# PhenX Toolkit

## Data Collection Worksheet

**Please Note:** The Data Collection Worksheet (DCW) is a tool to aid integration of a PhenX protocol into a study. The PhenX DCW is not designed to be a data collection instrument. Investigators will need to decide the best way to collect data for the PhenX protocol in their study. Variables captured in the DCW, along with variable names and unique PhenX variable identifiers, are included in the PhenX Data Dictionary (DD) files.

A downloadable PDF of the full National Health and Nutrition Examination Survey (NHANES) Body Composition Procedures Manual is available here: http://www.cdc.gov/nchs/data/nhanes/nhanes_11_12/Body_Composition_Procedures_Manual.pdf The following is a summary version of the full NHANES protocol. There are several overarching, critical issues for high-quality data collection of anthropometric measures which optimize the data in gene-environment etiologic research. These issues include: (1) the need for training (and retraining) of study staff in anthropometric data collection; (2) duplicate collection of measurements, especially under field conditions; (3) use of more than one person for proper collection of measurements where required; (4) accurate recording of the protocols and the measurement units of data collection; and (5) use of required and properly calibrated equipment. **NOTE:** Dual-energy X-ray absorptiometry (DXA) measurement is not complex, but does require costly hardware, specialized software to analyze the DXA scans, rigorous quality control, certified examiners, and continuous equipment calibration and monitoring. Although excerpts of the National Health and Nutrition Examination Survey (NHANES) protocol are provided for informational purposes, investigators should review all facets of the protocol prior to undertaking DXA examinations in a study. A detailed description of the NHANES protocol is available from the Centers for Disease Control and Prevention (CDC) website. The following excerpts from the NHANES 1999-2006 protocols refer to a specific make and model DXA scanner. Several brands of DXA scanners are available and manufacturer-specific software, calibration, and quality control practices should be followed. **<u>DXA Equipment:</u>** Several DXA densitometer devices are marketed commercially. The Hologic™ 4500A fan beam X-ray bone densitometer was used in NHANES 1999-2009 protocol. In 2011, the NHANES systems were replaced with the Discovery/A systems. Neither of these systems are made anymore, but this protocol is applicable to the current Hologic Horizon whole body models (models A or W.)

**Whole Body DXA Scan:**

- Record the participant information and relevant information about the DXA machine and software. At a minimum, height, weight, sex, and ethnicity

should be entered since these are used in some of the DXA calculations.

- Check to see if the participant is positioned correctly for the whole body scans. NHANES used the positioning recommended by the International Society for Clinical Densitometry as outlined in detail in Hangartner et al. (2013).
- Check one more time to ensure that no objects will interfere with the movement of the table or the runner belt.

**Conducting the Scan:**

- Conduct a whole body scan according to the directions specified by the International Society for Clinical Densitometry (Hangartner, 2013).
- Once initiated, the DXA system will scan until complete.
- Insure that the participant does not speak or move during the exam.
- After the scan is completed, a screen displaying the DXA image appears. This image should look like a whole body X-ray with bones and soft tissue clearly visible, without any distortion from movement, and with the whole body in the field. The scan may be repeated up to three times if the scan quality can be improved. (The conditions under which a scan may or may not be repeated are outlined below in the section entitled Ensuring Quality of Scan.)

**Ensuring Quality of Scan:** The conditions under which a scan may or may not be repeated include:

- **Participant movement during the exam:** If the participant moves during the exam, tell them to remain still and complete the scan. If the conditions of the scan can be improved such that you think a second scan would improve the quality, complete a second exam. Explain the procedure again with an emphasis on the importance of remaining quiet and still throughout the scan.
- **Positioning problem:** If you complete a scan and upon review, notice a problem with the position of the participant that can be corrected (i.e. body part off scanner, hip overlapping the hands, etc.), get permission from the participant and repeat the scan. In some cases, you may not be able to correct the positioning problem. For example, if the participant has a curvature of the spine or other physical condition that might limit ideal positioning, repeating the scan will not improve the positioning problem.
- **Hands positioned along sides, not flat:** If the participant is too wide for the table and the hands cannot be positioned flat by their side, then you should use offset scanning. Ideally, you would determine this before the first scan. Offset scanning is the positioning of the participant offset to the table axis such that the left arm is off the table but the entire torso is still in the scan field. Both Hologic and GE systems have special analysis routines that will reflect the right arm values to the left to create a complete scan.

- **Too tall for the table, feet cut out of the scan:** If the participant is too tall for the table and you cannot get the entire body in the scan, there are two options. First, if only one scan is to be acquired, make sure you get the entire head in the scan. Missing feet should be noted in the comments field. Missing feet will alter the whole body mass but will not impact the total body bone mineral density (BMD) or percentage of body fat (%BF) very much. If a complete scan is desired, move the patient further up the table such that the head is resting off the table and the feet are within the scan field. Using the two scans, one can generate a whole scan by using the head, arms, and torso from the first scan and the legs from the second. This has to be done manually in post analysis.
- **Pillow used for head support:** If the participant's head is not positioned optimally because of excess neck fat or back problems, a radiolucent pillow can be used to support the head. The use of a pillow should be noted in the comments field. If the pillow is used correctly, the scan is valid.
- **Equipment failure:** If you have an equipment problem during a scan, use the emergency stop button to insure that the participant can get off the scanner without it accidently starting. If the problem can be resolved during the visit, repeat the scan.

## Completing the Second Scan

Second scans are acquired in the same way as a first scan with repositioning. Focus on the cause for repeating the scan and make the necessary modifications (reposition, remove jewelry or objects, etc.). Before starting the scan, make sure that all corrections have been made. If a problem occurs with this scan, you will only be able to repeat one more time for a total of three attempts.

## Results

DXA is the preferred method for assessing bone mineral content (BMC) and BMD. The posterior-anterior (PA) lumbar spine and PA proximal femur scans are typically acquired for all osteoporosis assessments of BMD in adults. For children, the PA lumbar spine and total body less head BMD and BMC are used to assess low bone density. Soft tissue measures can only be acquired from whole body scans and may be helpful in evaluating patients with chronic conditions associated with malnutrition (such as anorexia nervosa, inflammatory bowel disease, cystic fibrosis), or with both muscle and skeletal deficits (such as idiopathic juvenile osteoporosis, or sarcopenic osteoporosis). Adults, BMD status is compared to the young adults reference data by deriving the T-score. In children with linear growth or maturational delay, spine and TBLH BMC and areal BMD results should be adjusted for absolute height or height age (Zemel et al., 2011) in addition to age and gender using Z-scores. SOURCE: International Society for Clinical

Densitometry. (2007). *2007 official positions and pediatric official positions of the International Society for Clinical Densitometry* (p. 25). Retrieved from http://www.iscd.org/wp-content/uploads/2012/10/ISCD2007OfficialPositions-Combined-AdultandPediatric.pdf

Protocol source: https://www.phenxtoolkit.org/protocols/view/20302