Manual 24

ABI and Pulse Wave Velocity Examination

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Study website - **http://www.cscc.unc.edu/aric/**

ARIC Visit 6 and NCS Study Protocol

Manual 24 – ABI and Pulse Wave Velocity

Table of Contents

1. Introduction

Pulse wave velocity (PWV) and the ankle-brachial ratio of systolic pressure (ABI) are measured in ARIC-NCS Visit 6 as part of an ancillary study supported by the National Institute on Aging, NIH. PWV and ABI are measured simultaneously on participants resting in the supine position using an OMRON VP-1000 plus device. The measurement protocol and instrumentation, described below, are standardized to those used during the Visit 5 examination. All ARIC cohort members who take part in Visit 6 are invited to have PWV and ABI measurements; cohort members whose Visit 6 exam predated the inclusion of this ancillary study are offered the PWV/ABI examination as part of Visit 7.

2. Ankle Brachial Index

The ratio of systolic blood pressure in the ankle divided by the systolic pressure in the arm, or ankle-brachial index (ABI) is a valid and clinically useful sign of peripheral artery disease. Asymptomatic adults with low ABI have been found to have increased risk of coronary heart disease and all-cause as well as cardiovascular disease mortality. The ABI is most often measured by recording in sequence the systolic blood pressure in each arm and ankle with the use of a conventional sphygmomanometer and a hand-help Doppler device, a process that is time consuming and open to operator variability. In ARIC the ABI is measured using the Omron VP-1000 plus device to reduce participant burden and inter-observer variation. Intra-individual variability is also reduced by repeating the measurement after five minutes.

The ABI measurement procedures are described in the following section, integrated with the pulse-wave velocity (PWV) measurement procedures which employ the same data acquisition device and setting. ARIC technicians are trained and certified in the use of the Omron VP-1000 plus to collect the ABI and the PWI during the same session. The data transfer and quality assurance procedures also are in common for the ABI and PWV.

3. Pulse Wave Velocity

An increase in the stiffness of central arteries adversely affects systemic cardiovascular function and is associated with a greater risk of disease. Further, arterial stiffness is the principal cause of increasing systolic and pulse pressure with advancing age. ARIC-NCS technicians record arterial stiffness using the Omron VP-1000 plus system, a device that is safe, noninvasive and automated, thus reducing observer-related variability. The device simultaneously measures PWV, the central (carotid) blood pressure, the augmentation index (an index of arterial wave reflection) and the ABI, and thus reduces participant and staff burden. In addition to carotid-femoral PWV, this device derives another measure of arterial stiffness, the brachial-ankle PWV. The latter does not require the placement of transducers and at this time is the only index of arterial stiffness used in routine clinical settings. Once the sensors are in place, the initial measurement is repeated for better data quality.

3.1. Workstation and Supplies

The ABI/PWV workstation includes Omron VP-1000 plus device, a PC laptop approved by the ARIC Coordinating Center, a laser printer (Brother HL-2140), a RossCraft segmometer model 4, a Gulick II anthropometric tape, and the following supplies:

a) ECG electrodes & PCG sensor pads (Omron Healthcare #047372; 1 box has 20 sets of electrodes and sensor pad; orders are placed with Omron Healthcare in Kyoto, Japan via Ms. Mayuko Kaneda, at mayuko_kaneda@ohq.omron.co.jp)

b) Alcohol swab/wipes

c) Letter size paper always loaded in the printer

d) Replacement printer cartridge (Brother TN-360 or TN-330)

e) Verify that the participant's height is recorded on the Exam Checklist. Otherwise, measure the participant's height with the wall-mounted stadiometer.

Supplies are checked daily, prior to testing.

3.2 Participant Orientation

The study participants wear loose fitting clothing. Scrubs should be offered to participants who wear thick clothing, to make it easier to record the femoral artery pulse. Prior to measuring the ABI/PWV the ARIC technician confirms that jewelry on the neck, including chains or necklaces, is removed. Socks or stockings are removed, or moved below the ankle to keep the participant's feet and toes warm.

3.3 Completion of the ABI/PWV Data Sheet

Fill out the participant's ID #, Testing (completion) date, and technician ID on the PWV data sheet (PWV form in CDART). If two ARIC technicians are in the room it is best to record the measurements directly on the PWV form in CDART.

[Height] Import the participant's height from the anthropometry test

[Arm circumference]
In order to select the appropriate cuff size, one arm is measured following the procedure used for this purpose in the sitting blood pressure protocol. The arm measurements need not be repeated if already done per protocol for the seated blood pressure measurement. Instead, they can be retrieved from Item A.2 of the SBP form. Note however that the cuff sizes differ for the two procures. Have the participant clear the upper arm area so that an unencumbered measurement may be made, if necessary.

The measurements are done in sequence and recorded on the PWV Data Sheet.

- Have the participant place the left arm along the side of the body, bending the elbow 90 degrees.
- Measure length of the arm, from the acromion (bony protuberance at the shoulder) to the olecranon (tip of the elbow), using the Gulick II anthropometric tape.
- Mark the midpoint on the dorsal surface of the arm.
- Have the participant relax the arm along the side of the body.
- Draw the tape snugly around the arm at the midpoint mark. Note: keep the tape vertical. The tape should not indent the skin.
- Measure and record the arm circumference on the Data Sheet. Measurements are done to the nearest (whole) centimeter, rounding down if 0.5.
- Select the arm cuff size according to the specifications shown below:

Size S upper arm circumference 16-25 cm
Size M upper arm circumference 20-32 cm
Size L upper arm circumference 30-38 cm

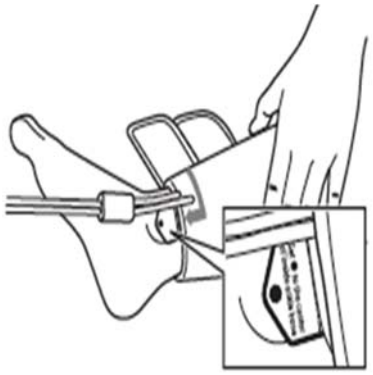
If the participant's arm circumference exceeds 38 cm, use the size L cuff and note this on the Data Sheet. If the size of the arm is such that the size L cuff does not fit, explain to the participant that a larger cuff is not available, thank the participant and discontinue the exam, and escort him/her to the next station.

To place the arm cuffs position the arrows on the arm creases. Wrap the cuffs loosely enough so that one or two fingers can be inserted between the cuff and the arm.

[Arm cuff chosen] Place the chosen size of the arm cuff.

[Ankle circumference]
Measure 7 cm proximal to the top edge of the inside ankle bone (tibia) and mark the spot. Draw the Gulick II anthropometric tape snugly around the ankle. Measure and record the ankle circumference on the Data Sheet, and select the ankle cuff size according to the specifications below.

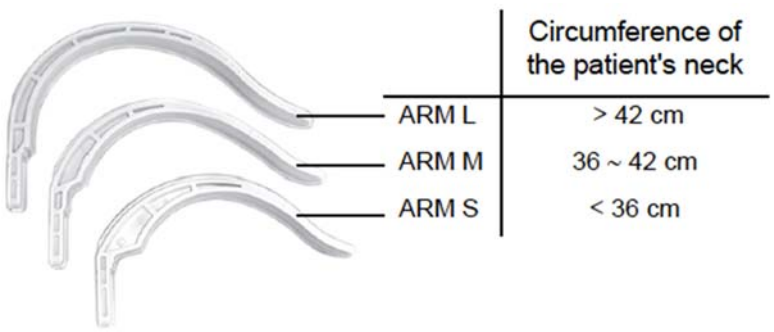
Size M - ankle circumference 16-33 cm
Size L - ankle circumference 30-38 cm



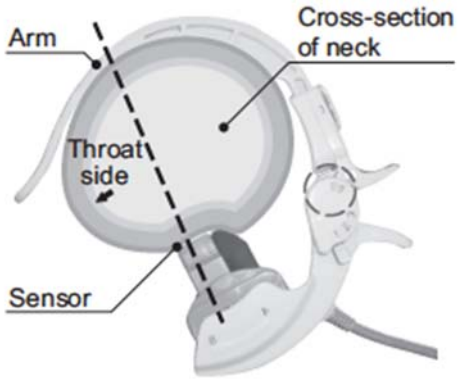
In attaching the ankle cuffs, align the tag on the ankle cuff with the top edge of the inside ankle bone (tibia) with the ● mark at the center of the bone. Wrap the ankle (distal) side of the cuff first than wrap the calf (proximal) side of the cuff. Tighten the cuff so that one or two fingers can be just barely inserted under the cuff.

[Ankle cuff chosen] Place the chosen size of the ankle cuff.

[Neck circumference]
The participant is asked to look straight up at the ceiling. The ARIC technician may raise the participant's chin slightly. Measure the neck circumference using the Gulick II anthropometric tape and record the measurement on the PWV Data Sheet. Measurements are done to the nearest centimeter, rounding down if 0.5. An arm with the appropriate neck size must be selected to properly attach the sensor on the neck of the subject. The arm is inserted into the sensor such that the red line is barely visible. Make sure that the pressure adjustment level is at "1".



	Circumference of the patient's neck
ARM L	> 42 cm
ARM M	36 ~ 42 cm
ARM S	< 36 cm



[Neck arm chosen] Place the chosen size of the neck arm.

[Arterial path length measurements]
Feel for the left carotid artery with your finger and locate the place where the pulse is most pronounced. To avoid placing excessive pressure in the carotid bifurcation, choose the most proximal site where the pulse is most pronounced. Use a dry erase marker to mark the spot.

Feel for the left femoral artery with your finger and locate the place where the pulse is most pronounced. Place a small tape to mark the spot.

Measure [Suprasternal notch-carotid distance] as the straight distance between the suprasternal notch and the carotid artery recording site (i.e., the spot on the neck that was previously marked) and record the number on the PWV data sheet.

Measure [Carotid-femoral distance the straight distance between the carotid artery recording site and femoral artery recording site (i.e., the top of the femoral sensor). In order to minimize effects of body contours (e.g., large stomach or bust) on the path length the straight horizontal distances are measured using a special segmometer specifically designed for PWV studies (Rosscraft Anthropometric Segmometer model 4, Surray, Canada) instead of surface tracing with a tape measure. Measurements are done to the nearest (whole) centimeter, rounding down if 0.5.

Enter these measurements on the PWV data sheet and distance (1) will be subtracted from the distance (2) (“difference in distance” as shown on the PWV form).

3.4 Preparation of the Equipment

Turn on the power of the main unit; the laptop computer is turned on last. Following a brief interval after the power is turned on, the ID entry screen appears. Enter the ARIC (subject) ID on this screen. Then select [Search/Next], and the Patient Information Screen appears. Data must be entered in the following 3 columns:

[Sex] – choose either “Male” or “Female”.
[Birth Date] – Enter the birth date in the format “MM/DD/YYYY”. (to protect the confidentiality of the participant, input arbitrary birth date that matches his/her age)
[Height] – Enter the height, as shown on the Exam Checklist (input range is 120-210 cm).

Ensure that the following are displayed in each column.

[Lcf] – Write down the number on #10 (difference in distance) in the PWV/ABI data sheet.
[Weight] – Leave blank.
[Waist] – Leave blank.
[Disease] – "No".

[Order No] – Enter "1" (for the first measurement).
[Meas Sensor] – "ECG, PCG, CAP, FAP"
[Meas Site] – "Both Bra + Both Ank"
If the participant indicates that there is a medical or post-surgical reason for not having the blood pressure measured on any of the 4 limbs, turn off the blood pressure cuff to that particular limb.

[Max Pressure] – "R Auto, L Auto"
[Sync Meas] – "Off"
[Doctor] – Leave blank.

[Technician] – select the technician's 3-digit ID and select [OK]. The technician information must be stored in advance under the Main Menu. To enter the technician's name, click on "Facil/Dr./Technician/Category" on the Main Menu screen. Click on the "Technician" tab and then "Add" to type the technician's ID.
[Category] – Leave blank.

When all data entry is complete, click "Next".

NOTE: With every measurement, the machine outputs a pdf file AND a cache file for printing purposes. The machine is capable of storing up to 200 tests. When the number of tests (or data) stored in the machine exceeds 200, the machine will begin deleting the oldest data. If you manually delete data, the machine will not delete old pdf files and cache files, as the elimination of these files is done when the number of data exceeds 200. This will create a small storage space as well as database area as you continue to accumulate pdf files and cache files in the machine. Note: Let the machine automatically delete the oldest data; do not make manual deletions.

3.4.a. Preparation of the Study Participant

Speaking slowly, the technician tells the participant: *"I will now measure the blood pressure in your arms and your ankles, and the elasticity of your arteries. To do this I will put four blood pressure cuffs on you, some of the patches used in physician offices to take an ECG, and also small microphones that will sit on your neck and your leg to record the pulsing of the blood while you are lying on this examination table. To do that I will ask you to open your gown to put a microphone on your chest. I will also feel for your pulse on the neck and the top of your leg."*

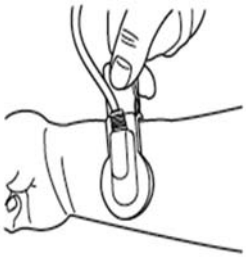
"Do you have any questions for me? Is there any reason I should not put a blood pressure cuff on one of your arms or ankles? This will take about 10 minutes; will you be comfortable lying on your back for about 10 minutes?" The machine will then pump up the 4 cuffs at the same time to record your blood pressure. The first time the cuff is inflated the pressure may feel high, but this is safe. If you are uncomfortable you should let me know, and we can stop.

Place the femoral sensor strap on the examination table before the participant lies down. The participant is positioned on the examination table in the supine position. Before a measurement is performed, clean the skin where the carotid and femoral sensors, ECG patches, and a PCG

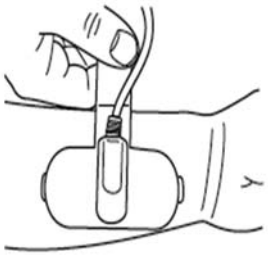
sensor directly contact the skin, using alcohol wipes. It is recommended that two trained ARIC technicians be present to set up the procedure, place the cuffs and electrodes.
The following steps are the followed without deviation from these instructions.

3.4.b. Attaching the ECG Clips

Prepare 3 ECG clip electrodes. While squeezing the side buttons of the ECG clips, attach ECG clip electrodes in the holes. Remove the protective sheets. Attach the ECG clips on the inner side of the wrist. Confirm that both electrodes are in full contact with the wrist.



Right ECG ELECTRODES CLIP
(with one electrode)

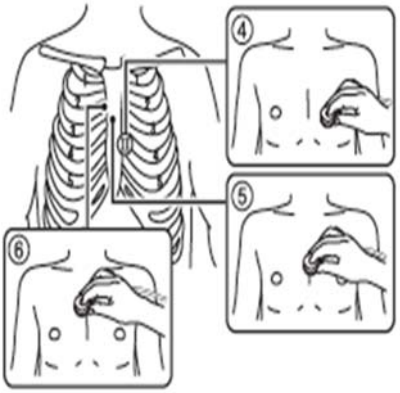


Left ECG ELECTRODES CLIP
(with two electrodes)

After each use, clean the surface with alcohol swab. The ECG sensor pads need to be replaced after ~10 participant use or at the end of the day.

3.4.c. Attaching the PCG Sensor

Prepare 1 PCG sensor pad. Remove the light blue sheet from the PCG sensor pad and attach the pad on the sensor. Remove the clear protective sheet from the PCG sensor pad. Place the PCG sensor at the left edge of the sternum in the fourth intercostal space (④). If "PCG OK" does not show up on the display, place the sensor in the middle of the third intercostal space (⑤) or near the right edge of the sternum in the second intercostal space (⑥). Place the PCG sensor weight (i.e., sandbag) on top of the PCG sensor.



If "PCG OK" still does not show up on the display, check the following conditions:

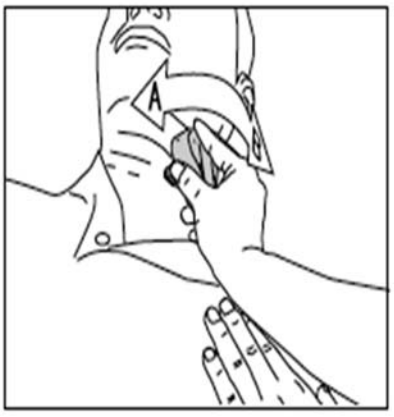
- Thick tissue (fat or muscle) that attenuates the heart sound.
- Body hair prevents the PCG sensor from making full contact with the skin.
- The contour of the body surface does not allow the PCG sensor to fully contact to the skin.
- The PCG sensor is tilted on the body and it is not firmly attached to the skin.

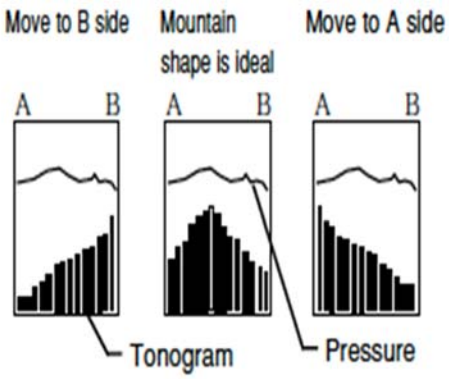
Confirm the readiness of the system by checking the screen to make sure that 1) the ECG and PCG messages indicate “OK”, 2) two or more blocks of lights are on for the PCG levels.

After each use, clean the surface with alcohol swab. The PCG sensor pads need to be replaced after ~10 participant use or at the end of the day.

3.4.d. Attaching the Carotid Sensor

Remove the pillow. Insert the sensor arm behind the neck so that the sensor will be securely attached with





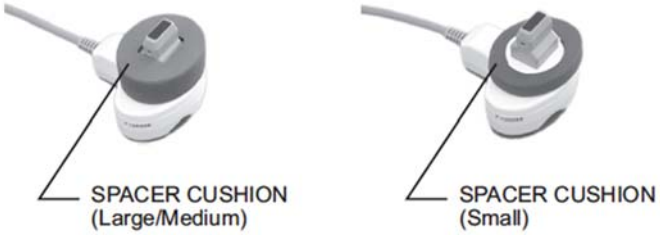
the arch of the arm supporting the back of the neck. To open the arm, hold the arm with your right hand. While keeping the sensor arm open with your right hand, feel for the left carotid artery with your finger and locate the place where the pulse is most pronounced. Place the head of the carotid sensor there. Check the tonogram on the screen; the tonogram should be mountain-shaped. If the shape of the tonogram is not convex or shaped like a mountain, adjust the position of the sensor. Then confirm that the active channel points to the peak of the mountain and the top of the active bar is green. Lastly, the pressure level line (indicating the degree of contact between the sensor and the skin) should be a relatively smooth line.

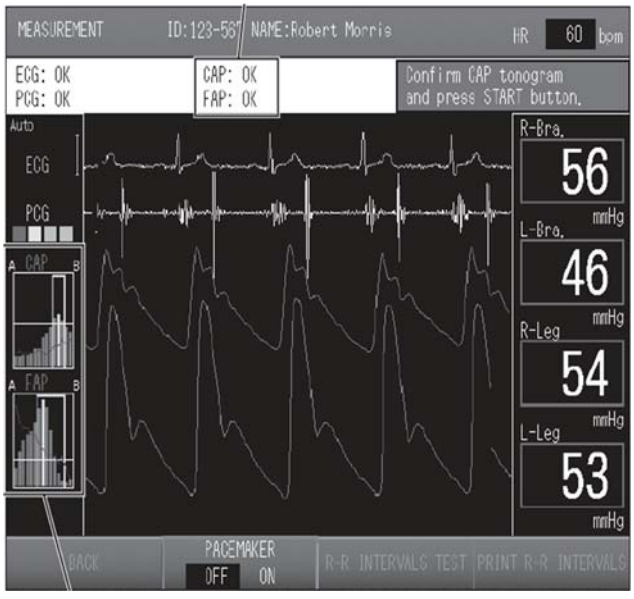
If the tonogram displays a steep slope, adjust the angle of the carotid sensor by sliding the sensor head to either A side or B side. When the message “Move sensor toward A-side” or “Move the sensor toward B-side” is displayed, move the sensor in the indicated direction to adjust the position. If the “Weak signal” message appears, adjust the pressure by changing levels from “1” to “2” and then to “3” if needed. At the discretion of the technician, the spot over the carotid artery may be marked lightly with an erasable felt tipped pen at the time the carotid sensor is removed. If the carotid sensor is pressed unnecessarily strongly against the neck, the error message “Excessive CAP pressure” will appear and an alarm will sound.

Note: the sensor head is very sensitive. Applying excessive pressure on the sensor head or treating it roughly may cause damage. It is important to keep the protective cap on the sensor when the unit is not in use. After each use, clean the sensor head gently with a swab and alcohol.

3.4.e. Attaching the Femoral Sensor

The femoral sensor is placed over the scrub-pants; thin fabrics do not interfere with signal acquisition but thick fabrics should be moved aside or removed with permission of the participant. Place the head of the femoral sensor on the spot that was previously marked with a tape. Make certain that the spot (where the pulse is most pronounced) has not moved as it influences the arterial path length measurement. Lift the ends of the strap and secure it with the strap holder to attach the sensor. The strap should be perpendicular to the vertical line of the subject’s body. If the wave is weak, place the PCG weight (i.e., sandbag) on the top of the sensor, remove/adjust a “spacer cushion” on the sensor, and/or hold down the sensor lightly with your hand.





The sensor head is very sensitive. Applying excessive pressure on the sensor head or treating it roughly may cause damage. It is important to keep the protective cap on the sensor when the unit is not in use. After each use, clean the sensor head by gently tapping with alcohol swab.

4. Measurement of the PWV and ABI

The measurement is made twice per testing session. Mention to the participant that the blood pressure measurement will now begin and press the [START] button. After the blood pressures are measured at the four limbs and the cuff is maintained at a fixed low pressure, the message “Confirm CAP tonogram and press [START] button” is displayed, and the measurement pauses. Confirm the shape of the tonogram again. If the signal is stable, press the [START] button to begin pulse wave measurement. If the [START] button is not pressed within 160 seconds, the system will start to measure the pulse wave automatically.

After the measurement ends, promptly remove the carotid sensor as it may be uncomfortable to the subject. Wait 2-5 minutes. During the waiting period, click “Remeasurement” and choose “In Same Condition”. On the measurement screen, click “Back” to go back to the Patient Information Screen and place “2” under the “Order ID” to denote that this is the second measurement under the same exam. Place the carotid sensor back on the marked spot. After the shape of the tonogram is confirmed, repeat the measurements by pressing the [START] button. After the second measurement, press the [END] button to end the examination, remove the sensors and electrodes, and assist the participant to the seated position.

If any of the blood pressure and PWV values are not reported on the printout, repeat the measurement (for a third time) after waiting 2-5 minutes. In this case, the “Order ID” will be “3”. Confirm that the participant is comfortable, assist him/her in standing up, and escort the participant to the next station on his/her itinerary.

5. Storing the Data on the Laptop Computer

At the end of the day, the study results are transferred from the vascular testing device to the Form folder on the laptop computer via the special Ethernet “crossover” cable. Note that a “crossover” cable of 6 ft. in length (or longer) is used; a regular ethernet cable does not work. To store the data on the laptop computer go to the “Main Menu” and click on “Print Report/Edit Patient Info”. Select the record to transmit and tap “Transmit Data”. All the data transmitted will be stored in the folder called “Form” on the computer’s C-drive. CSV files are recorded in the document called “Append1” and the back-ups are recorded in “Append2”. Individual summary data from each test will be stored as a pdf file. Keep a copy of the printout for back-up purposes. If another participant is to be tested, go to the ID screen and start a new testing session. Otherwise, turn off the machine to end the session.

6. Procedure Completion Record

Completion of an ABI/PWV Data Sheet in CDART (form PWV) records the completion of his procedure. If no ABI/PWV data were collected on a study participant, this also needs to be recorded on the PWV form (permanently missing).

7. Transfer of the Data to the ARIC Coordinating Center

On a weekly basis and a fixed day of the week, e.g., every Friday, the study records stored on the laptop are transferred to the ARIC Coordinating Center. As part of this transfer, the records must be exported to the connected laptop computer. Each field center designates one staff person and one back-up person to transfer the ABI/PWV records to the ARIC CC. The user verifies that that the laptop computer is connected to the internet.

An ABIPWV icon installed on the laptop that supports the VP-1000 Omron system transfers the .CSV and .PDF files to the Coordinating Center. After making sure all records have been transferred from the Omron and verifying that the laptop can access the internet, the user will click on the ICON once per week to transfer the files. The program activated by the ICON does the following:

- Renames append1.csv to a unique file name that identifies the site and the date/time.
- Transfers the .csv and the pdf files from the c:\Form folder to the ARIC Coordinating Center;
- Creates a subdirectory within a hidden folder labeled with the current date, and moves the transferred files into it.

After this step has been completed, the c:\Form folder will be empty.

8. Study results reported to the participant

The ABI values for the each extremity are included in the summary report of study results the participants receive approximately 6 weeks after the ARIC exam visit. Pulse wave velocity values are not reported to the participants/their physicians as these are of research value only and there are no clinical standard or threshold values for these measures. The printed waveforms and graphics are used by ARIC only for quality assurance and feed-back to the study technicians; they are not shared with the study participants or their providers of medical care.

9. Training and Certification

The ARIC PWV personnel need not be health professionals, but they must be trained and certified by ARIC in the PWV/ABI measurement protocol.

Initial Central Training. Technologists from each Field Center are trained by Dr. Hirofumi Tanaka. A combination of didactic presentations and hands-on practical demonstrations and practice of the vascular testing device are conducted. Power point presentations include anatomy and physiology of arterial circulation, pathophysiology of atherosclerosis and arterial stiffening, technical background of PWV and ABI techniques, key findings using these techniques, and basic operation of the equipment. The hands-on practical demonstrations include calibration checks, cleaning, sensor replacements, printing and transferring data reports, and testing of classmates and other clinical staff and investigators. Following training, technicians must be certified after successfully demonstrating calibration checks, sensor placement, care and maintenance of the sensors, and data transfer. Only certified technologists will perform the measurement for ARIC participants. To retain certification, technicians must collect good quality data on at least 10 participants each month during the examination period.

Retraining Sessions. Certification of new technicians after the initial training may be performed by a centrally-trained certified PWV/ABI technician. An internet-based didactic seminar, identical to the presentation given during the initial training, is given by Dr. Tanaka. The hands-on practical training is given by a certified PWV/ABI technologist from the field center. The performance of the new technologist is observed by a certified PWV/ABI technologist for the first 10 tests. The data collected are then be examined by Dr. Tanaka who determines if the technician is certified for testing. It is the responsibility of each field center to report to the ARIC Coordinating Center when the certification procedures are complete.

Follow-up and technician support. Problems and difficulties encountered by the technicians will be shared among all the technicians and possible solutions will be given during phone or web-based conferences conducted every 3-6 months throughout the study period. The performance of the technologists at each site will be evaluated using the variability/reliability data compiled for each technician.

If persistent data quality problems are identified a site visit will be conducted by Dr. Tanaka to observe and evaluate the techniques used for the measurements of PWV and ABI, calibration procedures, and adherence to the PWV/ABI protocols using the checklist. Suboptimal quality testing sessions and protocol violations will be reviewed and discussed during the site visits, and these points will be reinforced later in a written report. Certification will be withheld if necessary.

10. Quality Assurance and Control

To ensure that the accuracy of the PWV/ABI measurements throughout the study duration, the following quality assurance measures are applied at all field centers: 1) recruitment of the most qualified personnel; 2) standardized training and certification; 3) retraining and recertification 4) uniform use of a standardized protocol; 5) ongoing quality control review of a sample of records collected by each study technician, with feedback to study technicians; 6) an equipment maintenance program.
A sample of 30 records per month is drawn by the Coordinating Center, stratified by field center and study technician, and reviewed for quality control by Dr. H. Tanaka. A quality grading is assigned to each record and feed-back is provided to the technicians at each field site.

11. Equipment Maintenance

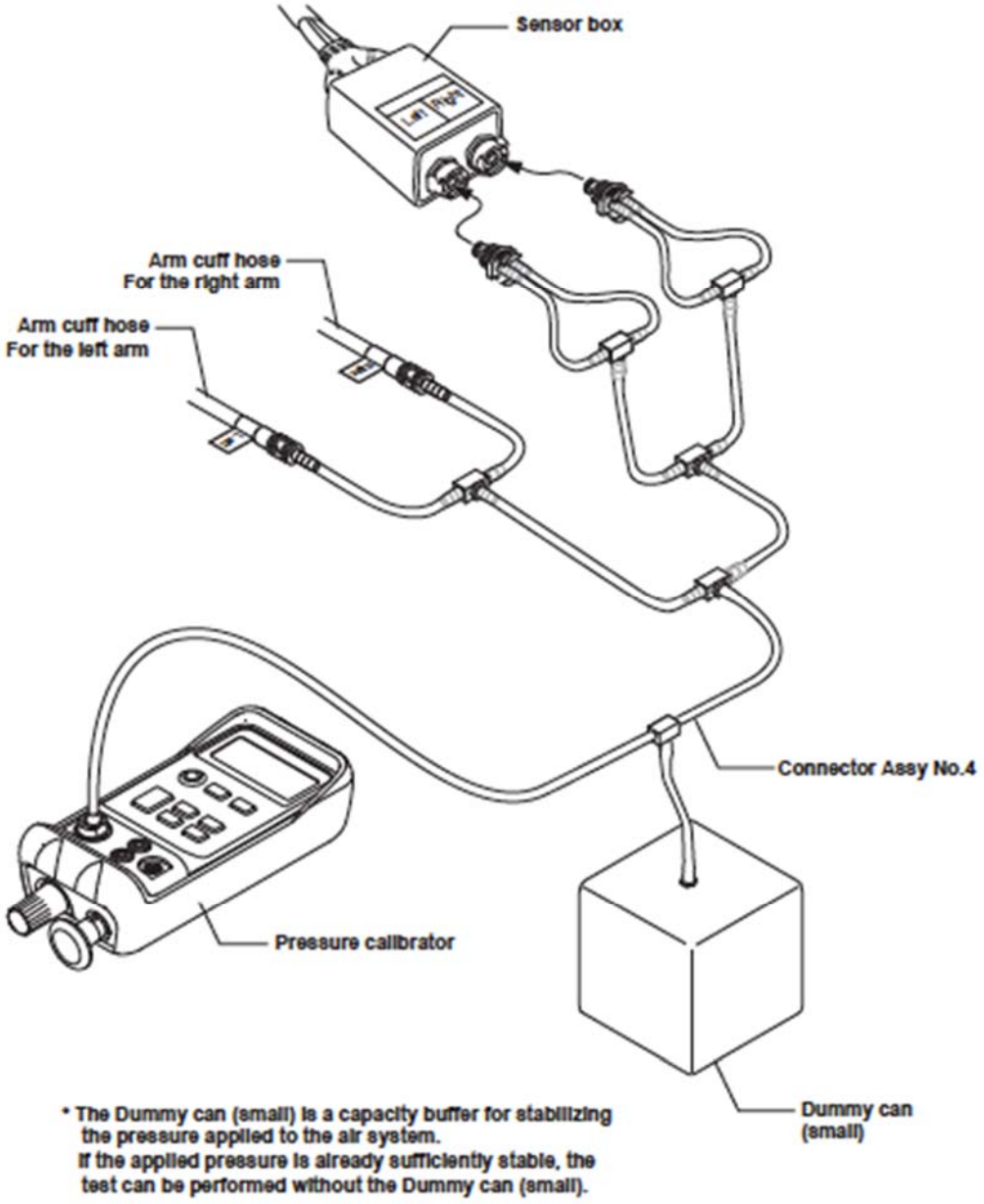
Each field center is responsible for the proper operation and maintenance of its equipment. A detailed record of equipment maintenance is kept at each field center. All staff are instructed to report any real or suspected equipment problems to the PWV/ABI team promptly. The machine is inspected once a month by the technician. These inspections include appearance and condition of all sensors, tubing, and fittings. The equipment unit is cleaned if inspection indicates that it is needed or at least once a month. The unit is cleaned by wiping them with a well-wrung out cloth moistened with a diluted neutral detergent. The tonometry sensors need to be gently wiped by gently tapping with (30-50%) isopropyl alcohol or (70%) ethyl alcohol swab. Apply pressure to the sensor as little as possible.

A maintenance program is run quarterly (4 times a year) consisting of 1) Air leakage test and 2) Pressure accuracy test. To run the maintenance program, under [Main Menu], choose [Maintenance Menu]. For the Air Leakage test, all the blood pressure cuffs must be wrapped firmly on a 3-inch diameter PVC pipes. Push “Start” to begin the test. The values on the last column (“Diff”) should be 20 mmHg or below after 2 minutes, to pass this test. Air leakage test must be performed on all the blood pressure cuffs used in the ARIC exam. Write down the blood pressure values on the last column (”Diff”) on the maintenance data sheet.

The Pressure accuracy test requires connecting the blood pressure tubing to a pressure calibrator (e.g., Netech DigiMano) through a Y-tube as shown below. Testing will be performed at 3 different pressure settings (50 mmHg, 150 mmHg, and 250 mmHg). Change the inflation pressure to one of the pressure settings and click on “Start Inflation” to begin the test. Ensure that the unit on the Netech DigiMano is “mmHg”. Write down all the pressure values displayed on the Omron machine as well as the pressure reading on the Netech DigiMano on the

maintenance data sheet. The pressure values recorded should be within ±3 mmHg of the pressure settings.

It is not necessary to perform the Inflation/Deflation Test.



In general, no maintenance is required on the laptop computer. In case of any system problems, the field center staff contacts the ARIC Coordinating Center.

Appendix 1

Pulse Wave Velocity/Ankle-Brachial Index Maintenance Sheet

ID NUMBER: | | | | | | | |

FORM CODE: P W M

DATE: 11/29/2016
Version 1.0

A. ADMINISTRATIVE INFORMATION

0a. Completion Date: ☐☐/☐☐/☐☐☐☐ (Month / Day / Year)

0b. Staff ID: ☐☐☐

Instructions: *This form is completed by the PWV/ABI technician during the maintenance procedure on the PWV/ABI system.*

SECTION A – AIR LEAKAGE TEST

1. Enter the values on the last column ("Diff") values

b. Small right arm cuff ..... ☐☐
c. Small left arm cuff ..... ☐☐
d. Medium right arm cuff ..... ☐☐
e. Medium left arm cuff ..... ☐☐
f. Large right arm cuff ..... ☐☐
g. Large left arm cuff ..... ☐☐
h. Medium right ankle cuff ..... ☐☐
i. Medium left ankle cuff ..... ☐☐
j. Large right ankle cuff ..... ☐☐
k. Large left ankle cuff ..... ☐☐

SECTION B - PRESSURE ACCURACY TEST

2. At 250 mmHg

a. Netech DigiMano reading (mmHg) ..... ☐☐☐
b. Right arm (mmHg) ..... ☐☐☐
c. Left arm (mmHg) ..... ☐☐☐
d. Right ankle (mmHg) ..... ☐☐☐
e. Left ankle (mmHg) ..... ☐☐☐

3. At 150 mmHg

a. Netech DigiMano reading (mmHg) ..... ☐☐☐
b. Right arm (mmHg) ..... ☐☐☐
c. Left arm (mmHg) ..... ☐☐☐

d. Right ankle (mmHg) ..... ☐☐☐

e. Left ankle (mmHg) ..... ☐☐☐

4. At 50 mmHg

a. Netech DigiMano reading (mmHg) ..... ☐☐☐

b. Right arm (mmHg) ..... ☐☐☐

c. Left arm (mmHg) ..... ☐☐☐

d. Right ankle (mmHg) ..... ☐☐☐

e. Left ankle (mmHg) ..... ☐☐☐