipment and Supplies for Blood Pressure

2.1.1 List of Equipment

The equipment used for the blood pressure component is listed below:

- Omron IntelliSense Blood Pressure Monitor (Model: HEM-907XL)
- Omron Battery Pack (Model: HEM-907-PBAT)
- AC Adapter (Model HEM-ADPT907)
- Air Tube 1.3m (Model: HEM-TUBE-130XL)
- Cuff/bladder set: Extra Large (Model: HEM-907-CX19)
- Cuff/bladder set: Large (Model: HEM-907-CL19)
- Cuff/bladder set: Medium (Model: HEM-907-CR19)
- Cuff/bladder set: Small (Model: HEM-907-CS19)

2.2 Description of Equipment for Blood Pressure

2.2.1 Omron IntelliSense Blood Pressure Monitor (HEM-907XL)

The Omron IntelliSense Blood Pressure Monitor (Model: HEM-907XL) will be used to measure blood pressure (BP) (See Exhibit 2-1). The Omron BP monitor is developed to measure blood pressure and pulse rate accurately and simply in a clinical setting.

Exhibit 2-1. Omron HEM-907XL BP monitor (Main Unit)



2.2.2 Display Items on Omron BP Monitor

The display items and buttons on the Omron BP Monitor are pictured in Exhibit 2-2 and described below.

Exhibit 2-2. Display items and buttons on the Omron HEM-907XL BP monitor



For more details see <https://www.manualslib.com/manual/115092/Omron-Intellisense-Hem-907xl.html>

1. **Display.** Displays blood pressure and pulse rate readings.
2. **HIDE (Non-Display) Button.** Switches display and non-display of measured results.
3. **DC Jack.** Connects the AC adapter.
4. **P-SET.** Pressure setting knob. In the AUTO position, inflation level is automatically set.

5. **MODE Selector.** Selects the operation mode, AVG, SINGLE, MANU, and CHECK mode.
6. **ON/OFF (Power) Button.** Turns on or off the unit.
7. **START Button.** Starts the measurement by inflating the air.
8. **DEFLATION.** Controls deflation and the Measurement Result Display Switch Button.
9. **Air Connector.** Connects the air tube.
10. **STOP Button.** Stops the measurement and deflates air rapidly.

2.2.3 Accessories for the Omron BP Monitor (HEM-907XL)

The accessories for the Omron BP Monitor include a battery pack, AC Adapter, and air tube (See Exhibit 2-3), and four arm cuffs (See Exhibit 2-4).

Exhibit 2-3. Battery pack, AC adapter, and air tube



Omron Battery Pack



Air Tube 1.3m



AC Adapter

Note: The air tube (1.3m) is available for the large, medium, or small cuff size. It is NOT for use with the extra-large cuff size. The extra-large cuff comes with an air tube with an integrated air plug.

Exhibit 2-4. BP arm cuffs



The Omron BP Monitor (HEM-907XL) comes with four arm cuffs with built in bladder. See Table 2-1 for the model numbers and respective arm circumference size of each cuff.

Table 2-1. Arm circumference and corresponding cuff size

Cuff size	Model #	Arm circumference ¹
2	HEM-97-CS19	17-21.9
3	HEM-97-CR19	22-31.9
4	HEM-97-CL19	32-41.9
5	HEM-97-CX19	42-50

¹ Omron Instruction Manual for IntelliSense Blood Pressure Monitor (Model HEM-907X L).

2.2.4 Supplies and Materials for Blood Pressure

- **Steel Measuring Tape.** A retractable steel measuring tape is used to take upper arm length and circumference measurements.
- **Adjustable Height Chairs.** The Health Technicians and SP are all seated during the exam. Adjustable height chairs enable positioning of the SP so that the feet rest directly on the floor.
- **Foam Pads.** Footpads are used to adjust the SP's feet so that the feet rest directly on a flat, firm surface. Arm pads are used to adjust the SP's arm so that the cuff is at heart level.

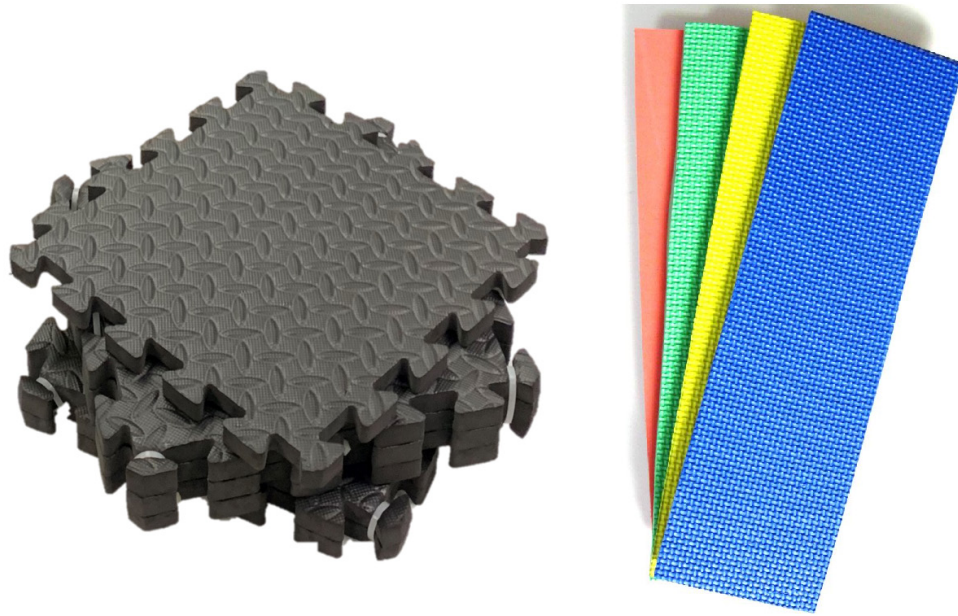
- **Stainless Steel Scissors.** For use to cut the sleeve of the SP's disposable shirt when taking blood pressure.
- **Pliers.** Pliers may be needed when changing luer locks.
- **Black Cosmetic Pencil.** When measuring the upper arm circumference, the health technician will make any body marks on the SP using a wax-based cosmetic pencil.
- **Baby Oil Drop Dispenser Bottle.** Baby oil is used for removing cosmetic pencil marks from the SP's skin. A small drop dispenser holds the oil for use during exams.
- **2" x 2" Gauze Pads.** The pads are used to wipe off cosmetic pencil marks with baby oil.
- **Sani-Cloth Germicidal Towelettes.** Disposable germicidal wipes are used to clean and disinfect the cuffs between participants.
- **Masking Tape.** Tape is used to pull together the cuts that were made on the SP's disposable shirt when measuring the upper arm circumference.
- **Alcohol Wipes.** Used to clean the steel measuring tape.

Exhibits 2-5 and 2-6 show photos of the supplies and materials for blood pressure.

Exhibit 2-5. Supplies for blood pressure



Exhibit 2-6. Foam pads



2.3 Equipment Care and Maintenance

Health technicians maintain all equipment used in their component. To ensure that all pieces of equipment are functional, daily visual checks and cleaning must be performed. Follow the procedures below to ensure that the blood pressure equipment functions properly and remains hygienic throughout the stand.

Start of Stand (Exhibit 2-7)

- Complete all Daily QC checks.
- Record the manufacturer serial number of the Omron HEM-907XL BP monitor.

Exhibit 2-7. Start of Stand QC Check screen

If the monitor requires replacement, record the serial number of the back-up monitor under the Equipment Swap tab of the ISIS Blood Pressure Quality Control Checks. ISIS will automatically save the serial number information to the study database.

Daily

- Wipe the monitor of the OMRON HEM-907XL with a soft cloth dampened with disinfectant alcohol or diluted detergent. Complete the cleaning by wiping the monitor with a soft, dry cloth.
- Wipe both sides of the blood pressure cuff with germicidal wipes. The cuff is to be wiped at the beginning of each day and also after each use.
- Check function settings on the OMRON machine (F1= 3 [measurements], F2= 5 [wait time], F3= 1 minute [intervals between readings]) (see Table 2-2).
- Check the mode: the selector should be set on “AVG.”
- Check the P-setting: the selector should be set on “Auto.”
- Make sure that the AC adapter cord of the OMRON unit is securely plugged in.

Table 2-2. Summary of key functions

Function #	Description	Set value
F1	Number of inflation	3 times
F2	Waiting time to start the first inflation	5 minutes
F3	Inflation interval	1 minute

2.3.1 Procedure to Verify the Function Settings

1. When the power is OFF, push the ON/OFF button and the START button for more than three seconds until F1 is displayed (Exhibit 2-8).
2. Push the START button and review the settings for F1, F2, and F3. Each time you push the START button, the functions change in sequential order.
3. After reviewing the settings, push the ON/OFF button to turn off the power.

Note: Pushing the DEFLATION button will change the set values.

Exhibit 2-8. Function settings



2.4 Annual Calibration Check

1. Connect the Baum® calibrated mercury true gravity portable desk model sphygmomanometer, inflation bulb, cuff, and the Omron monitor with the T-tube.
2. Tightly wrap the cuff over a sturdy cylinder.
3. Release the valve of inflation bulb to completely remove the air inside the cuff.
4. Push the ON/OFF (power) Button to turn on the monitor.
5. Set the MODE Selector to “CHECK.”
6. With the valve open, check that the reference manometer displays zero.
7. Close the valve of inflation bulb and inflate the cuff to the pressure to be checked, based on the manometer read, specifically.
 - Increase the pressure to approximately 200 mm Hg and deflate slowly, stopping when the reference manometer indicates approximately 100 mm Hg.
 - Record and compare the pressures indicated on the Baum manometer and on the Omron monitor.

- Open the valve so the pressure decreases to zero over 2-3 seconds and check that the Baum manometer and the Omron manometer displays zero pressure. Record the pressure (adapted from Turner MJ, Speechly C, and Bignell. Sphygmomanometer calibration: Why, how, and how often? Australian Family Physician Vol. 36, No. 10, October 2007).
- Accuracy of the monitor is validated to be ± 3 mm Hg or 2 percent of standard manometer reading.

2.5 Inventory

For the purpose of inventory management, equipment is designated as nonconsumable items, and supplies are those items that are depleted throughout a stand and used on a daily basis. Each MEC should have a data list of the serial numbers of the devices in use and update the list as needed.

At the beginning and end of each stand, the health technician assigned to the room will inventory all component-specific equipment and supplies. Supplies ordered from the warehouse by the previous team during tear down should be on site when the next team arrives to set up a new stand.

Health technicians will check all newly received supplies against the associated packing lists before incorporating them into the existing inventory. Any needed items should be noted on the inventory list, reported to the MEC manager, and documented in the Unusual Field Occurrence (UFO) system.

2.6 Equipment Malfunctions

All equipment malfunctions or repair needs must be reported promptly to the technologist in charge of blood pressure, the MEC manager, and the home office component lead. If the issue is computer related and cannot be resolved by the health technologist and/or MEC manager, please contact the home office ISIS support staff. A complete set of backup equipment is kept in each MEC for use until the malfunctioning equipment can be repaired or replaced.

Equipment issues should be documented in the Unusual Field Occurrence (UFO) system and Equipment Tracking System (ETS) as appropriate (refer to the *UFO Utility Manual* and *ETS User Guide* for details). The component lead will contact the equipment manufacturer for assistance.

If ISIS is completely unavailable for use during a session, the examiner can still perform the component. The examiner should record all the measurements on the Blood Pressure Recording

Form (see Appendix F). Examiners should print all hard-copy form data legibly. The Blood Pressure Recording Form can be scanned and emailed to the home office. The component lead will then complete a Back-End-Edit-Request (BEER) to add the data to the study database.

3. Protocol

3.1 Introduction to the Blood Pressure Measurement

The technologist should briefly explain the blood pressure measurement when the sample person (SP) is brought into the room. The exam should be explained in more detail as the exam is being conducted. Refer to Appendix E for a copy of the blood pressure talking points. Below is a suggested introductory script, but the examiner should use his or her own words for this explanation. This is an explanation, not a standard script, so the technologist may adjust the explanation to the level of understanding of the examinee. The script used for an 8-year-old will be different from the script used for a 59-year-old.

Suggested Introduction to Component (English Version):

“As part of your examination today, you are having your blood pressure taken using this machine. It will take a series of three blood pressure readings.”

Suggested Introduction to Component (Spanish Version):

“Como parte de su examen de hoy, le tomarán la presión arterial con esta máquina. La máquina tomará una serie de tres lecturas de presión arterial.”

3.2 Procedures for Blood Pressure Measurement

For the purpose of standardization, blood pressure is measured in the right arm unless specific SP conditions prohibit the use of the right arm or if SPs self-report any reason that the blood pressure procedure should not be taken in the right arm. If the measurements cannot be taken in the right arm, they are taken in the left arm. In all cases, if there is a problem with both arms, the blood pressure is not taken. There are no protocol-specific reasons for excluding SPs from pulse measurement. However, because pulse is obtained at the same time as BP, if BP is not obtained, a pulse measurement will not be available. Whether BP is taken on the right or left arm, it will always be taken on a bare upper arm.

3.2.1 SPs Excluded from Blood Pressure

SPs are excluded from blood pressure measurement if they have any condition that could potentially cause them harm or discomfort or would prevent accurate blood pressure measurement. BP measurements are not done when both arms have a rash, gauze/adhesive dressings, casts, are withered, puffy, have tubes, open sores, hematomas, wounds, arteriovenous (AV) shunt, or any other intravenous access device. Also, women who have had an axillary nodal biopsy or resection, or a unilateral radical mastectomy do not have their blood pressure measured in the affected arm. If there is a condition with both arms, the blood pressure is not taken.

3.2.2 Steps to Obtain Blood Pressure

Several steps must be followed before taking the first blood pressure. This section presents these steps, also referred to as blood pressure premeasurement procedures. They are:

- Set up the device for a 5-minute rest and three BP determinations one minute apart;
- Open blood pressure application by scanning the SP ID bracelet;
- Explain procedure;
- If necessary, measure arm circumference;
- Seat participant in the chair and position for blood pressure;
- Identify upper arm brachial pulse;
- Mark brachial pulse;
- Apply blood pressure cuff;
- Make sure the SP is in the right position;
- Emphasize complete silence, no talking during rest time;
- Push the START button on the monitor;
- Start a 5-minute rest period/no talking;
- Observe that SP maintains appropriate position;
- Obtain three BP readings and pulse 1 minute apart;

- Record the BP and pulse observation (double key the BP and pulse observations);
- Explain the results to the SP; and
- Refer SP to the clinician for levels 1-2 BP readings (see Appendixes A, B, and C for blood pressure referral levels, categories, and actions required for children and adults).

3.2.2.1 Prepare Blood Pressure Monitor Settings

At the beginning of each session, the health technician in charge of the room will confirm that the blood pressure monitor is set to the correct settings as described in Chapter 2. Prior to the measurement, complete the following steps:

1. For the cuff sizes small, medium, and large, connect the air tube to the main unit by attaching the air plug to the base of the air connector. For the extra-large cuff, connect the tubing directly to the base unit.
2. Check that the DC jack of the monitor is attached to the AC adapter and that the AC adapter is plugged into a power outlet.
 - A. The AC sign should be visible in the lower window (Exhibit 3-1).
 - B. The power for the unit should be turned off.
3. Confirm the MODE selection is set to average (AVG), see Exhibit 3-2.
4. Confirm the P-SET (pressure setting or inflation level) knob is set to AUTO (Exhibit 3-2).
5. Set the device to **HIDE** mode.

Exhibit 3-1. Attaching the Omron to the AC adapter

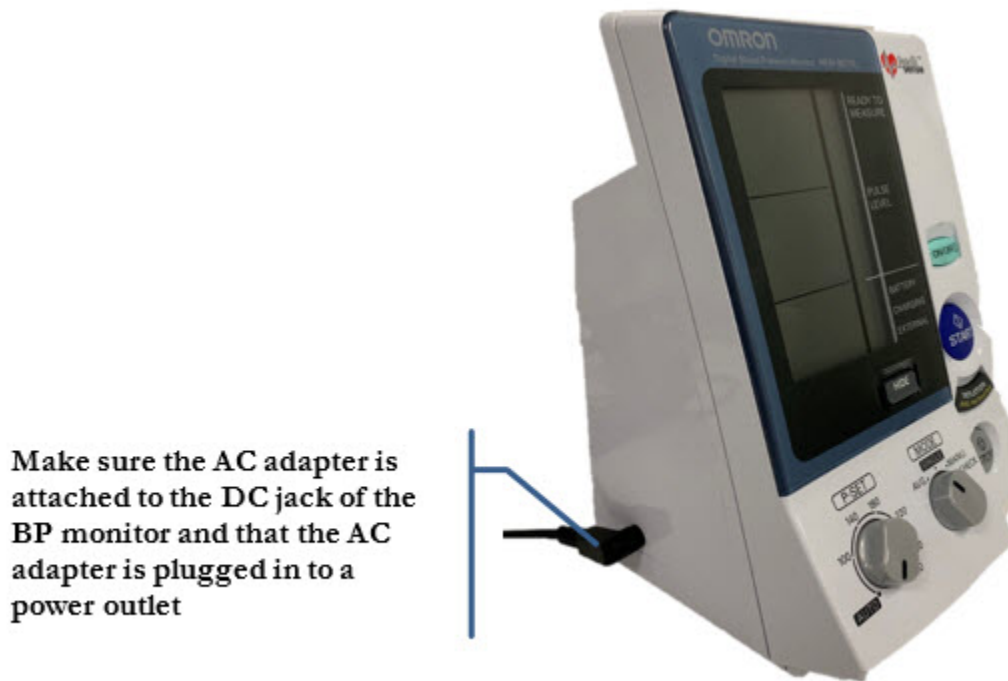
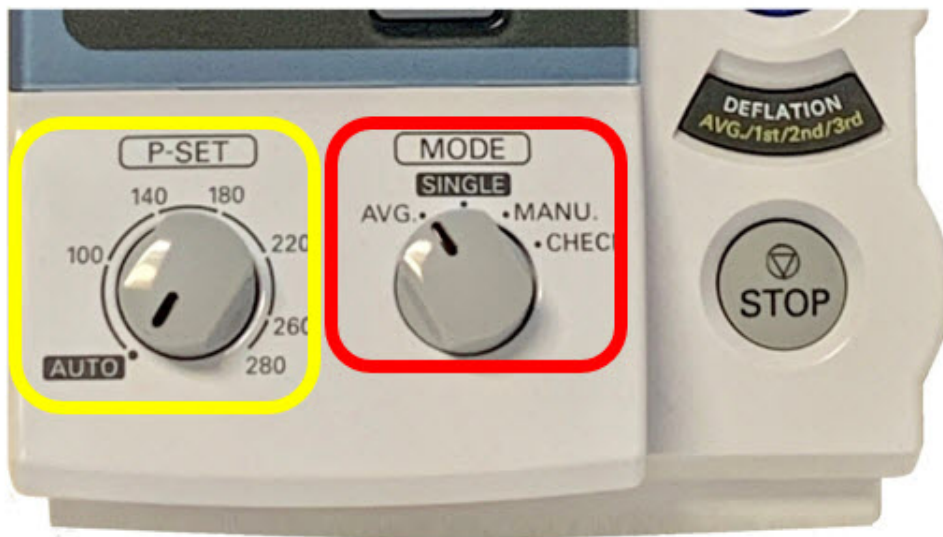


Exhibit 3-2. P-SET and MODE selections



Connect the air tube securely to the main unit by securing the air plug to the base of the air connector (Exhibit 3-3).

Note: The extra-large cuff comes with an air tube with an integrated air plug. Connect the air plug of the cuff securely to the air connector when connecting to the main unit.

Exhibit 3-3. Connecting the air tube



3.2.2.2 Open the Blood Pressure Application

As soon as the SP arrives, the SP ID bracelet must be scanned to launch the blood pressure application. Ask pre-BP component questions.

3.2.2.3 Explain the Procedure

Inform the SP that you will be taking a series of three blood pressure measurements. The talking points below can assist you in describing the protocol.

“I am going to take a series of three different blood pressures. Before taking your first blood pressure reading there will be a 5-minute waiting period.

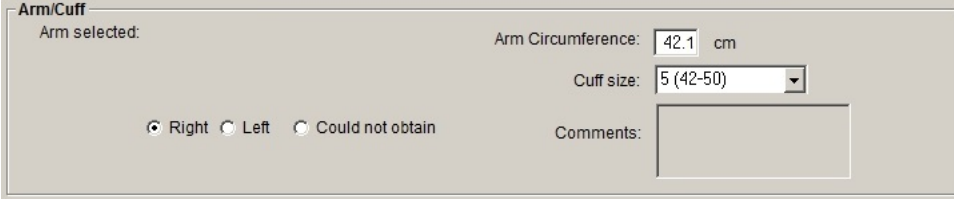
In order for us to take accurate blood pressure readings, it is important that during the waiting period, and during the blood pressure measurements, you:

- Sit up straight with your back against the back of the chair, making sure to keep both feet flat on the floor.
- Because moving and talking can change your blood pressure, we ask you not to talk or move your position while I am taking your blood pressure.
- After the resting period, I will take three blood pressure readings one minute apart.
- Do you have any questions?

3.2.2.4 Arm Circumference Protocol to Determine Cuff Size

In the anthropometry exam, the right upper arm circumference is measured; if the SP has not yet been to the body measures component, the health technician will measure the upper arm circumference. This is solely to determine the blood pressure cuff size; the SP will have the formal survey arm circumference measured again in the anthropometry component. If the SP has been in the anthropometry component prior to blood pressure, the arm circumference value and the corresponding blood pressure cuff size are displayed on the first screen of the blood pressure application as shown in Exhibit 3-4.

Exhibit 3-4. Display of arm circumference measurement in blood pressure



The screenshot shows a software interface titled "Arm/Cuff". It contains the following elements:

- Arm selected:** A label above three radio buttons: Right, Left, and Could not obtain.
- Arm Circumference:** A text input field containing "42.1" followed by "cm".
- Cuff size:** A dropdown menu showing "5 (42-50)".
- Comments:** An empty text area.

If the examiner is required to make the arm circumference measurement, use the following series of steps. First, measure the length of the upper arm:

- **Position the SP.** Direct the SP to turn away from you. Ask him or her to stand upright with their weight evenly distributed on both feet; the right arm bent 90° at the elbow, and the right palm facing up. Demonstrate the correct position if necessary.
- **Mark the Measurement Site.** Locate the end of the spine of the right scapula by following the scapula out to the arm until it makes a sharp V-turn to the front of the body (Exhibit 3-5). Using the cosmetic pencil, make a horizontal line on the **uppermost edge of the posterior border** of the scapula spine extending from the acromion process (see Exhibit 3-6).
- **Take the Measurement.** Hold the zero end of the measuring tape at this mark and extend the tape down the **center** of the posterior surface of the arm to the tip of the olecranon process, the bony part of the mid-elbow (Exhibit 3-7). Take the measurement to the nearest 0.1 cm.
- **Mark the Midpoint.** Divide the value in half to calculate the midpoint of the measured length. Ask the SP to hold the zero end of the measuring tape with his/her free hand; make a horizontal mark at the midpoint and cross this mark with a **perpendicular line centered** on the posterior surface of the arm (see Exhibit 3-9). This mark defines the site at which the arm circumference will be measured. Tell the SP to relax their arm and let it hang loosely.

- **Position the SP.** Ask the SP to turn so that you stand **facing** his or her right side. Do not stand behind the SP for this measurement. Have the participant stand upright with their weight evenly distributed on both feet, their shoulders relaxed, and their right arm hanging loosely at their side. Flexing or tightening the arm muscles will yield an inaccurate measurement.
- **Take the Measurement.** Wrap the measuring tape around the arm at the level of the upper arm mid-point mark. Position the tape **perpendicular** to the long axis of the upper arm. Pull the two ends of the overlapping tape together so that the zero end sits below the measurement value and the result lies on the lateral aspect of the arm (not the posterior surface). Check that the tape fits snug around the arm but does not compress the skin (Exhibit 3-10).

Exhibit 3-5. Upper arm bony landmarks

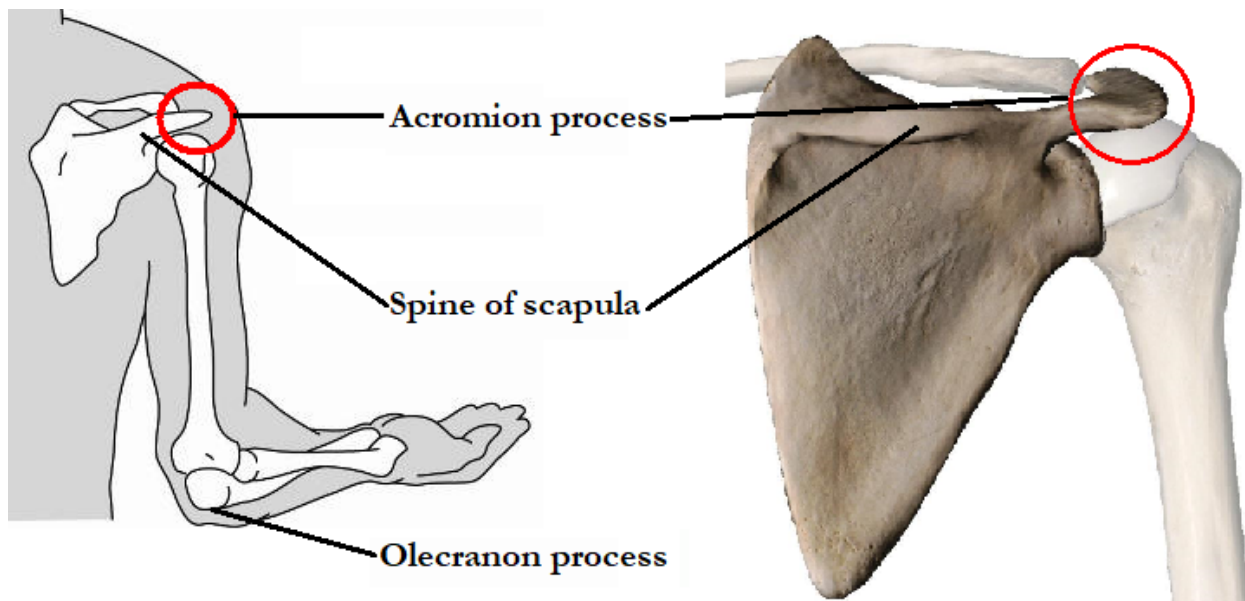


Exhibit 3-6. Marking spine extending from acromion process



Important. The tape must be centered on the posterior surface of the arm. Exhibit 3-7 shows the correct placement of the measuring tape centered on the posterior surface of the arm; Exhibit 3-8 shows the measuring tape placed incorrectly.

Exhibit 3-7. CORRECT tape placement for upper arm length



Exhibit 3-8. INCORRECT tape placement for upper arm length



Exhibit 3-9. Marking upper arm length midpoint



Exhibit 3-10. Measurement of mid arm circumference



3.2.2.5 Position SP for Blood Pressure Measurements

The SP sits in a height-adjustable office style chair. Ask the SP to sit all the way to the back of the chair so that the spine is straight. The back should be supported and both feet should rest flat on the floor, and the SP should appear comfortable. Shorter SPs may need the chair height lowered; tall SPs may need the chair height raised to correctly position for the BP measurement. If necessary, place SP's feet on a foot stool or floor pads.

The arm should be bare and unrestricted by clothing. Position the arm on the table with the palm of the hand turned upward and the elbow slightly flexed. The midpoint of the upper arm should be at the level of the heart, located at the junction of the fourth intercostal space. Very tall SPs may need to place their arm on an arm rest or pillow to bring their upper arm to the correct position.

3.2.2.6 Locate Brachial Pulse

The purpose of palpating the brachial pulse is for the proper application of the blood pressure cuff. To find the brachial pulse, find the brachial artery on the medial side of the arm on the cleft between the biceps and triceps muscles (Exhibit 3-11). Position the SP with the right palm turned upward and the arm slightly bent at the elbow. Palpate the brachial with the pads of the index and middle fingers (Exhibit 3-12). Using a cosmetic pencil, draw a line where the pulse is most strongly palpated and extend the line toward the medial epicondyle to the level of the antecubital fossa (elbow crease), see Exhibit 3-13. The “ART” indicator on the cuff will be placed along this line to approximately 1 inch above the antecubital fossa.

Exhibit 3-11. Brachial artery

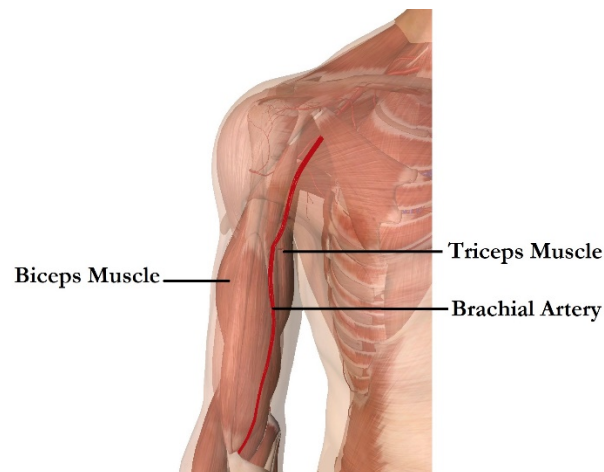


Exhibit 3-12. Locating the brachial artery



Exhibit 3-13. Marking the brachial pulse



If the pulse cannot be felt in the arm, check the radial pulse. If no radial or brachial pulse is palpable on the right arm, use the left arm unless contraindicated. If a radial pulse is apparent, whether or not the brachial pulse can be felt, the blood pressure measurement should be attempted.

3.2.2.7 Apply Appropriate Blood Pressure Cuff Sizes

Use the blood pressure cuff size displayed on the first screen of the blood pressure application (Exhibit 3-4). The blood pressure cuff size is determined by the blood pressure application using the arm circumferences listed in Table 3-1.

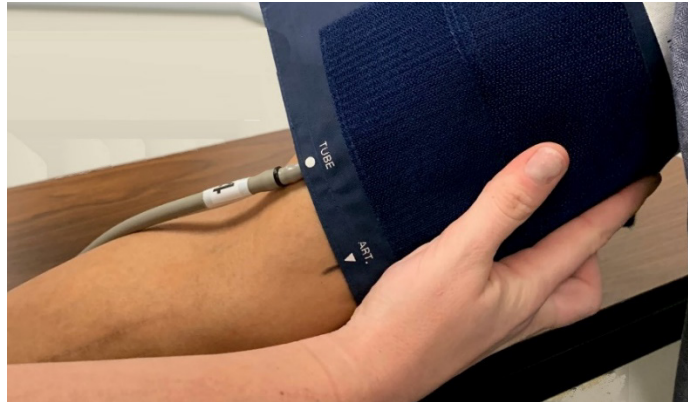
Table 3-1. Arm circumference and corresponding cuff size

Cuff size	Bladder width by length (cm)	Mid Arm circumference (cm) cuffing parameters
2	9.2 X 16.68	17-21.9
3	12.49 X 23.52	22-31.9
4	14.98 X 31.19	32-41.9
5	17.98 X 37.89	42-50

Wrap the selected blood pressure cuff according to the steps listed below:

- Position the “ART” indicator of the cuff over the upper arm brachial artery mark at least 1 inch above the crease of the elbow. For long thin arms, the cuff should be placed in the middle of the arm. Place the marker on the cuff directly over the brachial artery (Exhibit 3-14).

Exhibit 3-14. Applying the blood pressure cuff



- Make sure the lower edge of the cuff, with its tubing connections, is about 1 inch above the natural crease across the inner aspect of the elbow (the cubital fossa).
- Wrap the cuff in a circular manner taking care not to wrap the cuff in a spiral direction. The cuff should fit snugly with the palm of the participant's hand turned upward. Make sure that the long edges of the cuff lie on top of each other as you wrap the cuff around (Exhibit 3-15).
- Secure the wrapped cuff firmly by applying pressure to the locking fabric fastener over the area where it is applied to the cuff.
- Check the fit of the cuff to ensure that it is secure but not tight. Two fingers should fit under the cuff (Exhibit 3-16).

Exhibit 3-15. Wrapped blood pressure cuff

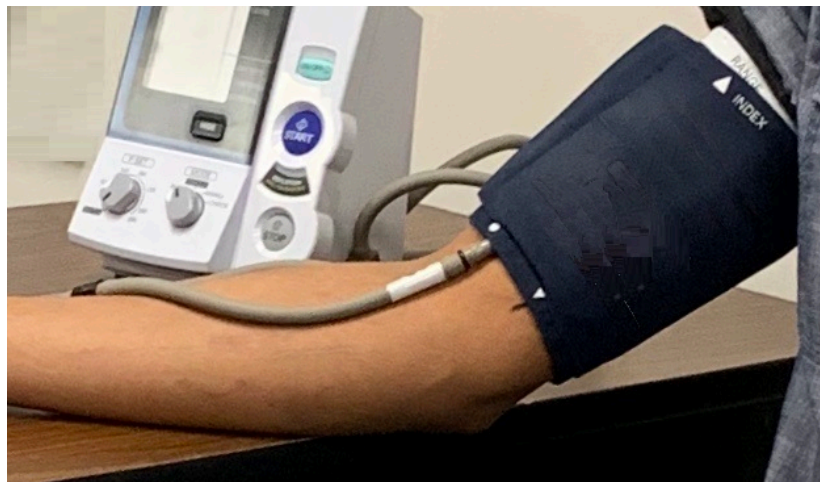
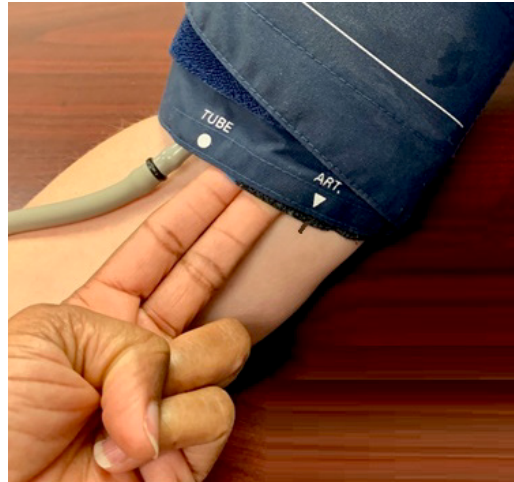


Exhibit 3-16. Blood pressure cuff fit

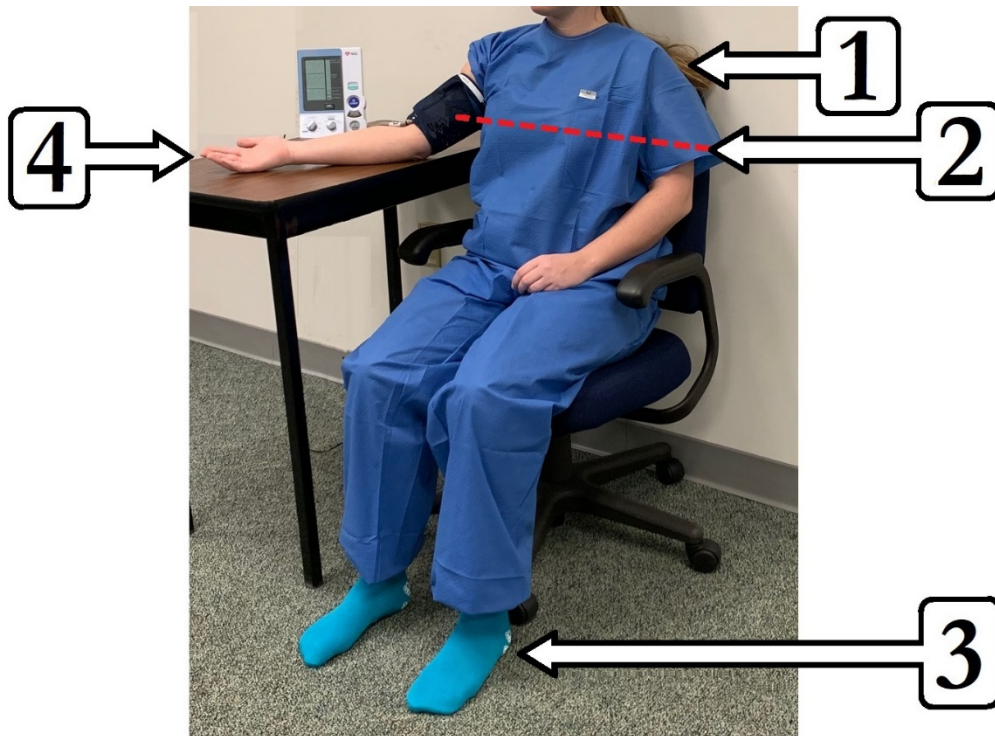


Some upper arm physiques can present special challenges in the proper application of a cuff. For example, very short upper arms with a large circumference that tapers markedly toward the antecubital space presents a special challenge. In this case, the cuff may be wrapped in a spiraling direction rather than keeping the edges of the cuff even around the arm. Also, applying the large cuff to an upper arm can be bulky and awkward. In all cases, the objective is to achieve the best contact of the bladder with the cuff so that the bladder inflates in the proper position over the brachial artery.

3.2.2.8 The 5-Minute Rest Period

After all the preparations are done and the individual is appropriately cuffed, check again that the SP is in a right position (Exhibit 3-17).

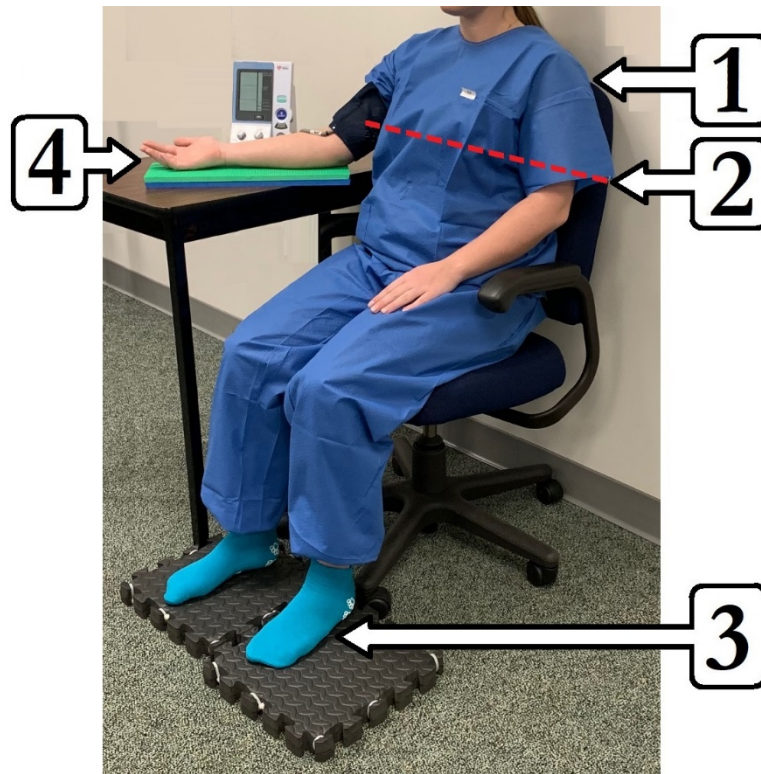
Exhibit 3-17. Correct position for blood pressure measurements



1. Back straight and supported.
2. Cuff at heart level.
3. Both feet flat on the floor.
4. Arm supported, upper arm bare and unrestricted by clothing. The arm can be positioned in the supine position (as shown in Exhibit 3-17) or rotated, if a rotated position is more comfortable and the arm remains supported.

Some SPs might not be able to have both feet flat on the floor and or their arm supported so that the cuff is at heart level. For those SPs, use foot foam pads to adjust the SP's feet so that both rest directly on a flat, firm surface and if necessary, use the arm foam pads to ensure the cuff is at heart level (Exhibit 3-18). Confirm that all cellular devices have been turned off or silenced and inform the SP that the 5-minute rest period will begin, and again reinforce that no conversing will take place from that point on until the end of the blood pressure measurements.

Exhibit 3-18. Foot and arm foam pads



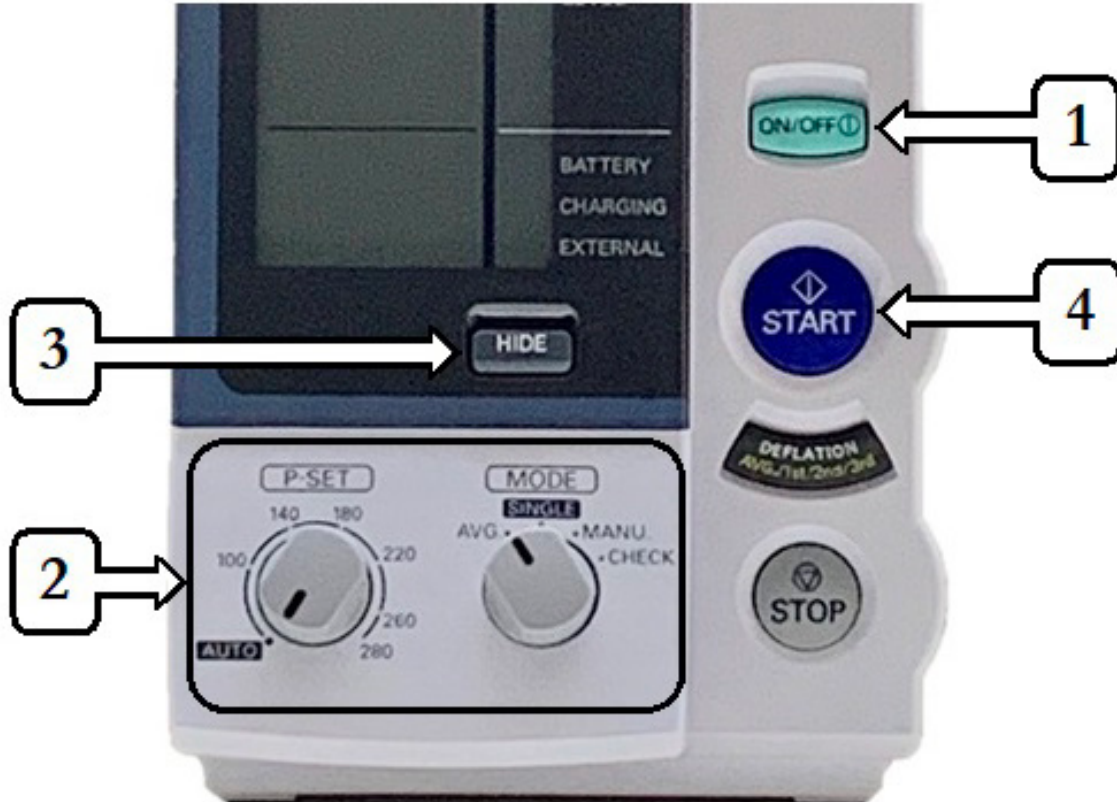
1. Back straight and supported.
2. Cuff at heart level.
3. Both feet flat on the foot foam pads.
4. Arm supported by arm foam pad, upper arm bare and unrestricted by clothing. The arm can be positioned in the supine position (as shown in Exhibit 3-17) or rotated, if a rotated position is more comfortable and the arm remains supported.

3.2.2.9 Obtaining BP Measurements and Pulse

To start the blood pressure measurement follow the steps below as shown in Exhibit 3-19:

1. Push the ON/OFF (power) button to turn on the power.
2. Verify the P-Set is set to “AUTO” and the MODE is set to “AVG.”
3. Push the “HIDE” button.
4. Push the “START” button to start the measurement.

Exhibit 3-19. How to start the blood pressure measurement



Note: The quiet period is a very important part of the blood pressure protocol. The examiner must reinforce its importance before the 5-minute rest period begins. In addition, the examiner must observe the SP's position throughout the blood pressure protocol because of the natural tendency for people to want to cross their feet or legs. During the quiet period, the examiner also needs to remain silent and refrain from doing any activities such as cleaning or prepping for the post measurement procedures.

The device will automatically obtain three BP measurements (systolic and diastolic) and will pulse 1 minute apart. While obtaining the measurements, continually observe the SP's position and the arm on the table with the palm of the hand turned upward. If the SP complains about pains due to cuff inflation and wants to stop, push the **DEFLATION** button. With each push of the button, the cuff is rapidly deflated in increments of 5 to 10 mm Hg (Exhibit 3-20).

Exhibit 3-20. How to deflate the blood pressure cuff



If an error occurs during measurement, the monitor will automatically start measurement again, if a second error occurs, measurement will automatically stop. In the situation where the device fails to obtain the BP measurement, an error display appears. Table 3-2 displays a list of error codes that may be displayed on the Omron BP Monitor with an explanation and a suggestion for how to correct the error. Refer to Appendix D for a list of quick tips to obtain accurate blood pressure measurements.

Table 3-2. List of error codes

Error code	Explanation	How to correct
Er1	Inflation error When the pressure does not exceed 12 mmHg within the set time after the start of inflation. When the inflation does not reach the set cuff pressure within the specified time after the start of inflation.	Confirm that the air tube connecting the cuff and the main unit is connected securely. Confirm that the air flow in the air tube connecting the cuff and the main unit isn't being restricted.
Er2	Deflation error When the deflation speed is too fast during the measurement. When the deflation speed is too slow during the measurement. When the measurement does not finish within the specified time after starting the measurement.	Confirm that the cuff is wrapped correctly. Check bladder for leaks and, if necessary, replace the bladder with a new one (or new cuff).
Er3	Overpressure error The cuff pressure exceeded 299 mmHg.	Confirm that air flow in the air tube connecting the cuff and the main unit isn't being restricted.

Table 3-2. List of error codes (continued)

Error code	Explanation	How to correct
Er4	Insufficient inflation error Blood pressure could not be measured due to insufficient inflation level.	If the measurement is made by setting the P-SET to "AUTO," ask the patient not to move during the inflation. Confirm that the P-SET is securely set to "AUTO." Turn the Knob counterclockwise as far as it goes until you can hear a click sound. If the measurement is made by manual inflation level setting, set the value to 30 to 40 mmHg higher.
Er5	Indeterminable blood pressure error Blood pressure could not be measured even when the cuff pressure reached the specified pressure.	Confirm that the cuff is wrapped correctly.
Er6	Low pulse level error Pulse wave was too small.	Confirm that the cuff is wrapped correctly.
Er7	Blood pressure error Relationship between systolic and diastolic pressures was abnormal.	Ask the patient not to move during the measurement. Check the patient for arrhythmia.
Er8	Pulse rate error Pulse rate did not stay within the range of 30 to 199 beats/min.	
Er9	Device error Main unit malfunction.	Contact Omron Healthcare's Customer Service toll-free at 1-877-216-1336.

3.2.2.10 Record BP Measurements

After all three inflations are finished, the measurements (SYSTOLIC, DIASTOLIC & PULSE) and the calculated average measurement are displayed. These measurements should be recorded in the data capture screens.

1. Press the DEFLATION button to advance through the three inflations and the average reading. The first screen will display the average blood pressure reading and subsequent screens will display the first, second, and third blood pressure readings.
2. Record all four readings on the Data Capture Screen 1.
3. You will be asked to enter the results twice (i.e., double keying). If the data from the first entry does not match that of the second entry, you will be asked to key in the data a third time. This feature is designed to reduce data entry errors that may result from either incorrect measurement or incorrect keying in. If a recorded value falls outside of the pre-programmed edit range, the system will alert you that the recorded value is unusual. If this occurs, please verify and correctly enter the results.

When finished recording results,

1. Push the ON/OFF (power) button to turn the machine off.
2. Remove the cuff from the SP's arm.

3.2.2.11 Hard and Soft Edits

Hard and soft edits are programmed into the application to minimize data entry error.

Hard Edits. Hard edit errors are limits imposed by the application that require a data value or prevent data entry outside the expected range. The following hard edits are programmed into the system:

- Systolic blood pressure cannot be greater than 300 mm Hg;
- Systolic blood pressure has to be greater than diastolic blood pressure;
- If there is no systolic, there can be no diastolic; and
- Neither systolic nor diastolic BP can be zero.

Soft Edits. Soft edits are limits imposed by the system that serve as an alert for possible data entry keying errors. A **soft edit** will check the entered value and ask for confirmation that the value is correct. If the value is confirmed, then the system will accept the entry and allow data entry to continue. The following soft edits are programmed into the system:

- The difference between systolic blood pressure and diastolic blood pressure cannot be less than 27 mm Hg or greater than 98 mm Hg.
- There are minimum and maximum systolic and diastolic measurements based on age range:
 - **8–17 yrs.** Systolic blood pressure minimum/maximum value : 83 to 133 mm Hg
 - **8–17 yrs.** Diastolic blood pressure minimum/maximum value: 46 to 83 mm Hg
 - **18–39 yrs.** Systolic blood pressure minimum/maximum value: 90 to 155 mm Hg
 - **18–39 yrs.** Diastolic blood pressure minimum/maximum value: 51 to 104 mm Hg
 - **40–59 yrs.** Systolic blood pressure minimum/maximum value: 91 to 179 mm Hg
 - **40–59 yrs.** Diastolic blood pressure minimum/maximum value: 54 to 108 mm Hg

- **60+ yrs.** Systolic blood pressure minimum/maximum value: 95 to 189 mm Hg
- **60+ yrs.** Diastolic blood pressure minimum/maximum value: 50 to 104 mm Hg
- The difference between minimum and maximum systolic blood pressure readings cannot be greater than 30 mm Hg.
- The difference between minimum and maximum diastolic blood pressure readings cannot be greater than 30 mm Hg.
- The minimum arm circumference is 17 cm based on the lowest arm range value of the available cuffs. (If the arm circumference is <17, a soft edit message is displayed and if the value is confirmed, the system will choose the cuff with a range closest to the arm circumference.)
- The maximum arm circumference is 50 cm based on the highest arm range value of the available cuffs. (If the arm circumference is >50, a soft edit message is displayed and if the value is confirmed, the system will choose the cuff with a range closest to the arm circumference.) However, you should still attempt to take BP and pulse.

3.3 Special Considerations

Obtaining complete and accurate blood pressure measurements can be more challenging under some circumstances. The following situations may require certain modifications to the procedures that would be followed under routine conditions.

3.3.1 SPs in Street Clothes

Some SPs refuse to change into the shirt provided to them as part of the standard survey examination gown. If a participant enters the exam room wearing his or her street clothes, complete the exam if the SP has a loose fitting or sleeveless shirt.

3.3.2 Comprehension or Language Difficulties

Some participants may have difficulty understanding the examination instructions. Use extreme caution when attempting to conduct the blood pressure exam on these participants. If the participant cannot understand your instructions due to a developmental disability or other type of physical or mental impairment, ask if a family member can help explain your directions to the participant. Regardless, if you believe the participant cannot comprehend well enough for you to

safely and accurately carry out the examination protocol, code it as “Could Not Obtain” and select “Communication Problem” as the reason for the Partial or Not Done exam status.

For many participants, language barriers are a common cause of difficulty in understanding examination procedures. For participants with limited English proficiency, an interpreter will be assigned to interpret during the exam. The interpreter must be present during the introduction of the exam and the instructions, must wait outside the examination room during the 5-minute rest period and the BP measurements and then return to the room once the BP measurements have been completed. If, as in the case of other forms of comprehension difficulties, you cannot safely and accurately perform the exam on the participant, then code it as “CNO” (Could Not Obtain) and select “Language Barrier” as the reason for the Partial or Not Done exam status.

3.3.3 Interruptions

If the participant is not able to stay quiet and continues to talk during the 5-minute rest period, pause the exam and re-explain to the SP the need for quiet and inactivity and continue with the exam. If the SP has a coughing spasm and takes some time to get settled, make the SP comfortable, re-start the rest period, and re-take 3 measures per protocol. Also, if you have to remove the cuff for any reason such as moving and or interruptions by family members, re-start the rest period and re-take the 3 measures per protocol.

4. Data Entry Screens

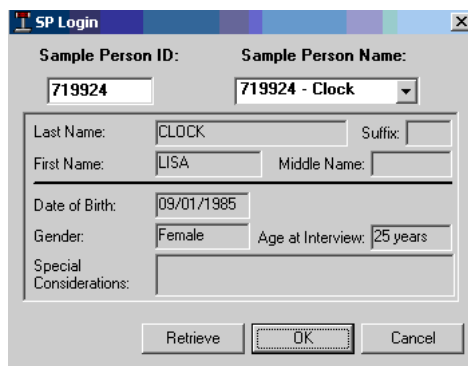
This section provides screenshots of the data entry screens for the blood pressure component along with a brief description of the features associated with the screens.

4.1 General Screen Information

When the coordinator assigns a survey participant (SP) to an exam room, a communication dialog box will appear on the Integrated Survey Information System (ISIS) computer screen. This will inform you that an SP has been assigned to this component. Click the **Close** button to remove the dialog box from the screen.

To begin the examination, click the “Login SP” icon, the first icon on the left in the standard toolbar. ISIS will present a dialog box that asks for the name and password of the examiner and the recorder. Wand the barcode on the SP’s identification bracelet or type the SP’s ID number to log the SP into the component. This will activate a dialog box (Exhibit 4-1) containing descriptive information about the SP (i.e., name, SP ID, age, etc.). Verify that the correct participant name appears on the screen. Contact the coordinator and MEC manager for assistance if the information in ISIS appears incorrect. Otherwise, click **OK** to initiate the examination.

Exhibit 4-1. Login SP screen



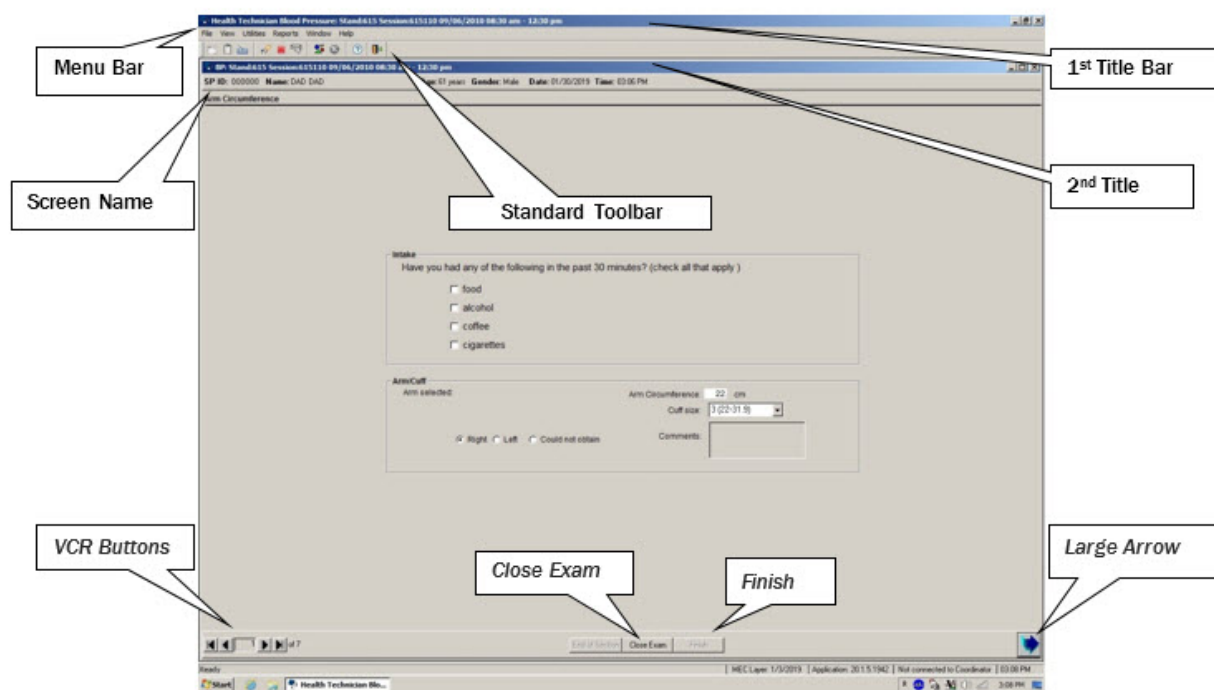
The screenshot shows a dialog box titled "SP Login" with the following fields and values:

Field	Value
Sample Person ID	719924
Sample Person Name	719924 - Clock
Last Name	CLOCK
First Name	LISA
Date of Birth	09/01/1985
Gender	Female
Age at Interview	25 years

Buttons at the bottom: Retrieve, OK, Cancel.

All ISIS screens have similar characteristics. As shown in Exhibit 4-2, at the very top of the screen is a title bar containing the component name (Health Technician Blood Pressure), stand number, session number, and session date and time. Below this are the menu bar and standard toolbar icons, which provide software application commands and shortcuts. Under the standard toolbar sits a second title bar that identifies the examination component (BP), stand number, session number, and session date and time. Below the second title bar are the SP ID, name, age, gender, and current date and time. The component screen name lies in the upper left of the main window area.

Exhibit 4-2. ISIS screen characteristics



At the bottom-left corner of the screen is the ISIS screen number and a set of arrow buttons for navigating the screens: The far left button moves to the first screen and the far right button moves to the last screen. Directly beside the screen number, the left button moves to the previous screen and the right button moves to the next screen. At the bottom-right corner of the screen is a large arrow. **Always click on the large arrow to advance to the next screen.**

In the middle of the bottom of the screen are two buttons: Close Exam and Finish. Clicking **Close Exam** will delete any data captured on the current screen, terminate the exam, and code the exam status as **Partial** or **Not Done**. **NEVER click the Close Exam button unless the exam**

must be discontinued and there is no other appropriate means to exit the application. Click the **Finish** button at the end of an exam. This sends a signal to the coordinator that the SP is available for the next assignment.

4.2 Arm Circumference Screen

The next screen in the ISIS blood pressure application is the Arm Circumference screen (Exhibits 4-3 and 4-4). In accordance with the blood pressure protocol, the screen will reflect fields depending on the age of the SP:

1. SPs aged 8-17 years: Arm Circumference (Exhibit 4-3); and
2. SPs aged 18 years and older: Intake and Arm Circumference (Exhibit 4-4).

Exhibit 4-3. Arm Circumference screen

BP: Stand:617 Session:617561 10/27/2011 01:30 pm - 05:30 pm

SP ID: 000000 Name: B, NANIA2 Age: 8 years Gender: Female Date: 03/19/2019 Time: 12:51 PM

Arm Circumference

Arm/Cuff

Arm selected:

Right Left Could not obtain

Arm Circumference: 0 cm

Cuff size:

Comments:

End of Section Close Exam Finish

Exhibit 4-4. Intake and Arm Circumference screen

BP: Standi617 Session61756110/27/2011 01:30 pm - 05:30 pm
SP ID: 291988 Name: B. NANIAZ Age: 18 years Gender: Female Date: 03/19/2019 Time: 12:51 PM

Arm Circumference

Intake
Have you had any of the following in the past 30 minutes? (check all that apply)

food
 alcohol
 coffee
 cigarettes

Arm/Cuff
Arm selected: Right Left Could not obtain

Arm Circumference: cm
Cuff size:

Comments:

4/7

End of Section Close Exam Print

Arm Selection: The default setting for Arm Selection is “Right.” If the measurements cannot be taken in the right arm and the left arm is used, select “Left” under Arm Selection. If there is a problem with both arms, select “Could not obtain.”

Arm Circumference: The official arm circumference measurement is obtained in Body Measures. If this component was completed prior to blood pressure, the arm circumference will be displayed on the screen (Exhibit 4-5). Arm circumference is used by the Blood Pressure application to determine the appropriate cuff size.

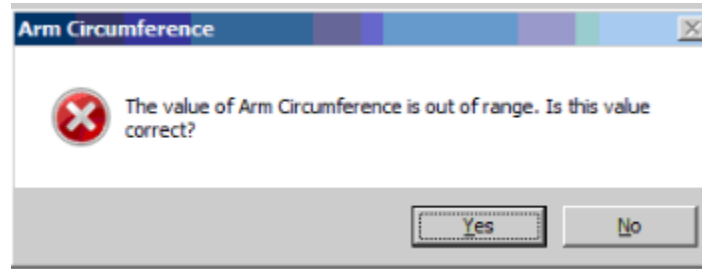
- Enter the arm circumference (if field is blank).
- The cuff size will be filled based on the arm circumference.

Exhibit 4-5. Cuff size

The screenshot shows a form titled "Arm/Cuff". It includes a section for "Arm selected:" with radio buttons for "Right", "Left", and "Could not obtain". There is a text input field for "Arm Circumference:" followed by "cm". A "Cuff size:" dropdown menu is open, showing options: "2 (17-21.9)", "3 (22-31.9)", "4 (32-41.9)", and "5 (42-50)". A "Comments:" text area is also visible.

- If the arm circumference is out of range, a message will be displayed to confirm whether or not the value entered is correct (Exhibit 4-6).
- If the value entered was incorrect, select “No” and enter the correct value.
- If the value entered was correct, this is a soft edit and will allow you to select “Yes” to confirm the value.

Exhibit 4-6. Out of range confirmation message



Intake: Intake questions are asked on SP’s 18 years and older. They elicit whether or not an eligible SP has consumed food, alcohol, coffee, or cigarettes in the last 30 minutes. Select all that apply. Answering “Yes” does not exclude SPs from the blood pressure component (Exhibit 4-7).

Exhibit 4-7. Intake question

The screenshot shows a form titled "Intake" with the question: "Have you had any of the following in the past 30 minutes? (check all that apply)". Below the question are four checkboxes: "food", "alcohol", "coffee", and "cigarettes". The "alcohol" and "cigarettes" checkboxes are checked.

4.3 Data Capture Screens

The next screens in the ISIS blood pressure application are the Data Capture Screens. Blood pressures are measured 3 times with a 30-second pause between each successive measurement. After the 3 inflations are finished and the calculated average measurements are displayed, perform the following steps:

- Record all four readings—Average, Reading 1, Reading 2, and Reading 3 on the Data Capture Screen 1 (Exhibit 4-8). See Chapter 3, Section 3.2.2.10 for detailed instructions on how to retrieve the data from the BP monitor.
- If a reading was not captured, select Could Not Obtain.
- Move to the next screen to re-enter the readings on Data Capture Screen 2.
- If the values in Data Capture Screen 1 (Exhibit 4-8) and Data Capture Screen 2 (Exhibit 4-9) are not consistent, Data Capture Screen 3 will be presented to correct the inconsistency. The fields that are inconsistent will be blank. The remaining fields (that were consistent) will be disabled (Exhibit 4-10).

Exhibit 4-8. Data Capture Screen 1 with values

The screenshot displays the 'Omron Data Capture Screen 1' interface. At the top, it shows session information: 'BP: Stand617 Session:617561 10/27/2011 01:30 pm - 05:30 pm'. Below this, patient details are listed: 'SP ID: 000000 Name: B,2 Age: 18 years Gender: Female Date: 03/19/2019 Time: 12:51 PM'. The main area contains four data entry sections:

- Average:** Systolic: 118 mm Hg, Diastolic: 78 mm Hg, Pulse: 90, Could Not Obtain
- Reading 1:** Systolic: 120 mm Hg, Diastolic: 80 mm Hg, Pulse: 90, Could Not Obtain
- Reading 2:** Systolic: 120 mm Hg, Diastolic: 80 mm Hg, Pulse: 90, Could Not Obtain
- Reading 3:** Systolic: 118 mm Hg, Diastolic: 78 mm Hg, Pulse: 90, Could Not Obtain

At the bottom, there are navigation controls: a set of arrows with '2' and 'of 7', and buttons for 'End of Section', 'Close Exam', and 'Finish'.

Exhibit 4-9. Data Capture Screen 2 with inconsistent readings from Screen 1

BP: Stand617 Session617561 10/27/2011 01:30 pm - 05:30 pm
SP ID: 000000 Name: B.2 Age: 18 years Gender: Female Date: 03/19/2019 Time: 12:51 PM
Omron Data Capture Screen 2

Reading	Systolic (mm Hg)	Diastolic (mm Hg)	Pulse	Could Not Obtain
Average	118	78	90	<input type="checkbox"/>
Reading 1	120	80	90	<input type="checkbox"/>
Reading 2	120	80	90	<input type="checkbox"/>
Reading 3	120	80	90	<input type="checkbox"/>

Navigation: 3 of 7 | End of Section | Close Exam | Finish

Exhibit 4-10. Data Capture Screen 3

BP: Stand617 Session617561 10/27/2011 01:30 pm - 05:30 pm
SP ID: 000000 Name: B.2 Age: 18 years Gender: Female Date: 03/19/2019 Time: 12:51 PM
Omron Data Capture Screen 3

Reading	Systolic (mm Hg)	Diastolic (mm Hg)	Pulse	Could Not Obtain
Average	118	78	90	<input type="checkbox"/>
Reading 1	120	80	90	<input type="checkbox"/>
Reading 2	120	80	90	<input type="checkbox"/>
Reading 3			90	<input type="checkbox"/>

Navigation: 4 of 7 | End of Section | Close Exam | Finish

- Enter the empty fields with the corrected data (Exhibit 4-11).

Exhibit 4-11. Data Capture Screen 3 – with corrected values

The screenshot displays the Omron Data Capture Screen 3 interface. At the top, it shows patient information: SP ID: 000000, Name: B, 2, Age: 18 years, Gender: Female, Date: 03/19/2019, Time: 12:51 PM. The screen is titled "Omron Data Capture Screen 3". It features four rows of data entry fields:

- Average:** Systolic: 118 mm Hg, Diastolic: 78 mm Hg, Pulse: 90, Could Not Obtain
- Reading 1:** Systolic: 120 mm Hg, Diastolic: 80 mm Hg, Pulse: 90, Could Not Obtain
- Reading 2:** Systolic: 120 mm Hg, Diastolic: 80 mm Hg, Pulse: 90, Could Not Obtain
- Reading 3:** Systolic: 118 mm Hg, Diastolic: 78 mm Hg, Pulse: 90, Could Not Obtain

The "Reading 3" row is highlighted with a yellow border. At the bottom, there are navigation buttons: "End of Section", "Close Exam", and "Finish".

- Once the values are corrected on Data Capture Screen 3, move to the next screen.
- If the four readings are consistent, the BP status will be set to Complete.

4.4 Error Code/Restart Screen

The next screen in the ISIS blood pressure application is the Error Code/Restart screen. If an error code is displayed after the first or second measure (see Table 3-2 in Chapter 3 for a list of the error codes):

- Select CNO on BP Data Capture Screen 1,
- Make corrections as necessary,
- Select “Yes” on the Error Code/Restart Exam screen question, “Did the machine display an error code during the measurements?” (Exhibit 4-12),

Exhibit 4-12. Error code

BP: Stand:617 Session:617561 10/27/2011 01:30 pm - 05:30 pm

SP ID: 000000 Name: B,2 Age: 18 years Gender: Female Date: 03/19/2019 Time: 12:51 PM

Error Code/Restart Screen

Did the machine display an error code during the measurements?

Enter any error codes

Rest Period re-started?

BP measures re-started?

5 of 7 End of Section Close Exam Finish

- Select the error code number from the drop-down list (Exhibit 4-13),

Exhibit 4-13. Error code numbers

BP: Stand:617 Session:617561 10/27/2011 01:30 pm - 05:30 pm

SP ID: 000000 Name: B,2 Age: 18 years Gender: Female Date: 03/19/2019 Time: 12:51 PM

Error Code/Restart Screen

Did the machine display an error code during the measurements?

Enter any error codes

Rest Period re-started?

BP measures re-started?

1
2
3
4
5

5 of 7 End of Section Close Exam Finish

- If you have to re-start the rest period, select “Yes” from the drop-down list (Exhibit 4-14),
 - Select “Yes - Error code” if you had to remove the cuff due to an error code.
 - Select “Yes - SP movement, talking, coughing, etc.” if the SP is not able to stay quiet and continues to talk, if the SP has a coughing spasm, or for any other interruption that takes some time to be settled.

Exhibit 4-14. Rest period re-started

BP: Stand:617 Session:617561 10/27/2011 01:30 pm - 05:30 pm

SP ID: 000000 Name: B,2 Age: 18 years Gender: Female Date: 03/19/2019 Time: 12:51 PM

Error Code/Restart Screen

Did the machine display an error code during the measurements? No

Enter any error codes

Rest Period re-started?

BP measures re-started?

No
Yes - Error code
Yes - SP movement, talking, coughing, etc.

5 of 7 End of Section Close Exam Finish

- If you have to re-start the measurement because the SP kept moving, talking, and/or coughing throughout the rest period, select “Yes – SP movement, talking, coughing” from the drop-down list (Exhibit 4-15).
- If you accidentally erased the measurements, select “Yes – Inadvertently erased BP measures” and restart the measurements without the rest period.

Exhibit 4-15. BP measures re-started

BP: Stand:617 Session:617561 10/27/2011 01:30 pm - 05:30 pm
SP ID: 000000 Name: B.2 Age: 18 years Gender: Female Date: 03/19/2019 Time: 12:51 PM

Error Code/Restart Screen

Did the machine display an error code during the measurements? No

Enter any error codes

Rest Period re-started? No

BP measures re-started?

- No
- Yes - Inadvertently erased BP measures
- Yes - SP movement, talking, coughing

5 of 7 End of Section Close Exam Finish

4.5 Blood Pressure Statement Screen

The next screen in the ISIS blood pressure application is the Blood Pressure Statement screen (Exhibits 4-16 through 4-25). In accordance with the blood pressure protocol, the screen will have different statements depending on the age and levels of referral necessary using the established guidelines. Refer to Chapter 5 for a detailed explanation of the referral levels.

Exhibit 4-16. BP statement – Normal (adult)

BP: Stand:615 Session:615110 09/06/2010 08:30 am - 12:30 pm
SP ID: 000000 Name: SP Name Age: 47 years Gender: Female Date: 01/30/2019 Time: 03:06 PM

Blood Pressure Statement

Average Systolic 110 Average Diastolic 70 Average Pulse 60

Your blood pressure today is within the normal range. You will receive your blood pressure and pulse measurements in a written report before you leave today

6 of 7 End of Section Close Exam Finish

Exhibit 4-17. BP statement – Elevated (adult)

BP: Stand:615 Session:615110 09/06/2010 08:30 am - 12:30 pm
SP ID: 00000 Name: SP Name Age: 47 years Gender: Female Date: 01/30/2019 Time: 03:06 PM

Blood Pressure Statement

Average Systolic Average Diastolic Average Pulse

Your blood pressure today is elevated. Based on national guidelines for the treatment of hypertension, you should take this report to a health care provider within the next 3-6 months to have your blood pressure rechecked. You will receive your blood pressure and pulse measurements in a written report before you leave today

6 of 7 End of Section Close Exam Finish

Exhibit 4-18. BP statement – High (adult)

BP: Stand:615 Session:615110 09/06/2010 08:30 am - 12:30 pm
SP ID: 00000 Name: SP Name Age: 47 years Gender: Female Date: 01/30/2019 Time: 03:06 PM

Blood Pressure Statement

Average Systolic Average Diastolic Average Pulse

Your blood pressure today is high. Based on national guidelines for the treatment of hypertension, you should take this report to a health care provider within two weeks. You will receive your blood pressure and pulse measurements in a written report before you leave today.

6 of 7 End of Section Close Exam Finish

Exhibit 4-19. BP statement – Very high (adult)

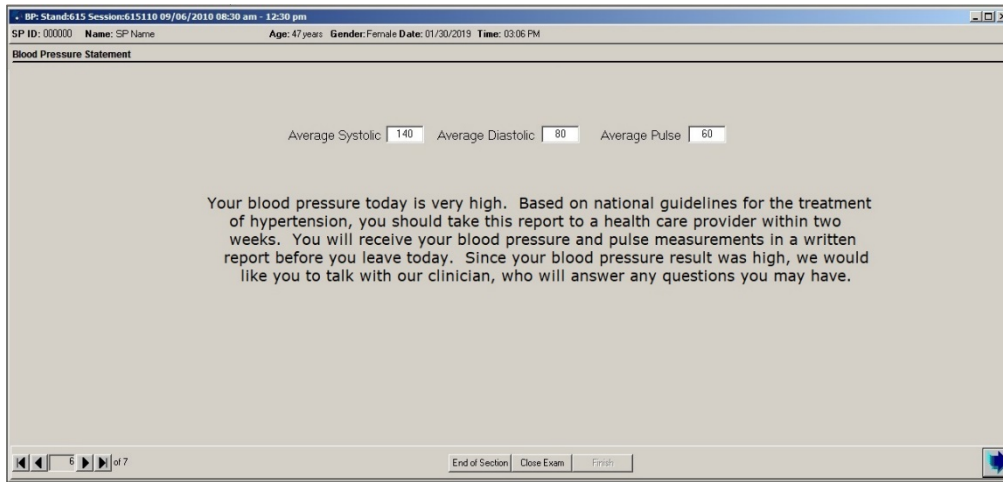


Exhibit 4-20. BP statement – Severely high (adult)

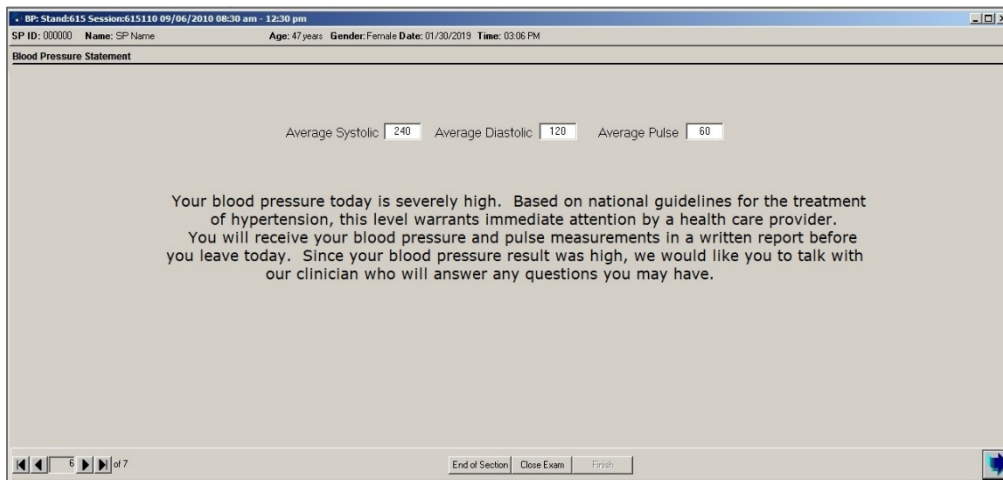


Exhibit 4-21. BP statement – Normal (children)

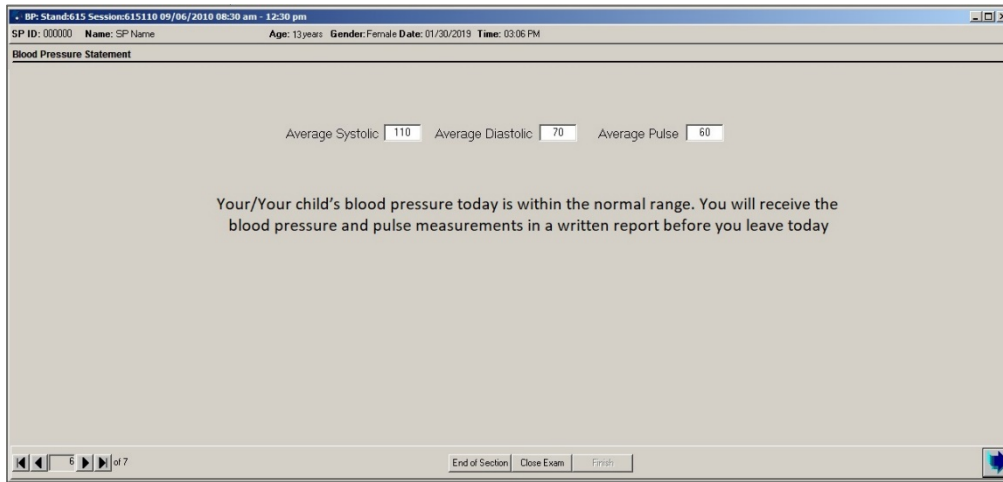


Exhibit 4-22. BP statement – Elevated (children)

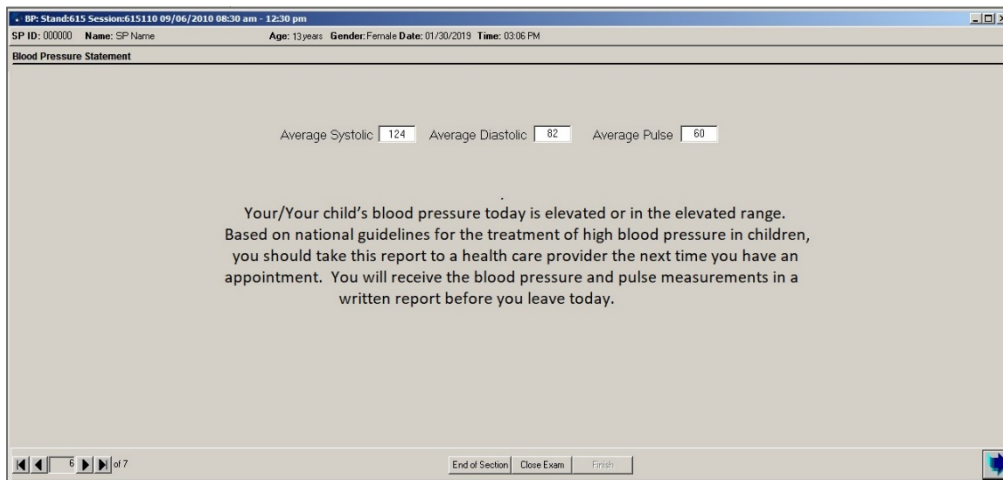


Exhibit 4-23. BP statement – High (children)

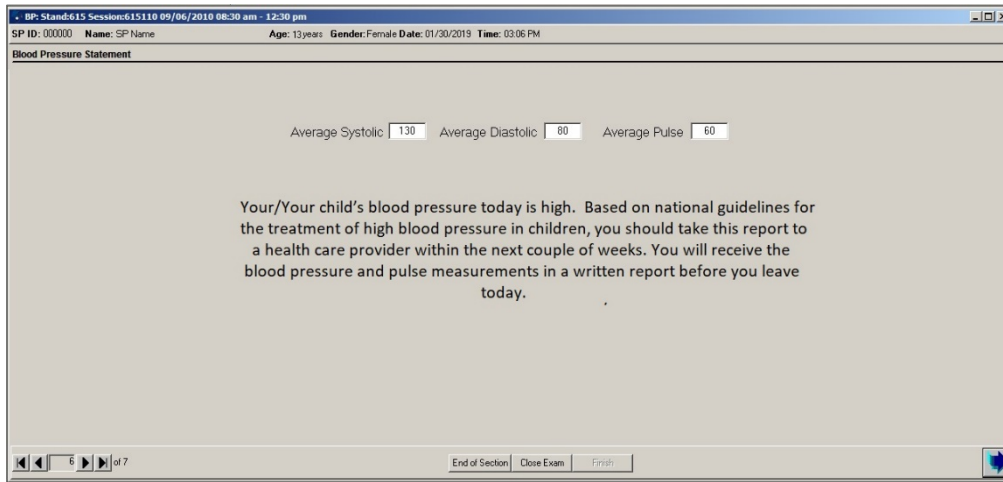


Exhibit 4-24. BP statement – Very high (children)

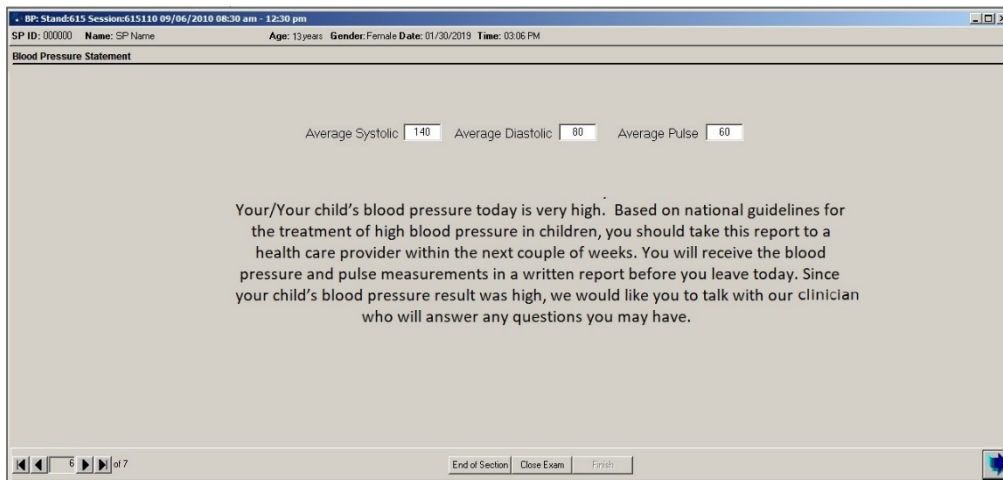


Exhibit 4-25. BP statement – Children 8-12 missing height measurement

BP: Stand:615 Session:615110 09/06/2010 08:30 am - 12:30 pm
SP ID: 00000 Name: SP Name Age: 13 years Gender: Female Date: 01/30/2019 Time: 03:06 PM

Blood Pressure Statement

Average Systolic Average Diastolic Average Pulse

You/Your child's will receive the blood pressure and pulse measurements in a written report before you leave today. If the blood pressure is above normal, we would like you to talk with our clinician who will answer any questions you may have.

6 of 7 End of Section Close Exam Finish

4.6 Blood Pressure Component Status Screen

The Blood Pressure Component Status (Exhibits 4-26 and 4-27) marks the final ISIS screen. The purpose of this screen is to document the overall status of the blood pressure examination: **Complete**, **Partial**, and **Not Done**. As with all other MEC exam components, ISIS will automatically default to one of these codes.

- **Complete.** All required measures were captured in ISIS.
- **Partial.** One or more required measures were NOT captured in ISIS.
- **Not Done.** No required measures were captured in ISIS.

For Partial and Not Done exams, use the drop-down menu beside the Comments box to select from a list of reasons that include safety exclusion; SP refusal; no time; physical limitation; communication problem; equipment failure; SP ill/emergency; interrupted; medical appliance; inconsistent measurement values; and other, specify. If you choose the “other, specify” comment, you must enter a description. Be as brief as possible. Only select “other, specify” if the comment does not fit into one of the defined comments.

Exhibit 4-26. Blood Pressure Component Status screen—complete

The screenshot shows a software window titled "BP: Stand:517 Session:617570 10/28/2011 08:30 am - 12:30 pm". The header bar contains patient information: "SP ID: 506388 Name: C, CHRISTINE1 Age: 47 years Gender: Female Date: 03/19/2019 Time: 01:26 PM". Below the header is the "Blood Pressure Status" section. In the center, there is a "Status" box with three radio buttons: "Complete" (which is selected), "Partial", and "Not Done". Below the status box are two text input fields: "Comments" and "Other text". At the bottom of the window, there is a navigation bar with a "7 of 7" indicator and buttons for "End of Section", "Close Exam", and "Finish".

Exhibit 4-27. Blood Pressure Component Status screen—partial

This screenshot is similar to Exhibit 4-26, but the "Partial" radio button is selected. The "Comments" dropdown menu is open, displaying a list of options: "communication problem", "equipment failure", "inconsistent measurement valu", "interrupted", "Language Barrier", and "no time". The "Other text" field is also visible below the dropdown. The rest of the interface, including the patient information and navigation buttons, remains the same as in Exhibit 4-26.

Lastly, click **Finish** to end the examination. Wait for a message from the coordinator indicating where to direct the SP. Thank the SP for participating and escort him or her to the next exam room or to the coordinator area.

5. Referrals and Report of Findings

5.1 Blood Pressure Referrals

SPs who have a BP measurement of “very high” and “severely high” will be referred to the MEC Clinician for evaluation. The clinician may choose to measure the BP again using the Omron BP monitor. The clinician will determine the level of referral necessary using the established guidelines.

5.1.1 Blood Pressure Referrals—Adults

Tables 5-1 through 5-4 provide the matrix of combinations of systolic and diastolic blood pressure results and the referrals that are generated when these BPs are present for adults. The left column specifies the minimum and maximum systolic pressure (SBP) groupings. The first row specifies the minimum and maximum diastolic blood pressure (DBP) categories. The matrix cells specify the BP category severity (1 to 5) for the SBP and the DBP combination. The category severity defines the MEC referral level. Refer to Appendix C for a copy of the adult blood pressure reference tables.

Table 5-1. Blood Pressure category (adults)¹

Systolic	Diastolic				
	<80	80-89	90-99	100-109	>/=110
<120	1	3	4	4	5
120-139	2	3	4	4	5
140-159	4	4	4	4	5
160-179	4	4	4	4	5
≥ 180	5	5	5	5	5

¹ Based on the ACC/AHA Hypertension Guidelines for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults, *American Journal of Hypertension*, 31(2), 2018, p.133-35.

Table 5-2. Blood pressure referral levels, category, and action guideline (adults)

BP category	Referral level	Physician guideline referral action
5	1	Indicates major medical findings (BP) that warrant immediate attention by a health care provider.
3 and 4	2	Indicates major medical findings (BP) that warrant attention by a health care provider within the next 2 weeks. These findings are expected to cause adverse effects within this time period and they have previously been undiagnosed, unattended, nonmanifested, or not communicated to the examinee by his/her personal health care provider.
2	2	Indicates elevated blood pressure, minor medical findings that an examinee already knows about, and is under care for, or findings that do not require prompt attention by a medical provider prior to 3-6 months.
1	3	Indicates no abnormal BP findings.

Table 5-3. Adults' blood pressure referral letter comments

BP category	BP referral level	Referral statement
5	1	The participant's blood pressure today is severely high. Based on national guidelines for the treatment of hypertension.
4	2	The participant's blood pressure today is very high. Based on the national guidelines for the treatment of hypertension.
3	2	The participant's blood pressure today is high. Based on the national guidelines for the treatment of hypertension.
2	2	The participant's blood pressure today is elevated. Based on the national guidelines for the treatment of hypertension.
1	3	The participant's blood pressure today is within the normal range.

Table 5-4. Table of blood pressure report of findings – comments (adults)

Report of findings level BP category	Report of findings message – English	Report of findings message – Spanish
1	Your blood pressure today is within the normal range.*	Su presión sanguínea hoy de sangre hoy está dentro del rango normal. **
2	Your blood pressure today is elevated. Based on national guidelines for the treatment of hypertension,* you should take this report to a health care provider within the next 3-6 months to have your blood pressure rechecked.	Su presión sanguínea hoy está elevada. Basado en las guías nacionales para el tratamiento de la hipertensión**, usted debería llevar este informe a un proveedor de cuidado de salud en los próximos 3 a 6 meses para que le vuelvan a tomar la presión sanguínea.
3	Your blood pressure today is high. Based on national guidelines for the treatment of hypertension,* you should take this report to a health care provider within two weeks.	Su presión sanguínea hoy está alta. Basado en las guías nacionales para el tratamiento de la hipertensión**, usted debería llevar este informe a un proveedor de cuidado de salud antes de dos semanas.
4	Your blood pressure today is very high. Based on the national guidelines for the treatment of hypertension,* you should take this report to a health care provider within two weeks.	Su presión sanguínea hoy está muy alta. Basado en las guías nacionales para el tratamiento de la hipertensión**, usted debería llevar este informe a un proveedor de cuidado de salud antes de dos semanas.
5	Your blood pressure today is severely high. Based on national guidelines for the treatment of hypertension,* this level warrants immediate attention by a health care provider.	Su presión sanguínea hoy está extremadamente alta. Basado en las guías nacionales para el tratamiento de la hipertensión** y debido al nivel de su presión sanguínea, usted debe ver un proveedor de cuidado de salud inmediatamente.

*The New ACC/AHA Hypertension Guidelines for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults. *American Journal of Hypertension*, 31(2), 2018, p. 133-35.

**Basado en las Guías nacionales para la prevención, detección, evaluación y tratamiento de la hipertensión en adultos (Hypertension Guidelines for Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults) de la Asociación Estadounidense de Cardiología (ACC, por sus siglas en inglés) y la Asociación Estadounidense del Corazón (AHA, por sus siglas en inglés). *American Journal of Hypertension*, 2018; 31 (2):133-135.

5.1.2 Blood Pressure Referrals—Children

Children’s normal blood pressures vary by age, weight, and height. Referral comments and Report of Findings comments are shown in Tables 5-5 and 5-6 and in Appendix B.

The table for children’s blood pressures is found in Appendix A, Child Blood Pressure Values.

Table 5-5. Referral comments for blood pressure (children)

BP category	Referral level	Referral statement*
4	1	The participant’s blood pressure is very high .*
3	2	The participant’s blood pressure is high .*
2	3	The participant’s blood pressure is elevated or in the elevated range .*
1	3	The participant’s blood pressure is normal .*

*Based on the American Academy of Pediatrics (AAP) Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. *Pediatrics* 2017; 140 (3):e20171904.

Table 5-6. Table of blood pressure report of findings – comments (children)

Report of findings level BP category	Report of findings message
1	Your child’s blood pressure today is within the normal range .*
2	Your child’s blood pressure today is elevated or in the elevated range .*
3	Your child’s blood pressure today is high .*
4	Your child’s blood pressure today is very high .*

*Based on the American Academy of Pediatrics (AAP) Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. *Pediatrics* 2017; 140 (3):e20171904.

6. Quality Control

6.1 Equipment and Room Setup Checks

The equipment, room supplies, and room setup need to be checked on a regular basis. Some checks are completed daily and others need only be completed at the beginning of each stand. These checks include calibration checks, maintenance inspection of equipment and supplies, and preparation of the room and equipment for the session exams.

Each time you log on to the application, the system will remind you to do quality control (QC) checks if the checks have not been completed for that period. The checks are to be completed daily, weekly, three times a week, and/or every stand. If you do not have time to do the checks when you log on, you can bypass this message and complete the checks at a later time. However, this message will be displayed each time you log on until you have completed the checks for that period. Once you have completed the checks and entered them in the system, the message box with the reminder will not be displayed again until the appropriate period has passed.

The daily and once-a-stand checks are listed in the following sections:

- Daily (Exhibit 6-1),
- Start of Stand (Exhibit 6-2), and
- End of Stand (Exhibit 6-3).

6.1.1 Daily

Exhibit 6-1. Quality control daily checks

QC Check	Done	Result	Comment
Clean Omron BP Monitor including the air tubes.	<input type="checkbox"/>		
Clean all BP Arm Cuffs.	<input type="checkbox"/>		
Check Omron Monitor settings for number of measurements (F1) is set to 3.	<input type="checkbox"/>		
Check Omron Monitor settings for waiting time until the start of the first interval (F2) is set to 5.	<input type="checkbox"/>		
Check Omron Monitor settings for measurement interval (F3) is set to 1 (minute).	<input type="checkbox"/>		

- Clean BP Monitor including the air tubes.
- Clean all BP Arm Cuffs.
- Check Omron Monitor settings for number of measurements (F1) is set to 3.
- Check Omron Monitor settings for waiting time until the start of the first interval (F2) is set to 5.
- Check Omron Monitor settings for measurement interval (F3) is set to 1 (minute).

6.1.2 Start of Stand

Exhibit 6-2. Quality control start of stand checks

QC Check	Done	Result	Comment
Complete all Daily QC checks	<input checked="" type="checkbox"/>		
Serial Number of BP monitor	<input checked="" type="checkbox"/>	01234567890AF	

- Complete all daily QC checks
- Serial Number of BP monitor

6.1.3 End of Stand

Exhibit 6-3. Quality control end of stand checks

QC Check	Done	Result	Comment
Complete Teardown procedures	<input type="checkbox"/>		

- Complete Teardown procedures

6.1.4 Incomplete QC Checks

- If you do not check that all items are complete, the system will display this message: “Not all of the QC items were done. Do you wish to exit?”
- If you want to complete the items before exiting, click “No” to this message and complete the items.
- If you wish to exit without completing all the QC checks, click “Yes” to this message.
- If all QC items were not complete, the system will remind you each time you log on that the QC checks are not complete.

6.2 Changing Set Values for the BP Monitor

The set values for the blood pressure monitor should be checked daily and changed to the values determined for this protocol if necessary. The steps to do this are outlined below.

6.2.1 Changing/Confirming the Number of Measurements (F1)

- Start with the power OFF.
- Press ON/OFF button for more than 3 seconds while holding the START button; F1 will be displayed.
- Press the START button and select the function to set. (Each time you push the START button, the functions change in order of F1, F2, F3.)
- To change the number of measurements, select F1.
- **The number of measurement should be set to 3.**
- If you need to change the number of measurements, push the DEFLATION (deflation control)/Measurement Result Display Switch Button to change the number to 3.

6.2.2 Waiting Time Until the Start of the First Measurement (F2)

- Complete the steps above under Section 6.2.1.
- To change the waiting time until the start of the first measurement, select F2.
- **The waiting time until the start of the first measurement should be set to 5.**

- If you need to change the waiting time until the start of the first measurement, push the DEFLATION (deflation control)/Measurement Result Display Switch Button to change the number to 0.

6.2.3 Measurement Interval (F3)

- Complete the steps above under Section 6.2.1.
- To change the measurement interval, select F3.
- **The measurement interval should be set to 1 minute.**
- If you need to change the measurement interval, push the DEFLATION (deflation control)/Measurement Result Display Switch Button to change the number to 1 minute.

6.3 Recording the Serial Number of the Monitor

Record the manufacturers serial number in the Result field (Exhibit 6-2). ISIS will automatically save the serial number information to the study database. If the monitor requires replacement, record the serial number of the new monitor under the Equipment Swap tab of the ISIS Blood Pressure Quality Control Checks screen (Exhibit 6-4). ISIS will automatically update and save the information to the study database.

Exhibit 6-4. Quality control equipment swap

QC Check	Done	Result	Comment
Serial Number of BP monitor	<input checked="" type="checkbox"/>	01234567890AF	

6.4 Observations, Replication, and Review

NCHS personnel and Westat component staff will visit the MEC teams at regular intervals to observe blood pressure examinations. To further monitor the quality of data collection, Westat component staff will generate reports from the ISIS intraweb. The number of blood pressure examinations and examination times: cumulative and sorted by session, by age group, and by technologist, as well as the reason for not done and partial examinations, will be analyzed for each stand.

Finally, retraining sessions will be arranged by the Westat component lead in coordination with the NCHS project officer when major protocol changes are introduced, or when a lack of standardization is observed among the technologists.

Appendix A
Child Blood Pressure Values

Appendix A

Child Blood Pressure Values

Girls – Age 7

Percentile of height = Less than 10%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 68	68-71	72-83	≥ 84
< 106	1	2	3	4
106-108	2	2	3	4
109-120	3	3	3	4
≥ 121	4	4	4	4

Percentile of height = 10-24%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 68	68-71	72-83	≥ 84
< 106	1	2	3	4
106-109	2	2	3	4
110-121	3	3	3	4
≥ 122	4	4	4	4

Percentile of height = 25-49%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 69	69-72	73-84	≥ 85
< 107	1	2	3	4
107-110	2	2	3	4
111-122	3	3	3	4
≥ 123	4	4	4	4

Percentile of height = 50-74%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 70	70-72	73-84	≥ 85
< 109	1	2	3	4
109-111	2	2	3	4
112-123	3	3	3	4
≥ 124	4	4	4	4

Girls - Age 7 (continued)

Percentile of height = 75-89%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 71	71-73	74-85	≥ 86
< 110	1	2	3	4
110-112	2	2	3	4
113-124	3	3	3	4
≥ 125	4	4	4	4

Percentile of height = 90-94%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 72	72-73	74-85	≥ 86
< 111	1	2	3	4
111-113	2	2	3	4
114-125	3	3	3	4
≥ 126	4	4	4	4

Percentile of height = 95% and higher

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 72	72-74	75-86	≥ 87
< 112	1	2	3	4
112-114	2	2	3	4
115-126	3	3	3	4
≥ 127	4	4	4	4

Girls - Age 8

Percentile of height = Less than 10%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 69	69-71	72-83	≥ 84
< 107	1	2	3	4
107-109	2	2	3	4
110-121	3	3	3	4
≥ 122	4	4	4	4

Percentile of height = 10-24%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 70	70-72	73-84	≥ 85
< 107	1	2	3	4
108-110	2	2	3	4
111-122	3	3	3	4
≥ 123	4	4	4	4

Percentile of height = 25-49%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 71	71-73	74-85	≥ 86
< 108	1	2	3	4
108-111	2	2	3	4
112-123	3	3	3	4
≥ 124	4	4	4	4

Percentile of height = 50-74%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 72	72-73	74-85	≥ 86
< 110	1	2	3	4
110-112	2	2	3	4
113-124	3	3	3	4
≥ 125	4	4	4	4

Girls - Age 8 (continued)

Percentile of height = 75-89%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 72	72-74	75-86	≥ 87
< 111	1	2	3	4
111-114	2	2	3	4
115-126	3	3	3	4
≥ 127	4	4	4	4

Percentile of height = 90-94%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 73	73-74	75-86	≥ 87
< 112	1	2	3	4
112-115	2	2	3	4
116-127	3	3	3	4
≥ 128	4	4	4	4

Percentile of height = 95% and higher

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 73	73-74	75-86	≥ 87
< 113	1	2	3	4
113-116	2	2	3	4
117-128	3	3	3	4
≥ 129	4	4	4	4

Girls - Age 9

Percentile of height = Less than 10%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 71	71-73	74-85	≥ 86
< 108	1	2	3	4
108-111	2	2	3	4
112-123	3	3	3	4
≥ 124	4	4	4	4

Percentile of height = 10-24%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 71	71-73	74-85	≥ 86
< 108	1	2	3	4
108-111	2	2	3	4
112-123	3	3	3	4
≥ 124	4	4	4	4

Percentile of height = 25-49%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 72	72-74	75-86	≥ 87
< 109	1	2	3	4
109-112	2	2	3	4
113-124	3	3	3	4
≥ 125	4	4	4	4

Percentile of height = 50-74%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 73	73-74	75-86	≥ 87
< 111	1	2	3	4
111-113	2	2	3	4
114-125	3	3	3	4
≥ 126	4	4	4	4

Girls - Age 9 (continued)

Percentile of height = 75-89%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 73	73-74	75-86	≥ 87
< 112	1	2	3	4
112-115	2	2	3	4
116-127	3	3	3	4
≥ 128	4	4	4	4

Percentile of height = 90-94%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 73	73-74	75-86	≥ 87
< 113	1	2	3	4
113-116	2	2	3	4
117-128	3	3	3	4
≥ 129	4	4	4	4

Percentile of height = 95% and higher

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 73	73-74	75-86	≥ 87
< 114	1	2	3	4
114-117	2	2	3	4
118-129	3	3	3	4
≥ 130	4	4	4	4

Girls – Age 10

Percentile of height = Less than 10%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 72	72-74	75-86	≥87
< 109	1	2	3	4
109-112	2	2	3	4
113-124	3	3	3	4
≥ 125	4	4	4	4

Percentile of height = 10-24%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 73	73-74	75-86	≥87
< 110	1	2	3	4
110-113	2	2	3	4
114-125	3	3	3	4
≥ 126	4	4	4	4

Percentile of height = 25-49%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 73	73-75	76-87	≥88
< 111	1	2	3	4
111-113	2	2	3	4
114-125	3	3	3	4
≥ 126	4	4	4	4

Percentile of height = 50-74%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 73	73-75	76-87	≥ 88
< 112	1	2	3	4
112-115	2	2	3	4
116-127	3	3	3	4
≥ 128	4	4	4	4

Girls - Age 10 (continued)

Percentile of height = 75-89%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 73	73-75	76-87	≥ 88
< 113	1	2	3	4
113-116	2	2	3	4
117-128	3	3	3	4
≥ 129	4	4	4	4

Percentile of height = 90-94%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 73	73-75	76-87	≥ 88
< 115	1	2	3	4
115-118	2	2	3	4
119-130	3	3	3	4
≥ 131	4	4	4	4

Percentile of height = 95% and higher

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 73	73-75	76-87	≥ 88
< 116	1	2	3	4
116-119	2	2	3	4
120-131	3	3	3	4
≥ 132	4	4	4	4

Girls - Age 11

Percentile of height = Less than 10%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 74	74-75	76-87	≥ 88
< 111	1	2	3	4
111-114	2	2	3	4
115-126	3	3	3	4
≥ 127	4	4	4	4

Percentile of height = 10-24%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 74	74-76	77-88	≥ 89
< 112	1	2	3	4
112-115	2	2	3	4
116-127	3	3	3	4
≥ 128	4	4	4	4

Percentile of height = 25-49%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 74	74-76	77-88	≥ 89
< 113	1	2	3	4
113-116	2	2	3	4
117-128	3	3	3	4
≥ 129	4	4	4	4

Percentile of height = 50-74%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 74	74-76	77-88	≥ 89
< 114	1	2	3	4
114-117	2	2	3	4
118-129	3	3	3	4
≥ 130	4	4	4	4

Girls - Age 11 (continued)

Percentile of height = 75-89%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 74	74-76	77-88	≥ 89
< 116	1	2	3	4
116-119	2	2	3	4
120-131	3	3	3	4
≥ 132	4	4	4	4

Percentile of height = 90-94%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-76	77-88	≥ 89
< 118	1	2	3	4
118-122	2	2	3	4
123-134	3	3	3	4
≥ 135	4	4	4	4

Percentile of height = 95% and higher

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-76	77-88	≥ 89
< 120	1	2	3	4
120-123	2	2	3	4
124-135	3	3	3	4
≥ 136	4	4	4	4

Girls - Age 12

Percentile of height = Less than 10%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-77	78-89	≥ 90
< 114	1	2	3	4
114-117	2	2	3	4
118-129	3	3	3	4
≥ 130	4	4	4	4

Percentile of height = 10-24%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-77	78-89	≥ 90
< 115	1	2	3	4
115-118	2	2	3	4
119-130	3	3	3	4
≥ 131	4	4	4	4

Percentile of height = 25-49%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-77	78-89	≥ 90
< 116	1	2	3	4
116-119	2	2	3	4
120-131	3	3	3	4
≥ 132	4	4	4	4

Percentile of height = 50-74%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-77	78-89	≥ 90
< 118	1	2	3	4
118-121	2	2	3	4
122-133	3	3	3	4
≥ 134	4	4	4	4

Girls - Age 12 (continued)

Percentile of height = 75-89%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 76	76-78	79-90	≥ 91
< 120	1	2	3	4
120-123	2	2	3	4
124-135	3	3	3	4
≥ 136	4	4	4	4

Percentile of height = 90-94%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 76	76-78	79-90	≥ 91
< 122	1	2	3	4
122-124	2	2	3	4
125-136	3	3	3	4
≥ 137	4	4	4	4

Percentile of height = 95% and higher

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 76	76-78	79-90	≥ 91
< 122	1	2	3	4
122-125	2	2	3	4
126-137	3	3	3	4
≥ 138	4	4	4	4

Girls - Ages 13-17

Systolic (mm Hg)	Diastolic (mm Hg)		
	< 80	80-89	≥ 90
< 120	1	3	4
120-129	2	3	4
130-139	3	3	4
≥ 140	4	4	4

Boys - Age 7

Percentile of height = Less than 10%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 68	68-70	71-82	≥ 83
< 106	1	2	3	4
106-109	2	2	3	4
110-121	3	3	3	4
≥ 122	4	4	4	4

Percentile of height = 10-24%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 68	68-70	71-82	≥ 83
< 107	1	2	3	4
107-109	2	2	3	4
110-121	3	3	3	4
≥ 122	4	4	4	4

Percentile of height = 25-49%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 69	69-71	72-83	≥ 84
< 108	1	2	3	4
108-110	2	2	3	4
111-122	3	3	3	4
≥ 123	4	4	4	4

Percentile of height = 50-74%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 70	70-72	73-84	≥ 85
< 109	1	2	3	4
109-111	2	2	3	4
112-123	3	3	3	4
≥ 124	4	4	4	4

Boys - Age 7 (continued)

Percentile of height = 75-89%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 70	70-72	73-84	≥ 85
< 110	1	2	3	4
110-113	2	2	3	4
114-125	3	3	3	4
≥ 126	4	4	4	4

Percentile of height = 90-94%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 71	71-73	74-85	≥ 86
< 111	1	2	3	4
111-114	2	2	3	4
115-126	3	3	3	4
≥ 127	4	4	4	4

Percentile of height = 95% and higher

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 71	71-73	74-85	≥ 86
< 111	1	2	3	4
111-115	2	2	3	4
116-127	3	3	3	4
≥ 128	4	4	4	4

Boys - Age 8

Percentile of height = Less than 10%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 69	69-71	72-83	≥ 84
< 107	1	2	3	4
107-110	2	2	3	4
111-122	3	3	3	4
≥ 123	4	4	4	4

Percentile of height = 10-24%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 70	70-72	73-84	≥ 85
< 108	1	2	3	4
108-111	2	2	3	4
112-123	3	3	3	4
≥ 124	4	4	4	4

Percentile of height = 25-49%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 70	70-72	73-84	≥ 85
< 109	1	2	3	4
109-111	2	2	3	4
112-123	3	3	3	4
≥ 124	4	4	4	4

Percentile of height = 50-74%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 71	71-73	74-85	≥ 86
< 110	1	2	3	4
110-113	2	2	3	4
114-125	3	3	3	4
≥ 126	4	4	4	4

Boys - Age 8 (continued)

Percentile of height = 75-89%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 72	72-74	75-86	≥ 87
< 111	1	2	3	4
111-114	2	2	3	4
115-126	3	3	3	4
≥ 127	4	4	4	4

Percentile of height = 90-94%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 72	72-74	75-86	≥ 87
< 112	1	2	3	4
112-115	2	2	3	4
116-127	3	3	3	4
≥ 128	4	4	4	4

Percentile of height = 95% and higher

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 73	73-74	75-86	≥ 87
< 112	1	2	3	4
112-116	2	2	3	4
117-128	3	3	3	4
≥ 129	4	4	4	4

Boys - Age 9

Percentile of height = Less than 10%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 70	70-73	74-85	≥ 86
< 107	1	2	3	4
107-111	2	2	3	4
112-123	3	3	3	4
≥ 124	4	4	4	4

Percentile of height = 10-24%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 71	71-73	74-85	≥ 86
< 108	1	2	3	4
108-111	2	2	3	4
112-123	3	3	3	4
≥ 124	4	4	4	4

Percentile of height = 25-49%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 72	72-74	75-86	≥ 87
< 109	1	2	3	4
109-112	2	2	3	4
113-124	3	3	3	4
≥ 125	4	4	4	4

Percentile of height = 50-74%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 73	73-75	76-87	≥ 88
< 110	1	2	3	4
110-114	2	2	3	4
115-126	3	3	3	4
≥ 127	4	4	4	4

Boys - Age 9 (continued)

Percentile of height = 75-89%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 74	74-75	76-87	≥ 88
< 112	1	2	3	4
112-115	2	2	3	4
116-127	3	3	3	4
≥ 128	4	4	4	4

Percentile of height = 90-94%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 74	74-76	77-88	≥ 89
< 113	1	2	3	4
113-117	2	2	3	4
118-129	3	3	3	4
≥ 130	4	4	4	4

Percentile of height = 95% and higher

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 74	74-76	77-88	≥ 89
< 114	1	2	3	4
114-118	2	2	3	4
119-130	3	3	3	4
≥ 131	4	4	4	4

Boys - Age 10

Percentile of height = Less than 10%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 72	72-75	76-87	≥ 88
< 108	1	2	3	4
108-111	2	2	3	4
112-123	3	3	3	4
≥ 124	4	4	4	4

Percentile of height = 10-24%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 73	73-75	76-87	≥ 88
< 109	1	2	3	4
109-112	2	2	3	4
113-124	3	3	3	4
≥ 125	4	4	4	4

Percentile of height = 25-49%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 74	74-76	77-88	≥ 89
< 111	1	2	3	4
111-113	2	2	3	4
114-125	3	3	3	4
≥ 126	4	4	4	4

Percentile of height = 50-74%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 74	74-76	77-88	≥ 89
< 112	1	2	3	4
112-115	2	2	3	4
116-127	3	3	3	4
≥ 128	4	4	4	4

Boys – Age 10 (continued)

Percentile of height = 75-89%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-77	78-89	≥ 90
< 113	1	2	3	4
113-117	2	2	3	4
118-129	3	3	3	4
≥ 130	4	4	4	4

Percentile of height = 90-94%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-77	78-89	≥ 90
< 115	1	2	3	4
115-119	2	2	3	4
120-131	3	3	3	4
≥ 132	4	4	4	4

Percentile of height = 95% and higher

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 76	76-77	78-89	≥ 90
< 116	1	2	3	4
116-120	2	2	3	4
121-132	3	3	3	4
≥ 133	4	4	4	4

Boys - Age 11

Percentile of height = Less than 10%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 74	74-76	77-88	≥ 89
< 110	1	2	3	4
110-113	2	2	3	4
114-125	3	3	3	4
≥ 126	4	4	4	4

Percentile of height = 10-24%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 74	74-77	78-89	≥ 90
< 111	1	2	3	4
111-113	2	2	3	4
114-125	3	3	3	4
≥ 126	4	4	4	4

Percentile of height = 25-49%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-77	78-89	≥ 90
< 112	1	2	3	4
112-115	2	2	3	4
116-127	3	3	3	4
≥ 128	4	4	4	4

Percentile of height = 50-74%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-77	78-89	≥ 90
< 114	1	2	3	4
114-117	2	2	3	4
118-129	3	3	3	4
≥ 130	4	4	4	4

Boys - Age 11 (continued)

Percentile of height = 75-89%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-77	78-89	≥ 90
< 116	1	2	3	4
116-119	2	2	3	4
120-131	3	3	3	4
≥ 132	4	4	4	4

Percentile of height = 90-94%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 76	76-77	78-89	≥ 90
< 117	1	2	3	4
117-122	2	2	3	4
123-134	3	3	3	4
≥ 135	4	4	4	4

Percentile of height = 95% and higher

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 76	76-77	78-89	≥ 90
< 118	1	2	3	4
118-123	2	2	3	4
124-135	3	3	3	4
≥ 136	4	4	4	4

Boys - Age 12

Percentile of height = Less than 10%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-77	78-89	≥ 90
< 113	1	2	3	4
113-115	2	2	3	4
116-127	3	3	3	4
≥ 128	4	4	4	4

Percentile of height = 10-24%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-77	78-89	≥ 90
< 114	1	2	3	4
114-116	2	2	3	4
117-128	3	3	3	4
≥ 129	4	4	4	4

Percentile of height = 25-49%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-77	78-89	≥ 90
< 115	1	2	3	4
115-117	2	2	3	4
118-129	3	3	3	4
≥ 130	4	4	4	4

Percentile of height = 50-74%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-77	78-89	≥ 90
< 117	1	2	3	4
117-120	2	2	3	4
121-132	3	3	3	4
≥ 133	4	4	4	4

Boys – Age 12 (continued)

Percentile of height = 75-89%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 75	75-77	78-89	≥ 90
< 119	1	2	3	4
119-123	2	2	3	4
124-135	3	3	3	4
≥ 136	4	4	4	4

Percentile of height = 90-94%

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 76	76-78	79-90	≥ 91
< 121	1	2	3	4
121-125	2	2	3	4
126-137	3	3	3	4
≥ 138	4	4	4	4

Percentile of height = 95% and higher

Systolic (mm Hg)	Diastolic (mm Hg)			
	< 76	76-78	79-90	≥ 91
< 122	1	2	3	4
122-127	2	2	3	4
128-139	3	3	3	4
≥ 140	4	4	4	4

Boys - Ages 13-17

Systolic (mm Hg)	Diastolic (mm Hg)		
	< 80	80-89	≥ 90
< 120	1	3	4
120-129	2	3	4
130-139	3	3	4
≥ 140	4	4	4

Appendix B
Child Blood Pressure References

Appendix B

Child Blood Pressure References

Blood Pressure – Children

Referral Levels:

Level 1	(Category 4)	Indicates major medical findings that warrant immediate attention by a health care provider.
Level 2	(Category 3)	Indicates major medical findings that warrant attention by a health care provider within the next 2 weeks. These findings are expected to cause adverse effects within this time period and they have previously been undiagnosed, unattended, nonmanifested, or not communicated to the examinee by his or her personal health care provider.
Level 3	(Categories 1 & 2)	Indicates no medical findings; minor medical findings that an examinee already knows about, and is under care for; or findings that do not require prompt attention by a medical provider.

Referral Comments for Blood Pressure (Children)

Referral Comments:

Statement for blood pressure in category 4	Level 1 referral	The participant's blood pressure is very high .*
Statement for blood pressure in category 3	Level 2 referral	The participant's blood pressure is high .*
Statement for blood pressure in category 2	Level 3 no referral	The participant's blood pressure is elevated or in the elevated range .*
Statement for blood pressure in category 1	Level 3 no referral	The participant's blood pressure is normal .*

Report of Findings Comments:

- Category 4 Your child's blood pressure today is **very high**.
- Category 3 Your child's blood pressure today is **high**.
- Category 2 Your child's blood pressure today is **elevated or in the elevated range**.*
- Category 1 Your child's blood pressure today is **within the normal range normal**.*

*Based on the American Academy of Pediatrics (AAP) Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. Pediatrics 2017; 140 (3):e20171904

Appendix C
Adult Blood Pressure Reference Tables

Appendix C

Adult Blood Pressure Reference Tables

Table C-1. Referral levels for adult blood pressure¹

Systolic	Diastolic				
	<80	80 – 89	90 – 99	100 – 109	>/=110
<120	1	3	4	4	5
120 – 139	2	3	4	4	5
140 – 159	4	4	4	4	5
160 – 179	4	4	4	4	5
≥ 180	5	5	5	5	5

¹ Based on the ACC/AHA Hypertension Guidelines for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults, American Journal of Hypertension, 31(2), 2018, p133-35.

Table C-2. Blood pressure referral levels, category, and action required

Referral level	BP category	Physician guideline referral action
Level 1	Category 5	Indicates major medical findings that warrant immediate attention by a health care provider.
Level 2	Categories 3 & 4	Indicates major medical findings that warrant attention by a health care provider within the next 2 weeks. These findings are expected to cause adverse effects within this time period and they have previously been undiagnosed, unattended, nonmanifested, or not communicated to the examinee by his or her personal health care provider.
Level 2	Category 2	Indicates elevated blood pressure, minor medical findings that an examinee already knows about, and is under care for, or findings that do not require prompt attention by a medical provider prior to 3-6 months
Level 3	Category 1	Indicates no abnormal medical findings.

Table C-3. Table of blood pressure report of findings comments – English and Spanish

Report of findings level	Report of findings Message – English	Report of findings Message – Spanish
1	Your blood pressure today is within the normal range.*	Su presión de sangre hoy está dentro del rango normal.**
2	Your blood pressure today is elevated. Based on national guidelines for the treatment of hypertension*, you should take this report to a health care provider within the next 3-6 months to have your blood pressure rechecked.	Su presión sanguínea hoy está elevada. Basado en las guías nacionales para el tratamiento de la hipertensión**, usted debería llevar este informe a un proveedor de cuidado de salud en los próximos 3 a 6 meses para que le vuelvan a tomar la presión sanguínea.
3	Your blood pressure today is high. Based on national guidelines for the treatment of hypertension*, you should take this report to a health care provider within two weeks.	Su presión sanguínea hoy está alta. Basado en las guías nacionales para el tratamiento de la hipertensión**, usted debería llevar este informe a un proveedor de cuidado de salud antes de dos semanas.
4	Your blood pressure today is very high. Based on the national guidelines for the treatment of hypertension*, you should take this report to a health care provider within two weeks.	Su presión sanguínea hoy está muy alta. Basado en las guías nacionales para el tratamiento de la hipertensión**, usted debería llevar este informe a un proveedor de cuidado de salud antes de dos semanas.
5	Your blood pressure today is severely high. Based on national guidelines for the treatment of hypertension*, this level warrants immediate attention by a health care provider.	Su presión sanguínea hoy está extremadamente alta. Basado en las guías nacionales para el tratamiento de la hipertensión** y debido al nivel de su presión sanguínea, usted debe ver un proveedor de cuidado de salud inmediatamente.

* The New ACC/AHA Hypertension Guidelines for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults. American Journal of Hypertension, 31(2), 2018, p133-35.

** Basado en las Guías nacionales para la prevención, detección, evaluación y tratamiento de la hipertensión en adultos (Hypertension Guidelines for Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults) de la Asociación Estadounidense de Cardiología (ACC, por sus siglas en inglés) y la Asociación Estadounidense del Corazón (AHA, por sus siglas en inglés). American Journal of Hypertension, 2018; 31 (2):133-135

Report of Findings Comments:

- Category 5 – Your blood pressure today is **severely high**.
- Category 4 – Your blood pressure today is **very high**.
- Category 3 – Your blood pressure today is **high**.
- Category 2 – Your blood pressure today is **elevated**.
- Category 1 – Your blood pressure today is **within the normal range**.

Appendix D
Blood Pressure Quick Tips

Appendix D

Blood Pressure Quick Tips

1. Set the Omron Machine

Function No.	Items to set	Set value
F1	Number of Inflatons	3 times
F2	Waiting time before 1 st inflation	5 minutes
F3	Inflation interval	1 minute
P-Set selector	How high to inflate	Auto
Mode	How many measurements	Avg

2. Position the SP

- Seated position, back straight, head looking straight ahead with feet flat
- Arm supported at heart level
- Monitor SP positioning throughout the exam

3. Select the Arm and Cuff Size

- Right arm is always the first choice but left arm can be selected if necessary
- Wrap cuff in a circular manner

4. 5-Minute Waiting Period and Blood Pressure Measurements

- Sitting quietly for 5 minutes is important
- Put Omron Machine in hide mode
- Double-key blood pressure results and pulse
- Wipe cuffs when finished

Appendix E
Blood Pressure Talking Points

Appendix E

Blood Pressure Talking Points

- As part of your examination today, your blood pressure will be taken.
- The machine will take 3 blood pressure measurements and there will be a 1-minute resting period between the measurements.
- When the machine inflates the cuff, it may feel tight and you will feel some pressure.
- While the machine is taking your blood pressure, I ask that you not talk or move and I will not talk either. Talking and moving can change your blood pressure.
- Before taking your blood pressure reading, there is going to be a 5-minute waiting period. I would like for you to sit down comfortably and quietly for those 5 minutes.
- Before we get started, do you have any questions? Thank you.

Appendix F
Blood Pressure Recording Form

Appendix F

Blood Pressure Recording Form

SP ID: _____ Stand #: _____ Session/Date: _____
Technologist: _____

Intake (18 yrs. +): Have you had any of the following in the past 30 minutes?

(Check all that apply)

- Food
- Alcohol
- Coffee
- Cigarettes

Arm Selected:

Right Left Could not obtain

Upper Arm Length: cm

Mid-Point of Upper Arm Length: cm

Arm Circumference: cm

- Cuff size:
- 2 (17-21.9)
 - 3 (22-31.9)
 - 4 (32-41.9)
 - 5 (42-50)

Data Capture 1:

BP Readings	Systolic		Diastolic		Pulse	CNO
Average =	<input type="text"/>	mm Hg	<input type="text"/>	mm Hg	<input type="text"/>	<input type="checkbox"/>
Reading 1 =	<input type="text"/>	mm Hg	<input type="text"/>	mm Hg	<input type="text"/>	<input type="checkbox"/>
Reading 2 =	<input type="text"/>	mm Hg	<input type="text"/>	mm Hg	<input type="text"/>	<input type="checkbox"/>
Reading 3 =	<input type="text"/>	mm Hg	<input type="text"/>	mm Hg	<input type="text"/>	<input type="checkbox"/>

Data Capture 2:

BP Readings	Systolic		Diastolic		Pulse	CNO
Average =	<input type="text"/>	mm Hg	<input type="text"/>	mm Hg	<input type="text"/>	<input type="checkbox"/>
Reading 1 =	<input type="text"/>	mm Hg	<input type="text"/>	mm Hg	<input type="text"/>	<input type="checkbox"/>
Reading 2 =	<input type="text"/>	mm Hg	<input type="text"/>	mm Hg	<input type="text"/>	<input type="checkbox"/>
Reading 3 =	<input type="text"/>	mm Hg	<input type="text"/>	mm Hg	<input type="text"/>	<input type="checkbox"/>

Error Code/Restart Exam:

Did the machine display an error code during the measurements? Yes No

If Yes, enter the error code:

Rest Period re-started? No
 Yes
 Yes – SP movement, talking, coughing, etc.

BP measures re-started? No
 Yes – Inadvertently erased BP measures
 Yes – SP movement, talking, coughing, etc.