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| **About the Measure** | |
| **Protocol Id** | 20702 |
| **Domain:** | Anthropometrics |
| **Measure:** | Height |
| **Definition:** | Height is the distance from the top of the participant’s head to the heels of his or her feet (i.e., the vertical length). |
| **Purpose:** | Height or stature is used to assess body size and bone length. Recumbent length is used to measure length of infants, and knee height may be used to estimate height when stature cannot be measured in older adults. |
| **Essential PhenX Protocols:** | Current Age [10101] Sex Assigned at Birth [11601] Gender Identity [11801] |
| **Related PhenX Protocols:** | Ethnicity and Race [11901] Arm Span [20101] Maximum Adult Height [20901] Weight - Measured Weight [21501] Weight - Self-Reported Weight [21502] Body Proportions [220201] Body Mass Index [570101] |
| **Measure Release Date:** | October 01, 2015 |

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| **About the Protocol** | |
| **Protocol Release Date:** | March 27, 2009 |
| **Protocol Review Date:** | October 01, 2015 |
| **PhenX Protocol Name:** | Height - Recumbent Length |
| **Protocol Name From Source:** | National Health and Nutrition Examination Survey III (NHANES III), Body Measurements, 1988 |
| **Protocol Availability:** | Available |
| **Keywords:** | Anthropometrics; body mass index; BMI; stature; Waist-to-Height Ratio; WHtR; NHANES; gerontology; aging; geriatrics |
| **Description:** | Recumbent length is measured from the top of the participant’s head to his or her heels while he or she is lying recumbent. This measure is taken on neonates, infants, and young children.  The Anthropometrics Working Group suggests that the measurements be taken to the nearest 0.1 cm. |
| **Specific Instructions:** | Three measurement protocols (Standing Height, Recumbent Height, and Knee Height) accommodate various groups of participants. Self-Reported Height should be used as a last resort only. Several overarching, critical issues for high-quality data collection of anthropometric measures that optimize the data in gene-environment etiologic research 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.  The notion of recommending replicate measurements comes from the reduction in random errors of measurement and accompanying improved measurement reliability when the mean of multiple measurements is used rather than the a single measurement. This improvement in measurement reliability, however, depends on the reliability of a single measurement in the hands of the data collectors in a particular study (Himes, 1989). For example, if a measure such as standing height in a given study has a measurement reliability of 0.95 (expressed as an intraclass correlation coefficient), taking a second measurement and using the mean of the two measurements in analyses will improve the reliability to only 0.97, yielding only a 2% reduction in error variance for the additional effort. If, in the same study, the reliability of a single triceps skinfold measurement was 0.85, using the mean, including a replicate measurement, would raise the reliability to 0.92 and yield a 7% reduction in error variance, more than a three-fold improvement compared with recumbent length. Because the benefits of taking replicate measurements are so closely linked with the existing measurement reliability, it is recommended that as a part of the training of those who will be collecting anthropometry data, a reliability study be conducted that will yield measurement reliability estimates for the data collectors, protocols, settings, and participants involved in that particular study (Himes, 1989). If the measurement reliability for a single measurement is greater than or equal to 0.95, the recommendation is that replicate measurement are not necessary and will yield little practical benefit. If the measurement reliability is less than 0.95, the recommendation is to include replicate measurements as prescribed.  If replicate measurements are indicated because of relatively low reliability, a second measurement should be taken, including repositioning the participant. A third measurement should be taken if the first two measurements differ by more than 1.0 cm. If it is necessary to take a third measurement, the two closest measurements are averaged. Should the third measurement fall equally between the first two measurements, all three should be averaged. |
| **Protocol:** | Recumbent length is measured on infants and children ages birth through 47 months of age in NHANES 2007-2008. An infantometer device is used. The device has a fixed headpiece, horizontal backboard, and movable foot piece. If the child is not wearing an examination gown, ask the parent or guardian to remove the child’s clothes except for a diaper or underpants or t-shirt. Position the child on the infantometer with the feet positioned against the foot piece (Exhibit 1) and the head against the headpiece (Exhibit 2). Children often cry when placed on the infantometer, so ask the parent or guardian to stand between the examiner and recorder, make eye contact, and reassure the child.  [img[020702\_Height\_1.jpg|]]  Exhibit 1. Proper Positioning of the Foot Piece of the Infantometer  [img[020702\_Height\_2.jpg|]]  Exhibit 2. Proper Positioning of the Headpiece of the Infantometer  One person supports the child’s head and ensures that the head is positioned in the Frankfort horizontal plane. To do this, apply gentle traction to bring the top of the head in contact with the fixed headpiece. Secure the child’s head in the proper alignment by lightly cupping the palms of your hands over the ears. A second person can align the child’s legs by placing one hand gently but with mild pressure over the knees. With the other hand, slide the foot piece to rest firmly against the soles of the feet. The toes should point upward with both soles of the feet flexed perpendicular against the acrylic foot piece. To encourage the child to flex the feet, run the tip of your finger down the inside of the foot.  NOTE: If you are unable to position both legs correctly, make certain that at least one leg is straight with the foot flexed against the foot piece so that a measurement can be made. The one-leg positioning is the exception rather than the rule and is only used when children are extremely agitated or uncooperative. |
| **Selection Rationale:** | The National Health and Nutrition Examination Survey 2007-2008 protocols were selected as best practice methodology and are the most widely used protocols to assess recumbent length. |
| **Source:** | Centers for Disease Control and Prevention, National Center for Health Statistics. (1988). *National Health and Nutrition Examination Survey 1988-1994: Body Measurements (Anthropometry)*. Hyattsville, MD: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.  A video of anthropometric procedures is available at [link[www.cdc.gov/nchs/nhanes/nhanes3/anthropometric\_videos.htm|http://www.cdc.gov/nchs/nhanes/nhanes3/anthropometric\_videos.htm]].  Certification for the Spanish translation can be found [link[www.phenxtoolkit.org/toolkit\_content/Spanish/translation\_certification\_feb2018.pdf|here]]. |
| **Language** | English Spanish Chinese |
| **Participant:** | This measure includes four protocols, and each protocol relates to the age of the participant and his or her ability to stand up straight. A fourth protocol for self-reported height is included but is considered a protocol of last resort when direct measurement of height or its proxy is not possible.  **Standing Height**  The standing height protocol is used for participants 2 years of age or older who can stand unassisted.  **Recumbent Length**  The recumbent length protocol is used for all infants and children from birth through 47 months of age.  **Knee Height**  The knee height protocol was used for participants 60 years of age or older or for individuals who cannot stand unassisted.  **Self-Reported Height\***  Study subject aged 16 years or older or by a knowledgeable adult proxy for children younger than 16 years of age.  \*NOTE: Self-reported height values are considered to be less accurate and are used only when measured height cannot be obtained.  **Interpretation:**  The Centers for Disease Control and Prevention (CDC) and the American Academy of Pediatrics recommends that children from birth to 2 years of age be followed for length using the CDC-World Health Organization standard, available at [link[www.cdc.gov/growthcharts/who\_charts.htm|http://www.cdc.gov/growthcharts/who\_charts.htm]].  Centers for Disease Control and Prevention. (2010). Use of World Health Organization and CDC growth charts for children aged 0-59 months in the United States. *MMWR*, 59(No. RR-9), 1-15. |
| **Personnel and Training Required:** | Technicians should be trained in the basic techniques of anthropometric measurements and specifically in handling newborns. |
| **Equipment Needs:** | Infantometer with a fixed headpiece, horizontal backboard, and an adjustable foot piece |
| **Standards** | |  |  |  |  | | --- | --- | --- | --- | | **Standard** | **Name** | **ID** | **Source** | | Logical Observation Identifiers Names and Codes (LOINC) | Recumbent length proto | 62295-1 | [LOINC](http://s.details.loinc.org/LOINC/<INSERT_ID>.html?sections=Web) | |
| **General References:** | Himes, J. H. (1989). Reliability of anthropometric methods and replicate measurements. *American Journal of Physical Anthropology, 79*, 77-80. |
| **Mode of Administration:** | Physical Examination |
| **Derived Variables:** | Body Mass Index (BMI), Waist-to-Height Ratio (WtHR) |
| **Requirements:** | |  |  | | --- | --- | | **Requirement Category** | **Required (Yes/No)** | | **Major equipment** | No | | **Specialized training** | No | | **Specialized requirements for biospecimen collection** | No | | **Average time of greater than 15 minutes in an unaffected individual** | No | |
| **Annotations for Specific Conditions:** | None |
| **Process and Review:** | The [link[phenxtoolkit.org/about/teams#erp1-members|Expert Review Panel #1]] reviewed the measures in the Anthropometrics, Diabetes, Physical Activity and Physical Fitness, and Nutrition and Dietary Supplements domains.  Guidance from the ERP includes:  • Added replicate measure language  • Changed unit of measurement  Back-compatible: no changes to Data Dictionary  Previous version in Toolkit archive ([link[www.phenxtoolkit.org/domains/view/20000#tab5content|link]]) |