

	Title:	Bone Mineral Density by Dual-energy X-ray Absorption (DXA) - Forearm Measurement		
	Version Date:	2014-JUL-10	Document Number:	SOP_DCS_0018
	Effective Date:	2014-OCT-15		
Data Collection Site (DCS)	Version:	2.1	Number of Pages:	7

1.0 Purpose:

The purpose of this document is to describe the standardized procedure for completing bone mineral density (BMD) measurement of the forearm on the Hologic Discovery A Dual Energy X-Ray Absorptiometry (DXA) machine.

2.0 Scope:

This document is to be used by the DCS staff when administering the BMD measurement of the forearm to a participant.

3.0 Responsibilities:

It is the responsibility of the DCS staff to perform the procedures as described in the current and approved version of the standard operating procedure.

4.0 Related Documents:

MAN_DCS_0014 - Additional training for the Dual-energy X-ray Absorptiometry (DXA)

5.0 Definitions:

- **Styloid:** usually serving as points of attachment for muscles, refers to the slender, pointed process (protrusion) of Ulna

6.0 Equipment:

- DXA machine (Hologic Discovery A)

7.0 Supplies:

- Radiation badges (If required by your institute);
- Hologic Non flexible 30 cm ruler; and,
- Disinfectant spray/Certainty Wipe.

8.0 Procedure Steps:

Contraindications:

- Pregnancy (Contraindications Questionnaire);
- Had an x-ray with contrast material such as barium in the last 7 days (Contraindications Questionnaire);
- Participated in any nuclear medicine studies in the past 7 days (Contraindications Questionnaire); or,
- Please make a note of the following in the comments section of Onyx:
 - Any metal implants in the arm (e.g., plates or screws);

- Previous breaks or fractures in the arm (Contraindications Questionnaire); or
- Prosthetic arm or arm joints (Contraindications Questionnaire).

The left arm is the default.

Step 1: Double click on APEX icon on the desktop to launch the Hologic software.

NOTE: Before proceeding you need to have the **participant's ID, date of birth, gender, height and weight from the DXA questionnaire.**

Step 2: In the Hologic Discovery A screen, select **Perform Exam.**

Step 3: If this is the first scan:

Click on the **New Patient** button.

Enter participant's ID, date of birth, gender, height and weight. Press **OK.**

If this is not the first scan:

In the "Patient ID" column, select the participant ID. Press **OK.**

Verify that participant information (height and weight) is entered accurately. Press **OK.**

Step 4: Select the type of exam: **Forearm** (left, or right if left is contraindicated) and then select **Next.**

Step 5: On the control panel press **Center.**

Step 6: The chair should be positioned at the centre of the table, but not touching. Have the participant place their arm on the table, approximately at the centre point, if possible. If they have sleeves on, the sleeve needs to be pushed up past the elbow.

Step 7: Measure the forearm in centimeters, from the tip of the elbow to the small bump on the wrist, with the Hologic ruler (See Figure). Write this measurement down, you will need to use it later for the analyzer step.

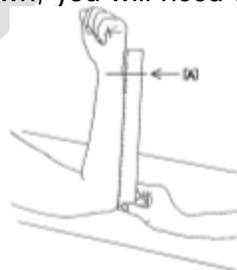
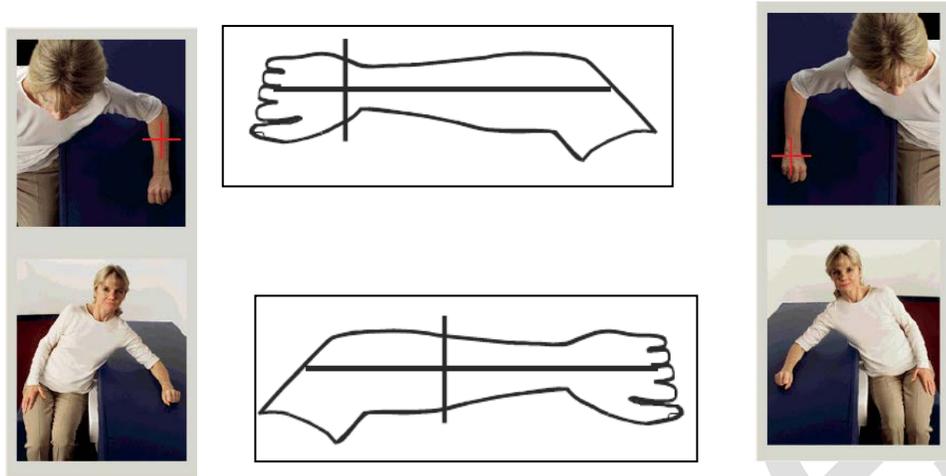


Figure. Measuring the Left Forearm

Step 8: The participant should be positioned with their forearm resting on the scanning table, with the hand in a soft fist (see pictures).



Step 9: On the control panel, press **Laser**.

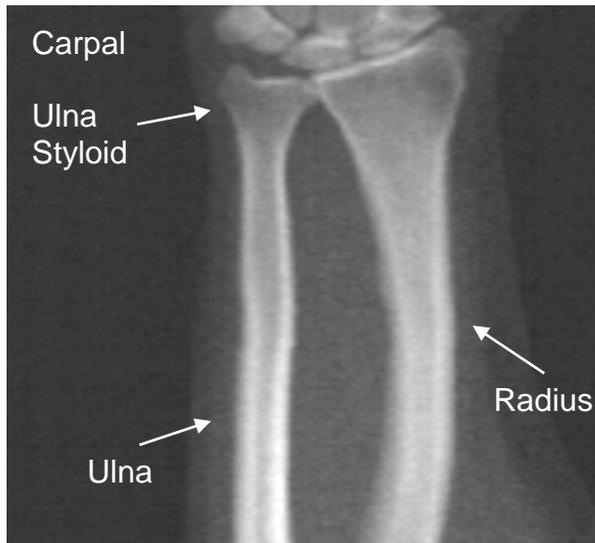
Step 10: Use the control panel of the DXA to position the starting point on the forearm. **Use exclusively the Arm arrows. Never touch the Table arrows.**
 Left forearm: Starts at the mid-forearm. Move the arm back and forth until the laser is parallel to the arm, and in line with the ring finger. Verify that the first row of carpal bones are within 15cm (6in) of the starting point (see picture), use a folded piece of paper to do this.

Right forearm: Starts at the first row of carpal bones (see picture). Move the arm back and forth until the laser is parallel to the arm, and in line with the ring finger.

Step 11: Warn the patient that the arm of the DXA at the bottom will move towards them and may touch them during the scan. Then click on **Start Scan**.

Warning: if the control panel x-ray indicator fails to shut off within 10 seconds after the end of the scan, press the red Emergency Stop button immediately. Call your Hologic service representative before resuming operation (see DXA Hologic Discovery A Calibration and Maintenance SOP).

Step 12: Inspect the image:



- The radius and ulna must appear straight and centred.
- The image shows at least the first row of carpal bones near the bottom for the right forearm scan, or near the bottom for the left forearm scan.
- The ulna side contains at least enough air to equal the ulna's shaft width.

Step 13: If the image is not acceptable, click **Reposition Scan**. **On the control panel, use exclusively the Arm arrows. Never touch the Table arrows.**

Repositioning Scan:

- Click **Reposition Scan** before the scanning is completed.
- Position the cursor over the forearm image.
 - NOTE:** you can use the scroll bars to reposition the image.
- To position the forearm:
 - Move the first row of carpal bones within the horizontal blue positioning line and the outer limit of the scan field.
 - The radius and the ulna should be parallel between the two blue vertical positioning lines.
- When the forearm is positioned correctly, click **Restart Scan**.
- Click **Start Scan**.

Repositioning Participant (if necessary):

- Adjust the forearm so that it is straight.
 - NOTE:** the participant's forearm should be moved to include or exclude more of the carpal bones.
- Click **Restart Scan**.
- Click **Start Scan**.

→ Evaluate the image as it displays. If the image is not satisfactory, click **Reposition Scan** before it is complete and repeat Step 14.

Step 14: If the image is acceptable, allow the scanning to complete.

Step 15: When the exam completes, an 'Exit Exam' window box displays. Press **Analyze Scan**.

Step 16: An 'Analyze Setup' window will open, click **Next**. Enter the length of the forearm (measured in Step 11).

To make adjustments

→ Click on **Sun/Moon** symbol  on the bottom left of the screen to adjust view of scan

→ Move the circle within the triangle to change the lightness or darkness of the scan. 

→ Press the **zoom** button twice.

→ Click on **Sun/Moon** symbol again to return

→ Click on **Global ROI** and center the image using the arrow keys.

→ Place the yellow line that is closest to the carpal bones at the tip of the ulna styloid (the ulna is the narrower of the two arm bones)

NOTE: Carpel bones are at the top of the scan on a left forearm so it is the TOP YELLOW LINE that is of interest. Carpel bones are at the bottom of the scan on a right forearm so it is the BOTTOM YELLOW LINE that is of interest.

→ In the Global ROI toolbox click **Line Mode**.

→ Adjust the two sidelines to bring the blue dotted lines into the outside edge of bone. Stop at the point where the blue line(s) first touches bone.

DO NOT ADJUST THE 1/3 DISTAL LINE. THIS APPLICATION IS USED FOR RESEARCH SITES.

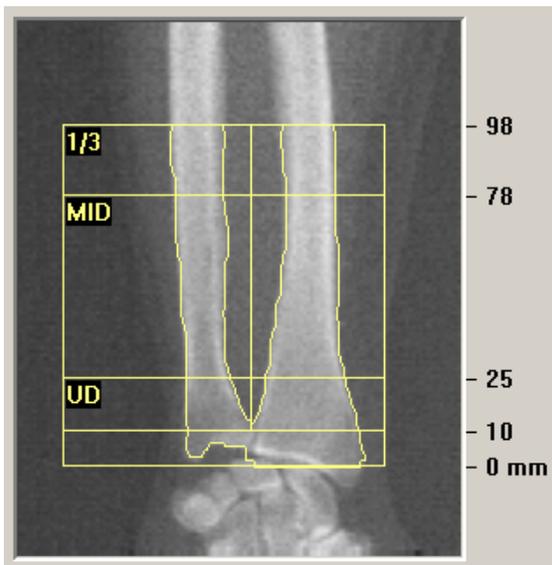
→ Click on **Bone Map**.

→ Verify that all bone has been filled in (edit if necessary).

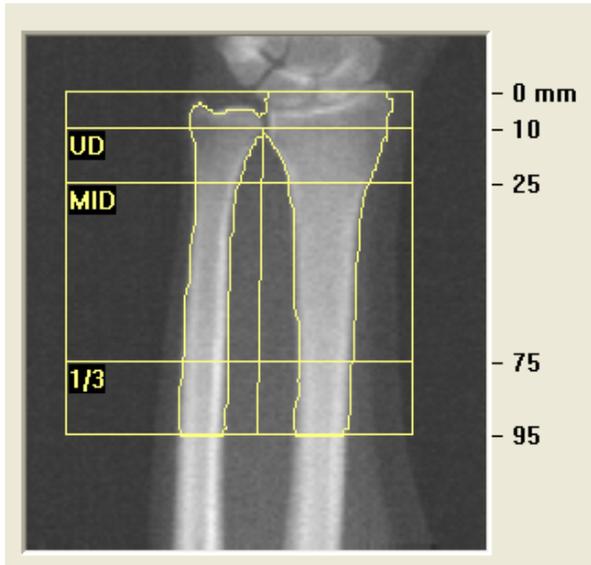
→ Click **MID/UD**.

→ The line should be going through the space between the end plates and joint of radius / ulna.

→ Verify that distal cortical bone is not included in the UD region.



Proper Analysis Right Forearm Scan



Proper Analysis Left Forearm Scan

→ Un-zoom by clicking on **Sun/Moon** then **zoom**. Click on the **Sun/Moon** again to return

→ Click the **Results** button. To exit from this page, click on **Close**.

Step 17: The 'DAP Report' window will open. Click **Ok**

Step 18: Select **Report** and then the 'Select Patient' window will pop up. Click the participant's forearm scan to select (press the ctrl button for the second one), then click on **Next**.

Step 19: Minimize the APEX program and go back to Onyx.

Step 20: At the *Interview Tab* in Onyx, look for Bone density – Forearm scan in the list of stages. Then select **Start** in that row.

Step 21: The "Bone density - Forearm: Start" window will pop up.

Step 22: Scan the Interview ID barcode, click on **Continue**.

Step 23: Press **Start** in the Instrument application launch to open the Hologic software. A 'Hologic Apex Receiver' box will pop up.

Step 24: Go back to the APEX program. Make sure the report type selected is 'Interpreting' with one copy. Select **DICOM/IVA**. Next the 'DICOM/IVA' page will come up, click on **Send**.

Step 25: One or two messages will pop up, click on **OK** (after each message) until you are back to the 'DICOM/IVA' page. Go back to Onyx.

Step 26: In Onyx press the **Capture** button. Wait until the 2 rows below go green, click on **OK**. Press **Refresh** so that the scans will appear on this page. If there is more than the required amount of scans, delete the appropriate ones.

Step 27: Click on **Next**. The 'Bone density – Forearm: Finish' screen will pop up.

Step 28: Click **Finish** indicate in the comments field if there was anything that may have affected the measurement. Ensure that comments do not contain any personally identifying information.

Step 29: Click **Continue** to return to the *Interview Tab* page.

Step 30: Return to the APEX program- Report and click on **Cancel**.

Step 31: You will now move on to the next scan. Depending on the scan, refer to that SOP. If the participant is unable or unwilling to do this scan, or no further scan is prompted, refer to the Final Steps below to see how to end the procedure.

Final Steps

Step 32: If the participant needs to change clothes, follow the steps in the Participant Changing SOP to ensure that they are provided with privacy and assistance, as required.

Step 33: Click on **Exit** in the bottom right corner. The 'Exit Analysis' window will open. Select the **Exit without shutdown** option.

Step 34: Wipe down the DXA tabletop.

9.0 Documentation and Forms:

- CRF_DCS_0014_2 - DXA Questionnaire Case Report Form

10.0 References:

- Body Composition Procedures Manual. NHANES; 2006.
- DEXA Calibration and Maintenance SOP (SOP_DCS_0043)

Revision History:

New Version #	Revision Date	Revision Author	Content Approval
2.1	2014-JUL-10	Lorraine Moss	Mark Oremus
Summary of Revisions			
Step 24, added "Make sure the report type selected is 'Interpreting' with one copy."			
Updated SOP formatting. Grammar and spelling changes.			
Reviewed and updated Scope, Purpose, and Responsibilities sections.			
New Version #	Revision Date	Revision Author	Content Approval
2.0	2013-Jan-07	Lorraine Moss	Mark Oremus
Summary of Revisions			
Between Step 4 & 5 removed the line reading: "weight) is entered then press OK."			
Added a picture for clarification under step 7.			
Added Training manual to section 7.0			
Various formatting throughout document.			
Added Calibration SOP to section 9.0			
Step 7 of section 6.0 Procedure Steps & Rationale has been changed to read: Measure the forearm in centimeters, from the tip of the elbow to the small bump on the wrist, with the Hologic ruler (See Picture). Write this measurement down, you will need to use it later			

for the analyzer step.
Added the sun/moon symbol to the "To Make Adjustments" section under step 16.
Step 4 re-worded to read - Select the type of exam: Forearm (left or right if left is contraindicated) and then select Next .
In section 5.0 updated: <ul style="list-style-type: none"> a. Radiation badges (If required by your institute); b. Disinfectant spray / Certainty Wipe.
In Step 1 corrected the word INC (behind APEX) to ICON
Step 13 re-worded to read – If the image is not acceptable, click Reposition Scan. On the control panel, use exclusively the Arm arrows. Never touch the Table arrows.
Step 10 re-worded to read – Use the control panel of the DXA to position the starting point on the forearm. Use exclusively the Arm arrows. Never touch the Table arrows.
Step 21 – Delete the last sentence which read "Enter your password."
Added styloid definition
Updated DXA questionnaire CRF name in section 7.0

Baseline