UKB: Physical and cognitive SOPs (from UK Biobank: Protocol for a large-scale prospective epidemiological resource)

http://www.ukbiobank.ac.uk/docs/UKBProtocolfinal.pdf

The included baseline measurements listed below were piloted in the integrated pilot (March-June 2006), as well as in the phase 1 pilot. Although there were minor modifications to Assessment Centre procedures between the two phases of piloting, average times for making these measures remained about 20 minutes. Additional measures were considered but excluded following the Phase 1 Pilot experience, chiefly based on the criteria of time available during the assessment (see Section 1.6.4)

Weight:

Weight will be measured using the Tanita BC-418 MA body composition analyser, which is described in detail below in Section 1.4.2.6. Staff will ask participants to remove shoes and heavy outer clothing and then step onto the footpads of the body composition analyser. Staff then press a button to start the analysis, during which weight (and several other variables) are measured.
The readings then download automatically to the assessment centre IT system. Measuring weight adds no delay to the bioimpedance assessment, and the body composition analyser is straightforward for staff to use. The analysers represent a moderate capital expense but they are robust (requiring only infrequent recalibration), they accurately measure body weight to within 0.1 kg, and they will also yield other potentially valuable information about body composition (Section 1.4.2.6). Automatic transmission of weight readings to the assessment centre IT system will reduce labour costs and improve data accuracy.

Height:

Standing and sitting height (shoeless) will be measured using a *Seca 202 height measure.*. Staff will read the measurements off analogue rulers and manually enter the readings into the assessment centre IT system, which will automatically and immediately flag up impossible or implausible values. The process of height measurement takes less than one minute and requires only a little staff training. The *Seca 202 height measure was* recommended (for use with adults) by experts involved in studies of child growth, and will involve only a minor capital expense.

Waist Circumference:

Waist circumference at the level of the umbilicus will be measured using a Wessex non-stretchable sprung tape measure that has been used in previous large health studies (including the BRIGHT hypertension study [1]). Staff will manually enter the readings into the assessment centre IT system, which will automatically and immediately warn staff of impossible or implausible values. Measurement of waist circumference typically takes about two minutes as it involves adjustment of some clothing by the participant, and it will involve negligible capital expenditure. However, measuring waist circumference will require a modest amount of staff training and monitoring to ensure that the measurements are done correctly.

Hip Circumference:

Hip circumference will be measured using the same tape measure as for waist circumference (Section 1.4.2.4). As with waist circumference, measuring hip circumference will require some staff training and monitoring, but the process is quite quick (about one extra minute) and involves almost no capital outlay.

Bio-impedance:

In UK Biobank, bio-impedance will be measured using the Tanita BC-418MA body composition analyser. This device measures bio-impedance by passing an extremely low, and completely imperceptible, via the trunk, legs and arms [2, 3]. Participants stand briefly in bare feet on the analyser's footpads, and hold its handles, while measurements of bio-impedance (and weight: Section 1.4.2.2) are made automatically and then downloaded electronically to the assessment centre IT system. This assessment takes about three minutes in total, and will require a modest amount of staff training to ensure that the analyser's (few) buttons are operated correctly. Tanita are the leading manufacturer of bio-impedance assessment equipment, and there are in-built algorithms for estimating body composition that have been developed in Western populations. This will not, however, preclude researchers from using the raw data on bio-impedance from UK Biobank since both measured and calculated values will be captured. The Tanita analysers represent a modest capital cost, but recurrent costs will be small (e.g. requiring only infrequent recalibration).

Hand grip strength:

Right and left hand grip strengths will be measured once each using a Jamar J00105 hydraulic hand dynamometer. The measurement of hand grip strength is dependent on maximal effort by the participant, so staff need to instruct participants how to use the equipment in order to help ensure that maximal effort is obtained. In terms of equipment, maintenance costs and participant's time, grip strength measurements require minimal resources. It takes a total of about two minutes for both right and left hands. Since manual input of data is required, there is the potential for errors within the range of valid values (although the IT system will flag up impossible or implausible values).

Spirometry:

The Vitalograph Pneumotrac 6800 spirometer was chosen chiefly because it performed slightly better in preliminary pilots, and linkage to the assessment centre IT appeared more straightforward. It was decided to make up to three measurements of lung function within a maximum of 6 minutes (since more attempts over a more prolonged period were not considered acceptable for participants). Staff are carefully trained in the conduct of the measures, including demonstration of the use of the equipment to participants, in order to increase the likelihood that two technically acceptable measurements are obtained. Spirometry requires minimal resources in terms of equipment and maintenance costs, but it does involve significant training and participant time. Electronic data capture of the flow curves in the assessment centre IT system allows immediate feedback to staff about the technical quality of the measurements, while also facilitating central validation.

Bone density:

Calcaneal bone density in the left heel will be assessed using the Norland McCue Contact Ultrasound Bone Analyser (CUBA), which provides a measure of Broadband Ultrasound Attenuation (BUA). While previous studies have measured

either one foot or both feet (and, in most instance, simply average the readings from both feet), time constraints mean it is only feasible to measure one foot. A small amount of contact gel is placed on the two transducers, and the participant is then asked to put their foot in the holder and to sit upright with slight pressure on their heel to ensure good contact. Staff will manually enter the readings into the assessment centre IT system, which will automatically and immediately warn staff of impossible or implausible values. Calcaneal ultrasound takes 1-2 minutes (provided the participant remains still), although preparations may increase the procedure time to 3-4 minutes. The analysers do represent a moderate capital expense but they are robust (requiring only infrequent recalibration) and straightforward to use (requiring only a modest amount of staff training and monitoring).

Blood Pressure:

Blood pressure (and pulse rate) will be measured in UK Biobank using the Omron HEM-7015IT digital blood pressure monitor. After correctly applying the blood pressure cuff, staff need only press a button on the monitor before waiting for the cuff to automatically inflate then deflate. Following this, the monitor automatically downloads the systolic and diastolic blood pressure (and pulse rate) readings to the assessment centre IT system. The process is then repeated, to obtain a second set of readings, after the participant has rested for about one minute. The blood pressure measurement process is quick (taking two to three minutes in total, including the one minute's rest) and simple (requiring minimal staff training and monitoring).

References:

1. Caulfield M, Munroe P, Pembroke J, et al. Genome-wide mapping of human loci for
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2. Jebb SA, Cole TJ, Doman D et al. Evaluation of the novel Tanita body-fat analyser to
measure body composition by comparison with a four-compartment model. *Brit Jf Nutr*
2000; 83: 115-22.
3. Prentice AM, Jebb SA. Beyond body mass index. *Obesity Reviews* 2001; 31:1-7.